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Negatively correlated author seniority and the number of acknowledged people: Name-recognition as a signal of scientific merit?

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Abstract

Evidence from five general-interest journals in economics reveals an inverse relationship between author seniority and the number of colleagues whom authors choose to thank and acknowledge. The large seniority effect is insensitive to the inclusion of controls for the number of co-authors, number of pages, number of words in the title, and journal fixed effects. The data are consistent with the hypothesis that name-recognition is an important signal used by economists in evaluating scientific merit.

JEL Classification: Z13; A11; D85

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1. Introduction

In some respects, it is puzzling that economists routinely include acknowledgments sections in their scientific writing. The marginal contribution of acknowledgments to the value of scientific output does not, for example, obviously exceed marginal cost in terms of scarce journal pages

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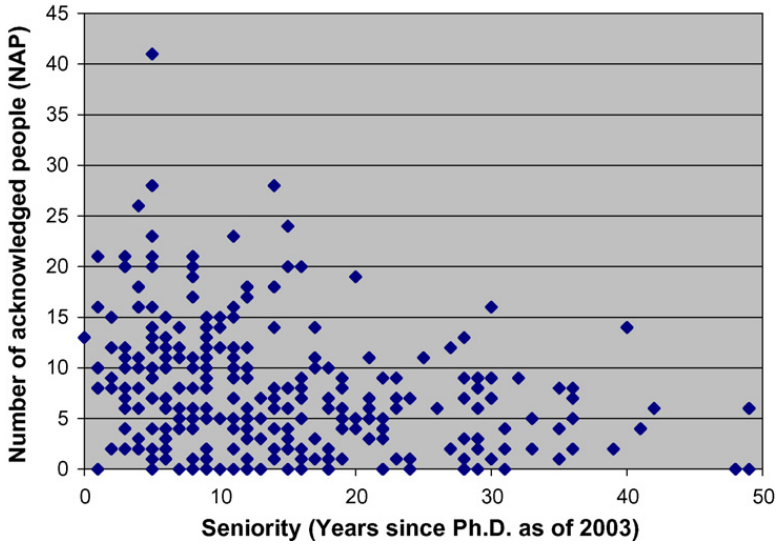

Fig. 1. Seniority and the number of acknowledged people. Number of acknowledged people plotted against years since the Ph.D. was earned among lead authors of the 276 articles published in *AER* (excluding *AER Papers and Proceedings*), *Econometrica*, *QJE*, *JPE* and *RES* in 2003. The simple correlation between seniority and NAP is −0.27.

and readers' attention.[2] Insofar as consumers of academic writing are interested enough to read acknowledgments – and many of us are – a number of non-trivial questions arise regarding the manner in which readers make use of the information conveyed in lists of acknowledged people.

To investigate the possibility that acknowledgments influence the interpretation of scientific writing and, consequently, affect authors' expected payoffs, it is useful to consider implications of the null hypothesis that acknowledgment sections simply reflect a long-established, exogenously given social norm in the academic profession. Under that hypothesis, one would expect zero correlation between the intensity with which authors thank colleagues and productivity-relevant characteristics of authors. There is a surprising pattern, however, concerning author seniority and the *number of acknowledged people* (NAP) in top-ranked journals. Authors in early phases of their careers say "thank you" noticeably more often than those with more experience in the profession do.

Fig. 1 shows the negative unconditional correlation between NAP and lead-author seniority among the 276 articles published in five general-interest economics journals during 2003. For each article, the figure plots the lead author's seniority, defined as the number of years (as of 2003) since earning the Ph.D., and its NAP. Although the fit is not especially tight, there is an unmistakable downward-sloping relationship. Corresponding plots for individual journals (not shown here) reveal different degrees of negative correlation between author seniority and NAP among articles appearing in *American Economic Review (AER)*, *Econometrica*, *Quarterly Journal*

[2] Day (1998) suggests that acknowledgments convey little, if any, scientifically relevant information. Laband and Tollison (2000a, 2003) report that collaboration among economists is common and seems to correlate positively with authors' productivity, which suggests the possibility of positive social returns from acknowledgments. However, as long as an acknowledged person's decision to contribute to another author's work does not depend on expectations of explicit acknowledgment, then the hypothesis that published acknowledgments provide little scientific value remains consistent with Laband and Tollison's findings.

of Economics (QJE), *Journal of Political Economy (JPE)*, and *Review of Economic Studies (RES)* (−0.33, −0.12, −0.25, −0.27 and −0.20, respectively).

Negative correlations between thanking behavior as measured by NAP and seniority suggest the possibility that acknowledgments function as a signaling device, used by relatively unknown authors to increase the perceived quality of their papers through name-recognition. If successful, such strategic signaling would increase chances that the paper is accepted for publication and received well by readers outside the review process, generating frequent citations after publication. Gigerenzer et al. (1999), for example, show that reliance upon recognition-based heuristics leads to ecologically valid inferences in a number of real-world environments. We therefore focus on the question of whether the data are consistent with the hypothesis that authors use name-recognition in an attempt to provide readers with an additional cue for evaluating their work's scientific merit.

There are, of course, non-instrumental reasons why younger authors might thank more colleagues, which have nothing to do with professional advancement, perhaps arising unintentionally as the result of natural skill accumulation along the academic career path. For example, younger authors may have lower skill and consequently higher demand for assistance, leading to more acknowledged people in their articles. Noting that the unconditional correlation in Fig. 1 alone does not prove the name-recognition hypothesis, this paper considers alternative theories that make distinct predictions about the effects of adding controls for article-, author- and journal-specific characteristics in regressions of NAP on seniority.

The possibility that thanking and referencing are used instrumentally as signaling devices is worth considering because of the potentially large social costs associated with inefficient scientific review.[3,4] Inefficiency in scientific review is not strictly limited to the formal review process and editorial decisions of academic journals. Even if reviewers chosen by journal editors never see the acknowledgments sections of submitted articles, as is standard protocol in double-blind review, there remains scope for acknowledgments to influence the managing editor and subsequent citation outcomes, which are determined largely by other scholars. Moreover, double-blind review is not the norm within economics. Even where it is adopted, reviewers in many cases will have already encountered the submitted manuscripts as working papers. Thus, we hypothesize that associating oneself with other scientists through acknowledgments serves to increase an article's perceived merit because of the recognition cue, defined as the binary outcome indicating whether the reader recognizes the author or anyone linked to the author's work as an acknowledged person.

Scientific networks may naturally organize themselves around a particular empirical or theoretical consensus and evolve by strengthening that consensus further. Folster (1995) stresses the relevance of this mechanism in interpreting his finding that, as theorized by Kuhn (1962), referees tend to select papers that make incremental steps within established paradigms. It is difficult to assess whether social networks in which recognition plays a role would be inefficient or rather efficiency-enhancing, especially when recognition is positively correlated with productivity. According to Laband and Piette (1994a), editors should be disinterested gatekeepers rather

[3] Azar (2004), for example, argues that the review process is important because it affects the productivity of all academics, and Van Dalen and Klamer (2005) link efficiency in the production of scientific knowledge to economic growth and broader measures of social well-being.

[4] Most of the qualitative results reported in this paper are reproducible using a different dependent variable, the number of references per article, instead of NAP. The number of references is more difficult to interpret, however, because of possible merit-based confounds. As pointed out by McCloskey (1985), scientists who work longer, or take up more challenging problems with larger accumulations of related literature, are likely to cite more papers and therefore produce articles with longer reference sections.

than self-interested deal cutters. Laband and Piette also point out that editorial favoritism generates sizable wealth redistributions among members of the scientific community, providing strong incentives for authors to attempt to influence the chances of publication and citation.[5] Among the simplest motives for signaling is to communicate one's active membership in, or willingness to enter, a particular scientific network. Insofar as editors, reviewers and readers rely on network affiliations in interpreting and evaluating scientific speech, and make inferences about uncertain aspects of an article's quality based on name-recognition, network affiliations may substantively condition aspiring academics' chances of success.

The suggestion that the number of acknowledged people may yield information about the efficiency of scientific production is important because, as stressed by Laband and Tollison (2000b), economists vigorously disagree over how to appraise scientific merit. Laband and Tollison (2003) report increasing thank-you (same as NAP) frequencies in three leading journals over four decades and estimate economically significant value attributable to the feedback and comments that colleagues provide. Laband et al. (2002) also find that citations per article have increased dramatically in recent years, which they attribute to higher levels of investment per article by authors rather than signaling motives. There are divergent perspectives about the efficiency of the review process and the role of network- and gatekeeper-effects in facilitating or hindering scientific progress. One group of observers interprets existing evidence as supportive of the proposition that markets for scientific ideas are competitive and efficient. Others express concern that production of scientific knowledge is hampered by non-competitive and inefficient processes that generate significant social costs (Azar, 2006).

Anecdotal evidence of editorial favoritism continues to follow the reputations of well known journal editors who exercised a high degree of discretion, such as Keynes at *Economic Journal* (Moogridge, 1992), Clower at *AER*, and Houthakker at *Review of Economics and Statistics* (Shepherd, 1995). There is statistical evidence suggesting that journals affiliated with specific departments are biased toward authors with links to those same departments. Yotopoulos (1961) reports that, in the period from 1950 to 1959, Chicago authors contributed 15.6% of the pages in the *JPE*, and Harvard authors published 14.5% of pages in the *QJE*. Graves et al. (1982) show that more than 50% of University of Chicago economics faculty output appeared in only three journals, all with affiliations to that university, during the period from 1974 to 1978. In contrast, Harvard economists accounted for less than 15% of pages in those journals during the same period. However, this statistical and anecdotal evidence has brought about little consensus in the literature on the economics of economics regarding the efficiency of editorial review.

Many aspects of the issue have been examined, among them different types of referee processes, the quality of published articles, and the characteristics of referees and editors. Blank (1991) analyzed the effects of single-blind versus double-blind refereeing on papers submitted to *AER* between 1987 and 1989 and found that authors at top-five ranked universities were not affected by the type of review process used. In contrast, Laband and Piette (1994b) analyzed citations of 1051 articles published in 28 economics journals. They found that papers published in journals employing double-blind review receive a greater number of subsequent citations than papers published in journals with single-blind review.

Medoff (2004) examined articles published in the *QJE* and *JPE* in 1990 and found no selection bias toward papers written by authors with Harvard and Chicago connections, respectively. He

[5] Publications in peer-reviewed journals are essential for professional advancement in many parts of the academic profession (Hamermesh et al., 1982; Diamond, 1986; Zivney and Bertin, 1992; Formby et al., 1993).

showed that articles by Harvard and Chicago faculty published in the *JPE* are more numerous and of higher quality (according to citation statistics) than articles written by authors with other affiliations.

Hamermesh (1994) studied the characteristics of referees at four general-interest and three field journals in economics, finding that the average referee has higher quality than the average paper being reviewed. Mackie (1998), on the other hand, surveyed referees at seven economics journals and found that referees do not use objective criteria in evaluating research papers.

Faria's (2005) theoretical model of strategic interaction between journal editors and authors predicted that editors of leading journals will choose to enforce strict norms of methodological orthodoxy, resulting in conformity among authors. Laband and Piette (1994a) found that, although journal editors sometimes practice editorial favoritism, on balance they use professional connections in an efficiency-enhancing pursuit of high-impact papers. Similarly, Medoff (2003) examined six core economics journals in 1990 and found that papers published by authors with editorial connections have higher quality than articles by those without such connections.

The main contributions of this paper are to demonstrate the negative correlation between seniority and NAP, and to propose NAP as a proxy for assessing the efficiency of scientific review. As Medoff (2004) argues, previous measures used to investigate the possibility of editorial bias are only rough proxies for the determinants of editorial outcomes because the fundamentals are difficult to observe directly. Rejected articles are typically not available for public observation, preventing easy comparison of published and unpublished authors. Also, the process by which editors choose referees is rarely observable or easy to quantify. Finally, the supply side of the submission process based on authors' preferences over journals leads to a confounding selection problem that is difficult to control for in empirical studies. Thus, caution must be applied in developing arguments that attempt to establish suspicious correlations as causal relationships.

The paper is organized as follows. Section 2 introduces competing theories with testable predictions and distinct efficiency implications. Section 3 describes the data and reports estimated regression models of NAP. Section 4 focuses on interpretations of the results and prospects for future investigations to make use of NAP.

2. Theories and hypotheses

When choices regarding whom to thank and acknowledge are decided in a strategic manner, with intent to send outcome-altering information to editors, reviewers, and other readers who may eventually decide to cite the paper, the author's signaling behavior is classified as *instrumental*. We do not assume that all acknowledgements are instrumental. Economists may use acknowledgments to articulate respect for academic tradition, or in pursuit of other social and psychological goals quite removed from any anticipated effects on professional advancement. When motivated as good-faith person-to-person gestures, without strategic consideration – emanating from introspective feelings of respect for academic tradition, acknowledgments are classified as *non-instrumental*. Hypotheses concerning the number of names that the authors of article i choose to thank or acknowledge, NAP_i, are enumerated below. These hypotheses make distinct predictions about conditional correlations between NAP_i and seniority, S_i, although potential confounds must be considered in each case.

2.1. Recognition-seeking

Consider an author (or group of authors) completing an article for which there is a well-defined discrete-valued goal, for example, having the article accepted for publication at a particular

journal.[6] Suppose the chance of success in achieving the goal associated with article i is given by probability $p_i \in [0, 1]$, which depends positively on the rate $r_i \in [0, 1]$ at which readers recognize the names of authors or scholars associated with them:

$$p_i = F(r_i), \quad F'(r_i) > 0, \tag{1}$$

where $F(\cdot)$ is a strictly increasing cdf assumed to be differentiable on the open unit interval.

Recognition can occur in one of two ways. Either the names of the authors already belong to the reader's knowledge set, or the authors successfully associate themselves via acknowledgements with scholars whose names are contained in the reader's knowledge set. All else equal, providing readers with additional names in the acknowledgments section (i.e., choosing larger values of NAP_i) creates more opportunities to land in the reader's knowledge set and, thus, for recognition to occur.[7]

We assume that seniority S_i also tends to increase the rate of recognition. *Ceteris paribus*, more time in the profession correlates with more publications, more conference presentations, more personal contacts, more invited talks, and more possibilities for an author's name to circulate and therefore be recognized within the scientific community. Putting these ideas together, the rate of recognition r_i can be written as a function of NAP_i and S_i:

$$r_i = r(\text{NAP}_i, S_i), \quad r_1 > 0, \quad r_2 > 0, \quad \text{and} \quad r_{12} < 0, \tag{2}$$

where r_1, r_2, and r_{12} are partial and cross-partial derivatives with respect to arguments one and two of r.

The assumption $r_{12} < 0$ is crucial because it implies negative correlation between S_i and the marginal benefit with respect to NAP_i. The function r is a cdf and therefore bounded from above by 1. As r approaches 1, the probabilistic premium with respect to NAP_i must decrease. Because r is increasing in S_i, higher levels of S_i imply smaller increases in the probability of recognition resulting from an additional acknowledgment. In other words, senior authors enjoy higher rates of recognition at every level of NAP_i, which implies less room for further increases in the rate of recognition and therefore less additional benefit from increasing NAP_i.

The mechanism described above generates an inverse relationship between seniority and the marginal (recognition-based) benefit with respect to NAP_i. When authors perceive their instrumental objective as depending positively on r_i, the shape of $r(\text{NAP}_i, S_i)$ given by (2) implies that optimally chosen NAP_i has an instrumental component that is decreasing in S_i. The prediction of negative correlation is summarized as following hypothesis:

H1 *(Instrumental recognition-seeking).* The expected marginal benefit of recognition-seeking is decreasing in seniority.

Provided that the costs of NAP_i are uncorrelated with S_i and that all other benefits (i.e., non-recognition-seeking-motivated benefits) of NAP_i are uncorrelated with S_i, H1 implies $\partial E[\text{NAP}_i|S_i]/\partial S_i < 0$. Auxiliary assumptions are needed to support this hypothesis. First, the marginal cost of NAP_i must be positive at some point over its range so that choice is properly modeled as a non-trivial constrained optimization problem. If NAP_i is costless, the optimal choice

[6] Other possible goals include achieving a target number of citations in subsequent years, winning a prize, or achieving a target level of influence by some other measure.

[7] Recognition-based decision making is consistent with boundedly rational but nevertheless well-performing heuristics discussed in Gigerenzer and Selten (2001).

of NAP_i will not necessarily be decreasing in S_i, even if the marginal recognition benefit with respect to NAP_i is decreasing in S_i. In that case, authors will set NAP_i at the upper bound of the choice set, which most likely has positive rather than negative correlation with S_i.

There are non-negligible time costs and risks associated with acknowledging additional names. For example, acknowledging someone who did not in fact provide help might harm the reputation of the acknowledging author. Listing too many names could result in those who are acknowledged feeling unhappy that their names were mentioned in a long and undistinguished list. There are also potential costs beyond the private cost incurred by the acknowledging author resulting from the possibility of inefficient over-allocation of colleagues' time in cases where recognition-signaling motivates an author to solicit too many people's input. Whatever the maximum possible value of NAP_i might be, its empirical range of 0–41 suggests that most authors typically choose strictly less than the maximum possible value. The other boundary case to consider arises when authors perceive exactly zero benefit from NAP_i or perceive its cost as prohibitively high. In such cases, optimal NAP_i is identically zero. In the 2003 data, 25 of 276 papers in our sample have $\text{NAP}_i = 0$.

2.2. Age confounds and journal effects

Because S_i is highly correlated with age, the possibility of confounding statistical links between age and NAP_i are worth considering in analyzing explanations for the empirical finding that $\text{corr}(\text{NAP}_i, S_i) < 0$. One channel through which age could influence NAP_i is the number of co-authors, denoted $N_{\text{AUTHORS}i}$. Junior authors in our data tend to have more co-authors, with an unconditional correlation between seniority and number of co-authors of -0.15. One possible reason for this is junior authors' narrow specialization during the dissertation phase of their careers and short time horizons for accumulating multiple competencies (i.e., those that make it efficient for senior authors to forgo gains from sub-task specialization in article production). Other possible reasons include differential need for mentoring in the development of substantive ideas and help with writing style, the protocols of journal submission, and professional correspondence (Coupe, 2004; Ellison, 2002; Heck and Zaleski, 1991). The empirical models in this paper therefore use the number of co-authors as a control.

Another channel through which age can influence NAP_i is individual propensities for loquaciousness or verbal expressiveness. Whether the mechanism is biological, cultural or generational, correlation between being young and favoring a writing style with dense verbiage could also generate negative correlations between S_i and NAP_i. Thus, the empirical models estimated below control for wordiness as a potential confound by including variables that measure the number of pages, $N_{\text{PAGES}i}$, and the number of words in each article's title, $N_{\text{WORDS}i}$. Journal-specific characteristics are controlled for with journal fixed effects, where J_{ij} denotes an indicator variable equal to one in case article i is published in journal j $(j = 1, \ldots, 5)$ and zero otherwise (with *AER* (J_{i1}) omitted as the reference class). The age-confound hypothesis can be summarized as:

H2 *(Age confounds account for the seniority effect).* Conditional correlation between S_i and NAP_i is approximately zero after controlling for the number of co-authors, loquaciousness, and journal-specific idiosyncrasies:

$$\frac{\partial}{\partial S_i} E[\text{NAP}_i | S_i, N_{\text{AUTHORS}i}, N_{\text{PAGES}i}, N_{\text{WORDS}i}, J_{i2}, \ldots, J_{i5}] = 0. \tag{3}$$

If selection on the supply side of the submission process rather than signaling to editors and referees is what accounts for negative correlation between NAP_i and S_i, then one would expect

thanking behavior to be similar across journals after controlling for appropriate information about authors. In other words, if – contrary to the recognition-based signaling hypothesis – reviewers do not rely on name-recognition as a cue, then there would be no reason for authors to make different thanking decisions by conditioning on journals and the specific characteristics of their editorial processes. Thus, we would interpret unequal expected numbers of acknowledged people across journals as evidence consistent with our hypothesis that authors strategically use name-recognition in anticipation of outcome-influencing effects in the editorial process. The null hypothesis of no differences in expected number of acknowledged people across journals can be expressed as:

H3 *(Invariance across journals).*

$$E[\mathrm{NAP}_i|S_i, N_{\mathrm{AUTHORS}i}, N_{\mathrm{PAGES}i}, N_{\mathrm{WORDS}i}, J_{ij} = 1] = E[\mathrm{NAP}_i|S_i, N_{\mathrm{AUTHORS}i}, N_{\mathrm{PAGES}i}, N_{\mathrm{WORDS}i}, J_{ij'} = 1], \quad (4)$$

for $j, j' \in \{1, \ldots, 5\}$.

2.3. Merit-based networks

Aside from occasional instances where authors' reputations decline following a particularly visible episode of bad performance, most authors' reputational capital is monotonically increasing in time and therefore increasing in seniority. Given senior authors' larger universe of professional acquaintances, greater accumulations of past speaking engagements and cumulative publications, it stands to reason that they should *ceteris paribus* have larger sets of colleagues from whom to request input, advice, proofreading services, etc. Exceptions are possible, for example, in cases of senior authors whose network of colleagues has aged to the point of becoming professionally inactive. For the relatively successful authors publishing in highly ranked journals considered in this paper, however, the assumption that authors' sets of colleagues are increasing in time seems well justified.

Seen in this light, personal connections may be interpreted as the result of professional success rather than the enabling inputs for achieving that success. Authors who earn professional success in a competitive environment on the merits of their creativity and scientific know-how naturally attract the attention of other talented and successful producers in the business, creating merit-based networks (e.g., Beckmann, 1994; Faria, 2002). If networks are markers of professional achievement rather than conduits for attaining that professional achievement, then unequal professional connections need not imply any departure from meritocratic competition and ediorial efficiency. Merit-based networks are consistent with efficiency in scientific production because they imply no divergence between probabilities of success on the one hand and talent, innovation, and scientific achievement on the other. This idea's primary empirical prediction is positive correlation between S_i and NAP_i [8]:

H4 *(Merit-based networks).* Authors with greater seniority have richer professional networks and therefore have a wider universe of names to choose from when selecting whom to acknowledge,

[8] The claim for this prediction rests on a uniformity assumption with respect to seniority concerning the costs of asking colleagues for help. If, for example, a senior scholar pays a higher psychic cost in terms of prestige or hierarchical status when asking a graduate student for help than the graduate student would incur by asking the senior colleague for help, then non-uniformity of costs would push correlations between S_i and NAP_i in the negative direction.

implying that:

$$\frac{\partial}{\partial S_i} E[\mathrm{NAP}_i | S_i, N_{\mathrm{AUTHORS}i}, N_{\mathrm{PAGES}i}, N_{\mathrm{WORDS}i}, J_{i2}, \ldots, J_{i5}] > 0. \quad (5)$$

2.4. Empirical models

According to the hypotheses described above, an encompassing empirical model of NAP_i should depend on seniority S_i (defined as the year 2003 minus the year in which the Ph.D. was earned), controls for potential age confounds (those with κ coefficients in Eq. (6)), and indicator variables (those with ϕ coefficients in (6)) to capture sensitivities of NAP_i to different editorial processes[9]:

$$\mathrm{NAP}_i = \alpha + \beta_{\mathrm{S}} S_i + \kappa_{\mathrm{PAGE}} N_{\mathrm{PAGE}i} + \kappa_{\mathrm{WORD}} N_{\mathrm{WORD}i} + \kappa_{\mathrm{AUTH}} N_{\mathrm{AUTH}i} + \phi_{\mathrm{ECMT}} J_{i2} + \phi_{\mathrm{QJE}} J_{i3} + \phi_{\mathrm{JPE}} J_{i4} + \phi_{\mathrm{RES}} J_{i5} + \epsilon_i. \quad (6)$$

The zero-mean error term ϵ_i captures unobserved heterogeneity and is assumed to be uncorrelated with the regressors.

3. Data and estimation of the model

The data consist of all 276 full-length articles published in *AER, Econometrica, JPE, QJE*, and *Review of Economics Studies* in 2003. Notes, comments, book reviews and all articles from *AER Papers and Proceedings* were excluded.

Table 1 lists the top-10 articles ranked according to the number of acknowledged people. All variables in Table 1 are directly observable from the published articles themselves with the exception of the lead author's seniority, which was computed based on publication dates of dissertations listed in Econlit and authors' websites. All top-10 authors have $\mathrm{NAP}_i > 20$ and are more than two standard deviations from the average non-top-10 author's NAP_i of 7.2. Antonio Rangel's $\mathrm{NAP}_i = 41$ tops the list by a wide margin. In the column under the heading seniority, one notices that the average top-10 author's seniority is almost 6 years less than that of the average non-top-10 author. Another interesting difference is that high- NAP_i articles tend to be longer and have slightly more co-authors. Also, top-10 articles are published predominantly in the *AER* and *QJE*.

Table 2 presents summary statistics (mean, min, max and standard deviation) for the variables used in the empirical models, with means broken out by journal title. Table 2 reveals that *QJE* articles have on average the youngest authors and the largest values of NAP_i. Note, too, that the average *QJE* article has slightly more co-authors and considerably more pages than the average article published in other journals.[10] The column of standard deviations indicates that these

[9] More general specifications that include geographical controls and various interaction terms were estimated, too, without changing any of the key relationships reported in the next section. Log specifications for all count variables and seniority were also estimated, again, without leading to substantive changes.

[10] After applying the page-conversion factors of Laband and Piette (1994a), which reduce the average length of *QJE* and *JPE* articles to 25.6 and 22.5 *AER*-equivalent pages, respectively, *QJE* articles are still the longest of the three. Applying the page-conversion factors in the regressions increases the magnitude of the estimated negative effect of seniority on NAP.

Table 1
Top-10-NAP articles and their characteristics[a]

Authors	Article title	Journal	NAP	Seniority	N_PAGES	N_WORDS	N_AUTHORS
A. Rangel	Forward and Backward Intergenerational Goods: Why Is Social Security Good for the Environment?	*AER*	41	5	22	13	1
S. Djankov et al.	Courts	*QJE*	28	5	65	1	4
K.-M. Yi	Can Vertical Specialization Explain the Growth of World Trade?	*JPE*	28	14	51	9	1
A. Abdulkadiroğlu and T. Sonmez	School Choice: A Mechanism Design Approach	*AER*	26	4	19	6	2
B.D. McCullough and H.D. Vinod	Verifying the Solution from a Nonlinear Solver: A Case Study	*AER*	24	15	20	10	2
P.M. Demarzo et al.	Persuasion Bias, Social Influence, and Unidimensional Opinions	*QJE*	24	15	60	7	3
D.H. Autor and M.G. Duggan	The Rise in the Disability Rolls and the Decline in Unemployment	*QJE*	23	5	49	11	2
P. Gompers et al.	Corporate Governance and Equity Prices	*QJE*	23	11	49	5	3
A. Estevadeordal et al.	The Rise and Fall of World Trade, 1870–1939	*QJE*	23	11	49	9	3
P. Antràs	Firms, Contracts, and Trade Structure	*QJE*	21	1	44	5	1
Mean (S.D.) among top-10-NAP articles							
Among top-10-NAP articles, 3 were published in *AER*, 6 in *QJE* and 1 in *RES*			26.1 (5.7)	8.6 (5.2)	42.8 (16.6)	7.6 (3.5)	2.2 (1.0)
Mean (S.D.) among non-top-10-NAP articles							
Among non-top-10-NAP articles, 45% were published in *AER*, 23% in *Econometrica*, 13% in *QJE*, 16% in *JPE*, and 14% in *RES*			7.2 (5.3)	14.4 (10.2)	25.9 (11.2)	8.6 (3.8)	1.9 (0.8)

[a] Among the 276 articles published in *AER*, *Econometrica*, *QJE*, *JPE* and *RES* in 2003.

Table 2
Summary statistics for NAP empirical model

	AER (mean)	*ECMT* (mean)	*QJE* (mean)	*JPE* (mean)	*RES* (mean)	ALL			
						Mean	S.D.	Min.	Max.
Dependent variable									
NAP (# acknowledged people)	8.1	5.1	12.2	8.0	7.1	7.9	6.4	0	41
Independent variables									
S (seniority)	15.5	15.0	10.1	13.9	13.9	14.2	10.1	0	49
N_PAGE (# pages in article)	18.4	29.1	38.9	31.9	24.2	26.5	11.9	4	67
N_WORD (# words in title)	9.4	7.6	9.0	8.7	7.1	8.5	3.8	1	22
N_AUTH (# authors)	2.0	1.9	2.1	1.9	1.8	1.9	0.8	1	5
Sample size	96 (35%)	60 (22%)	40 (14%)	43 (16%)	37 (13%)	276			

variables are highly dispersed, which makes comparisons of unconditional means difficult to interpret.

Table 3 presents the paper's main results. The table shows estimates of three nested models: a bivariate regression of NAP_i on S_i; a model of NAP_i that includes S_i but is otherwise based on the fundamentals of demand for outside help as proxied by the number of pages (longer papers imply that authors demand greater input from non-authors) and loquaciousness as proxied by the number of words in the title; and the full encompassing model with journal fixed effects. Table 3 shows that the seniority effect is rather insensitive to the inclusion of controls for article-, author- and journal-characteristics. The standard errors used in all calculations are based on robust variance estimators that allow for within-journal correlation of error terms.

The magnitude of the seniority effect implies that 10 additional years in the economic profession decreases the expected number of acknowledged people by 1.5. Relative to the sample average $\bar{NAP} = 7.9$, seniority effects are sizable and statistically significant. The data are consistent with H1 ($\beta_S < 0$) while rejecting H2 ($\beta_S = 0$) and H4 ($\beta_S > 0$). The data also reject all restricted

Table 3
Estimated models of NAP[a]

	Bivariate		Add fundamentals		Encompassing	
	Coeff.	*t*	Coeff.	*t*	Coeff.	*t*
Variables						
S (seniority)	−0.17	−4.7	−0.16	−4.4	−0.15	−4.3
N_PAGE (# pages in article)			0.09	2.8	0.09	1.4
N_WORD (# words in title)			0.01	0.1	−0.08	−0.9
N_AUTH (# authors)			−0.38	−0.8	−0.54	−1.4
ECMT (J_2) [econometrica]					−4.13	−5.7
QJE (J_3)					1.50	1.0
JPE (J_4)					−1.65	−1.8
RES (J_5)					−1.94	−4.3
Constant	10.33	16.3	8.55	5.1	10.53	13.2
R^2	0.08		0.10		0.19	

[a] Sample size for all models is 276.

models in favor of the encompassing model and reject the invariance hypothesis H3: $\phi_{\text{ECMT}} = \phi_{\text{QJE}} = \phi_{\text{JPE}} = \phi_{\text{RES}} = 0$, with the test statistic $F(4, 267) = 6.88$ whose p-value is 0.0000. As mentioned previously, these results are robust to log transformations of the count variables, and the inclusion of interaction terms and geographical proxies derived from author affiliations listed on each article.

4. Discussion

The data show conditionally as well as unconditionally that junior authors acknowledge significantly more colleagues than senior authors do. The effect is consistent with the hypothesis that recognition plays a non-negligible role in the determination of scientific merit. Although the data do not rule out all other explanations, they do seem to rule out at least two non-signaling theories as primary explanations for empirical seniority effects. First, the hypothesis that age-related confounds account for the seniority effect finds little empirical support since the seniority effect is persistently insensitive to the inclusion of controls. The hypothesis of merit-based networks is more difficult to assess. Holding all else equal, the idea that as scholars become more senior they accumulate larger networks of colleagues who can be consulted predicts the opposite association from that which is present in the data. However, if more senior scholars have lower demand for input from colleagues, or if the costs of asking for input in terms of prestige and professional status are increasing in seniority, then the connection between seniority and NAP becomes less clear, perhaps non-monotonic. Another possibility is that both recognition-signaling and merit-based network effects are simultaneously present. This would imply that the conditional effect of S_i on NAP_i reflects a combination of two, possibly countervailing influences. Without evidence that senior authors face higher costs of acknowledging, or that senior authors have smaller networks—hypotheses which strike us as implausible, the data seem to best support the recognition-signaling hypothesis.

One could attempt to re-test the hypotheses considered above using alternative measures of seniority based on citation indexes instead of our measure, which is based on time elapsed since completion of the Ph.D. A thorny endogeneity problem arises, however, when citation statistics are included as explanatory variables for thanking behavior. If recognition-signaling is common practice and is effective at increasing the expected number of publications or citations, then individuals who acknowledge more colleagues will, on average, be more senior according to citation-based measures. This would lead to positive correlations between seniority and NAP, not because rising seniority increases the size of merit-based networks and leads to larger NAP, but because larger NAP *ceteris paribus* causes marginally greater professional output and, with it, increased seniority. If recognition does indeed influence readers' appraisals of scientific merit and, thus, their decisions of which papers to cite, then citation statistics do not provide an exogenous measure of seniority.

One strategy for future research would be to collect additional data that facilitate within-author comparisons of acknowledging behavior through time and across journals. Another issue worth investigating would be to estimate cross-sections from previous decades, possibly uncovering a generational confound by which thanking behavior has become more prevalent through time based on exogenous cultural change. Additional data could also help sort out whether authors demand less input from colleagues as they become more senior simply as the result of greater maturity and competence as a function of time. Whereas the maturation story naturally suggests that demand for colleagues' input decreases as a smooth function of time, the alternative account based on signaling implies a decreasing step-function for acknowledging behavior, through time,

based on the idea that reductions in the marginal benefit of recognition occur in discrete jumps corresponding to the dates of an author's major publications and promotions. By collecting multiple observations on authors through time, one might be able to distinguish between time-proportional reductions in demand for colleagues' input versus publication-date-driven reductions in the benefit of recognition. The data reported in this paper, however, already show that such fundamentals-based explanations do not easily account for variation in acknowledging behavior across journals. Perhaps more needs to be understood about idiosyncratic editorial processes to better control for the noticeably different absolute levels of acknowledgments in different journals.

The possibility that recognition-based signaling partially accounts for authors' acknowledging behavior calls into question the reliability of face-value interpretation of citation statistics as an unbiased measure of inherent scientific quality. The recognition-seeking motive enjoys the virtue of simplicity and is consistent with the data. Even in the absence of overt politicking or devious intent, recognition-based signaling through acknowledgments may give rise to distortions that create a divergence between important professional outcomes, such as article acceptance and citation measures, and inherent scientific merit. Whether superior incentive mechanisms or review policies would improve the correspondence between the professional outcomes of academics and inherent scientific merit remains an open question.

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