

Technological Advance, Intellectual Property Rights and Media Bias: Evidence from China's Newspaper Industry¹

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Abstract

This study examines the interplay between technological advancements, intellectual property rights enforcement, and media bias, with a focus on how practices like copyright infringement by platforms supported by lenient government policies push financially struggling newspapers in China toward pro-government reporting during their digital transition. We find that expanded 3G coverage significantly increased political bias in favor of the government, as newspapers, facing declining advertising revenues, became more reliant on government subsidies. This shift led to a stronger alignment with state propaganda, a decline in critical reporting, and an increase in entertainment content to retain readership. Falsification tests confirm that these effects are specifically tied to the 3G technology breakthrough, which enabled news browsing on mobile phones, and do not extend to earlier breakthroughs such as 2G. The results hold when using lightning frequencies as an instrumental variable.

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1 Introduction

The advance of information technologies has not fortify democracy as once anticipated, but instead witnesses increased political polarization, a revival of nationalism, and a resurgence of strongman rule. These changes in the political landscape can be partially attributed to the influence of new technologies on the media sector, which reshaped public attitudes, as evidenced in China where the political centralization that began after 2013 coincided with a notable shift in the media landscape toward a pro-government bias during the same period. However, given this context, an intriguing question arises: what underlying mechanisms or dynamics of technological advancements contribute to the media's increasing alignment with pro-government narratives?

While censorship is a notable way technology affects the media, this paper focuses on a different challenge: the poorly enforced intellectual property rights amid newspapers' shift to digital. During this digital shift, platforms like *Toutiao*, one of China's largest mobile news aggregation platforms which sharing ownership with TikTok, blatantly scrape online newspaper content to attract traffic. The Chinese government's lenient stance on copyright infringements, coupled with minimal penalties, essentially endorses this practice. As mobile platforms like *Toutiao* become the primary news source, newspapers find themselves cornered into selling their content at minimal prices, forfeiting their ability to monetize online content. This forces reliance on local government subsidies, significantly biasing their reporting in favor of the government.

Utilizing the regional variances in China's 3G coverage, this study explores the impact of 3G technology on local newspapers' political leanings. Adopting the methodology from Qin et al. (2018), we develop an index to measure newspapers' political bias by categorizing content into themes such as government-endorsed reporting, sensitive or negative coverage, and commercial content. The analysis focuses on prefecture and county-level newspapers, which are more market-oriented and therefore more vulnerable to the financial pressures brought by shrinking readership and advertising revenues due to mobile internet adoption. The results show that 3G coverage significantly increased the political bias of these newspapers, pushing them to align more closely with government narratives. Also, dynamic event studies highlight that the impact of 3G unfolded gradually as newspapers adjust their strategies to the new technological landscape.

To address potential endogeneity concerns, we employ lightning strike frequency as an instrumental variable to capture exogenous variations in the speed of 3G network expansion. Lightning strikes affect the cost of maintaining mobile network infrastructure, leading to slower 3G rollout in high-frequency regions. The results confirm that 3G expansion causally increased media bias, with IV estimates showing a stronger effect compared to OLS, consistent with heterogeneous impacts on regions more constrained by lightning frequency.

We conduct extensive robustness checks, including alternative measures of media bias, placebo tests using 2G networks and broadband internet, to ensure the validity of the results. The findings remain consistent across alternative measures of media bias and adjustments for population density, supporting the robustness of the analysis. Placebo tests with 2G networks and broadband internet coverage further confirms that the observed effects are unique to 3G's capabilities in facilitating mobile internet access.

Finally, mechanism analysis reveals that declining advertising revenues drive newspapers to increase reliance on government subsidies, thereby aligning content more closely with state propaganda. Furthermore, we identify significant heterogeneity in the effects of 3G expansion across different regions, reflecting variations in local market conditions and government control. Through these methodological advancements, this study contributes to the broader understanding of how digital innovation interacts with media economics and political control in contexts characterized by centralized economies.

Broadly speaking, this article contributes to the growing literature on the political effects of the internet and social media. Several studies have shown that access to broadband internet hurts the incumbents' political position. For example, the expansion of high-speed cable internet in Malaysia was shown to have contributed to ending the corrupt ruling coalition's 40-year monopoly on power (Miner 2015). In South Africa, the spread of mobile internet also shifted votes away from the ruling political party (Donati 2019). Social media has helped coordinate protest activity in Russia (Enikolopov et al., 2020). Recent studies, such as those by Guriev et al. (2021), demonstrate how mobile broadband reshapes political attitudes by exposing corruption and challenging existing power structures.

Our research also contributes to the study of the role of media in democratic processes. It has long been a central theme in economics and political science, yielding two distinct perspectives. Prat and Strömberg (2013) exemplifies the optimistic view, arguing that media enhances democratic quality by informing rational voters, thereby aligning electoral outcomes with the quality of governance. From this perspective, media empowers voters through information dissemination, fostering transparency and accountability. Conversely, a critical perspective highlights media's potential to distort public opinion through propaganda and the exploitation of cognitive biases. Pioneering studies such as Krosnick and Kinder (1990) and Iyengar and Kinder (1987) emphasize the manipulative dissemination of information that renders audiences susceptible to becoming "victims" of misinformation. Entman (1993) further argues that such media bias not only misguides voters but also limits democratic representatives' capacity to respond effectively to public opinion. These dynamics, often termed "media bias," are frequently linked to deliberate state control of information, particularly in autocratic regimes (Adena et al., 2015; Yanagizawa-Drott, 2014). Empirical studies underscore the societal costs of propaganda, such as diminished public trust and reduced accountability, while also demonstrating the importance of media freedom in curbing corruption and enhancing government oversight (Brunetti & Weder, 2003; Enikolopov et al., 2011).

This paper fits into studies of the media control. In the context of China, the media operates under strict state supervision, adhering to the Chinese Communist Party's (CCP) propaganda goals (He, 2007). This "prosperity without freedom" phenomenon illustrates how economic liberalization coexists with rigid political control, limiting the media's ability to foster rational discourse. Scholars have noted that Chinese media bias often reinforces stereotypes and social norms, creating entrenched regional disparities. Such biases not only misrepresent reality but also influence political attitudes and civic engagement. These findings highlight the dual economic and political functions of media in centralized economy settings, where profitability often coexists with state-directed content (Qin et al., 2018).

The rest of the paper proceeds as follows. The next section describes the institutional background. Section 3 explains how we measure the political bias of Chinese newspapers and 3G coverage. Section 4 presents the empirical analysis of media bias, with robustness checks as well

as causal inference. Section 5 explores the mechanism, while we illustrate the heterogeneity in Section 6. We discuss the significance of our findings in Section 7. Section 8 concludes. All appendix material is found in the Appendix.

2 Institutional Background

2.1 Newspaper Regime in China

Newspapers, as a vital medium for disseminating news and information, occupy a central role in the mass media ecosystem and represent an indispensable form of traditional media. A defining feature of newspapers in China is their assignment to fulfill political propaganda tasks. Nonetheless, the newspaper industry was once one of the most profitable in China. To facilitate a deeper understanding of China's newspaper industry and provide context for subsequent analyses, this section summarizes the key characteristics of the sector.

First, regarding ownership, all newspapers in China must be wholly or predominantly state-owned. These publications are required to be affiliated with a supervising government authority, which holds ultimate personnel appointment and dismissal powers and oversees critical editorial matters. Control over non-national newspapers is decentralized, with local governments assuming leadership and regulatory responsibilities.² Typically, lower-tier newspapers operate independently from those at higher levels. As direct owners, local CCPs oversee the newspapers under their jurisdiction, support their operations through fiscal allocations, and exercise the authority to claim and distribute their financial returns.

Second, the primary political objective of Chinese newspapers is to implement the ideological and policy directives. This includes safeguarding national security, maintaining fiscal revenues, and ensuring high employment levels—objectives aligned with a media policy designed to mobilize political action and sustain regime stability. To this end, newspapers are tasked with promoting the CCP's ideology and leadership, disseminating the Party's decisions and government

² The ownership structure of Chinese newspapers aligns with the hierarchical levels of the Chinese Communist Party of China (CCPC) system, spanning the national, provincial, prefecture, and county levels.

policies to officials and the public, and suppressing news that could negatively impact regime stability (Zhao, 1998).³ Non-compliance with Party directives may result in severe consequences, such as the withdrawal of published editions, license revocation, dismissal of editors, or demotion of relevant government officials (He, 2007).

Third, Chinese newspapers once enjoyed substantial profit margins. Starting in 1979, China began to allow several provincial-level newspapers, including *People's Daily*—the most important mouthpiece of the CCP—to generate advertising revenue and profits. The profit objectives of newspapers were formally approved by regulatory authorities in 1988. Newspapers owned by the CCP came to be regarded as quasi-state-owned enterprises and operated under the slogan "supervised by politicians, managed by entrepreneurs." It is estimated that by the late 1990s, advertising revenue accounted for at least 70% of the total income of mainstream newspapers (Man, 2001). The profits of newspapers not only sustained their own operations but also served as an important source of local government finances. In the 1990s and early 2000s, many newspapers, including several Party Dailies, were among the largest taxpayers in their respective regions. The profits from newspapers could support local fiscal budgets through the elimination of subsidies, taxation, and residual revenues.

Although Party Dailies were primarily subscribed to by government officials, employees of public institutions, and members of the CCP, their readership varied significantly across regions and time periods. In the 1980s, subscriptions to Party Dailies in many provinces and localities doubled or even tripled. One supporting piece of evidence is the establishment of non-governmental distribution networks, including street vendors, during this period, which were designed to meet the growing demand for newspapers and diverse information (Wu, 2004). According to a survey of newspapers in nine developed provinces, the major Party Dailies had

³ These newspapers are categorized into different types, including Daily, Evening, and Metro (or similar designations). The Daily newspapers serve as the official mouthpiece of the CCPC, with their editorial policies strictly governed by the propaganda department of the corresponding CCPC level. In contrast, Evening and Metro newspapers are subject to relatively less stringent editorial and managerial controls. The primary distinction between these two categories lies in their publication schedules: Evenings are typically published in the afternoon, while Metros are released in the morning. Since the 1990s, general-interest newspapers have been permitted to establish subsidiary publications, often named Evening or Metro. These subsidiaries feature more content unrelated to propaganda and actively incorporate non-state capital. The marketization of China's newspaper industry exhibits an uneven trajectory, with non-party-affiliated newspapers advancing in market-oriented reforms more rapidly than national or party-affiliated newspapers.

daily circulations exceeding 500 thousand copies, with revenues comparable to the most profitable state-owned enterprises at the time (Yang and Sun, 2001).

2.2 Expansion of 3G Technology

The third-generation (3G) mobile networks represent a qualitative shift from previous communication technologies and serve as a key driver of the rapid dissemination of network content and information. 3G is the first generation of mobile broadband internet technology that allows users to freely browse websites, access media, upload videos, or interact with others via video on mobile devices such as smartphones. The qualitative change brought by a mobile broadband connection primarily stems from certain mobile applications (Apps), notably social media platforms like WhatsApp, Telegram, and China's WeChat (Rainie and Wellman, 2012). This shift also includes content providers that generate advertising revenue through user traffic, such as *Toutiao*, a popular Chinese news aggregation platform. These platforms are particularly suited to users of mobile broadband. The convenience of mobile connectivity allows users to participate in online activities anytime and anywhere. Although these applications can be accessed via fixed internet connections, the vast majority of active social media users engage with these platforms through their mobile phones.⁴ The widespread adoption of 3G networks has influenced internet users' behavior and content producers' business operations through three main channels: the probability of obtaining a connection (the extensive margin), the amount of time spent online (the intensive margin), and online behaviors (Qin et al., 2018).

The adoption of 3G technology in China was a gradual process, initiated by national-level policy support and the issuance of licenses. On April 1, 2008, China Mobile launched its 3G services in a pilot program across eight relatively developed cities, including Beijing. These cities' users became the first to experience 3G networks.⁵ By the end of 2008, the number of 3G users nationwide had reached 419,000. In 2009, the Ministry of Industry and Information Technology (MIIT) granted 3G licenses to China's three major telecommunications operators, marking China's

⁴ According to YouTube, more than 70% of YouTube watch time comes from mobile devices. See <https://www.youtube.com/intl/en-GB/about/press/>, accessed July 19, 2020. Twitter reports that already by 2012, two-thirds of its users were mobile, and by 2015 the share of mobile users had reached 80%. See <https://www.statista.com/chart/1520/number-of-monthly-active-twitter-users/>, accessed July 19, 2020).

⁵ See https://www.miit.gov.cn/jgsj/yxj/xxfb/art/2020/art_0dc9abf55154455b87fc7aea6b19674d.html.

official entry into the 3G era.⁶ As 3G base stations continued to be built, the network's coverage gradually expanded to more cities, leading to a rapid increase in the number of users. By 2011, 3G coverage had extended to virtually all cities at or above the prefecture level, as well as most county towns, townships, major highways, and scenic areas. The number of 3G base stations reached 714,000, and the number of 3G users had grown to 73.76 million.⁷ In 2013, the number of new 3G users exceeded 100 million, bringing the total number of users to 250 million, with a penetration rate of 28.2%.⁸ This growth not only reflects the widespread adoption of 3G technology but also underscores the surge in demand for mobile internet services. Furthermore, the diffusion of 3G technology showed regional disparities, with the telecommunications industry in the southeastern coastal provinces developing at a notably faster pace.⁹

2.3 3G technology and Intellectual Property Infringement

Since the nationwide adoption of 3G technology, the Chinese media industry has undergone significant transformation, with a marked negative impact on the print media sector, leading to a decline in its profitability. First, the limitations of traditional media distribution. The medium of print media is paper, which cannot compete with the speed and convenience of mobile networks in terms of cost and accessibility. In the era of information "fast food," the publication speed of newspapers lags far behind the real-time updates provided by online news, resulting in poor timeliness. Second, the lack of content diversity and interactivity in traditional print media. Due to space and cost constraints, newspapers are heavily limited in the amount and type of content they can publish, which pales in comparison to the openness and richness of online information. Moreover, print media is notably deficient in interactivity, unable to gather user feedback or facilitate real-time communication in the way mobile applications can. As a result, an increasing number of readers have shifted to mobile devices and new media platforms for reading, browsing, searching, and interacting, leading to a sharp decline in the readership of print media. This has caused a dramatic shift from bustling newspaper stands to an increasingly deserted market. On the other hand, print media has also relied on advertising revenue as its main profit model. As mobile

⁶ See <http://www.chinanews.com.cn/cj/cyzh/news/2009/01-07/1518148.shtml>.

⁷ See https://www.miit.gov.cn/gxsj/tjfx/txy/art_4430424e5a4a4963abc796e6d07225f9.html.

⁸ See <https://www.isc.org.cn/article/27305.html>.

⁹ See https://www.miit.gov.cn/jgsj/yxj/xxfb/art/2020/art_844bec63c9384332803f01ab2a077b13.html.

network technology expanded, advertisers redirected their investments into online ads, which attracted greater traffic, thus significantly squeezing the advertising revenue of print media.

In the face of the challenges posed by new media, traditional print media must adapt their business strategies. However, the ineffectiveness of intellectual property protection has made this transition less promising. Traditional print media, such as newspapers, have explored diversified business models, including building proprietary platforms, developing independent media apps, joining major social media platforms, and adopting subscription-based revenue models, all in an attempt to generate more profit. Yet, these efforts have failed to restore print media's previous profit levels. The primary reason lies in intellectual property protection issues, which constitute a significant challenge for traditional media. Original works created through substantial investments in human resources, material, and editorial costs are often illegally reproduced and used by online media without permission, allowing perpetrators to steal, disseminate, and profit from them at minimal cost, often reaping substantial advertising revenue.¹⁰ This leads to severe, multifaceted losses for traditional media and disrupts the healthy development of the news industry. The main issue is that the rapid development of new media has intensified the difficulty of copyright protection for traditional publishing.¹¹ Mobile networks have made it possible for every user to become a distributor of copyrighted works. Public awareness of intellectual property rights and the willingness to pay for content were relatively weak in China in earlier years. During the process of copyright works being disseminated, infringement is often difficult to identify, evidence of infringement is hard to gather, and copyright infringement lawsuits are time-consuming, expensive, and yield minimal compensation, which has undermined the confidence of traditional publishers in defending their copyrights.¹²

¹⁰ "If you don't count the printing cost, the cost of each word of the New Beijing News is five RMB, but the copyright revenue is very low, and it is difficult to defend the copyright." A relevant person in charge of the New Beijing News lamented. See <http://media.people.com.cn/n/2014/0614/c40606-25148890.html>.

¹¹ According to the data, local people's courts nationwide received and concluded 88,583 and 88,286 new intellectual property civil cases of first instance in 2013, representing an increase of 1.33% and 5.29%, respectively, over 2012. Among them, 51,351 new copyright cases were received, a year-on-year decrease of 4.64%.

See <https://www.chinanews.com/cj/2014/06-25/6318361.shtml>.

According to the Haidian District Court in Beijing, as of September 2015, the number of traditional media suing online media for copyright infringement cases accepted by the court had already doubled compared to the number of cases accepted in the whole of the previous year. See <http://culture.people.com.cn/n/2015/1014/c172318-27695400.html>.

¹² See <http://ip.people.com.cn/n1/2020/1221/c136655-31973571.html>.

In China, the news aggregation platform *Toutiao* is notorious for its copyright infringement activities. Launched in August 2012, *Toutiao* claimed to be merely a "news aggregator," using machine algorithms to capture and promote articles, thereby enhancing the visibility of original content creators. However, the platform extensively reposted news from traditional media outlets, amassing 120 million users and securing \$100 million in funding, while paying nothing to traditional media for copyright fees. In June 2014, *Guangzhou Daily* filed a lawsuit against *Toutiao*, accusing it of massively reposting articles and severely violating the intellectual property rights of the plaintiffs. Both parties presented their arguments, but the tribunal did not issue a judgment on the case immediately.¹³ In August 2015, *Chutian Metropolis Daily*, a media outlet under Hubei Daily Media Group, also sued *Toutiao*, alleging that since January 2013, the platform had used a large amount of the plaintiff's original works—text, images, and other content—without permission and without compensation, through illegal reposting.¹⁴ However, these two cases did not curb *Toutiao*'s copyright infringement practices. In addition, *Toutiao* was also sued by Tencent, Phoenix New Media, and Sohu. In July 2017, Tencent prevailed in 287 copyright infringement disputes, with each report compensating between 810 and 1,980 RMB, totaling only 270 thousand RMB.¹⁵ Due to the difficulty of collecting evidence, the lengthy legal process, and the underdeveloped intellectual property protection system, such cases often take a long time to resolve. For example, the copyright dispute between *Modern Express* and *Toutiao* lasted three years before reaching a final judgment, with the platform ultimately ordered to pay over 110 thousand RMB in damages. Such low-cost violations are clearly difficult to deter.

2.4 Newspaper Survival and Political Bias

A stable source of funding is a prerequisite for the healthy operation of the newspaper industry. In China, the primary sources of funding for newspapers have been the "allocation system" and

¹³ These include the influential original work "Inspiration and Reflection on Guangzhou's Suspension of 'Island of Abandoned Babies'" published in *Guangzhou Daily*.

See <http://ip.people.com.cn/n/2014/0606/c136655-25113540.html>.

¹⁴ Chutian Metropolis Daily commentator wrote: "When the cohesion of sweat and blood of the news works, was simple and rough copy, paste, and even arbitrarily tampered with; when the painstakingly polished media brand, was illegally abused and again and again in the dust, we had to take up the weapons of the law."

See http://m.cnr.cn/news/20150812/t20150812_519521280.html.

¹⁵ See <https://bjhdfy.bjcourt.gov.cn/article/detail/2017/07/id/4016042.shtml>.

"marketization." The widespread adoption of 3G technology, however, has disrupted the traditional newspaper industry's path toward marketization. We define the operational model dependent on CCP or government fiscal funds as the "allocation system" and the one dependent on advertising, audiences, and industry support as "marketization." Since the inception and development of China's newspaper industry, its funding sources have oscillated between these two models, forming two distinct types: the "blood transfusion" model, where the allocation system predominates and marketization plays a supplementary role, and the "blood production" model, where marketization is the primary source of funding, with the allocation system serving as a supplement. Since 2016, traditional print media have faced even greater challenges, with many newspapers sinking into the quagmire of losses, unable to continue operations and forced to shut down. The commercial model of "secondary sales" for traditional media has become increasingly unfeasible, and newspapers can no longer rely on self-generated profits to sustain their operations.

The reliance on a singular source of funding has raised concerns regarding the quality of newspaper journalism and potential media bias. In order to ensure the normal supply of news as a "quasi-public good," and more importantly, to maintain the continuity of its propaganda tasks and public opinion guidance, the state has incorporated news provision into the public cultural service system through government purchases of services. This has been funded via fiscal subsidies provided by governments at various levels. According to publicly available data, starting in 2013, regions such as Guangdong, Shanghai, Chongqing, and Hebei have provided direct financial support to local newspapers through fiscal subsidies and various preferential policies.¹⁶ While some applaud this approach as a positive intervention, others argue that it may lead to media outlets

¹⁶ From 2013 to 2015, the Guangdong Provincial Party Committee and Provincial Government took out 150 million yuan in cash each year and gave 70 million yuan to Nanfang Daily and 50 million yuan to Yangcheng Evening News. Starting from 2016, the amount of support was increased to 200 million yuan in cash per year; the Shenzhen Municipal Party Committee and Municipal Government each gave 100 million yuan in cash to the Shenzhen SAR Newspaper Group each year for six consecutive years; the Chongqing Municipal Party Committee and Municipal Government gave 100 million yuan in financial allocations to Chongqing Daily each year and purchased 100,000 copies of Chongqing Daily at the expense of the treasury; the Zhuhai Municipal Party Committee and Municipal Government gave 30 million yuan in financial support to Zhuhai SAR Newspaper each year; and the province of Jilin, Inner Mongolia Autonomous Region to bear the distribution of provincial party newspapers by financial contribution; Shanghai Municipal Party Committee and Municipal Government to purchase 100,000 copies of Shanghai Observatory by financial contribution; Hebei Province has also issued relevant policies to require all levels of financial support for media at all levels. On the evening of December 14, 2016, GD Media announced that its wholly-owned subsidiary Guangzhou Daily Newspaper Business Operation Co. Ltd. had received the "Notice from Guangzhou Municipal Bureau of Finance on the Support of Party Newspapers Media Development Funds", arranging RMB350 million to support party newspaper media development funds for the printing and distribution expenses of Guangzhou Daily. See <http://media.people.com.cn/n1/2017/0308/c40606-29131974.html>, and <https://www.lanjinger.com/d/34840>.

overly catering to government interests, thereby compromising journalistic objectivity and lowering content quality. Against this backdrop, this paper examines the impact of the introduction of 3G technology on media bias in newspapers and the underlying mechanisms driving this effect.

3 Data and Measurement Method

3.1 Directory of Chinese Newspapers

This section outlines the key characteristics of the Chinese newspaper industry, drawing heavily on the directory of all Chinese newspapers that published articles between 2008 and 2022. Based on Qin et al. (2018), we construct this newspaper directory from four sources: (i) the *Chinese Newspaper Directory*, published by the National Press and Publication Administration, the authority responsible for issuing newspaper licenses; (ii) the *Annual China Journalism Yearbooks*, published by the Chinese Academy of Social Sciences; (iii) the *China Newspaper Industry Yearbooks*, published by a research institute; and (iv) WiseNews, a Hong Kong-based newspaper content data provider. For each newspaper, we collect information on its headquarters location, publication date, direct ownership, funding sources, government regulatory body, administrative level within the Chinese government hierarchy, and content orientation. Table A1 reports the number of newspapers included in our directory for each year. During the sample period, the WiseNews database contained up to 619 newspapers published in mainland China, with the number of newspapers varying slightly each year. Geographically, these newspapers cover all provinces in mainland China, making our sample representative of the Chinese newspaper market.

The newspapers are classified into four distinct types based on ownership structure and naming conventions: (i) Party Daily, serving as the CCP's official mouthpiece; (ii) Party Evening, including Evening and Metro newspapers directly owned by the CCP; (iii) Subsidiary, encompassing Evening and Metro publications owned by parent newspapers; and (iv) Other, covering content-focused publications such as digest general, field industry, economics, law, life services, entertainment, and sports. Panel B of Table A1 reports the number of general-interest newspapers by type and administrative level within our sample.

Figure A1 illustrates the historical evolution of Chinese newspapers from 2007 to 2022. In 2007, our newspaper catalog contained 205 publications. Spurred by the self-financing policy and the rapid expansion of the advertising industry, all four types of newspapers entered the market, leading to a doubling in their numbers by 2008. However, 2009—the year when 3G technology was first introduced in mainland China—saw a slight decline in newspaper numbers, although growth resumed in 2010. This trajectory may have been influenced by the global financial crisis and China’s fiscal expansion policies. Subsequently, the number of newspapers stabilized until 2013, when widespread adoption of 3G technology in mainland China marked the beginning of a downward trend. A similar pattern is observed in the right-hand panel of Figure A1, which disaggregates newspaper numbers by administrative level. The decline is particularly pronounced among prefecture- and county-level newspapers, suggesting that these tiers have been the primary drivers of the observed trends in the newspaper market.

3.2 Measurement of Media Bias

We adopt a media bias measure constructed following Qin et al. (2018). Measuring media bias across newspapers presents a significant challenge, as different target audiences may drive variations in focus areas, while linguistic styles can evolve over time. Existing approaches, such as using references to the typical ideologies of think tanks (Groseclose and Milyo, 2005), partisan vocabulary (Gentzkow and Shapiro, 2010), or semantic sentiment analysis (Tetlock, 2007), are unsuitable for Chinese newspapers. This limitation arises from China’s strict censorship regime, which prohibits the publication of any content that opposes the mainstream official ideology or conveys negative sentiment. Qin et al. (2018) offer a viable alternative by proposing an event-based media bias measure. This approach quantifies the extent and stance of newspaper coverage on specific events by analyzing the frequency of articles on common, temporally stable topics. This method enables a systematic assessment of media bias, even within the constraints of the Chinese media environment.

As previously discussed, newspaper content can be categorized into three main types: Party Line, Mass Line, and Bottom Line. Using the digital archives of WiseNews, a Hong Kong-based

newspaper content provider, we searched for keywords related to nine topics under these three themes. The nine topics include Leader mentions, Xinhua cites, Epoch stories, Corruption, Disasters, Accidents, Crime, Sport, and Entertainment. Based on these content categories, we define nine variables. Each variable measures the proportion of articles within a specific category relative to the total number of articles published. This classification provides a structured framework for analyzing the thematic focus of Chinese newspapers.

In the domain of Propaganda, we code three types of content to capture newspapers' adherence to the Party line. First, we count the number of articles mentioning the 7,147 political leaders at or above the division (prefecture) level who held office during the sample period. Second, we compute the number of articles sourced from or citing Xinhua News Agency, a key instrument of the CCP's propaganda objectives. Third, we identify the number of articles reporting on the top ten annual news events listed by Xinhua News and *The Epoch Times*, two media outlets with stark ideological differences. Notably, *The Epoch Times* is a Chinese-language newspaper operated by an overseas organization critical of the CCP. The relative coverage of these two sources serves as a proxy for the omission of unfavorable news relative to political propaganda.

For Monitoring, we capture reports on Corruption, Disasters, and Accidents. Corruption cases are emblematic of top-down accountability mechanisms and a core aspect of the mass line. Major disasters and accidents, particularly those caused by human error or misconduct, are often perceived as reflections of government incompetence or mismanagement. Similar to Qin et al. (2018), we extract data on Chinese disasters and accidents involving more than 30 fatalities from the EM-DAT database. By regulation, events causing over 30 deaths significantly impact local leaders' prospects for promotion. Consequently, local officials often seek to suppress news coverage of such incidents. During the sample period, we identify 158 such events and retrieve the number of articles reporting these incidents within a defined timeframe before and after their occurrence.

In the category of Entertainment, we measure three types of soft news: Sports, Entertainment (e.g., movies and music), and Crime stories. Details on keywords used for these searches are provided in Appendix.

Table 1 presents summary statistics on the proportion of articles dedicated to each topic across the entire newspaper sample. On average, 6.31% of articles mention political leaders, while 2.5% reference Xinhua News Agency. Coverage of the Epoch Times' top ten news stories is approximately 18.7% of the coverage devoted to Xinhua's top ten stories. Corruption-related articles account for 0.25% of total content, disaster-related articles constitute a mere 0.04%, and accident-related stories make up 0.41%. As for Bottom Line topics, 2.32% of articles focus on sports, 2.89% on entertainment, and 1.06% on crime stories.

The right-hand portion of the table disaggregates these statistics by administrative level and newspaper type. Notably, newspapers based in capital cities exhibit the highest frequency of political leader mentions. Party Dailies mention political leaders at twice the rate of other types of newspapers, consistent with expectations that Party-affiliated dailies are more politically controlled. Interestingly, central newspapers report more frequently on corruption and accident-related stories compared to their local counterparts. Similarly, Party Dailies demonstrate a greater focus on these topics, indicating their intensive implementation of the Mass Line. In contrast, Party Evenings and Subsidiaries exhibit greater attention to entertainment-related content. This finding aligns with their positioning as distinct from Party Dailies, targeting a general readership rather than serving as a direct political mouthpiece.

Following Qin et al. (2018), we employ Principal Component Analysis (PCA) to compress the nine variables described earlier into a single scalar, capturing the intensity of political alignment reflected in newspaper content. Appendix Table A2 reports the components and factor loadings of the PCA. Notably, consistent with Qin et al. (2018), the first principal component explains approximately 32.48% of the variation. Figure A2 illustrates the relationship between the PCA first component and two variables: the predicted probability of a newspaper being a Party Daily and predicted advertising revenues. A higher value of the PCA first component indicates greater political bias. The observed correlations are in line with expectations, providing some validation for the feasibility of this measurement approach.

To further assess the reliability of the PCA first component as a measure of media bias, we examine individual newspapers. Table A3 lists the top 10 and bottom 10 newspapers ranked by media bias at the prefecture and county levels. Among the most biased newspapers, nine are

identified as Party-affiliated publications. Conversely, the least biased newspapers are exclusively Subsidiary or Other types. Moreover, significant variation in bias exists across newspapers within each type. As shown in Figure A3, some Party Dailies exhibit lower bias than certain newspapers of other types. However, on average, Party newspapers display higher levels of bias compared to Others, consistent with their more direct alignment with political directives.

3.3 Measurement of 3G Coverage

We utilize data from OpenCellID, the world's largest open database of cell towers, to analyze the distribution of over 1.61 million 3G base stations in China from 2008 to 2022. In prior research, global 3G network expansion data has generally been sourced from Collins Bartholomew's Mobile Coverage Explorer (e.g., Guriev et al., 2021). This dataset compiles coverage maps submitted to the GSM Association by mobile network operators worldwide, representing their interests. However, the database does not include information on 3G coverage in China. An alternative viable source is OpenCellID, which derives base station location data from reports submitted by OpenStreetMap users. This dataset covers global regions, including China. Although OpenStreetMap contributors in China are relatively limited, the database contains information on base stations in densely populated areas across 372 Chinese prefecture-level cities, covering the majority of urban regions. Thus, OpenCellID provides a reasonably reliable estimate of mobile network coverage.

We define 3G network coverage rate based on base station information. OpenCellID includes base station-level details, such as location, network technology type (2G-5G), the date first recorded, the last recorded date, and average signal strength. We imported this geolocation data into ArcGIS to estimate coverage radius and range based on network technology type and signal strength. The typical coverage radius of a 3G base station is approximately 2–5 kilometers; we adopt a 5-kilometer radius to estimate the influence of 3G coverage more comprehensively. After accounting for overlaps in coverage, we aggregate base station coverage areas at the city level. By definition, if a grid cell is covered by 4G or higher technology, it is also considered covered by 3G. Under the assumption that 3G coverage can only expand and not contract, we adjust the raw

base station coverage data accordingly. The 3G coverage rate for each region is then calculated as the ratio of the 3G-covered area to the total area of the region. Figure A4 illustrates the 3G coverage distribution in China in 2022. In general, the more developed eastern regions exhibit higher 3G coverage rates, whereas the western regions, characterized by large areas unsuitable for human habitation, have significantly fewer mobile network base stations. To mitigate the impact of uninhabited areas such as mountainous regions, we assume that all regions achieved full mobile network user coverage in the latest year of available data. Using this assumption, the 3G coverage rate for that year serves as the denominator to estimate annual 3G coverage for prior years.

Figure 1 depicts the annual trends in the average 3G coverage rate and the average predicted newspaper circulation across cities nationwide. It shows that 3G coverage began to increase significantly in 2010, with an accelerated growth rate after 2014. By 2016, the growth slowed as 3G coverage neared saturation, effectively achieving full coverage. In contrast, the average newspaper circulation exhibits a year-on-year decline, with the rate of decrease closely mirroring the trajectory of 3G coverage expansion. Notably, after 3G coverage reached near saturation, the decline in newspaper circulation became more pronounced, suggesting a potentially amplified substitution effect as digital connectivity expanded.

4 Empirical Strategy and Results

4.1 Main Specification

We estimate the impact of the expansion of mobile broadband internet on media bias in Chinese newspapers. As described earlier, we measure each newspaper's media bias and each city's 3G network coverage rate. We then analyze the relationship between newspaper media bias and 3G coverage using a difference-in-differences model with prefecture and year fixed effects:

$$Bias_{irt} = \alpha + \beta_1 3G_{rt} + X'_{rt} \mu_1 + \delta_i + \vartheta_t + \gamma_{p \times t} + \varepsilon_{irt}$$

where i , r , and t index newspapers, prefectures (regions), and years, respectively. The variable $Bias_{irt}$ is our measure of media bias for newspaper i in prefecture r at year t . $3G_{rt}$ represents

the 3G coverage ratio in prefecture r at year t , our main explanatory variable. The time-varying controls X_{rt} include a set of variables at the prefecture level: population, GDP per capita, total employment, and number of foreign-invested enterprises. The first three variables are expressed in logarithmic form. The variables δ_i and ϑ_t are newspaper and year fixed effects. Standard errors are clustered by prefectures.

Based on the earlier discussion of the mechanisms, we posit that mobile network technology influences newspapers' political bias by truncating their path to marketization, thereby increasing their reliance on government subsidies. Central and provincial-level newspapers, given their broader audience reach, are subject to stricter political oversight. Consequently, 3G expansion primarily impacts the political bias of prefecture and county-level newspapers, which were previously more market-oriented. In both our baseline and subsequent analyses, we focus on newspapers at these two administrative levels. Our primary hypothesis is that the expansion of 3G mobile network technology increases newspapers' political bias, suggesting that the coefficient β_1 is expected to be positive.

4.2 Mobile Broadband Internet and Media Bias

Table 2 presents the main results. Column (1) shows regressions including only prefecture-level characteristics, newspaper fixed effects, and year fixed effects. In Column (2), we re-estimate the model while controlling for province $\times$ year fixed effects, relying solely on the differential expansion of 3G across prefectures within the same province. This is a stringent specification as it removes part of the relevant variation, given that 3G networks often expanded simultaneously across all regions within a province. In China, 3G expansion was gradual, with significant autocorrelation in coverage levels within provinces. To exclude the confounding effect of censorship intensity as an alternative explanation, we include newspaper's ownership $\times$ year fixed effects in the regressions to control for changes in the intensity of government censorship across different types of newspapers over time.

The first two columns show the average effect of mobile network technology on the media bias of all prefecture- and county-level newspapers. The coefficient on 3G Coverage is positive

and statistically significant at the 1% level, indicating that the adoption of mobile network technology has indeed increased the political bias of traditional print media. For reference, the median value of media bias in the regression sample is -0.051, with the 10th and 90th percentiles at -0.977 and 0.759, respectively. The economic interpretation of the coefficient on 3G Coverage is as follows: for a representative newspaper with a media bias value at the sample median, a 50% increase in 3G coverage in its region would lead to an increase in media bias by 0.25 (0.005×50), raising it to 0.199, approximately the 75th percentile in the sample.

We also perform robustness checks on the measurement of mobile network coverage. The baseline measure of 3G coverage does not account for regional differences in population density. To verify that our findings are not driven by this factor, Column (3) of Table 2 reports results from the baseline specification while adding year dummies interacted with quintile dummies for population density. The results remain consistent with those in the first two columns, suggesting that our findings are not sensitive to whether 3G coverage accounts for population density. Moreover, differences in the speed of mobile network rollouts may affect local newspaper responses. Faster 3G adoption in a given region is likely to draw greater attention from mobile users, potentially increasing penetration rates. This would amplify the probability of users substituting mobile devices for print media as their primary source of news, intensifying the short-term impact on local newspapers. In Column (4), we use the increase of 3G coverage ratio as the explanatory variable, and the results remain robust, reinforcing the conclusion that the expansion of mobile network technology significantly increases newspapers' political bias.

To further validate the impact of mobile network technology deployment and interpret the results, we examine the effect of 3G coverage on the number of articles related to nine distinct topics in newspapers. The magnitude of the estimated effects is substantial. In Table 3, we rescale the coefficients to measure the effect size of 3G network expansion. We also provide statistical data to better contextualize the magnitude of these effects (as shown in the last two rows of Table 3). For instance, the coefficients suggest that a 1% increase in 3G coverage is associated with a 0.082% increase in the proportion of articles mentioning leaders. Based on this result, on average, if a region transitions from having no mobile network technology to full 3G coverage, the proportion of articles in local newspapers mentioning leaders would increase by 8.2%, or

approximately 0.845 standard deviations (the standard deviation of leader-mentioning articles in the regression sample is 9.7, so $8.2/9.7 = 0.845$). Similarly, a 1% increase in 3G coverage leads to a 0.034% increase in the proportion of articles quoting Xinhua News Agency, and a 0.079% decrease in the bias towards unfavorable propaganda. If a region were to move from no mobile network coverage to full 3G coverage, the proportion of articles quoting Xinhua would increase by 3.4%, or 2.429 standard deviations (the standard deviation of Xinhua-quoting articles in the regression sample is 1.4, so $3.4/1.4 = 2.429$); the bias towards unfavorable propaganda would decrease by 7.9%, or 0.359 standard deviations (the standard deviation of unfavorable propaganda bias in the regression sample is 22.0, so $7.9/22.0 = 0.359$).

Interestingly, the expansion of mobile network technology does not have a significant impact on the coverage of *the Mass Line* in local newspapers. This outcome may be attributed to the fact that the sample period for the regression starts from 2007. As early as 2001, the State Council issued the "Regulations on Administrative Accountability for Major Safety Accidents," which required the involvement of key government leaders and senior officials in accident prevention efforts and the subsequent accountability for such incidents.¹⁷ In cases of accidents caused by inadequate prevention, those responsible, particularly leaders, could face administrative penalties such as demotion or dismissal, significantly affecting their career progression. Furthermore, the *Production Safety Accident Report and Investigation Handling Regulations*, promulgated in 2007, explicitly defined accidents with over 30 fatalities as "particularly major accidents."¹⁸ The *Regulations on Safety Production Responsibility for Local Party and Government Leaders*, issued in 2018, formally introduced a "one-vote veto" system for safety production responsibilities for leaders at the county level and above, stipulating that leaders held accountable for safety violations would be disqualified from performance evaluations, promotions, or reappointment.¹⁹ Therefore, regardless of mobile network coverage, local leaders are likely to tightly control media coverage of such incidents.

We conduct robustness checks on the above results. Appendix Table A4 presents the regression results for 3G coverage considering population density. The coefficient results remain

¹⁷ See https://www.gov.cn/gongbao/content/2001/content_60842.htm.

¹⁸ See https://www.gov.cn/gongbao/content/2007/content_632082.htm.

¹⁹ See https://www.gov.cn/zhengce/2018-04/18/content_5283814.htm.

robust. Additionally, in Appendix Table A5, we report the regression results for an aggregated prefecture-level panel, where we compute simple averages of the dependent variables across newspapers in each prefecture and year. As in the baseline specification, we control for prefecture and year fixed effects, as well as regional covariates (specifically, we include the prefecture's per capita GDP, democracy, employment rate, and the number of foreign-invested enterprises in the set of covariates). The results are consistent and robust.

4.3 2G and Broadband Internet as Placebo Treatments

A potential concern is that 3G mobile network technology might influence the political orientation of newspapers through mechanisms other than providing mobile broadband internet access.

To address this, we first consider the expansion of 2G networks. While 2G allows for voice calls and text messaging, its internet capabilities are very limited, particularly in not permitting unrestricted browsing or mobile news reading. The key difference between 2G and 3G mobile networks lies in the fact that 3G facilitates the instantaneous transmission of photos or videos in news stories—forms that can evoke stronger emotional responses (Castells, 2015, p. 15; Castells, 2019, p. 20; Durante and Zhuravskaya, 2018). Such reactions are politically more significant than text-based information (Guriev et al., 2021). Therefore, mobile applications developed with 3G technology are more likely to attract users and siphon advertising profits from traditional print media. If the political orientation of newspapers is not influenced by mobile networks but by other aspects of communication technology, then 2G expansion would have similar effects as 3G expansion. The results in Table 4 indicate that, compared to 3G, the expansion of 2G networks had no significant impact on the political orientation of local newspapers (Columns (1) and (3)). In Column (3), controlling for the number of 2G users does not affect the estimates of the 3G effect. These findings suggest that the impact of 3G on newspapers is driven by its influence on mobile broadband internet access, rather than by other factors.

Next, we consider the concurrent impact of broadband internet access. In China, the expansion of fixed broadband and 3G mobile network technologies progressed nearly simultaneously. In 2013, China launched the "Broadband China" strategy, positioning "broadband

networks" as a "strategic public infrastructure" essential for economic and social development. The strategy set two phased goals: by 2015, achieve 50% household penetration of fixed broadband, 32.5% penetration of 3G users, and 95% of administrative villages covered by broadband; by 2020, achieve full broadband coverage in urban and rural areas, with 70% household penetration of fixed broadband, 85% penetration of 3G and above technologies, and more than 98% of administrative villages covered by broadband. Therefore, the results from the baseline regressions may not solely be attributed to the expansion of 3G network technology but could also reflect the spread of fixed broadband networks. Moreover, the key distinction between 3G and broadband is that broadband is fixed—it cannot be accessed anytime or anywhere and is limited to use at a computer station, meaning its impact on newspapers may not be as substantial as that of mobile 3G networks. In Column (2) of Table 4, we regress using the number of households with fixed broadband access as the independent variable. The results indicate that fixed broadband access has no significant impact on media bias in newspapers. After controlling for the extent of fixed broadband penetration, the results for 3G coverage remain robust.

We report the p-values from T-tests comparing the coefficients of the main variables with the baseline coefficients in Table 4. The results in Columns (1) and (2) show that the effects of 2G and fixed broadband penetration are significantly different from the effects of 3G coverage. Column (3) presents the p-values from the T-test comparing the 3G coverage coefficient in this regression with the baseline coefficient. This result shows that after controlling for 2G and fixed broadband, the estimated coefficient for 3G coverage does not change significantly. In Appendix Table A6, we also check the effect of 3G coverage on the number of articles related to the nine topics, after controlling for 2G and fixed broadband. The results remain robust.

4.4 Event Study Analysis

In this section, we examine the dynamics of the impact of 3G mobile network technology on newspapers.

First, the effects of 3G mobile network technology on the content bias of newspapers may take time to materialize. After being exposed to 3G technology, readers may not immediately stop subscribing to newspapers, as subscriptions are typically annual. As a result, the impact on

newspaper sales and advertising revenues may not be immediate. In the final column of Table 4, we consider the lagged effects of 3G coverage. The results remain robust.

Second, we conduct an event study to explore the average treatment effect of the introduction of 3G network technology. The results are presented in Figure 2. The figure reports the coefficients on dummies indicating the years around the 3G introduction event, with newspapers' political bias as the dependent variable. We observe that after the introduction of 3G technology, the political bias of newspapers continues to increase. Notably, the treatment effect exhibits considerable variation in later years. A possible explanation for this result is that, a few years after the introduction of 3G, print media began to explore channels to expand their influence through mobile network technology. Some newspapers found a way forward without relying on government subsidies. Therefore, their political bias may no longer continue to increase.

Appendix Figure A5 presents the event study for the number of articles related to the nine topics following the introduction of 3G technology. In these analyses, we focus on a significant increase in the 3G coverage of prefectures. As an event, we consider the cases (i.e., prefecture-year combinations) where the 3G coverage increased by more than 20 percentage points compared to the previous year. During the sample period, the average increase in 3G coverage was 33.73 percentage points. Between 2008 and 2018, there were 125 prefecture-year observations where 3G coverage experienced such a significant increase. The results show that a substantial increase in 3G coverage led to a continued rise in the number of articles related to the Party Line, no significant effect on the Mass Line, and an increase in articles related to the commercial route.

4.5 The Frequency of Lightning Strikes as an IV

An alternative explanation for our baseline results is that regions with stronger political intervention capabilities are more likely to undertake large-scale infrastructure projects, thereby increasing 3G network coverage. At the same time, the political bias of local newspapers may also be more pronounced. In other words, the baseline specification may suffer from omitted variable bias or other endogenous issues.

To address the remaining concerns regarding potential violations of the identification assumptions in our baseline difference-in-differences specification, and following the approach of Manacorda and Tesei (2020) and Guriev et al. (2021), we use variation in the frequency of lightning strikes in each prefecture as an exogenous source of variation in the speed of regional 3G expansion. The frequency of lightning strikes has been shown to impact the diffusion of digital technologies due to the increased expected costs associated with voltage surges and dips (Andersen et al., 2012). The equipment required for mobile network infrastructure is particularly vulnerable to electrical surges caused by lightning strikes, which can lead to immediate damage and accelerate the depreciation of equipment over time (Martin, 2016). We predict that regions with a higher frequency of population-weighted lightning strikes per square kilometer will experience slower 3G expansion. Although power-surge protection systems can mitigate this issue, they are expensive, not always effective, and less readily available in less-developed regions. In wealthier areas, telecom operators are more willing to absorb the costs of natural disaster-related damages, whereas in underdeveloped regions, such efforts are less likely to be made. We estimate the following first-stage equation at the region-year level:

$$3G_{irt} = \nu + \delta \cdot [Linghting_r \times t \times Poor_r] + Z'_{rt}\mu_1 + \delta_i + \vartheta_t + \varepsilon_{irt}$$

where $Linghting_r$ denotes the frequency of lightning strikes of prefecture r ; $Poor_r$ is a dummy indicating the prefecture with below-median per capita income;

We obtained the lightning strike frequency data for each city from the National Meteorological Information Center of China (NMIC). The NMIC data website provides records of cloud-to-ground lightning strikes for most cities in China. We calculated the average number of lightning strikes per city since 1995, and weighted the frequency by the area of each city to compute the population-weighted lightning strike frequency. The final measurement represents the potential degree of impact.

Table 5 reports the regression results for this specification. We find that the adoption of 3G technology is significantly slower in regions with a higher frequency of lightning strikes. This effect is more pronounced—in both magnitude and statistical significance—in prefectures with below-median income. The F-statistics for the excluded instruments are 22.79 and 33.19 in the two specifications, respectively. The second-stage results, presented in columns (2) and (4),

confirm our main finding: 3G expansion leads to a significant increase in newspapers' political bias.

We also report the corresponding OLS estimates, using the same sample as in the IV regression, at the bottom of Table 5. Comparing these estimates to the IV results, we find that the magnitude of the point estimates in the IV regressions is approximately twice as large as in the corresponding OLS regressions. A potential explanation for the difference in magnitude between the OLS and IV estimates is the presence of heterogeneous local average treatment effects (LATE). If 3G expansion has a larger effect on newspapers in regions where the rollout is potentially constrained by the frequency of lightning strikes (complier regions), we would expect the IV estimate to be larger than the OLS estimate.

Overall, the results presented in this section strongly suggest that the positive effect of 3G mobile networks on media bias can be interpreted as causal.

5 Evidence on the Mechanism

In this section, we examine whether and how the availability of 3G networks affects the media bias of newspapers. As discussed in the institutional background section, the rapid expansion of 3G technology significantly altered the way information is disseminated, leading to a dramatic shift in the survival environment for traditional print media. The timeliness and interactivity of 3G networks allowed them to replace print media as the dominant platform for information, putting newspapers under dual pressure from reader loss and declining advertising revenues. This transformation has affected the profit models and business operations of newspapers. To adapt to the new media environment, newspapers have had to adopt diversified business models. However, due to weak intellectual property protection, this transformation has often been only partially successful. Newspapers frequently encounter intellectual property infringement issues during this process, making it difficult for their innovative and original content to be effectively protected, which exacerbates their operational difficulties. This financial pressure may prompt newspapers to rely on government subsidies or fiscal support, potentially increasing their political dependence.

Consequently, the government may require newspapers to adopt specific political stances in exchange for financial support, or newspapers may proactively "cater" to the government's preferences, both of which would lead to greater political bias in their content.

5.1 Newspaper Profitability and Government Subsidy Dependence

We first investigate the direct impact of 3G network expansion on newspaper sales and advertising revenue, and then analyze the impact of newspaper sales on the increase in media bias due to 3G network expansion. Panel A of Table 6 reports the results of the first step. The results show that an increase in 3G coverage leads to a significant decrease in newspaper sales and advertising revenue.

Higher sales indicate that a newspaper is less impacted by the revenue shock caused by mobile networks. Therefore, newspapers with higher sales should exhibit less bias. In the first three columns of Table 6 Panel B, we use newspaper sales, sales volume, and the number of printed pages as measures of sales revenue. These data are sourced from the *Chinese Newspaper Directory*. Since the directory only provides sales data for a subset of newspapers, we predict the sales volume of the remaining newspapers using their characteristics, such as newspaper tier, content type, type of regulator, audience size, publication volume, and years in operation, as well as regional characteristics that change annually. The results show that newspapers with higher sales are indeed less impacted by the disruption caused by 3G technology.

The widespread adoption of 3G technology significantly reduced the profits of newspapers, forcing them to rely on government subsidies. On the one hand, mobile network technology fueled the rapid development of mobile applications, which attracted customers away from newspapers, leading to a decline in newspaper circulation. As a result, advertisers shifted their spending to mobile applications with greater traffic, further squeezing newspaper advertising revenue. Meanwhile, the weak awareness of the need to pay for content, combined with inadequate intellectual property protection, meant that many newspapers could not generate adequate revenue from the reports they invested in producing. This suppressed newspapers' incentives to offer high-quality reporting. These dual factors severely impacted the profitability of newspapers. Faced with

such circumstances, newspapers had no choice but to rely on fiscal support for their operations. The loss of independence inevitably affects their content and exacerbates political bias.

In Column (4), we introduce newspaper advertising revenue. Advertising revenue data are sourced from the *China Newspaper Industry Yearbooks*. Similarly, only a small number of newspapers report their advertising revenue. We use the same method to predict the advertising revenue for the remaining newspapers. The results show that newspapers with higher advertising revenues are less likely to have their content bias influenced by external factors.

Column (5) directly considers the effect of government fiscal support. Government subsidy data are obtained from the statistical yearbooks of each city. We use expenditures on "culture, sports, and media" within fiscal spending as a measure of a newspaper's reliance on government financial support. Although this indicator serves as a rough estimate, it is the most appropriate data available to us. We find that newspapers in cities with greater fiscal reliance exhibit more pronounced content bias.

The ability of newspapers to generate revenue through other channels also determines their content orientation. To survive in the mobile internet era, newspapers need to proactively develop online services. In Column (6), we consider newspapers' online dissemination capabilities as a measure of their ability to generate revenue through other channels. The data come from *People's Daily*, which since 2013 has ranked newspapers based on their mobile dissemination influence in China, using a list called the "Top 100 Newspapers in Mobile Dissemination." The metrics include comment volume, user subscriptions, user activity, push notifications, and ratings. We find that newspapers ranked among the top 100 are less affected by the impact of 3G technology on their content. This suggests that other revenue channels help maintain their independence.

5.2 Intellectual Property Protection

In Table 7, we examine regional heterogeneity in intellectual property infringement and protection. Column (1) uses the number of intellectual property cases filed in each region as a measure of the extent of infringement. On the one hand, a higher number of cases likely indicates more lawsuits filed by traditional media against online media for infringement, reflecting the degree to which local newspapers are directly affected by infringement. On the other hand, a higher

number of cases also suggests a stronger perception of the difficulties involved in protecting intellectual property, which may undermine newspapers' confidence in pursuing a market-oriented path. Both of these pathways are likely to drive local newspapers to rely more heavily on fiscal subsidies, thereby increasing media bias. It is important to note that the number of filed cases may not perfectly represent the extent of infringement, as newspapers in less-developed regions may have a lower awareness of intellectual property rights and may not resort to legal action even when infringed. Therefore, in Column (2), we replace the number of cases with infringement cases adjusted for GDP. The coefficients of the interaction terms in both columns confirm the above hypotheses.

In response to such infringement cases, relevant authorities have taken measures to improve intellectual property protection. Since 2012, the National Intellectual Property Administration has launched a program to select "Intellectual Property Protection Model Cities," based on voluntary applications and centralized evaluations. Thus, being designated as a model city not only reflects the city's proactive stance on intellectual property protection but also indicates its capacity for safeguarding intellectual property. In Column (3), we introduce a dummy variable for whether a region is a model city. The results show that in regions with stronger intellectual property protection, the impact of 3G technology on newspaper media bias is attenuated.

6 Heterogeneity of City Characteristics

In this subsection, we discuss the heterogeneity of city characteristics. First, when examining the results after introducing instrumental variables (IV), we find that the IV estimates are approximately twice as large as the OLS estimates. A potential explanation for this is that the impact of 3G technology is more pronounced in less-developed regions. In Column (1) of Table 8, we first examine the heterogeneity by per capita income. We find that 3G technology indeed has a smaller impact in more developed regions. These areas typically have higher levels of marketization, more advanced public attitudes, and greater opportunities for newspapers to explore alternative revenue channels.

Second, we consider the differences in government fiscal expenditures. Columns (2) and (3) introduce interaction terms between total government fiscal expenditures and fiscal deficits. We find that cities with higher fiscal expenditures or larger fiscal deficits are less affected by the impact of 3G technology. Fiscal expenditure is strongly positively correlated with local development levels, and this result can be interpreted similarly to the findings based on per capita income. Additionally, fiscal expenditure or deficits may also reflect the local government's ability to intervene. The greater the government's intervention capacity in various sectors, the less it may need to use media outlets, such as newspapers, to guide public ideology, resulting in less interference in newspaper content.

Finally, we examine the degree of openness at the local level. In Columns (4) and (5), we use the share of imports and exports in GDP and foreign investment as measures of openness. The results show that there is no significant heterogeneity in the impact of 3G technology on newspaper bias with respect to the level of openness.

7 Discussion

In the previous analysis, we found that 3G networks have led to an increase in the political bias of newspapers. Why is this result important, and what are its potential implications?

To understand this result, it is essential to consider an important fact: in China, editorial rights are strictly regulated. Only media outlets with specific qualifications and levels are authorized to engage in independent news reporting and editing. Editorial rights refer to the privilege of media organizations to obtain firsthand information, including the full process from interviewing, editing, to publishing resources. According to regulations, the legitimate news gathering activities of journalists are legally protected, and no organization or individual is allowed to interfere with or obstruct journalists' lawful activities. This is crucial for ensuring the authenticity, originality, and timeliness of news. Policies explicitly prohibit non-public capital from engaging in news gathering and dissemination. Journalists are required to adhere to the Party's ideological stance.²⁰ This means that in China, not all media have the right to conduct interviews and edit news. Media

²⁰ See https://www.gmw.cn/01gmr/2005-03/23/content_201742.htm.

outlets without editorial rights, such as some online media platforms, often rely on content provided by traditional media, which somewhat limits their ability to publish original news.

Although traditional media have editorial rights, their poor profitability and reliance on government subsidies may reduce the incentive for journalists to discover, interview, and report high-quality news. On one hand, the content of newspapers and other traditional media tends to be politically biased, resulting in lower news quality. On the other hand, market-oriented non-traditional media, lacking editorial rights, are unable to produce original news and can only repost content. Taken together, this results in a broader media market in China that is biased, with diminishing content quality. Ultimately, this hinders the development of the media sector, impedes the role of media in society, and restricts social progress and development.

8 Conclusion

This study investigates the impact of the proliferation of 3G mobile networks on media bias in China's newspaper industry, providing novel insights into the intersection of technological advancement, media dynamics, and political influence. Our analysis, leveraging a difference-in-differences framework, reveals that the expansion of 3G coverage significantly amplified the political bias of local newspapers. This finding is consistent with the hypothesis that technological shocks can alter the financial dependencies of media organizations, pushing them to align more closely with government agendas in response to declining market revenues.

The empirical results indicate that 3G's influence operates through multiple mechanisms. First, the advent of mobile broadband reduced readership and advertising revenues for traditional print media, forcing many newspapers to rely increasingly on government subsidies for survival. Second, this reliance incentivized newspapers to produce content that aligns more closely with the propaganda objectives of the central government, as evidenced by increased mentions of political leaders and citations from official news agencies such as Xinhua. These adjustments in content composition highlight a strategic shift towards political alignment as a means of securing fiscal support.

Our robustness checks, including placebo tests with 2G networks and broadband internet coverage, reinforce the conclusion that the observed changes in media bias are attributable to the unique capabilities of 3G networks in facilitating mobile internet access. Moreover, the dynamic analysis illustrates that the impact of 3G unfolds progressively, reflecting the time required for technological adoption to reshape media consumption patterns and financial structures.

This research contributes to the broader literature on media economics and political communication by demonstrating that technological advancements can exacerbate existing biases within state-controlled media ecosystems. It also highlights the unintended consequences of digital innovation in non-democratic contexts, where new technologies may entrench rather than disrupt central control.

Future research could extend this analysis by exploring the long-term effects of subsequent technological developments, such as the introduction of 4G and 5G networks, and their implications for media pluralism and public discourse. Additionally, comparative studies across different political regimes could offer valuable insights into the generalizability of these findings and the nuanced ways in which technology interacts with institutional constraints to shape media landscapes.

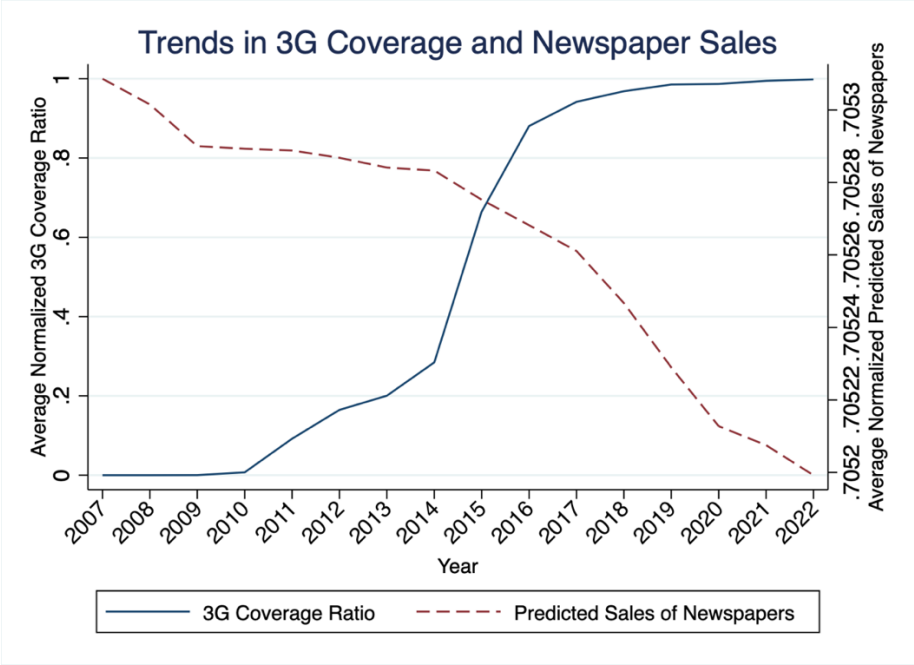
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Figures & Tables

Figure 1 Trends in 3G Coverage and Newspaper Sales



Notes: The 3G coverage ratio and predicted sales are both normalized. Since only some of their sales data were published, we forecasted the sales of the rest of the newspapers using their characteristics, such as their administrative level, content type, type of regulator, audience size, number of articles published, and number of years since their founding, as well as year-to-year changes in their regions.

Figure 2 Event Study Analysis

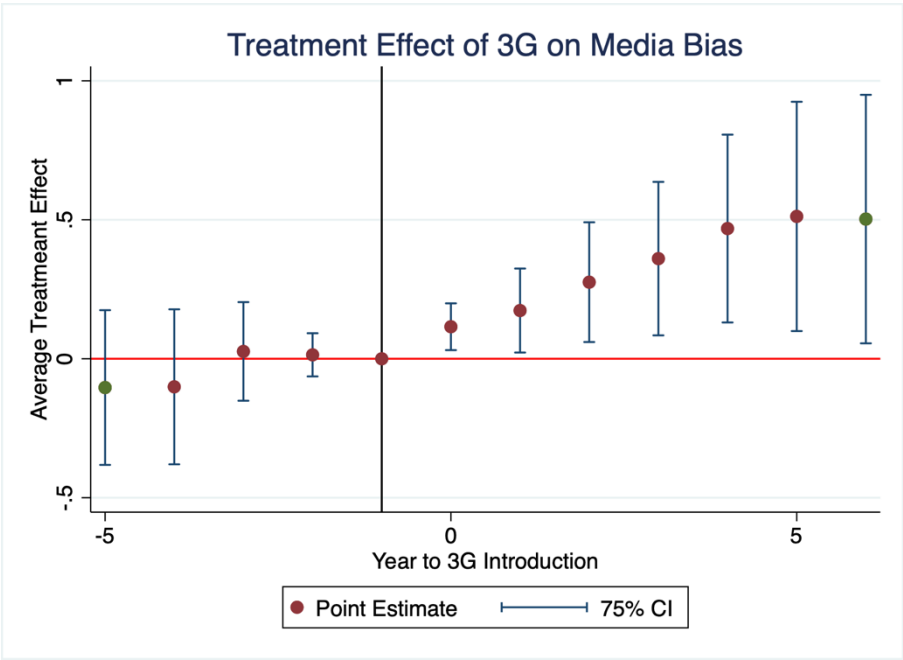


Table 1 Descriptive Statistics

Variable	Obs.	Mean	Std.	Min	Max
3G Coverage Ratio	3846	54.130	42.785	0.000	100.000
Media Bias (the first PCA component)	3846	-0.088	1.240	-12.448	22.242
Leader mentions	3846	372.551	358.736	0	2,726
Xinhua cites	3846	905.133	1,034.348	0	8,403
Xinhua top10 news mentions	3846	146.287	122.300	0	1,049
Epoch top10 news mentions	3846	39.031	82.601	0	802
Corruption	3846	30.411	28.085	0	233
Disasters	3846	43.605	69.647	0	1,084
Accidents	3846	2.606	10.083	0	221
Crime	3846	155.224	187.201	0	1,582
Sport	3846	312.459	335.380	0	4,240
Entertainment	3846	319.638	263.352	0	2,178
Total articles	3846	17,603.375	57,571.743	23	992,603

Note: This table presents the descriptive statistics for the key variables in this paper. Variable definitions are provided in Section 3.2. All variables are at the newspaper-by-year level.

Table 2 The Impact of Mobile Internet (3G) on Political Bias of Newspapers

Dep Var	Political Bias			
Measure Method			Population	Δ Coverage ratio
	Coverage ratio	Coverage ratio	weighted coverage ratio	
	(1)	(2)	(3)	
3G Coverage	0.005*** (0.002)	0.005*** (0.002)	0.004*** (0.002)	0.008*** (0.003)
Observations	3846	3846	3846	3846
R-squared	0.482	0.509	0.543	0.509
Regional Controls	Yes	Yes	Yes	Yes
Newspaper FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Province $\times$ Year FE	No	Yes	Yes	Yes
Ownership $\times$ Year FE	Yes	Yes	Yes	Yes
Number of regions	167	165	165	165
Number of newspapers	386	383	383	383

We conduct the following penal data specification:

$$Bias_{irt} = \alpha + \beta_1 3G_{rt} + X'_{rt} \mu_1 + \delta_i + \vartheta_t + \gamma_{p \times t} + \kappa_{n \times t} + \varepsilon_{irt}$$

Where i indexes the newspaper. The dependent variable is the political bias of newspapers. our set of basic controls: GDP, population, total employment, and the number of foreign-invested enterprises. Standard errors are clustered by prefecture in parentheses. ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Table 3 The Impact of Mobile Internet (3G) on the Topics of Newspaper

Dep Var	Leader Mentions	Xinhua Cites	Negative Information 1 (Epoch/Xinhua)	Negative Information 2 (Corruption, Disaster, & Accident)
	(1)	(2)	(3)	(4)
3G coverage ratio	0.082*** (0.016)	0.034*** (0.002)	-0.079** (0.037)	0.000 (0.001)
Observations	3846	3846	3846	3846
R-squared	0.600	0.465	0.722	0.696
Regional Controls	Yes	Yes	Yes	Yes
Newspaper FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Province × Year FE	Yes	Yes	Yes	Yes
Ownership × Year FE	Yes	Yes	Yes	Yes
Mean of dep var	14.045	2.306	14.475	0.575
SD of dep var	9.668	1.444	21.959	0.539

The dependent variable of the first column is the proportion of articles mentioned leader to the total number of articles. The dependent variable of the second column is the proportion of articles cited from Xinhua to the total number of articles. The dependent variable of the third column is the proportion of articles hostile to propaganda (measured by the number of articles mentioned the top 10 news provided by the Epoch Times) to the proportion of articles aimed for propaganda (measured by the number of articles mentioned the top 10 news provided by Xinhua). The dependent variable of the forth column is the proportion of reports on corruption, disasters, and accidents to the total number of articles. Standard errors are clustered by prefecture in parentheses. ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Table 4 Placebo Test: the Impact of 2G and Internet on Political Bias of Newspapers

Dep Var	Political Bias			
	(1)	(2)	(3)	(4)
2G Coverage	0.002 (0.068)		-0.016 (0.067)	
Broadband Internet Coverage		-0.002 (0.004)	-0.001 (0.004)	
3G Coverage ratio			0.005** (0.002)	
The lag of the 3G Coverage ratio				0.005** (0.002)
p-value	0.011	0.000	0.361	0.104
Observations	3645	3645	3645	3846
R-squared	0.511	0.511	0.512	0.509
Regional Controls	Yes	Yes	Yes	Yes
Newspaper FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Province × Year FE	Yes	Yes	Yes	Yes
Ownership × Year FE	Yes	Yes	Yes	Yes
Number of prefectures	165	165	165	165
Number of newspapers	383	383	383	383

Column (1) reports results for the effect of 2G coverage. Column (2) reports results for the effect of broadband internet coverage. Column (3) shows baseline result with 2G coverage and broadband internet included as control variables. Column (4) redoes the baseline regression with the lag of 3G coverage ratio as independent variable. Baseline controls are included. Standard errors are clustered by prefecture in parentheses. In the first two columns we report the p-values of the coefficients of variable of interest and the baseline coefficients for t-tests. Column (3) reports the p-values of the 3G coverage ratio coefficients and the baseline coefficients for t-tests. Column (4) reports the p-values of the coefficients of the lag of 3G and the baseline coefficients for t-tests. ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Table 5 Lightning Strikes, 3G Coverage, and Newspaper Bias

Dep Var	3G Coverage ratio	Political Bias	3G Coverage ratio	Political Bias
Stages, 2SLS:	First Stage	Second Stage	First Stage	Second Stage
	(1)	(2)	(3)	(4)
1[High frequency of lightning strikes] × Year × Poor	-0.033*** (0.007)		-0.048*** (0.008)	
3G Coverage		0.016* (0.012)		0.013*** (0.007)
F-stat, excluded instrument		22.79		33.19
Observations	3141	3141	3141	3141
Corresponding OLS on 3G coverage		0.007*** (0.002)		0.007*** (0.002)
Regional Controls	Yes	Yes	Yes	Yes
Newspaper FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Province × Year FE	No	No	Yes	Yes
Ownership × Year FE	Yes	Yes	Yes	Yes
Number of regions	144	144	142	142
Number of newspapers	336	336	333	333

The table presents the results of an IV analysis, where the average frequency of lightning strikes in a region is used as an IV for the expansion of regional 3G coverage. The methodology follows Manacorda and Tesei (2020) and Guriev et al. (2021). High frequency of lightning strikes is defined by the region being in the top half of the distribution of lightning strikes. Odd columns present the results of the first stage. Even columns show the results of the second stage. Columns (1)-(2) present the results for all the countries in the sample; columns (3)-(4) show results for the subsample of countries with below-median GDP per capita.

We conduct the following penal data specification:

$$3G_{irt} = \nu + \delta \cdot [Linghting_r \times t \times Poor_r] + Z'_{rt} \mu_1 + \delta_i + \vartheta_t + \gamma_{p \times t} + \kappa_{n \times t} + \varepsilon_{irt}$$

$$Bias_{irt} = \alpha + \beta \cdot 3G_{rt} + X'_{rt} \mu_1 + \delta_i + \vartheta_t + \gamma_{p \times t} + \kappa_{n \times t} + \varepsilon_{irt}$$

Where i indexes the newspaper. Standard errors are clustered by prefecture in parentheses. ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Table 6. Mechanism: Profitability and Government Subsidy Dependence

Panel A						
Dep Var	Sales Amount		Sales Volume	# of Prints	Adv Revenue	
	(1)		(2)	(3)	(4)	
3G Coverage Ratio	-0.726** (0.294)		-1.525*** (0.413)	-168.656*** (35.636)	-22.143*** (5.742)	
Observations	3787		3787	3787	3787	
R-squared	0.831		0.744	0.798	0.172	
Regional Controls	Yes		Yes	Yes	Yes	
Newspaper FE	Yes		Yes	Yes	Yes	
Year FE	Yes		Yes	Yes	Yes	
Province × Year FE	Yes		Yes	Yes	Yes	
Ownership × Year FE	Yes		Yes	Yes	Yes	
Panel B						
Dep Var	Political Bias					
Key Var	Sales Amount	Sales Volume	# of Prints	Adv Revenue	Gov Subsidy	Online Spread Capability
	(1)	(2)	(3)	(4)	(5)	(6)
3G Coverage Ratio	0.033*** (0.012)	0.029*** (0.009)	0.021*** (0.006)	0.005*** (0.002)	0.008*** (0.003)	0.004*** (0.002)
3G Coverage × Key Var.	-0.037*** (0.014)	-0.029*** (0.010)	-0.035*** (0.011)	-0.012** (0.006)	0.003*** (0.001)	-0.009** (0.005)
Observations	3787	3787	3787	3787	2395	3787
R-squared	0.482	0.509	0.543	0.490	0.621	0.463
Regional Controls	Yes	Yes	Yes	Yes	Yes	Yes
Newspaper FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Province × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Ownership × Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Panel A shows the direct impact of 3G coverage on sales and advertising revenue. We conduct the following penal data specification in Panel B:

$$Bias_{irt} = \alpha + \beta_1 3G_{rt} + \beta_2 Key_{it} + \beta_3 3G_{rt} \times Key_{it} + X'_{rt} \mu_1 + \delta_i + \vartheta_t + \gamma_{p \times t} + \kappa_{n \times t} + \varepsilon_{irt}$$

Where i indexes the newspaper. The dependent variable is the political bias of newspapers. Standard errors are clustered by prefecture in parentheses. ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Table 7. Mechanism: Intellectual Property Protection

Dep Var	Political Bias		
Key Var	IP Infringement Cases	GDP Adjusted IP Infringement	IP Demo City
	(1)	(2)	(3)
3G Coverage Ratio	0.005*** (0.002)	0.002 (0.002)	0.004*** (0.002)
3G Coverage × Key Var.	0.013** (0.007)	0.009** (0.004)	-0.001* (0.001)
Observations	3587	3587	3587
R-squared	0.590	0.517	0.410
Regional Controls	Yes	Yes	Yes
Newspaper FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Province × Year FE	Yes	Yes	Yes
Ownership × Year FE	Yes	Yes	Yes

Standard errors are clustered by prefecture in parentheses. ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Table 8. Heterogeneity: City Characteristics

Dep Var	Political Bias				
Key Var	GDP per capita	Fiscal Support	Fiscal Deficit	Openness	Foreign Investment
	(1)	(2)	(3)	(4)	(5)
3G Coverage Ratio	0.021** (0.015)	0.007*** (0.002)	0.007*** (0.002)	0.005** (0.003)	0.005*** (0.002)
3G Coverage × Key Var.	-0.002* (0.001)	-0.014** (0.006)	-2.571** (1.157)	-0.001 (0.003)	0.002 (0.003)
Observations	3837	3837	3846	3846	3846
R-squared	0.510	0.510	0.510	0.509	0.509
Regional Controls	Yes	Yes	Yes	Yes	Yes
Newspaper FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Province × Year FE	Yes	Yes	Yes	Yes	Yes
Ownership × Year FE	Yes	Yes	Yes	Yes	Yes

Appendix

A1 Search Keywords

For all the nine content categories presented in the paper, we search the relevant key words in the digital archives of the newspapers in WiseNews from 2007 to 2022.

Total number of articles: To count the total number of articles by newspaper and year, we search for a string that is used in nearly all articles. The string we search for is any digit from 0-9 or “日” (“day”) or “不” (“No”). The variables listed below except for Epoch Stories are expressed in percentage of the total articles (the ratio of the number of each category of articles to the total number of articles in a newspaper within one year multiplied by 100).

Leader Mentions: To count the number of articles mentioning political leaders, we collect the positions and names of 7147 leaders during the 2007-2022 period. We then search for the combination of their names and positions from one year before to the last year of every leader’s official term. Finally, we record the total number of articles that mention these word strings at the newspaper-year level.

Xinhua Cites: We search for the string “新华社” (Xinhua News Agency) in WiseNews and record the total number of articles that mention it at the newspaper-year level.

Epoch Stories: We select the top 10 annual events listed by Xinhua News and the Epoch Times from 2007 to 2022. The Epoch Times is published and circulated outside China and is regarded as the most anti-CCP newspaper. We search for key words related to these events in WiseNews and record the total number of relevant articles at the newspaper-year level. We then calculate the ratio of the number of articles covering top events listed by the Epoch Times to the total number of articles covering top events listed by either Xinhua News or the Epoch Times. The variable is defined by multiplying this ratio by 100.

Corruption: The number of articles covering corruption is obtained by searching keywords that identify corruption cases but not corruption speeches by politicians and government officials. The strings we use include the key words "(腐败 或 贪污 或 受贿 或 金钱) and (双规 或 调查 或 审查 或 检察机关) and (免去 或 罢免 或 查处 或 惩处 或 撤消 或 撤除)." The

corresponding English translation is ("(corruption or embezzle or bribed or money) and (dual-discipline – a word specifically used by governments or CCP organs – or investigate or examine or prosecutor) and (replace or dismiss or prosecute or punish or revoke or rescind).

Disaster and accident stories: We obtain disaster data from EM-DAT, an international disaster database. We select 158 disasters with more than 30 fatalities that took place in China from 2007 to 2022. The search uses keywords that identify each disaster, and the search is limited to a time window from two days before to 40 days after an event. Accidents include transportation accidents and industrial accidents.

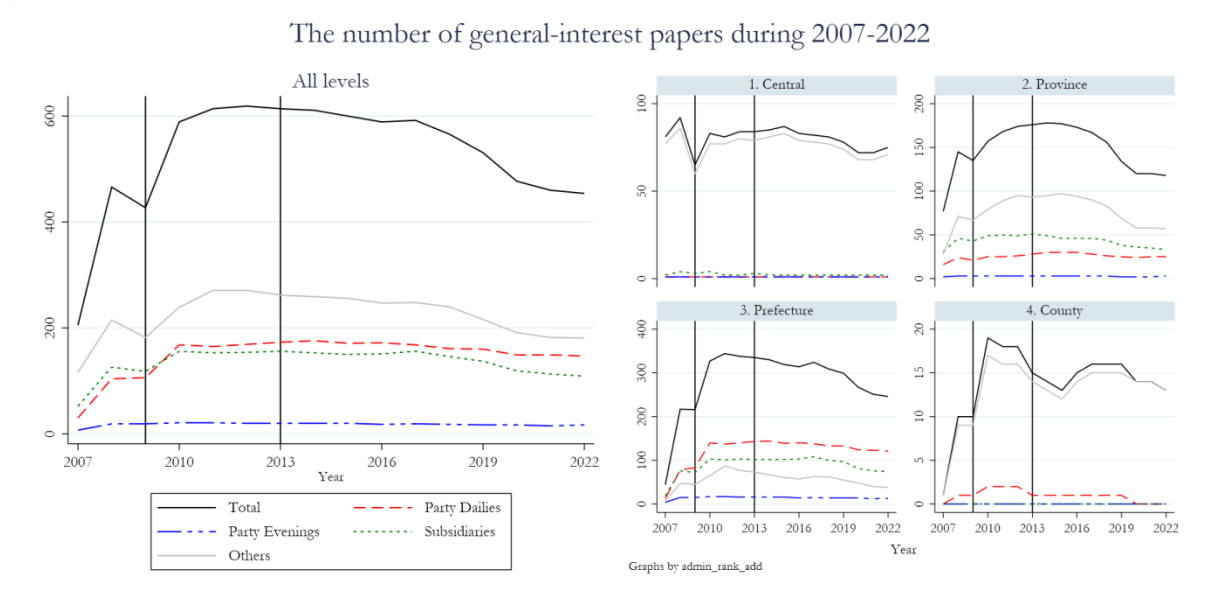
Sports: The keyword strings we use are "体育比赛 or 运动会 or 足球 or 篮球 or 乒乓球 or 羽毛球 or ((游泳 or 蛙泳 or 蝶泳 or 仰泳 or 自由泳) and 比赛) or 排球 or (田径 and 比赛) or 长跑 or 短跑 or 冬泳 or 保龄球 or 网球 or 台球 or 桌球". ("sports competition or Games or football or basketball or Ping-Pong or Badminton or ((swimming or breaststroke or butterfly or backstroke or crawl) and competition) or volleyball or ('track and field' and competition) or marathon or sprint or winter swimming or bowling or tennis or billiards or table tennis").

Entertainment: The keyword strings we use are "电影 or 电视 or 话剧 or 戏剧 or 戏曲 or 主演 or 演员 or 歌手 or 歌星 or 影星 or 音乐剧 or 演唱会 or 演奏会 or ((流行 or 主流 or 摇滚 or 民俗 or 民族) and 音乐) or 唱片 or 歌迷会 or 影迷会". ("movie or television or drama or opera or play or starring or actor or singer or singing star or movie star or musical or concert or symphony or ((popular or mains stream or rock or folk or minority) and music) or CDs or fan club").

Crime: The keyword strings we use are "歹徒 or 行凶 or 凶犯 or 罪犯 or 杀人 or 强奸 or 抢劫 or 黑社会". ("scoundrel or attack or murderer or criminal or killer or rape or rob or gangster").

A2 Figures & Tables

Figure A1 General-interest Newspapers during 2007-2022



Notes: The first vertical line indicates 2009, which is the first year of nationwide rollout of 3G network in China. The second vertical line indicates 2013, when the mobile subscriber penetration exceeded 30% and China's Ministry of Industry and Information Technology (MIIT) announced that the 3G network has covered all towns and villages in the country.

Figure A2. Expected Advertising Revenue and Probability to Be Party Newspaper versus PCA First Component

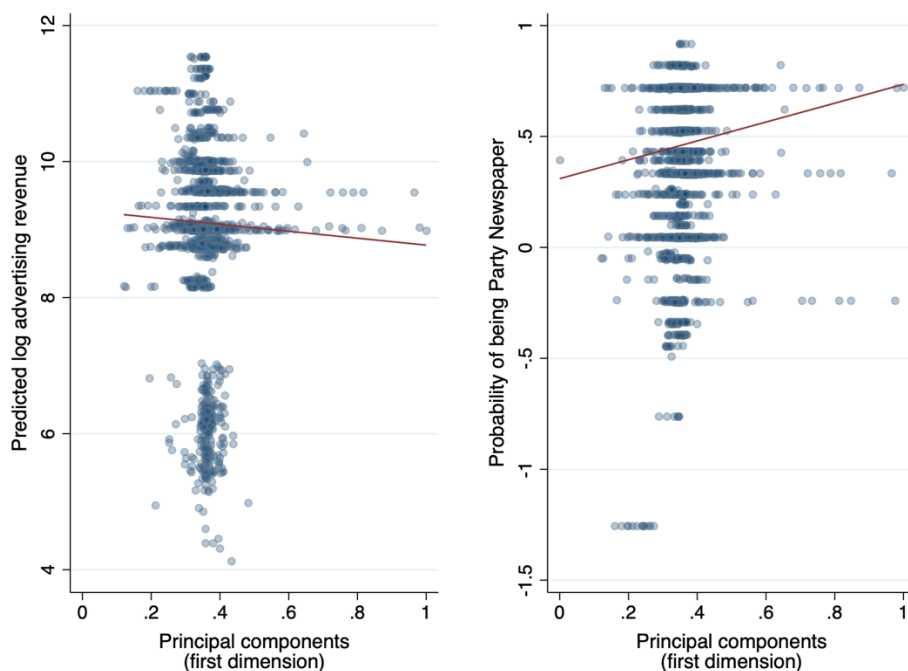


Figure A3. Density Distribution of Newspaper bias by Newspaper Type

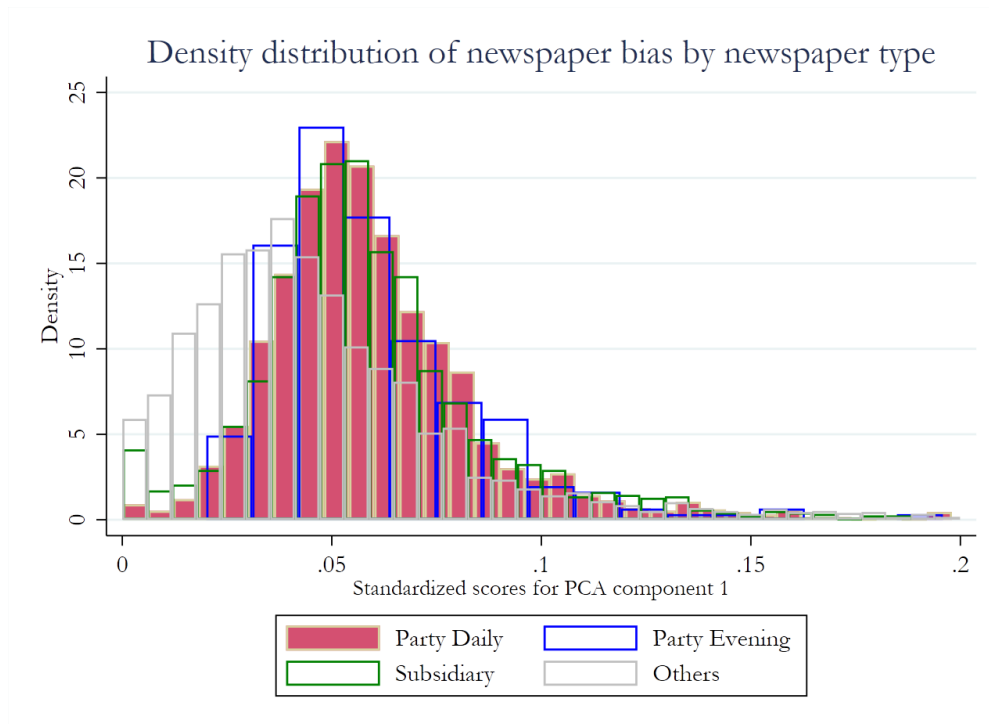


Figure A4. Distribution of 3G Coverage in China in 2022

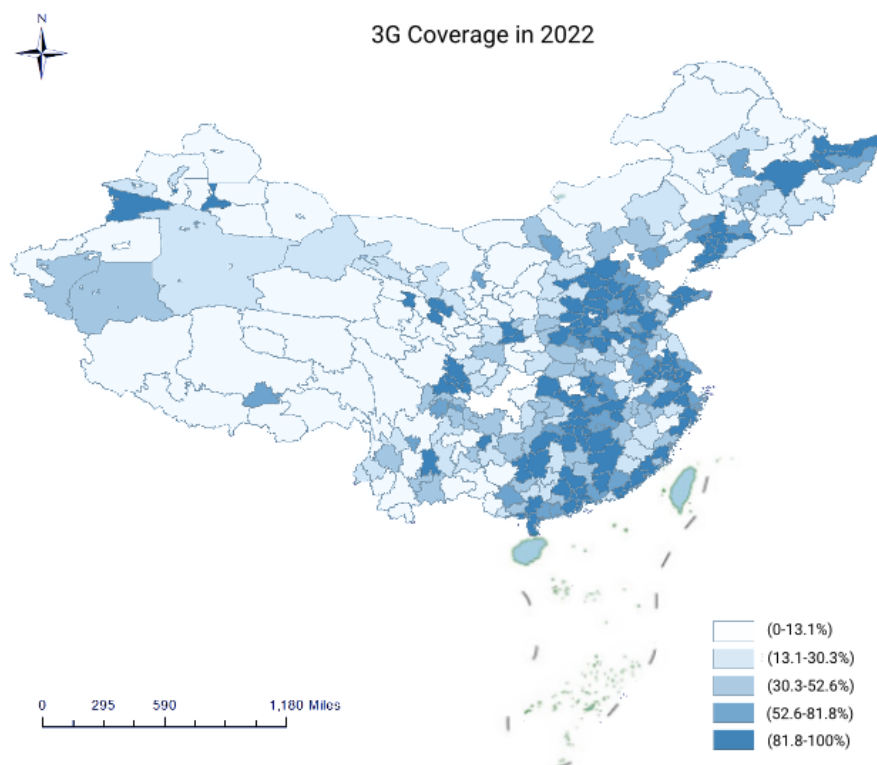


Figure A5 Event Study Analysis on Nine Topics

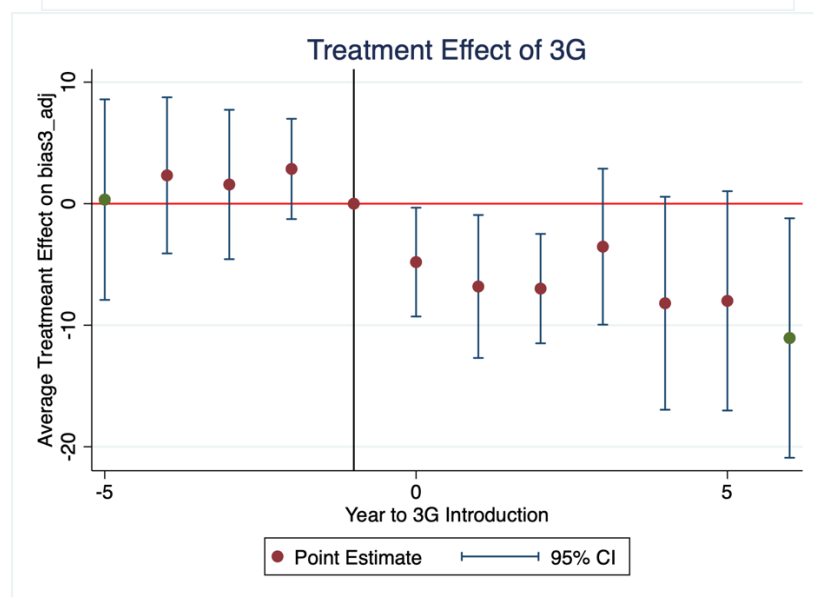
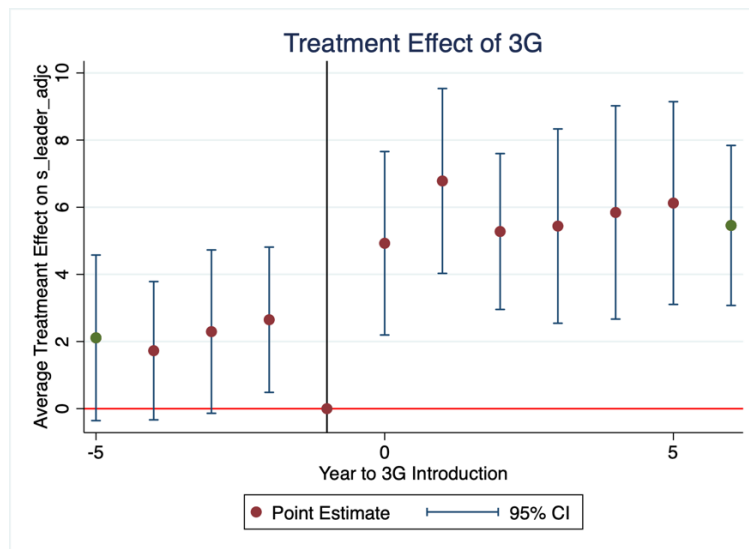
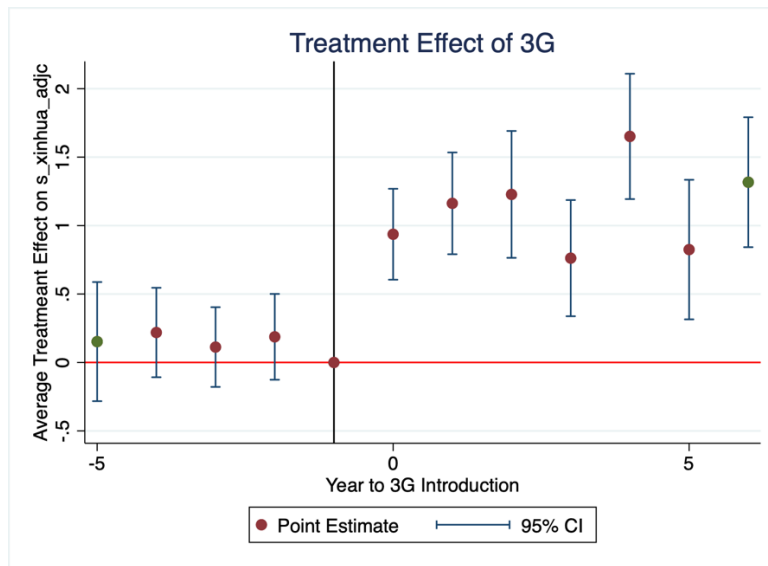


Table A1 Descriptive Statistics

Panel A. Number of general-interest newspapers in 2007-2022, by year

Year	2007	2008	2009	2010	2011	2012	2013	2014
Freq.	205	466	427	589	614	619	614	611
	2015	2016	2017	2018	2019	2020	2021	2022
	600	589	592	566	531	477	460	454

Panel B. Number of general-interest newspapers in 2007-2022, by type and administrative rank

Administrative rank	Party dailies	Party evenings	Subsidiaries	Other	Total
Central	1	1	2	70	74
Province	17	6	20	4	47
Prefecture	20	4	37	35	96
Total	38	11	59	109	217

Panel C. Summary statistics

Overall								
Variables	Observations	Mean	SD	Min	Max			
Leader mentions	8,394	6.31	7.57	0.00	89.01			
Xinhua cites	8,413	2.50	4.31	0.00	94.63			
Corruption	8,414	0.25	0.52	0.00	13.57			
Disasters	8,414	0.04	0.20	0.00	11.43			
Accidents	8,413	0.41	0.83	0.00	31.60			
Sport	8,404	2.32	3.71	0.00	83.96			
Crime	8,409	1.06	1.76	0.00	82.28			
Entertainment	8,407	2.89	4.34	0.00	97.09			
Epoch	7,582	18.73	26.37	0.00	100.00			
Total	8,414	25,499	96,607	251	1,086,258			
Mean	By rank				By type			
					Party	Party		
	Central	Province	Capital city	Prefecture	dailies	evenings	Subsidiary	Other
Leader mentions	3.56	6.38	7.18	4.32	9.87	5.48	4.70	5.01
Xinhua cites	1.65	2.22	2.94	1.98	4.03	3.00	2.85	1.25
Corruption	0.30	0.24	0.24	0.16	0.35	0.20	0.18	0.22
Disasters	0.07	0.04	0.02	0.02	0.03	0.04	0.03	0.04
Accidents	0.49	0.45	0.38	0.24	0.44	0.51	0.40	0.39
Sport	1.55	2.56	2.45	1.80	2.11	3.38	3.16	1.88
Crime	0.73	1.27	1.06	0.77	0.81	1.51	1.52	0.92
Entertainment	2.48	3.35	2.82	1.80	2.57	3.98	3.40	2.71
Epoch	18.22	21.12	17.58	16.49	12.20	20.70	22.61	20.78

Note: All variables are at the newspaper-by-year level in Panel C.

Table A2 PCA Results

Component	Eigenvalue	Proportion	Variable	Comp1	Comp2
Comp1	2.923	0.3248	Leader mentions	0.197	0.558
Comp2	1.214	0.1349	Xinhua cites	0.057	0.342
Comp3	0.998	0.1109	Epoch	0.125	0.191
Comp4	0.906	0.1007	Corruption	0.261	0.590
Comp5	0.757	0.0841	Disasters	0.348	0.118
Comp6	0.711	0.0790	Accidents	0.027	-0.058
Comp7	0.593	0.0659	Sport	0.493	-0.256
Comp8	0.532	0.0591	Entertainment	0.520	-0.291
Comp9	0.365	0.0406	Crime	0.489	-0.140

Notes: The PCA uses the residuals from a regression of content categories on prefecture by year fixed effects. The last columns report the factor loading of each variable for the 1st and 2nd components.

Table A3 Top and Bottom Bias Newspaper

Rank	Bias	Newspaper	Type	Rank	Province	Prefecture
1	0.720	Jinling Evening	Party Evenings	prefecture	Jiangsu	Nanjing
2	0.579	Guangzhou Daily	Party Daily	prefecture	Guangdong	Guangzhou
3	0.528	Jinhua Daily	Party Daily	prefecture	Zhejiang	Jinhua
4	0.480	Jinhua Evening	Party Evenings	prefecture	Zhejiang	Jinhua
5	0.416	Handan Evening	Party Evenings	prefecture	Hebei	Handan
6	0.410	Xin News	Subsidiary	prefecture	Heilongjiang	Haerbin
7	0.404	Haerbin Daily	Party Daily	prefecture	Heilongjiang	Haerbin
8	0.400	Benxi Evening	Party Evenings	prefecture	Jiangsu	Benxi
9	0.399	Kunming Daily	Party Daily	prefecture	Yunnan	Kunming
10	0.153	Yingkou Evening	Party Evenings	prefecture	Liaoning	Yingkou
-10	0.304	Jianghuai Morning Post	Subsidiary	prefecture	Anhui	Hefei
-9	0.300	Nanguo City News	Other	prefecture	Guangxi	Nanning
-8	0.299	Futures Daily	Subsidiary	prefecture	Henan	Zhengzhou
-7	0.291	Modern Health Daily	Other	prefecture	Hubei	Wuhan
-6	0.289	Jiangsu Business News	Other	prefecture	Jiangsu	Nanjing
-5	0.265	Liyang Times	Other	prefecture	Jiangsu	Changzhou
-4	0.234	Zhezhong Daily News	Subsidiary	prefecture	Zhejiang	Jinhua
-3	0.225	Wuyi Today	Other	County	Zhejiang	Jinhua
-2	0.219	Lan Jiang Herald	Other	prefecture	Zhejiang	Jinhua
-1	0.211	Yiwu Business News	Other	prefecture	Zhejiang	Jinhua

Source: Chinese newspaper directory data constructed by the authors based on Qin et al. (2018) and WiseNews.

Table A4 The Impact of Mobile Internet (3G) on the Topics of Newspaper

Dep Var	Leader mentions	Xinhua cites	Hostile to Propaganda (Epoch/Xinhua)	Negative Information (Corruption, Disaster, & Accident)
	(1)	(2)	(3)	(4)
3G coverage ratio (considering population density)	0.070*** (0.024)	0.033*** (0.002)	-0.066 (0.046)	-0.002 (0.001)
Observations	3846	3846	3846	3846
R-squared	0.617	0.483	0.735	0.716
Regional Controls	Yes	Yes	Yes	Yes
Newspaper FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Province × Year FE	Yes	Yes	Yes	Yes
Ownership × Year FE	Yes	Yes	Yes	Yes

Year dummies interacted with dummies for each quintile of population density are controlled in the regression. Standard errors are clustered by prefecture in parentheses. ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Table A5 Robustness using Prefecture-year Averages as the Unit of Analysis

Dep Var	Political Bias	Leader mentions	Xinhua cites	Hostile to Propaganda (Epoch/Xinhua)	Negative Information (Corruption, Disaster, & Accident)
	(1)	(2)	(3)	(4)	(5)
3G coverage ratio	0.006*** (0.003)	0.094*** (0.017)	0.035*** (0.004)	-0.141** (0.065)	-0.002 (0.003)
Observations	2007	2007	2007	2007	2007
R-squared	0.235	0.711	0.559	0.784	0.410
Regional Controls	Yes	Yes	Yes	Yes	Yes
Prefecture FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Province × Year FE	Yes	Yes	Yes	Yes	Yes
Ownership × Year FE	Yes	Yes	Yes	Yes	Yes

We take simple averages of the dependent variables across newspapers in each prefecture and year. Standard errors are clustered by prefecture in parentheses. ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Table A6 Placebo Test: the Impact of 2G and Internet on Topics of Newspapers

Dep Var	Leader mentions	Xinhua cites	Hostile to Propaganda (Epoch/Xinhua)	Negative Information (Corruption, Disaster, & Accident)
	(1)	(2)	(3)	(4)
3G Coverage ratio	0.079*** (0.015)	0.033*** (0.002)	-0.078* (0.039)	-0.000 (0.001)
2G Coverage	-0.452 (0.655)	0.149** (0.071)	-1.149 (1.626)	0.066* (0.038)
Broadband Internet Coverage	-0.014 (0.024)	0.001 (0.004)	-0.002 (0.060)	-0.003 (0.002)
Observations	3592	3592	3592	3592
R-squared	0.602	0.470	0.721	0.700
Regional Controls	Yes	Yes	Yes	Yes
Newspaper FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Province × Year FE	Yes	Yes	Yes	Yes
Ownership × Year FE	Yes	Yes	Yes	Yes

Standard errors are clustered by prefecture in parentheses. ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent levels, respectively.