

Writing to Bridge the Divide: Investigating the Influences of Readability on Citations across Research Camps

Seongkyoon Jeong, Seth Washispack, Zac Rogers (W.P. Carey School of Business, Arizona State University)

Motivation

Problem

As science advances, an extant domain evolves to become distinct subdomains

- Seen by multiple research camps varying by methodologies and topics within a discipline (e.g. qualitative vs. quantitative)¹
- Methodological divide widely recognized in natural and social sciences^{2,3}

Divide limits communication across subdomains¹

- Constrains learning by researchers from different subdomains⁴
- Hampers potential scientific advances⁴

Science leaders have called for a solution to this problem⁴

Solution

Simple solution to this problem suggested: improved communication⁵

Clear writing is important for knowledge dissemination and creation in science⁶

Yet, insufficient evidence, especially for the divide problem, has been provided



Research Objectives

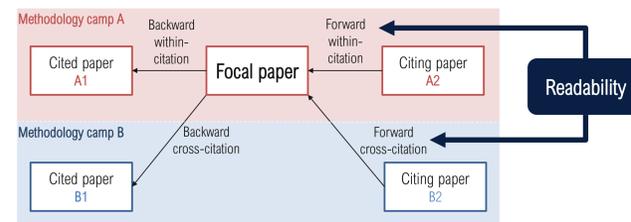
To investigate the impact of readability on scientific knowledge dissemination between different research methodology camps

Questions

1. Does the readability of scientific articles improve the dissemination and further development of scientific knowledge?
2. Does readability facilitate cross-fertilization between methodology camps?
3. How does the idiosyncratic nature of methodology camps affect the role of readability in said cross-fertilization?

Framework

We identify types of methodology used in scientific articles and estimate the impact of readability on received citation (forward citation) within- and across camps



Data & Method

Data

- Articles published in 8 leading journals in Operations and Supply Chain Management
- 13,661 articles published from 1969 to 2018
- Either analytical models or empirical methods are used in the articles

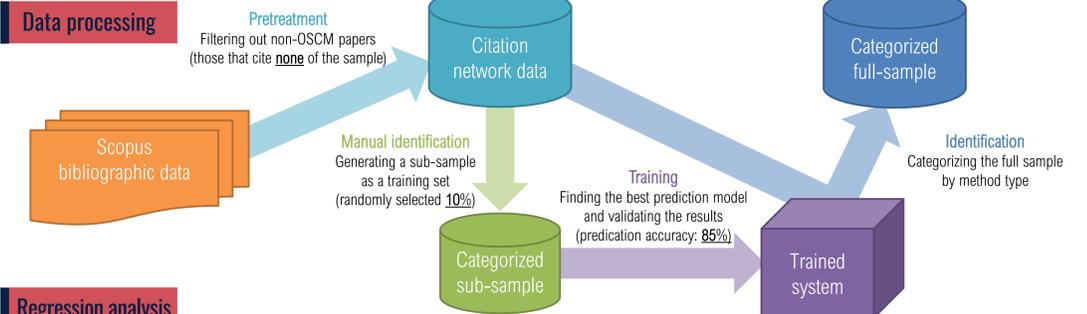
Challenges

- Noise from multidisciplinary journals
- High volume of articles to identify research method types
- Ambiguous readability measurement

Solutions

- Article filtering based on citation network
- Supervised machine learning for type identification based on abstract text
- Using readability consensus score (available at <https://pypi.org/project/textstat/>)

Data processing



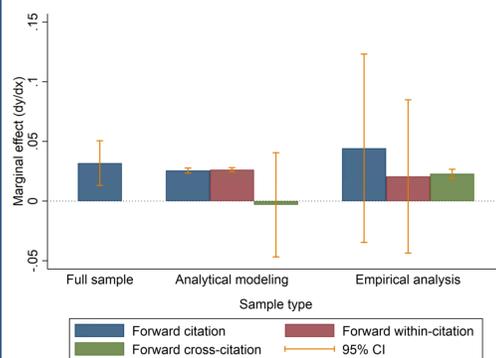
Regression analysis

- Level of analysis: journal article; Sample count: 8,980 (6,880 analytical method articles + 2,100 empirical method articles)
- Estimation: Negative binomial model with publication year and journal title fixed effects
- Independent and control variables: readability, count of previous publication in each method, backward within-citation, backward cross-citation, paper length, paper order, award winner (dummy), school rank, US institution (dummy), and team size

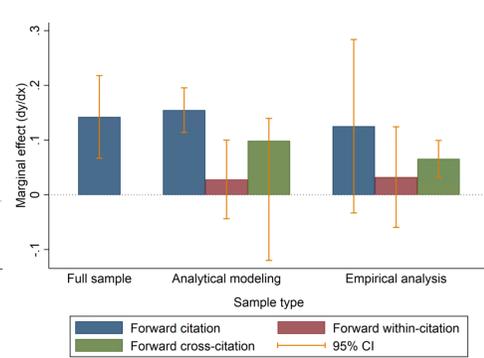
Results

We estimated the impacts of readability and other variables on dependent variables (i.e., total citation, forward within-citation, and forward cross-citations), using full, analytical modeling, and empirical analysis samples, separately to address the different nature of each method camp. We compared the key coefficients between models as shown in following figures.

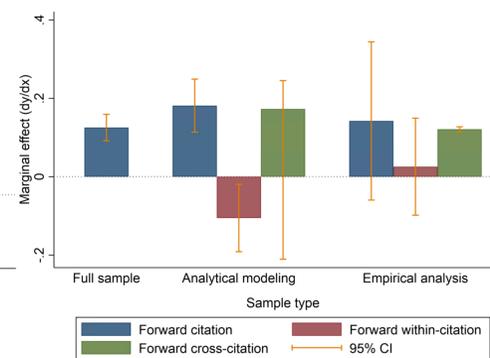
Readability



Previous cross-publication



Backward cross-citation



Readability impact (partial support)

Readability increases count of total citation, forward within-citation, and forward cross-citation (partial support); readability matters

Network impact (partial support)

Previous cross-publication count increases forward cross-citation; that is, scientific audience cites through in a network channel formed within the research camp

Trade-offs in knowledge exploration (partial support)

Exploring a different methodological domain increases total citation, yet it decreases forward within-citation. There are trade-offs in selecting knowledge domains

Post-hoc analysis

Experience impact As a post-hoc analysis, we investigated the source of asymmetric results between analytical and empirical camps. T-test results for backward cross-citation gap between both camps suggest that empirical researchers cite analytical articles much frequently than analytical researchers cite empirical articles ($p < 0.01$, mean difference = 2.54). In particular, the backward cross-citation count of analytical articles is fewer than 1, on average. These results show experience in scientific knowledge exploration reduces the burden from reading difficulty, especially when researchers access different knowledge domains.

Conclusions

Readability impact: Readability increases scientific knowledge dissemination within and across methodological camps, cross-fertilizing scientific domains.

Network impact: Scientific network is formed not only through scientific interests but also through methodological orientation; a cross-camp team helps cross-fertilization.

Trade-offs: Specialization in scientific methodology generates trade-offs in scientific knowledge exploration. Addressing another scientific domain may yield positive outcome but reduce attention from "home-ground"

Experience: Familiarity with research in the other field could contribute to the asymmetric findings. In other words, cognitive distance between domains can be reduced by accumulating experience.

Implications

1 Education policy

Stress exposure to various methods camps and importance of writing training in formal education (e.g., PhD program)

2 Journal management policy

Include readability as a criterion in structured review forms so as to achieve wider scientific audience and increase scientific impact

3 Research policy

Encourage working in teams composed of researchers from diverse research methodologies camps. Incentivize researchers to voluntarily organize such a team

Acknowledgment

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