WHY DO SOME ACADEMIC ARTICLES RECEIVE MORE CITATIONS FROM POLICY COMMUNITIES?

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Abstract

We (1) present the landscape of the citations of Public Administration and Policy (PAP) scholarly articles in policy documents, and (2) examine influencing factors along three dimensions: collaborative teams, cross-disciplinary interactions, and disruptive paradigms. Using data from the 30 most-cited PAP peer-reviewed journals and 38,062 documents from 1,107 policy institutions, we find that 10.1% of all PAP scholarship receives high citations from both academics and policy communities. Collaborative teams, cross-disciplinary interactions, and disruptive paradigms can all increase the citations within policy communities, yet the relationships are not linear. Non-academic authors can consistently attract more policy citations, whether publishing alone or collaborating with academics. An article should ideally cite no more than 13 disciplinary subjects. No significant trade-off between scholarly and policy impact as scholarly citations and the academic reputation of authors often translate into policy citations. These findings offer novel and concrete insights into optimizing academic research for policy impact. *(150 words)*

Keywords: policy impact, scholarly impact, public administration, knowledge production, computational social science, network analysis, natural language processing

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EVIDENCE FOR PRACTICE

- About 10.1% of all PAP scholarship receives high citations from both academics and policy communities.
- Policy institutions consistently favor interdisciplinary knowledge and disruptive paradigms, with the influence of the former being the most significant and robust.
- Non-academic authors can consistently attract more policy citations, whether publishing alone or collaborating with academics.
- An article should ideally cite no more than 13 disciplinary subjects; otherwise, the article becomes too dispersed to find its niche in attracting attention from policy communities.
- No significant trade-off between scholarly and policy impact as scholarly citations and the academic reputation of authors often translate into policy citations.

Ever since the introduction of the "Impact Factor" (Garfield, 1955), the academic community has widely embraced it as one of the most important, if not the most important, criteria for assessing the reputation and influence of academic journals. This initiative later culminated in the establishment of the Science Citation Index in 1961 and the Social Science Citation Index in 1972. The fundamental premise underlying these metrics is that the influence of scholarly work can be gauged and ranked according to the frequency of citations it receives from other academic studies (Garfield, 1972). These inventions have significantly influenced how scholars assess the impact of their articles, as they strive to publish in journals with high Impact Factors to obtain recognition and advance their careers. However, since the Impact Factor is only determined by citations within the academic community, it unavoidably fosters an incentive structure that prioritizes scholarly use within academia while overlooking its broader societal and policy impact. The research community in the social sciences and humanities urgently needs to demonstrate its societal and political relevance (Reale et al., 2018). This study fills in this gap by examining the policy impact of scholarly articles based on their citations in policy documents issued by think tanks, government agencies, and international organizations.

We focus our inquiry on Public Administration and Policy (PAP) journals because of this academic community's core identity in bridging scholarship-practice gap and influencing policy development (Glied, 2022; Pandey et al., 2022; Walker et al., 2019). In particular, we have three motivations: *(1)* to present the citation landscape of PAP scholarship in documents published by

policy institutions, *(2)* to identify the factors that can elevate the citations of academic articles within policy communities, and *(3)* to determine the scenarios in which these factors exert the greatest impact.

To accomplish the three motivations, we tracked articles published in 344 peer-reviewed PAP journals over a century, from 1923 to 2023. These articles were then cross-referenced with 38,062 documents from 1,107 policy institutions that cited them. To maintain a high level of accuracy and consistency, we focused our in-depth analysis on the 30 most frequently cited PAP journals and the policy documents associated with them. The findings are presented in two parts.

First, the *descriptive results* provide an overview of the landscape of academic scholarship utilization by policymaking communities, responding to Motivation 1. On a broad scale, we categorized the PAP articles cited by policy documents into four groups based on their scholarly and policy citations:

1. *Dual Darlings*: Articles that received high citations from both scholars and policy institutions, accounting for 10.1% of all PAP scholarship.
2. *Policy Magnets*: Articles that received low scholarly citations but high policy citations, comprising 9.02%.
3. *Academic Ivories*: Articles that received high scholarly citations but low policy citations, totaling 6.79%.
4. *Unnoticed*: Articles that received low citations from both scholars and policy institutions, forming the majority at 74.09%.

In terms of policy institutions that utilize PAP scholarship, the majority are intergovernmental organizations (IGOs) or located within the Organisation for Economic Co-operation and Development (OECD) countries. These policy institutions, on average, cite PAP scholarship that is around 8 to 10 years old. There is a downward trend in the age of citations in recent years, suggesting a quicker assimilation of the latest PAP scholarship. Notably, over time, IGOs have also become significant producers of PAP scholarship.

Second, the *inferential statistics* address Motivations 2 and 3, examining if and to what extent the theorized factors significantly impact the visibility of academic articles within policy communities. Overall, collaborative teams bridging scholars and practitioners, cross-disciplinary interactions citing articles from a variety of research fields, and disruptive research paradigms challenging conventional approaches, can all contribute to a higher policy citation, albeit nuances exist.

Looking at the perspective of knowledge users (i.e., policy institutions), both the interactions between disciplines and disruptiveness of research are valued, with the influence of the former being the most significant and robust. From the perspective of knowledge producers (i.e., the authors of scholarship), the positive influence of non-academic authors on policy citations is consistent and pervasive across varying collaboration scenarios (e.g., sole-authored or team-authored). While cross-disciplinary interactions are highly valued by policy communities, an article should cite references from no more than 13 disciplinary subjects; otherwise, the article can become too dispersed to find its niche in attracting policy attention.

Public Administration and Policy: Policy Impact as Heartbeat

This study centers on public administration, allowing for the interpretation of empirical findings within a rich and nuanced context. The field of public administration, committed to the study of governance and the implementation of public policy, has a long-standing history of pursuing policy impact (Behn, 1995; Kettl, 2000). Among various social science branches, public administration scholarship positions itself at the intersection of academia and practice, citing its policy impacts as one of its key features and contributions (Behn, 1995; Orr & Bennett, 2012). This field incorporates various disciplinary approaches (e.g., managerial, political, and legal), and different levels and units of analysis (e.g., individuals, society, and government), all of which are indispensable in prescribing solutions to practitioners and policymakers (Rosenbloom, 1983; Wallmeier et al., 2019, p. 496). Therefore, we reference this field as "Public Administration and Policy" in this study to underscore its interdisciplinary focus and commitment to policy impact.

The research field of PAP is deeply rooted in pragmatism, and its founding scholars were both practitioners and scholars (Behn, 1996). However, along with the development of PAP as an academic discipline, the divide between academics and practice became a notable issue in advancing this field further—a common dilemma facing by most research fields in social science. Bolton and Stolcis (2003) summarized a range of reasons explaining that the pursuits of practitioners and scholars differ in terms of knowledge (i.e., theoretical versus pragmatic), methods (i.e., data-supported versus logic-driven and scientific method versus case studies), and institutional arrangements (i.e., academic-oriented versus practitioner-oriented journals and academic tenure versus organizational performance). However, empirical studies testing these propositions and scholarly efforts on narrowing these gaps are still woefully lacking (Hall & MacDonald, 2023, pp. 728–729).

Increase Policy Citations: Collaboration, Cross-Discipline, and Disruptiveness

This study focuses on the *citations* of academic articles in *policymaking communities*. For scholarly research to achieve policy impact, it needs to be recognized by policy communities in the first place. Furthermore, *policy citation*—the number of times that a scholarly article is cited by policy documents—is more direct and quantifiable than *impact* (Reale et al., 2018; Reed et al., 2021; Weiss, 1979).

Nelson et al. (2023) conducted an exhaustive review of the myriad factors influencing the utilization of academic scholarship in public policy. Through their comprehensive analysis of 60 articles, nearly 40 determinants were distilled that elucidate the use of academic social science research in public policy. This extensive, albeit non-exhaustive, list delivers a current and thorough snapshot of the academic consensus on this topic. Moreover, it furnishes compelling evidence indicating that the integration of knowledge into policy is a multi-stage process that involves practitioners, scholars, the interaction between these two actors, and the nature of the research itself (Nelson et al., 2023, p. 14). In alignment with this processual perspective and their

extensive list, we identify three salient conceptual factors that span from knowledge production to its dissemination and may substantially influence policy visibility: *collaboration* between scholars and practitioners, *cross-disciplinary* interactions, and *disruptiveness* of research paradigm.

Collaborative Teams: Knowledge Co-Production between Academics and Practitioners

The challenges of bridging theory and practice have long been recognized in public administration. Scholars have advocated for the co-production of knowledge, involving practitioners, academics, communities, and various stakeholders at all stages of research, including theorization, data collection, data analysis, and dissemination of findings (Orr & Bennett, 2012; Schwoerer et al., 2022).

Collaborative research is crucial because science represents just one avenue through which public policy can be influenced. The theory of societal learning identifies multiple pathways to impact policy, including faith, tradition, mass media, professional practices, markets, politics, and ideology (Kirlin, 1996, p. 420). Within this framework, policy analysis transcends its role as a mere problem-solving tool, serving as an important component of the democratic process. It offers ideas and frameworks that shape citizen preferences and rationality amid increasing political complexities (Shulock, 1999, p. 240; Weiss, 1977). Moreover, scholars suggest that collaboration with practitioners is a prerequisite for other factors, such as interdisciplinarity, to effectively influence public policy (de Sandes-Guimarães et al., 2022). Science alone is unlikely to provide definitive guidance on most of the urgent issues our societies face. It must be combined with other approaches. As Kirlin suggests, "an important challenge for public administration in a democracy is to improve the whole of societal learning" (Kirlin, 1996, p. 420).

The call for collaborative research between practitioners and academics is not unique to PAP and has been echoed in other research areas. For example, citizen science and participatory research invite non-professionals to participate in various aspects of the research process, including project design, outcomes measurement, engagement of new audiences, and identification of new research directions (Bonney et al., 2016, pp. 10–13). The collaborative

approach has also been promoted in management (Van de Ven, 2018) and sustainability research (Norström et al., 2020). A primary purpose of all these collaborative efforts is to foster more inclusive engagement with science, ensuring that research is not only grounded in real-world contexts but also yields benefits for society.

However, tensions between scholars and practitioners persist in such collaborations due to differences in timeframes, presentation of findings, and expectations (Buick et al., 2016, p. 38). The effectiveness of co-production in enhancing practical relevance and policy impact requires further empirical evidence for confirmation. The question remains: Can co-production truly enhance practical relevance and policy impact, and if so, how does its effectiveness compare to other factors?

Cross-Disciplinary Interactions: Producer and User Perspectives

Communication and collaboration between different academic disciplines have been widely promoted since the 1990s (Gibbons et al., 1994). The cross-disciplinary interactions take various approaches, such as *multidisciplinary*, which involves the juxtaposition of insights and methods from different disciplines without necessarily integrating them; *interdisciplinary*, which merges concepts and methodologies from different fields to create new perspectives or frameworks; and *transdisciplinary*, which transcends individual disciplinary boundaries to address shared complex problems, often incorporating non-academic stakeholders in the research process (Wagner et al., 2011). Scholars and policymakers have given high expectations to cross-disciplinary collaborations, hoping such efforts can bridge the gaps between existing disciplines, produce ground-breaking knowledge, and solve societal issues that have become too complex to be handled by any single discipline (D'Este et al., 2019; Klein, 1999; OECD, 2010; Rigney & Barnes, 1980). Publications on interdisciplinarity across all research fields have been steadily increasing, funding agencies give priorities to cross-disciplinary proposals, and research centers bridging different disciplines have been an increasingly common feature of universities (Jacobs & Frickel, 2009, pp. 46–54; Ma et al., 2023, p. 5).

The research field of PAP is a perfect example of cross-disciplinary efforts. The field was started to respond to the challenges in the public sector that did not pickup enough attention in existing disciplines such as political science and administrative science. (Henry, 1975; Rosenbloom, 1983). As the field grew, scholars from more disciplines (e.g., economics, psychology, and sociology) joined this interdisciplinary effort, and the research field itself started to obtain distinct identity in academia (Vogel & Hattke, 2022, p. 21; Wright, 2011).

Studies about the scientific impact of cross-disciplinary efforts are many, but most of them do not go beyond scholarly communities. More empirical evidence are needed to support the proposition that cross-disciplinary interactions can also increase scholarly works' policy and practical impact. A few empirical studies found that, although the relation between the interactions and impact is generally positive, there are preconditions and nuances. For example, effective collaboration between scholars and practitioners is a prerequisite for interdisciplinarity to be effective (de Sandes-Guimarães et al., 2022). Scientists with an interdisciplinary focus are more likely to conduct market- and transactional-oriented research projects, which "typically implies one-off exchanges of highly standardized technologies between buyer and seller" (D'Este et al., 2019).

Disruptive Paradigms: Research as Enlightenment and Social Criticism

The concept of the "research paradigm," introduced by Kuhn, has become a cornerstone in the philosophy of science (Kuhn, 1970). Kuhn's theory posits that established research paradigms are essential for knowledge accumulation during periods of "normal science," where researchers primarily focus on solving puzzles within existing paradigms. However, this focus on established paradigms can stifle novel and disruptive work, leading to fewer scientific revolutions. Recent advances in computational methods have spurred interest in studying the disruptiveness of scientific development (Edelmann et al., 2020, p. 68), with findings indicating a trend towards less disruptive science across disciplines (Park et al., 2023).

Disruptive paradigms have always been central to the development of PAP as a distinct research field and discipline. For example, the politics-administration dichotomy, a notable landmark from the early 1900s, emphasized that the impartial and apolitical functions of government should be studied in their own right (Goodnow, 1900), and the research of administrative bureaucracies should be separated from its host discipline—political science (Henry, 1975, p. 384). Consider the New Public Management (NPM) as another example. Although it is debatable to categorize NPM as a new paradigm (Gruening, 2001; O'Flynn, 2007), and there are differing opinions on its consequences for democracy (Lynn Jr., 2001), this school of thought has introduced new values and an administrative culture (e.g., focusing on professional management, efficiency, and output controls) to the so-called "bureaucratic paradigm" in traditional PAP, receiving great popularity among scholars, policymakers, and practitioners (Gow & Dufour, 2000, p. 578).

The paradigms of PAP continue to be a rich area of discussion, encompassing theories, methods, disciplinary development, and more (e.g., Kettl, 2000; Rommel & Christiaens, 2006). A common insight shared across these discussions, and also emphasized by Kuhn, is that novel paradigms can break existing impasses, elevate research, and resonate with practitioners (Kettl, 2000). However, it is important to note that the application of Kuhn's concept to social sciences should be approached with caution. The dynamic and context-dependent nature of social phenomena, alongside the cumulative and incremental advancement of knowledge in social sciences, challenges the direct applicability of paradigm shifts as envisioned by Kuhn (Dogan, 2001). Furthermore, the relationship between disruptiveness and innovation in research warrants further empirical investigation (Christensen et al., 2018). Despite these complexities, PAP research importantly fulfills the roles of "enlightenment" and "social criticism" as described by Weiss (1977), positions that are key to winning the acclaim of not only scholars but also policymakers and public administrators (Bogenschneider et al., 2019, p. 789).

Framing Research Questions: An Interdisciplinary Approach

As readers may already notice, besides using PAP as our disciplinary focus, we draw knowledge from numerous fields to frame our research questions, primarily scientometrics, sociology of knowledge, and philosophy of science. For clarity, Table 1 summarizes how various research fields contribute to different aspects of this study and helps frame the research questions. By adopting an interdisciplinary approach, our research aims to identify the diverse factors that influence the policy citations of scholarly articles. While our inquiry spans multiple research fields, the core of our investigation remains centered on understanding the determinants of policy citations specifically within the PAP realm.

Table 1: FRAMING RESEARCH: INTERDISCIPLINARY PERSPECTIVES

	Theoretical perspective	Contribution to framing research	Example measures
Public Admin. and Policy	Knowledge co-production	Historical and disciplinary background, collaboration, controls	Proportion of non-academic authors
Scientometrics	Research impact	Collaboration, controls	*h*-index, citation count, citation network, article and author attributes
Sociology of knowledge	Social network	Cross-disciplinary interactions	Betweenness centrality
Philosophy of science	Research paradigm	Disruptiveness	*D* measure

Scientometrics mainly focuses measuring academic research, including the quantification of scientific outputs and their impact through metrics like citations. It was applied in a few PAP studies, such as evaluating the development of the research field (Ni et al., 2017) and the relationship between scholarly collaboration and productivity (Corley & Sabharwal, 2010). We adopt various scientometric measures as key variables, including citation metrics, disciplinary subject categories, and co-citation networks.

However, scientometrics itself does not account for the contextual and social dimensions of science production (Hicks et al., 2015). Sociology of knowledge complements this with its emphasis on the social and political processes influencing knowledge production and dissemination such as studying how scholarly relations influence the formation of consensus (Ma & Bekkers, 2024; Shwed & Bearman, 2010) and the discourse analysis of "public value" in public administration (Wallmeier et al., 2019). Our study leverages social network analysis theories and metrics related to network positions.

Philosophy of science further enriches our framework by examining the nature of scientific knowledge and practice such as the theorization of research paradigms and normal science (Kuhn, 1970). Notably, our research incorporates the idea of disruptive paradigms in shaping academic and policy landscapes, alongside a measure for quantifying disruptiveness.

Explore the Nuances: "The More the Better" or Optimal Efforts?

For most of the factors that have the potential to influence policy citations, the empirical evidence is not decisive. When it comes to collaboration and knowledge co-production, practitioners often need immediate solutions to urgent demands. This need can conflict with scholars' focus on thorough, analytical, and robust analysis. Scholars may also need to censor or modify the presentation of findings for practical reasons. The expectations of practitioners and scholars may clash in collaboration, resulting in a lack of clarity and necessitating further communication efforts. Moreover, collaboration is often heavily influenced by various individual and organizational factors. Policymakers and administrators from different institutions can have dramatically different reactions to the same research findings (Belkhodja et al., 2007; Cherney, 2015; Newman et al., 2016), and differences in institutional contexts can often hinder collaboration (Dewaele et al., 2021). Given these complexities, co-production between practitioners and academics is not a panacea and may not be as effective as we might hope.

The results regarding cross-disciplinary interactions and disruptiveness are also mixed. Both highly disciplinary and highly interdisciplinary studies tend to have low scholarly impact,

suggesting an "optimum of interdisciplinarity beyond which the research is too dispersed to find its niche and under which it is too mainstream to have high impact" (Larivière & Gingras, 2010, p. 126). Increasing efforts to connect distant disciplines may also result in less useful knowledge (Fontana et al., 2022). Moreover, cross-disciplinary interactions are theoretically multi-dimensional, and different dimensions may play varying roles in increasing impact (Huutoniemi et al., 2010; Wang et al., 2015). As for disruptiveness, novel studies may have a higher potential for impact but also carry greater risk, and there is often a delayed recognition of these studies as novel contributions (Wang et al., 2017).

In general, these explanatory factors and policy citations may have non-linear relationships. There may be optimal points beyond which the marginal gains will decrease, indicating a complex interplay between these elements.

Research Questions

To summarize our research questions, the ultimate goal of this study is to test the relationships between policy citations and various influencing factors. In the meantime, we also framed the following open questions to guide our exploratory analysis:

1. From the perspective of knowledge production, which PAP journals are the leading producers of policy-cited scholarship? How can we characterize these academic works?
2. Considering the utilization of academic scholarship, who are the primary policy consumers, and how can they be characterized?
3. How can we describe the relationships between PAP scholarship and the policy documents that cite them? What patterns emerge in the citation behavior within policy communities?

METHODS

Data

The empirical analysis of this study relies on two datasets: the *Scholarly Set*, a representative sample of PAP scholarship, and the *Policy Set*, an assemblage of policy documents that cite any entry from the *Scholarly Set*.

PAP Scholarship

Defining the scope of public administration and policy is the initial step for this study. Given the highly interdisciplinary nature of this research field (Vogel & Hattke, 2022, pp. 21–22), establishing a definitive scope is extremely challenging if not impossible. For this study, we choose to prioritize comprehensiveness, relying on three lists of journals widely recognized by scholars and practitioners to compile a list of PAP journals:

1. ***Web of Science Master Journal List (WOS)***.[1] As one of the earliest and most well-known bibliographic databases, Web of Science is a primary source for evaluating the performance of academic journals. Although its ranking methods are debatable, it remains one of the most authoritative sources and is widely used in scientometric studies. We retrieved all the journals in the "Public Administration" category from both Social Science Citation Index and Emerging Sources Citation Index. This source suggests 85 PAP journals.
2. ***SCImago Journal & Country Rank (SJR)***.[2] The SJR is another journal ranking system published by Scopus, one of the largest bibliographic databases (Baas et al., 2020). Its "Public Administration" category suggests 176 PAP journals.

[1] https://mjl.clarivate.com/collection-list-downloads
[2] https://www.scimagojr.com/index.php

3. ***Google Scholar***.[3] As the most comprehensive bibliographic database (Gusenbauer, 2019), Google Scholar maintains lists of top publications by research fields. We included the top 20 journals in the "Public Policy & Administration" category [4].

By amalgamating journal lists from the above sources, we identified 344 unique journals based on the International Standard Serial Number, a unique identifier for serial publications. We then collected article records from these journals, drawing from four major bibliographic databases to construct a dataset representative of PAP scholarship. Primarily, we utilized OpenAlex[5], renowned for its comprehensiveness and accessibility (Priem et al., 2022). The General Index[6] offered full-text analysis (Pulla, 2019), while the Scopus API[7] and Google Scholar supplemented any missing data from the prior sources (Baas et al., 2020). We selected these databases based on two principles: their promotion of open science for transparency and reproducibility, and their provision of comprehensive API access for diverse computational analysis (Velez-Estevez et al., 2023). Table 2 provides a breakdown of the bibliographic records according to their sources.

Table 2: SOURCES OF BIBLIOGRAPHIC RECORDS

	OpenAlex	General Index	Scopus	Google Scholar	Overton
Title, abstract	X				
Full-text *n*-grams		X			
Authorship	X		X	X	
Affiliation	X		X		
Cited references	X		X		
Scholarly citation count	X				
Policy citation count					X

[3] https://scholar.google.com/

[4] https://web.archive.org/web/20230201200242/https://scholar.google.com/citations?view_op=top_venues&hl=en&vq=soc_publicpolicyadministration

[5] https://openalex.org/

[6] https://archive.org/details/GeneralIndex

[7] https://dev.elsevier.com/

Policy Documents

All policy documents in the Overton[8] database that cite any PAP journals identified by the aforementioned sources were gathered. The Overton database, established in 2019, serves as a response to the misuse and overuse of traditional bibliometric indicators in research impact evaluation (Szomszor & Adie, 2022). These metrics, such as article citation counts and journal Impact Factors, often merely reflect scholarly influence within the academic sphere (Reuter & Smith-Ready, 2002, p. 340), consequently inducing academic malpractices like "Impact-Factor obsession" and the conflation of citation counts with research impact (Cagan, 2013; Hicks et al., 2015).

Overton has amassed and indexed "policy documents," broadly defined as "documents written for or by policymakers," from over 30,000 organizations across more than 180 countries[9]. These policy institutions include government departments like the Publications Office of the European Union, IGOs such as the OECD, and think tanks like the U.S.-based Brookings Institution. Despite being the most extensive collection of its kind to date, it is important to acknowledge its significant limitations (Szomszor & Adie, 2022, pp. 630–632). The database is predominantly comprised of documents from North American entities. Furthermore, the majority of these documents are in English. Although in many countries (e.g., Brazil, France, Japan, and Taiwan), more than 80% of the content is in local languages, these non-English documents often do not adhere to standard citation practices. This makes tracking their use of scholarly articles almost impossible. Given these significant limitations, this study's findings may primarily pertain to English-speaking countries.

Refining Datasets for Analysis

Though we have collected bibliographic records of articles published by 344 PAP journals from various sources, there is significant variance in the quality of these records and the journals

[8]https://www.overton.io/

[9]https://web.archive.org/web/20230417130703/https://help.overton.io/article/what-sources-does-overton-track/

themselves. For accurate empirical analysis, the raw datasets require refinement to ensure (1) the exclusion of low-quality data records, minimizing noise and enabling accurate estimation, and (2) the refined datasets remain representative.

To achieve the two objectives, we limited our analysis to articles from the top 30 journals that are most frequently cited in policy documents. As shown in Table 3, these journals represent 72.91% of the policy-citations and 67.51% of the scholarly citations. This indicates that our refined dataset effectively encompasses a significant portion of the total records. The number of publications per journal, along with the percentage of articles cited by policy communities, is detailed in Appendix Table C1.

Figure 1 provides further insight into articles from these top journals, sorted by publication year. These articles range from 1923 to 2023. However, due to varying levels of missing data for different variables, not all observations are included in the regression analysis, with a significant increase in articles available for analysis post-2000. For inclusion in the regression analysis, a data record must meet three criteria according to the characteristics of any legitimate peer-reviewed journal article. First, the number of cited references must exceed 0. Absence of this data point also invalidates *#WOS category*. Second, the number of authors should be more than 0. Missing this data point can also undermine the calculations of numerous author-related explanatory variables, such as *%Non-acad* and *Broker*. Lastly, the number of countries, as indicated by author affiliations, must be greater than 0, considering an article must be written by one or more authors from at least one country.

Measures

Policy Citations

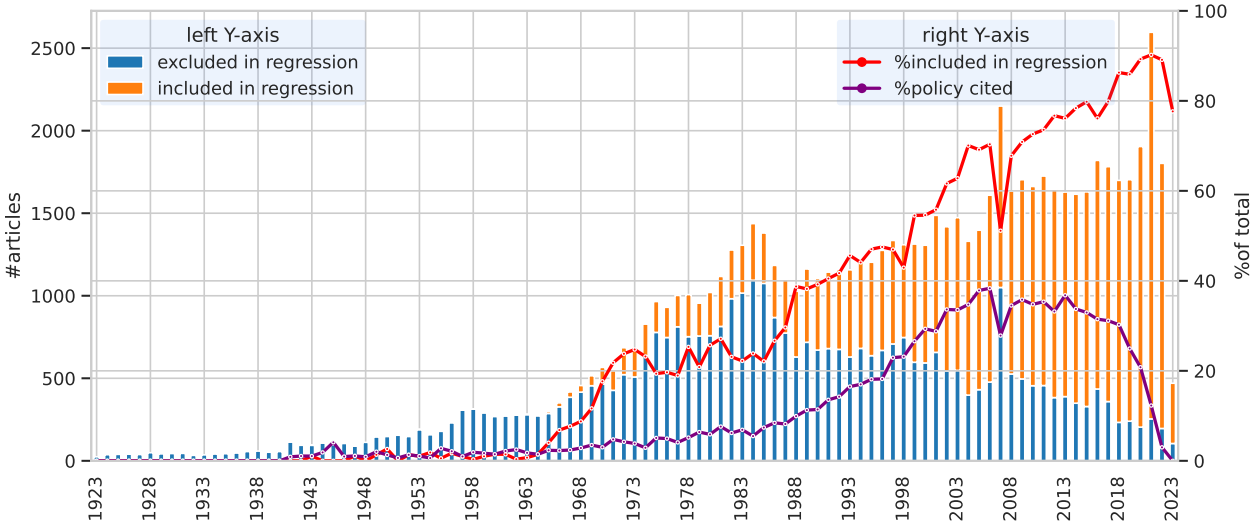
The policy citations of academic articles are quantified by the numbers of citations the articles receive from policy documents in the *Policy Set*. While these citation counts symbolize the

Table 3: TOP 30 POLICY-CITED PUBLIC ADMINISTRATION & POLICY JOURNALS: CITATION METRICS

	Name	Policy citation		Scholarly citation	
		#	%	#	%
1	J. Policy Anal. Manage.	4,575	5.98%	94,163	3.05%
2	Clim. Policy	4,559	5.96%	41,099	1.33%
3	Public Adm. Rev.	4,066	5.31%	215,288	6.98%
4	J. Eur. Public Policy	3,522	4.60%	98,231	3.18%
5	Admin. Sci. Q.	2,904	3.79%	697,340	22.59%
6	Hum. Resour. Health	2,823	3.69%	35,230	1.14%
7	J. Soc. Policy	2,737	3.58%	39,935	1.29%
8	J. Eur. Soc. Policy	2,525	3.30%	39,895	1.29%
9	Sci. & Public Policy	2,341	3.06%	36,133	1.17%
10	Can. Public Policy	2,117	2.77%	29,877	0.97%
11	Public Adm. Dev.	2,010	2.63%	25,058	0.81%
12	Contemp. Econ. Policy	1,761	2.30%	29,063	0.94%
13	Soc. Policy & Adm.	1,761	2.30%	33,238	1.08%
14	Public Adm.	1,742	2.28%	86,115	2.79%
15	Governance	1,474	1.93%	47,345	1.53%
16	JPART	1,409	1.84%	88,551	2.87%
17	Policy Sci.	1,346	1.76%	53,307	1.73%
18	Criminol. Public Policy	1,160	1.52%	27,037	0.88%
19	J. Educ. Work	1,155	1.51%	20,453	0.66%
20	Int. Soc. Secur. Rev.	1,141	1.49%	8,609	0.28%
21	Public Mgmt. Rev.	1,025	1.34%	45,564	1.48%
22	Educ. Adm. Q.	1,015	1.33%	70,141	2.27%
23	Aust. J. Public Adm.	1,010	1.32%	23,519	0.76%
24	Public Fin. Rev.	1,009	1.32%	10,005	0.32%
25	Int. Rev. Adm. Sci.	880	1.15%	27,359	0.89%
26	Policy Stud. J.	855	1.12%	49,195	1.59%
27	J. Public Policy	770	1.01%	29,396	0.95%
28	Policy Politics	720	0.94%	26,754	0.87%
29	Gov. Oppos.	697	0.91%	26,907	0.87%
30	Int. J. Public Adm.	695	0.91%	28,791	0.93%
	Total	55,804	72.91%	2,083,598	67.51%

Notes: JPART = Journal of Public Administration Research and Theory. Percentages show the proportion of all observations. Journals ordered by policy citations.

Figure 1: JOURNAL ARTICLES BY PUBLICATION YEAR



visibility and acknowledgment of academic work in the policymaking process, they do not inherently signify the direct impact of the scholarship on policy outcomes.

Collaboration: Non-Academic and International

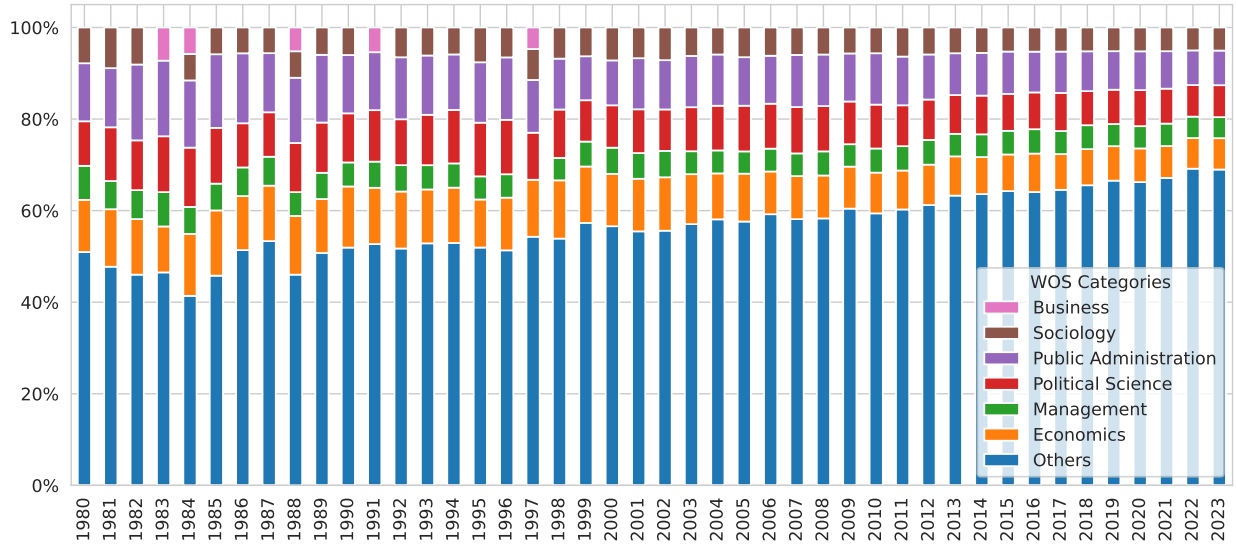
We measured collaboration from two aspects. We first measured the percentage of non-academic authors (*%Non-acad*). To be counted as non-academic, the authors should have no affiliations with universities or colleges. Moreover, we counted the number of countries of an article's affiliations to quantify its international collaboration (*#Country*).

Cross-Disciplinary Citations: Producer and Consumer Perspectives

As we introduced earlier, the interactions between different disciplines take various forms, such as multidisciplinary, interdisciplinary, and transdisciplinary. Distinctions between these approaches and how to measure them are complex research questions by themselves and go beyond the scope of this research (Huutoniemi et al., 2010; Porter et al., 2006; Wagner et al., 2011; Wang et al., 2015; Wang et al., 2017). In this study, we adopt *cross-disciplinary citations* to approximate the overall interactions between different disciplines from both the producer and consumer perspectives (Larivière & Gingras, 2010, p. 127).

The citation of scholarship from diverse disciplines (WOS category). From the author's perspective, an article can cite literature from different disciplines as its knowledge base. Popular measures usually calculate the number of WOS categories of the references cited by articles or journals. For example, the "Citations Outside Category" (Porter & Chubin, 1985; Porter & Rafols, 2009, p. 732) and other variations were proposed as informative bibliometric measures and widely adopted in later studies (Tomov & Mutafov, 1996). Following this practice, we calculated the number of WOS categories of all the references cited by a journal article as an indicator of that article's cross-disciplinary citation. Figure 2 presents the largest WOS categories of the references cited by the policy-cited PAP articles (i.e., PAP journal articles cited in policy documents).

Figure 2: CITED WOS CATEGORIES IN POLICY-CITED PAP ARTICLES



Notes: WOS = Web of Science; PAP = Public Administration and Policy. For visual clarity, only listing the largest six categories.

Being cited as key references bridging different scholarly communities (Broker). The *WOS category* is a widely used measure, but it depends on a pre-defined taxonomy and can be potentially biased; it also leaves out the understanding of social dynamics behind knowledge integration (Wagner et al., 2011, p. 23). To understand the social dynamics, we borrowed two instruments from bibliometrics and network analysis, co-citation network and betweenness

centrality, to quantify the cross-disciplinary citations from a consumer's perspective (i.e., how journal articles are cited by policy communities). Appendix A.1 has more technical details.

Disruptiveness: Citation and Linguistic Patterns

Some of the most recent and notable studies all operationalize the disruptiveness of a scholarly work according to its citation patterns (e.g., Park et al., 2023; Wu et al., 2019). The measure, commonly referred to as *D* value, assumes that if a focal work *i* is extremely disruptive, studies published after the focal work will only cite *i* but not the studies referred by the focal work. Following the same rationale, if the focal work is extremely developmental, all the following studies will cite both the focal work and those cited by the focal work.

The *D* value is a measure from a consumer's perspective based on citations—how it is used by the scholarly community. Similar to defining cross-disciplinary citations, the disruptiveness of a scholarly article can also be measured from a producer's perspective based on language. From an author's angle, articles with disruptive implications are more likely to contain negation words such as "not" and "never," which are "reliable indicators of how a person thinks, regardless of what they were talking about" (Boyd & Schwartz, 2021, p. 24). Therefore, we calculated the frequency of *negation* words in full texts using the Linguistic Inquiry and Word Count (LIWC), a gold standard for analyzing the psychological process and meaning of word use (Tausczik & Pennebaker, 2010).

Control Variables

We prepared the control variables from three perspectives: basic attributes, methodology approach, and publication outlet.

Basic attributes. Articles with more scholarly citations or authored by star researchers may also attract more attention from practitioners because they have greater visibility. Therefore, we controlled the *scholarly citation* of an article and the average *h*-index of all authors. The *h*-index was proposed by Hirsch (2005) as an indicator to evaluate a researcher's scientific output. It

means, for example, a researcher with an *h*-index of 4 has four articles with at least four citations. Compared to other indicators such as the number of published articles and total citations, *h*-index is a relatively robust measure of quantifying a researcher's output and reputation and has been widely used in academia since its invention (Hirsch, 2007). We also included the *number of authors* as a control variable because larger teams have more opportunities to interact across various disciplines (Haeussler & Sauermann, 2020), include nonacademic individuals, and interact with policy institutions through team members. *Article age* is also controlled because its authors' reputation and its policy and scholarly citations are generally a function of time. We also controlled for *article length*, as longer articles can use a broader range of keywords (e.g., negation words) and cite more references. Lastly, we considered the *number of cited references*, which enhances the likelihood of cross-disciplinary citations.

Methodology. Depending on the purposes of using knowledge, policy institutions may prefer academic studies employing certain *methodological approaches* (Hoydal & Toge, 2021). For example, from policymakers' perspective, large scale quantitative studies and experiments usually stand out (Monaghan & Ingold, 2019). Given it is difficult to manually code tens of thousands of scholarly articles, we used the frequency of terms in full texts to approximately quantify different methodological approaches. The list of terms includes: "variable*," "interview*," "survey*," and "experiment*." In addition, we accounted for whether an article is *empirical*, as conceptual and opinion pieces may be more likely to be directly cited by policy institutions because of their immediate relevance and accessibility, whereas empirical studies, with their intensive focus on methodology, might attract less interest from policy communities. Appendix A.2 details the coding of this variable with a state-of-the-art Large Language Model and its validation.

Publication outlets. The characteristics of scholarly outlets may also influence policy visibility. Open-access articles are evidenced to acquire significantly more scholarly citations (Piwowar et al., 2018), and can also be easily accessed by policy institutions which usually do not have subscriptions to various academic databases. The readership of academic journals also

varies significantly from journal to journal. Therefore, we controlled both *open access* and *journals* as fixed effects in regression analysis.

Selection of Regression Models

Given the dependent variable, policy citation count, (1) is a count variable, (2) displays signs of over-dispersion ($Mean = 0.70$, $Variance = 12.48$), and (3) is inflated with excessive zero values (i.e., 80.88% of the scholarly articles are not cited by policy documents), we chose the zero-inflated negative binomial (ZINB) regression to predict policy citations. Appendix B.3 has more details.

RESULTS

Dissecting PAP Scholarship in the Policy Arena

Table 4 presents the top 20 PAP articles ranked by the number of policy citations. The table reveals a diverse array of topics, ranging from planning theory and job design to financial openness and educational leadership, suggesting that policy communities draw from a broad spectrum of academic insights for decision-making. The articles span over five decades, from 1959 to 2014, highlighting the enduring relevance of foundational theories and models in contemporary policymaking. The frequent appearance of journals such as *Administrative Science Quarterly* and *Public Administration Review* indicates that policy communities may regard these journals as reliable academic sources.

Figure 3 further elucidates the disparity between policy and scholarly citations by categorizing all articles into four groups based on their z-scores for policy and scholarly citations. The "Dual Darlings" category is especially important, comprising 10.1% of the total (7,968 articles). This category includes articles that have effectively balanced academic rigor with practical relevance. Articles in the highlighted upper right corner (117 articles), with z-scores exceeding 3 for both policy and scholarly citations, are particularly noteworthy as they exemplify the ideal blend of academic research and policy applicability (refer to Appendix Table C2 for the top articles).

The "Policy Magnets" category, accounting for 9.02% of the total (7,115 articles; refer to Appendix Table C3 for the top articles), includes articles cited more frequently by policy communities than scholars. These articles likely focus on practical insights or industry-specific knowledge that is directly applicable to policymaking.

Conversely, the "Academic Ivories" category, making up 6.79% of the total (5,354 articles, refer to Appendix Table C4 for the top articles), represents articles that are highly cited academically but have limited policy impact. This suggests that the research, while academically valuable, may not effectively translate into the policy domain.

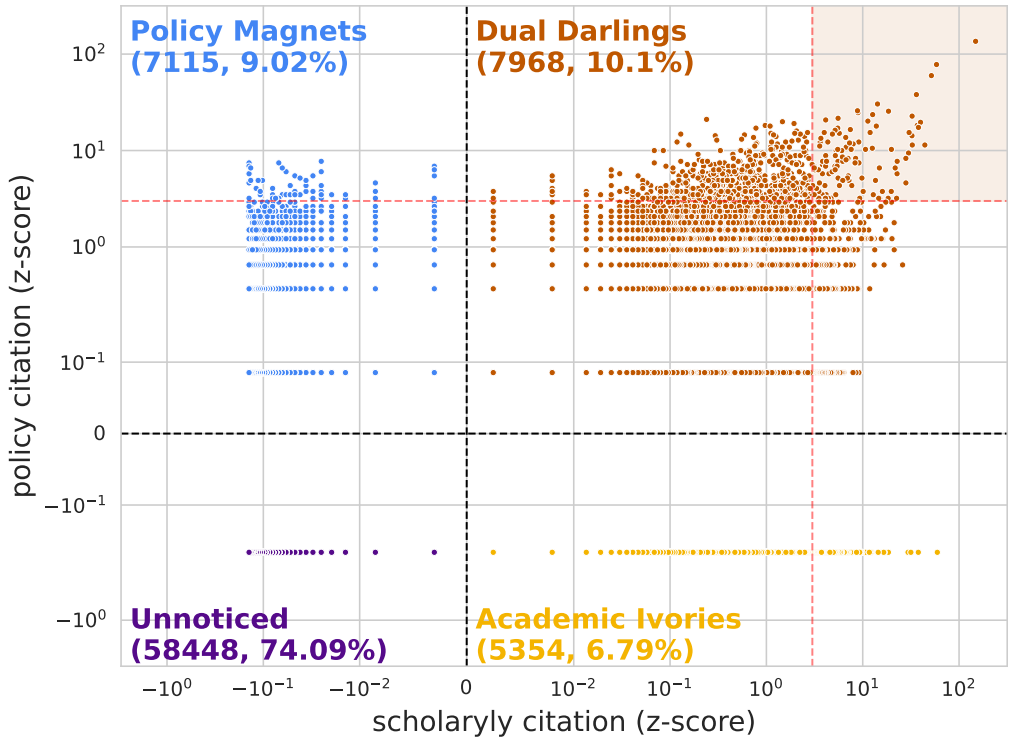
Table 4: TOP 20 ACADEMIC ARTICLES BY POLICY CITATIONS

	Title	Journal	Year	Citation	
				Policy	Scholarly
1	Absorptive capacity: a new perspective on learning and innovation	Admin. Sci. Q.	1990	480	26,994
2	Dilemmas in a general theory of planning	Policy Sci.	1973	276	10,621
3	Job demands, job decision latitude, and mental strain: implications for job redesign	Admin. Sci. Q.	1979	212	9,399
4	The science of "muddling through"	Public Adm. Rev.	1959	135	6,577
5	The populist zeitgeist	Gov. Oppos.	2004	108	2,612
6	The impact of leadership on student outcomes: an analysis of the differential effects of leadership types	Educ. Adm. Q.	2008	92	1,628
7	Collaborative governance in theory and practice	JPART	2007	91	3,387
8	The many meanings of research utilization	Public Adm. Rev.	1979	88	1,647
9	The 'southern model' of welfare in social Europe	J. Eur. Soc. Policy	1996	84	2,328
10	A garbage can model of organizational choice	Admin. Sci. Q.	1972	81	5,937
11	Transition management for sustainable development: a prescriptive, complexity-based governance framework	Governance	2010	77	1,033
12	The impact of taxes and social spending on inequality and poverty in Argentina, Bolivia, Brazil, Mexico, Peru, and Uruguay	Public Fin. Rev.	2014	75	69
13	Community organization and rural development: a learning process approach	Public Adm. Rev.	1980	74	775
14	Learning from abroad: the role of policy transfer in contemporary policy-making	Governance	2000	72	2,078
15	Economic freedom of the world: an accounting of the literature	Contemp. Econ. Policy	2014	71	292
16	Interorganizational collaboration and the locus of innovation: networks of learning in biotechnology	Admin. Sci. Q.	1996	70	7,255
17	What determines the value of life? a meta-analysis	J. Policy Anal. Manage.	2002	68	377
18	The effects of California's paid family leave program on mothers' leave-taking and subsequent labor market outcomes	J. Policy Anal. Manage.	2013	65	202
19	A public management for all seasons?	Public Adm.	1991	65	6,713
20	An advocacy coalition framework of policy change and the role of policy-oriented learning therein	Policy Sci.	1988	64	2,539

Notes: JPART = Journal of Public Administration Research and Theory. Articles ordered by policy citations. The selected results may suggest conceptual articles receive more policy citations, but regression analyses do not statistically support this. See Tables C10–C12 for details.

Lastly, the "Unnoticed" category, which encompasses a staggering 74.09% of the total (58,448 articles), includes articles that receive scant attention from both policy communities and scholars. This sizable category raises concerns regarding the relevance and utility of a significant portion of PAP scholarship.

Figure 3: DISSECTING THE INFLUENCE: PAP ARTICLES BY POLICY AND SCHOLARLY CITATIONS



Profiling the Policy Consumers and Their Citing Behavior

Frequent Users of PAP Scholarship: OECD Countries

The PAP scholarship has widely influenced policy communities across the globe, as demonstrated by its citation in 38,062 policy documents. These documents are published by a diverse set of 1,107 institutions from 106 countries or regions. Table 5 details the distribution of these documents and institutions within the top countries/regions. Tables C5 through C7 in the appendix break down the top policy institutions by type, which includes governmental organizations (381 in total), international governmental organizations (72 in total), and think tanks (654 in total).

Table 5 reveals that the 71 IGOs are the most frequent users of PAP scholarship, generating 8,877 policy documents, which accounts for 23.32% of the total. Breaking it down further, the majority of these documents are primarily from OECD (5.67%), World Bank (4.67%), and the World Health Organization (3.08%).[10] This showcases the vital role PAP scholarship plays in informing policies at some of the most significant global institutions.

The United States emerges as the second most prolific user of PAP scholarship, accounting for 18.66% of all policy documents. Furthermore, U.S. policy institutions constitute a significant 24.30% share, showing that PAP scholarship has widespread usage across a multitude of U.S. policy institutions.

The United Kingdom and the European Union also contribute significantly to the production of policy documents utilizing PAP scholarship, though their respective producer profiles are markedly distinct. The UK has contributed 5,066 policy documents, representing 13.31% of the total, generated by 186 institutions (16.80% of the total). Conversely, the EU's 3,816 policy documents (amounting to 10.03% of the total) originate from a smaller number of institutions - just 19 in fact, which comprise only 1.72% of the total. Notably, these are predominantly governmental entities, including the Publications Office of the European Union (producing 2,339 documents, or 6.15% of the total), the European Parliamentary Research Service (contributing 388 documents, or 1.02% of the total), and the Joint Research Centre (providing 371 documents, or 0.97% of the total).

The distribution presented in Table 5 reveals a concentration of policy documents and institutions in OECD countries. The only non-OECD country in the list is Brazil, which contributes 418 policy documents (1.10%) from 8 policy institutions (0.72%). This skewed distribution suggests an overrepresentation of English-language policy documents in the database, highlighting a significant limitation of the data source. It also points to broader challenges in promoting the fair and equitable use of knowledge, an aspect that will be further discussed.

[10]The United Nations would rank among the top three if its subsidiaries were combined.

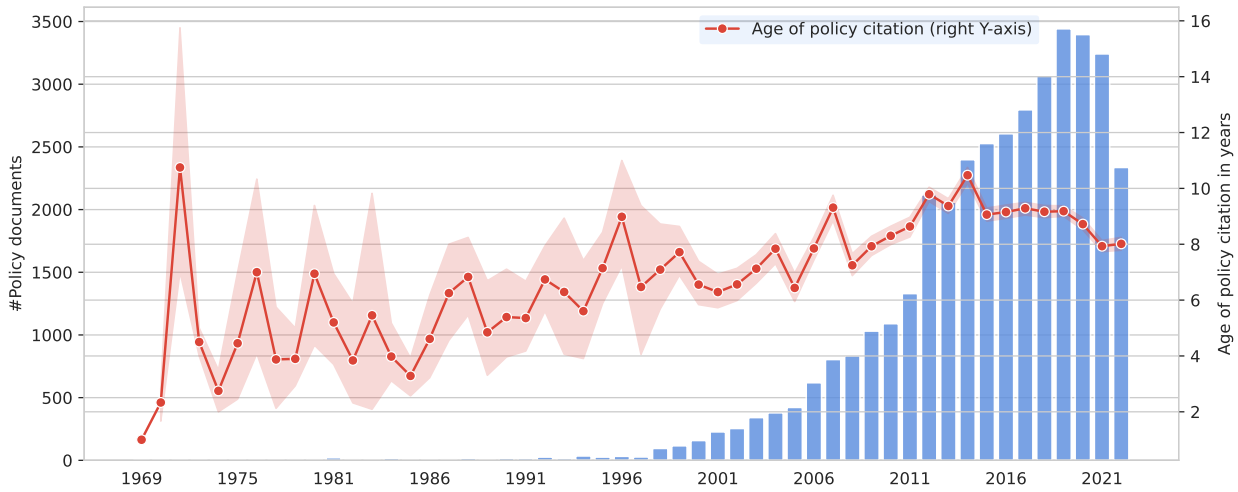
Table 5: TOP 20 COUNTRIES/REGIONS BY POLICY DOCUMENTS AND POLICY INSTITUTIONS

	Country	Policy documents		Policy institutions	
		#	%	#	%
1	IGO	8,877	23.32%	71	6.41%
2	USA	7,101	18.66%	269	24.30%
3	UK	5,066	13.31%	186	16.80%
4	EU	3,816	10.03%	19	1.72%
5	Canada	2,275	5.98%	39	3.52%
6	Australia	1,798	4.72%	46	4.16%
7	Germany	1,681	4.42%	57	5.15%
8	Sweden	714	1.88%	37	3.34%
9	Belgium	700	1.84%	28	2.53%
10	Netherlands	667	1.75%	20	1.81%
11	France	531	1.40%	25	2.26%
12	Norway	504	1.32%	13	1.17%
13	Brazil	418	1.10%	8	0.72%
14	Finland	391	1.03%	9	0.81%
15	Ireland	310	0.81%	16	1.45%
16	Italy	231	0.61%	10	0.90%
17	Austria	212	0.56%	9	0.81%
18	South Korea	203	0.53%	3	0.27%
19	Switzerland	203	0.53%	12	1.08%
20	Estonia	198	0.52%	6	0.54%
	Total	35,896	94.31%	883	79.77%

Patterns of Policy Citations

Figure 4 depicts the quantity of policy documents by year and the age of policy citations (i.e., subtracting the publication year of the scholarly article from that of the policy document). Due to the database's availability, the majority of the policy documents are published post-2000 (Szomszor & Adie, 2022, p. 629). The aggregate age of citation (i.e., the combined citation of different types of policy institutions) fluctuates between 10 and 8 years. As more policy documents are compiled, a downward trend is suggested in recent years, indicating that the latest PAP scholarship is being assimilated more swiftly by policy communities. Notably, the utilization of PAP scholarship is approximately two years faster than other research areas indexed in the Overton database of policy documents–the mean age of cited references across all policy documents is around 10 years and does not significantly vary between areas (Szomszor & Adie, 2022, p. 635).[11] No consistent difference between different types of policy citations by institution type (i.e., IGO, government, and think tank) was identified.

Figure 4: POLICY DOCUMENTS BY YEAR AND AGE OF POLICY CITATIONS



Figures 5 and 6 provide additional insight into citation relationships. Figure 5 illustrates the institutional origins of scholarly articles cited by policy institutions. While readers interested in

[11]The comparison may be inappropriate since Szomszor and Adie reported the mean age of all types of references, including both peer-reviewed and non-peer-reviewed materials.

specific institutions can delve into the specifics, it is noteworthy that IGOs, particularly the World Bank and World Health Organization, stand out as significant contributors to PAP scholarship.

On the other hand, Figure 6 illustrates the relationship between policy institutions and the journals they cite. The most frequently cited journals reveal an interesting trend: these journals are drawing attention from an increasingly diverse range of policy institutions. For instance, the journal *Administrative Science Quarterly* mainly garnered citations from the OECD between 2000 and 2004. However, from 2015 to 2019, its citing institutions expanded to include the Publications Office of the European Union, RAND Corporation, OECD, and the Analysis & Policy Observatory in Australia.

Predicting Policy Citations

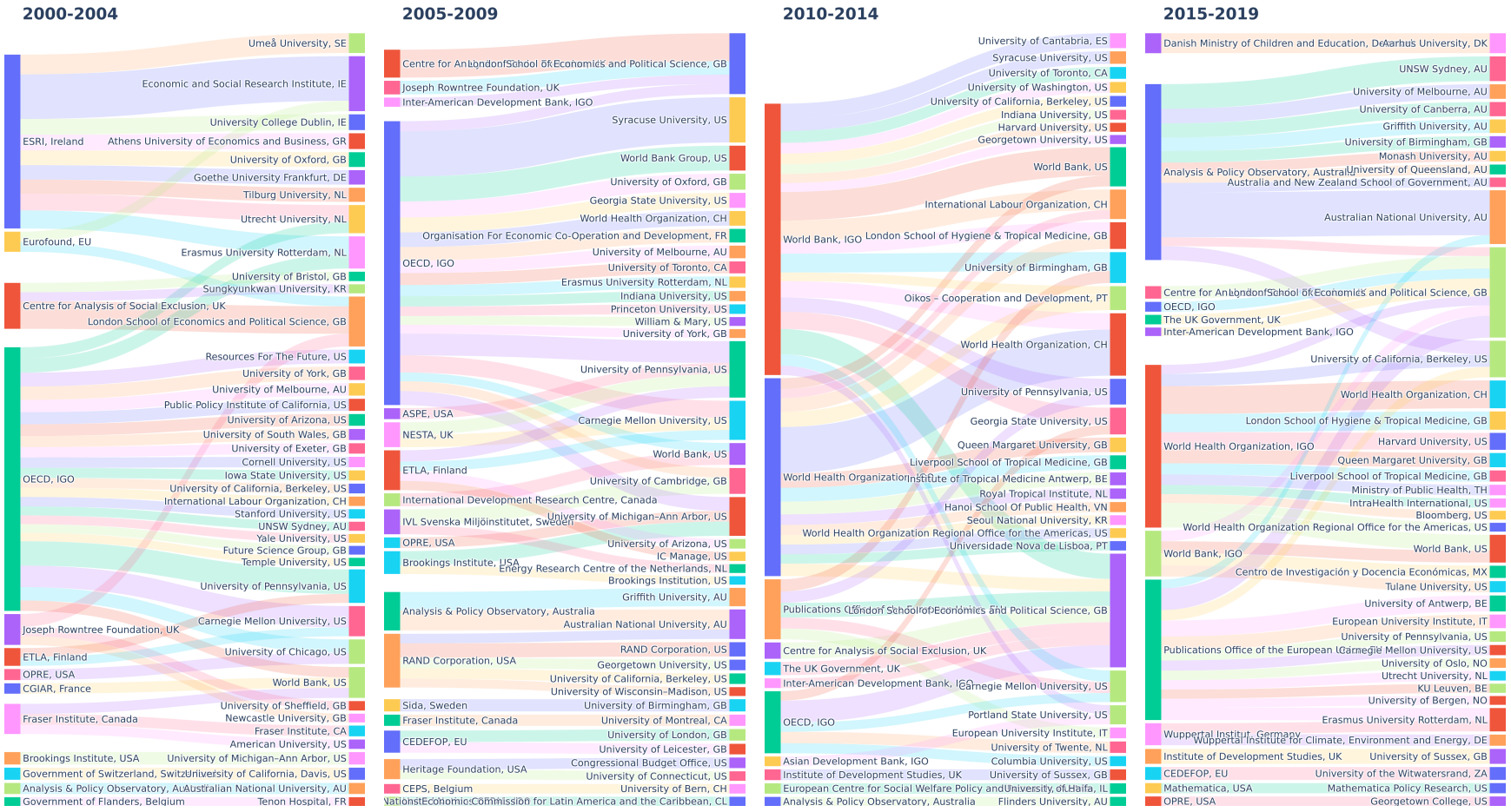
Describing the Curvilinear Relationships

Descriptive statistics of variables of interest and control variables are displayed in Tables C8 and C9 in the appendix, respectively. Data quality issues can be observed from the proportion of valid observations and the distribution of values, which will be further scrutinized in the "Robustness test" section.

Figure 7 portrays the coefficients from the ZINB model, including quadratic forms of explanatory variables (Main model). The values of the standardized coefficients suggest that *Broker*, *WOS category*, and *Non-acad* exert the most considerable positive impact on policy citations. Quadratic terms of these variables also indicate diminishing marginal effects on policy citations as these explanatory variables increase, reflected by their negative values.

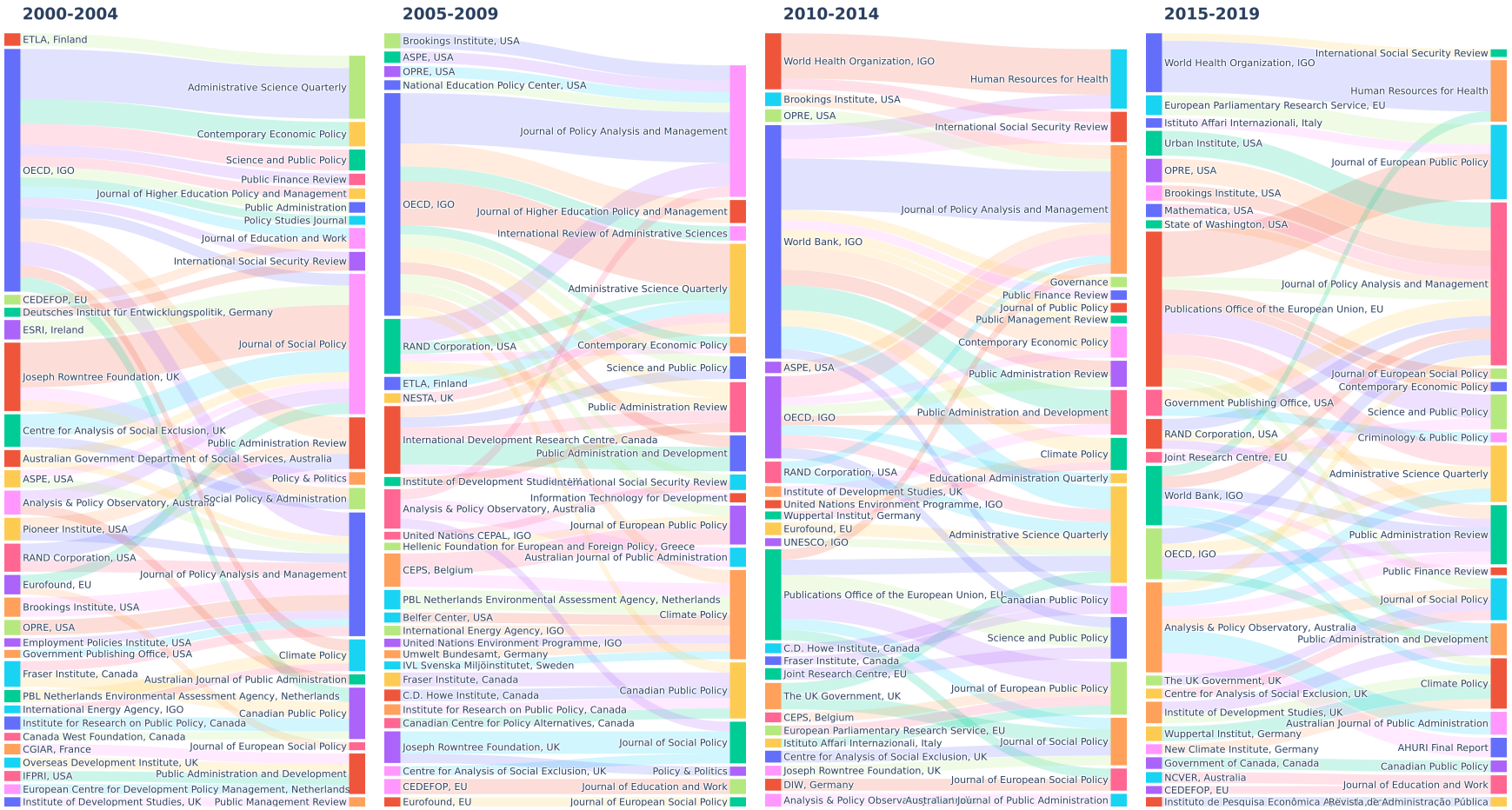
Figure 8 visually depicts, *ceteris paribus*, the curvilinear relationship between each explanatory variable and policy citations, leveraging coefficients from the Main model. Observing the slopes of the six functions, it becomes apparent that recognition as knowledge brokers connecting different disciplines by policymaking institutions (i.e., *Broker*) has the most pronounced, nearly linear, positive effect on policy citations. The effects of *%Non-acad* and

Figure 5: CITATION RELATIONS BETWEEN POLICY INSTITUTIONS AND SCHOLARLY AFFILIATIONS, 2000–2019



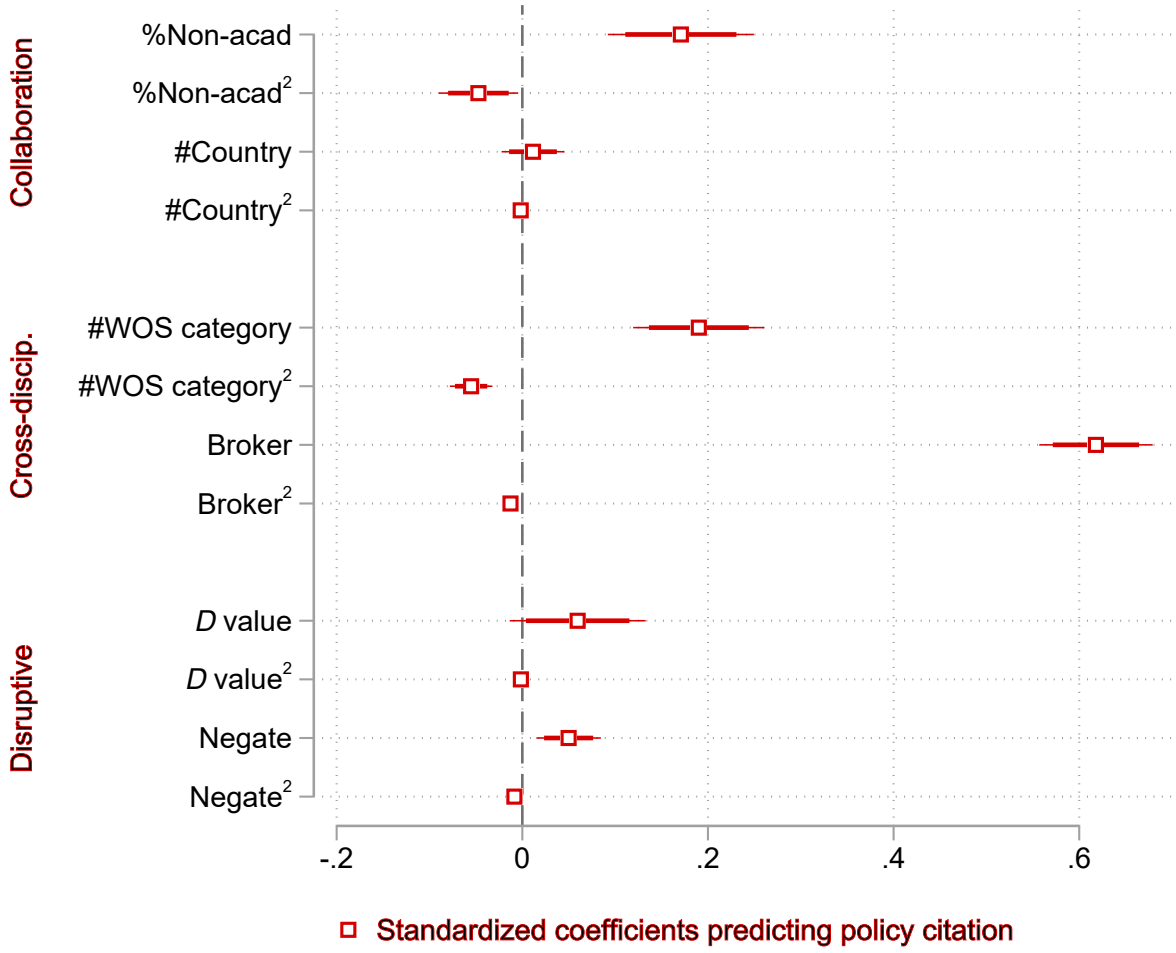
Notes: These Sankey diagrams show the top 50 citation links between policy institutions (left) and the originating institutions of cited articles (right) across different time periods. The width of the links signifies the volume of citations. Color assignments do not consistently correspond to specific institutions across diagrams.

Figure 6: CITATION RELATIONS BETWEEN POLICY INSTITUTIONS AND JOURNALS, 2000–2019



Notes: These Sankey diagrams show the top 50 citation links between policy institutions (left) and cited journals (right) across different time periods. The width of the links signifies the volume of citations. Color assignments do not consistently correspond to specific institutions or journals across diagrams.

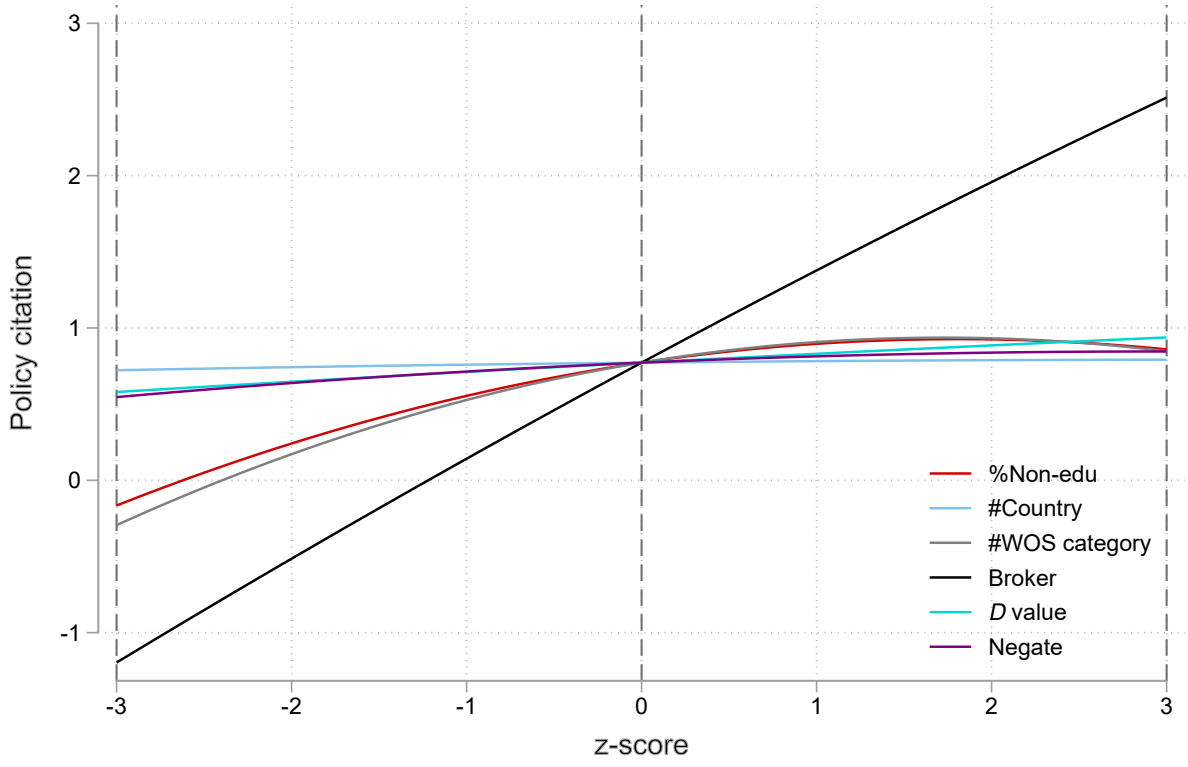
Figure 7: PREDICTING POLICY CITATIONS: COLLABORATION, CROSS-DISCIPLINARY INTERACTION, AND DISRUPTIVENESS



Notes: DV = Policy citations. Control variables are omitted. Appendix Table B1's Model 1 lists detailed statistics. The width of lines shows confidence intervals at levels of 0.01 and 0.05.

WOS category are smaller but remain significant when the *z-score* is below 0. However, their marginal effects on policy citations diminish significantly, even turning negative when the *z-score* exceeds 1.5. The slopes of other variables hover close to zero, indicating their negligible effects on increasing policy citations. We delve into these critical values in more detail below.

Figure 8: THE CURVILINEAR RELATIONS BETWEEN EXPLANATORY VARIABLES AND POLICY CITATIONS



Notes: Table 6 lists the critical values of the functions.

Critical Values for Optimal Impact

Table 6 provides the critical values for each of the functions illustrated in Figure 8. Assuming all other factors remain constant, the marginal effects of all explanatory variables on policy citations increase, albeit at a diminishing rate. We can interpret the table as follows:

1. The ideal percentage of non-academic authors per article is 79.65%. The marginal effect of *%Non-acad* becomes negative once this variable's value exceeds 1.81. This suggests that if

Table 6: PREDICTING POLICY CITATIONS: CRITICAL VALUES OF THE VARIABLES OF INTEREST

	Slope at z-score = -3	Slope at z-score = 3	%Decrease of slope from -3 to 3	z-score at vertex (slope = 0)	Practical implication
%Non-acad	0.313	-0.113	136%	1.81	Non-academic authorship should not surpass 80.35%
#Country	0.017	0.001	92%	3.40	Influence negligible
#WOS category	0.356	-0.141	140%	1.73	Cite no more than 13 WOS categories
Broker	0.656	0.542	17%	24.32	Consistently increase policy citations
D value	0.064	0.051	21%	19.76	Influence negligible
Negate	0.075	-0.001	101%	2.94	Influence negligible

the proportion of non-academic authors rises above 80.35%[12], it may start to negatively impact policy citations. However, if we consider the heterogeneity of team composition, the positive influence of non-academic authors on policy citations is consistent and pervasive across varying collaboration scenarios (e.g., sole-authored or team-authored). Appendix B.2.1 has more details.

2. For over 99.7% of the observations (i.e., within three standard deviations from the mean), an increase in *#Country* leads to a positive impact on policy citations, albeit the magnitude of this marginal effect is negligible compared to other factors.
3. The optimal number of WOS subject categories referenced in an article is 13. The marginal effect of the variable *#WOS category* turns negative once its value surpasses 1.73 z-score. This suggests that if an article cites references from more than 13.21 WOS subject categories[13], such citing behavior may negatively impact policy citations. Approximately 6.18% of all the articles cite more than this optimal number.
4. Being circulated as references in policy communities that bridge scholarship from different areas consistently leads to higher policy citations. However, the positive marginal effect decreases at a slight rate (i.e., a 17% decrease from the largest to the smallest marginal effect for 99.7% of all observations).
5. For over 99.7% of the observations, being circulated in policy communities as references that disrupt existing paradigms, and increasing the use of negation language consistently results in a positive impact on policy citations. However, the magnitudes of these marginal effects are minor when compared to other factors.

[12] $= 0.35\ (std) \times 1.81\ (z\text{-}score) + 0.17\ (mean)$
[13] $= 4.4(std) \times 1.73\ (z\text{-}score) + 5.6\ (mean)$

Robustness Tests

Given the complexities associated with data quality, research design, and empirical analysis, we have undertaken extensive robustness tests of the results outlined by Table 7. Details can be found in Appendix B.

Table 7: GUIDELINES FOR ROBUSTNESS TESTS

Research stage	Possible causes of bias
Data quality	(1) Missing data by year; (2) Missing institutional affiliation data
Research design	(3) Heterogeneity of team composition; (4) Heterogeneity of policy citations
Statistical methods	(5) Model selection; (6) Model specification

DISCUSSION

Why do some academic articles receive more attention from policy communities? This study adopts an interdisciplinary approach (Table 1) to unravel the factors that make certain scholarly works more prominent to policy communities. Collaborative teams bridging scholars and practitioners, cross-disciplinary interactions citing articles from a variety of research fields, and disruptive research paradigms challenging conventional approaches, can all contribute to more policy citations. However, the magnitude of their impact varies significantly. The most potent factor is being cited by policy communities as references bridging different themes ($\beta = 0.62$), followed by citing literature from different disciplines in research articles ($\beta = 0.19$), and collaborating with non-academic authors ($\beta = 0.17$). Although the remaining factors are statistically significant, their influence is comparatively small.

The descriptive results also uncover an encouraging fact: a notable 10.1% of all PAP scholarship garners high citations from both academic and policy circles. However, they also reveals a cautionary note: a substantial 74.09% of PAP scholarship rarely receives citations from either scholarly or policy communities.

These findings culminate in three practical recommendations for improving policy citations: (1) Prioritizing the perspectives of policy communities, (2) Engage with scholarship across multiple disciplines while avoiding excessive dispersion to maintain focused efforts, and (3) Foster collaborations with non-academic authors. Additionally, the results and limitations of this study underscore a significant obstacle to broadening the global influence of PAP scholarship. Subsequent sections will elaborate on each of these points in detail.

Prioritizing Policy Community Perspectives

The two most influential factors in increasing policy citations both revolve around cross-disciplinary citation, albeit from different perspectives. The most significant factor is being cited by policy communities working on different themes, a measure that reflects the perspective

of policy communities. In contrast, the second factor, which involves citing literature from different disciplines, reflects the academic perspective. The influence of the policy community's viewpoint on policy citations is considerably greater than that of the academic viewpoint. While both relationships exhibit a curvilinear nature, the impact of the policy community's perspective decreases at a much slower rate (Table 6).

This divergence between policy community and academic perspectives can also be found in descriptive evidence. Figure 2 presents the top six WOS categories of the references cited by the policy-cited PAP journal articles (i.e., PAP journal articles cited in policy documents). This figure reveals a notable increase in the proportion of references categorized as "Others" from approximately 50% in the 1980s to about 70% in the 2020s. In contrast, Vogel and Hattke (2022, 21, Figure 3) observed a different pattern for all PAP journal articles, where the references in the "Other" category consistently represented around 10% from 1970 to 2020.[14] By comparing these findings, it is evident that the knowledge base (i.e., cited references) of policy-cited PAP journal articles is significantly more diverse than that of PAP research in general.

These findings empirically delineate the differences between policy community and academic perspectives, emphasizing the necessity to align with policy community viewpoints to boost policy citations. Methodologically, they also emphasize the need for future studies to develop measures that reflect the interests of policy users. This approach ensures that the measures used in research are truly representative of the interests within policy communities. Many existing measures predominantly reflect academic interests. This study reminds us that to create impactful and policy-relevant research, we must engage policy communities at various stages of research, from the formulation of research questions to the development of methodologies.

[14]Figure 3 in Vogel and Hattke (2022, p. 21) also displays the WOS categories of PAP articles' references, with a slight difference: it presents the top seven WOS categories and groups the rest as "Other." The most significant divergence lies in their sample, comprising solely articles published in *Public Administration*. Nonetheless, despite the substantial difference in sample size, the contrast of the "Other" categories remains noteworthy.

Targeting Optimal Efforts: Theoretical and Practical Implications

As discussed in the introduction, existing research has raised concerns about nonlinear relationships between the efforts of increasing policy citations and their outcomes, challenging the notion of "the more, the better." While these speculations are theoretically sound, their practical implications may be limited.

Among all the quadratic terms we examined, only the practice of citing literature from different disciplines exhibits a significant curvilinear feature—citing beyond 13 subject categories negatively impacts policy citations. Approximately 6.18% of all articles cite more than this optimal number, which aligns with previous findings on scholarly citation: "purely interdisciplinary articles ($> 95\%$) obtain, on average, lower citation rates, are published in lower impact factor journals, and are less likely to be among the 5% most cited articles" (Larivière & Gingras, 2010, p. 128).

While the nonlinear relationship may be theoretically intriguing, in reality, most scholarly articles do not reach this optimal number. For all articles, half cite fewer than five WOS subject categories ($Median = 5$), and 75% of all articles cite fewer than eight categories ($75\%\ percentile = 8$). Therefore, the real concern here is not excessive cross-disciplinary interactions, but rather its insufficiency. There are still untapped potentials for increasing the visibility of our work to policy communities.

The nonlinear relationships uncovered in this study may reflect the underlying complexities of how scholarly works interact with policy communities. Recognizing and understanding these nonlinearities is crucial for both theoretical advancement and practical application. However, in practice, we should not overly worry about the over-dispersed cross-disciplinary interactions because, in most cases, we are not diverse enough.

Expanding Global Impact of PAP Scholarship

Although the users of PAP scholarship span 106 countries or regions, their distribution is highly uneven, with nearly 80% hailing from OECD or advanced economies. This pronounced imbalance can be attributed to several factors, chief among them being language barriers and geographic biases. The PAP scholarship and the policy documents examined in this study primarily consist of English-language materials and documents from North American organizations. Such significant imbalance underscores the accessibility challenges faced by non-English speaking scholars and policymakers, easily limiting the global reach of PAP scholarship.

Another factor is the difficulty in tracking citations of scholarly articles by policy documents, especially those in non-English languages. The policy database does cover many non-English speaking or non-OECD countries such as Japan (which ranks 7th by the number of policy documents and is also an OECD country) and China (which ranks 10th and is not an OECD country) (Szomszor & Adie, 2022, p. 631), and most of their policy documents are in local languages. However, none of these countries feature among the top citers of PAP scholarship (Table 5). This discrepancy could be because policy documents in local languages might prefer citing scholarly work published in the same language or might not adhere to standard citation practices. Consequently, tracking the impact of English-language PAP scholarship in these documents becomes particularly challenging.

The discrepancy in citing PAP scholarship may largely stem from language barriers, given the established status of English as the international lingua franca in academia (Tardy, 2004). The dominance of English in academic discourse often marginalizes the work of scholars and research from non-English-speaking countries (Ferguson et al., 2011; Gomez et al., 2022; Salager-Meyer, 2008). Only recently have social scientists begun to confront these issues, propelled by developments in open science and computational linguistics. For instance, Linkov et al. (2021) developed a Linguistic Diversity Index to promote citations from articles published in less

commonly used languages. Additionally, researchers in China and Korea have explored the integration of Western academic works by scholars publishing in their native languages (Gong et al., 2019; Ma, 2024; Shin et al., 2021).

The reasons for the citation disparity must extend beyond simple geographic or linguistic differences, though exploring these underlying factors is beyond the scope of this study. Nonetheless, the discrepancy is both evident and significant. Future research should explore these issues further to expand the global reach and impact of PAP scholarship.

Limitations and Future Studies

We would like to acknowledge and remind readers of several limitations inherent in this study, each of which offers opportunities for further exploration and refinement.

Policy citation vs. policy impact. While policy citation counts symbolize the visibility and acknowledgment of academic work within the policymaking process, they do not inherently signify the direct impact of the scholarship on policy outcomes. Future research should explore methods to directly measure policy impact, considering both quantitative and qualitative aspects. Furthermore, adherence to citation standards is inconsistent within policy communities. For instance, a key policy document in the United States, the "Economic Report of the President," only began including citations in 2010. Citation standards should extend beyond academia to become common practice within policy communities, facilitating the analysis of interactions between academic research and policy formulation.

Critical values as reference points. The critical values identified in this study, such as citing no more than 13 subject categories, should be treated as reference points rather than definitive guidelines. These values may vary across different contexts, and more empirical studies are needed to confirm the size of impact, the critical thresholds, and the nuances that may arise in different settings.

Methodological validity and novelty. Given the innovative methodology employed in this study, the validity of the measures must be further confirmed by subsequent empirical research.

For example, “non-academic authors” are those who have no affiliations with universities or colleges. However, one’s affiliational status often varies over time. Similarly, ranking top journals by policy citations, akin to any widely used journal ranking metric, may introduce bias, as inclusion in the list could result from one or two highly cited articles. Depending on the research questions, future studies might employ normalized measures or those less sensitive to outliers. With advancements in multilingual and large language models, new computational techniques can explore interactions between scholarly work and policy documents across languages, potentially broadening our understanding of how academic knowledge is used equitably in policymaking—an essential direction for further research.

Data quality and availability. It is worth noting that the quality of data sources has significantly improved since 2000. We can optimistically anticipate that future studies will leverage newly available data sources of enhanced quality.

Geographical and temporal considerations. As previously discussed, the study’s focus on OECD and advanced economies may limit its applicability to other regions. Future research should strive to include more diverse geographical perspectives. Additionally, the temporal scope of the study may influence the findings, and future work could explore how these relationships have evolved over time.

CONCLUSION

In conclusion, our study employs the citations by policy documents to stimulate and provide a foundation for evaluating the policy impact of scholarly articles. It complements recent studies using conventional methods such as surveys (Bozeman et al., 2023; Nelson et al., 2024) and interviews (Bogenschneider et al., 2019), thereby enriching the methodological toolkit available for exploring this subject. Our study underscores the importance of fostering collaboration between practitioners and scholars, encouraging interdisciplinary interactions, and posing thought-provoking and paradigm-shifting questions. Furthermore, there is no substantial trade-off between scholarly impact and policy impact. Scholarly citations and the academic reputation of authors often translate into recognition and citations within policy communities. Future research can continue improving the understanding of the relationship between academia and policy, reaffirming our commitment to serving practice and the real world.

REFERENCES

Baas, J., Schotten, M., Plume, A., Côté, G., & Karimi, R. (2020). Scopus as a curated, high-quality bibliometric data source for academic research in quantitative science studies. *Quantitative Science Studies*, *1*(1), 377–386. https://doi.org/10.1162/qss_a_00019

Behn, R. (1996). Public Management: Should It Strive to be Art, Science, or Engineering? *Journal of Public Administration Research and Theory*, *6*(1), 91–123. https://doi.org/10.1093/oxfordjournals.jpart.a024305

Behn, R. D. (1995). The Big Questions of Public Management. *Public Administration Review*, *55*(4), 313. https://doi.org/10.2307/977122

Belkhodja, O., Amara, N., Landry, R., & Ouimet, M. (2007). The Extent and Organizational Determinants of Research Utilization in Canadian Health Services Organizations. *Science Communication*, *28*(3), 377–417. https://doi.org/10.1177/1075547006298486

Bogenschneider, K., Day, E., & Parrott, E. (2019). Revisiting theory on research use: Turning to policymakers for fresh insights. *American Psychologist*, *74*(7), 778–793. https://doi.org/10.1037/amp0000460

Bolton, M. J., & Stolcis, G. B. (2003). Ties That Do Not Bind: Musings on the Specious Relevance of Academic Research. *Public Administration Review*, *63*(5), 626–630. https://doi.org/10.1111/1540-6210.00325

Bonney, R., Phillips, T. B., Ballard, H. L., & Enck, J. W. (2016). Can citizen science enhance public understanding of science? *Public Understanding of Science*, *25*(1), 2–16. https://doi.org/10.1177/0963662515607406

Boyd, R. L., & Schwartz, H. A. (2021). Natural Language Analysis and the Psychology of Verbal Behavior: The Past, Present, and Future States of the Field. *Journal of Language and Social Psychology*, *40*(1), 21–41. https://doi.org/10.1177/0261927X20967028

Bozeman, B., Lindsay, S., Nelson, J. P., & Bretschneider, S. (2023). Speaking truth to power … or to the Ivory tower? Public affairs researchers' reports of practitioners' use of their research. *Public Management Review*, 1–26. https://doi.org/10.1080/14719037.2023.2252819

Buick, F., Blackman, D., O'Flynn, J., O'Donnell, M., & West, D. (2016). Effective Practitioner–Scholar Relationships: Lessons from a Coproduction Partnership. *Public Administration Review*, *76*(1), 35–47. https://doi.org/10.1111/puar.12481

Cagan, R. (2013). The San Francisco Declaration on Research Assessment. *Disease Models & Mechanisms*, *6*(4), 869–870. https://doi.org/10.1242/dmm.012955

Cherney, A. (2015). Academic–industry collaborations and knowledge co-production in the social sciences. *Journal of Sociology*, *51*(4), 1003–1016. https://doi.org/10.1177/1440783313492237

Christensen, C. M., McDonald, R., Altman, E. J., & Palmer, J. E. (2018). Disruptive Innovation: An Intellectual History and Directions for Future Research. *Journal of Management Studies*, *55*(7), 1043–1078. https://doi.org/10.1111/joms.12349

Corley, E. A., & Sabharwal, M. (2010). Scholarly Collaboration and Productivity Patterns in Public Administration: Analysing Recent Trends. *Public Administration*, *88*(3), 627–648. https://doi.org/10.1111/j.1467-9299.2010.01830.x

de Sandes-Guimarães, L. V., Velho, R., & Plonski, G. A. (2022). Interdisciplinary research and policy impacts: Assessing the significance of knowledge coproduction. *Research Evaluation*, *31*(3), 344–354. https://doi.org/10.1093/reseval/rvac008

D'Este, P., Llopis, O., Rentocchini, F., & Yegros, A. (2019). The relationship between interdisciplinarity and distinct modes of university-industry interaction. *Research Policy*, *48*(9), 103799. https://doi.org/10.1016/j.respol.2019.05.008

Dewaele, A., Vandael, K., Meysman, S., & Buysse, A. (2021). Understanding collaborative interactions in relation to research impact in social sciences and humanities: A meta-ethnography. *Research Evaluation*, *30*(2), 179–190. https://doi.org/10.1093/reseval/rvaa033

Dogan, M. (2001). Paradigms in the Social Sciences. In N. J. Smelser & P. B. Baltes (Eds.), *International Encyclopedia of Social & Behavioral Sciences*. Elsevier Science.

Edelmann, A., Wolff, T., Montagne, D., & Bail, C. A. (2020). Computational Social Science and Sociology. *Annual Review of Sociology*, *46*(1), 61–81. https://doi.org/10.1146/annurev-soc-121919-054621

Ferguson, G., Pérez-Llantada, C., & Plo, R. (2011). English as an international language of scientific publication: A study of attitudes. *World Englishes*, *30*(1), 41–59. https://doi.org/10.1111/j.1467-971X.2010.01656.x

Fontana, M., Iori, M., Leone Sciabolazza, V., & Souza, D. (2022). The interdisciplinarity dilemma: Public versus private interests. *Research Policy*, *51*(7), 104553. https://doi.org/10.1016/j.respol.2022.104553

Garfield, E. (1955). Citation Indexes for Science: A New Dimension in Documentation through Association of Ideas. *Science*, *122*(3159), 108–111. https://doi.org/10.1126/science.122.3159.108

Garfield, E. (1972). Citation Analysis as a Tool in Journal Evaluation: Journals can be ranked by frequency and impact of citations for science policy studies. *Science*, *178*(4060), 471–479. https://doi.org/10.1126/science.178.4060.471

Gibbons, M., Limoges, C., Nowotny, H., Schwartzman, S., Scott, P., & Trow, M. (1994). *The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies*. SAGE Publications, Limited.

Glied, S. (2022). Presidential Address: Connecting the Dots: Turning Research Evidence into Evidence for Policymaking. *Journal of Policy Analysis and Management*, *41*(3), 676–682. https://doi.org/10.1002/pam.22394

Gomez, C. J., Herman, A. C., & Parigi, P. (2022). Leading countries in global science increasingly receive more citations than other countries doing similar research. *Nature Human Behaviour*, 1–11. https://doi.org/10.1038/s41562-022-01351-5

Gong, K., Xie, J., Cheng, Y., Larivière, V., & Sugimoto, C. R. (2019). The citation advantage of foreign language references for Chinese social science papers. *Scientometrics*, *120*(3), 1439–1460. https://doi.org/10.1007/s11192-019-03146-4

Goodnow, F. J. (1900). *Politics and Administration: A Study in Government*. Macmillan.

Gow, J. I., & Dufour, C. (2000). Is the New Public Management a Paradigm? Does it Matter? *International Review of Administrative Sciences*, *66*(4), 573–597. https://doi.org/10.1177/0020852300664002

Gruening, G. (2001). Origin and theoretical basis of new public management. *International Public Management Journal*, *4*(1), 1–25. https://doi.org/10.1016/S1096-7494(01)00041-1

Gusenbauer, M. (2019). Google Scholar to overshadow them all? Comparing the sizes of 12 academic search engines and bibliographic databases. *Scientometrics*, *118*(1), 177–214. https://doi.org/10.1007/s11192-018-2958-5

Haeussler, C., & Sauermann, H. (2020). Division of labor in collaborative knowledge production: The role of team size and interdisciplinarity. *Research Policy*, *49*(6), 103987. https://doi.org/10.1016/j.respol.2020.103987

Hall, J. L., & MacDonald, B. D. (2023). Scholarly hypocrisy or apostasy in public administration: Preaching to the choir, or to an empty room? *Public Administration Review*, *83*(4), 725–733. https://doi.org/10.1111/puar.13686

Henry, N. (1975). Paradigms of Public Administration. *Public Administration Review*, *35*(4), 378–386. https://doi.org/10.2307/974540

Hicks, D., Wouters, P., Waltman, L., de Rijcke, S., & Rafols, I. (2015). Bibliometrics: The Leiden Manifesto for research metrics. *Nature*, *520*(7548), 429–431. https://doi.org/10.1038/520429a

Hirsch, J. E. (2005). An index to quantify an individual's scientific research output. *Proceedings of the National Academy of Sciences*, *102*(46), 16569–16572. https://doi.org/10.1073/pnas.0507655102

Hirsch, J. E. (2007). Does the h index have predictive power? *Proceedings of the National Academy of Sciences*, *104*(49), 19193–19198. https://doi.org/10.1073/pnas.0707962104

Hoydal, O. S., & Toge, A. G. (2021). Evaluating social policies: Do methodological approaches determine the policy impact? *Social Policy & Administration*, *55*(5), 954–967. https://doi.org/10.1111/spol.12682

Huutoniemi, K., Klein, J. T., Bruun, H., & Hukkinen, J. (2010). Analyzing interdisciplinarity: Typology and indicators. *Research Policy*, *39*(1), 79–88. https://doi.org/10.1016/j.respol.2009.09.011

Jacobs, J. A., & Frickel, S. (2009). Interdisciplinarity: A Critical Assessment. *Annual Review of Sociology*, *35*(1), 43–65. https://doi.org/10.1146/annurev-soc-070308-115954

Keahey, K., Anderson, J., Zhen, Z., Riteau, P., Ruth, P., Stanzione, D., Cevik, M., Colleran, J., Gunawi, H. S., Hammock, C., Mambretti, J., Barnes, A., Halbah, F., Rocha, A., & Stubbs, J. (2020). Lessons Learned from the Chameleon Testbed, 219–233.

Kettl, D. F. (2000). Public Administration at the Millennium: The State of the Field. *Journal of Public Administration Research and Theory*, *10*(1), 7–34. https://doi.org/10.1093/oxfordjournals.jpart.a024267

Kirlin, J. J. (1996). The Big Questions of Public Administration in a Democracy. *Public Administration Review*, *56*(5), 416–423. https://doi.org/10.2307/977040

Klein, J. T. (1999). *Mapping Interdisciplinary Studies. The Academy in Transition* (tech. rep.). Association of American Colleges and Universities, 1818 R Street NW, Washington, DC 20009-1604; Tel: 800-297-3775 (Toll Free); Fax: 202-265-9532; Web site: http://www.

Kuhn, T. S. (1970). *The Structure of Scientific Revolutions* (Second Edition, Enlarged). University of Chicago Press.

Larivière, V., & Gingras, Y. (2010). On the relationship between interdisciplinarity and scientific impact. *Journal of the American Society for Information Science and Technology*, *61*(1), 126–131. https://doi.org/10.1002/asi.21226

Linkov, V., O'Doherty, K., Choi, E., & Han, G. (2021). Linguistic Diversity Index: A Scientometric Measure to Enhance the Relevance of Small and Minority Group Languages. *SAGE Open*, *11*(2), 21582440211009191. https://doi.org/10.1177/21582440211009191

Lynn Jr., L. E. (2001). The Myth of the Bureaucratic Paradigm: What Traditional Public Administration Really Stood For. *Public Administration Review*, *61*(2), 144–160. https://doi.org/10.1111/0033-3352.00016

Ma, J. (2024). Neutral, Non-Disruptive, and Native: Why Do Chinese Nonprofit Scholars Cite English Articles? *Nonprofit and Voluntary Sector Quarterly*, *53*(4), 1028–1056. https://doi.org/10.1177/08997640231196892

Ma, J., & Bekkers, R. (2024). Consensus Formation in Nonprofit and Philanthropic Studies: Networks, Reputation, and Gender. *Nonprofit and Voluntary Sector Quarterly*, *53*(1), 127–158. https://doi.org/10.1177/08997640221146948

Ma, J., Ovalle, J., & Wang, Y. (2023). Institutional factors influencing knowledge production for practice: Evidence from nonprofit studies. *PLOS ONE*, *18*(10), e0293360. https://doi.org/10.1371/journal.pone.0293360

Monaghan, M., & Ingold, J. (2019). Policy Practitioners' Accounts of Evidence-Based Policy Making: The Case of Universal Credit. *Journal of Social Policy*, *48*(2), 351–368. https://doi.org/10.1017/S004727941800051X

Nelson, J. P., Bozeman, B., Bretschneider, S., & Lindsay, S. L. (2024). How do academic public administration and public policy researchers affect policymaking? Functional groupings from survey data. *Scientometrics*, *129*(1), 65–93. https://doi.org/10.1007/s11192-023-04860-w

Nelson, J. P., Lindsay, S., & Bozeman, B. (2023). The Last 20 Years of Empirical Research on Government Utilization of Academic Social Science Research: A State-of-the-Art Literature Review. *Administration & Society*, 00953997231172923. https://doi.org/10.1177/00953997231172923

Newman, J., Cherney, A., & Head, B. W. (2016). Do Policy Makers Use Academic Research? Reexamining the "Two Communities" Theory of Research Utilization. *Public Administration Review*, *76*(1), 24–32. https://doi.org/10.1111/puar.12464

Ni, C., Sugimoto, C. R., & Robbin, A. (2017). Examining the Evolution of the Field of Public Administration through a Bibliometric Analysis of Public Administration Review. *Public Administration Review*, *77*(4), 496–509. https://doi.org/10.1111/puar.12737

Norström, A. V., Cvitanovic, C., Löf, M. F., West, S., Wyborn, C., Balvanera, P., Bednarek, A. T., Bennett, E. M., Biggs, R., de Bremond, A., Campbell, B. M., Canadell, J. G., Carpenter, S. R., Folke, C., Fulton, E. A., Gaffney, O., Gelcich, S., Jouffray, J.-B., Leach, M., … Österblom, H. (2020). Principles for knowledge co-production in sustainability research. *Nature Sustainability*, *3*(3), 182–190. https://doi.org/10.1038/s41893-019-0448-2

OECD. (2010). *Multidisciplinary and interdisciplinary research* (tech. rep.). OECD. Paris. https://doi.org/10.1787/9789264059474-13-en

O'Flynn, J. (2007). From New Public Management to Public Value: Paradigmatic Change and Managerial Implications. *Australian Journal of Public Administration*, *66*(3), 353–366. https://doi.org/10.1111/j.1467-8500.2007.00545.x

Orr, K., & Bennett, M. (2012). Public Administration Scholarship and the Politics of Coproducing Academic–Practitioner Research. *Public Administration Review*, *72*(4), 487–495. https://doi.org/10.1111/j.1540-6210.2011.02522.x

Pandey, S. K., Cheng, Y. (, & Hall, J. L. (2022). Epistemic decolonization of public policy pedagogy and scholarship. *Public Administration Review*, *82*(6), 977–985. https://doi.org/10.1111/puar.13560

Park, M., Leahey, E., & Funk, R. J. (2023). Papers and patents are becoming less disruptive over time. *Nature*, *613*(7942), 138–144. https://doi.org/10.1038/s41586-022-05543-x

Piwowar, H., Priem, J., Larivière, V., Alperin, J. P., Matthias, L., Norlander, B., Farley, A., West, J., & Haustein, S. (2018). The state of OA: A large-scale analysis of the prevalence and impact of Open Access articles. *PeerJ*, *6*, e4375. https://doi.org/10.7717/peerj.4375

Porter, A. L., & Chubin, D. E. (1985). An indicator of cross-disciplinary research. *Scientometrics*, *8*(3), 161–176. https://doi.org/10.1007/BF02016934

Porter, A. L., & Rafols, I. (2009). Is science becoming more interdisciplinary? Measuring and mapping six research fields over time. *Scientometrics*, *81*(3), 719–745. https://doi.org/10.1007/s11192-008-2197-2

Porter, A. L., Roessner, J. D., Cohen, A. S., & Perreault, M. (2006). Interdisciplinary research: Meaning, metrics and nurture. *Research Evaluation*, *15*(3), 187–195. https://doi.org/10.3152/147154406781775841

Priem, J., Piwowar, H., & Orr, R. (2022). OpenAlex: A fully-open index of scholarly works, authors, venues, institutions, and concepts. https://doi.org/10.48550/arXiv.2205.01833

Pulla, P. (2019). The plan to mine the world's research papers. *Nature*, *571*(7765), 316–318. https://doi.org/10.1038/d41586-019-02142-1

Reale, E., Avramov, D., Canhial, K., Donovan, C., Flecha, R., Holm, P., Larkin, C., Lepori, B., Mosoni-Fried, J., Oliver, E., Primeri, E., Puigvert, L., Scharnhorst, A., Schubert, A., Soler, M., Soòs, S., Sordé, T., Travis, C., & Van Horik, R. (2018). A review of literature on evaluating the scientific, social and political impact of social sciences and humanities research. *Research Evaluation*, *27*(4), 298–308. https://doi.org/10.1093/reseval/rvx025

Reed, M. S., Ferré, M., Martin-Ortega, J., Blanche, R., Lawford-Rolfe, R., Dallimer, M., & Holden, J. (2021). Evaluating impact from research: A methodological framework. *Research Policy*, *50*(4), 104147. https://doi.org/10.1016/j.respol.2020.104147

Reuter, P., & Smith-Ready, J. (2002). AssessingJPAM after 20 Years. *Journal of Policy Analysis and Management*, *21*(3), 339–353. https://doi.org/10.1002/pam.10048

Rigney, D., & Barnes, D. (1980). Patterns of Interdisciplinary Citation in the Social Sciences. *Social Science Quarterly*, *61*(1), 114–127.

Rommel, J., & Christiaens, J. (2006). Beyond the Paradigm Clashes in Public Administration. *Administrative Theory & Praxis*, *28*(4), 610–617. https://doi.org/10.1080/10841806.2006.11029554

Rosenbloom, D. H. (1983). Public Administrative Theory and the Separation of Powers. *Public Administration Review*, *43*(3), 219–227. https://doi.org/10.2307/976330

Salager-Meyer, F. (2008). Scientific publishing in developing countries: Challenges for the future. *Journal of English for Academic Purposes*, *7*(2), 121–132. https://doi.org/10.1016/j.jeap.2008.03.009

Schwoerer, K., Keppeler, F., Mussagulova, A., & Puello, S. (2022). CO-DESIGN-ing a more context-based, pluralistic, and participatory future for public administration. *Public Administration*, *100*(1), 72–97. https://doi.org/10.1111/padm.12828

Shin, J. C., Huang, J. W., Lee, J.-k., & An, Y. (2021). Localization of social science research in selected academic disciplines in South Korea. *Current Sociology*, 00113921211048528. https://doi.org/10.1177/00113921211048528

Shulock, N. (1999). The paradox of policy analysis: If it is not used, why do we produce so much of it? *Journal of Policy Analysis and Management*, *18*(2), 226–244. https://doi.org/10.1002/(SICI)1520-6688(199921)18:2⟨226::AID-PAM2⟩3.0.CO;2-J

Shwed, U., & Bearman, P. S. (2010). The Temporal Structure of Scientific Consensus Formation. *American Sociological Review*, *75*(6), 817–840. https://doi.org/10.1177/0003122410388488

Szomszor, M., & Adie, E. (2022). Overton: A bibliometric database of policy document citations. *Quantitative Science Studies*, *3*(3), 624–650. https://doi.org/10.1162/qss_a_00204

Tardy, C. (2004). The role of English in scientific communication: Lingua franca or Tyrannosaurus rex? *Journal of English for Academic Purposes*, *3*(3), 247–269. https://doi.org/10.1016/j.jeap.2003.10.001

Tausczik, Y. R., & Pennebaker, J. W. (2010). The Psychological Meaning of Words: LIWC and Computerized Text Analysis Methods. *Journal of Language and Social Psychology*, *29*(1), 24–54. https://doi.org/10.1177/0261927X09351676

Tomov, D. T., & Mutafov, H. G. (1996). Comparative indicators of interdisciplinarity in modern science. *Scientometrics*, *37*(2), 267–278. https://doi.org/10.1007/BF02093624

Van de Ven, A. H. (2018). Academic-practitioner engaged scholarship. *Information and Organization*, *28*(1), 37–43. https://doi.org/10.1016/j.infoandorg.2018.02.002

Velez-Estevez, A., Perez, I. J., García-Sánchez, P., Moral-Munoz, J. A., & Cobo, M. J. (2023). New trends in bibliometric APIs: A comparative analysis. *Information Processing & Management*, *60*(4), 103385. https://doi.org/10.1016/j.ipm.2023.103385

Vogel, R., & Hattke, F. (2022). A century of Public Administration: Traveling through time and topics. *Public Administration*, *100*(1), 17–40. https://doi.org/10.1111/padm.12831

Wagner, C. S., Roessner, J. D., Bobb, K., Klein, J. T., Boyack, K. W., Keyton, J., Rafols, I., & Börner, K. (2011). Approaches to understanding and measuring interdisciplinary scientific research (IDR): A review of the literature. *Journal of Informetrics*, *5*(1), 14–26. https://doi.org/10.1016/j.joi.2010.06.004

Walker, R. M., Chandra, Y., Zhang, J., & Witteloostuijn, A. (2019). Topic Modeling the Research-Practice Gap in Public Administration. *Public Administration Review*, *79*(6), 931–937. https://doi.org/10.1111/puar.13095

Wallmeier, F., Helmig, B., & Feeney, M. K. (2019). Knowledge Construction in Public Administration: A Discourse Analysis of Public Value. *Public Administration Review*, *79*(4), 488–499. https://doi.org/10.1111/puar.13005

Wang, J., Thijs, B., & Glänzel, W. (2015). Interdisciplinarity and Impact: Distinct Effects of Variety, Balance, and Disparity. *PLOS ONE*, *10*(5), e0127298. https://doi.org/10.1371/journal.pone.0127298

Wang, J., Veugelers, R., & Stephan, P. (2017). Bias against novelty in science: A cautionary tale for users of bibliometric indicators. *Research Policy*, *46*(8), 1416–1436. https://doi.org/10.1016/j.respol.2017.06.006

Weiss, C. H. (1977). Research for Policy's Sake: The Enlightenment Function of Social Research. *Policy Analysis*, *3*(4), 531–545.

Weiss, C. H. (1979). The Many Meanings of Research Utilization. *Public Administration Review*, *39*(5), 426–431. https://doi.org/10.2307/3109916

Wright, B. E. (2011). Public Administration as an Interdisciplinary Field: Assessing Its Relationship with the Fields of Law, Management, and Political Science. *Public Administration Review*, *71*(1), 96–101. https://doi.org/10.1111/j.1540-6210.2010.02310.x

Wu, L., Wang, D., & Evans, J. A. (2019). Large teams develop and small teams disrupt science and technology. *Nature*, *566*(7744), 378. https://doi.org/10.1038/s41586-019-0941-9

ONLINE APPENDIX

WHY DO SOME ACADEMIC ARTICLES RECEIVE MORE CITATIONS FROM POLICY COMMUNITIES?

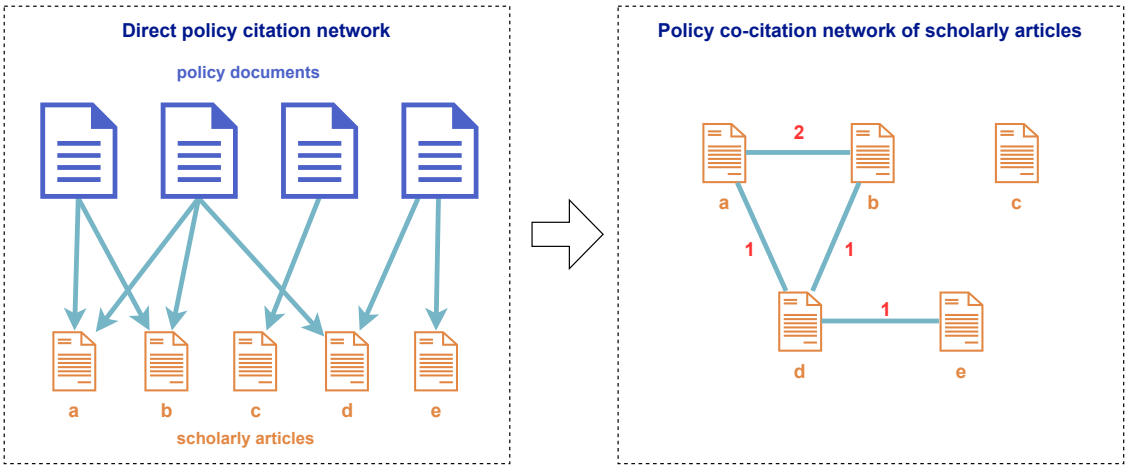
Forthcoming at *Public Administration Review*
Preprint available at *https://doi.org/10.31219/osf.io/8372e*

A Methods

A.1 Co-Citation Network and Betweenness Centrality

In a co-citation network, each node represents a journal article, and two articles are connected if they have been cited together by another article (Small, 1973). Co-citation analysis is especially useful for identifying specialties within a research area because articles that are on or useful to the same topic are often cited together. In this study, we constructed the co-citation network using policy citations—two scholarly articles are connected if they are cited together by a policy document. As Figure A1 illustrates, we can expect that scholarly articles that are important to the same policy issue should have more connections with each other in the co-citation network.

Figure A1: CONSTRUCTING POLICY CO-CITATION NETWORK OF SCHOLARLY ARTICLES



Notes: The numbers in the right sub-figure represent weights of links.

After constructing the policy co-citation network, we need to quantify the extent to which a scholarly article spans across different specialties of knowledge base (i.e., cross-disciplinary citations according to how scholarly articles are used by policy documents). Articles that bridge different themes of work are knowledge brokers and structural holes in the co-citation network (Burt, 1992; Wagner et al., 2011, p. 22), and their importance can be measured by "betweenness centrality" (Freeman, 1977; Leydesdorff et al., 2017).

A.2 Coding Articles with Large Language Model

Using machine-learning models as tools to automatically code unstructured data has become increasingly popular in social sciences and has been tested as reliable tools (e.g., Anastasopoulos & Whitford, 2019; Ma, 2021; Rodriguez & Spirling, 2022). Along with the development of Transformer-based techniques and models (Vaswani et al., 2017), such as BERT and ChatGPT models (Devlin et al., 2019; OpenAI et al., 2024), the validity of automated coding with these Large Language Models (LLMs) has also been greatly improved (Bosley et al., 2023; Laurer et al., 2023; Ziems et al., 2024).

Regarding openness, LLMs can be divided into two primary categories: proprietary and open-sourced. Proprietary LLMs, like ChatGPT (OpenAI et al., 2024), are developed and maintained by private organizations, which restrict access to their underlying architectures and training data. On the other hand, open-sourced LLMs, such as Llama2 and the Qwen series models (Bai et al., 2023; Touvron et al., 2023), provide publicly accessible code and detailed training information.

From a research application perspective, proprietary LLMs often benefit from substantial investment in development and maintenance, leading to potentially more advanced models and better results. However, their closed nature limits external researchers' ability to fully understand, customize, or audit the model's internal workings and training data. This restriction can pose challenges for replicability and transparency in research (Bosley et al., 2023, p. 5).

In contrast, open-sourced LLMs promote a higher degree of transparency and flexibility, allowing researchers to modify the model to suit specific research needs, understand its decision-making processes, and ensure reproducibility of findings. The open nature supports collaborative improvements and innovation but might require more resources from researchers to manage and potentially lacks the polish and optimization provided by proprietary models.

In this research, we employed Qwen1.5, a state-of-the-art open-sourced language model as of February 2024,[1] for coding all PAP articles as "empirical" or not, based on the articles' abstracts. We used below prompt to instruct Qwen1.5:

```
You are a helpful research assistant[2], think step by step[3], always
return result in format 'yes' or 'no'.  Nothing else.  Read below
article abstract, tell me if the article is an empirical research using
any empirical observations or data.
===
{article abstract}
```

Additionally, a doctoral student manually coded a random sample of 100 abstracts, using the same prompt for instruction as provided to the LLM. The comparison of the coding outcomes between the human and the LLM, formatted as a confusion matrix, is displayed in Table A1. According to the results, 2% of the records were identified as noisy and excluded. The accuracy of LLM coding stands at 91.84%, with a precision of 85.71%, a recall of 100%, and an F1 score of 92.30%. These metrics significantly surpass those reported in other studies (e.g., Bosley et al., 2023; Laurer et al., 2023; Ma, 2023; Ma & Bekkers, 2024).

Table A1: CONFUSION MATRIX OF CODING ARTICLES USING LLM

		Human	
		Empirical	Not empirical
LLM	Empirical	48	0
	Not empirical	8	42

Note: LLM = Large language model (i.e., `Qwen/Qwen1.5-72B-Chat-AWQ`).

[1] Refer to the Open LLM Leaderboard at https://huggingface.co/spaces/HuggingFaceH4/open_llm_leaderboard.
[2] Role define.
[3] Invoke chain-of-thought for reasoning and improved accuracy (Wei et al., 2022).

B Robustness Tests

B.1 Data Quality

B.1.1 Missing Data by Year

As discussed in the method section and Figure 1 illustrates, due to varying levels of missing data for different variables in different years, not all observations are included in the Main model (i.e., Model 1 in Table B1). We tested the robustness of the Main model by (1) only including observations of journal articles that are published after 2000 because data quality was much better after that year (Model 2 in Table B1);[4] and (2) only including journal articles that are published in the year with over 60% valid observations (Model 3 in Table B1). The results do not suggest substantial differences.

B.1.2 Missing Institutional Affiliation Data

The type of institutional affiliation (i.e., academic or non-academic) has the most missing values and may impact the estimation of *%Non-acad*. This is mainly because either (1) the bibliographic records do not have the information of affiliations or (2) the texts describing affiliations are irregular or incomplete therefore can hardly be identified (e.g., "Research Department"). To handle this missing data problem, we ran the full regression model with two opposite coding strategies—either coding all missing values as "academic" (Model 1 in Table B1) or "non-academic" (Model 4 in Table B1), and the "true" estimations should lie between the values of the two models. As the results suggest, the coefficients of *%Non-acad* are consistent across different coding strategies.

[4]This also responds to the concern that collaborative teams are a more modern activity in PAP. We thank this suggestion from an anonymous reviewer.

Table B1: ROBUSTNESS: DATA QUALITY (VARIABLES OF INTEREST)

	(1) Main	(2) Publication year $\geq$ 2000	(3) $>60\%$ valid per year	(4) Null affiliation as non-acad
Collaboration				
%Non-acad	0.17^{***}	0.16^{***}	0.16^{***}	0.15^{***}
	(5.6)	(5.0)	(4.7)	(6.2)
%Non-acad^2	-0.047^{**}	-0.036^{*}	-0.030	-0.071^{**}
	(-2.8)	(-2.1)	(-1.6)	(-3.1)
#Country	0.012	0.028^{*}	0.027^{+}	0.011
	(0.88)	(2.1)	(1.9)	(0.84)
#Country^2	-0.0017^{**}	-0.0021^{***}	-0.0020^{***}	-0.0017^{**}
	(-3.3)	(-3.7)	(-3.5)	(-3.2)
Cross-disciplinary				
#WOS category	0.19^{***}	0.16^{***}	0.13^{***}	0.19^{***}
	(6.9)	(4.9)	(3.9)	(6.9)
#WOS category^2	-0.055^{***}	-0.036^{***}	-0.029^{**}	-0.055^{***}
	(-6.2)	(-3.6)	(-2.8)	(-6.2)
Broker	0.62^{***}	0.59^{***}	0.60^{***}	0.62^{***}
	(26)	(20)	(18)	(26)
Broker^2	-0.013^{***}	-0.012^{***}	-0.013^{***}	-0.013^{***}
	(-24)	(-19)	(-18)	(-24)
Disruptiveness				
D value	0.060^{*}	0.023	0.013	0.061^{*}
	(2.1)	(0.51)	(0.27)	(2.1)
D value^2	-0.0015	0.0032	0.0042	-0.0016
	(-0.52)	(0.68)	(0.83)	(-0.56)
Negate	0.050^{***}	0.044^{**}	0.044^{**}	0.049^{***}
	(3.7)	(3.0)	(3.0)	(3.6)
Negate^2	-0.0085^{**}	-0.0085^{**}	-0.0074^{**}	-0.0084^{**}
	(-3.0)	(-3.1)	(-2.8)	(-3.0)
Observations	31,079	22,073	19,574	31,079
AIC	76,854.1	61,932.9	54,411.8	76,874.7
BIC	77,338.0	62,397.0	54,869.0	77,358.7

Note: DV = Policy citation. Table C10 shows the results of control variables. t statistics in parentheses. $^{+}$ $p<0.10$, * $p<0.05$, ** $p<0.01$, *** $p<.001$

B.2 Research Design

B.2.1 Heterogeneity of Team Composition

More than 50% of the PAP articles are sole-authored in the dataset, while the largest team-authored article includes 47 authors. These extreme values in team size may introduce bias to our estimations. For instance, the values of *%Non-acad* for sole-authored articles are fixed at either 0% or 100%.

Table B2 presents models testing the heterogeneity of team composition. Model 2 excludes both sole-authored papers and those written by extremely large teams (i.e., $1 < \#Authors \leq 7$, representing 99% of all observations), while Model 3 specifically focuses on sole-authored articles, with the dummy variable *Sole non-acad* coding the author profile as either practice-oriented or academic. The Main model is the same as aforementioned

The Main model in Table B2 indicates a positive, but curvilinear relationship between author profile and policy citation. This pattern implies that collaboration with non-academics can enhance policy citation, with an optimal value at $Non\text{-}acad = 1.79$ z-score (equivalent to 79.65% of team members). By excluding papers without collaboration (i.e., $teamsize = 1$) or those with unusually large teams (i.e., $team\ size > 7$), Model 2 reveals that the quadratic term becomes negligible and statistically non-significant, leaving only the positive linear coefficient. This suggests a continuous positive effect of adding non-academics to a team on policy citation. Model 3, focusing on sole-authored papers, indicates that works authored by non-academics garner more policy citations than those penned by academics.

Overall, the results across these models underscore a consistent and pervasive positive effect of non-academics in attracting policy citations, across various scenarios of collaboration.

B.2.2 Heterogeneity of Policy Citations

The policy documents are published by various types of institutions such as governmental organizations, IGOs, and think tanks (Tables C5—C7), and these organizations may differ in their

Table B2: ROBUSTNESS: HETEROGENEITY OF TEAM COMPOSITION (VARIABLES OF INTEREST)

	(1) Main	(2) $1 <$ Team size ≤ 7	(3) Sole-authored
Collaboration			
%Non-acad	0.17^{***}	0.14^{***}	
	(5.6)	(4.4)	
%Non-acad^2	-0.047^{**}	-0.0042	
	(-2.8)	(-0.24)	
Sole non-acad			0.13^{**}
			(3.2)
#Country	0.012	0.030	0.53^{+}
	(0.88)	(1.1)	(1.8)
#Country^2	-0.0017^{**}	-0.0022	-0.22^{+}
	(-3.3)	(-0.36)	(-1.8)
Cross-disciplinary			
#WOS category	0.19^{***}	0.14^{***}	0.23^{***}
	(6.9)	(3.9)	(5.6)
#WOS category^2	-0.055^{***}	-0.029^{**}	-0.077^{***}
	(-6.2)	(-2.7)	(-4.8)
Broker	0.62^{***}	0.60^{***}	0.70^{***}
	(26)	(21)	(16)
Broker^2	-0.013^{***}	-0.013^{***}	-0.014^{***}
	(-24)	(-21)	(-16)
Disruptiveness			
D value	0.060^{*}	-0.0024	0.096^{***}
	(2.1)	(-0.050)	(3.6)
D value^2	-0.0015	0.0041	-0.0039
	(-0.52)	(0.75)	(-1.4)
Negate	0.050^{***}	0.038^{*}	0.062^{**}
	(3.7)	(2.1)	(3.0)
Negate^2	-0.0085^{**}	-0.0047	-0.012^{**}
	(-3.0)	(-1.2)	(-2.7)
Observations	31,079	13,650	17,239
AIC	76,854.1	41,462.1	34,265.3
BIC	77,338.0	41,898.3	34,699.6

Note: DV = Policy citation. The Main model is the same as aforementioned. Table C11 shows the results of control variables. t statistics in parentheses. $^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < .001$

citing behavior of PAP scholarship. We ran the full regression model with separating different types of policy citations to test the heterogeneity of dependent variable. As Table B3 suggests, the coefficients of explanatory variables are consistent across predicting different types of policy citations.

B.3 Statistical Methods

B.3.1 Model Selection

The ZINB regression intends to handle the heterogeneity among the zero values by theorizing different processes behind the zeros (Long & Freese, 2001). (1) Some observations may be *always* zero (i.e., "excess zeros"). For example, a scholarly article that is behind the paywall may hardly be read or cited by policy institutions without a paid subscription. (2) Some observations can have zero counts or any other possible values, which are usually called "true zeros" and are of our main interests. Statistically, the ZINB regression estimates two models simultaneously, one for the excess zeros and one for the true zeros. By modeling the excess zeros separately, our primary interest of estimation, the true zeros, can be more accurate and less suffer from the heterogeneity risk.

We used two variables to assist with modeling excess zeros. (1) A binary variable indicates whether an article is open access or not, with the assumption that a paywall can obstruct the access of policy intuitions. (2) A binary variable indicates whether an article receives scholarly citations that have a z-score above 0 or below, with the assumption that a scholarly "unnoticed" article is also less likely to be visible to policy institutions.

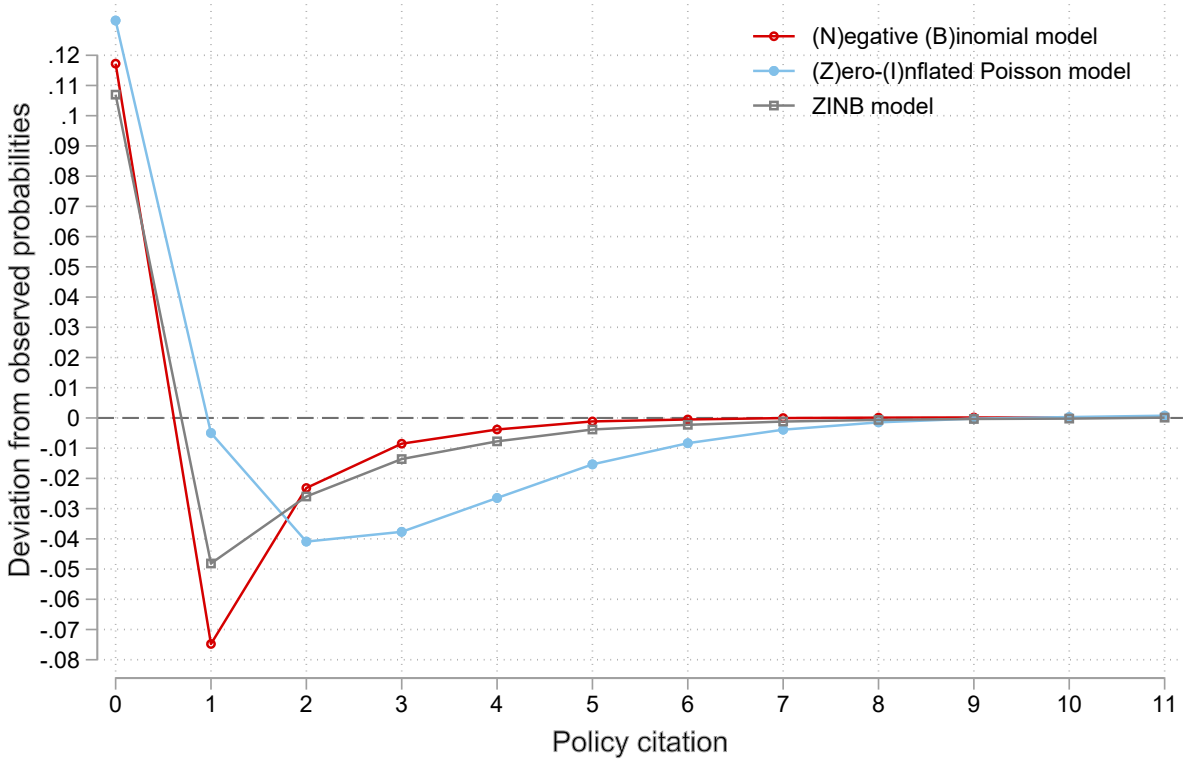
We empirically tested the performance of different model techniques (i.e., Poisson, negative binomial, zero-inflated Poisson, and ZINB; Figure B1). The results suggest that the ZINB model has the best fit overall.

Table B3: ROBUSTNESS: HETEROGENEITY OF POLICY CITATION (VARIABLES OF INTEREST)

	(1) Main	(2) Govt.	(3) IGO	(4) Think tank
Collaboration				
%Non-acad	0.17^{***}	0.26^{***}	0.20^{***}	0.098^{*}
	(5.6)	(5.8)	(3.5)	(2.5)
%Non-acad^2	-0.047^{**}	-0.096^{***}	-0.033	-0.029
	(-2.8)	(-3.9)	(-1.1)	(-1.3)
#Country	0.012	-0.031	0.057^{*}	0.010
	(0.88)	(-1.6)	(2.5)	(0.49)
#Country^2	-0.0017^{**}	-0.00040	-0.0022^{+}	-0.0027
	(-3.3)	(-0.64)	(-1.8)	(-1.3)
Cross-disciplinary				
#WOS category	0.19^{***}	0.20^{***}	0.080	0.21^{***}
	(6.9)	(5.1)	(1.6)	(6.0)
#WOS category^2	-0.055^{***}	-0.050^{***}	-0.033^{*}	-0.062^{***}
	(-6.2)	(-4.0)	(-2.1)	(-5.5)
Broker	0.62^{***}	0.47^{***}	0.54^{***}	0.51^{***}
	(26)	(22)	(20)	(23)
Broker^2	-0.013^{***}	-0.0093^{***}	-0.011^{***}	-0.010^{***}
	(-24)	(-20)	(-17)	(-20)
Disruptiveness				
D value	0.060^{*}	0.059^{*}	0.034	0.065^{*}
	(2.1)	(2.2)	(0.59)	(2.4)
D value^2	-0.0015	-0.0026	0.0020	-0.0030
	(-0.52)	(-0.91)	(0.34)	(-1.0)
Negate	0.050^{***}	0.058^{**}	0.0023	0.045^{**}
	(3.7)	(2.7)	(0.090)	(2.6)
Negate^2	-0.0085^{**}	-0.012^{*}	0.00024	-0.0076^{*}
	(-3.0)	(-2.3)	(0.040)	(-2.3)
Observations	31,079	31,079	31,079	31,079
AIC	76,854.1	41,915.8	33,710.9	48,948.8
BIC	77,338.0	42,399.8	34,194.8	49,432.8

Note: DV = Policy citation. The Main model is the same as aforementioned. Table C12 lists the control variables. t statistics in parentheses. $^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < .001$

Figure B1: COMPARE DIFFERENT REGRESSION METHODS



Notes: The Y-axis shows the difference between the observed probabilities for each citation count and the mean probabilities from different models. The regular Poisson model is omitted for clarity because its deviation is too large and distorts the Y-axis. All the models slightly under-predict zeros (80.88% of the observations) and over-predict counts one through three (13.87% of the observations). Overall, the ZINB model has the best fit. This model (1) is a zero-inflated negative binomial regression; (2) predicts excess zeros with (i) a binary variable that indicates whether an article is open-access or not, (ii) a binary variable that indicates whether an article receives scholarly citations that have a z-score above 0 or below.

B.3.2 Model Specification

In statistical terms, the theoretical speculation about the non-linear relations between policy citation and its influencing factors aims to find the best functional form of the regression model, specifically whether the model specification can be improved by including non-linear-transformed variables.

The likelihood-ratio test suggests that the model with quadratic terms (i.e., full model) is significantly different from the model without (i.e., nested model; $p < 0.001$). In terms of information loss, the quadratic model has much smaller values ($AIC = 76,854.07$,

$BIC = 77,338.04$) than the linear model ($AIC = 77,794.55$, $BIC = 78,228.45$). Therefore, the ZINB model with quadratic terms is statistically better than its nested model.

C Additional Tables

Table C1: TOP 30 POLICY-CITED PUBLIC ADMINISTRATION & POLICY JOURNALS: ARTICLE NUMBER

	Name	Total articles		Policy-cited articles	
		#	%	#	%*
1	J. Policy Anal. Manage.	5,208	2.60%	875	16.80%
2	Clim. Policy	1,877	0.94%	928	49.44%
3	Public Adm. Rev.	8,214	4.10%	1,192	14.51%
4	J. Eur. Public Policy	2,245	1.12%	1,018	45.35%
5	Admin. Sci. Q	4,065	2.03%	581	14.29%
6	Hum. Resour. Health	1,271	0.63%	592	46.58%
7	J. Soc. Policy	5,024	2.50%	731	14.55%
8	J. Eur. Soc. Policy	1,281	0.64%	449	35.05%
9	Sci. & Public Policy	4,166	2.08%	685	16.44%
10	Can. Public Policy	3,820	1.90%	798	20.89%
11	Public Adm. Dev.	3,852	1.92%	566	14.69%
12	Contemp. Econ. Policy	2,009	1.00%	512	25.49%
13	Soc. Policy & Adm.	2,864	1.43%	601	20.98%
14	Public Adm.	5,412	2.70%	591	10.92%
15	Governance	1,836	0.92%	398	21.68%
16	JPART	1,650	0.82%	409	24.79%
17	Policy Sci.	1,466	0.73%	313	21.35%
18	Criminol. Public Policy	1,365	0.68%	369	27.03%
19	J. Educ. Work	882	0.44%	276	31.29%
20	Int. Soc. Secur. Rev.	2,095	1.04%	308	14.70%
21	Public Mgmt. Rev.	1,583	0.79%	376	23.75%
22	Educ. Adm. Q.	1,918	0.96%	288	15.02%
23	Aust. J. Public Adm.	4,079	2.03%	451	11.06%
24	Public Fin. Rev.	867	0.43%	250	28.84%
25	Int. Rev. Adm. Sci.	3,509	1.75%	329	9.38%
26	Policy Stud. J.	3,166	1.58%	367	11.59%
27	J. Public Policy	1,424	0.71%	255	17.91%
28	Policy Politics	1,694	0.84%	323	19.07%
29	Gov. Oppos.	2,661	1.33%	264	9.92%
30	Int. J. Public Adm.	3,396	1.69%	319	9.39%
	Total	84,899	42.33%	15,414	60.51%

Note: JPART = Journal of Public Administration Research and Theory. * In proportion of total publications by a journal; all other percentages show the proportions of all observations.

Table C2: TOP ARTICLES OF PUBLIC ADMINISTRATION AND POLICY IN "DUAL DARLINGS"

	Title	Journal	Year	Citation	
				Policy	Scholarly
1	Absorptive capacity: A new perspective on learning and innovation	Admin. Sci. Q.	1990	480	26,994
2	Dilemmas in a general theory of planning	Policy Sci.	1973	276	10,621
3	Job demands, job decision latitude, and mental strain: Implications for job redesign	Admin. Sci. Q.	1979	212	9,399
4	The science of "muddling through"	Public Adm. Rev.	1959	135	6,577
5	The populist zeitgeist	Gov. Oppos.	2004	108	2,612
6	The impact of leadership on student outcomes: An analysis of the differential effects of leadership types	Educ. Adm. Q.	2008	92	1,628
7	Collaborative governance in theory and practice	JPART	2007	91	3,387
8	The many meanings of research utilization	Public Adm. Rev.	1979	88	1,647
9	The 'southern model' of welfare in social Europe	J. Eur. Soc. Policy	1996	84	2,328
10	A garbage can model of organizational choice	Admin. Sci. Q.	1972	81	5,937
11	Transition management for sustainable development: A prescriptive, complexity-based governance framework	Governance	2010	77	1,033
12	Community organization and rural development: A learning process approach	Public Adm. Rev.	1980	74	775
13	Learning from abroad: The role of policy transfer in contemporary policy-making	Governance	2000	72	2,078
14	Interorganizational collaboration and the locus of innovation: Networks of learning in biotechnology	Admin. Sci. Q.	1996	70	7,255
15	A public management for all seasons?	Public Adm.	1991	65	6,713
16	An advocacy coalition framework of policy change and the role of policy-oriented learning therein	Policy Sci.	1988	64	2,539
17	Architectural innovation: The reconfiguration of existing product technologies and the failure of established firms	Admin. Sci. Q.	1990	62	6,905
18	What's measured is what matters: Targets and gaming in the English public health care system	Public Adm.	2006	61	1,025
19	New public management is dead–long live digital-era governance	JPART	2005	59	1,376
20	Overcoming the tragedy of super wicked problems: Constraining our future selves to ameliorate global climate change	Policy Sci.	2012	58	964

Note: Articles ordered by policy citation.

Table C3: TOP ARTICLES OF PUBLIC ADMINISTRATION AND POLICY IN "POLICY MAGNETS"

	Title	Journal	Year	Citation	
				Policy	Scholarly
1	Career education that works: an economic analysis using the British Cohort Study	J. Educ. Work	2017	28	21
2	Employer engagement in British secondary education: wage earning outcomes experienced by young adults	J. Educ. Work	2014	27	13
3	Incremental CH4and N2O mitigation benefits consistent with the US Government's SC-CO2estimates	Clim. Policy	2015	25	25
4	Labour market outcomes of national qualifications frameworks in six countries	J. Educ. Work	2017	24	14
5	Marginal abatement cost curves and the quality of emission reductions: a case study on Brazil	Clim. Policy	2015	23	25
6	Were We Really All in it Together? The Distributional Effects of the 2010-15 UK Coalition Government's Tax-benefit Policy Changes	Soc. Policy & Adm.	2018	22	15
7	Qualifications frameworks and learning outcomes: challenges for Europe's lifelong learning area	J. Educ. Work	2012	22	21
8	Learning outcomes: good, irrelevant, bad or none of the above?	J. Educ. Work	2012	20	17
9	Measuring the integration and coordination dynamics of the European Research Area	Sci. & Public Policy	2013	20	20
10	Spurring Job Creation in Response to Severe Recessions: Reconsidering Hiring Credits	JPAM	2013	20	25
11	Reducing global GHG emissions by replicating successful sector examples: the 'good practice policies' scenario	Clim. Policy	2018	19	18
12	The educational implications of introducing a NQF for developing countries	J. Educ. Work	2011	18	5
13	Carbon pricing and competitiveness: are they at odds?	Clim. Policy	2020	18	19
14	Unequal unions? A comparative decomposition of income inequality in the European Union and United States	J. Eur. Soc. Policy	2019	18	7
15	The Effect of Private School Competition on Public School Performance in Georgia	Public Fin. Rev.	2006	17	24
16	Charter High Schools' Effects on Long-Term Attainment and Earnings	JPAM	2016	16	21
17	THE ECONOMIC VALUE OF PREVENTING RESPIRATORY AND CARDIOVASCULAR HOSPITALIZATIONS	Contemp. Econ. Policy	2006	16	16
18	Climate change adaptation cost in the US: what do we know?	Clim. Policy	2014	16	19
19	A ?Building-up? approach to measuring program costs	JPAM	1999	15	4
20	Quantifying international public finance for climate change adaptation in Africa	Clim. Policy	2021	15	11

Note: JPART = Journal of Public Administration Research and Theory; JPAM = Journal of Policy Analysis and Management. Articles ordered by policy citation.

Table C4: TOP ARTICLES OF PUBLIC ADMINISTRATION AND POLICY IN "ACADEMIC IVORIES"

	Title	Journal	Year	Scholarly citation
1	Dimensions of Organizational Task Environments	Admin. Sci. Q	1984	3,063
2	Rhetorical Strategies of Legitimacy	Admin. Sci. Q	2005	1,801
3	Representing and Testing Organizational Theories: A Holistic Construal	Admin. Sci. Q	1982	1,798
4	A Qualitative Analysis of Conflict Types and Dimensions in Organizational Groups	Admin. Sci. Q	1997	1,715
5	The Storytelling Organization: A Study of Story Performance in an Office- Supply Firm	Admin. Sci. Q	1991	1,413
6	Identity Ambiguity and Change in the Wake of a Corporate Spin-off	Admin. Sci. Q	2004	1,389
7	Being in the Right Place: A Structural Analysis of Individual Influence in an Organization	Admin. Sci. Q	1984	1,318
8	Top Management Team Demography and Process: The Role of Social Integration and Communication	Admin. Sci. Q	1994	1,249
9	Follow the Leader: Mimetic Isomorphism and Entry Into New Markets	Admin. Sci. Q	1993	1,243
10	An Empirical Assessment of Organizational Commitment and Organizational Effectiveness	Admin. Sci. Q	1981	1,240
11	A Strategic Contingencies' Theory of Intraorganizational Power	Admin. Sci. Q	1971	1,206
12	Socioemotional Wealth and Corporate Responses to Institutional Pressures: Do Family-Controlled Firms Pollute Less?	Admin. Sci. Q	2010	1,122
13	Managerial Response to Changing Environments: Perspectives on Problem Sensing from Social Cognition	Admin. Sci. Q	1982	1,088
14	Modes of Interorganizational Imitation: The Effects of Outcome Salience and Uncertainty	Admin. Sci. Q	1997	1,050
15	Impetus for Action: A Cultural Analysis of Justice and Organizational Citizenship Behavior in Chinese Society	Admin. Sci. Q	1997	1,009
16	The Context of Organization Structures	Admin. Sci. Q	1969	1,001
17	Performance, Aspirations, and Risky Organizational Change	Admin. Sci. Q	1998	980
18	Managerial Incentives, Monitoring, and Risk Bearing: A Study of Executive Compensation, Ownership, and Board Structure in Initial Public Offerings	Admin. Sci. Q	1994	916
19	From Fiefs to Clans and Network Capitalism: Explaining China's Emerging Economic Order	Admin. Sci. Q	1996	914
20	Board Composition: Balancing Family Influence in S&P 500 Firms	Admin. Sci. Q	2016	906

Note: Articles ordered by scholarly citation.

Table C5: TOP 10 POLICY INSTITUTIONS: GOVERNMENT

	Institution Name	Country	#Docs	%Docs
0	Publications Office of the European Union	EU	2,339	6.15%
1	The UK Government	UK	671	1.76%
2	Government of Canada	Canada	399	1.05%
3	European Parliamentary Research Service	EU	388	1.02%
4	Joint Research Centre	EU	371	0.97%
5	Government Publishing Office	USA	335	0.88%
6	UK Parliament Select Committee Publications	UK	319	0.84%
7	OPRE	USA	305	0.80%
8	Government of Finland	Finland	278	0.73%
9	Eurofound	EU	209	0.55%

Table C6: TOP 10 POLICY INSTITUTIONS: THINK TANK

	Institution Name	Country	#Docs	%Docs
0	Analysis & Policy Observatory	Australia	1,291	3.39%
1	RAND Corporation	USA	909	2.39%
2	Institute of Development Studies	UK	838	2.20%
3	International Development Research Centre	Canada	470	1.23%
4	Brookings Institute	USA	422	1.11%
5	Instituto de Pesquisa Econômica Aplicada	Brazil	364	0.96%
6	Urban Institute	USA	304	0.80%
7	Joseph Rowntree Foundation	UK	268	0.70%
8	Fraser Institute	Canada	267	0.70%
9	German Institute for Economic Research (DIW)	Germany	243	0.64%

Table C7: TOP 10 POLICY INSTITUTIONS: INTERGOVERNMENTAL ORGANIZATION

	Institution Name	Country	#Docs	%Docs
0	OECD	IGO	2,159	5.67%
1	World Bank	IGO	1,778	4.67%
2	World Health Organization	IGO	1,173	3.08%
3	Inter-American Development Bank	IGO	520	1.37%
4	UNESCO	IGO	491	1.29%
5	Asian Development Bank	IGO	426	1.12%
6	United Nations CEPAL	IGO	309	0.81%
7	United Nations Environment Programme	IGO	197	0.52%
8	Food and Agriculture Organization of the United Nations	IGO	180	0.47%
9	International Monetary Fund	IGO	130	0.34%

Table C8: DESCRIPTIVE STATISTICS OF DEPENDENT AND EXPLANATORY VARIABLES

Variable	Obs. (%)	Mean (Std)	Min.	50%	Max.
Policy citation	78,885 (100%)	0.70 (3.5)	0	0	480
D value	78,885 (100%)	0.013 (0.078)	−1.0	0	1.0
Negate	78,885 (100%)	0.0020 (0.0050)	0	0	0.11
%Non-acad	69,930 (88.65%)	0.17 (0.35)	0	0	1.0
#Country	61,852 (78.41%)	1.1 (0.46)	1.0	1.0	24
#WOS category	42,189 (53.48%)	5.6 (4.4)	0	5.0	32
Broker	70,962 (89.96%)	0.000 027 (0.000 35)	0	0	0.037

Note: Showing descriptive statistics of raw values. Control variables are listed in Appendix Table C9.

Table C9: DESCRIPTIVE STATISTICS OF CONTROL VARIABLES

Variable	Obs. (%)	Mean (Std)	Min.	50%	Max.
Scholarly citation	78,885 (100%)	26 (180)	0	2.0	26994
h-index	69,928 (88.65%)	15 (15)	0	11	243
#Authors	70,962 (89.96%)	1.7 (1.4)	1.0	1.0	47
Article age	78,885 (100%)	27 (19)	0	24	100
Article length (#unigram)	62,502 (79.23%)	2727 (1932)	6.0	2623	24188
#Cited references	42,189 (53.48%)	22 (21)	1.0	16	301
Term freq.: "variable"	62,502 (79.23%)	0.00048 (0.0012)	0	0	.0227273
Term freq.: "interview"	62,502 (79.23%)	0.00023 (0.00073)	0	0	.0342255
Term freq.: "survey"	62,502 (79.23%)	0.00033 (0.00090)	0	0	.0268456
Term freq.: "experiment"	62,502 (79.23%)	0.00017 (0.00083)	0	0	.0431937
Empirical					
Yes	21,857 (35.94%)				
No	38,956 (64.06%)				
Open access					
Yes	10,338 (13.11%)				
No	68,547 (86.89%)				

Note: Showing descriptive statistics of raw values. Variables of interest are listed in Table C8.

Table C10: ROBUSTNESS: DATA QUALITY (CONTROL VARIABLES)

	(1) Main	(2) Publication year $\geq$ 2000	(3) $>60\%$ valid per year	(4) Null affiliation as non-acad
Scholarly citation	0.42^{***}	0.62^{***}	0.72^{***}	0.42^{***}
	(19)	(12)	(12)	(19)
Author *h*-index	0.10^{***}	0.065^{***}	0.052^{***}	0.10^{***}
	(8.6)	(4.8)	(3.5)	(8.7)
#Authors	0.062^{***}	0.062^{***}	0.061^{***}	0.062^{***}
	(5.0)	(4.9)	(4.6)	(5.0)
Article age	-0.35^{***}	0.20^{***}	0.27^{***}	-0.36^{***}
	(-13)	(4.0)	(4.7)	(-13)
Article length	0.23^{***}	0.23^{***}	0.23^{***}	0.23^{***}
	(14)	(12)	(11)	(14)
TF: "variable*"	0.020^{*}	0.0086	0.0057	0.020^{*}
	(2.1)	(0.87)	(0.55)	(2.1)
TF: "interview*"	-0.028^{***}	-0.027^{**}	-0.025^{**}	-0.028^{***}
	(-3.7)	(-3.2)	(-2.8)	(-3.7)
TF: "survey*"	0.026^{**}	0.026^{*}	0.022^{*}	0.027^{**}
	(2.8)	(2.5)	(2.0)	(2.9)
TF: "experiment*"	0.0032	0.0069	0.0068	0.0033
	(0.44)	(0.89)	(0.85)	(0.45)
#Reference	-0.11^{***}	-0.12^{***}	-0.12^{***}	-0.11^{***}
	(-7.6)	(-7.2)	(-6.6)	(-7.7)
Open access	0.080^{**}	0.15^{***}	0.17^{***}	0.080^{**}
	(2.8)	(4.8)	(5.3)	(2.8)
Empirical	0.042^{+}	0.028	0.022	0.043^{+}
	(1.8)	(1.1)	(0.84)	(1.9)
Observations	31,079	22,073	19,574	31,079
AIC	76,854.1	61,932.9	54,411.8	76,874.7
BIC	77,338.0	62,397.0	54,869.0	77,358.7

Note: DV = Policy citation. Table B1 shows the results of variables of interest. t statistics in parentheses. $^{+}$ $p<0.10$, * $p<0.05$, ** $p<0.01$, *** $p<.001$

Table C11: ROBUSTNESS: HETEROGENEITY OF TEAM COMPOSITION (CONTROL VARIABLES)

	(1) Main	(2) $1 <$ Team size ≤ 7	(3) Sole-authored
Scholarly citation	0.42^{***}	0.42^{***}	0.30^{***}
	(19)	(16)	(6.8)
Author *h*-index	0.10^{***}	0.071^{***}	0.12^{***}
	(8.6)	(4.1)	(7.8)
#Authors	0.062^{***}	0.045^{*}	0
	(5.0)	(2.2)	(.)
Article age	-0.35^{***}	-0.051	-0.48^{***}
	(-13)	(-1.2)	(-13)
Article length	0.23^{***}	0.20^{***}	0.24^{***}
	(14)	(8.9)	(9.9)
TF: "variable*"	0.020^{*}	0.00044	0.047^{**}
	(2.1)	(0.040)	(2.8)
TF: "interview*"	-0.028^{***}	-0.029^{**}	-0.016
	(-3.7)	(-3.0)	(-1.3)
TF: "survey*"	0.026^{**}	0.016	0.040^{*}
	(2.8)	(1.5)	(2.4)
TF: "experiment*"	0.0032	0.0069	-0.012
	(0.44)	(0.82)	(-0.89)
#Reference	-0.11^{***}	-0.12^{***}	-0.068^{**}
	(-7.6)	(-6.4)	(-3.2)
Open access	0.080^{**}	0.15^{***}	0.014
	(2.8)	(4.3)	(0.28)
Empirical	0.042^{+}	0.053^{+}	-0.020
	(1.8)	(1.8)	(-0.56)
Observations	31,079	13,650	17,239
AIC	76,854.1	41,462.1	34,265.3
BIC	77,338.0	41,898.3	34,699.6

Note: DV = Policy citation. The Main model is the same as aforementioned. Table B2 shows the results of variables of interest. t statistics in parentheses.
$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < .001$

Table C12: ROBUSTNESS: HETEROGENEITY OF POLICY CITATION (CONTROL VARIABLES)

	(1) Main	(2) Govt.	(3) IGO	(4) Think tank
Scholarly citation	0.42^{***}	0.30^{***}	0.36^{***}	0.35^{***}
	(19)	(15)	(14)	(16)
Author *h*-index	0.10^{***}	0.021	0.14^{***}	0.11^{***}
	(8.6)	(1.4)	(6.5)	(8.4)
#Authors	0.062^{***}	0.063^{***}	0.050^{*}	0.074^{***}
	(5.0)	(3.5)	(2.3)	(4.5)
Article age	-0.35^{***}	-0.35^{***}	-0.27^{***}	-0.37^{***}
	(-13)	(-9.3)	(-5.4)	(-11)
Article length	0.23^{***}	0.19^{***}	0.22^{***}	0.23^{***}
	(14)	(8.2)	(7.4)	(11)
TF: "variable*"	0.020^{*}	0.027^{*}	0.042^{*}	0.0037
	(2.1)	(2.2)	(2.5)	(0.29)
TF: "interview*"	-0.028^{***}	-0.019	-0.045^{**}	-0.019^{*}
	(-3.7)	(-1.6)	(-2.7)	(-2.0)
TF: "survey*"	0.026^{**}	0.021^{+}	0.041^{**}	0.019^{+}
	(2.8)	(1.7)	(2.8)	(1.7)
TF: "experiment*"	0.0032	0.013	0.0012	-0.0058
	(0.44)	(1.3)	(0.090)	(-0.70)
#Reference	-0.11^{***}	-0.11^{***}	-0.10^{***}	-0.12^{***}
	(-7.6)	(-5.1)	(-3.8)	(-6.6)
Open access	0.080^{**}	0.14^{***}	-0.064	0.042
	(2.8)	(3.6)	(-1.1)	(1.1)
Empirical	0.042^{+}	0.11^{**}	-0.032	0.031
	(1.8)	(3.0)	(-0.72)	(1.0)
Observations	31,079	31,079	31,079	31,079
AIC	76,854.1	41,915.8	33,710.9	48,948.8
BIC	77,338.0	42,399.8	34,194.8	49,432.8

Note: DV = Policy citation. The Main model is the same as aforementioned. Table B3 lists the variables of interest. *t* statistics in parentheses. $^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < .001$

References

Anastasopoulos, L. J., & Whitford, A. B. (2019). Machine Learning for Public Administration Research, With Application to Organizational Reputation. *Journal of Public Administration Research and Theory*, *29*(3), 491–510. https://doi.org/10.1093/jopart/muy060

Bai, J., Bai, S., Chu, Y., Cui, Z., Dang, K., Deng, X., Fan, Y., Ge, W., Han, Y., Huang, F., Hui, B., Ji, L., Li, M., Lin, J., Lin, R., Liu, D., Liu, G., Lu, C., Lu, K., … Zhu, T. (2023). Qwen Technical Report. https://doi.org/10.48550/arXiv.2309.16609

Bosley, M., Jacobs-Harukawa, M., Licht, H., & Hoyle, A. (2023). Do we still need BERT in the age of GPT? Comparing the benefits of domain-adaptation and in-context-learning approaches to using LLMs for Political Science Research.

Burt, R. S. (1992). *Structural holes: The social structure of competition*. Harvard University Press.

Devlin, J., Chang, M.-W., Lee, K., & Toutanova, K. (2019). BERT: Pre-training of Deep Bidirectional Transformers for Language Understanding. *arXiv:1810.04805 [cs]*.

Freeman, L. C. (1977). A Set of Measures of Centrality Based on Betweenness. *Sociometry*, *40*(1), 35–41. https://doi.org/10.2307/3033543

Laurer, M., Atteveldt, W. v., Casas, A., & Welbers, K. (2023). Less Annotating, More Classifying: Addressing the Data Scarcity Issue of Supervised Machine Learning with Deep Transfer Learning and BERT-NLI. *Political Analysis*, 1–17. https://doi.org/10.1017/pan.2023.20

Leydesdorff, L., Wagner, C. S., & Bornmann, L. (2017). Betweenness and diversity in journal citation networks as measures of interdisciplinarity—A tribute to Eugene Garfield. *Scientometrics*, 1–26. https://doi.org/10.1007/s11192-017-2528-2

Long, J. S., & Freese, J. (2001). Predicted Probabilities for Count Models. *The Stata Journal*, *1*(1), 51–57. https://doi.org/10.1177/1536867X0100100103

Ma, J. (2021). Automated Coding Using Machine Learning and Remapping the U.S. Nonprofit Sector: A Guide and Benchmark. *Nonprofit and Voluntary Sector Quarterly*, *50*(3), 662–687. https://doi.org/10.1177/0899764020968153

Ma, J. (2023). Bridging State and Nonprofit: Differentiated Embeddedness of Chinese Political Elites in Charitable Foundations. *Journal of Chinese Political Science*, *28*(3), 483–510. https://doi.org/10.1007/s11366-022-09796-1

Ma, J., & Bekkers, R. (2024). Consensus Formation in Nonprofit and Philanthropic Studies: Networks, Reputation, and Gender. *Nonprofit and Voluntary Sector Quarterly*, *53*(1), 127–158. https://doi.org/10.1177/08997640221146948

OpenAI, Achiam, J., Adler, S., Agarwal, S., Ahmad, L., Akkaya, I., Aleman, F. L., Almeida, D., Altenschmidt, J., Altman, S., Anadkat, S., Avila, R., Babuschkin, I., Balaji, S.,

Balcom, V., Baltescu, P., Bao, H., Bavarian, M., Belgum, J., … Zoph, B. (2024). GPT-4 Technical Report. https://doi.org/10.48550/arXiv.2303.08774

Rodriguez, P. L., & Spirling, A. (2022). Word Embeddings: What Works, What Doesn't, and How to Tell the Difference for Applied Research. *The Journal of Politics*, *84*(1), 101–115. https://doi.org/10.1086/715162

Small, H. (1973). Co-citation in the Scientific Literature: A New Measure of the Relationship Between Two Documents. *Journal of the American Society for Information Science (pre-1986)*, *24*(4).

Touvron, H., Martin, L., Stone, K., Albert, P., Almahairi, A., Babaei, Y., Bashlykov, N., Batra, S., Bhargava, P., Bhosale, S., Bikel, D., Blecher, L., Ferrer, C. C., Chen, M., Cucurull, G., Esiobu, D., Fernandes, J., Fu, J., Fu, W., … Scialom, T. (2023). Llama 2: Open Foundation and Fine-Tuned Chat Models. https://doi.org/10.48550/arXiv.2307.09288

Vaswani, A., Shazeer, N., Parmar, N., Uszkoreit, J., Jones, L., Gomez, A. N., Kaiser, Ł., & Polosukhin, I. (2017). Attention is All you Need. *Advances in Neural Information Processing Systems*, *30*.

Wagner, C. S., Roessner, J. D., Bobb, K., Klein, J. T., Boyack, K. W., Keyton, J., Rafols, I., & Börner, K. (2011). Approaches to understanding and measuring interdisciplinary scientific research (IDR): A review of the literature. *Journal of Informetrics*, *5*(1), 14–26. https://doi.org/10.1016/j.joi.2010.06.004

Wei, J., Wang, X., Schuurmans, D., Bosma, M., Ichter, B., Xia, F., Chi, E., Le, Q. V., & Zhou, D. (2022). Chain-of-Thought Prompting Elicits Reasoning in Large Language Models. *Advances in Neural Information Processing Systems*, *35*, 24824–24837.

Ziems, C., Held, W., Shaikh, O., Chen, J., Zhang, Z., & Yang, D. (2024). Can Large Language Models Transform Computational Social Science? *Computational Linguistics*, *50*(1), 237–291. https://doi.org/10.1162/coli_a_00502