The Great Firewall and Knowledge Diffusion

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Motivation

National restrictions on cross-border data access are increasing in a large number of countries.

- The restrictions most often are designed to restrict access to information/news or keep data localized, but their effects can be wide ranging.

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China has been particularly active and is usually listed as the most restrictive country regarding cross-border data.

- Internet restrictions were authorized in in 1997, begun in 1998, and continue to expand their reach
- The Great Firewall, started in 2006, relates primarily to cross-border traffic.

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Great Firewall

- blocks Google news and search, google.com (2010)
  - Loss of Google search limits visibility of research outside China
    - All Chinese researchers are restricted. All research outside China is less accessible.
    - 784 Chinese researchers surveyed in 2010 by Nature; **80%** use the search engine to find academic papers; **60%** use it to get information other scientists' programmes
    - Traffic to Wiley Online Library from Google Scholar and Google down 15 and 30 percent.

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    - all Google-related sites were blocked
    - including webpage hosting at **sites.google.com**.

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    - economics papers about China?

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As a result, scholars in China, a large and rising share of the global total, are unable to easily access foreign research posted on those pages.

This Project

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1. Does the implementation of the Great Firewall have an effect on the diffusion of knowledge in economics?
   - Are papers hosted on sites.google.com, Google Sites (GS), less likely to be cited?
2. Are papers about China less likely to be cited?
3. Are Chinese authors less likely to cite GS papers, even after they have been published?
4. Which researchers are most likely to be affected?

The Problem Hits Close to Home

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  - Nathan Zorzi
  - *Davin Chor* (huh? still? after working on this paper for years?)

Literature

- Great Firewall, Google search and information flows
  - Li et al. (2023) [export quality]; Kong et al. (2022) [innovation]; Zheng and Wang (2020) [patents]; Wang et al. (2022)[disclosure] ; Li and Li (2024) [stock price informativeness]

- Knowledge flows across space
  - Jaffe et al (1993); Peri (2005); Belenzon and Schankerman (2013); Head et al. (2018); Sin (2018); Wuestman et al (2019); Ganguli et al. (2020); Bernard et al. (2023)

- China and global knowledge production
  - Xie and Freeman (2019); Qiu et al. (2022); Piracha et al. (2022); Aghion et al. (2023); Economist (2024)

Timeline

- 1998
  - Golden Shield project initiated
    - China begins restricting the internet within the country and across borders.
- 2008
  - sites.google.com launched.
- 2009
  - Great Firewall activity increases. YouTube, Twitter, Facebook all blocked.
- 2010
  - Google hacked by Operation Aurora.
  - Google moves its news service to Hong Kong. google.hk is largely unavailable in China.
  - China retaliates, google.com blocked
  - Other Google-related sites are unavailable including sites.google.com.
- 2011-present
  - 2017 Cambridge University Press self-censors hundreds of published articles.
  - 2021 Springer Nature (Nature & Scientific American) self-censors 000's of articles.
  - Economics papers on China?

Data Construction

1. Assemble a list of academic staff at economics departments ranked in the top 50 by Tilburg University in 2019, **2991 staff**.
2. Retain those with Google Scholar pages, **1804 unique authors**.
3. All papers on the author profile pages scraped from Google Scholar, **145,590 papers**.
4. Deduplication, both within- and across-authors, yields English language papers in social sciences, **94,299 papers** have at least one citation.
5. 70,995 author names extracted from the papers, grouped where necessary using fuzzy matching algorithms yielding **61,439 author**s in total.
6. Scrape search results to find personal websites. **7,024 authors** had personal websites hosted on GS.

Sample

Starting from the broad set of 94,299 papers

- Papers with a start date 2000-2008, inclusive
- Retain papers with at least one pre-treatment citation
- Citations by paper by year from 2004-2020
- **25,505 unique papers**

Google Sites

We measure GS usage at the paper level

- AtLeastOne = 1 if at least one author has a GS personal page
- 85% of papers with AtLeastOne=1 have just one GS author.

Summary Statistics

Papers with Startdate between 2000 and 2020

Paper-level Citations

	2009					2020				
		Flow		Cumulative			Flow		Cumulative	
	N	mean	med.	mean	med.	N	mean	med.	mean	med.
Total	27,806	9	2	38	9	68,296	11	2	98	18
AtLeastOne	6,040	8	2	30	8	20,354	11	3	74	17
China	480	9	2	36	8	1,728	12	2	82	14
					Baseline Regression Sample					
Total	25,505	9	3	41	10	25,505	12	2	175	41
AtLeastOne	5,345	8	3	33	10	5,345	11	2	150	45
China	430	10	3	40	9	430	9	1	159	37

Cumulative Citations

Cumulative Citations and Google Sites, 2020

	Startdate 2000-2020	
At Least One GS Author	-33.40	-8.62
	(2.87)	(2.89)
Paper Age Dummies	N	Y
Obs.	68,296	68,296

Google Site Usage and Selection

GS usage may not be random

- Authors at top departments less likely to use personal webpages to advertise papers.
  - 3 groups of papers based on maximum rank of the authors: 1-10, 11-20, and 21-50.
- MaxRank and AtLeastOne
  - 28.6% for rank 21-50
  - 19.4% for rank 11-20
  - 14.0% for rank 1-10

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- MaxRank and AtLeastOne
  - 28.6% for rank 21-50
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  - 14.0% for rank 1-10
- Multi-author papers more likely to have at least one author with a GS personal page.
  - 4 groups of author team size: 1, 2, 3 , and 4+
- Author Number and AtLeastOne
  - 11.8% for 1 authors
  - 21.9% for 2 authors
  - 25.0% for 3 authors
  - 28.9% for 4+ authors

We include interactions of paperage fixed effects with MaxRank and NumAuths groups.

Baseline Specification

The analysis is done at the level of the paper (p).

Dependent var: Citations (annual flow) of a paper
The baseline specification is

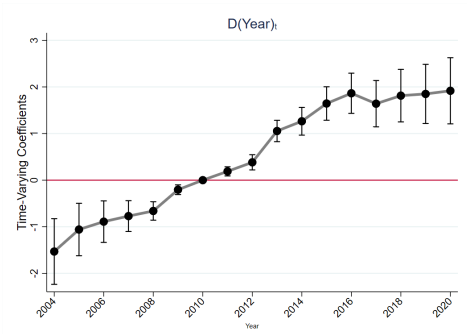
$$\begin{aligned} C_{pt} &= \sum_t \beta_{Gt}(D_t \times \mathbf{I}(AtLeastOne_p)) + \\ &\quad + \sum_n \sum_a \beta_{na} \mathbf{I}(NumAuths_p = n)\mathbf{I}(PaperAge_{pt} = a) \\ &\quad + \sum_m \sum_a \beta_{ma} \mathbf{I}(MaxRank_p = m)\mathbf{I}(PaperAge_{pt} = a) \\ &\quad + D_t + D_p + \varepsilon_{pt} \end{aligned}$$

with $\beta_{G2010} = 0$, errors clustered at the paper level, including paper and year fixed effects.
$AtLeastOne_p = 1$ if at least one of the authors has a webpage hosted on GS.

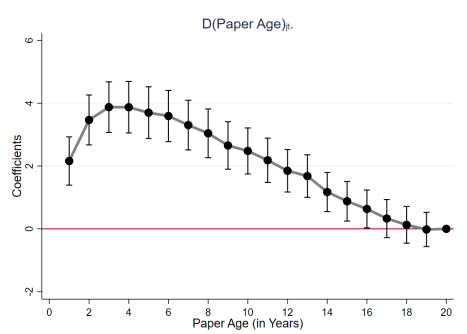
Baseline

Trends, Paper Age

Figure 1: Baseline Specification



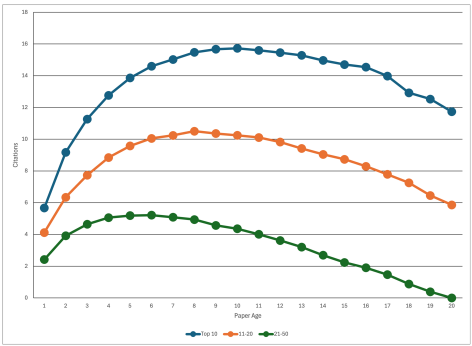
(a) Time



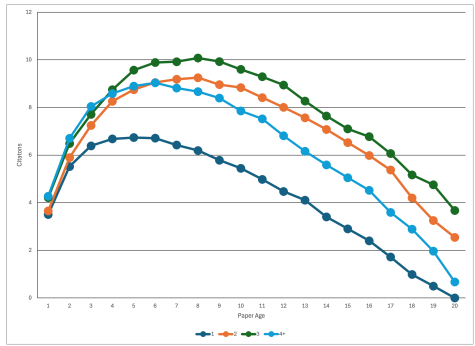
(b) Paper Age

Paper citations rise over time. Citations rise, then fall, with paper age.

Paper Age by Group



(a) Max Rank

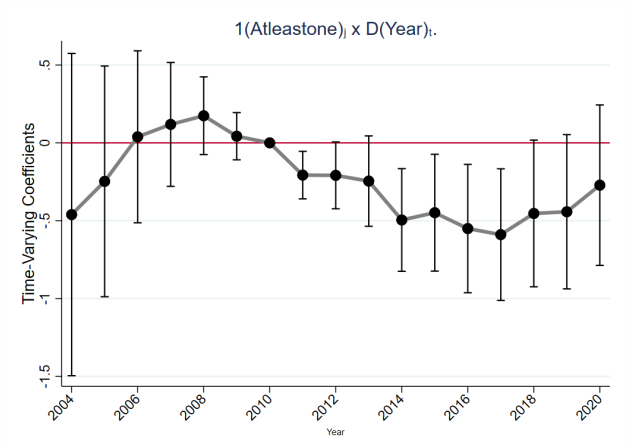


(b) # of Authors

Lifecycle of paper citations varies by maxrank and authornumber group.

Google Sites Effects

Effects of At Least One Author Hosting on GoogleSites



Papers on GS have 3.9 fewer citations after 2010.

Papers on China

- China does not just block large domains: Google Facebook, NYTimes, etc
- Sites containing information deemed unacceptable may also be blocked.
- There is no direct evidence that economics papers about China are deemed unacceptable.
- We enhance the baseline specification to include an indicator if a paper has China in the title or abstract but is not on GS, $ChinaRef_p$, interacted with year dummies.

China Paper Specification

Dependent var: Citations (annual flow) of a paper

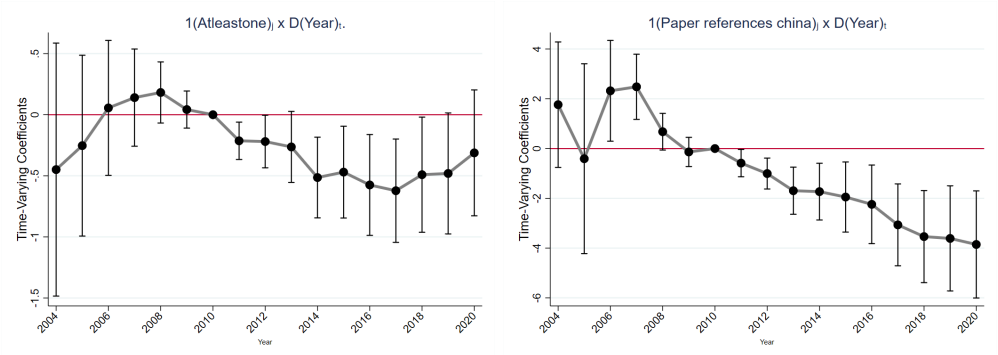
$$C_{pt} = \sum_t \beta_{Gt}(D_t \times \mathbf{I}(AtLeastOne_p)) + \sum_t \beta_{Ct}(D_t \times \mathbf{I}(ChinaRef_p)) + \\ + \textit{Paper Age Interaction groups} + D_t + D_p + \varepsilon_{pt}.$$

$AtLeastOne_p = 1$ if at least one of the authors has a webpage hosted on GS.

$ChinaRef_p = 1$ if the paper has China in the title or abstract and is not on GS.

Baseline + China

Effects on Papers that Reference China



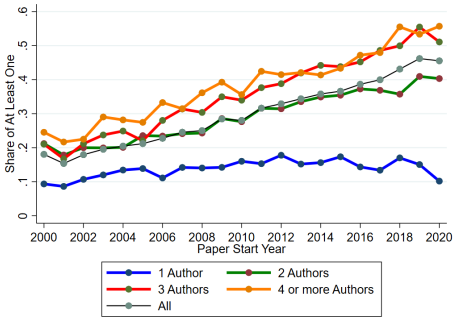
Papers about China are cited less after 2010.
GS effect is larger (4.2), smaller se.s.

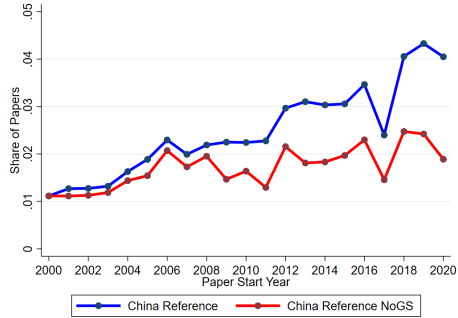
Growing Over Time

The importance of this (lack of) knowledge flow is rising over time.

- More researchers are using Google Sites.
- More papers are being written about China.
-
-

Growing Importance of GS and China Papers in Recent Years





Among papers with a Top 50 author:
Share of papers hosted on GS rising rapidly.
Share of papers on China also rising.

Citing Data - Is China Not Citing?

Web of Science - *published* papers citing other *published* papers

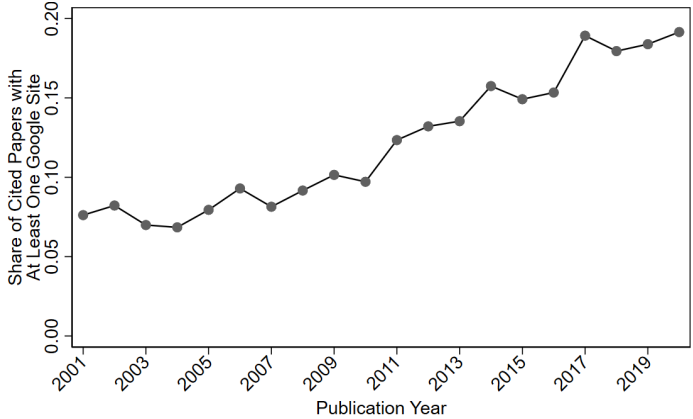
- We scrape Web of Science for every published paper from 2000 to 2020 that cites a published paper in our original sample by Top 50 authors.
- 236,198 citing papers with pub date from 2016-2020 in Business/Economics journals.
  - By construction, every citing paper cites at least one paper by a Top 50 author.
  - 25,797 Top 50 papers are cited; 3,277 GS papers are cited

Growing Over Time

The importance of this (lack of) knowledge flow is rising over time.

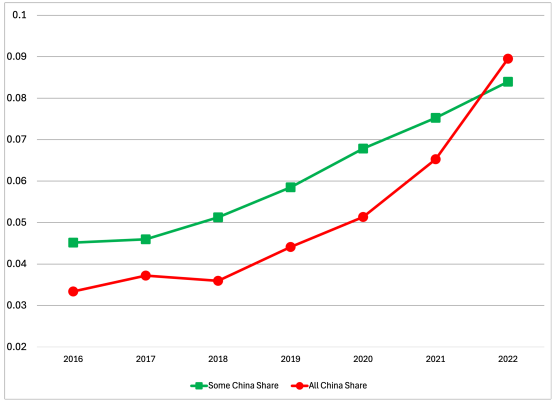
- More researchers are using Google Sites.
- More papers are being written about China.
- More published papers are being written by researchers in China.
- Share of cited published papers with at least one author using GS is rising.

Growing Importance of GS Papers on Web of Science (published papers)



GS papers are increasing as a share of cited published papers by top 50 authors.

Growing Importance of China-based Authors on Web of Science (published papers)



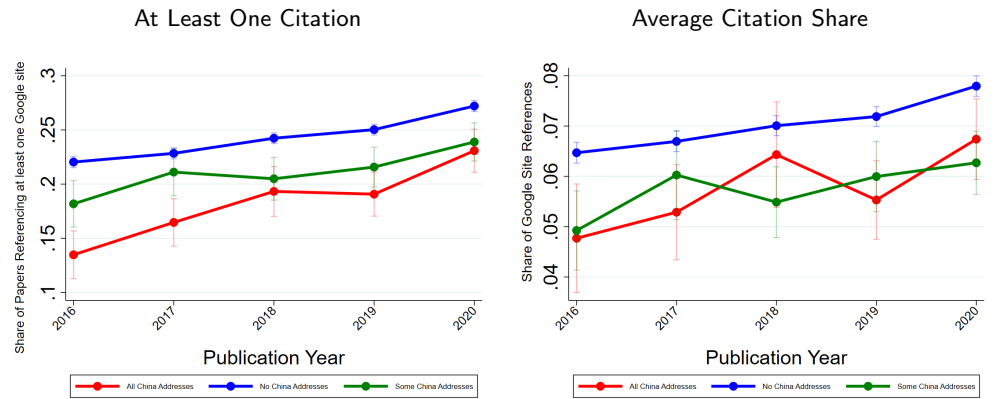
Published papers by China-Based authors are an increasing share of an increasing total.

Citations by China-based Authors

Web of Science - *published* papers citing other *published* papers

- Two measure of GS citation frequency
  - Average share of cited GS papers out of all Top 50 papers cited.
  - Share of papers that cite at least one GS paper.
- Three groups of papers
  - No China-based authors.
  - Some China-based authors.
  - All China-based authors.

Google Sites and Citations by Authors in China



China-based authors are 17% less likely to cite a GS paper than authors outside China.
Share of GS paper cites is 13% lower for China-based authors.

Distribution of Effects

Younger vs Older Research Teams

- The effects of GS and China papers may vary with the seniority of the author team
  - Older teams may have greater visibility in the profession regardless of GS hosting.
    - 50.1 vs 30.8 average cumulative citations in 2009.
  - Younger teams are more likely to host personal pages on Google Sites.
    - 27.7% vs 13.4%.

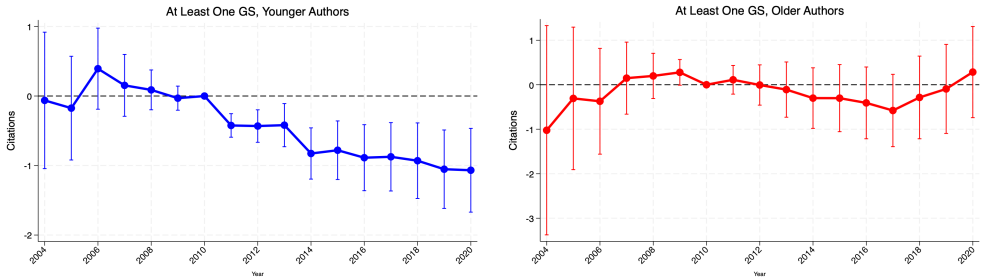
- We split the sample based on the most recent Ph.D year on the team of authors.
  - Younger team: most recent phd obtained after 1994 (13348 papers).
  - Older team: most recent phd obtained before 1995 (12157 papers).

- Using the baseline+China specification we run separate regressions with full sets of fixed effects and interactions.

Baseline + China: Younger vs Older Teams

GS effects

Google Sites Effects

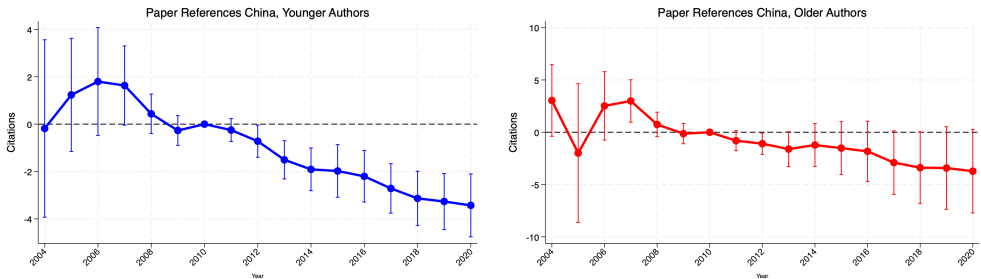


GS effects are much larger and significant for younger teams.
Cumulative GS effect is a reduction of 7.7 citations, smaller se.s.

Baseline + China: Younger vs Older Teams

Effects on China Papers

Effects on Papers that Reference China



Effects on China papers by younger teams are much larger.

Conclusions

Internet restrictions by China are limiting the flow of knowledge to Chinese researchers.

- The Great Firewall blocks websites hosted by Google (and others) after 2010.
- Citations are lower after 2010 for papers hosted on Google sites, and for papers about China
- Published papers by China-based authors are less likely to cite published papers by authors who have a Google site.
- Younger teams are affected the most.