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Media Competition, Media Capture, and Pollution in China

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Motivation

Motivation

- Media is the watchdog of society and monitors the (mis-) behaviors of different market participants.
  - e.g. governments, business corporations, and individuals.

- Free entry and competition are often recognized as the foundation for media to fulfill this role.
  - e.g. Mullainathan and Shleifer (2005); Gentzkow, Glaeser, and Goldin (2006).

- Policies that restrict media competition are controversial, rare, and often draw wide criticism when they occur.
  - e.g. Steiner (1952); Beebe (1977).

Media Market is Different

- Besides the role of watchdogs, media are sometimes bought off by market participants to shape public opinion in their favor.
  - e.g. polluting firms pay "hush money" for newspapers to turn a blind eye on their emission violations.

- Such interaction between media outlets and firms have negative externalities which neither party internalize.

- Social welfare could be potentially improved by decreasing the competitiveness and hence increasing market power of media, making them more difficult to be bought off.

- Yet, there is little empirical research on these issues.

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This Paper

- We exploit a dramatic media reform in China that forced 80% of the country's county-level newspapers to exit in 2003.

- We focus on one specific outcome:
  ⇒ **How does this media reform affect pollution generated by local firms?**

- We find that:
    - Newspaper exit lowers firms' emission level and intensity.
    - Results are likely driven by the increased market power of media.
    - Newspapers report more pollution-related issues after their competitors exited.
    - Cities with a lower ratio of "easy-to-influence" newspapers before the reform are more affected by the reform; SOEs, large firms, and old firms are less affected.

- Policymakers should take into account the uniqueness of the media market when designing media regulations.

Contribution

- **Provide among the first pieces of evidence on how media competition affects firms' production and polluting activities.**

- Causes of reporting bias:
    - see the reviews by Gentzkow, Shapiro, and Stone (2015); Puglisi and Snyder (2015).

- Media capture (most studies focus on government capture):
    - see the reviews by Prat (2015) and Enikolopov and Petrova (2015).

- Role of pollution information in environmental protection:
    - e.g. Barwick et al. (2019); Greenstone et al. (2020); Tu et al. (2020), etc.

- Consequences of China's newspaper exit reform:
    - Qin, Stromberg, and Wu (2018): focus on political outcomes.

China's Media Market

- There were over 1,300 newspapers nationwide in 2002, or on average roughly 5 per prefecture.
  - Many of these are county dailies that report mostly on local events and target local readers.

- Newspapers depend critically on advertising revenues to survive.
  - By the end of the 1990s, it was estimated that advertising revenues accounted for at least 70 percent of the overall income of Chinese newspapers (Man, 2001).

- Firms have substantial power in influencing news reporting.
  - e.g. advertisements and donations; bribe with gifts or "hush money".
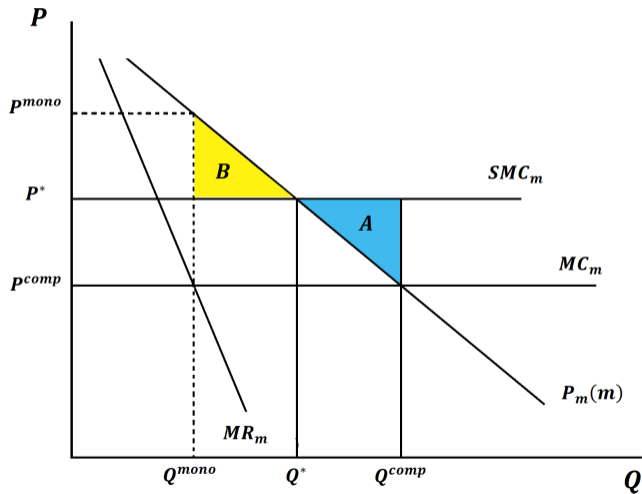 - journalists were seldom investigated or punished.

The Media Exit Reform: Closing the County Dailies

- Pre-reform, township and village-level governments were often mandated to subscribe to a large number of dailies, including many county dailies.

- In 2003, the central government withdrew the licenses of more than 80% of county-level dailies, in order to reduce the burden on farmers and curb the social protests by farmers.

- The total number of county dailies fell from 325 in 2002 to 75 in 2004.

- As a result, prefectural newspaper markets experienced various degrees of reduction in competitiveness.
  ⇒ The reform should be exogenous to polluting firms' emission activities.

Conceptual Framework: Intuition

- Two parties: newspapers and firms.

- Firms purchase misinformation from newspapers: e.g., increase positive reportings (ads) or reduce negative reportings (hush money).

- Firms are price-takers while newspapers possess market power; neither internalizes environmental externalities of misinformation.

- Two market failures: "under-produce" due to market power; "over-produce" due to not internalizing environmental externalities.

- "Second-best" is reached when these forces exactly offset each other.

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Conceptual Framework: Intuition

Firm-level Data

- Environmental Survey and Reporting (**ESR**) database 1999-2009:
  - Maintained by the Ministry of Environmental Protection (MEP) in China;
  - Focus on two outcome variables: total COD emissions and COD emission intensity (emissions/output value).

- Annual Survey of Industrial Firms (**ASIF**).
  - Includes all the state-owned enterprises (SOEs) and private industrial enterprises with annual sales exceeding 5 million Chinese yuan;
  - Follow Cai and Liu (2009) and He, Wang, and Zhang (2020) to clean the data.

- Firm-level registration data from the Chinese State Administration for Industry and Commerce (**SAIC**).

- Match firms in the ESR dataset with the firms in the ASIF dataset based on their names and locations.

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Newspapers Data

- Newspaper Competition and Revenue Data constructed by Qin, Stromberg, and Wu (2018), which includes basic newspaper information for around 1,800 general-interest newspapers in China from 1981 to 2011.
  - Identify affiliated prefecture
  - Identify changes in county dailies resulting from the "Closing County Dailies" reform
  - Include ad revenue information for about 10% of all newspapers.

  ▸ Distribution   ▸ Changes

- Negative news about firms' pollution from two databases: the China Core Newspapers Full-text Database (CCND) of China National Knowledge Infrastructure (CNKI) and the WiserOne Media database.
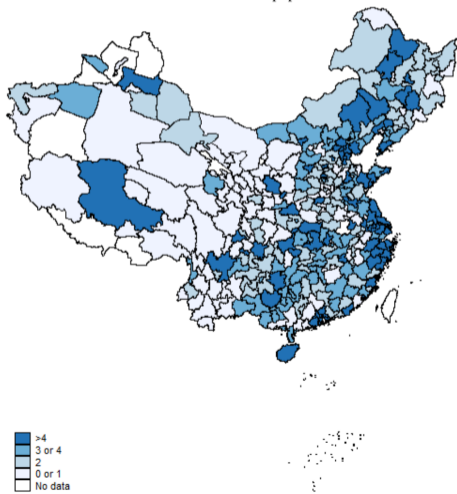
  ▸ Definition   ▸ Textual Analysis

- Summary Statistics:

  ▸ Firm-level   ▸ Prefecture-level and Newspaper-level

Distribution of newspapers across prefectures

Figure 1. The Number of newspapers in 2002 and the Closing-County-Daily Reform
Panel A. Number of Newspapers in 2002

>4
3 or 4
2
0 or 1
No data

- For each newspaper, we identify its affiliated prefecture and calculate the number of newspapers in that prefecture and year.

- Figure 1A plots the distribution of newspapers across Chinese prefectures in 2002.

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Changes in county dailies

Panel B. Prefectures Affected by the Media Reform

Decline
no decline
No data
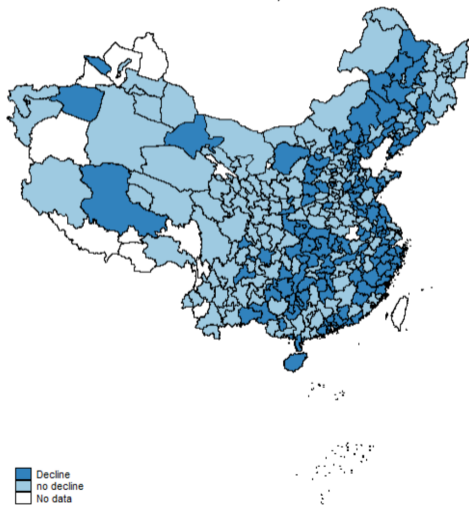
- Identify changes in county dailies resulting from the "Closing County Dailies" reform, which is shown in Figure 1B.

- The variations in both measurements are large and are not clustered in specific regions.

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DiD and Event Study Model

- To examine how the "Closing County Dailies" reform affects polluting firms' emissions, we estimate the following Difference-in-Differences (DiD) model:

$$\log P_{icpt} = \beta_0 + \beta_1 \, Treat_c * Post_t + \beta_2 X_c * t + u_i + v_{pt} + \varepsilon_{ipt} \tag{1}$$

  - P_{icpt} is the emission level of firm i in city (prefecture) c of province p in year t;
  - $Treat_c$ is a dummy variable indicating whether there are exits in county dailies during the reform in city/prefecture c, and $Post_t$ is a dummy indicating 2003 and after;
  - $X_c * t$ indicates pre-reform city-level characteristics interacted with the time trend;
  - v_{pt} is province-by-year fixed effect.

- Event study analysis to assess the plausibility of the parallel trend:

$$\log P_{icpt} = \beta_0 + \sum_{k \neq -1} r_k D_{icpt}^k + \beta_2 X_c * t + u_i + v_{pt} + \varepsilon_{ipt} \tag{2}$$
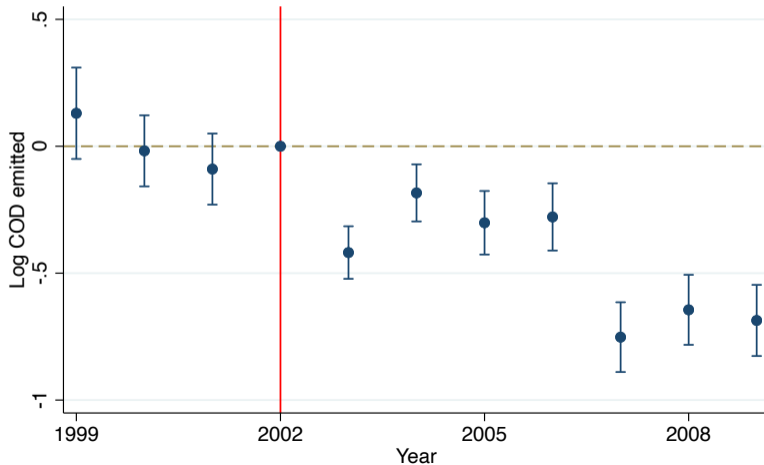
Baseline Results: DiD

Table 2. Impacts of the "Closing County Dailies" Reform on Firms' Polluting Activities

Dependent variable	Log COD emitted		Log COD emission intensity	
	(1)	(2)	(3)	(4)
Treat*Post2003	-0.401***	-0.418***	-0.162***	-0.167***
	(0.042)	(0.042)	(0.018)	(0.018)
Prefecture char*Trends	No	Yes	No	Yes
Province by year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Observations	304,177	303,274	293,841	292,952
Adjusted R-squared	0.440	0.441	0.685	0.685

Notes: This table reports the difference-in-differences regression results for the impacts of the "Closing County Dailies" reform on COD emissions and emission intensity. The main explanatory variable is the interaction term of the treatment indicator and post-2003 indicator. The treatment indicator equals one if there is any decline in the number of County dailies in a prefecture during 2002-2004, and zero otherwise. The post-2003 indicator equals one for 2003 and after and zero otherwise. Standard errors clustered at the firm level are reported in parentheses. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

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Baseline Results: Event Study

Panel A. Impacts on COD Emissions

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Baseline Results: Event Study

Panel B. Impacts on COD Emission Intensity

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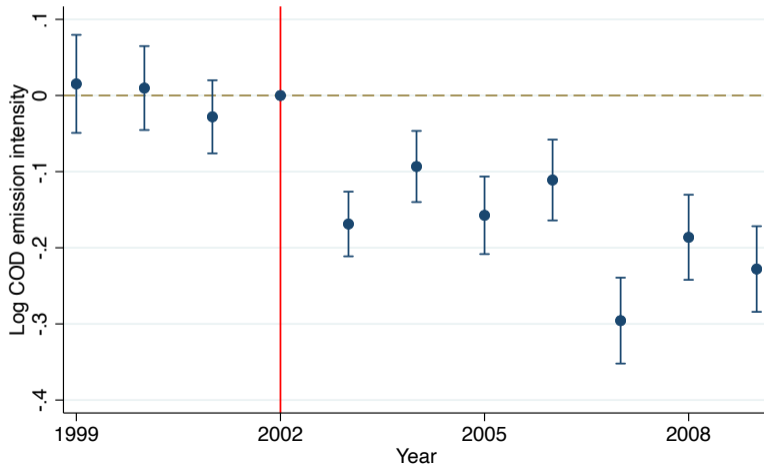
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Robustness Checks

- Combine the baseline DiD model with matching:
  - match by geographical closeness;
  - match by propensity score.

  ▸ Geographical Matching   ▸ Propensity Score Matching

- Use an alternative treatment measure: the changes in the number of newspapers between 2002 and 2004, scaled by the number of newspapers in 2002.

  ▸ Alternative Treatment

- Use alternative ways to calculate the standard errors.
  - cluster standard errors both at the firm and year levels;
  - cluster standard errors at both firm and province-by-year levels.

  ▸ Cluster SE

- Report the results for SO_2 emissions. ▸ SO_2

Mechanisms: Reporting on Pollution Increased

Mechanism: Reform made the media market less competitive and gave the remaining newspapers greater market power when bargaining with firms

- Estimate the impacts of newspaper exit on pollution-related reporting:
    1. Did the remaining newspapers increase their reporting on firms' pollution when their competitors exited the media market?
    2. Did the total number of news articles on pollution increase in a prefecture when the market became less competitive?

    $\Rightarrow$ The increased market power of media makes them less likely to be captured by local firms?

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Reporting on Pollution: Model

- Test whether the remaining newspapers increase their reporting on firms' pollution:

$$\log\left(1 + Y_{ict}\right) = \beta_0 + \beta_1 \, Treat_c * Post_t + \beta_2 X_c * t + u_i + \nu_t + \varepsilon_{ipt} \tag{3}$$

- To examine the aggregated impacts:

$$\log\left(1 + Y_{ct}\right) = \beta_0 + \beta_1 \, Treat_c * Post_t + \beta_2 X_c * t + u_c + \nu_t + \varepsilon_{it} \tag{4}$$

Reporting on Pollution: DiD Results

Table 3. Impacts of the Closing-County-Dailies Reform on News about Pollution

Y=Log(1+negative news)	(1)	(2)	(3)	(4)
	Newspaper level Analysis		Prefecture level Analysis	
Treat*Post2003	0.865***	0.775***	0.737**	0.631**
	(0.177)	(0.151)	(0.336)	(0.317)
Very Negative	No	Yes	No	Yes
Newspaper FE	Yes	Yes	No	No
Prefecture FE	No	No	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Prefecture char*Trends	Yes	Yes	Yes	Yes
Observations	1,183	1,183	475	475
Adjusted R-squared	0.662	0.653	0.786	0.771

Notes: This table reports the difference-in-differences regression results for the impacts of the "Closing County Dailies" reform on the number of negative news articles using within-newspaper variation (Columns 1–2) and within-city variation (Columns 3–4). The dependent variables are the logarithm of 1 plus the number of negative (or very negative) news articles on firms' pollution incidents. The main explanatory variable is the interaction term of the treatment indicator and post-2003 indicator. The treatment indicator equals one if there is any decline in the number of County dailies in a prefecture during 2002-2004. The post-2003 indicator equals one for 2003 and after, and zero otherwise. Standard errors are clustered at the newspaper level in Columns 1–2, and at the prefecture level in Columns 3–4. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

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Heterogeneity

- More Powerful Firms are Less Affected:
  - SOEs vs. Non-SOEs;
  - large polluters vs. small polluters;
  - new firms vs. old firms.

  ⇒ Impacts of the reform are larger among non-SOEs, smaller polluters, and newer firms. ▸ Results

- Pre-reform Market Conditions
  - "Easy-to-influence" newspapers: commercial newspapers and county-level dailies, both of which rely critically on advertising revenues;
  - "Difficult-to-influence" newspapers: higher-level dailies, newspapers belonging to higher-level government entities, and newspapers focusing on political and sports news.

  ⇒ Results are mainly driven by cities with fewer pre-reform "easy-to-influence" newspapers. ▸ Results

More Powerful Firms are Less Affected

Table 6: Heterogeneity based on Firm Characteristics

	SOE (1)	Non-SOE (2)	Large (3)	Small (4)	Old (5)	New (6)
Panel A. Impacts on COD Emissions (log)						
Treat*Post2003	-0.175*	-0.279***	-0.255***	-0.550***	-0.347***	-0.440***
	(0.097)	(0.068)	(0.055)	(0.064)	(0.058)	(0.067)
Observations	38,148	134,414	150,129	141,486	156,276	130,486
Adjusted R-squared	0.511	0.464	0.495	0.434	0.485	0.449
Panel B. Impacts on COD Emission Intensity (log)						
Treat*Post2003	-0.081**	-0.128***	-0.044***	-0.292***	-0.133***	-0.177***
	(0.038)	(0.025)	(0.017)	(0.032)	(0.024)	(0.029)
Observations	37,138	132,111	150,129	133,631	149,013	127,851
Adjusted R-squared	0.675	0.686	0.746	0.596	0.694	0.698
Prefecture char*Trends	Yes	Yes	Yes	Yes	Yes	Yes
Province by year FEs	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table reports the difference-in-differences regression results for the impacts of the "Closing County Dailies" reform on COD emissions and emission intensity for subsamples with different firm Characteristics. SOE=1 if the state is the controlling holder. Large/small firms are determined by the median of firm production output value, and new/old firms are determined by the median of firm age. The main independent variable is the interaction term of the treatment indicator and post-2003 indicator. The treatment indicator equals one if there is any decline in the number of County dailies in a prefecture during 2002-2004, and zero otherwise. The post-2003 indicator equals one for 2003 and after, and zero otherwise. Standard errors are clustered at the firm level. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

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Impacts Depend on Pre-reform Market Conditions

Table 5: Heterogeneity based on Pre-reform Market Conditions

	Ratio of Pre-reform Business-oriented Newspapers <= Median	Ratio of Pre-reform Business-oriented Newspapers > Median
	(1)	(2)
Panel A. Impacts on COD Emissions (log)		
Treat*Post2003	-0.578***	-0.031
	(0.064)	(0.099)
Observations	152,092	151,071
Adjusted R-squared	0.445	0.448
Panel B. Impacts on COD Emission Intensity (log)		
Treat*Post2003	-0.224***	0.067
	(0.026)	(0.043)
Observations	145,259	147,582
Adjusted R-squared	0.682	0.696
Prefecture char*Trends	Yes	Yes
Province by year FE	Yes	Yes
Firm FE	Yes	Yes
Year FE	Yes	Yes

Notes: This table reports the difference-in-differences regression results for the impacts of the "Closing County Dailies" reform on COD emissions and emission intensity for prefecture cities with different pre-reform market conditions. The main independent variable is the interaction term of the treatment indicator and post-2003 indicator. The treatment indicator equals one if there is any decline in the number of County dailies in a prefecture during 2002-2004, and zero otherwise. The post-2003 indicator equals one for 2003 and after, and zero otherwise. Standard errors are clustered at the firm level. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

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Firm Adjustments

- Reduce Emissions:
    - Reduce production or upgrade their technology to make the production process cleaner;
    - Clean up emissions at the end of the pipes by installing abatement equipment.

    ⇒ Both production adjustment and the "end-of-the-pipe" treatment contributed to the overall reduction in COD emissions.

    ‣ Results

- Entry of COD-Intensive Firms:
    ⇒ The reform reduced the number of new firms (by 11%) and total employment in the COD-intensive industries (by 15.5%).

    ‣ Results

Firm Adjustments: Reduce emissions

Table 7: Impacts of the "Closing County Dailies" Reform on Firm Production and Performance

Dependent variable	Log COD gen (1)	COD abated /COD gen (2)	Log production (3)	Log value added (4)	ROA (5)	TFP (6)
Treat*Post2003	-0.393***	0.008*	-0.039**	-0.091***	-0.006***	-0.062***
	(0.044)	(0.004)	(0.015)	(0.018)	(0.002)	(0.015)
Prefecture char*Trends	Yes	Yes	Yes	Yes	Yes	Yes
Province by year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	303,274	282,113	292,952	133,183	177,704	99,556
Adjusted R-squared	0.501	0.582	0.853	0.829	0.556	0.651

Notes: This table reports the difference-in-differences regression results for the impacts of the "Closing County Dailies" reform on firms' production and performance. The main independent variable is the interaction term of the treatment indicator and post-2003 indicator. The treatment indicator equals one if there is any decline in the number of County dailies in a prefecture during 2002-2004, and zero otherwise. The post-2003 indicator equals one for 2003 and after, and zero otherwise. Standard errors are clustered at the firm level. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

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Extensive Margin: Entry of COD-Intensive Firms

Table 8: Impacts of the Closing-County-Dailies Reform on COD intensive Industries at the Extensive Margin

Dependent variable	Log(1+new firms)	Log(1+employees)
	(1)	(2)
Treat*Post2003	-0.124***	-0.168*
	(0.046)	(0.095)
Prefecture char*Trends	Yes	Yes
Year FE	Yes	Yes
Prefecture FE	Yes	Yes
Observations	3,030	3,030
Adjusted R-squared	0.906	0.772

Notes: This table reports the difference-in-differences regression results for the impacts of the "Closing County Dailies" reform on new firms and employment in COD intensive industries. The main independent variable is the interaction term of the treatment indicator and post-2003 indicator. The treatment indicator equals one if there is any decline in the number of County dailies in a prefecture during 2002-2004, and zero otherwise. The post-2003 indicator equals one for 2003 and after, and zero otherwise. Standard errors are clustered at the prefecture level. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

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Conclusions

- Case study shows that **limiting the degree of market competition might potentially benefit the general public**.

- Results are likely **driven by the increased market power of media**.

- It is important to consider the **unique features of the media market** when evaluating media industry regulation.

- Our conclusions cannot be readily generalized to other social domains (like political).

- Welfare implication is still unclear: need to know how welfare gain from decrease in pollution compares with welfare loss from DWL and potential loss of diversity in contents and opinions.

Model Setup

- We mainly reflect the "second-best" interaction between firms and newspapers, rather than modelling a two-sided media market with multi-homing readers (e.g Ambrus et al. 2016),

- Two types of agents: newspaper outlets and firms.
    - Firms pay outlets (i.e. buy "ads") in exchange for misinformation that curbs media exposure of their polluting activities.
    - Newspaper outlets are financed solely by firms' payments and not by subscription fees. Outlets choose the overall quantity of misinformation and sell it to firms.
    - Firms are price-takers while newspapers have some market power.

Firm's Problem

- Firms have a Cobb-Douglas production function with two inputs: capital K and misinformation m:

$$\max_{K,m} P \cdot K^{\alpha} \cdot m^{\beta} - r \cdot K - P_m \cdot m$$

- Output price P and capital rent r are constant and exogenous.

- Price of misinformaion P_m is endogenous.

- Solving for the problem would show that demand for misinformation goes down as P_m goes up.

Newspaper's Problem

- N newspapers participating in Cournot competition:

$$\max_{m_i} P_m(M) \cdot m_i - c \cdot m_i$$

- where $M = \sum_{i=1}^{N} m_i$ is total misinformation supplied by this media market. c is constant unit cost of misinformation.

- Solving the above problem gets the following condition:

$$\frac{P_m - c}{P_m} = \frac{1}{|\varepsilon_d| \cdot N}$$

- where ε_d is price elasticity of demand and N is the number of newspapers.

- Intuitively, the smaller the number of newspapers, the larger the price markup.

Policy-Maker's Problem and Condition for "Second-Best"

- The policy-maker alters N, or equivalently, $\zeta \equiv \frac{1}{|\varepsilon_d| \cdot N}$, to maximize the surplus of representative firm and newspapers minus the welfare loss from environmental damage related to misinformation.

$$\max_{\zeta} W = \Pi_{firm}(\zeta) + \Pi_{newspapers}(\zeta) - D(M(\zeta))$$

- where $dD/dM > 0$

- Setting $\dfrac{W}{\zeta} = 0$ and plugging in the F.O.C.s of firm's and newspaper's problems, we get:

$$P_m(\zeta) \cdot \zeta = \frac{dD(M)}{dM}$$

- which intuitively means that "second-best" is reached when marginal environmental damage of misinformation equates the level of price markup.

Propositions

- Prop 1: As $N \downarrow$, total misinformation $\downarrow$.

- Prop 2: As $N \downarrow$, emissions $\downarrow$.

- Prop 3: As $N \downarrow$, TFP $\downarrow$.

- Prop 4: As $N \downarrow$, direction of welfare change depends:

  - welfare $\uparrow$ if initial marginal environmental damage of misinformation $dD(M)/dM$ is high.

  - welfare $\downarrow$ if welfare gain from lowering $D(M)$ is dominated by welfare loss from DWL.

Media Reporting on Pollution

- Newspaper reporting on pollution incidents is common.
  - The GDP-environment tradeoff became salient in the early 2000s, promoting the general public's demand for this type of news.

- News on pollution is seldom censored by the government.
  - 98% of the news articles on pollution could be accessed.
  - Local newspapers focus mostly on reporting local pollution issues.

Criteria of Defining Negative News

- We have four criteria when defining negative news:
  - First, we focus on firms' pollution, rather than on pollution related to automobiles, households' coal usage, and farmers' straw burnings.
  - Second, we drop articles in which the contents were most likely provided by firms.
  - Third, we keep only articles that criticize polluting activities, rather than those providing general discussions of pollution.
  - Fourth, we drop central-level newspapers that mostly cover nationwide events (mostly in Beijing and Shanghai).

- In total, we have nearly 10,000 such negative news from 2000 to 2009. Our data is an unbalanced panel: if a newspaper/prefecture never shows in the database prior to a specific year, the number of negative news reports from the newspaper/prefecture will be coded as missing, instead of zero.

Textual Analysis of Negative News

- First, we construct a list of words that are considered negative and are frequently seen in the news reports on firms' pollution, which include:
  - "pollution," "disaster," "deterioration," "death," "exacerbation," "wastewater," "waste gas," "conflict," "threat," "exceeding standards," "harmful," "serious," "hazard," "pressing," "tough," "loss," "sacrifice," "urgent," "shutdown," and "disease."

- Calculate the share of negative words in each news article and drop the news articles when the share is less than 2 percent.

- Our results are not sensitive to the choice of cutoff.

Summary Statistics: Firm-level

Panel A: Firm-level variables

Variable	Mean	Std. Dev.	Median	10th Pctl.	90th Pctl.
COD emitted (kg)	114,873	370,874	16,319	468	210,000
COD emission intensity (kg/10k yuan)	55.2	186.6	4.0	0.1	102.5
Treat	0.58	0.49	1	0	1
Treat_Alt	-0.15	0.33	-0.12	-0.50	0.03
COD generated (kg)	344,176	1,088,219	34,600	915	671,000
Production (10k, 2010 constant yuan)	22,608	70,488	3549	231	44,520
Value added (10k, 2010 constant yuan)	8,288	22,183	1,889	254	17,326
ROA	0.05	0.12	0.02	-0.04	0.17
TFP	2.00	0.97	2.02	0.82	3.18
SO2 emitted (kg)	198,491	714,393	36,200	3,571	336,693
SO2 emission intensity (kg/10k yuan)	80.6	191.7	16.3	0.6	196.8

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Summary Statistics: Prefecture-level and Newspaper-level

Panel B: Prefecture-level (and newspaper-level) variables

Variable	Mean	Std. Dev.	Median	10th Pctl.	90th Pctl.
Negative news (newspaper-level)	6.55	13.74	1	0	19
Negative news (prefecture-level)	16	43.01	2	0	40
HHI of newspapers' advertisement revenues	0.65	0.27	0.56	0.33	1
Ratio of pre-reform business-oriented newspapers	0.42	0.31	0.5	0	0.8
New firms in COD intensive industries	59.02	86.46	34	8	136
Employees in new firms in COD intensive industries	517.39	1429.68	165	14	1,236

Notes: This table presents summary statistics for the main variables. Our primary sample period spans from 1999 to 2009.

Robustness Checks: Propensity Score Matching

Table A2: DID Results Using Propensity Score Matching

Dependent variable	Log COD emitted	Log COD emission intensity
	(1)	(2)
Treat*Post2003	-0.636***	-0.224***
	(0.058)	(0.023)
Prefecture char*Trends	Yes	Yes
Province by year FE	Yes	Yes
Firm FE	Yes	Yes
Year FE	Yes	Yes
Observations	235,196	227,314
Adjusted R-squared	0.468	0.676

Notes: This table reports the difference-in-difference regression results with propensity score matching. We first regress the treatment dummy on a set of socio-economic variables, including the logarithm of the population in 2000, the urbanization rate in 2000, the unemployment rate in 2000, the logarithm of the distance to the nearest seaport, and the provincial capital dummy. Then we match each treated prefecture to a control prefecture based on the propensity score and only keep the matched prefectures. Finally, we run our main firm-level regressions using the matched sample. The main independent variable is the interaction term of the treatment indicator and post-2003 indicator. The treatment indicator=1 if there is any decline in the number of County dailies in a prefecture during 2002–2004, and =0 otherwise. The post-2003 indicator=1 for 2003 and after, and =0 otherwise. Standard errors clustered at the firm level are reported in parentheses. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

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Robustness Checks: Alternative Treatment

Table A3: DID Results Using Alternative Treatment Indicator

Dependent variable	Log COD emitted	Log COD emission intensity
	(1)	(2)
Treat_Alt*Post2003	0.449***	0.212***
	(0.058)	(0.024)
Prefecture char*Trends	Yes	Yes
Province by year FE	Yes	Yes
Firm FE	Yes	Yes
Year FE	Yes	Yes
Observations	303,399	293,072
Adjusted R-squared	0.440	0.685

Notes: This table reports the regression results from Equation (1) using the change in the number of newspapers between 2002 and 2004 scaled by the number of newspapers in 2002 as the treatment variable (Treat_Alt). The main independent variable is the interaction term of this alternative treatment indicator and post-2003 indicator. The post-2003 indicator=1 for 2003 and after, and =0 otherwise. Standard errors clustered at the firm level are reported in parentheses. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

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Robustness Checks: Geographical Matching

Table A1: DID Results Using Geographic Neighbors as Control Groups

Dependent variable	Log COD emitted	Log COD emission intensity
	(1)	(2)
Treat*Post2003	-0.459***	-0.177***
	(0.047)	(0.019)
Prefecture char*Trends	Yes	Yes
Province by year FE	Yes	Yes
Firm FE	Yes	Yes
Year FE	Yes	Yes
Observations	271,132	262,077
Adjusted R-squared	0.444	0.690

Notes: This table reports the difference-in-difference regression results from Equation (1). We keep the treated prefectures and their neighboring prefectures. The main independent variable is the interaction term of the treatment indicator and post-2003 indicator. The treatment indicator=1 if there is any decline in the number of County dailies in a prefecture during 2002–2004, and =0 otherwise. The post-2003 indicator=1 for 2003 and after, and =0 otherwise. Standard errors clustered at the firm level are reported in parentheses. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

Robustness Checks: Different Ways of Clustering SE

Table A4: DID Results Using Alternative Clustered Standard Errors

	Log COD emitted (1)	Log COD emission intensity (2)
Treat*Post2003	-0.418***	-0.167***
	(0.108)	(0.041)
	[0.116]	(0.046)
Prefecture char*Trends	Yes	Yes
Province by year FE	Yes	Yes
Firm FE	Yes	Yes
Year FE	Yes	Yes
Observations	303,274	292,952
Adjusted R-squared	0.441	0.685

Notes: This table reports the difference-in-difference regression results from Equation (1) using alternative ways to cluster the standard errors. The dependent variables are log COD emitted and log COD emission intensity (COD emitted/production). The main independent variable is the interaction term of the treatment indicator and post-2003 indicator. The treatment indicator=1 if there is any decline in the number of County dailies in a prefecture during 2002-2004, and =0 otherwise. The post-2003 indicator=1 for 2003 and after, and =0 otherwise. Standard errors clustered at the firm and year levels are reported in the parentheses. Standard errors clustered at the firm and province-year levels are reported in the square brackets. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

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Robustness Checks: SO_2

Table A5: DID results with sulfur dioxide as dependent variables

Dependent variable	Log SO2 emitted	Log SO2 emission intensity
	(1)	(2)
Treat*Post2003	-0.182***	-0.030**
	(0.036)	(0.015)
Prefecture char*Trends	Yes	Yes
Province by year FE	Yes	Yes
Firm FE	Yes	Yes
Year FE	Yes	Yes
Observations	390,104	378,051
Adjusted R-squared	0.428	0.716

Notes: This table reports the difference-in-difference regression results from Equation (1) with log SO2 emitted and log SO2 emission intensity as dependent variables. The main independent variable is the interaction term of the treatment indicator and post-2003 indicator. The treatment indicator=1 if there is any decline in the number of County dailies in a prefecture during 2002-2004, and =0 otherwise. The post-2003 indicator=1 for 2003 and after, and =0 otherwise. Heteroscedasticity-consistent standard errors are reported in parentheses. Standard errors are clustered at the firm level. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.
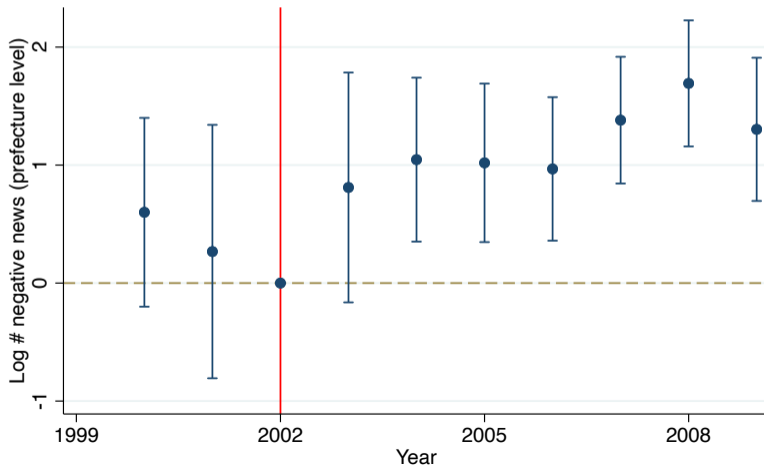
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Reporting on Pollution: Event Study Results

Panel A. Newspaper Level Estimates
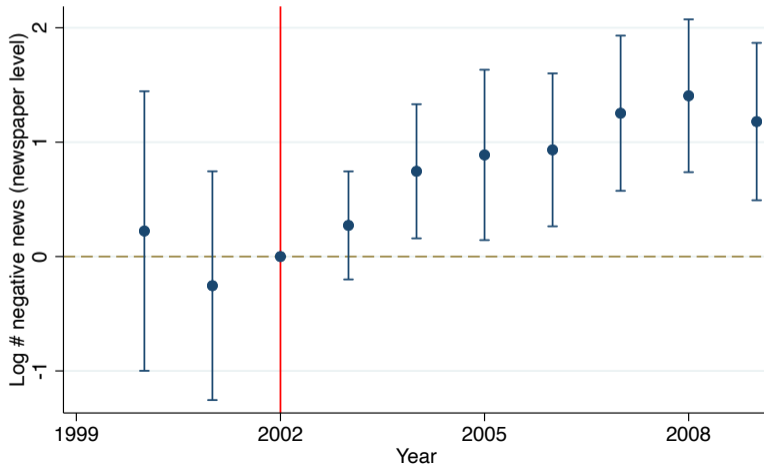
Reporting on Pollution: Event Study Results

Panel B. City Level Estimates

Mechanisms: Fewer Newspapers Reduce HHI

$$HHI_{ct} = \beta_0 + \beta_1 \log(\#Newspapers) + u_c + v_t + \varepsilon_{it} \tag{5}$$

Table 4: Number of Newspapers and the HHI of newspapers' advertisement revenues

Dependent variable HHI	(1)	(2)
Log(#newspaper)	-0.196***	-0.196***
	(0.047)	(0.050)
Prefecture char*Trends	No	Yes
Prefecture and year FEs	Yes	Yes
Observations	535	535
Adjusted R-squared	0.901	0.904

Notes: This table reports the results for association between the number of newspapers and the HHI of newspapers' advertisement revenues at the prefecture level. The dependent variable is HHI calculated based on advertisement revenues, and the main independent variable is the number of newspapers in a prefecture in a certain year. The data are available for 2003–2011. Heteroscedasticity-consistent standard errors are reported in parentheses. Standard errors are clustered at the prefecture level. ***, **, * indicate significance at the 1%, 5%, and 10% levels, respectively.

⇒ Fewer newspapers lead to higher media market concentration, i.e., greater market power.