The Great Firewall and Knowledge Diffusion*

Andrew B. Bernard	Esther Bøler	Davin Chor	Sirig Gurung	Wei Lu
Tuck@Dartmouth	Imperial B School	Tuck@Dartmouth	SIEPR	World Bank
CEP, CEPR & NBER	CEP & CEPR	NBER		

January 2025

Abstract

This paper examines the role of internet restrictions on the flow of knowledge across borders. China, through the Great Firewall (GFW), imposes substantial restrictions on the flow of data in and out of the country including blocking Google.com and its subdomains. Webpages of academic researchers that are hosted on sites.google.com are blocked in China. We find that research articles written by authors who host their personal website on sites.google.com have significantly fewer citations and that the reduced citations begin at the same time as the Chinese restrictions on Google. The reductions in citations is even larger for papers that reference China in the title or abstract even if those papers are not hosted on a google site. The reduced citations are largest for young research teams. Published papers by China-based teams are less likely to cite published papers with at least one author hosting on Google Sites.

JEL Classifications: F14, D83, L86, O3

Keywords: internet, citations, information accessibility; academic publications; knowledge production; Google; China Google, China

*We thank Treb Allen, Sam Asher, Yang Jiao, Paul Novosad, and Nina Pavcnik and seminar audiences at EITI, Chicago, Dartmouth, Imperial, Yale, UCSD and METC for helpful comments. Paige Xu and Bashudha Dhamala provided excellent research assistance. All errors are our own.

1 Introduction

National restrictions on internet access are growing. Countries from China to Qatar to Russia substantially limit which websites their residents can view online. While designed primarily to restrict access to news and non-sanctioned information, these restrictions can have unintended consequences on the flow of other information across borders. This paper examines the unintended effects of China's prohibition of Google on citations of non-Chinese academic research.

China implemented internet restrictions in the 1990s under the Golden Shield project to gather data on internet usage of its citizens/residents and to limit what could be posted online.[1] Our interest is in a subset of the Golden Shield known as the Great Firewall which has the ability to block content from outside China. The Great Firewall is the colloquial term for the nation-wide internet control that filters and censors foreign content in mainland China (Ensafi et al. (2015)). The absolute control over internet content enables the Chinese government to manage idea, knowledge, and information exchange without international interference, like a "closed economy". Since the Chinese government owns all internet service providers (ISPs), it can monitor and control what information people in China access online.

In 2010, China used the Great Firewall to block Google search and news, and subsequently all Google-related sites in China including webpage hosting at sites.google.com (GS). As a result, scholars in China, a large and rising share of the global total, were, and continue to be, unable to easily access research posted on those pages. It is well known that it is possible to circumvent the restrictions of the Great Firewall using VPNs and other techniques including private file-sharing; even so, the Chinese authorities have been known to implement counter-measures periodically that obstruct VPNs. The inability to **easily** and reliably search, find, and download content from restricted sites thus raises the cost of accessing academic research hosted on those sites.

This paper examines the (potentially) unintended effect of these restrictions on citations of academic economics research. We call this effect unintended because China does not block access to personal webpages of researchers hosted on other platforms. In addition, the same research working papers that are blocked when hosted on Google Sites (GS) are potentially available if the researcher has an affiliation with a research organization such as the National Bureau of Economic Research (NBER) in Cambridge, MA or the Centre for Economic Policy Research (CEPR) in Paris. Similarly, some repositories of working papers are not blocked by the Great Firewall.

We assemble a panel dataset of papers (published and unpublished) and their citations from researchers based at top 50 economics departments using data from Google Scholar. We find that, as of 2020, total lifetime citations of papers hosted on GS are significantly lower than those for

[1] The Great Firewall of China, Bloomberg News October 12, 2017

papers hosted on other services. Using a difference-in-difference approach we find that the change in relative citations begins in 2010, precisely when the Great Firewall began blocking Google. After 2010, annual citations fell significantly and persistently for GS-hosted papers relative to non GS-hosted papers. This effect remains even after controlling for paper, year, and paper age fixed effects and differential citation lifecycles across groups of papers.

The Great Firewall does not just block domains of large organizations such as Google, but also attempts to restrict access to information on specific topics. We hypothesize that the Chinese government does not want its citizens to have unfettered access to economic research on China. Looking at papers about China that were hosted on otherwise unblocked websites, we find an even larger decline in relative citations after 2010.

While our baseline specification necessarily focuses on an older sample of papers to look at citations before and after 2010, there is evidence to suggest that the knowledge-restricting effects of the Great Firewall may be much greater now than in the past. China-based authors are an increasing fraction of academic economics researchers and the share of papers hosted on GS has been rising rapidly over time.

Our primary dataset of papers and citations from Google Scholar does not allow us to directly check whether the decline in citations after 2010 is due to the behavior of China-based researchers. Instead we use an alternative dataset on published papers citing other published papers from Web of Science by Clarivate. In the period 2016-2020, papers whose authors are all based in China are significantly less likely to cite published papers with at least one co-author hosting on GS. This finding suggests that the effects of GS on citations persist over time, remain for published papers, and are especially pronounced for China-based researchers.

We finish by investigating the role of team visibility in mitigating or accentuating the effect of GS being blocked in China. Less visible researchers are more likely to have lower citations due to GS being blocked precisely because they are not as prominent in the profession. We use the most recent PhD year among co-authors on a paper to construct two groups of papers, a group of older teams whose authors all received their PhD before 1995 and a younger group where the most recent PhD year was after 1994. The results are sharply different across the groups: younger teams have large, significant negative effects that increase over time if they host on GS while the effects are essentially non-existent for older teams. Similarly, the reduction of citations of papers about China are much stronger for younger than older teams. The effects of blocking Google by China fall disproportionately on less visible, younger research teams.

This paper contributes to the literature on the diffusion of knowledge and ideas across space. Citations have been found to decrease with distance, and across borders (Peri, 2005).[2] Recent

[2]Ganguli et al. (2020) find that the effect of distance is even stronger when comparing patent interferences, i.e. when two or more independent parties submit close to identical claims of invention nearly simultaneously, than it is for patent citations.

contributions find that this distance effect has decreased over time (Head et al., 2019), and is less relevant for academic papers than it is for patents (Belenzon and Schankerman, 2013).[3] In addition, knowledge flows are found to reach much farther than trade flows (Peri, 2005). We contribute to this literature by showing how knowledge flows across borders are hindered by internet restrictions.

There is a growing body of work examining the increasing importance of China in global knowledge production (Xie and Freeman (2019), Qiu et al. (2022), Aghion et al. (2023)). Some of this work focuses more specifically on the effects of the Great Firewall on knowledge and information flows. Zhou (2025) investigates the impact of the Great Firewall on the development of domestic apps. By blocking foreign apps, the Great Firewall prompted an expansion of the domestic user base and increased innovation efforts. Sun (2025) estimates substitution patterns across products targeted by digital bans and finds a welfare loss of the Great Firewall from the use of inferior domestic apps. Zheng and Wang (2020) find that the Firewall altered the behavior of inventors in China in that they became less able to seek distant knowledge. This led to the economic value of their inventions decreasing, compared to inventors in neighboring regions, not impacted by the Great Firewall. Similarly, Kong et al. (2022) also find evidence that suggests that the Great Firewall has had a negative effect on foreign knowledge spillovers, as it adversely impacted the intensity and quality of innovation of firms that rely on foreign knowledge, where the affected firms cite fewer foreign patents, and their innovation efficiency declines after Google's exit from China. Our work complements these studies as our focus is on measuring the decline in the use of foreign knowledge due as a result of restictions imposed by the Great Firewall.

The paper is also related to a literature on other consequences of the Great Firewall. Li et al. (2023) find that limited information accessibility after Google was blocked led to deteriorating export quality. Firms and products facing greater information frictions in China experienced a decline in their export quality. Wang et al. (2023) show that the Great Firewall is associated with the strategic disclosure of information by Chinese firms. As investors had more difficulty assessing foreign markets and projects, Chinese firms disclosed more optimistic expectations of foreign projects relative to domestic ones. We contribute by demonstrating an effect of the Firewall on academic citations, and we focus on foreign papers rather than on the outcomes of Chinese scholars themselves. In addition, we are able to compare the effects on blocked and unblocked knowledge.

The paper proceeds as follows. Section 2 discusses the Great Firewall, aspects of its goals and operation, and how it relates to economics research. Section 3 describes the construction of the data on authors, co-authors, and articles. Section 4 discusses potential selection issues and presents our baseline empirical specification. Section 5 then reports regression findings and

[3]Sin (2018) finds that the distance effect has decreased over time also for book translations.

extensions. In Section 6, we use a different citation data source to assess whether researchers in China are less likely to cite papers hosted on GS. Section 7 considers the role of researcher visibility in moderating the effects of GS being blocked. Appendices report regression coefficients and document in more detail the process of data acquisition and cleaning.

2 The Great Firewall

The 1997 regulation titled (in English) "Computer Information Network and the Internet Security Protection and Management Measures" was the first formal regulation that specifically addressed internet security and content management in China. This laid the foundation for many of China's internet censorship practices that are still in place today. Among other provisions, this legal framework established a licensing requirement for internet service providers (ISPs), while empowering the government to require ISPs to monitor and block online content deemed to be politically sensitive, subversive, or harmful to national security.[4] This regime was tightened steadily over time. Violation of various internet security rules was made a criminal offence in 2000, while formal regulation of internet news was introduced in 2005. The ramp up of China's internet censorship enforcement became particularly pronounced around the late 2000s and early 2010s, coinciding with key events such as the 2008 Beijing Olympics, the 2008 Tibetan unrest, 2009 Urumqi riots, the 2010 award of the Nobel Peace prize to human rights activist Liu Xiaobo, as well as the Arab Spring.[5]

Perhaps unsurprisingly, it is not straightforward to pin down the precise origins of the Great Firewall project. During the 2000s, this effort was reportedly under the direction of Li Changchun, the senior Chinese Communist Party leader in charge of propaganda.[6] The Great Firewall (GFW) itself is designed to block access to selected foreign websites and information deemed unacceptable by the Chinese authorities and to control (and slow) cross-border internet traffic. Sites may be selected to be blocked because of their overall purpose, i.e. the New York Times (news) and DuckDuckGo (search) or because they contain keywords or phrases deemed to be inadmissible. If a link is closed then other links from the same machine will likely also be blocked, a form of "guilt by association".

Some commonly used technical methods for the GFW include IP blocking, DNS spoofing filtering and redirection, URL filtering, and Virtual Private Network (VPN) blocking. Although

[4] https://baike.baidu.com/item/计算机信息网络国际联网安全保护管理办法

[5] The criminalization of internet-related offences was adopted at a Standing Meeting of the Ninth National People's Congress in December 2000 (关于维护互联网安全的决定, http://www.legaldaily.com.cn/IT/content/2022-07/15/content_8744071.html), while the "Regulations on the Administration of Internet News Information Services" were released in September 2005 (互联网新闻信息服务管理规定, https://www.gov.cn/flfg/2005-09/29/content_73270.htm

[6] https://web.archive.org/web/20100104124506/http://freemorenews.com/2009/08/30/burn-after-reading-gfw/

a user could technically bypass the GFW using VPNs or proxies, the GFW uses deep packet inspection and machine learning to shut down suspected VPN or proxy tunnels, and as of today, many fewer commercial VPN services are viable in China compared to a few years ago (Tang, 2016). While there has been evidence that suggests disparity between the number of servers found in each city, Wright (2012) argues that there is no discernible overall geographic pattern to the nature or extent of filtering despite significant variation. Therefore, the GFW may be better understood as a decentralized and semi-privatized operation in which low-level filtering decisions are left to local authorities and organizations and high-level control is loose regarding implementation (Wright, 2012).

The first part of the GFW was enacted at the end of 2006, making it difficult for citizens to reach foreign sites that the government deemed illegal, including Google. By 2010, largely in response to Operation Aurora, a China-based hack of western Internet services, Google decided to redirect its mainland China customers to its Hong Kong-based site (BBC News, 2010). China responded by banning Google.com in mainland China in 2010, although it was still accessible sporadically. In mid-2014, the CCP intensified its crackdown on the Google search engine and Google-related products due to the 25th anniversary of Tiananmen; Google, the primary search engine in the rest of the world, has since been erased entirely from the Chinese market.

The blocking of related websites is precisely the source of restrictions that are the subject of this paper. Google.com was blocked in 2010 because the main search feature of Google was returning results deemed unacceptable to the Chinese government. In addition, the news feature of Google provided access to restricted foreign news sites and content and Google refused to self-censor its search and news results. The web-hosting feature of Google at sites.google.com was likely not considered problematic by the Chinese government per se but instead was "guilty" merely by being a subdomain of the larger Google site. Other examples of the (potentially) unintended consequences of blocking Google are the failure of websites with Google fonts, Google Analytics, Google CDNs and reCaptcha.[7] Google.com and sites.google.com remain blocked in China to this day.

2.1 VPNs

Just because webpages hosted on Google are not easily visible in China does not mean that they are completely unavailable. Residents of countries with substantial online government censorship are not the only internet users who may want to hide their country of origin or establish a secure connection to a website. Access to country-restricted content, such as Netflix US and BBC iPlayer, is marketed as a feature by providers of Virtual Private Network (VPN) software.

[7]The problems are not limited to Google. Content on Facebook, X, AWS and Dropbox is regularly blocked in China.

VPNs are advertised as a means to protect one's personal data and to shield online activity from outside observers, either government or internet service providers or other online agents, by rerouting the user's internet traffic through a remote server before sending it on to the final destination.

However, in China, only VPNs authorized by the Chinese government can be legally used. These authorized VPNs have backdoors that allow the government to monitor activity. Other VPNs, while not legal, are available in China. However they do not provide uninterrupted easy access to restricted content. One feature of the GFW is that access today may not guarantee access one day later (or even one hour later). Users of unauthorized VPNs also face the risk of legal action including fines, though the stringency of enforcement is known to vary over time.[8] The ultimate effect is to dramatically raise the search cost of acquiring information on restricted internet sites. In practice, this means that a working VPN is best used to go to specific sites, and not for more informal internet searches. If a researcher knows which particular site they want to visit, a VPN may solve that problem. If they are not sure what sites they should visit to learn about current research, the cost may be substantially higher or prohibitive.

2.2 The role of working papers in economics

This study focuses on the effect of the GFW through sites.google.com (GS) on the citations of economics research outside China. The field of economics is particularly useful in this regard because there is a widespread norm of sharing and presenting working papers early in the research process, usually many years before formal publication in a refereed journal.[9] Unlike many other academic fields, researchers in economics learn about these early stage papers, cite them and are influenced by them before formal publication. In fact, it is generally not considered appropriate for papers presented at conferences or in departmental seminars to have been accepted for publication.

This feature of the economics literature means that online posting of working papers, often through personal websites, is a crucial means of disseminating current research. Economics researchers are likely to look at personal web pages to see what topics are being researched. Authors who host their personal webpages on GS will be harder to find and thus less likely to be cited by China-based researchers.

In academic economics, as in the broader global economy, China has become increasingly important in the last two decades. China has roughly the same number of colleges and universities

[8]The following website – `https://tech.co/vpn/are-vpns-legal` – characterizes this enforcement as "arbitrary". There are periodic news reports of prosecutions in China related to the sale and use of illegal VPNs: `https://www.theguardian.com/world/2023/oct/09/chinese-programmer-ordered-to-pay-1m-yuan-for-using-virtual-private-network`.

[9]Publication in an academic journal does not guarantee articles will be available in China. Spring Nature self-censored 1000s of articles at China's request in 2017 (Reuters, 2017). Websites of academic publishers have also been blocked in China.

as the US (Statista.com) and the fraction of papers in economics journals with an author based at a Chinese university rose from 5.2% (816) in 2004 to 9.5% (5077) in 2020.[10]

The rise of China-based economic researchers means that an increasing share of citations in economics are coming from China and these cited references are less likely to be papers hosted on GS websites because of the GFW.

2.3 Possible Solutions and Mitigation

In spite of the growth in Chinese economic research and the concurrent difficulty in seeing websites hosted on GS, there are several reasons that the GFW might have a small impact on the flow of knowledge across the border in the economics profession.

First, it is possible that VPNs and other workarounds might mitigate the lack of information for Chinese scholars.[11] Second, if non-Chinese researchers are aware of the problem, they have an incentive to shift their web hosting away from Google, resulting in fewer personal research webpages being hosted on GS. However, the fraction of papers with at least one author on GS has steadily increased over our sample period.

Finally, authors may submit their papers to other sites that aggregate and disseminate economic research. However, not all these sites are available in China. The largest repository for disseminating economics working papers, SSRN.org, is blocked in China, while RePEc.org, another large internet repository of academic material, is not blocked.

The fact that webpages are blocked in China if they are hosted on GS would be less problematic if non-Chinese researchers were aware both that their webpages are being blocked in China and that the restriction has a noticeable effect on the dissemination of their research.

3 Data

Our goal is to determine whether non-Chinese academic economists are cited less often if they host their personal webpage on Google Sites (GS). To do this, we take a paper-based approach- rather than an author-based approach in order to control for as many unobserved characteristics of the authors as possible. Running regressions of total author citations on a dummy for the GS characteristic of the personal webpage fails to control for substantial heterogeneity in author ability, institutional visibility and other strong determinants of citations. Following a paper-based approach with paper fixed effects helps control for a large number of time-invariant unobservables.

The ideal dataset would have comprehensive information on cited as well as citing papers including date of first dissemination online, date of any eventual journal publication, existence in

[10] Results from searches on WebofScience.com using CU=(china) and SO=(economics) and YR=(2004 or 2020).

[11] One such workaround involves a network of Chinese researchers sharing non-Chinese working papers on sites in China behind the firewall.

working paper series, the names of all authors, and citations by year. Webhosting sites would be randomly assigned across authors.

Data for authors on cited papers would include the existence of a personal webpage, the hosting site, home institution, age, gender, PhD year and additional institutional affiliations (including thinktanks). In addition, to confirm that any observed effects on citations are due to the GFW, we would like to have citing paper information with the location of all the authors. We are able to assemble a version of the data for cited papers from Google Scholar but technical problems prevent linking those papers to the Google Scholar data on the citing papers (see Appendix B.6 for details). In Section 6, we create a dataset from the Web of Science from Clarivate to explore the citing behavior of China-based authors.

3.1 Sample Creation

We start by assembling a list of academic staff at economics departments/institutions ranked as in the top 50 by Tilburg University in 2019. From that list of 2,991 individuals, we retain those with Google Scholar pages in 2023, resulting in 1,804 unique authors. All papers on the profile pages of these authors are scraped from Google Scholar in 2023 yielding an initial set of 145,590 papers.

Deduplication of papers, both within- and across-authors, trims that initial list to 102,842 main English language papers in the social sciences.[12] 96,987 of these papers have a cumulative citation count of at least one through 2020. Using the fuzzy matching merging score set to 80, the broad sample drops to 94,299 papers.

All 70,995 author/co-author names are extracted from these papers and grouped where necessary using fuzzy matching algorithms (co-author names were less clean due to differing spellings and name formatting) yielding 61,439 authors in total and 59,635 authors not on the original list of authors from the top 50 schools. We did not go back to scrape all the additional papers by the coauthors, so each paper in the dataset contains one or more authors at the top 50 institutions.[13]

For all the authors (original top50 and co-authors), we scrape Google search results to look for personal websites and to determine whether the personal websites are hosted on GS. 7,024 out of 61,439 had personal websites hosted on GS.[14]

In order to determine the start of life for each paper in the sample, we create a *startdate* variable using two distinct pieces of information available in the scraped data from Google Scholar. One,

[12]Deduplication involved removing multiple copies of same paper names using a fuzzy matching algorigthm. We also drop any papers in fields outside social sciences.

[13]Given the enhanced visibility of authors at top 50 institutions we may be under-weighting the negative effects on citations of hosting on GS.

[14]We do not have precise information about when any particular website was created or when it started being hosted on GS. The Wayback Machine potentially contains such data but gives relatively imprecise information and is contingent on when the sites and papers were indexed.

called "publication date" by Google Scholar, is most likely associated with either publication of the paper in an academic journal or the publication of the paper in a formal working paper series. The second variable is the year the paper is first recorded as cited by Google Scholar, "first citation". Both of these measures are noisy, with some first citations occurring decades before the paper was circulating and with publication dates not systematically assigned across papers. We manually clean these variables before creating our preferred measure, *startdate*, as the min of the two variables.[15] Further limiting our attention to papers with a startdate between 2000 and 2020 inclusive reduces the set of papers to 68,296.

The baseline sample for the regression analysis includes papers with a *startdate* between 2000 and 2008 inclusive with at least one citation before 2010. In order to establish whether citations are associated with the onset of the GFW prohibition on Google, we include papers that are first cited/published before 2010 so we can determine if they have differential trends before and after the GFW restrictions.[16] We choose 2000 as the oldest *startdate* to make sure each paper could have been searchable on the public internet. We include annual citations for each paper from 2004 until 2020. We start in 2004 as Google Scholar citations are less comprehensive in earlier years. These restrictions trim the larger sample down to 25,505 unique papers in the baseline sample.

For each paper, we have the following variables: *startdate*, citations by year, the number of authors, the number of authors with a personal page hosted on GS, the number of authors at top 50 institutions, the rank (1-50) of the institution for top50 authors, and the title and abstract.

We construct our paper-level measure of exposure to Google Sites as an indicator variable that is one if at least one author hosts a personal webpage on Google Sites, (AtLeastOne). This choice should bias us against finding effects at the paper level relative to using a count of authors using GS or a fraction. In practice, 85% of papers with AtLeastOne=1 have a single author hosting on GS.

Table 1: Paper-level Citations

	Broad Sample - 2020				
		Flow		Cumulative	
	N	mean	med.	mean	med.
Total	68,296	11	2	98	18
AtLeastOne	20,354	11	3	74	17
China	1,728	12	2	82	14
	Baseline Regression Sample - 2009				
Total	25,505	9	3	41	10
AtLeastOne	5,345	8	3	33	10
China	430	10	3	40	9

[15] The data appendix describes our effort to clean these variables.

[16] As mentioned above, the precise timing of the prohibition on Google.com is hard to date but during and after 2010 the site was almost continuously blocked by the GFW.

Table 2: 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

The first panel of Table 1 shows summary statistics for the broad sample of papers with *startdate* between 2000 and 2020 and at least one citation before 2010. The mean and median flow of citations in 2020 is similar for all papers, papers with AtLeastOne author hosting on GS, and papers about China. The cumulative totals differ quite a bit across the three samples with both AtLeastOne and China papers having lower means and medians. In 2009, before any treatment, both the flow and cumulative citations for the three groups are similar.

4 Empirics

To begin, by way of motivation, we check whether the cumulative citations are lower for papers with at least one author with a personal webpage on GS. We run a cross-sectional regression for the year 2020 on the sample of 68,296 papers of the form:

$$CumCite_p \quad = \quad \beta \mathbf{I}(AtLeastOne)_p + \sum_a \beta_a \mathbf{I}(PaperAge_p = a) + \varepsilon_p \tag{1}$$

where $CumCite_p$ is the cumulative number of citations for the paper since $startdate_p$, $(AtLeastOne)_p$ is an indicator variable if the paper has at least one author with a personal page on GS, and $PaperAge_p$ is the number of years since $startdate_p$.

Table 2 reports the results for all papers and papers with a *startdate* on or after 2000, without and with paper age fixed effects. The simple cross-section shows a significant negative coefficient on the GS variable. Controlling for paper age, we find 8.62 fewer citations for papers who had at least one author hosting a webpage on sites.google.com. Given that the mean level of citations for this sample of papers is 98 and the median is 18, this represents a substantial reduction in citations over the life of the paper.

4.1 Selection and GS

In this section, we discuss possible issues with paper and author characteristics that could be correlated with GS webhosting and might affect the path of citations over the life of a paper.

Authors who choose to host on GS might have different characteristics and the nature of the *AtLeastOne* variable might induce a correlation between GS and other paper characteristics.

We use two variables to help control for omitted author and paper characteristics. First, we consider the rank of the institution of the highest ranked author on the paper.[17] Authors at higher ranked institutions may have less need for personal web pages to advertise their papers and their papers may have a different citation lifecycle due to the high visibility of the authors and their institutions. We create three sets of papers, one if *MaxRank* is in the top 10 departments, one if *MaxRank* is in the rank 11-20 group, and one if the highest ranked author is in at an institution ranked 21-50.[18] These three sets of papers have significantly different shares of papers with *AtLeastOne* = 1, ranging from a high of 27.8% for the 21-50 group to 20.3% in the 11 to 20 group to a low of 11.4% for papers with an author in the top ten departments. Lower ranked authors are more likely to have a GS personal webpage.

Figure 1a shows that the citation path over the age of the paper for the three groups of papers also varies substantially. That the level of citations is positively correlated with the *MaxRank* of the authors is probably unsurprising. However the top-ranked group shows a more rapid increase in citations early in the paper lifecycle, peaking around year 10, and declining less afterwards. The lowest rank group peaks lower and earlier and declines rapidly. These results and the large variation in GS hosting argue for the inclusion of separate *paperage* effects for the papers in the different *MaxRank* groups.

Our measure of GS hosting, *AtLeastOne*, equals one if any of the authors hosts a personal webpage on GS. This means that papers with more authors will have a higher probability of *AtLEastOne*=1 even if hosting is randomly assigned across authors. In the baseline sample the fraction of GS hosted papers rises with the number of authors, 11.8%, 21.6%, 25.0%, and 29.4% for 1, 2, 3, and 4+ authors. As multi-authored papers tend to receive more citations (171) than single-authored papers (127), we separately control for *paperage* and author numbers in our regression.[19] Figure 1b shows the citation path over the age of the paper for papers with 1,2, 3, and 4+ authors. Except for single authored papers, the lifecycle of citations is similar across the groups.

4.2 Baseline

The substantially lower lifetime citations for papers with *AtLeastOne* provides suggestive evidence that the GFW has reduced citations. We now turn to our preferred difference-in-difference specification where we examine the paths of citations for individual papers before and after the

[17] Since every paper has at least one author at a top 50 institution this is equivalent to the highest rank of the top50 authors.

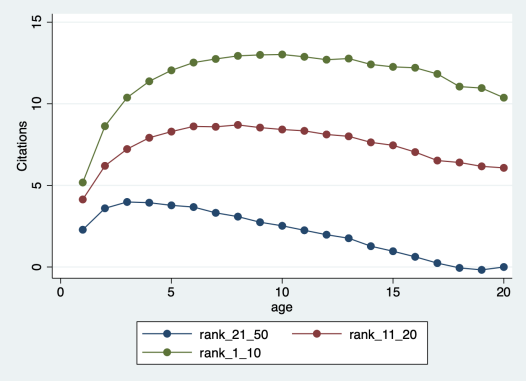
[18] The three groups have 8,904, 7,523 and 11,126 papers respectively.

[19] We include four dummies and interactons with *paperage*for papers with 1, 2, 3, and 4+ authors.

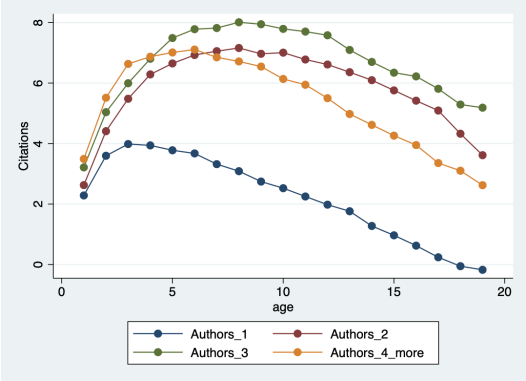
blocking of Google by the GFW. Splitting the sample into papers with no authors on GS versus papers with at least one author on GS allows us to check for pretrends as well as different relative citation rates after 2010.

Figure 1: Citations by Paper Age

(a) Paper and MaxRank Group



(b) Paper Age and Author Number Group



Sample includes papers with startdate between 2000-2008 inclusive
Basic specification: paper, year, and paperage FEs

We regress annual citations for each paper on year dummies interacted with an indicator for at least one author having a personal webpage on sites.google.com (*AtLeastOne*), a complete set of paper age (*PaperAge*) dummies interacted respectively with the four groups of number of authors (*NumAuths*) and the three groups of maximum author institution rank (*MaxRank*), as well as year and paper fixed effects.

The baseline specification is

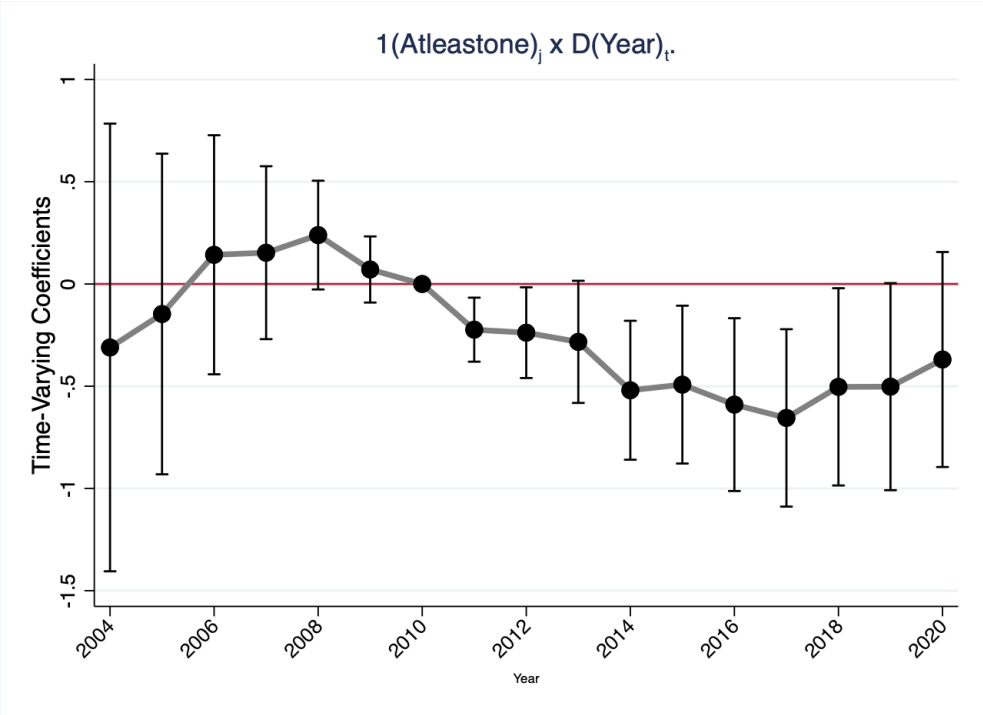
$$\begin{aligned} C_{pt} \quad = \quad & \sum_t \beta_{Gt}(D_t \times \mathbf{I}(AtLeastOne_{ip})) + \\ & + \sum_n \sum_a \beta_{na} \mathbf{I}(NumAuths_p = n)\mathbf{I}(PaperAge_{pt} = a) \\ & + \sum_m \sum_a \beta_{ma} \mathbf{I}(MaxRank_p = n)\mathbf{I}(PaperAge_{pt} = a) \\ & D_t + D_p + \varepsilon_{pt} \end{aligned} \tag{2}$$

with $\beta_{G2010} = 0$ and standard errors clustered at the paper level.

5 Results

Figure 2 shows the coefficients of *AtLeastOne* by year in the baseline specification.[20] Following the blocking of Google in 2010, the relative citation rates for papers hosted on GS is lower in each year, usually significant and increasing in magnitude over time . On average in the post-treatment period, these papers received 0.44 fewer citations per year, or 3.8% fewer citations overall. There is no evidence of pretrends, none of the coefficients before 2010 are significantly different from zero.

Figure 2: Effects of At Least One Author Hosting on GoogleSites



(a) Sample includes papers with *startdate* between 2000-2008 and at least onecitation before 2010.

(b) Basic specification: paper, year, and paperage FEs, Paperage interactions w Author Number groups and MaxRank groups

5.1 China Papers

As mentioned earlier, the GFW both blocks specific domains such as the Wall Street Journal as well as sites containing individual words or content that are deemed inadmissible. While the blocking of Google.com is well known and the timing is fairly well documented, it is less clear what other content is not allowed to pass through.

[20] Appendix A reports the coefficients and standard errors.

Here, we hypothesize that the GFW is also blocking pages that contain economics papers about China itself. Controlling news and information about China from outside sources is one of the stated purposes of the GFW so it stands to reason that the Chinese government might not want academic papers about China to be readily available. We construct a variable, *ChinaReference*, that equals one if the title or abstract of the paper contains "China" and if the paper does not have an author with a personal page on GS.

Since websites on GS are already blocked, any such paper would already be largely unavailable in China. In fact, in the baseline specification, papers with *ChinaReference*=1 would be in the control sample and, if blocked separately, would reduce the estimated coefficients on *AtLeastOne* after 2010.

We are uncertain when China began blocking content more broadly, so we assume it also occurred in 2010 and augment the baseline specification with a full set of year dummies interacted with *ChinaReference* as given in equation 3,

$$\begin{aligned} C_{pt} &= \sum_t \beta_{Gt}(D_t \times \mathbf{I}(AtLeastOne_{ip})) + \\ &\quad \sum_t \beta_{Ct}(D_t \times \mathbf{I}(ChinaRef_{ip})) + \\ &\quad + \sum_n \sum_a \beta_{na}\mathbf{I}(NumAuths_p = n)\mathbf{I}(PaperAge_{pt} = a) \\ &\quad + \sum_m \sum_a \beta_{ma}\mathbf{I}(MaxRank_p = n)\mathbf{I}(PaperAge_{pt} = a) \\ &\quad D_t + D_p + \varepsilon_{pt}. \end{aligned} \tag{3}$$

Figure 3a shows the year-by-year coefficients for *AtLeastOne*. The pattern from the baseline specification is preserved although the coefficents after 2010 are more negative, averaging -0.46, and the standard errors are smaller. This suggests that blocked papers about China had been grouped with unblocked papers in the baseline results.

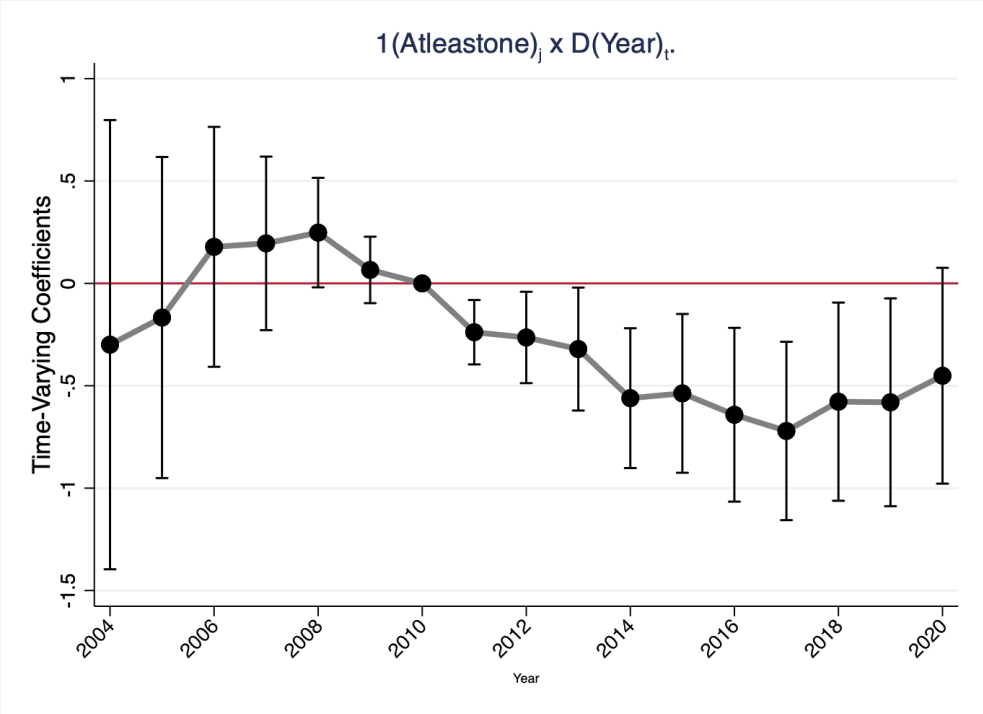
Figure 3b shows the year-by-year coefficients on the *ChinaReference* variable. Again the trend is downward, papers not on GS that have China in the title or abstract are significantly less likely to be cited after 2010 relative to other non-GS papers.[21] The magnitude of the coefficients are dramatically larger, with the cumulative effect between 2011 and 2020 amounting to 24.3 fewer citations. The average paper in this group had 149 cites by 2020.[22]

[21] There is the possibility that the blocking of papers about China started earlier, i.e. in 2007.

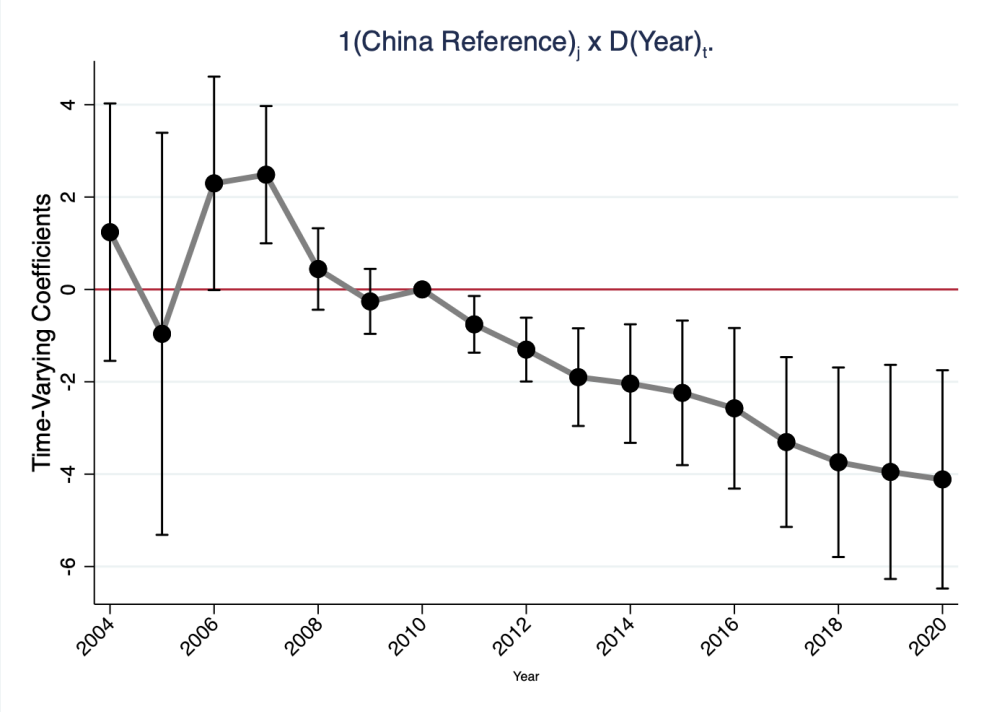
[22] In results available from the authors we show that papers about India, or other BRICS countries show no differential citation patterns after 2010.

Figure 3: Effects on Papers that Reference China

(a) *AtLeastOne* googlesite by year



(b) Paper References China by year



(c) Sample includes papers with *startdate* between 2000-2008 inclusive

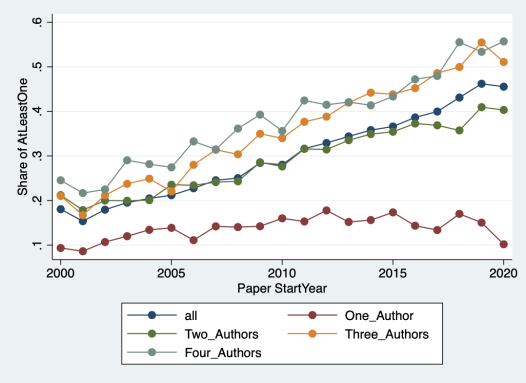
(d) Basic specification: paper, year, and paperage FEs, Paperage interactions w Author Number groups and MaxRank groups

5.2 Implications

By construction the baseline sample of papers for our empirical exercise predates the imposition of the restrictions on Google-related sites in 2010. We use papers whose start date was between 2000 and 2008 inclusive. This sample therefore consists of relatively old papers. However the growth in the use of personal websites, and Google Sites in particular, means that the aggregate impact of these restrictions is potentially much greater for the full sample of papers from recent years.

Figure 4: Papers Over Time

(a) Papers with AtLeastOne GS Author



(b) Papers about China

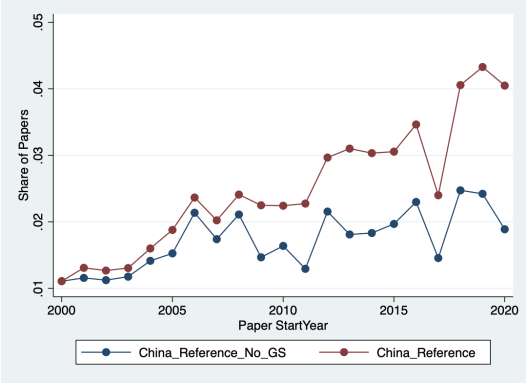


Figure 4a shows the fraction of papers with at least one GS by paper start year and the number of authors on the paper. Overall the fraction of new papers with at least one GS has risen from 18.1 % in 2000 to 45.5% in 2020. Most of that increase occurs after 2008, the last year of new papers in our baseline sample. Considering papers grouped by the number of authors, we find that GS papers have risen in all categories, but the fastest increase is for papers with three and four+ authors. At the same time those two categories have increased their share of papers from 28.% in 2000 to 63.0% in 2020.

In line with the rise of China as an economic power, the fraction of new papers referencing China has also increased in the past several decades from 1.1% in 2000 to 4.1% in 2020 as shown in Figure 3b. Surprisingly, new papers that reference China in the most recent decade (2011-2020) are slightly more likely to have at least one author with a page on Google Sites. It does not appear that writing about China increases awareness of the fact that personal pages on Google Sites are blocked in China.[23]

[23]The fact that one of the authors of this paper continues to host a personal academic webpage on GS suggests perhaps that researchers do not care about the loss of citations, even after becoming aware of the issue.

6 China and the Absence of Citations

Up to this point, we have established that the unexpected blocking of Google by China in 2010 had an adverse impact on citations of papers by authors hosting personal web pages on sites.google.com. In this section we present evidence that those missing citations are, in fact, driven by papers whose authors are based in China. We create a new dataset of published papers from the Web of Science and show that papers written by teams based entirely in China are less likely to cite research where at least one author has a personal page on sites.google.com.[24]

6.1 Data

The source of the data in this section is the citation database in Web of Science (WoS) Core Collection by Clarivate. This online resource contains information on published-to-published paper links, i.e. citations by published papers of other published papers.[25] While the citation index does contain historical information for some journals, data typically starts in the year the journal first was included in the WoS and there was a large increase in journal coverage after 2010 making any comparison to our earlier results problematic.

We start by collecting all the published papers in Business and Economics journals from 2000-2020 inclusive that cite one or more published papers by a Top 50 author. These criteria yield 517,637 citing papers in Business and Economics journals. We then focus on the period 2016-2020 resulting in a sample of 236,198 citing papers. By construction, every citing paper in the sample cites at least one paper by a Top 50 author. 25,797 Top 50 papers are cited; of those 3,277 have at least one author with a personal page on GoogleSites.

The WoS data includes author affiliations with geographic information. This allows us to create three groups of papers: those with no authors located in mainland China (China), papers with all authors located in China; and papers with some authors located in China. All three designations are time-invariant and are accurate as of the publication date of the citing paper.[26]

The WoS data confirms both the increasing importance of Google Sites and the rise of China-based authors in academic economics research. Figure 5 shows the increase in the share of published papers by Top 50 authors with at least one co-author hosting a personal page on GoogleSites from 2000 to 2020. From 2010 to 2020 this share of "treated" published papers increases by over 70 percent.

In Figure 6, we show the rapid increase in published papers with authors in China in recent

[24]While Google Scholar does show citing papers, it is not possible to systematically assemble citing paper data with geographic information on authors affiliations.

[25]The WoS potentially does contain information on the citations of unpublished papers by published papers; however, this information is not available at scale so our analysis is restricted to published-published paper links.

[26]For an author with multiple affiliations we only categorize them as being in China if all the affiliations are located in China.

years. From 2016-2020, the share of papers with all authors located in China rises by 50 percent from 3.3 to 5.1 percent of all papers in the citing sample. The share of papers with some authors in China rises at a comparable rate.[27]

Figure 5: Rising Share of Cited Published Papers with AtLeastOne

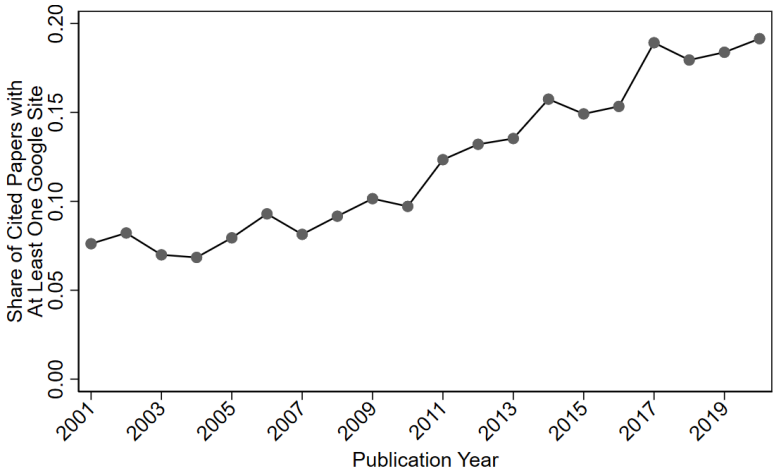
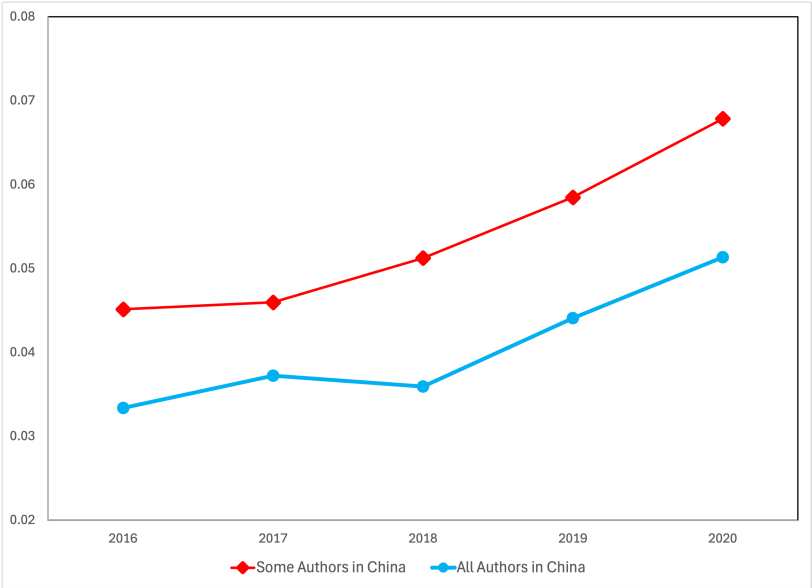


Figure 6: Rising Share of Published Papers by Researchers in China



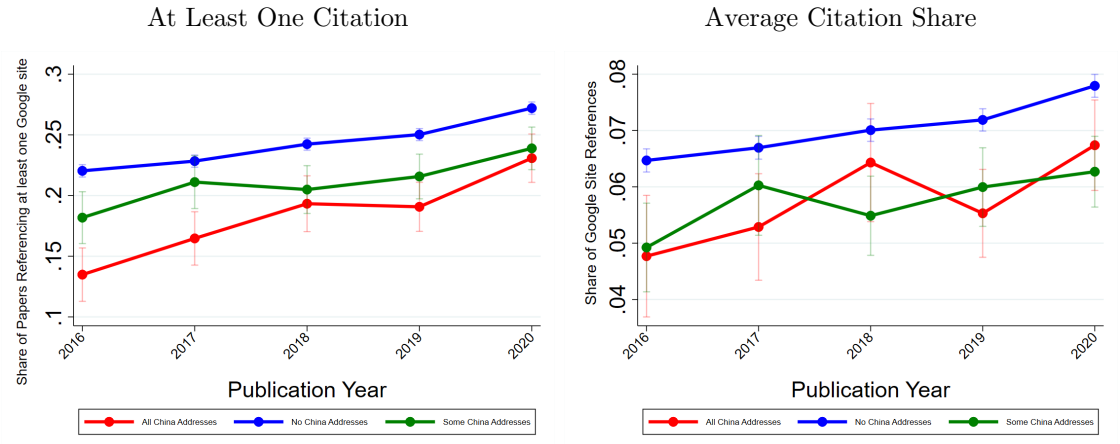
We create two measures of the propensity to cite papers with AtLeastOne equal to one. First, for each paper we create an indicator if it cites at least one GS paper by a top 50 author. We then create the share of papers in each geography-based paper category where this indicator equals one (at least one citation). Second, for each citing paper, we calculate the share of all cited Top

[27]By 2022, the share of published papers by authors entirely in China increased to 9.0 percent of the total.

50 papers that have AtLeastOne equal one. We then average this share across all papers in a geography-based paper category (average citation share).

Fig 7 shows both measures from 2016-2020. Citations of GS papers are rising over the period for all geographic groups, both in terms of the share of such papers cited and the average citation share as would be expected given the trend in Figure 5. However, the differences between the geographic groups are large and significant and remain over time. Citing papers with all authors in China are 17 percent less likely to cite a GS paper than papers with no authors in China.

Figure 7: Citations of GS Papers by Authors in China



Combined with the earlier results showing reduced citations for papers with an author using GS, these findings strongly suggest that the reduction in citations is coming from the rising share of economics papers by China-based authors.

7 Visibility

We now return to the original sample of papers to investigate whether there are systematic differences in the treatment effect across papers by different types of authors. We have found that papers with at least one author hosting a webpage on Google Sites are less likely to be cited after 2010 and that published papers by authors in China are less likely to cite such papers. It is likely that authors who are less well-established in academic networks are more likely to be affected by the loss of visibility in China. We have already shown a significant difference in citation life-cycles for researchers at institutions of different ranks. However, other characteristics such as gender, thinktank affiliation and seniority are also likely to matter for researcher visibility.

Of these characteristics, we are only able to systematically retrieve data on seniority given by the PhD year of the authors. We split the sample based on the most recent PhD year on the team of authors. Older teams have authors who all obtained their PhD before 1995 (12157 papers).

One or more members of younger teams obtained their PhD after 1994 (13348 papers).

Older teams 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%. Using the baseline+China specification in equation 3, we run regressions with full sets of fixed effects and interactions separately for papers by the two types of teams.

Figure 8: Younger vs Older Teams - Google Sites

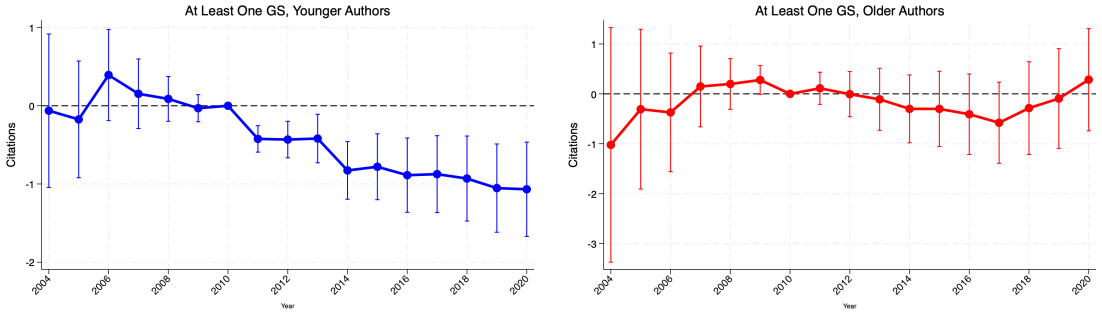


Figure 8 shows the coefficents on AtLeastOne interacted with year dummies for the two groups of teams. The differences are large and significant. Younger teams have negative, significant effects that are steadily increasing in magnitude after 2010. The magnitude of the cumulative loss of citations for papers with at least one author hosting on Google Sites is 7.7, almost twice as large as reported earlier. In contrast the effect on older teams in small and never significant. GS effects are much larger and significant for younger teams.

Figure 9: Younger vs Older Teams - China Papers

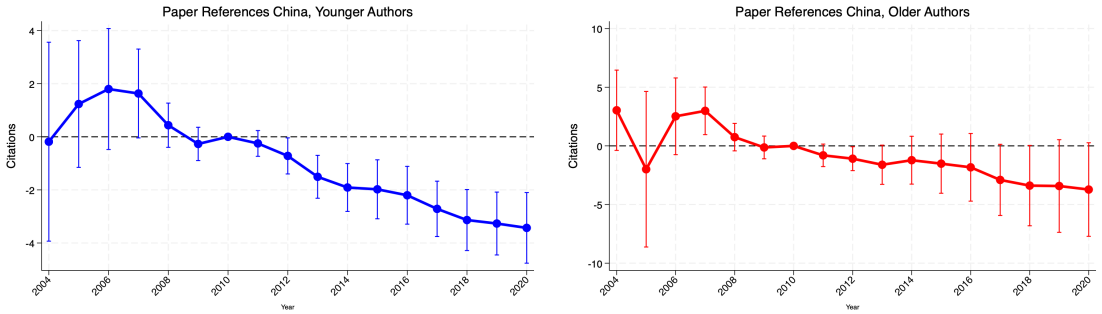


Figure 9 shows the estimated coefficient for papers that reference China by younger and older teams. Both groups have negative coefficients that are increasing in magnitude over time. However, the effects on China papers by younger teams are much larger and are significant in every year.

The differences between young and older teams are large and suggestive of an important role

for visiblity as an omitted variable in the overall analysis. Less visible, younger researchers are more likely to see a significant reduction in relative citations after China blocked Google Sites in 2010. Similarly, papers about China show bigger negative effects if they are written by younger teams.

8 Conclusion

This paper examines the effects of internet restrictions on the flow of knowledge across borders. When China used the GFW to block Google search and news in 2010, it had the (potentially) unintended consequence of also blocking personal webpages hosted on sites.google.com (GS). The work of academic researchers outside China hosting on GS became much harder to find by China-based scholars.

Using data from Google Scholar on both published and unpublished academic economics papers, we show that the blocking of Google significantly lowered annual citations by authors with a GS webpage. The results are large in magnitude and increasing over time. We find that papers about China, not hosted on GS, also showed a very large and persistent drop in citations starting around the same year.

Using more recent data on citations of published papers by other published papers from Web of Science (WoS), we show that China-based research teams are 17 percent less likely to cite published papers that are hosted on GS. Given the rising share of economics researchers based in China and the increased usage of GS, these reductions in knowledge flows are likely increasing in importance. The long term effects of such reduced access are an important topic for further research.

References

Aghion, P., C. Antonin, L. Paluskiewicz, D. Stromberg, X. Sun, R. Wargon, and K. Westin (2023). Does Chinese Research Hinge on US Coauthors? Evidence from the China Initiative. Technical report, College de France.

Belenzon, S. and M. Schankerman (2013, 07). Spreading the Word: Geography, Policy, and Knowledge Spillovers. *The Review of Economics and Statistics 95*(3), 884–903.

Ensafi, R., P. Winter, A. Museen, and R. J. Crandall (2015). Analyzing the Great Firewall of China Over Space and Time. *Proceedings on Privacy Enhancing Technologies 2015*(1), 61–76.

Ganguli, I., J. Lin, and N. Reynolds (2020, April). The paper trail of knowledge spillovers: Evidence from patent interferences. *American Economic Journal: Applied Economics 12*(2), 278–302.

Head, K., Y. A. Li, and A. Minondo (2019, 10). Geography, Ties, and Knowledge Flows: Evidence from Citations in Mathematics. *The Review of Economics and Statistics 101*(4), 713–727.

Kong, D., C. Lin, L. Wei, and J. Zhang (2022). Information accessibility and corporate innovation. *Management Science 68*(11), 7837–7860.

Li, G., H. Ding, and F. Jia (2023). Information Accessibility and Export Quality: Evidence from China. *Review of International Economics*, 1–30.

Peri, G. (2005). Determinants of knowledge flows and their effect on innovation. *The Review of Economics and Statistics 87*(2), 308–322.

Qiu, S., C. Steinwender, and P. Azoulay (2022). Who Stands on the Shoulders of Chinese (Scientific) Giants? Evidence from Chemistry. Technical Report 30772, NBER.

Reuters (2017). Springer Nature blocks access to certain articles in China. November 1, 2017.

Sin, I. (2018). The gravity of ideas: How distance affects translations. *The Economic Journal 128*(615), 2895–2932.

Sun, R. (2025). Blocking the Giants: Theory and Evidence from the Great Firewall. Technical report, Rotman School of Management.

Wang, K., X. Yu, and B. Zhang (2023). Panda games: Corporate disclosure in the eclipse of search. *Management Science 69*(6), 3263–3284.

Xie, Q. and R. B. Freeman (2019). Bigger than you thought: China's contribution to scientific publications and its impact on the global economy. *China & World Economy 27*(1), 1–27.

Zheng, Y. and Q. R. Wang (2020). Shadow of the Great Firewall: The Impact of Google Blockade on Innovation in China. *Strategic Management Journal 41*(12), 2234–2260.

Zhou, J. (2025). Firewall for Innovation. Technical report, MIT.

A Appendix

Regression results

Results for Figure 2

VARIABLES	(1) Citation Count
2004 x *AtLeastOne*	-0.311
	[0.665]
2005 x *AtLeastOne*	-0.147
	[0.477]
2006 x *AtLeastOne*	0.143
	[0.355]
2007 x *AtLeastOne*	0.153
	[0.257]
2008 x *AtLeastOne*	0.239
	[0.162]
2009 x *AtLeastOne*	0.071
	[0.098]
2010 x *AtLeastOne*	0.000
	[0.000]
2011 x *AtLeastOne*	-0.223**
	[0.095]
2012 x *AtLeastOne*	-0.238*
	[0.135]
2013 x *AtLeastOne*	-0.283
	[0.182]
2014 x *AtLeastOne*	-0.520**
	[0.207]
2015 x *AtLeastOne*	-0.492**
	[0.235]
2016 x *AtLeastOne*	-0.590**
	[0.257]
2017 x *AtLeastOne*	-0.655**
	[0.264]
2018 x *AtLeastOne*	-0.503*
	[0.293]
2019 x *AtLeastOne*	-0.502
	[0.308]
2020 x *AtLeastOne*	-0.369
	[0.320]
Observations	394,862

Paper, year, and paper age fixed effects included.
Paper age interactions with MaxRank groups and Author Number groups included.
Robust standard errors in brackets.
*** p<0.01, ** p<0.05, * p<0.1

Results for Figure **??**

VARIABLES	Citation Count		
2004 x *AtLeastOne*	-0.299	2004 x China Reference	1.240
	[0.667]		[1.694]
2005 x *AtLeastOne*	-0.167	2005 x China Reference	-0.961
	[0.477]		[2.646]
2006 x *AtLeastOne*	0.178	2006 x China Reference	2.297
	[0.356]		[1.405]
2007 x *AtLeastOne*	0.195	2007 x China Reference	2.485***
	[0.258]		[0.903]
2008 x *AtLEastOne*	0.248	2008 x China Reference	0.442
	[0.163]		[0.536]
2009 x *AtLEastOne*	0.066	2009 x China Reference	-0.259
	[0.099]		[0.428]
2010 x *AtLEastOne*	0.000	2010 x China Reference	0.000
	[0.000]		[0.000]
2011 x *AtLEastOne*	-0.239**	2011 x China Reference	-0.756**
	[0.096]		[0.373]
2012 x *AtLEastOne*	-0.264*	2012 x China Reference	-1.303***
	[0.136]		[0.420]
2013 x *AtLEastOne*	-0.321*	2013 x China Reference	-1.899***
	[0.182]		[0.643]
2014 x *AtLeastOne*	-0.561***	2014 x China Reference	-2.039***
	[0.208]		[0.780]
2015 x *AtLeastOne*	-0.537**	2015 x China Reference	-2.240**
	[0.236]		[0.952]
2016 x *AtLeastOne*	-0.642**	2016 x China Reference	-2.574**
	[0.258]		[1.057]
2017 x *AtLeastOne*	-0.721***	2017 x China Reference	-3.305***
	[0.265]		[1.118]
2018 x *AtLeastOne*	-0.578**	2018 x China Reference	-3.743***
	[0.294]		[1.247]
2019 x *AtLeastOne*	-0.581*	2019 x China Reference	-3.952***
	[0.309]		[1.409]
2020 x *AtLeastOne*	-0.451	2020 x China Reference	-4.113***
	[0.320]		[1.437]
Observations	394,862		

B Appendix

Data Details

B.1 Website Scraping/Classification

- Used https://serpapi.com/SerpAPI to retrieve search results for authors affiliated with top 50 Economics graduate program institutions.
  - Search criterion: "{Name} Economics Personal website".
  - Search results from SerpAPI are in JSON format which is easy to handle in python as a dictionary. Saved all search results (the searcher plan allows up to 2,000 downloads per hour. Can be faster if you upgrade).
- Screened for google, github, wix, weebly, wordpress, personal, academic, and other sites based on website urls that appeared in the google search[28].

B.2 Authors from Top 50 institutions

- After initial screen of sites returned from google search, downloaded the source codes for the "personal" and "other" websites to find google, wix, wordpress and weebly websites that are not obvious to screen using the url. Searched for company watermarks and copyright notices. Below are the updated updated number of authors with a site on a given domain (github site source code does not have anything unique about it other than the url, so it wasn't worth screening for those.):
  - # Authors with no sites: 8
  - # Authors with Google Sites: 368 (19%)
  - # Authors with GitHub Sites: 25
  - # Authors with Weebly Sites: 12
  - # Authors with Wix Sites: 14
  - # Authors with Wordpress Sites: 22
  - # Authors with Personal Sites: 357
  - # Authors with Academic Sites: 1940
  - # Authors with Other Sites: 513
  - # websites reclassified after source code check: 45
- Further screened for whether there was a perfect match for author name in the website source code. This was done for google sites only. After this, there are 357 authors with a google site match (18%).
- Each observation is by author-website in the final dataset, with indicators for each of the eight possible domain classifications.

[28] Domain classification criteria are in the appendix

B.3 Coauthors

- Initial screen and source code check for domain verification are identical to the Author website classification.
- After initial screen of sites returned from google search and further checking website source code to verify website domain::
  - # Authors with no sites: 4978
  - # Authors with Google Sites: 5993
  - # Authors with GitHub Sites: 359
  - # Authors with Weebly Sites: 195
  - # Authors with Wix Sites: 199
  - # Authors with Wordpress Sites: 15
  - # Authors with Personal Sites: 9158
  - # Authors with Academic Sites: 45928
  - # Authors with Other Sites: 18672
  - # websites reclassified after source code check: 27
- Coauthor names are not in a standardized format, so source code check for presence of name in the website source code is particularly helpful for these names. Again, this was done for google sites only. After this, there are 5096 authors with a google site match (8.5%)[29].

B.4 Domain Classification Criteria

- Google Sites:
  - a url in the format "https://sites.google.com/..." is flagged as google site. Further, the site must have some permutation of the first name, last name (or middle name if present) in order to screen for related author google sites that come up in the search results.
  - Some google sites have custom urls (eg. "https://www.yeowhweechua.com/" is a google website). These urls fall in the "personal" category (defined below), and a source code check is done to determine whether the site is hosted on the google domain.
- Github Sites:
  - Github sites tend to consistently have a url of the above format. Unfortunately, there is nothing in the source code that uniquely identifies a github site other than the url.
- Weebly Sites:
  - Of the format "https:/____.weebly.com/...". The url must also have some permutation of the name where underscored.

[29] Alternatively, matched each coauthor with the author affiliated with a top 50 institution with whom they coauthor and the name of the paper that they worked on and checked for matches with Top50 author name and a fuzzy match for paper name in the website in the research page instead. While this screen is more stringent, it performed similarly to searching for a match with coauthor name in the website source code.

  - Weebly site urls can be customized. In the source code, I have searched for "Powered by Weebly" or "weebly.com" in the "personal" and "other" sites to categorize them as a weebly site.

- Wix Sites:
  - Of the format "https://____.wixsite.com/..." or "https://____.wix.com/...". The url must also have some permutation of the name where underscored.
  - Wix site urls can be customized. In the source code, I have searched for "Wix.com Website builder" in the "personal" and "other" sites to categorize them as a wix site.

- Wordpress Sites:
  - Of the format "https://____.wordpress.com/...". The url must also have some permutation of the name where underscored.
  - Wordpress site urls can be customized. In the source code, I have searched for "wordpress.com" in the "personal" and "other" sites to categorize them as a wix site. This is a very weak check, but doesn't seem like there is anything else in the source code that is clearly unique to a wordpress site.

- Personal Sites:
  - Of the format "https://____.(com—net—info)/...". Where the underscored. Part is some variation of the author name. Includes common ones like "https://{firstname}{lastname}.(com—n obviously, but also sometimes relies on first 3 letters of first name or first 5 letters of last name for matching (since names like Alexander abbreviates to Alex, long Russian last names have shorter versions, etc).
  - The source codes of these websites are checked to categorize them as one of the above categories.

- Academic Sites:
  - Simply, a site with ".edu". Also, foreign domains tend to be academic sites (".fr", ".uk", ".de", etc) usually with multiple matches per author. Sites for graduate students, alumni, student page profiles and websites that lead to pdfs are excluded.

- Other Sites:
  - Essentially all other sites, with a small caveat described below.
  - All websites that obviously do not host research have been removed. These include social media sites, media sites, blogs, websites of popularly affiliated companies, organizations with about pages but no research page etc. Also, any page that leads to a pdf or document.

B.5 Paper Title Deduplication

In the process of paper title deduplication, a deduplication run was executed using the matchit command to eliminate multiple copies of the same paper within a given author. This was particularly relevant for instances like "The Missing Profits of Nations" by Zucman, where variations in paper names ("The Missing Profits of Nations (Working Paper No. 24701)", "i Zucman,

G.(2018):"The Missing Profits of Nations"") resulted in separate line entries on the author's Google Scholar page that the prior fuzzy merging algorithm failed to identify as the same paper. Additionally, to account for different cutoffs in the bigram-based fuzzy merging score, five new citation count variables were generated: citation_count_75, citation_count_80 (used as the baseline dependent variable), citation_count_85, citation_count_90, and citation_count_95. These variables correspond to varying thresholds in the bigram-based fuzzy merging score, where a higher score indicates a greater share of identical bigrams across any two paper titles being compared.

Paper Start Year

B.5.1 pub_year Cleaning

- Cleaned the publication year for papers that show pub_year $\leq$ 1975. This includes mostly inaccurately scraped pub_year or old scriptures wrongly classified to an author due to a common name (e.g., John Taylor).
- Cleaned up pub_year $\geq$ 2024 due to inaccurate scraping.
- Cleaned the irrelevant entries for those with length(paper_title) $\leq$ 10, which was mostly inaccurate scraping; not found in author's Google Scholar's page and no info on other details (title, publisher, coauthors, etc.), or non-economic papers falsely classified under the author's name.
- Cleaning the irrelevant entries for those with length(paper_title) $>$ 11 & length(paper_title) $\leq$ 15 (similar reasons as above).

The pub_year variable underwent a series of cleaning procedures to address some concerns in the output scraped by the API. Firstly, entries with a pub_year $\leq$ 1975 were addressed. This subset primarily contained inaccurately scraped pub_year values or cases where old papers were erroneously linked to authors due to common names (e.g., "John Taylor"). The next step involved cleaning entries with pub_year $>$ 2023, targeting inaccuracies arising from flawed scraping processes. Further cleaning was carried out for entries with a paper title length of less than or equal to 10 characters, and a similar process was applied to those with titles ranging from 11 to 15 characters. In both cases, the decision to clean was motivated by the identification of wrongly classified papers, such as incoherent paper titles that were misclassified on the author's Google Scholar page and have since been removed, as well as instances of non-economic papers falsely associated with the author's name.

B.5.2 Min Year Cleaning

- Sieved out papers that either have: (i) a very early year of first citation; or (ii) have a year of first citation that precedes by many years the pub_year.
- Cleaned observations with min_year $\leq$ 1975.
- Dropped the non_econ papers.
- Fixed the citation_count for those that are falsely shown as having past citations, but don't actually have them.

Fixed the publication year for those with incorrect publication year(papers/books that have multiple volumes or have been republished, or have had updated publications years later) With diff_year being defined as min_year-pub_year

Cleaned up the pub_year for papers with diff_year < -10. There are two main categories of noise that were cleaned out: (a) non-econ papers that are once again attributed to namesakes; or (b) instances where the citation count bar graph when scraped had an erroneous early year entry followed by a long series of zero citatons before the actual citation counts start. In the latter case, going back to Google Scholar now oftentimes shows that the early year noise is cleaned out subsequently by Google Scholar itself. For (a), we drop the paper. For (b), we drop the erroneous first year and regenerate the cumulative citations variable.

Additionally, papers with either an unusually early year of first citation or a first citation year significantly preceding the pub_year were filtered out. For entries with min_year less than or equal to 1975, a multi-step cleaning process was implemented. This included dropping non-economic papers, rectifying citation_count for cases falsely indicating past citations no longer reflected on the Google Scholar page, and correcting publication years for entries with inaccuracies due to multiple volumes, republishing, or updates. Entries with a difference between min_year and pub_year less than -10 underwent this further cleaning. Two primary categories of noise were addressed during the cleaning process: (a) non-economic papers incorrectly attributed to namesakes, leading to their exclusion; and (b) instances where the citation count bar graph, when initially scraped, contained an erroneous early year entry followed by a prolonged zero time series before the actual citation counts commenced. In the latter case,revisiting Google Scholar often revealed that the early year noise was subsequently cleaned out by Google Scholar itself. For category (a), the decision was made to drop the respective paper. In the case of category (b), the erroneous first year was excluded, and the cumulative citations variable was regenerated.

B.6 Citation data issues with Google Scholar

Google Scholar it is possible to see the citing papers for any given paper on Google Scholar, to assemble a comprehensive list of citi