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ORIGINAL ARTICLE

Does digital surveillance boost citizen compliance? Evidence from China

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Abstract
Authoritarian regimes increasingly deploy digital surveillance to monitor citizens, but how this affects citizen compliance remains understudied. We argue that, beyond repressing or deterring regime opponents, digital surveillance serves as an instrument of everyday governance that operates through psychological mechanisms rather than direct coercion. Specifically, pervasive monitoring fosters routine compliance with the regime through self-regulation and mutual observation. However, these effects attenuate over time as citizens habituate to surveillance and update risk assessments about noncompliance. We test this argument against empirical evidence from China. Drawing on in-depth fieldwork and employing a quasi-natural experiment enabled by two pilot surveillance projects that coincided with two national social surveys, we reveal digital surveillance's paradoxical short- and long-term effects: Newly introduced surveillance significantly boosts citizen compliance. Over time, however, this effect diminishes, and even reinforced surveillance cannot sustain the initial surge in compliance. The findings highlight both the potency and the limits of digital surveillance as a tool of authoritarian governance.

KEYWORDS
authoritarian control, China, citizen compliance, digital surveillance, mixed research methods

INTRODUCTION

Authoritarian regimes have long used surveillance to monitor citizens and maintain regime stability by sanctioning or deterring potential threats to the regime (Dallin & Breslauer, 1970;

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Davenport, 2007). Traditionally, autocracies heavily rely on secret police and human informants to implement surveillance (Greitens, 2016; Mattingly, 2019). With technological advancements (Feldstein, 2021; Hellmeier, 2016), new tools of social control emerge. Governments around the world, spearheaded by China, increasingly utilize digital surveillance such as street cameras, big data, and artificial intelligence to identify dissidents and suppress possible threats through large-scale monitoring (Czuba, 2025; Lyon, 2013; Xu, 2021; Zeng, 2022). However, how digital surveillance affects the political attitudes and behaviors of ordinary citizens who do not actively challenge the regime is understudied. A crucial question remains unanswered: Does digital surveillance bolster authoritarian control by making ordinary citizens more compliant with the regime?

This research addresses this question by studying China, an authoritarian regime at the forefront of developing and deploying digital surveillance. We define digital surveillance as the technological monitoring of individuals' observable features or behaviors in physical spaces through equipment like CCTV cameras, ID scanners, and cellphone tracking systems. Existing studies primarily examine digital surveillance as a repressive tool that helps states identify and punish regime opponents (Gohdes, 2020; Xu, 2021). However, surveillance does not always lead to repression or sanctions for the vast majority of citizens who do not actively challenge the regime. To understand its effects on citizen behaviors, we conceptualize digital surveillance as an instrument of everyday governance that creates an environment of constant monitoring and shapes citizens' compliance with the regime through psychological mechanisms.

We argue that digital surveillance, particularly widely installed and visible monitoring equipment like CCTV cameras, can send out cues of daily, inescapable monitoring and remind citizens of potential punishments for violation of public rules. This omnipresent sense of being watched creates ambient psychological pressure on citizens, motivating them to self-regulate their observable conduct in alignment with perceived expectations of the surveillant, i.e., the state. Moreover, when citizens subject to the same monitoring witness others' conformity, the mutual observation reinforces self-regulation. Through these mechanisms, the widespread deployment of digital surveillance encourages public displays of conformity and deference to the state and its rules, which can be understood as behavioral compliance with the regime.

However, this compliance-inducing effect is not static. As citizens become habituated to constant monitoring, surveillance cues recede into the background of everyday life. More critically, prolonged exposure allows citizens to learn that routine noncompliance rarely triggers punishment, leading them to recalibrate risk assessments regarding violations of imperfectly enforced rules. This combination of habituation and updated risk perception gradually erodes the pressure to comply. Therefore, while initial contact with digital surveillance increases citizen compliance, such compliance-inducing effect wanes over time. This temporal dynamic highlights the complex nature of digital surveillance as a tool of authoritarian control, with impacts that may extend well beyond its original design.

To empirically examine how digital surveillance affects citizen compliance over time, we adopt mixed research methods that combine in-depth field research and a quasi-natural experiment design utilizing two waves of major surveillance pilot projects completed in 2005 and 2010, respectively. We conducted in-depth field research and semi-structured interviews with local citizens, officials, and police in South China in 2022 (see Supplementary Material Section A for detailed fieldwork design), which yielded both quantitative and qualitative evidence for our proposed mechanisms linking digital surveillance and citizen compliance. Next, we leverage the two pilot surveillance projects and two coinciding nationally representative social surveys to statistically test the time-varying effects of digital surveillance on citizen compliance. We find that initial exposure to digital surveillance significantly increases citizen compliance. But this effect diminishes after about 2 years, and even reinforced surveillance cannot restore the initial surge in compliance. We also conduct robustness checks to address challenges, including nonrandom assignment of surveillance treatments, potential reverse

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causality, alternative explanations for the declining surveillance effect, and spatial spillover effects of surveillance. The results reinforce our arguments that while surveillance can initially induce citizen compliance, its effect wanes over time.

This research advances our understanding of digital surveillance as a tool of authoritarian governance in three ways. First, while existing studies emphasize surveillance's role in suppressing or preventing active opposition in authoritarian regimes, we demonstrate its broader function in fostering "quasi-voluntary compliance" (Levi, 1989) among ordinary citizens who do not actively oppose the regime. Second, we reveal how authoritarian regimes can induce mass compliance without relying extensively on overt coercion but through subtle, pervasive psychological pressure that shapes citizens' everyday behavior. Third, we contribute to debates on the efficacy of digital surveillance in bolstering authoritarian rule. By unveiling the working mechanisms and time limit of digital surveillance's compliance-inducing effect, this research provides fresh insights about both the potency and the limitations of surveillance as a tool of authoritarian control.

The rest of this paper is organized as follows. "Digital Surveillance and Authoritarian Control: Theoretical Analysis" section reviews existing studies on digital surveillance as a tool of authoritarian control and lays out our arguments and hypotheses about its compliance-inducing effect. "Digital Surveillance and Citizen Reactions in China" section provides fieldwork-based evidence to reveal how China's evolving digital surveillance systems shape citizens' behaviors. "Quantitative Method and Data" section explains the quantitative strategy and data sources. "Statistical Results" section presents the statistical results derived from multiple models. "Robustness Checks" section conducts additional robustness checks. The last section concludes.

DIGITAL SURVEILLANCE AND AUTHORITARIAN CONTROL: THEORETICAL ANALYSIS

State surveillance has long been used to maintain regime stability and subdue citizens in authoritarian regimes (Gieseke, 2014; Greitens, 2016). Traditionally, autocracies heavily rely on secret police and human informants to implement surveillance (Greitens, 2016; Mattingly, 2019). However, with the advancement of information and telecommunications technology (ICT), large-scale surveillance can be achieved at a lower cost, allowing authoritarian regimes to efficiently monitor citizens and identify regime opponents (Guriev & Treisman, 2019; Huang et al., 2019; Qin et al., 2017; Zeng, 2022).

A growing body of literature has examined digital surveillance's role in suppressing or preventing opposition to authoritarian rule. Comparative studies show that improved internet connectivity in repressive regimes such as Syria, Iraq, and North Africa is associated with more precise state violence targeting opponents (Gohdes, 2020; Pierskalla & Hollenbach, 2013; Shapiro & Weidmann, 2015). In China, surveillance tools such as street cameras are used to monitor and repress opponents on a large scale, reducing the need for costly co-optation strategies (Xu, 2021). Beyond targeted suppression, surveillance serves as preventive repression by deterring potential resistance (Dallin & Breslauer, 1970). Modern surveillance infrastructure enables the regime to identify and neutralize threats before they take shape (Pei, 2024). More broadly, studies, especially after the Snowden revelations, find that online surveillance can generate a "chilling effect" by deterring people from voicing opinions and exercising civil rights that may challenge the regime (Penney, 2016, 2017), an effect identified in both democratic and authoritarian settings (Lyon, 2015).

Departing from existing studies' focus on actual or potential regime challengers, we contend that digital surveillance serves a more general but understudied function of inducing citizen compliance in authoritarian regimes. Compliance is a multidimensional concept

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encompassing distinct forms of conformity to authority and rules, ranging from adherence to specific laws (Tyler, 1990) and tax obligations (Levi, 1989; Slemrod, 2019) to, more broadly, support for political institutions and governance arrangements (Easton, 1975; Geddes & Zaller, 1989). Compliance also operates at different levels: behavioral compliance denotes observable rule-following behaviors, with or without underlying normative commitment (Cialdini & Goldstein, 2004; Deutsch & Gerard, 1955), whereas normative compliance involves internalized beliefs about the obligation to obey authorities and the legitimacy of their rule (Kelman, 1958; Tyler, 2006).

We focus on citizens' behavioral compliance with the regime, defined as demonstrated conformity and deference to the state and its rules. It is broader than legal compliance, because the rules include not only formal laws but also government regulations and informal expectations regarding citizen conduct, such as orderly behavior and respect for authority, that are often unevenly articulated and inconsistently enforced. Our focus, therefore, is observable rule-following behaviors, regardless of whether citizens internalize the obligation to obey authorities or accept their legitimacy.

For the vast majority of citizens who have no intention of challenging the regime, surveillance induces compliance by creating an environment of pervasive monitoring and generating subtle psychological pressure to conform, even to imperfectly enforced rules. Cultivating such compliance is crucial for authoritarian governance because states cannot rely solely on coercion but must foster broad-based compliance with everyday rules and regulations (Dimitrov, 2013; Levi, 1989; Slemrod, 2019). By fostering mass conformity, digital surveillance contributes to what Levi (1989) terms "quasi-voluntary compliance," i.e., citizens comply when they observe others complying and perceive that authorities could enforce rules, even without direct coercion. Surveillance thus reduces governance costs and enhances regime stability through routinized inducement for compliance rather than constant enforcement (Levi, 1997; Slemrod, 2019).

Digital surveillance induces citizen compliance mainly through two mechanisms. First, widely deployed visible surveillance equipment, such as CCTV cameras, triggers the psychological process of self-awareness and prompts individuals to self-regulate their behavior in alignment with perceived expectations (Carver & Scheier, 1998; Deci & Ryan, 1987). Psychological studies find that the mere presence of surveillance equipment serves as a powerful cue of constant monitoring, subjecting individuals to psychological pressure to conform even in the absence of enforcement or punishment (Duval & Wicklund, 1972; Plant & Ryan, 1985). Perceptibility is essential here, as surveillance must be observable to direct attention inward and activate self-regulation (Carver & Scheier, 1981). Studies of the chilling effect echo these findings by demonstrating how awareness of surveillance can lead individuals to restrain their online expressions (Penney, 2017; Stoycheff et al., 2019). Cognitive evaluation theory further suggests that surveillance creates distinct evaluative pressure as individuals infer the surveillant's expectations and adjust behavior accordingly (Enzle & Anderson, 1993; Oulasvirta et al., 2014; Ryan, 1982). Consequently, even without direct coercion, individuals under surveillance become motivated to align their behaviors with the presumed norms, standards, and interests of the surveillant (Gächter et al., 2025; Lepper & Henderlong, 2000; Ryan & Deci, 2000).

Second, social dynamics reinforce digital surveillance's compliance-inducing effect through mutual observation and normative influence. Based on social learning theory, individuals look to peer behaviors for cues on appropriate conduct (Bandura, 1977). When citizens see others publicly demonstrating compliance under surveillance, it amplifies conformity motives beyond mere self-awareness (Yoeli et al., 2013). The visibility of surveillance infrastructure is essential here, as visible equipment like CCTV cameras creates shared awareness that all citizens are subject to the same surveillance gaze, thus receiving and providing multiplicative social proof of appropriate behaviors (Welsh & Farrington, 2009). Through this process, citizens reach a mutual understanding

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about what behaviors are socially desirable (Gächter et al., 2025), transforming individual conformity into collective compliance.

The two mechanisms of self-regulation and mutual observation work in tandem to foster mass conformity across the broader population that does not actively challenge the regime. This subtle modulation of behavior allows authoritarian regimes to maintain stability and induce broad-based compliance with everyday rules and regulations without resorting to direct coercion. The result is a pervasive form of social control that generates widespread compliance through environmental cues and social dynamics.

However, while surveillance may induce compliance in the short run, its effects are likely to attenuate over time due to habituation. Psychological research indicates that individuals can adapt to persistent changes to the environment and become desensitized to constant stimuli over prolonged periods (Frederick & Loewenstein, 1999). In the realm of surveillance, persistent exposure can lead to psychological fatigue (Nguyen et al., 2011). Research on ubiquitous surveillance in home environments shows that concerns about monitoring tend to decline after three to six months as people adopt new routines, and surveillance recedes into the background of everyday life (Oulasvirta et al., 2012). The initially prominent surveillance cues—the perception of monitoring equipment and the sense of being watched—gradually become normalized and no longer trigger behavioral changes.

Moreover, when citizens gradually learn through experience that noncompliance with everyday rules that are not rigorously enforced rarely triggers actual punishment, they may recalibrate their risk assessments (Gibbs, 1968; Nagin, 2013). Whereas states maintain strict enforcement to deter serious crimes or political threats (Kilgour & Zagare, 1991), they typically lack both motivation and capacity for consistent enforcement of ordinary infractions of daily rules, such as minor traffic violations, littering, jaywalking, or public disorder behaviors (Sherman, 1990; Weisburd & Eck, 2004). Authoritarian regimes particularly prioritize monitoring and punishing regime-threatening activities, while routine rule violations are often not their primary concerns (LeBas & Young, 2024). Additionally, surveillance capacity far exceeds enforcement capacity due to resource constraints: while digital systems can monitor thousands of minor infractions simultaneously, investigating, prosecuting, and sanctioning these violations would require way more resources (Pratt et al., 2002). However, deterrence theories suggest that for surveillance to generate enduring effects, it must be coupled with a credible threat of punishment (Gibbs, 1968). Therefore, when citizens observe that routine violations captured by surveillance tools consistently go unpunished, they begin to understand the priorities and practical limits of state enforcement. This recalibration, coupled with psychological habituation to surveillance cues, gradually erodes the initial compliance-inducing effect, similar to the deterrence decay of crime-prevention systems like police patrols and crackdowns (Nagin, 1998; Sherman, 1990).

In summary, we argue that digital surveillance can initially increase citizen compliance with the regime through self-regulation and mutual observation. However, the compliance-inducing effect is likely to decline over time as citizens undergo psychological habituation and reassess the risks of noncompliance under sustained monitoring, particularly in the lack of consistent enforcement of everyday rules. Therefore, we derive two hypotheses about the short and long-term effects of surveillance:

Hypothesis 1. Newly introduced digital surveillance will increase citizens' compliance with the regime.

Hypothesis 2. Digital surveillance's compliance-enhancing effect will diminish over time.

DIGITAL SURVEILLANCE AND CITIZEN REACTIONS IN CHINA

Digital surveillance projects

A series of institutional transformations in post-Mao China, including marketization and the dissolution of work units, have eroded the Communist regime's capability to monitor its citizens (Walder, 1986, 1994). However, since the beginning of the millennium, the Chinese government has significantly enhanced its monitoring capacity via institutional innovations such as grid governance (Cai, 2018; Xu & He, 2022) and the adoption of ICT-facilitated surveillance (Roberts, 2018).

China has been developing digital surveillance systems for over two decades through projects like the "Golden Shield Project", "3111 Initiative", "Skynet", and "Safe City". These projects were implemented with different priorities, gradually creating an integrated and pervasive surveillance system. In 1998, in response to the public security challenges and declining monitoring capacity, the Ministry of Public Security proposed building a digital surveillance system, aiming to enhance the efficiency and effectiveness of the police force. The proposal was approved and funded by the central government in 2001 (Schwarck, 2018; Walton, 2001).

As the first major surveillance project, the Golden Shield Project (GSP) began in 2003 to establish an integrated surveillance infrastructure in pilot areas, including an internal network connecting law enforcement agencies, population databases consolidating citizen information, ID scanners and ID tracking systems, as well as CCTV cameras in high-traffic public spaces like airports, train stations, subway stations, hotels, and major intersections. In 2005, 40 cities completed the installation of digital surveillance and received the Ministry of Public Security's award in 2006 (Schwarck, 2018). Building on this foundation, the 3111 Initiative was launched in 2005 to expand surveillance coverage by installing dense networks of street cameras and alarm systems. Whereas GSP surveillance primarily focused on high-traffic public spaces, the 3111 Initiative extended monitoring more broadly across public spaces, including residential areas and commercial districts. The project, jointly conducted by the Ministry of Public Security and the involved provincial governments (Chin & Lin, 2022; Li, 2015), was completed in four pilot cities in 2008 and another 22 cities in 2010.[1]

Despite their different technological scopes—GSP established surveillance infrastructure combining backend systems with on-the-ground monitoring equipment, while 3111 concentrated on expanding camera networks—both projects centered on deploying pervasive, visible surveillance equipment, particularly CCTV cameras that citizens could easily perceive in daily life. These projects set pilot cities apart from nonpilot areas through systematically enhanced surveillance intensity and quality enabled by comprehensive institutional support from ministerial, provincial, and city levels, including earmarked funds (*zhuanxiang zijin*), technical support for system design, implementation, optimization, and evaluation, and continuous operational guidance (Pang, 2008; Schwarck, 2018; Wang, 2008).

Citizen reactions: Fieldwork data

To understand how digital surveillance shapes citizen behaviors, we conducted in-depth fieldwork and systematic interviews in S city, Guangdong Province, in 2022 (see Supplementary Material Section A for fieldwork design and interview protocols). We interviewed three groups across multiple communities: ordinary citizens who experienced surveillance installation

[1]The 3111 Initiative expanded to over 400 county-level units in 2012, but our analysis focuses on these 26 city-level implementations to correspond with the available survey data discussed below.

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($n=22$), community officials responsible for local governance ($n=16$), and police officers operating state surveillance systems ($n=7$). All interviews followed a standardized protocol with common questions for all respondents and specific questions based on their role in the state surveillance system.

To assess citizens' initial and longer-term reactions, we asked about respondents' perception of surveillance (particularly CCTV) installation, their psychological reactions to being monitored, observed behavioral changes under surveillance, and adaptation over time (see Supplementary Material Section A for interview questions and coding standards). Table 1 presents the systematically coded responses. Overall, respondents reported that when cameras were first installed, most people noticed them, experienced psychological pressure, and perceived improvements in public security and everyday rule-following. Over time, however, most respondents described habituation to the cameras and observed a reemergence of noncompliant behaviors. The following sections draw on detailed interview accounts to illuminate how these patterns emerged.

Short-term effect

Under the GSP and 3111 projects, visible surveillance equipment such as street cameras and ID scanners became widely installed in public spaces, and real-name registration and ID scanning requirements were enforced at train stations, airports, hotels, internet cafés, and other places. Citizens soon became aware that they were being monitored regularly. Based on our interviews, the awareness was nearly universal—95% of citizens and all community officials and police we interviewed noticed surveillance cameras' appearance in the mid-2000s to 2010s. The interviewees noted that "the cameras seemed to pop up overnight in places where they were never seen

TABLE 1 Interviewee reactions to digital surveillance.

Interview response patterns	Citizens ($n=22$)	Officials ($n=16$)	Police ($n=7$)
Initial Psychological Reactions			
I noticed the installed surveillance cameras	95%	100%	100%
I felt safer under surveillance cameras	100%	100%	100%
I felt psychological pressure under surveillance cameras	77%	63%	29%
Initial Behavioral Shifts			
I became more well-behaved in public	91%	100%	100%
I saw other residents become more well-behaved in public	86%	94%	100%
Digital surveillance improved public security	100%	100%	100%
Long-term Adaptation			
I became habituated to surveillance cameras	86%	100%	100%
I felt other residents became habituated to surveillance cameras	82%	94%	86%
I noticed rules were not always enforced	73%	100%	100%
I observed the reemergence of some noncompliant behaviors that disappeared after the initial surveillance installation	68%	88%	86%

Note: For all three interview groups, the percentage is the proportion of interviewees answering "yes" to the question in that group.

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before" and "there was a lot of talk among neighbors when the cameras first appeared." The new surveillance devices "were impossible to miss" as their installations widely attracted curiosity and inquiry among onlookers. After the installation, local daily news reports frequently stressed the importance of surveillance in crime detection, which further enhanced public awareness of surveillance systems.[2] These accounts confirm that ordinary citizens indeed noticed the introduction of digital surveillance and developed a clear perception of being monitored daily. This perceptibility is theoretically significant because the compliance-inducing effects we propose operate primarily through visible surveillance infrastructure that citizens can easily perceive.[3]

Our interviews show that the psychological impact of surveillance cameras was immediate and profound. All respondents reported feeling safer under surveillance, yet 77% of ordinary citizens simultaneously experienced psychological pressure from being watched.[4] The middle-aged residents who witnessed the initial surveillance installation recalled a "constant awareness" of street cameras.[5] One citizen described feeling "somewhat unnatural, uncomfortable, stressful, but safe" when first entering surveilled areas.[6]

This widespread awareness quickly translated into modified behaviors: nearly all our interviewed citizens (91%) reported becoming more careful about their public conduct, including following traffic rules, not littering, avoiding inappropriate behaviors, and generally being more mindful of everyday civility. As one citizen confessed, "I no longer dared to walk bare-chested outside in summertime (a common but inappropriate male behavior in China) after surveillance cameras appeared."[7] Another resident recalled, "I used to pick basil from my neighbor's garden for cooking, but since CCTV cameras appeared in the alley, I felt pressured and didn't dare do it anymore."[8] These reactions illustrate self-regulation in action: individuals adjusting their conduct under monitoring, even without explicit enforcement.

These behavioral changes are reinforced through mutual observation. Among the citizens interviewed, 86% observed increased compliance among others. One citizen explained: "After the installation of surveillance cameras, I noticed my neighbors all stopped dumping trash at will, and the whole street looked cleaner. I felt I should follow along, too."[9] Another resident described a similar pattern: after cameras were installed, construction workers stopped dumping renovation waste in the residential complex.[10] These accounts illustrate how compliance spread through mutual observation: residents observed one another's behavior and adjusted their conduct accordingly, creating a cascading pattern of compliance.

Community officials provided detailed observations of collective behavioral changes, with 94% observing residents becoming more well-behaved. One described the dramatic transformation of a recycling station: "Before surveillance cameras were installed, some residents dumped large furniture like unwanted wardrobes and beds near the recycling station, leading others to follow. We had to send staff to clean up mountains of garbage regularly."[11] After the

[2]Interviews with citizens in Guangdong Province, August–October 2022.

[3]In comparison, we also asked respondents about their perceptions of the social credit system, another surveillance system operating through backend data processing and hardly noticeable to citizens. Only 31% of respondents knew about this system, and 11% were constantly aware of it. It also had limited impacts on citizen behavior: 27% of respondents reported becoming more law-abiding, and 24% observed others becoming more law-abiding under the social credit system (see Supplementary Material Table A2 for detailed interview questions). These different patterns further support that perceptibility is a key condition for digital surveillance to influence behavior.

[4]The lower percentages of community officials and police officers acknowledging psychological pressure are likely due to their roles as surveillants rather than subjects of surveillance.

[5]Interview with a citizen in Guangdong Province, October 2022.

[6]Interview with a citizen in Guangdong Province, October 2022.

[7]Interview with a citizen in Guangdong Province, September 2022.

[8]Interview with a citizen in Guangdong Province, October 2022.

[9]Interview with a citizen in Guangdong Province, October 2022.

[10]Interview with a citizen in Guangdong Province, October 2022.

[11]Interview with a community official in Guangdong Province, August 2022.

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surveillance installation, "the dumping phenomenon completely disappeared. Residents would carry large items to proper disposal sites despite the inconvenience."[12] Similarly, community officials reported improved compliance with parking regulations and reduced littering and jaywalking in monitored areas.[13]

Our interviews with policemen working in grassroots stations, public security bureaus, and the command center (*zhihui zhongxin*)[14] also confirm the effects of surveillance on citizen behaviors. Front-line policemen observed broad changes in public conduct under surveillance. "Just the presence of cameras changed how people behave," one officer explained. "You see it in everything – how they conduct themselves in public squares, dispose of trash, and follow traffic rules." A traffic police officer offered a concrete example: "At well-monitored intersections, most drivers naturally follow traffic rules without us having to intervene. The cameras themselves create a more orderly environment."[15]

These observations reveal how surveillance induces compliance through self-regulation and mutual observation. Perceived monitoring generates psychological pressure that prompts individuals to align their behavior with state-promoted rules and norms. Meanwhile, individual adjustments diffuse as citizens observe others' heightened conformity and update their own conduct. Together, these processes produce broad behavioral shifts and collective compliance.

Long-term decay

However, such compliance-enhancing effects appeared transitory, as citizens became psychologically adapted to surveillance presence. As one interviewee put it, "Now we take those cameras for granted and behave as if they were not there."[16] A long-term resident explained, "In the beginning, I would watch out for cameras. Now I forget they're even there most of the time."[17] This habituation was pervasive: 86% of citizens and all officials and police interviewed reported becoming personally accustomed to surveillance over time. Moreover, 82% of citizens, 94% of officials, and 86% of police observed others becoming habituated as well.

The generational difference further illuminates this temporal change: Younger generations who grew up under pervasive surveillance tend to perceive it as normal "urban infrastructure" just like "tap water" and reported little motivation for self-regulation under camera gaze.[18] One young adult noted: "They may be new to my parents' generation, but for us they've always been there. We don't really think about them."[19] This suggests that the cameras that initially commanded attention had gradually faded into the background of everyday life, no longer triggering heightened self-awareness as they did before.

Alongside this psychological adaptation, citizens also learn from personal experience about enforcement realities. The recognition was widespread: 73% of citizens, and all community officials and police officers interviewed acknowledged that not all rules were enforced. Minor violations captured by cameras rarely triggered punishment. The community official who witnessed the initial improvement with garbage dumping observed a gradual

[12]Interview with a community official in Guangdong Province, August 2022.

[13]Interviews with community officials in Guangdong Province, August to October 2022.

[14]Command Center is a public security organ responsible for collecting, analyzing, and sharing intelligence, based on which it issues warnings and dispatches police forces. It is the "brain" of the digital surveillance system.

[15]Interviews with policemen in Guangdong Province, August 2022.

[16]Interviews with citizens in Guangdong Province, October 2022.

[17]Interviews with citizens in Guangdong Province, September 2022.

[18]Interviews with citizens in Guangdong Province, October 2022.

[19]Interviews with citizens in Guangdong Province, September 2022.

reversal: "The recycling station remained clean for about two to three years after the surveillance installation. Then residents began sneaking out at midnight to dump large items, believing that community staff don't patrol at night and surveillance cameras don't work well in the dark." Moreover, "when residents found that surveillance didn't bring punishment, they started dumping large garbage even during daytime."[20] Individual citizens described similar learning processes. One noted, "I once dropped a cigarette butt under a camera and felt nervous about it. But later I realized that I was worrying for nothing, as the cameras wouldn't monitor such minor issues."[21] Another resident confessed, "We have seen neighbors littering or parking illegally without any consequences. If they can do it, so can I."[22] Through these experiences, residents recalibrated their risk assessments about noncompliance. The mutual observation that initially amplified compliance now undermined it by providing social proof that people can get away with minor infractions under incomplete enforcement.

Police officers confirmed surveillance's declining effectiveness, describing a "discounting effect" (*xiaoguo dazhe*) over time. As one officer put it, "After a few years, people realized that most of what cameras capture has no consequences. The deterrent effect gradually disappears unless we constantly patrol and actively enforce."[23] Our interviews with police officers clarify why minor infractions go unpunished despite extensive surveillance coverage: an enforcement gap driven by inadequate motivation and capacity. Police officers distinguish between serious crimes and what they call "moral borderline" behaviors: "Unlike criminal activities, which trigger immediate law enforcement, minor offenses caught on camera, such as littering and flyposting, are not crimes like robbery. We would not act on them unless there's a complaint, and even then, we would only issue a verbal warning."[24]

Besides, capacity constraints make complete enforcement impossible. As another officer explained, "these 'moral borderline' cases can hardly be deterred by surveillance alone. But we cannot enforce every rule of daily life – it would be too tedious. We have to rely on people's voluntary compliance."[25] Another command-center officer elaborated: "We see hundreds of minor infractions on cameras every day: electric bikes running red lights, jaywalking, unauthorized parking and construction, etc. If we dispatched police force to pursue each case, we'd need to increase our manpower by hundreds or thousands of times."[26] Even during occasional campaigns to strengthen enforcement, "frontline workers had to work overtime every day trying to enforce everything, to the point of collapse. It's exhausting and expensive."[27] Moreover, citizens also understand "these enforcements would inevitably withdraw" after the end of the campaigns.[28] As citizens learned about the incomplete enforcement of daily rules, surveillance gradually lost its deterrent effect.

This learning process led to visible behavioral changes. Most citizens (68%), community officials (88%), and police (86%) observed some noncompliant behaviors returning over time. As residents adapted psychologically to constant monitoring and learned that surveillance was not backed by perfect enforcement, the pressure that initially induced mass compliance gradually eroded.

Overall, the fieldwork evidence provides empirical foundations for surveillance's initial compliance-inducing effect through self-regulation and mutual observation, as well as its decline due to habituation and recalibration of risk assessment.

[20]Interview with a community official in Guangdong Province, August 2022.

[21]Interview with a citizen in Guangdong Province, September 2022.

[22]Interview with a citizen in Guangdong Province, September 2022.

[23]Interviews with policemen in Guangdong Province, October 2022.

[24]Interviews with policemen in Guangdong Province, August 2022.

[25]Interviews with policemen in Guangdong Province, October 2022.

[26]Interviews with policemen in Guangdong Province, August 2022.

[27]Interview with a community official in Guangdong Province, September 2022.

[28]Interview with a community official in Guangdong Province, August 2022.

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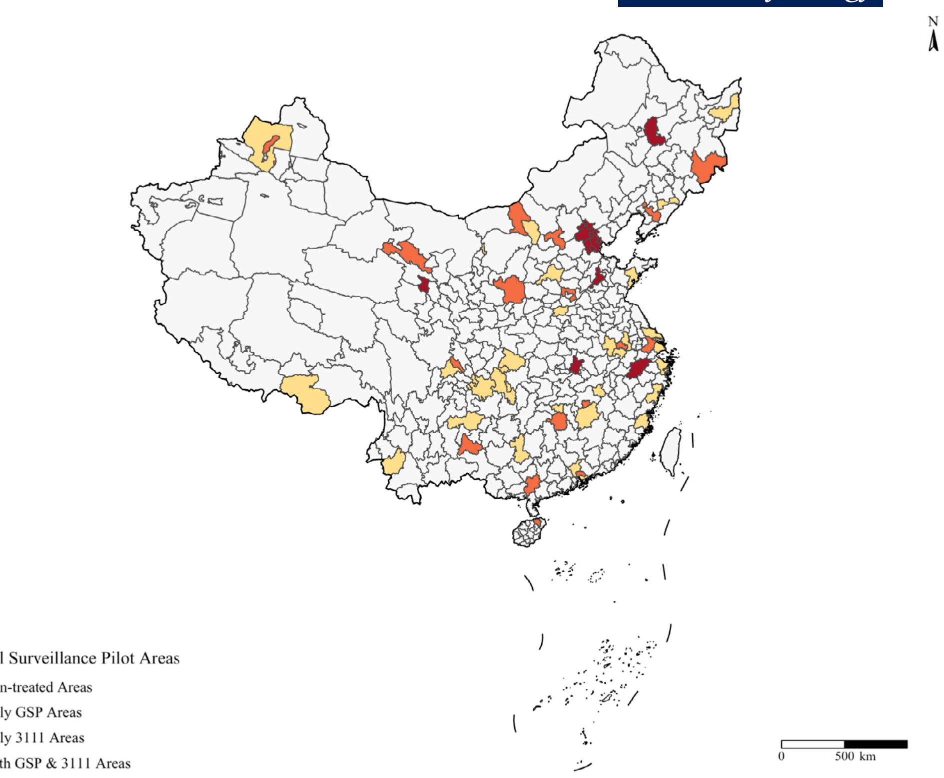

FIGURE 1 Geographical distribution of GSP & 3111 pilot areas (in 2010). *Source*: Authors' coding of the GSP and 3111 lists provided by the Ministry of Public Security.

QUANTITATIVE METHOD AND DATA

To statistically test the hypotheses, this study utilizes the GSP completed in 2005 and the 3111 Initiative completed in 2010 as two quasi-natural experiments to examine the short and long-term effects of digital surveillance on citizen compliance.[29] We analyze the policy records of the two projects to identify the pilot regions where digital surveillance was installed. Among the 293 prefecture-level cities in China, 40 cities implemented GSP in 2005, and 26 cities implemented the 3111 Initiative by 2010.[30]

Figure 1 displays the geographical distribution of these pilot areas as of 2010.

Next, we utilize two waves of the Chinese General Social Survey (CGSS) to gauge citizens' compliance with the regime.[31] CGSS is a series of nationally representative surveys, covering

[29]While we refer to the implementations of digital surveillance as quasi-natural experiments, we acknowledge that the selection of pilot areas was not random. According to the Chinese government, these pilot areas were primarily selected for their status as "critical (*zhongdian yaohai*)" areas, driven by political and socioeconomic calculations. However, research on policy experimentation in China shows that informal political connections, bureaucratic negotiations, and undisclosed strategic motives also influence pilot selection (Wang & Yang, 2025), and these factors are largely unobservable. Acknowledging this limitation, we use propensity score matching to balance observable characteristics between respondents in pilot and non-pilot cities (see Supplementary Material Section E) and test whether pre-existing compliance predicts pilot selection (Section F) to partly address the nonrandom treatment issue.

[30]See http://e-gov.org.cn/article-36311.html for the cities completing the Golden Shield Project in 2005 and http://www.21csp.com.cn/zhanti/bjyyfw/Article.asp?ID=1420 for the 3111 pilot areas. Last accessed February 18, 2024.

[31]CGSS, jointly launched by Renmin University of China and Hong Kong University of Science and Technology in 2003, is a member of the International Social Survey Programme (ISSP). See: http://cgss.ruc.edu.cn/English/Home.htm. Last accessed June 18, 2026.

TABLE 2 Coding of citizen compliance (2006 & 2010).

	CGSS2006		CGSS2010	
Our coding of *compliance*	**Original coding**	**%**	**Original coding**	**%**
0	1 [strongly disagree]	5.32	1 [strongly disagree]	3.53
	2 [disagree]	30.67	2 [disagree]	11.48
			3 [indifferent]	16.56
1	3 [agree]	41.84	4 [agree]	43.66
	4 [strongly agree]	14.88	5 [strongly agree]	24.18
Missing	5 [no answer]	7.28	−1 [not applicable]	.01
			−2 [do not know]	.07
			−3 [no answer]	.51
Total: 6013		**100**	**Total: 7222**	**100**

Note: the statistics only include urban participants in both years.
Source: CGSS 2006 and 2010.

urban and rural citizens in all (or almost all) provinces in China using a multi-stage stratified design.[32] As both GSP and 3111 only included pilots in urban areas, we excluded rural participants from this study. We use the CGSS conducted in 2006 (CGSS2006 thereafter) with 6013 urban participants to examine the short-term effect of GSP, and the CGSS conducted in 2010 (CGSS2010 thereafter) with 7222 urban participants to examine the short and long-term effects of the 3111 Initiative and GSP, respectively.[33]

For the dependent variable, as we define compliance as citizens' demonstrated conformity and deference to the state and its rules, we measure it with the following survey questions. We interpret respondents' agreement with these statements as a behavioral manifestation (Li, 2023; Tang, 2016) of compliance with and deference to the government and its rules.

- **CGSS2006**: *Do you agree or disagree with the following statement: Complying with the government can never be wrong (fucong zhengfu zongshi buhui cuode)?*
- **CGSS2010**: *Do you agree or disagree with the following statement: Citizens should comply with the government (laobaixing yinggai fucong zhengfu)?*

Given the different scales to record responses between CGSS2006 and CGSS2010, and the infrequent selection of "strongly disagree" in both years, we convert the initial responses into a binary variable, *compliance*, to ensure consistency across the different surveys. Specifically, we code "agree" and "strongly agree" as 1, and the other answers, including "strongly disagree", "disagree", and "indifferent", as 0. For situations where participants have chosen "no answer", "not applicable", or "do not know", these responses are coded as missing values (see Table 2).

To justify the survey questions as a credible measure of citizen compliance, we tested whether they correlate with behavioral patterns of citizens' compliance or noncompliance with the government and its rules. First, we calculated city compliance levels by aggregating individual responses to the survey questions. Next, we exhausted all available data sources to come up with several

[32]CGSS2006 used 125 counties/districts as Primary Sampling Units (PSUs) across five geographic strata (Beijing/Tianjin/Shanghai, provincial capitals, eastern, central, and western areas), while CGSS2010 used 140 counties/districts as PSUs in a two-layer structure with mandatory PSUs in major cities (Beijing/Tianjin/Shanghai/Guangzhou/Shenzhen) and lottery-selected PSUs in other districts/counties. We obtained detailed geographic codes to identify all 105 prefectures sampled in CGSS2006 and 89 in CGSS2010.

[33]The installation of surveillance systems in 3111 pilot areas was completed before CGSS2010, as the accreditation started as early as April 2008 (Wang, 2008).

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city-level indicators that capture citizens' noncompliant behaviors, including protests, which measure citizens' defiance against the Chinese government's prohibition of mass mobilization; traffic accidents, which reflect citizens' violation of traffic rules and regulations; and criminal cases including arrests and prosecutions, which measure citizens' violation of laws in general (see Supplementary Material Section B for details). We found the survey-based compliance level is negatively correlated with the number of protests, traffic accidents, criminal arrests, and prosecutions, with correlation coefficients of −.19 (p-value = .08), −.28 (p-value = .01), −.43 (p-value = .00), and −.44 (p-value = .00), respectively. It is also significantly negatively correlated with the per capita values of these behavioral indicators.[34] This test suggests our measurement can credibly gauge citizen compliance not only in expressed opinions but also in real-world behaviors.

We also acknowledge the possibility of preference falsification in survey responses within authoritarian contexts (Jiang & Yang, 2016; Kalinin, 2016; Kuran, 1991, 1997). To address this issue, we constructed a self-censorship index,[35] which serves as a proxy of preference falsification by measuring the difference in nonresponse rates between politically sensitive and nonsensitive questions (see Supplementary Material Section C for details). As shown in the following section, including this index in our regression models does not significantly alter our results, suggesting our findings are robust to potential preference falsification.

The key explanatory variable is whether the subjects resided in pilot areas that had completed digital surveillance at the time of taking the CGSS2006 or CGSS2010 survey.[36] We obtained detailed geographic identifiers that enable matching survey respondents to the prefecture level. Based on the geocoded data, we construct the treatment variables as follows: for CGSS2006, we create a binary variable that equals 1 for the subjects residing in GSP pilot areas during the survey period, and 0 otherwise. For CGSS2010, given the presence of both GSP and 3111 pilot areas, we create multiple treatment variables with four categories: GSP-only areas; 3111-only areas; areas in both GSP and 3111; and areas in neither GSP nor 3111 (the baseline). This coding scheme allows us to evaluate the effect of early GSP adoption in comparison to the more recent 3111 implementation and to distinguish the individual and cumulative impacts of the two surveillance projects.[37]

The numbers of CGSS2006 and CGSS2010 participants living in the surveillance pilot areas are presented in Table 3.

We use the probit model and maximum likelihood estimation (MLE) to analyze the effects of digital surveillance on citizens' compliance levels with the following specifications:

$$\Pr\left(COMPLY_i = 1\right) = \Phi\left(\beta_0 + \beta_1 SURVEIL_i + \alpha_1 x_{1i} + \ \dots \ + \alpha_k x_{ki}\right),$$

where Φ is the cumulative distribution function of the standard normal distribution. $SURVEIL_i$ represents the treatment variable(s) indicating whether the subjects live in digital surveillance pilot areas. In addition to the key explanatory variable, we include individual-level demographics and city-level controls x_{1i} to x_{ki}, which may influence citizens' compliance levels.

Individual-level factors, including gender, age, household income, education, marital status, hukou registration, and employment, are often predictors of attitudes and behaviors. The Chinese Communist Party (CCP) membership and military service experience are also included because they may foster citizen compliance by emphasizing political loyalty, discipline,

[34]Due to data availability, we could only find city-level data for the indicators in 2010 and test their correlations with the CGSS2010 question.

[35]We take inspiration from Shen and Truex (2021).

[36]We use the locations where participants are sampled. We acknowledge the limitations that we cannot recover the full residential history of the survey participants.

[37]We acknowledge that non-pilot cities may have installed surveillance equipment as well. However, pilot areas received top-down funding and technical support and enjoyed systematic advantages that distinguish them from non-pilot cities. Thus, our treatment variable captures the systematic differences in surveillance capacity and quality between pilot and non-pilot areas rather than the mere presence of surveillance.

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TABLE 3 CGSS2006 and CGSS2010 observations in GSP & 3111 pilot areas.

	CGSS2006		CGSS2010			
Areas	**Total**	**GSP**	**Total**	**Only GSP**	**Only 3111**	**Both GSP & 3111**
Observations	6013	2290	7222	1553	278	1305
Percentage	100	38	100	22	4	18

Source: CGSS 2006 and 2010, and authors' coding of the GSP and 3111 pilot areas.

and adherence to rules. As discussed earlier, we further control for a self-censorship index to address concerns about preference falsification in survey responses.

We also control for the city-level factors that may influence citizen compliance. First, we control for the administrative level of cities, coding central-controlled municipalities, provincial capitals, and sub-provincial (*fushengji*) cities as 1, and 0 otherwise. Cities with higher administrative status often have more developed institutions, better public services, and tighter state control, which may systematically affect citizens' political behaviors and compliance levels.

Second, economically advanced cities tend to harbor more educated and liberal citizens who may be less susceptible to state indoctrination or coercion (Chen & Nordhaus, 2011; Henderson et al., 2012). Thus, we control for economic development using average nighttime light intensity as a proxy.[38] Nighttime light intensity provides a more reliable measure of economic activities, bypassing potential problems of economic data manipulation at local levels (Wallace, 2016, 2023).

Besides, we control for local coercive capacity and enforcement intensity as measured by per capita fiscal expenditures on public security. This variable, hand-collected from each city's statistical yearbook, measures per capita spending on police forces, prosecutors, courts, and other law enforcement activities. Controlling for local coercive capacity helps us disentangle the effects of digital surveillance from other forms of state coercion while also accounting for local enforcement capacity following surveillance alerts.

Lastly, as one way to address the potential endogeneity problem that cities with higher compliance levels may be more likely to be selected as surveillance pilot areas, we control for city-wide compliance before the surveillance treatment by innovatively utilizing the National Civilized City (NCC) award as a proxy. The NCC is a triannual official award conferred by the Chinese central government based on assessments of citizens' social morals, civic manners, and obedience to rules (Li et al., 2022). By measuring Chinese cities' social orderliness and civility, the NCC title serves as an informative proxy for city-level compliance (see Supplementary Material Section D for details). Specifically, we control for the 2005 NCC award in the analysis of CGSS2006 and the 2008 NCC award in the analysis of CGSS2010.

STATISTICAL RESULTS

Short-term effect of digital surveillance

We examine the short-term effect of GSP on citizen compliance using the CGSS2006 survey data with seven model specifications. Model 1 is the baseline model, including only the

[38]Nighttime light data are provided by the Defense Meteorological Satellite Program (DMSP) Operational Linescan System (OLS), and we apply the continuity correction method (Cao et al., 2015). The average DMSP-OLS nighttime light intensity is strongly positively correlated with per capita GDP, with correlation coefficients of .8236 ($p < .001$) and .8444 ($p < .001$) in 2006 and 2010, respectively.

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treatment variable. Model 2 incorporates individual-level demographic controls. Model 3 introduces the self-censorship index to address potential preference falsification in survey responses. Model 4 adds city-level controls, including administrative level, economic development, coercive capacity, and pre-existing compliance levels. We use the one-year lag of the city controls to avoid reverse causality. In Model 5, we adjust for the complex survey design by specifying parameters including probability weights, stratification, primary sampling units, and finite population correction to obtain more accurate estimates.[39] This cluster-based adjustment additionally addresses our hierarchical data structure, adjusting for city-level effects on individual compliance outcomes. Model 6 employs Multiple Imputation by Chained Equations (MICE) to address missing values, particularly valuable for survey data where missingness may not occur randomly.[40] Model 7 combines the survey design adjustments with multiple imputations, addressing both the survey design and missing data issues.

Table 4 presents the regression results. Across all models, the positive effect of GSP on compliance is statistically significant and stable in magnitude. These results support our Hypothesis 1 that citizens respond to newly introduced digital surveillance with enhanced compliance with the regime. This relationship is robust to both individual and city-level controls as alternative explanations for compliance and when accounting for the survey sampling process and missing values.

For the individual-level factors, compliance tends to be higher among female, older, lower-income, married, rural, and less educated individuals. The self-censorship index shows a small but significantly positive effect on compliance, suggesting that individuals are more prone to self-censorship and tend to express higher compliance. However, including this index does not substantially alter the magnitude or significance of GSP's effect, indicating that our main finding is robust to potential distortion by preference falsification. Among city-level factors, higher administrative levels and NCC award recipients are associated with increased citizen compliance, but the surveillance effect remains significant even when accounting for all these factors.

Figure 2 shows the marginal probability of compliance based on Model 7, which suggests that living under digital surveillance (GSP) increases the probability of citizen compliance by around 8.5%.

Long-term effect of digital surveillance

We utilize CGSS2010 to examine the long-term effect of GSP and the short-term effect of the 3111 Initiative on citizen compliance. Our multi-categorical coding distinguishes three treatment scenarios: treated only by GSP, only by 3111, and by both GSP and 3111 implementations. This approach allows us to assess the individual effects of each surveillance program and their cumulative effect.

We apply the same seven model specifications as in the CGSS2006 analysis. Model 1 includes only the treatment variables. Model 2 adds demographic controls. Model 3 incorporates the self-censorship index. Model 4 introduces city-level controls, using 2009 data for administrative level, economic development, and coercive capacity, and the 2008 NCC award

[39]We use Stata's “svyset” command to account for CGSS's multi-stage stratified sampling design. These adjustments correct for differential selection probabilities across sampling units and strata, account for the clustering of observations within PSUs, and handle correlated errors within sampling units.

[40]We use Stata's “mi” command to perform 20 rounds of imputation through MICE, which iteratively imputes missing values while preserving complex relationships between variables. In CGSS2006, missing values occurred mainly in household income (12.6%) and compliance (7.3%), with other variables having less than 1% missingness. In CGSS2010, household income had 14.7% missing values, while all other variables, including compliance, had less than 1% missingness.

TABLE 4 Short-term effect of digital surveillance (CGSS2006).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Surveillance: GSP	.259***	.28***	.28***	.137**	.198***	.165***	.223***
	(.035)	(.040)	(.040)	(.055)	(.029)	(.052)	(.032)
Male		−.107***	−.104***	−.103***	−.112***	−.083**	−.088***
		(.039)	(.039)	(.039)	(.008)	(.036)	(.010)
Age		.000	.000	.000	.002***	.000	.003***
		(.002)	(.002)	(.002)	(.000)	(.002)	(.001)
Household Income (Log)		−.058**	−.058**	−.075***	−.101***	−.069***	−.090***
		(.025)	(.025)	(.026)	(.006)	(.025)	(.016)
Married		.106**	.108**	.123**	.129***	.154***	.141***
		(.05)	(.05)	(.05)	(.01)	(.046)	(.020)
Town Hukou		−.069	−.064	−.066	−.052***	−.089*	−.065***
		(.053)	(.053)	(.053)	(.011)	(.048)	(.019)
Secondary Education		−.037	−.031	−.044	−.03**	−.059	−.059**
		(.056)	(.056)	(.056)	(.012)	(.053)	(.021)
Tertiary Education		−.167**	−.159**	−.189**	−.178***	−.206***	−.205***
		(.076)	(.076)	(.076)	(.017)	(.071)	(.029)
Employed		−.062	−.057	−.054	−.123***	−.049	−.085***
		(.042)	(.042)	(.043)	(.008)	(.040)	(.015)
CCP Member		−.009	−.009	−.004	.108***	−.009	.100***
		(.066)	(.066)	(.066)	(.013)	(.063)	(.027)
Military Experience		.087	.089	.105	−.024	.130	.029
		(.089)	(.089)	(.089)	(.017)	(.084)	(.029)
Self-censorship Index			.006***	.006***	.003***	.005***	.004**
			(.002)	(.002)	(.001)	(.002)	(.001)
Administrative Level				.123**	.076***	.106**	.069**
				(.056)	(.026)	(.051)	(.028)

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TABLE 4 (Continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
2005 Avg Nighttime Lights (Log)				−.031	−.047***	−.029	−.055***
				(.022)	(.009)	(.021)	(.009)
2005 Public Security Expenditure Per Capita (Log)				.033	.05***	.037	.061***
				(.036)	(.012)	(.033)	(.015)
NCC Award				.157**	.149***	.148***	.153***
				(.068)	(.039)	(.061)	(.040)
_cons	.187***	.900***	.869***	.921***	1.056***	.790***	.802***
	(.022)	(.254)	(.254)	(.28)	(.076)	(.268)	(.158)
Adjust for Survey Sampling Effect					Y		Y
Multiple Imputation						Y	Y
Observations	5575	4890	4890	4890	4890	6013	6013
Model Significance	.000	.000	.000	.000	.000	.000	.000

Note: Standard errors are in parentheses.
***$p < .01$; **$p < .05$; *$p < .1$.

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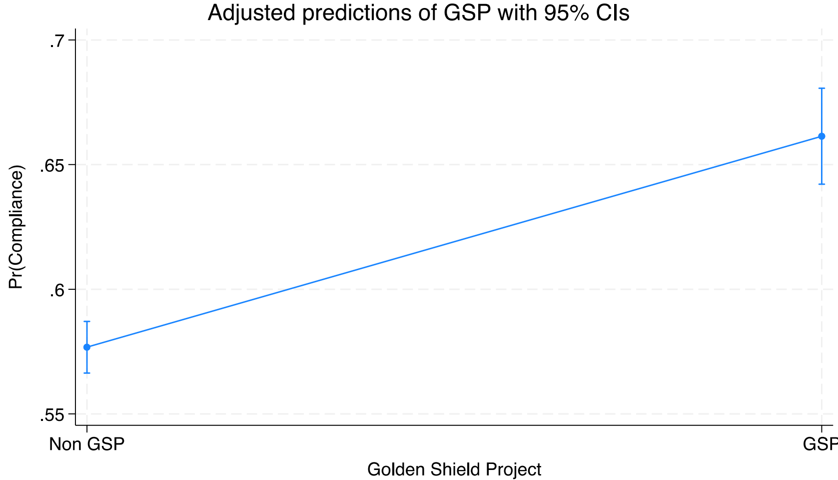

FIGURE 2 Predicted margins of GSP (CGSS2006).

as a proxy of prior city-level compliance. Model 5 adjusts for complex survey design, which also addresses the hierarchical data structure and geographical variations. Model 6 handles missing data using multiple imputations through chained equations. Model 7 combines survey design adjustments and multiple imputations.

The regression results in Table 5 reveal divergent short and long-term impacts of digital surveillance on compliance. Across all models, the newly introduced 3111 surveillance (Only 3111) is associated with significantly higher compliance compared to nontreated areas. This further supports Hypothesis 1 about the compliance-inducing effect of newly deployed digital surveillance.

However, the treatment effect of only GSP is either negative or statistically insignificant across the models. This pattern suggests that citizens who have lived under GSP surveillance for over 5 years are no more compliant than their counterparts in nontreated areas. The movement toward null or negative effects indicates that compliance weakens under longstanding GSP, which supports Hypothesis 2 about the declining compliance-inducing effect in the long run.

For citizens experiencing both GSP and 3111, the coefficient is insignificant in Model 1 but becomes positive and statistically significant in all other models, though lower than that of Only 3111. This suggests that surveillance reinforcement through technological advancement and expanded implementation can partially restore the compliance-inducing effect, but it cannot sustain the compliance level achieved by the initial introduction of digital surveillance.

The surveillance effects remain relatively stable after controlling for individual characteristics, self-censorship tendencies, and city-level factors, which helps to isolate the impacts of digital surveillance from alternative compliance drivers. Of the individual-level controls, the older, lower-income, rural, and less educated respondents are more compliant, aligning with the patterns observed in the CGSS2006 analysis. Besides, individuals who are more prone to self-censorship tend to express higher compliance. For city-level factors, citizens in cities with higher administration levels and lower economic development tend to be more compliant.

Figure 3 shows the marginal probability of compliance under digital surveillance based on Model 7. The marginal estimation suggests that the newly introduced digital surveillance (Only 3111) increases the probability of compliance by 16.6%, whereas the early GSP (Only GSP) decreases the probability of compliance by 1.1%. As for the areas that experienced the dual treatment of GSP and 3111, their compliance level is 5.5% higher than that of the control group.

TABLE 5 Short and long-term effects of digital surveillance (CGSS2010).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Surveillance: Only GSP	−.212***	−.126***	−.123***	.060	.033	−.002	−.031
	(.038)	(.046)	(.046)	(.069)	(.021)	(.061)	(.020)
Surveillance: Only 3111	.457***	.524***	.526***	.565***	.558***	.564***	.560***
	(.092)	(.101)	(.101)	(.103)	(.032)	(.095)	(.028)
Surveillance: Both GSP & 3111	−.033	.104**	.111**	.261***	.244***	.176***	.162***
	(.042)	(.05)	(.05)	(.075)	(.024)	(.067)	(.023)
Male		.056	.06*	.058	.061***	.063*	.070***
		(.036)	(.036)	(.036)	(.007)	(.033)	(.006)
Age		.011***	.011***	.012***	.012***	.013***	.013***
		(.001)	(.001)	(.001)	(0)	(.001)	(.000)
Household Income (Log)		−.081***	−.081***	−.061***	−.041***	−.056**	−.038***
		(.021)	(.021)	(.022)	(.005)	(.022)	(.011)
Married		.064	.072	.061	.006	.077*	.026***
		(.045)	(.045)	(.045)	(.009)	(.040)	(.008)
Town Hukou		−.083*	−.094**	−.1**	−.09***	−.097**	−.087***
		(.045)	(.045)	(.046)	(.01)	(.042)	(.008)
Secondary Education		−.236***	−.210***	−.196***	−.213***	−.158***	−.179***
		(.051)	(.051)	(.052)	(.011)	(.048)	(.010)
Tertiary Education		−.464***	−.432***	−.4***	−.422***	−.360***	−.375***
		(.069)	(.069)	(.07)	(.012)	(.064)	(.014)
Employed		−.021	−.024	−.025	.006	−.012	.016**
		(.041)	(.041)	(.041)	(.008)	(.037)	(.007)
CCP Member		−.013	−.016	−.029	−.043***	−.027	−.039***
		(.051)	(.051)	(.051)	(.009)	(.048)	(.010)
Military Experience		.055	.056	.053	.051*	−.053	−.087***
		(.162)	(.162)	(.163)	(.03)	(.139)	(.024)

(Continues)

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TABLE 5 (Continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Self-censorship Index			.026***	.026***	.024***	.028***	.028***
			(.007)	(.007)	(.001)	(.008)	(.005)
Administrative Level				.074	.071***	.106*	.109***
				(.064)	(.021)	(.058)	(.020)
2009 Avg Nighttime Lights (Log)				−.088***	−.084***	−.085***	−.088***
				(.025)	(.011)	(.023)	(.010)
2009 Public Security Expenditure Per Capita (Log)				−.077*	−.065***	−.068*	−.051***
				(.041)	(.014)	(.038)	(.014)
NCC Award				.02	.009	−.004	−.014
				(.06)	(.017)	(.054)	(.016)
_cons	.513***	1.091***	1.046***	1.365***	1.13***	1.151***	.908***
	(.021)	(.226)	(.227)	(.281)	(.076)	(.269)	(.118)
Adjust for Survey Sampling Effect					Y		Y
Multiple Imputation						Y	Y
Observations	7179	6094	6094	6094	6094	7222	7222
Model Significance	.000	.000	.000	.000	.000	.000	.000

Note: Standard errors are in parentheses.
***$p < .01$; **$p < .05$; *$p < .1$.

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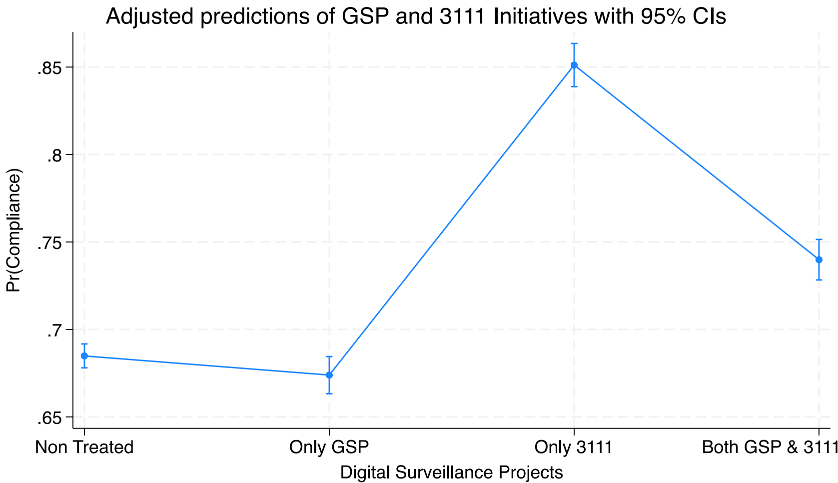

FIGURE 3 Predicted margins of GSP & 3111 (CGSS2010).

Time-varying effect of digital surveillance

To better understand the time-varying effect of digital surveillance and to take advantage of the staggered GSP and 3111 installations, we run an additional analysis by pooling the CGSS2006 and CGSS2010 data to estimate the effect of the years under surveillance on citizen compliance. Though we don't have panel data to track the same individuals over time, the pooled cross-sectional data leveraging staggered surveillance implementation helps reveal temporal patterns in the compliance-inducing effect of digital surveillance.

To capture the temporal variation of digital surveillance exposure, we generate a continuous variable indicating the number of years under surveillance at the time of each survey. As 40 cities completed the GSP implementation in 2005, we code the CGSS2006 participants in the GSP areas as having lived under surveillance for 2 years, covering 2005 and 2006; the CGSS2010 participants in the GSP-only areas are coded as experiencing 6 years of surveillance from 2005 to 2010.[41] As four cities completed the 3111 implementations in 2008 and another 22 cities finished in 2010, we code the CGSS2010 participants living in these cities as 3 years and 1 year under surveillance respectively. For respondents living in nontreated areas in both surveys, we code them as 0. Table 6 shows the coding and distribution of the *year under surveillance* variable.

We control for individual-level and city-level factors and employ similar model specifications as before. We also include a dummy variable, CGSS2010 (1 for CGSS2010 and 0 for CGSS2006), to account for the fact that the two surveys were conducted in different years under different settings. In addition to this dummy variable, Model 1 includes only the *year under surveillance* variable. As our two hypotheses posit a curvilinear effect of surveillance on the dependent variable, we include both *year under surveillance* and its quadratic term to test for nonlinearity. Model 2 adds individual-level demographic controls. Model 3 accounts for the tendency of self-censorship. Model 4 incorporates city-level variables including administrative level, economic development, local coercive capacity, and prior compliance level. Model 5 handles missing data through multiple imputations.[42] By leveraging the pooled data and the new time-based treatment measure, we

[41]For this coding approach, we have to assume citizens were immediately exposed to surveillance implementation (this is supported by our fieldwork observations discussed earlier) and remained residents of the sampled cities.

[42]We do not adjust for the survey design effect for the polled analysis as CGSS2006 and CGSS2010 have different sampling processes.

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TABLE 6 Coding years under surveillance (pooled CGSS2006 & 2010).

Surveillance treatment	Year under surveillance	Freq.	Percent
Respondents in nontreated areas	0	7769	58.70
CGSS2010 respondents in 3111 areas completed in 2010	1	849	6.41
CGSS2006 respondents in GSP areas	2	2330	17.60
CGSS2010 respondents in 3111 areas completed in 2008	3	734	5.55
CGSS2010 respondents in GSP-only areas	6	1553	11.73
Total		**13,235**	**100**

Source: CGSS 2006 & 2010 data and authors' coding of the surveillance pilot areas.

can evaluate how the length of exposure to digital surveillance affects citizens' compliance levels, more clearly differentiating the short and long-term effects.

As Table 7 shows, the coefficient of *year under surveillance* is positive and highly significant across all models. Meanwhile, the coefficient of its quadratic term is consistently and significantly negative, indicating a diminishing marginal effect of surveillance as exposure extends. The curvilinear effect confirms our hypotheses that surveillance systems can cultivate obedient citizens in the short run, but the effect wanes over time. The results remain stable across all models, which reveal an important temporal dynamic in how digital surveillance alters public compliance.

The control variables perform similarly to previous models. Older, lower-income, rural, less educated, and more self-censored individuals tend to be more compliant. At the city level, areas with higher administrative levels and lower economic development tend to have more compliant residents. The CGSS2010 respondents display more compliance on average, which may result from the different design of the survey question and/or the changing political environment in China.

Figure 4 shows the estimated margins of *year under surveillance* on compliance based on Model 5 in Table 7. For those participants who experienced no surveillance, the predicted compliance probability is 65.4%. This rises to 69.2% after 1 year under surveillance, peaking at 71.0% after 2 years. The effect then begins to decline and finally drops to 57.9% after 6 years. Within our observation period, this inverted U-shaped pattern suggests that digital surveillance strongly boosts compliance in the first 2 years after its introduction, but the effect erodes gradually afterward. These estimated margins lend further confidence to our hypotheses about the initially positive but eventually declining effect of surveillance on compliance.

Overall, the statistical results support our hypotheses about digital surveillance's divergent short and long-run effects on citizen compliance. Newly introduced surveillance systems significantly increase citizen compliance in the first 2 years or so. However, the initial gains erode with prolonged exposure, likely owing to citizens' habituation and updated risk assessment of surveillance.

ROBUSTNESS CHECKS

This section runs additional checks to further ensure the reliability of our findings.

First, to address concerns about the nonrandom assignment of surveillance treatments, we employ individual-level propensity score matching (PSM) using generalized boosted models (GBM) (Caliendo & Kopeinig, 2008; McCaffrey et al., 2004). While we cannot fully explain the selection of surveillance pilot areas due to limited information, PSM helps mitigate potential biases of nonrandom selection by comparing individuals who are similar in relevant personal characteristics, such as age, education, and income, that may affect compliance, except for their exposure to surveillance, thus isolating the treatment effect more effectively

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TABLE 7 Time-varying effect of digital surveillance (pooled CGSS2006 & 2010).

	(1)	(2)	(3)	(4)	(5)
Year Under Surveillance	.118***	.176***	.177***	.149***	.133***
	(.02)	(.023)	(.023)	(.03)	(.027)
Year Under Surveillance ^{2}	−.026***	−.034***	−.034***	−.03***	−.028***
	(.004)	(.004)	(.004)	(.005)	(.004)
Male		−.014	−.011	−.011	.000
		(.027)	(.027)	(.027)	(.024)
Age		.007***	.007***	.007***	.008***
		(.001)	(.001)	(.001)	(.001)
Household Income (Log)		−.069***	−.069***	−.061***	−.049***
		(.016)	(.016)	(.016)	(.016)
Married		.052	.055*	.052	.072**
		(.033)	(.033)	(.033)	(.029)
Town Hukou		−.092***	−.094***	−.1***	−.117***
		(.034)	(.034)	(.034)	(.031)
Secondary Education		−.131***	−.119***	−.119***	−.109***
		(.037)	(.037)	(.038)	(.035)
Tertiary Education		−.326***	−.31***	−.315***	−.311***
		(.051)	(.051)	(.051)	(.047)
Employed		−.049*	−.047	−.046	−.037
		(.029)	(.029)	(.029)	(.027)
CCP Member		−.02	−.021	−.023	−.020
		(.04)	(.04)	(.04)	(.037)
Military Experience		.026	.03	.04	.035
		(.076)	(.076)	(.076)	(.070)
Self-censorship Index			.009***	.008***	.008***
			(.002)	(.002)	(.002)
Administrative Level				.124***	.117***
				(.041)	(.038)
Avg Nighttime Lights (Log)				−.051***	−.048***
				(.016)	(.015)
Public Security Expenditure Per Capita (Log)				−.015	−.014
				(.026)	(.024)
NCC Award				.074*	.062
				(.044)	(.040)
CGSS 2010	.268***	.292***	.317***	.333***	.297***
	(.025)	(.029)	(.029)	(.036)	(.181)
_cons	.234***	.85***	.802***	.862***	.674***
	(.02)	(.163)	(.164)	(.184)	(.034)
Multiple Imputation					Y
Observations	12,754	10,984	10,984	10,984	13,235
Model Significance	.000	.000	.000	.000	.000

Note: Standard errors are in parentheses.

***$p < .01$; **$p < .05$; *$p < .1$.

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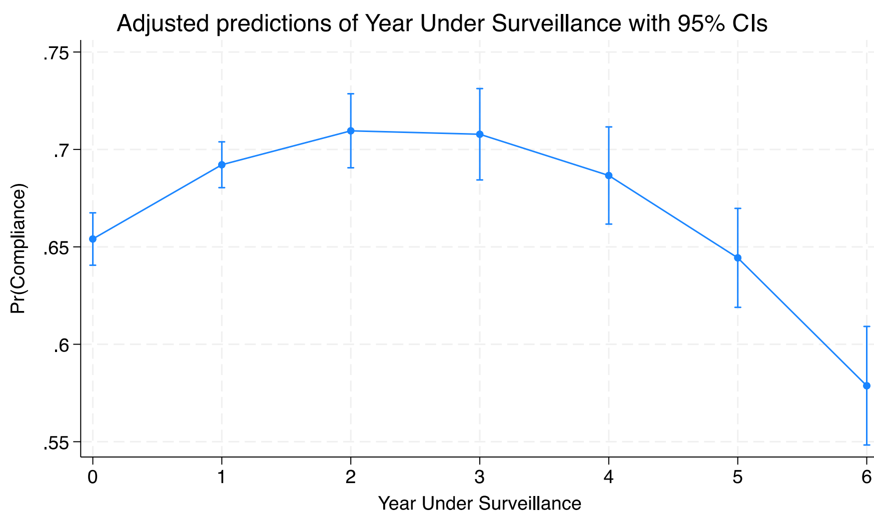

FIGURE 4 Predicted margins of year under surveillance (Pooled CGSS2006 & 2010).

at the individual level (Marschner & Donoghoe, 2018). We estimate propensity scores flexibly using GBM, which leverages machine learning to model complex relationships and iteratively refine the matches (Cefalu et al., 2021; Greifer, 2022). We then run weighted regression models, controlling for city-level characteristics, to estimate average treatment effects. The individual-level matching achieves adequate balance and strongly supports our main findings (see Supplementary Material Section E for details). For CGSS2006, compliance probabilities are approximately 57% in non-GSP areas and 65% in GSP areas, confirming the short-term compliance-inducing effect. For CGSS2010, probabilities are 69% in nontreated areas, 64% in early GSP areas, 86% in newly treated 3111 areas, and 70% in double-treated areas, reiterating the short-term gain and confirming the long-term decay.

Second, to address potential reverse causality concerns that the Chinese government might select obedient areas for surveillance piloting, we predict 3111 pilot locations using city-level compliance data from CGSS2006. We also control for city-level factors that might affect pilot selection, including local economic development, coercive capacity, urbanization rate, and population density (see Supplementary Material Section F for details). Our analyses show that the 2006 compliance levels do not significantly predict 3111 pilot enrollment, alleviating concerns about endogenous surveillance adoption based on pre-existing compliance.

Third, to provide macro-level evidence on the time-varying effects of surveillance and to address concerns that the diminishing treatment effect may be driven by nonpilot cities catching up in surveillance deployment and converging to treated areas instead of declining compliance within treated areas, we longitudinally trace the city-level compliance by aggregating the individual-level survey data. We identify the same 28 cities surveyed in both CGSS2006 and CGSS2010, differentiate them according to their GSP and 3111 participations, and trace their average compliance levels over time (see Supplementary Material Section G for details). To make the 2006 and 2010 data comparable, we standardize the cities' compliance levels in each year by dividing their distance from the yearly average by the yearly standard deviation. By comparing the 28 cities' standardized compliance levels in 2006 and 2010, we find that GSP-only areas' compliance levels declined substantially (from .14 in 2006 to −.38 in 2010), and GSP cities joining the new 3111 Initiative also recorded a decline from .14 in 2006 to .06 in 2010, while nontreated areas remain stable with a modest increase (from −.09 in 2006 to .07 in 2010). These patterns indicate that the diminishing treatment effect is driven primarily by the

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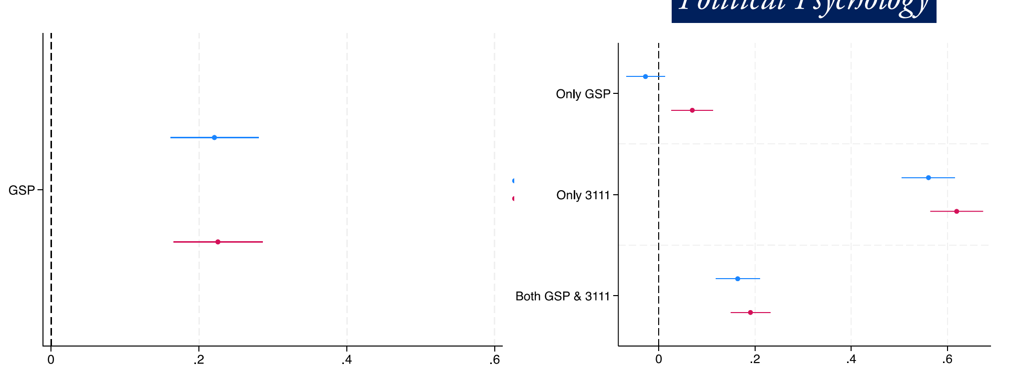

FIGURE 5 Comparison of surveillance effects with and without controlling for spatial spillover effect (based on full model). The graph on the left shows the effects of GSP treatment on citizen compliance in CGSS2006; the graph on the right shows the effects of the multiple treatments on citizen compliance in CGSS2010.

declining compliance within the treated population, rather than nontreated areas catching up in surveillance deployment and compliance level.

Last but not least, to address concerns about the potential spillover effects of digital surveillance to nearby nontreated areas that may lead to biased estimations, we construct a spatially lagged treatment variable to examine how surveillance effects may transcend administrative boundaries. Theoretically, digital surveillance can influence behaviors through mutual observation and social learning. This implies that surveillance implemented in one city may shape compliance patterns in neighboring regions. To account for the spatial spillovers, we employ spatial lag techniques using a distance-based spatial matrix, where the influence of surveilled areas on nonsurveilled areas is weighted by their proximity (see Supplementary Material Section H for details). We apply this approach to both GSP and 3111 treatments. Based on the estimation results of Model 7 in Tables 4 and 5 in the previous section and Tables H2 and H3 in Supplementary Material Section H, Figure 5 presents a comparison of the surveillance effects before and after accounting for the spatial spillover effect. We can see that the coefficient estimation of the surveillance system remains largely stable after incorporating the spatially lagged treatment variable in the regression models, underscoring the robustness of our conclusions.

CONCLUSION

This research conceptualizes digital surveillance as a tool of everyday governance and examines its effects on citizen behavior in authoritarian contexts. By mixed research methods combining in-depth fieldwork and quasi-natural experiment design based on two waves of digital surveillance pilots in China, we identify the paradoxical short- and long-term effects of digital surveillance on citizens' behavioral compliance with the regime. The empirical evidence demonstrates that widely perceivable digital surveillance, when first introduced, can exert subtle psychological pressure on citizens through self-regulation and mutual observation, encouraging public display of conformity and deference to the regime and its rules. However, this compliance-inducing effect wanes over time, as citizens become habituated to surveillance and recalibrate risk assessment about its punitive consequences when enforcement remains incomplete. Our estimates suggest that compliance declines after about 2 years, and even surveillance reinforcement can only partially restore the initially elevated compliance level.

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Therefore, we argue that digital surveillance can serve as a powerful tool of authoritarian control by inducing citizen compliance with the regime, but with a time limit.

This research advances our understanding of how authoritarian regimes maintain social control beyond traditional coercion. While existing studies focus on how surveillance helps repress or deter opposition (Davenport, 2007; Greitens, 2016; Pei, 2024; Penney, 2016; Xu, 2021), we demonstrate its broader role in shaping the behavior of ordinary citizens who may never actively challenge authority. Different from outright violence, which modern authoritarian regimes increasingly avoid (Guriev & Treisman, 2019), digital surveillance creates an environment of constant monitoring and subtle psychological pressure to foster routine compliance. By revealing how the prevalent presence of surveillance, even without explicit incentives or penalties, can induce citizens' compliance with the regime, this research joins a growing literature to understand the soft tools of authoritarian governance (Hassan et al., 2022; Mattingly, 2019; Zhan, 2021).

Meanwhile, this research exposes digital surveillance's inherent constraints. Although the perception of being monitored initially generates psychological pressure and social dynamics that foster compliance, citizens become habituated to surveillance over time and realize that many rules of everyday governance are not perfectly enforced. If authoritarian regimes fail to match their monitoring capabilities with effective enforcement, digital surveillance may gradually lose its deterrent effect, akin to scarecrows losing their efficacy over time. To maintain surveillance's compliance-inducing effect, regimes must consistently enforce monitored behaviors. Otherwise, the habituation and learning process can potentially breed defiant attitudes in the long run (LeBas & Young, 2024). This inherent limitation helps explain why authoritarian regimes must constantly innovate and intensify their control measures.

Lastly, we acknowledge several limitations. First, our survey data from 2006 and 2010 capture surveillance effects on compliance within this window, but we cannot assess earlier or later years because this is the only period with publicly available data on Chinese citizens' compliance with the regime. Further studies are needed to examine how digital surveillance influences behavior over longer horizons and amid advancing technologies, especially those less visible ones. Second, our evidence comes from China, which leads the world in the ranking of "most surveilled cities" and exceeds the second place by 600% (Bischoff, 2022).[43] Whether similar effects arise in countries and regions with less intensive surveillance remains to be tested. Third, the transferability of digital surveillance's compliance-inducing effects across political systems needs investigation. Cities in democracies, such as Delhi, London, and Los Angeles, also rank among the most surveilled (Bischoff, 2022), which provides a good basis for comparative studies across regime types. These remaining issues provide fascinating directions for future research.

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[43]The ranking is based on the statistics of "cameras per person". Estimates for China in 2022 use the average of all the cities where surveillance statistics are available, while other countries in the rankings use the statistics of their most surveilled cities.

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DATA AVAILABILITY STATEMENT

Raw data and analysis scripts for the quantitative study are available at Harvard Dataverse: https://doi.org/10.7910/DVN/SVKFDK.

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