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Exploring the dynamics of corruption perceptions in sustained anti-corruption campaigns: a survey experiment in China

Yating Pan [1 ✉], Zhan Shu[2] & Zhipeng Ye[3]

Evidence increasingly shows that anti-corruption investigations generate negative perceptions in the short run and lead to perceptions of reduced corruption in the long run. However, there is a lack of research on the effects of anti-corruption investigations on corruption perceptions within sustained anti-corruption campaigns. In certain nations, anti-corruption campaigns can be relentless. In such sustained campaigns, can fluctuations in the annual number of investigations affect corruption perceptions? This study aims to address the gap by conducting a survey experiment in China. The findings indicate that corruption perceptions are formed in an online evaluation fashion rather than a memory-based one. Individuals spontaneously form and revise their perceptions by integrating new information into their existing evaluations. Corruption perceptions are positively correlated with both the past trend in the annual number of investigations and recent investigations. Unexpected recent investigations can reverse people's corruption perceptions that are based on past trends. These findings are applicable to other nations in which anti-corruption campaigns are sustained and anti-corruption information is publicly accessible.

[1] School of Public Policy and Management, Tsinghua University, 30 Shuangqing Road, Haidian District, 100084 Beijing, China. [2] School of International Communications, University of Nottingham, University Park, Nottingham NG7 2RD, United Kingdom. [3] School of Public Administration, East China Normal University, 200062 Shanghai 3663 N. Zhongshan Rd China. ✉email: pyt15@tsinghua.org.cn

Introduction

Corruption can be defined as the abuse of power to pursue private profit at the expense of the public interest (Jensen et al., 2010; Keliher and Wu, 2016). Although functionalists argue that corruption can lubricate political mechanisms and reduce the chances of political violence (Pharr and Putnam, 2000), it's more widely acknowledged that corruption undermines government performance and erodes political trust (Seligson, 2002; Richey, 2010), thereby challenging the political legitimacy of a nation (Anderson and Tverdova, 2003; Chang and Chu, 2006; Gingerich, 2009; Morris and Klesner, 2010). In recent decades, there has been a growing phenomenon of anti-corruption efforts aimed at combating the misuse of public resources (Mungiu-Pippidi, 2006). Anti-corruption institutions have been established in many nations, and anti-corruption campaigns have been launched.

Corruption perception refers to individuals' assessment of the level of corruption, and it is influenced by people's tolerance toward corruption and their evaluations of a government's anti-corruption measures (Bauhr and Grimes, 2014; Dimitrov, 2013). High corruption perceptions can undermine political stability and the legitimacy of governments (Melgar et al., 2009). Therefore, public perceptions of corruption should be considered when guiding efforts to combat corruption and when adjusting a government's future work (Li et al., 2016).

There is debate over the relationship between the number of investigations and corruption perceptions. It is widely argued that corruption investigations reduce corruption and therefore mitigate corruption perceptions in the long run (Grönlund and Setälä, 2012; Hakhverdian and Mayne, 2012; Villoria et al., 2013). In the short run, however, anti-corruption efforts that reveal corruption scandals may lead to people's "informed disenchantment" and increase their corruption perceptions (Sun et al., 2022; Wang and Dickson, 2022; Zhu, 2017; Corbacho et al., 2016). Most relevant studies focus on the number of anti-corruption investigations over a specific period when examining the effects of anti-corruption efforts. However, there is a lack of empirical research on sustained anti-corruption campaigns that involve long-term and comprehensive efforts aimed at combating corruption. Corruption is often deeply rooted in societal, economic, and political structures, and some governments may continuously strive to bring about lasting change in these areas. Theoretically and practically, it is necessary to look into how people process anti-corruption information and form their perceptions.

In a sustained anti-corruption campaign, the relationship between anti-corruption investigations and corruption perceptions can be even more complex. As stated earlier, anti-corruption efforts can affect perceptions in a positive direction since they convince people that corruption is less prevalent, while the exposure of corruption cases may be interpreted as evidence of its existence. Therefore, each year's investigations can be seen as the anti-corruption effects of previous years. We argue that in a sustained anti-corruption campaign, it is not just the total number of investigations that matters. Presenting information in different orders may lead to different effects (Anderson and Hubert, 1963), and the impact of corruption investigations on corruption perceptions may differ with fluctuations in the annual number of investigations.

This study researches corruption perceptions within sustained anti-corruption campaigns. How do different trends in the annual number of corruption investigations affect people's perceptions? How do individuals update their perceptions in response to new investigations? Examining the formation of corruption perceptions can help uncover cognitive mechanisms that contribute to negative perceptions and legitimacy crisis (Booth and Seligson, 2009). We conducted an online survey experiment in China to investigate how year-to-year fluctuations in the number of corruption investigations affect corruption perceptions. The survey findings suggest that people engage in online evaluation when assessing corruption levels in a sustained anti-corruption campaign. They continuously revise their perceptions based on new information. We observe that different past trends in the annual number of anti-corruption investigations result in different perceived levels of corruption, and new investigations that reveal unexpected corruption numbers can reverse people's corruption perceptions.

The paper is structured as follows: "Literature review and hypotheses" section reviews relevant literature and puts forward hypotheses by explicating the two possible evaluation models. In "Methods," we present our online survey experiment conducted in China. "Results and findings" reports the results and findings regarding how year-to-year fluctuations in the number of corruption investigations impact people's corruption perceptions. It also discusses that individuals form their perceptions in an online evaluation fashion rather than a memory-based one. "Conclusion and limitations" highlights the implications and limitations of this research.

Literature review and hypotheses

Corruption and corruption perceptions. Corruption can be measured using objective and subjective indicators. Objective indicators include the number of officials disciplined, the number of anti-corruption investigations or convictions, etc. (Zhu and Gong, 2015). The indicators can also reflect a government's anti-corruption efforts and capabilities (Alt and Lassen, 2014).

The subjective indicators are typified by corruption perceptions. Corruption perceptions represent people's subjective evaluations of perceived corruption (Kanol, 2015), reflecting opinions rather than experiences (Treisman, 2007). Corruption perceptions are widely used to measure corruption, although the reliability of these perceptual indexes remains controversial due to perceptual bias. Disparities exist between the actual level of corruption and these subjective measures (Melgar et al., 2009; Golden and Picci, 2005). An empirical research based on Indonesian data even suggests no correlation between corruption perceptions and actual corruption (Olken, 2009). However, it is more widely believed that while corruption perceptions might not provide an exact depiction of actual corruption, the two are highly correlated (Mocan, 2008).

The influencing factors of corruption perceptions. The influencing factors of corruption perceptions have been widely researched. First, an individual's place of residence, which implies his socio-economic and cultural background, is believed to impact corruption perceptions (Melgar et al., 2009).

Second, three primary channels of information, which are personal experience, media coverage, and grapevine, contribute to shaping people's beliefs about corruption. As suggested by Sharafutdinova (2010), individuals who have personal experience of corruption tend to perceive a higher level of corruption compared with those who have no relevant experience. However, it has been found that most people have no corruption experience, even in nations where corruption is known to be common, and they primarily rely on news media for information about government corruption (Zhu et al., 2013). As pointed out by Lambsdorff (1999), it is the circulation of information, rather than personal experience, that most significantly influences corruption perceptions.

Both formal and informal information sources play crucial roles in setting the public agenda and shaping how people

perceive corruption (Singer, 2011; Pan and Shu, 2022). Given that corruption is often covert, the public has limited access to complete information about government corruption, particularly in those low-information authoritarian nations (Zhu et al., 2013; Corbacho et al., 2016). Informal information sources, such as grapevine news, can serve as supplements. While some scholars argue that grapevine news causes people to overestimate the actual level of corruption (Robinson, 1976), evidence suggests that mass media can also contribute to unreasonable collective behavior. The media are known to be biased (Entman, 2007), potentially emphasizing corruption news and exaggerating the situation (Duffy et al., 2008). Media exposure can consequently lead to systematic biases among people. An empirical study based on South Korean data suggests that those who obtain corruption information from traditional media may perceive a relatively high level of corruption, while news consumption on social media does not boost perceived corruption (Park and Lee, 2017).

Evidence from authoritarian nations may lead to a different conclusion. Mass media, which are not necessarily government-owned, can be controlled and manipulated by illiberal regimes to forge a government-supportive public opinion. In China, mass media are mandated to relay the editorial content of the government-owned Xinhua News Agency when reporting political news (Zhu et al., 2013). Thus, evidence from China demonstrates that state-controlled media coverage can significantly lower public perceptions of corruption, while grapevine information might influence audiences in the opposite way (Zhu et al., 2013).

Third, corruption perceptions can be influenced by the government's anti-corruption efforts. The relationship between the two is complex and nuanced. Ni and Sun (2015) argue that increased anti-corruption efforts do not necessarily cause a change in public perceptions of corruption. Some other scholars believe that anti-corruption efforts aimed at combating corruption and promoting good governance can ultimately reduce perceived corruption in the long term. However, increasing evidence indicates that intensive anti-corruption efforts may actually aggravate corruption perceptions rather than mitigate them (Zhang and Kim, 2018). Such efforts expose a corrupt political culture and damage the government's reputation, leading the public to believe that corruption is widespread in the short term. Olken and Pande (2012) introduce the example of Indonesia, suggesting although the downfall of Soeharto in 1998 led to a decrease in actual corruption, the allegations of corruption disclosed by the accompanying freer press resulted in an increase in corruption perceptions. Therefore, in a sustained anti-corruption campaign, the positive long-term effects of anti-corruption investigations may be overshadowed by the annual number of investigations in the subsequent years, which can serve as an indicator of anti-corruption accomplishments.

Memory-based evaluation vs. online evaluation. Corruption perceptions refer to people's subjective evaluations of corruption. Within the realm of social psychology, two models of evaluation —memory-based evaluation and online evaluation—can be applied to understand corruption perceptions.

Memory-based evaluation suggests that people are more inclined to make judgments when they are requested to do so (Hastie and Park, 1986). This model assumes that judgments are based on information recall, where individuals retrieve relevant information from memory (Chartrand and Bargh, 1996; Lichtenstein and Srull, 1987; Mackie and Asuncion, 1990). An effect known as the "recency effect" occurs in information recall, indicating that the most recent information holds the greatest influence. Therefore, according to the memory-based evaluation

model, people's evaluations are largely shaped by the most recent information. Researchers are increasingly discovering that anti-corruption investigations, particularly recent ones, uncover corruption scandals and negatively impact public corruption perceptions. That is, the recent number of investigations is positively related to corruption perceptions. When the number of investigations in the recent period is large, people perceive a high level of corruption. Conversely, a small number of investigations result in perceptions of low corruption.

On the other hand, the online evaluation model suggests that people continually form and revise their attitudes by integrating new information into their existing evaluations (Tormala and Petty, 2001). Beliefs are continuously evolving, with evaluations being updated as new information is received. The evaluation formation process concludes after receiving the latest information. In this model, the sequence of information significantly influences belief formation and updating. In addition to the most recent information, evaluations are also influenced by individuals' prior beliefs. Therefore, according to the online evaluation model, people's evaluations are shaped by both prior and the most recent information.

In a sustained anti-corruption campaign, the annual number of anti-corruption investigations fluctuates, indicating a sequence of information that can affect public perceptions of corruption. The trends can be categorized as upward, downward, or flat. An upward trend denotes a continuous increase in the annual number of corruption investigations, a downward trend represents a decline over the years, and a flat trend indicates stabilization. Taking an upward trend as an example, individuals initially perceive a low level of corruption when the number of investigations is low. However, their perceptions may progressively increase as the annual number of investigations rises, culminating in a high perceived level of corruption. One assertion is that upward trends in investigation numbers correlate with relatively high levels of corruption perception.

Hence, according to the online evaluation model, trends in investigations number shape the formation of corruption perceptions, with the most recent information prompting individuals to revise their beliefs. Both a past upward trend in the number of anti-corruption investigations and a high recent number of investigations can contribute to a high level of perception. Based on the online evaluation model, we expect corruption perceptions to be influenced by both the number of corruption investigations in the most recent year and the past trend of investigations.

It is widely believed that individuals' corruption experiences that correlate with their pre-existing beliefs can significantly influence the impact of anti-corruption efforts on corruption perceptions. Wang and Dickson (2022) find that individuals' prior beliefs regarding officials' integrity can influence how an anti-corruption initiative affects the level of public support for the government. Consequently, we anticipate that alongside recent anti-corruption efforts, people's pre-existing beliefs about corruption can strongly shape their perceptions of it. In the context of a sustained anti-corruption campaign, we posit that corruption perceptions are formed in an online fashion rather than a memory-based one. We formulate the hypothesis that individuals' perceptions of corruption are influenced by the past trend in the number of anti-corruption investigations. This hypothesis can disprove the memory-based evaluation model if supported.

Hypothesis 1: All else being equal, people's perceptions of corruption positively correlate with the past trend in investigation numbers.

The online evaluation model suggests that individuals consistently integrate new information into their existing evaluations. Accordingly, we propose the hypothesis that past trends in the

number of investigations shape the formation of corruption perceptions, with the most recent information promoting individuals to revise their beliefs.

Hypothesis 2: Recent investigations, which unveil corruption numbers unexpected by the public, can reverse individuals' corruption perceptions that are based on past trends in the number of investigations.

The current study delves into how individuals respond to fluctuations in the number of corruption investigations throughout a sustained anti-corruption campaign. We aim to examine whether the public adopts the online evaluation model when perceiving corruption by empirically testing the hypotheses outlined above.

Methods

In early 2022, we conducted an online survey experiment on Chinese respondents to examine the hypotheses. Since China embarked on its market reforms in the late 1970s, the accompanying political corruption has escalated social discontent and has become an intractable problem (Teets et al., 2010). The Communist Party of China launched its first anti-corruption campaign in 1982. The Xi Jinping government has started its anti-corruption campaign since the 18th National Congress held in late 2012, which is widely seen as the least compromising and the most effective campaign since the founding of the People's Republic of China (Keliher and Wu, 2016). Hundreds of thousands of officials, including "tigers" (senior corrupt officials) and "flies" (junior corrupt officials), have been investigated and disciplined. According to a report released by the Central Commission for Discipline Inspection, around 631,000 corruption cases were investigated in China in 2021. The government considers its anti-corruption campaign as an important achievement. Discipline Inspection Commissions always publish a notification when they start investigating a corrupt suspect, and their publicly available annual review reports reveal the number of corruption investigations conducted every year. Chinese mass media typically relay these notifications and annual reports by giving a positive spin to justify the campaign. Therefore, Chinese respondents are likely to have a good understanding of sustained anti-corruption campaigns.

Participants. We recruited participants on Sina Weibo, one of the most popular social media platforms on which people openly share information and exchange ideas in China (Vuori and Paltemaa, 2015). Since the public typically learns about annual figures of corruption investigations from media reports, we aimed to recruit a representative sample of news consumers. We posted the recruitment advertisement in the comments sections of hot news posts on Weibo, offering a ¥2 cash bonus to each volunteer.

A total of 2626 volunteers completed our questionnaire. We excluded 111 of them who spent less than 1 min finishing the questionnaire (30 s for the control group) and another 198 inattentive participants who failed the attention check questions. We have a final sample of 2317 participants, 1205 male (52.0% of

the participants) and 1112 female (48.0% of the participants), ranging in age from 16 to 65 years (mean = 30.25 years old, median = 29 years old) (see Supplementary Appendix Table A1). This sample is representative of news consumers on the social media platform (see Supplementary Appendix Table A2).

Research design. We asked our participants to fill in an online questionnaire at https://www.wjx.cn/. The survey began with questions concerning participants' demographic characteristics that might influence their corruption perceptions. As a guise, we asked about participants' reading habits and whether they liked working with numbers.

In the experiment, we introduced a fictitious country instead of China to control for respondents' pre-existing knowledge and attitudes toward Xi's anti-corruption campaign. Adapted from a real news post reported by Chinese state-owned media, we claimed the fictitious country had initiated an anti-corruption campaign since 9 years ago when the current generation of leadership took power, and we set the corruption ratio to be the same as in China. According to the figure for the year 2021, China's population had reached 1.44 billion, government-affiliated institutions had about 50 million staff members, and more than 4 million government officials had been investigated since the 18th Communist Party of China National Congress (the Central Commission for Discipline Inspection, 2021). In our experiment, the fictitious country had a population of 480,000, government-affiliated institutions had 16,700 staff members, and 1330 corruption cases had been investigated since the campaign started. We intentionally set the figures relatively low to reduce the cognitive burden associated with large numbers.

After introducing the background information of the fictitious country and providing the total number of corruption investigations, participants were shown nine individual news reports that revealed the numbers of investigations for each of the past 9 years, one at a time. The only difference among the nine reports was the number of anti-corruption investigations launched each year. To ensure participants' engagement and information processing, an attention check question followed each news report, asking participants to select the correct number of anti-corruption investigations for the specified year.

By assigning values to the annual number of investigations for each year, we created a 2*2 design that crossed the past trend in the number of anti-corruption investigations (an upward trend and a downward trend) with the number of investigations in the most recent year (high and low). These combinations of past trends and recent numbers, along with a control group that did not receive annual figures, were employed (see Table 1). The total number of anti-corruption investigations was the same across all the five groups.

We examine how different past trends and recent investigations result in differences in participants' corruption perceptions among the five groups. The online evaluation model suggests that people form and update their evaluations based on new information. We design the upward/downward past trends in

Table 1 Anti-corruption investigation conditions of experimental stimuli.			
		Past trend	
		Upward	**Downward**
The number in the most recent year	High	Condition 1- Continuous upward condition (446 participants)	Condition 4- Unexpected increase condition (492 participants)
	Low	Condition 2- Unexpected decrease condition (465 participants)	Condition 3- Continuous downward condition (426 participants)
Undisclosed		Condition 5- Undisclosed condition (488 participants)	

Table 2 The annual figures of corruption investigations in conditions 1–4.			
	Condition 1	Condition 2	Condition 3	Condition 4
	Continuous upward condition	Unexpected decrease condition	Continuous downward condition	Unexpected increase condition
2013	20	20	275	250
2014	52	61	243	217
2015	84	102	212	184
2016	116	143	180	151
2017	148	184	148	119
2018	180	225	116	86
2019	212	267	84	53
2020	243	308	52	20
2021	275	20	20	250

the number of investigations and the high/low number of investigations in the most recent year to explore how corruption perceptions are affected by the fluctuations in the number of investigations (see Table 2 for annual figures). Our experiment design allows us to observe the process by which people form and update their beliefs, shedding light on how individuals react to different past trends and how their perceptions change with the introduction of the most recent information.

The five conditions are as follows:

Condition 1. In the continuous upward trend condition, the annual number of anti-corruption investigations increases from a low level in 2013 to a high level in 2021 ($k = 3194.4$).

Condition 2. In the unexpected decrease condition, the annual number of anti-corruption investigations increases from a low level in 2013 to a high level in 2020 ($k = 4107.1$) and then decreases to the same level as 2013 in 2021.

Condition 3. In the continuous downward trend condition, the annual number of anti-corruption investigations decreases from a high level in 2013 to a low level in 2021 ($k = -3194.4$).

Condition 4. In the unexpected increase condition, the annual number of anti-corruption investigations decreases from a high level in 2013 to a low level in 2020 ($k = -3285.7$) and then increases to the same level as 2013 in 2021.

Condition 5. In the undisclosed condition, the participants were not provided with the annual figures.

The participants were randomly assigned to one of the five groups. After giving the treatments of annual figures, we asked the respondents to evaluate the government's current corruption level. We used the following question to measure it: "To what extent do you perceive the government to be corrupt currently after the 9-year anti-corruption effort?" The respondents were asked to evaluate on a scale from 1 (not corrupt at all) to 5 (extremely corrupt), with a higher score indicating a higher level of perceived corruption.

Results and findings

Descriptive analysis. In support of the random sampling principle, we found no significant differences among the respondents in the five groups regarding gender, $\chi^2 (4) = 1.36$, $p = 0.85$; and age, $F(4, 2312) = 0.71$, $p = 0.59$ (see Supplementary Appendix Table A3).

Regarding the outcome variable, significant differences were observed among respondents' perceived levels of corruption

across the five groups ($\chi^2 = 2072.56$, $df = 16$, $p < 0.001$) (see Table 3). The average perceived corruption level was 2.42 in the undisclosed condition (Condition 5), and it was 1.42 in the continuous downward condition (Condition 3) (see Table 2). In contrast, respondents tended to perceive relatively high levels of corruption (above scale 4) in the other three groups, which were 4.34 in the continuous upward condition (Condition 1), 4.06 in the unexpected decrease condition (Condition 2), and 4.15 in the unexpected increase condition (Condition 4). Among the four treatment groups in our experiment, respondents perceived a high level of corruption when either the trend in the number of anti-corruption investigations was upward or the number of investigations in the most recent year was high.

The online evaluation model proposes that individuals form and revise their perceptions in response to newly released information. Accordingly, Hypothesis 1 predicts that the past trend of investigations and the recent number of investigations work together to affect corruption perceptions. We found that four combinations of past trend and recent number of investigations can generate different levels of corruption perception, which confirmed hypothesis 1 while rejecting the memory-based evaluation model that neglects the critical role of past trend of investigations. Specifically, the perceived level of corruption was low (mean = 1.42) in the continuous downward condition (Condition 3), in which the past trend was downward and the number of investigations in the most recent year was low. It was the opposite in the continuous upward condition (Condition 1), with an average perceived corruption level of 4.34. Respondents perceived high levels of corruption in both the unexpected decrease condition (mean = 4.06) and the unexpected increase condition (mean = 4.15), where either the past trend was upward or the number of corruption investigations in the most recent year was high. Hypothesis 1 is supported.

Hypothesis 2 predicts that the number of anti-corruption investigations in the most recent year can revise people's pre-existing perceptions that are based on past trend. Our experiment reveals that respondents form and revise their evaluations in an online evaluation fashion. In the continuous upward condition (Condition 1), the annual number of corruption investigations continues to climb, reaching the highest level in the final year. In the unexpected decrease condition (Condition 2), the number of corruption investigations surprisingly decreases in the final year after eight consecutive years of growth. Respondents perceived corruption to be prevalent (mean = 4.34) in the continuous upward condition, and the average perceived level of corruption was 4.06 in the unexpected decrease condition. The difference in corruption perceptions between the two groups can be attributed to the decrease in the final year.

Meanwhile, an unexpected increase in the recent number of investigations can reverse people's corruption perceptions that are based on the past downward trend in investigations. Specifically, in the continuous downward condition (Condition 3), the annual number of corruption investigations continues to decline, and respondents perceived the level of corruption to be low (mean = 1.42). In the unexpected increase condition, the number of corruption investigations surprisingly increased in the final year after eight consecutive years of decrease, and the average perceived level of corruption was 4.15. We observe a clear difference in corruption perceptions between the above two groups as a result of the unexpected increase. The sudden change in the most recent year updated people's beliefs and led them to perceive a significantly higher level of corruption. Hypothesis 2 is supported.

Regression results. Building upon the aforementioned analysis, we further test the two hypotheses using the Ordinary Least

Table 3 Descriptive statistics of respondents' corruption perceptions.

	Perceived level of corruption			
	mean	SD	Min	Max
Condition 1 (Continuous upward condition)	4.34	0.48	1	5
Condition 2 (Unexpected decrease condition)	4.06	1.25	1	5
Condition 3 (Continuous downward condition)	1.42	0.51	1	5
Condition 4 (Unexpected increase condition)	4.15	0.76	1	5
Condition 5 (Undisclosed condition)	2.42	1.11	1	5

Table 4 Regression results for respondents' corruption perceptions.

	Perceived level of corruption			
	Model 1	Model 2	Model 3	Model 4
Past trend in number of investigations	1.32*** (0.05)		1.39*** (0.04)	2.61*** (0.04)
Recent number of investigations		1.46*** (0.05)	1.52*** (0.04)	2.71*** (0.04)
Past trend in number of investigations* Recent number of investigations				−2.39*** (0.05)
Gender	1.18*** (0.05)	1.19*** (0.05)	1.20*** (0.04)	1.17*** (0.03)
Age	0.001 (0.003)	0.004 (0.003)	0.002 (0.002)	0.001 (0.002)
Observation	1829	1829	1829	1829
F	375.33	458.99	908.97	1923.58
Adj R-squared	0.38	0.43	0.67	0.57

Standard errors in parentheses, $*p < 0.05$, $**p < 0.01$, $***p < 0.001$.

Squares (OLS) regression method. Respondents' corruption perception is the dependent variable, while the past trend in number of investigations and the recent number of investigations are the two independent variables, coded as dummy variables (upward = 1, downward = 0; high = 1, low = 0). Our analysis takes gender (coded as a dummy variable, male = 1, female = 0) and age (a continuous variable) as control variables. The results are reported in Table 4. In Model 1 and Model 2, each independent variable is included separately while controlling for respondents' gender and age. Model 3 contains all independent variables and control variables. Model 4 introduces an interaction term between the explanatory variables to assess whether the recent number of investigations can reverse people's corruption perceptions that are based on the past trend in number of investigations.

Model 1 and Model 2 reveal that either the past trend in the annual number of investigations ($\beta = 1.32$, $p < 0.01$) or recent investigations ($\beta = 1.46$, $p < 0.01$) is positively correlated with the perceived level of corruption, respectively. Model 3 further verifies that respondents' corruption perception is simultaneously related to the annual number of investigations ($\beta = 1.39$, $p < 0.01$) or recent investigations ($\beta = 1.52$, $p < 0.01$). This suggests that individuals perceive a high level of corruption either when the past trend is upward or when the recent number of investigations is high. Thus, Hypothesis 1 and the online evaluation model are supported. In other words, the above results also suggest that respondents' corruption perception is not solely shaped by the recent number of investigations that is argued by the memory-based evaluation model.

The interaction between the past trend and the recent number of investigations shows a significant association with corruption perception ($\beta = -2.39$, $p < 0.01$), as shown in model 4. The interaction effect is graphically depicted in Fig. 1, which plots two regression lines for upward and downward past trend in numbers, indicating that the recent unexpected corruption numbers can influence and even reverse people's corruption perceptions that are based on trends over the past several years. The plot reveals that the impact of the recent number of
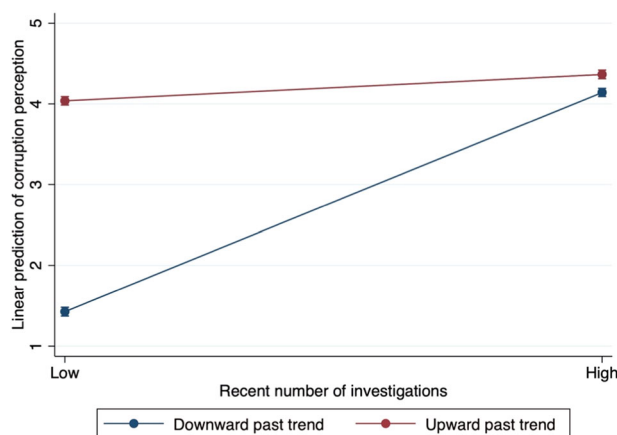

Fig. 1 Interaction effect of past trend and recent number of investigations on corruption perception. The linear predictions for the recent number of investigations on corruption perception, depending on whether the past trend in the number of investigations is upward or downward, are presented. The "recent number of investigations" is coded on the x-axis. The red line represents the participant group with an upward past trend, while the blue line represents the participant group with a downward past trend of investigations.

investigations on corruption perception is heightened when respondents have experienced a downward past trend in number of investigations. In other words, the marginal reverse effect of the "Unexpected Increase Condition" ($|4.15-1.42| = 2.73$) outweighs that of the "Unexpected Decrease Condition" ($|4.06-4.34| = 0.28$). This further bolsters the support for Hypothesis 2.

Discussion. This work explores how the formation of corruption perceptions is affected by fluctuations in the annual number of corruption investigations. In the experiment, we assigned

different groups to upward/downward trends in the annual number of investigations and high/low number of investigations in the most recent year. After receiving the treatments, respondents were asked to evaluate their perceived level of current corruption.

The result suggests that when informed about a large number of corruption investigations launched during a long-term anti-corruption campaign, people tend to perceive the current corruption level to be relatively low (mean = 2.42). However, when being provided with the annual figures, people's perceptions of government cleanliness can vary depending on the sequence of information. This indicates that corruption perceptions are formed in an online evaluation fashion rather than a memory-based fashion and are affected by both recent investigations and past trends in the number of investigations. Specifically, people perceive a high level of corruption when either the past trend in the annual number of corruption investigations is upward or the number of investigations in the most recent year is large. Our regression analysis further confirms that respondents' corruption perceptions are positively associated with both recent investigations and past trends in the number of investigations, aligning with the propositions of the online evaluation model.

These findings fit with previous studies suggesting that anti-corruption efforts can lead people to perceive corruption as more prevalent. Moreover, this study focuses on a sustained anti-corruption campaign and provides evidence that it is not only the total number of investigations or recent investigations that affect corruption perceptions but also the fluctuations in the annual number of investigations. Different trends in the annual number of investigations result in different corruption perceptions. A continuous downward trend leads people to believe that corrupt officials have been removed and perceive a low corruption level. Conversely, a continuous upward trend leads people to believe that corruption is prevalent and perceive a high corruption level.

People revise their corruption perceptions based on new information from recent investigations, and the extent of revision is influenced by pre-existing attitudes that are associated with past trends. Comparing the perceived levels of corruption in the downward trend condition and the unexpected increase condition, we find that an unexpected increase following a downward trend leads people to update their perceptions and perceive more corruption than they may do in a downward trend condition. Meanwhile, an unexpected decrease following a continuous upward trend does not convince people that the government has successfully reduced its corruption level, and the perceived level of corruption does not significantly decrease compared with that of the upward trend condition. This suggests that corruption perceptions can be revised as new information is received, and individuals may have their own interpretations of the unexpected decrease or increase, leading to varying perceptions of corruption levels.

Conclusion and limitations
Conclusion. Corruption, which poses a significant challenge to good governance, is a concern for governments worldwide. Many governments resort to anti-corruption campaigns to tackle this issue, and in some countries, these campaigns are sustained over time.

Previous studies have indicated that anti-corruption investigations can have mixed effects on corruption perceptions. In the short term, investigations may increase corruption perceptions by exposing corruption scandals. However, in the long run, they are expected to have a positive influence by signaling that authorities are taking action against corruption to reduce its prevalence. This study furthers the understanding by analyzing how anti-

corruption investigations influence corruption perceptions in sustained campaigns. It argues that each year's anti-corruption investigations can be seen as a result of previous anti-corruption efforts. Therefore, the total number of investigations within a specific period is not sufficient to explain corruption perceptions, and fluctuations in the annual number of investigations can serve as indicators of a campaign's effectiveness and affect how corruption is perceived. Building upon the online evaluation model, this work highlights the significance of past trends in the annual number of investigations and recent investigations, as well as their varied combinations, in explaining the evolving perceived level of corruption within a sustained campaign.

To explore citizens' corruption perception formation, we conducted a survey experiment in China. The findings reveal how year-to-year fluctuations in the number of corruption investigations affect individuals' perceptions. It demonstrates that corruption perceptions are formed in an online evaluation fashion. Individuals spontaneously form and revise their perceptions based on new information about annual figures. People's current perceptions are built on their prior beliefs, which are affected by past trends of corruption investigations, and they update their perceptions in response to recent investigations.

More specifically, an upward trend in the annual number of investigations correlates with high corruption perceptions, while a downward trend evokes the opposite effect. Unexpected new information can reverse individuals' corruption perceptions that are based on the past trend in the annual number of investigations. An unexpected increase following a downward trend significantly leads people to perceive more corruption. In contrast, an unexpected decrease has a comparatively minor effect in revising their existing negative perceptions.

This study contributes to the existing literature on the effects of anti-corruption investigations on corruption perceptions, particularly in the context of sustained campaigns. It sheds light on how corruption perceptions can be affected by past trends in the annual number of anti-corruption investigations and recent investigations. Importantly, it highlights that corruption perceptions are formed in an online evaluation fashion. People view the number of anti-corruption investigations as quantitative evidence of the effectiveness of previous efforts, interpreting a downward trend as progress in combating corruption. These findings are of interest to those studying corruption perceptions, government satisfaction, and public opinion. They suggest that governments should initiate anti-corruption efforts early to avoid counterproductive outcomes in sustained campaigns. The findings of this paper can also be applicable to other nations where governments publicly report anti-corruption information.

It is worth noting that this work does not enumerate and analyze all possible fluctuations in the annual number of corruption investigations. Further research should thus explore fluctuations that may lead people to perceive a low level of corruption. For instance, can an unexpected decrease lasting for 2 or 3 years result in the perception of a clean government?

Limitations. This study did not control for individuals' corruption experiences, which may influence respondents' corruption tolerance, and individuals' educational background, which may influence their ability to read, analyze and interpret anti-corruption information. Moreover, we posted the recruitment advertisement in the comments sections of hot news posts on Weibo. The sample in this study represents social media users who are likely to engage in public affairs and give their comments, but it does not represent the general population in China. Social media have been extensively used to access news information, and as Gonzalez-Bailon et al. ([2010](#)) find, online discussions, although

not demographically representative of the population, are representative of public opinion trends. However, further investigations are needed to determine whether the findings are generalizable to the general population.

Moreover, our experiment cannot perfectly simulate the complexity of reality. In reality, the media may delve deeply into the details of sensational corruption cases, which has been found to increase corruption perception (Sun et al., 2022). Furthermore, in order to avoid the possible influence of individuals' pre-existing political attitudes and their knowledge about the anti-corruption campaign, our participants were presented with a fictitious country. However, this may limit the external validity of the study to a certain extent.

Data availability

The datasets generated or analyzed during this study are available from the corresponding author upon reasonable request.

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Author contributions

YP did the conception and design, literature research, analysis, and interpretation. ZS performed the research, collected the data, and analyzed the data. ZY did regression analysis and interpretation. All authors contributed to drafting and revising the manuscript. All authors gave final approval of the paper as well as their agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Competing interests

The authors declare no competing interests.

Ethical approval

This study followed the ethical guidelines in the Declaration of Helsinki. Approval for this particular type of study was not required in accordance with the policy of the corresponding author's institution.

Informed consent

Informed consent was obtained online from all individual participants included in the study prior to the enrollment. The consent form is available (in Chinese) upon request.

Additional information

Supplementary information The online version contains supplementary material available at https://doi.org/10.1057/s41599-023-02084-0.

Correspondence and requests for materials should be addressed to Yating Pan.

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