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Citation Success Over Time: Theory or Empirics?

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Citation Success Over Time: Theory or Empirics?

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Abstract: This study investigates the citation patterns of theoretical and empirical papers over a period of almost 30 years, while also exploring the determinants of citation success. The results indicate that empirical papers attract more citation success than theoretical studies. However, the pattern over time is very similar with yearly mean citations peaking after around 4 years. Moreover, among empirical papers it appears that the cross-country studies are more successful than single country studies focusing on North America data or other regions.

JEL Classification: A11, B40, C0, N01, Z0

Keywords: Citations, Theory, Empirics, Cross-Country, North America

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1. Introduction

Citations analysis is gaining popularity in academia as a bibliometric tool to assess researchers' performance (Radicchi et al. 2008). Citations measure the foci of fellow academics' attention and have been used, rightly or wrongly, to aid decisions about the quality of researchers, the appointment and promotion of people, and the generation of grants (Radicchi et al. 2008, Merton 1973). However, despite the increasing use of citation data there is a lack of knowledge in economics with respect to the patterns of citations over time. In this paper, we aim to further this knowledge base by presenting the citation pattern for a sample of 1,072 papers published in the *American Economic Review*.

A particular focus of the paper is on the comparative citation performance of theoretical and empirical papers. The proportion of economics papers with empirical analyses has grown rapidly in the past few decades, due partly to advances in computing technology. Figlio (1994), for example, demonstrated that the proportion of empirical papers in three top economics journals (*AER*, *Quarterly Journal of Economics and Journal of Political Economy*) rose from 27% in 1960 to more than 55% in 1992. Empirical papers may also have grown in popularity because they generate higher citation counts relative to theoretical papers, perhaps as they are more easily accessible, thereby incurring lower opportunity costs of time (key results are easier and faster to check and understand). In this paper we also explore the difference between single country studies and studies that use several countries as their sample, and whether there are relative advantages to using North American data; a pertinent consideration as we are only comparing papers from the *AER*.

Our empirical analyses demonstrate that empirical papers accumulate significantly more citations than theoretical papers, and that the citation time series are very similar for both categories of papers. Additionally, we find that using North American data does not provide any significant advantage in the accumulation of citations compared to datasets from countries in other regions. However, conducting a cross-country analysis compared to a single country study has a statistically significant impact in the accumulation of citations.

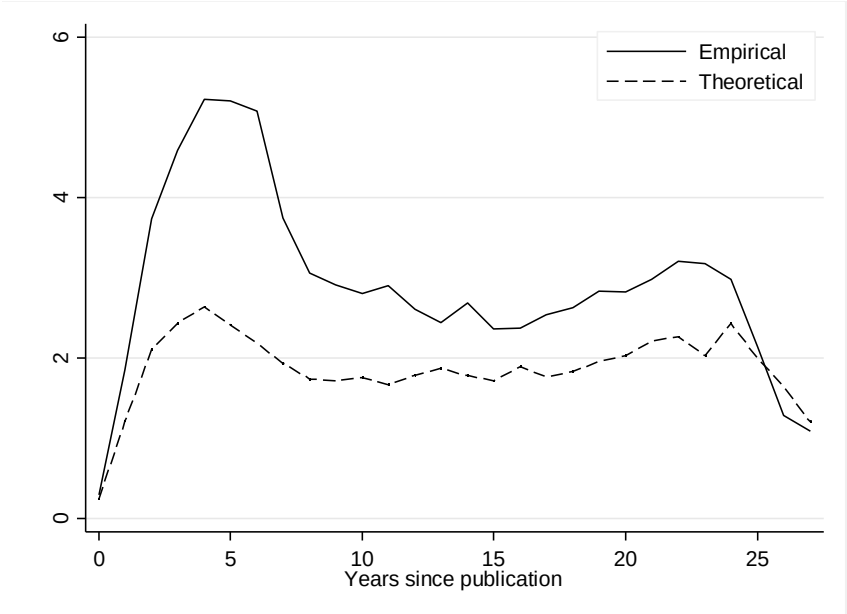
It is important to recognise that citation counts are an imperfect measure of quality and impact, despite their widespread use. Citations can be biased in favor of subfields with the largest populations (Arrow 2011). They can also be driven by fashion and therefore may not reflect the most promising avenues for scientific progress (van Dalen and Klamer 2005). Merton (1973) is critical of the uncritical use of citations, as frequent use leads to a change in citation practices and to a contamination of the measurement through manipulation. For example, there is the problem of

self-citations: numerous studies (e.g., Blair et al., 1986; Davis and Papanek, 1984) argue that self-citations are solely self-serving. Yet the evidence is mixed, as an analysis by Medoff (2006) does not find that self-citations have a significant quantitative effect on the total number of citations an article receives.

2. Descriptive analysis

The data are all papers published in issues 1, 3, 4 and 5 of the *AER* between 1984–1988 and 2004–2008, excluding therefore *Papers and Proceedings* articles. Citations of these papers are generated through the *ISI Web of Knowledge* as provided by Thomson Reuters.[1] *Figure 1* presents mean citations on a yearly basis, and differentiates between empirical and theoretical papers. A paper was categorised as theoretical if it didn't contain any empirical analysis. Papers that used simulations were also categorised as theoretical. Interestingly, both paper types have similar citation patterns: citations peak for both types at around four years after publication, and display similar trends thereafter. Overall, for this time period empirical papers generated many more citations (twice as many at the peak and around 50% more citations for many years). When performing a t-test on the equality of the means we find that the difference is statistically significant at the 1% level.

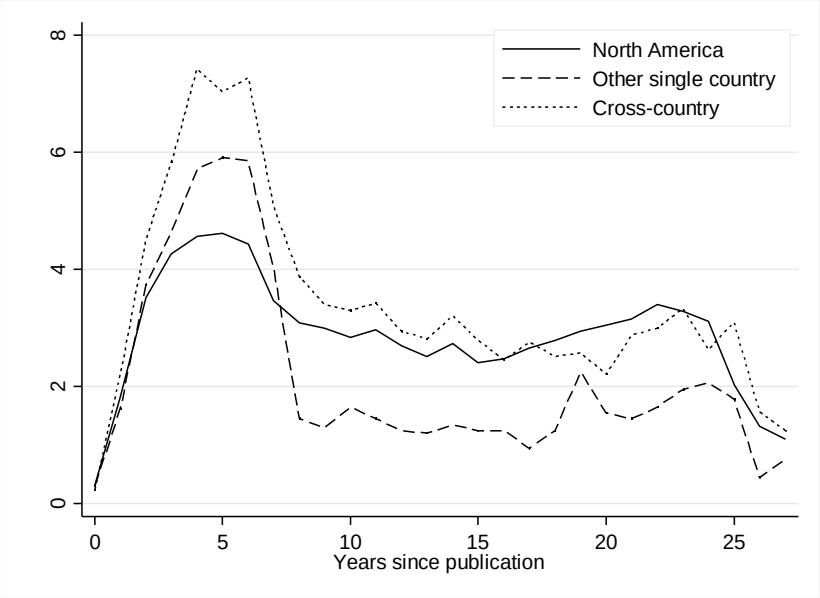
Figure 1: Mean Citations over time for Empirical and Theoretical Papers Published in the AER



[1] All citations an article accumulated over its lifetime until 6 July 2011. We have not excluded self-citations.

In Figure 2 we present the time series of citations for empirical papers using data on single countries (North America, other) and multiple countries. In the figure, *North America* are papers that used data from either the US or Canada, *Other single country* are papers that used data from other regions such as Europe, Latin America, Asia, Oceania or Africa, and *Cross-country* are papers that used data from at least two different countries. The citation patterns are again quite similar with a peak for all three cases around 4 years. Cross-country studies generate more citations than single country studies within the first 15 years. In general, it seems there is no comparative advantage in working with North American data.

Figure 2: Mean Citations over time for Types of Empirical Papers Published in the AER



3. Multivariate analysis

We estimate the effect of paper type (theoretical versus empirical, North America versus other-single versus cross-country) on citations by modelling the citation count of paper *i* in year *t* (C_{it}) using a random-effects negative binomial regression model:

$$Pr(C_{it} = c_{it}|X_{it}, \delta_i) = \frac{\Gamma(\lambda_{it} + c_{it})}{\Gamma(\lambda_{it})\Gamma(c_{it} + 1)}\left(\frac{1}{1+\delta_i}\right)^{\lambda_{it}}\left(\frac{\delta_i}{1+\delta_i}\right)^{c_{it}}$$

where $\Gamma(\cdot)$ denotes the gamma integral, $\lambda_{it} = exp(X_{it}\beta)$, X_{it} is a vector of paper-specific characteristics, and δ_i is the dispersion parameter that varies randomly across papers with $1/(1+$

$\delta_i) \sim Beta(r, s)$. Unlike the Poisson regression model, this model is designed to explicitly handle over-dispersion, which is a common feature of count data. As control variables we include: an indicator that the article is not a note, reply, comment or errata (*Main article*); proportion of authors whose affiliation at time of publication was in a top 10 university (*Top10 university*); proportion of authors whose place of PhD was in a top 10 university (*Top10 PhD*)[2]; proportion of male authors (*Share of Males*); mean academic age of the authors, defined as the year of publication minus the year of PhD obtained (*Academic Age*); number of authors (*One Co-Author* etc.); an indicator for more recent contributions (*Year 2004-2008 Articles*); a quadratic time trend (*Years since Publication*); and paper page length (*Length*).

For robustness we also model 'Citations per published page' as an alternative to citations. This common metric provides an alternative approach for controlling differences in paper page length between paper types (e.g. empirical papers are longer on average than theoretical papers). Citations per page are modelled using a left censored random-effects Tobit regression due to the large proportion of papers without yearly citations.

In Table 1, coefficient estimates from the negative binomial and Tobit models are presented in columns (1) and (2) for the full sample of papers, and in columns (3) and (4) for the sample of empirical papers. In line with results from the descriptive section, the regression results strongly suggest that empirical papers (reference group) are cited more often than theoretical papers: the coefficient on *Theoretical* is statistically significant at the 1% level in columns (1) and (2). The estimated marginal effect of *Theoretical* on number of citations (assuming a zero random effect in the negative binomial model) equals -0.40 (*p*-value = 0.002), indicating that empirical papers receive on average 0.4 more citations per year than theoretical papers.

Among the empirical papers, we observe that cross-country studies are significantly more likely to be cited than single-country empirical papers. The estimated marginal effect of *Cross Country* on number of citations equals 0.92 (*p*-value = 0.042), indicating that empirical papers using cross-country data receive on average 0.92 more citations per year than single-country empirical papers using non-North American data.

[2] The variables *top10 university* and *top10 PhD* were constructed using the institutional ranking developed by Amir and Knauff (2008).

Table 1: Results of Random Effects Negative Binomial (1,3) and Tobit (2,4) Regression Models

	All Papers		Empirical Papers	
	Citations	Citations/Page	Citations	Citations/Page
	(1)	(2)	(3)	(4)
Theoretical	**-0.154*****	**-0.071*****		
	(0.049)	(0.024)		
North America			**0.146**	**0.015**
			(0.101)	(0.042)
Cross Country			**0.244****	**0.096***
			(0.117)	(0.050)
Main Article	**1.118*****	**0.364*****	**1.036*****	**0.251*****
	(0.079)	(0.031)	(0.122)	(0.044)
Top10 University	**0.143****	**0.156*****	**0.163****	**0.167*****
	(0.060)	(0.032)	(0.079)	(0.038)
Top10 PhD	**0.051**	**0.010**	**0.071**	**-0.021**
	(0.058)	(0.029)	(0.080)	(0.035)
Share of Males	**-0.152**	**0.008**	**-0.013**	**0.000**
	(0.116)	(0.055)	(0.138)	(0.058)
Academic Age	**0.061****	**0.004**	**0.038**	**0.014**
	(0.029)	(0.014)	(0.041)	(0.018)
One Co-Author	**0.191*****	**0.063****	**0.192*****	**0.035**
	(0.050)	(0.026)	(0.069)	(0.031)
Two Co-Author	**0.280*****	**0.093****	**0.288*****	**0.093****
	(0.080)	(0.039)	(0.095)	(0.042)
Three or more Co-Authors	**0.641*****	**0.192****	**0.690*****	**0.168****
	(0.189)	(0.088)	(0.195)	(0.082)
Year 2004-2008 Articles	**0.038**	**0.081*****	**0.089**	**0.126*****
	(0.067)	(0.027)	(0.088)	(0.031)
Years since Publication	**0.113*****	**0.026*****	**0.125*****	**0.032*****
	(0.004)	(0.002)	(0.006)	(0.002)
Years since Publication^2	**-0.429*****	**-0.099*****	**-0.482*****	**-0.121*****
	(0.017)	(0.007)	(0.023)	(0.008)
Length	**0.022*****		**0.012****	
	(0.004)		(0.005)	
N	18036	18036	8401	8401
Prob.>chi^2	0.000	0.000	0.000	0.000

Notes: Coefficients in bold , Standard errors in parentheses. The symbols *, **, *** represent statistical significance at the 10%, 5%, and 1% levels, respectively. The paper type reference group is: empirical papers in models (1) and (2), and all single-country articles that have used data from other regions than North America in models (3) and (4).

We also find interesting coefficient estimates on a number of control variables. Looking at the year of publication we see a non-linear relation (increasing at a decreasing rate) as shown in the previous figures. We find that researchers from top universities attract a greater number of citations which may indicate that quality matters; however, Stigler, Stigler, and Friedland (1995) point out that the network of citations is the "product of a complex combination of factors, ranking from scientific influence and social contact to an element of pure chance in the timing of publication of accepted papers" (p. 344). The results indicate that the gender ratio (share of males) does not matter. On the other hand, the length of a paper has a strong impact on citation success (see columns (1) and (3)).

Given that we are focusing on one specific top journal, the published length may indeed be an indicator of the quality of the paper (competition among scarce publishing space). We also observe that cooperation (more authors within a paper) is positively correlated with citation success. As Frey (2010) points out, "modern scientific activity is based on a marked division of labor" (p. 3).

4. Conclusion

This study compares the citation success of theoretical and empirical papers and discovers very similar patterns over time. Both graphical representations and regression results indicate that empirical papers attract a significantly higher number of citations than theoretical papers. Moreover, the results indicate that amongst empirical papers, cross-country studies are most successful. Importantly though, as we are only investigating one particular (top) journal the results are not necessarily representative of the entire economics discipline.

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