NBER WORKING PAPER SERIES

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Working Paper 31150
http://www.nber.org/papers/w31150

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
April 2023

We have received no funding for this research. The views expressed herein are those of the authors and do not necessarily reflect the views of the National Bureau of Economic Research.

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April 2023
JEL No. A14,B41

ABSTRACT

The scholarly impact of academic research matters for academic promotions, influence, relevance to public policy, and others. Focusing on writing style in top-level professional journals, we examine how it changes with age, and how stylistic differences and age affect impact. As top-level scholars age, their writing style increasingly differs from others'. The impact (measured by citations) of each contribution decreases, due to the direct effect of age and the much smaller indirect effects through style. Non-native English-speakers write in different styles from others, in ways that reduce the impact of their research. Nobel laureates' scholarly writing evinces less certainty about the conclusions of their research than that of other highly productive scholars.

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They shall bring forth fruit in old age. [Psalm 92:14]

I. Introduction

The essence of academic scholarship is contained in what academics write, and the rewards to successful writing - research that affects the public and other scholars - are substantial. These range from purely monetary (as an immense literature—with early examples of Holtmann and Bayer, 1970, in the natural sciences; Hamermesh *et al*., 1982, in economics; Diamond, 1986, in mathematics, shows), to honors ranging from appointment as a Fellow in some academic society to the pinnacles—a Nobel Prize in the natural sciences (and economics), a Fields Medal in mathematics (Hamermesh and Pfann, 2012; Borjas and Doran, 2015), and others. Our major question goes behind the effects of successful scholarship to ask: Does **how** we write affect the success of our writing? Before we can answer that question, however, we examine how our writing styles vary with our demographic characteristics, most importantly, our age/experience as researchers. After all, if academic success is related to both age and the style in which we present our research, we need to separate out the indirect effects of age through style to the direct effects of age on success. Parsing out these causes allows us to get a glimpse into one possible source of the well-recognized decline in creative activity with age (Lehman, 1953; Levin and Stephan, 1991; Weinberg and Galenson, 2019; and many others).

To answer these questions, we need information on publishing patterns over scholars' lives, on the style of their publications, and on the impact of their research on the scholarly community, all in relation to the author's age at which the research appears. These data requirements begin to be satisfied in a sample of all publications that appeared between 1969 and 2018 in the so-called "Top 5" economics journals. This sample contains many of the most influential economics publications over the past half century, and the individuals in the sample represent the upper crust of contributors to economic knowledge. Using textual analysis to measure style, for each article we then obtain its subsequent citations to measure its scholarly impact. For each author we also obtain her/his date of completion of a doctorate.

Section II details the sample we construct, describes the measures of writing style, and provides statistics describing the publications. In Section III we present the first set of main results, linking writing

style to age and showing how deviations in style from norms that prevailed at the time of publication and in the sub-field of the research vary with age. Section IV examines how writing style and age relate to citations and infers the direct and indirect (through style) impacts of age on the subsequent impact of scholarship. Finally, in Section V we analyze how the writing styles of the most successful economic researchers—Nobel laureates—differ from those of other successful economists, thus examining the characteristics of the most influential scholarly research.

II. The Sample, and the Measurement of Sentiment

A. Publications in Economics, 1969-2018

The corpus of texts that we analyze consists of all 16,827 research articles published in English in the "Top 5" economics journals: *American Economic Review (AER), Econometrica (ETRCA), Journal of Political Economy (JPE), Quarterly Journal of Economics (QJE), and Review of Economic Studies (REStud)*, from 1969-2018.[1] Entries not included in the dataset are editor's notes, conference announcements and programs, auditor's reports, indexes, other similar non-research focused entries, and articles in the AEA *Papers and Proceedings*. Special symposium articles are included. Importantly, the dataset utilizes entire articles, not just article titles or abstracts, as is sometimes the basis of corpora in the literature that investigates academic research.

We exclude all entries that are comments/replies/rejoinders, etc., and also those that are Nobel or presidential addresses (American Economic Association or Econometric Society), since the former may depend on the original article being discussed, while the latter need not be purely scientific articles. These exclusions reduce the sample to 15,138 articles. With multiple authors on a majority of these articles, we have over 20,000 author/article entries. Many of the authors are "one-hit wonders," and many others appear only a few times. Since we wish to concentrate on the life-cycle relationship of age to style and scholarly impact, we restrict the sample to authors with at least five articles among the 15,138. For each of these highly successful authors we attempted to obtain the year when they began their careers, which we take as

[1]The texts were downloaded individually from JSTOR by the first author.

the year of receipt of the Ph.D.[2] Through online searches and emails, both to authors and, where necessary, their colleagues, both current and surviving, we obtained this measure for all but one individual (who authored six articles in the first three years included in the sample). Our final sample thus contains 12,812 articles authored by 1,389 different individuals.[3] We record the gender of each author (since Kosnik, 2022a, demonstrates gender differences in style even within the same sub-field in economics).[4] We also identify whether an author was a native English-speaker or not, following the criteria in Olney (2017) (and treating economists born and attending university in the Indian sub-continent and Quebec as non-native English-speakers).

Of particular interest is the cohort of individuals who entered the profession (received their doctorate or equivalent) between 1969 and 1978. For these 359 scholars (which we call the 1970s cohort), who authored 3,562 of the articles in the sample, we can observe nearly their entire professional careers, thus creating a longitudinal sample of the leading scholars in this cohort whose members had 40-49 years to publish the scholarly research that we include.

The main source of sample selectivity is along the criterion of scholarly success—having at least five research articles in these most visible scholarly outlets in economics. We recognize that the "Top 5" are only a few of the 182 economics journals that were indexed in *EconLit* in 1969 (and of the more than 1,000 included today), and that many articles in other outlets receive more attention (Oswald, 2007; Heckman and Moktan, 2020). On average, however, articles published in these journals do attract the most attention (Hamermesh, 2018). The exclusion of authors with few "Top 5" publications is restrictive, but it allows us to follow careers over a reasonably long period of time. We admittedly concentrate on the careers

[2]For the 0.5 percent of authors without a Ph.D. we add five years to the date when they received an undergraduate degree and count their professional experience from that year.

[3]Because several articles may have the same pair, triplet, quadruplet or even, in one case each, a quintuplet or sextuplet of co-authors in the sample, only 9,280 separate articles are included. In calculating sample statistics describing authors and in estimating models, we thus weight each of the 12,812 observations by the inverse of the number of times it appears in the sample.

of academic stars, so that in none of our analyses can we infer anything about the careers of scholars with relatively few top-level scholarly contributions.[5]

For each entry we have its length in pages (which we normalize to the word count of the *AER* before 2000). Since styles may differ by type of article, we also include the first-listed top-level *JEL* classification of each article, aggregated into five groups: Theory and methodology (*JEL* = C); microeconomics and industrial organization (*JEL* = D, L); macroeconomics, international economics, and financial economics (*JEL* = E, F, G); public economics, health/education, and labor and demographic economics (*JEL* = H, I, J); and other. We also know the decade of publication, 1969-78, …, 2009-18, which we use in transforming the raw measures of sentiment that we create.

The top panel of Table 1 describes the characteristics of the articles. They are distributed fairly evenly across the five *JEL* groups, with the exception of the smaller category of other—miscellaneous—articles. Despite the apparent growth in publishing, the distribution of articles is nearly uniform across the decades. The decadal distribution is explained by the logorrhea of authors publishing in these journals, a near tripling of page lengths over the five decades, and the requirement that authors have five articles in the sample.

As is well-known, publishing top-level economics is a young person's game (see Hamermesh, 2013, for cross-section evidence). In the 1970s cohort the median age post-Ph.D. at an article's publication was 10 years, with only 0.6 percent of articles published before an author received his/her doctorate.[6] Among those with Ph.D. degrees received before 1972, only 7 percent of the articles they published in this

[5]During the decade of the 1970s perhaps 8,000 Ph.D. degrees in economics were conferred in the U.S. Our sample of 359 usable observations thus probably represents the most successful five percent of publishers in that cohort.

[6]This is the largest cohort in the sample, accounting for 26 percent of authors. The pre-1969 cohorts included 14 percent of authors, the 1979-88 cohort 23 percent, the 1989-98 cohort 20 percent, and two youngest cohorts together 17 percent. The year of receipt of Ph.D. ranged from 1937 to 2014.

half-century appeared when they were more than 35 years post-Ph.D.[7] But even in the full sample, the median Ph.D.-age at publication is also only 10 years.

Only 0.7 percent of the articles published in 1969-78 contained female authors who were in the sample, a percentage that reached 5.7 in the decade 2009-18. The 1970s cohort is only 1.2 percent female, while 7.0 percent of sample members with doctorates 1979 or later are women. In the first three decades of our sample, 76, 77, and 70 percent respectively of authors were native English-speakers. In the last two decades (1999-2008 and 2009-2018) this fraction had fallen to 55 percent and 44 percent respectively.

The second panel of Table 1 describes the achievements of this selected sample and of the sub-sample, the 1970s cohort. Nearly one-quarter of the 1,389 authors barely qualified for inclusion, with only five papers published in these outlets. The maximum number of articles anyone published in these journals during this half century is 60. Restricting the calculations to the 1970s cohort, the distribution looks quite similar to the overall distribution, although it is shifted slightly to the right.

B. *Measuring the Sentiment of Economic Research*

Sentiment analysis is a technique for identifying the emotive tenor of a piece of writing. (The use of sentiment measures in economics is discussed by Gentzkow *et al*., 2019.) They have been used in many areas of scholarly research, including analyses of the Old and New Testaments (Houk, 2002; Kenny, 1986), examinations of the authorship of individual Federalist papers (Mosteller and Wallace, 1963), newspapers' reflections of economic uncertainty (Baker *et al*., 2016), and the success of online listings in affecting click-rates (Ludwig *et al.,* 2013).[8] We utilize three sentiment scores: a positive/negative score (POSN), a certainty/tentativeness score (CERT), and a contemporaneity/past score (CONP). Each score j is calculated

[7]Even this young age overstates the degree to which top-level publishing is a young person's game, since the likely publication lag between acceptance of an article and its publication in these journals was always nearly a year and is today often even greater.

[8]Examinations of economic writing style from a viewpoint of rhetoric have been produced by McCloskey (1998) and Goldschmidt and Szmrecsanyi (2007), among others.

as a net count of all relevant word or word-phrases in document i divided by the total number of relevant words:

(1) $$z_{iaj} = (\Sigma c_{iaj} - \Sigma t_{iaj}) / \Sigma(c_{iaj} + t_{iaj}) \text{ , j=1, …, 3 ,}$$

where z_{iaj} is the net score for article i by author a along criterion j. c_{iaj} is the count of its positive (certain) words, and t_{iaj} the count of its negative (tentative) words. CONP is calculated based on the c_{ia3} indicating future or present tenses in verbs, t_{ia3} indicating verbs in the past tense. Each of the three indicators is thus based on counts of words classified into two contrasting types. POSN is the most frequently studied sentiment in the literature on natural language processing; and while CERT and CONP are newer, they have gained traction in various literatures (Pennebaker and Stone, 2003; Kosnik, 2022b).

If POSN > (<) 0, we infer that an article has a net positive (negative) emotive tone. The size of the final score indicates its degree of net positivity or negativity. If CERT > (<) 0, an article has an overall emotive tone of certainty (tentativeness). If *CONP* > (<) 0, the article has a contemporary (past-focused) emotive tone. For all three measures the size of the sentiment score indicates the degree of the particular sentiment.

Key to any sentiment score are the words and phrases that comprise the c_{ij} and t_{ij}. Appendix Tables A1-A3 provide examples of the kinds of words and phrases in each of the three sentiment scores. The dictionaries utilized for this analysis were built up from the Harvard IV dictionary (https://textanalysis.info/pages/category-systems/general-category-systems/harvard-iv-dictionary.php), the Linguistic Inquiry and Word Count (LIWC) dictionary (Pennebaker, 2015), and the Regressive Imagery dictionary (Martindale, 1990), with edits made to fit the context of writing in academic economics.[9] These edits primarily involved recognizing econometric-based words as neutral, rather than as indicative of emotive content. For example, "average," "limit," "regression," "subtract," and "ordinary" were marked as indicative of negative sentiment in the original dictionaries, but we treat them as neutral here. Similarly,

[9]Tailoring the dictionary to the context is important, as some words have different meanings in different contexts. "Vice," for example, would be categorized as a negative word in most situations, but in a human resources managerial handbook it might refer primarily to vice-presidents and so be categorized in that context as neutral. It then would have no bearing on such a handbook's positive/negative sentiment score.

"aggregate," "natural," "validity," "append," and "value" were marked as indicative of positive sentiment in the original dictionaries, but we also treat them as neutral. Dictionary creation is a somewhat subjective endeavor, which is why we relied, as much as possible, on the category dictionaries created by previous researchers which have been honed over many years of use. We tailored them only (as is standard in the literature) within the specific context of economics and econometrics.[10]

Each of the articles in the corpus was entered into a relational database where variables associated with the articles could be analyzed independently, for examples, year of publication, journal of publication, page length, author's native language, gender, and, of course, author's Ph.D.-age. The text itself was left unstructured and organized within a vector-space model (VSM), where each element of the vector indicates the occurrence of a particular word or phrase within the paper. The vector elements were not transformed or weighted in any way, instead being left as raw frequency counts, so that if a given word was used more than once in a paper, its degree of emphasis was reflected in a higher count and thus a higher $\Sigma(c_{iaj}+t_{iaj})$.

The textual analysis yielded the measures z_{iaj}. Because there are trends in style (Kosnik, 2022a; 2022b) and differences in style across sub-fields, we transform each z_{iaj} as:

$$z^{*}_{iaj} = z_{iaj} - z^{'}_{..j}, \tag{2}$$

where $z^{'}_{..j}$ is the score averaged over all articles by all authors in a *JEL* group in a decade (so that each score is adjusted by the norm of sentiment for its sub-field (5) and decade (5), i.e., 25 norms). The calculations of the z^{*}_{iaj} also allow examining the sizes of the departures of style, whether positively or negatively, from the sub-field/decade norm describing the article's sentiments, which we denote as z^{*2}_{iaj}. Like the measures of sentiment themselves, these departures may be related to the authors' Ph.D.-ages and to the success of their articles.[11]

[10]After the initial word counts and sentiment scores were calculated, spot checking with KWIC (keyword-in-context) was performed to make sure the words being categorized as negative or positive really indicated such sentiment in the article.

[11]Using the quadratics in z^{*}_{iaj} to measure departures from norms is arbitrary, implicitly assuming increasing effects as the departure increases. We re-estimated all the models in Sections III and IV, replacing z^{*2}_{iaj} by $\left|z^{*}_{iaj}\right|$. The coefficient estimates become slightly less significant, and the fits are not as good. This suggests that the implicit assumption of increasing marginal effects regardless of the sign of the departure from the norm underlies behavior in the dataset.

As a check on the mechanical counting of words and the creation of the z_{iaj}, we took the pairs of articles that represented the extreme values of POSN and CERT among articles published 2009-18 in the *JEL* categories (H, I, J). A group of advanced undergraduates was asked to rate which article in the pair was more Positive (Certain). Of the 12 undergraduates handling each pair, 11 produced the same ranking as the computerized text analysis ($p = 0.0002$) along each of these two dimensions. This simple test provides some assurance that the mechanical ranking of sentiments accords with what a reader would perceive.[12]

The bottom panel of Table 1 lists summary statistics of the z_{iaj}, z^*_{iaj}, and z^{*2}_{iaj}. On average the sentiment of the articles in the sample is quite negative, they are written in a very tentative voice, and they tend to be contemporary oriented. Sixteen percent of the articles have a net positive sentiment, four percent express certainty in their sentiments, and almost none contains a net past-oriented sentiment. The crucial point for our empirical analyses is that there is substantial variation in sentiment across the sample along all three criteria.[13] Moreover, as Appendix Table B2 shows, while the correlations among the deviations and their squares are positive, they are not very large. The three measures of the sentiments expressed in economics articles are nearly independent.

III. Age, Style, and Style Norms

We first consider nonparametrically how style and style norms relate to age by examining the local polynomial smoothed relationship between a sentiment measure and the Ph.D.-age of authors at the time their paper was published. Figures 1a-1c show these for each of POSN, CERT, and CONP, including 95-percent confidence bands around the estimates. While these figures cover the entire range of ages when the author's articles appeared, the paucity of publications before an author received the Ph.D., or after Ph.D.-age 35 unsurprisingly makes the confidence bands over those ranges very wide. The most useful comparisons are of the

[12]We subjected this manuscript to the same analysis of sentiments that underlies the body of the paper. Basing the adjusted scores on publications in the 2009-18 decade in the *JEL* group "Other," the z^* scores on POSN, CERT, CONP were 0.110, 0.111, and -0.140 respectively, while those on the z^{*2} were 0.012, 0.012, and 0.020 respectively. All six measures were within one standard deviation of their respective group means.

[13]There are also significant differences across the five journals, with all of them being more positive and more contemporary-oriented than the *AER*, and all but the *QJE* being written in a more certain voice than the *AER*, as Appendix Table B.1 shows.

patterns of sentiments when the authors are between Ph.D.-ages 0 and 35. Assuming a Ph.D. is received at age 28, that is roughly equivalent to 28-63 years of age.[14]

These comparisons demonstrate a monotonic and highly statistically significant increase in the positivity of writing style with age over the relevant Ph.D.-age range (Figure 1a), mirroring the results in Pennebaker and Stone (2003) based on laboratory experiments on a small sample of creative writers. Conversely, there is a significant monotonic decrease in the certainty of writing styles over this age range (Figure 1b). There is essentially no relation between age and the present/past orientation of the authors' styles (Figure 1c), except that with the small sample of articles by very senior authors, there is a significant decrease in present orientation after a Ph.D.-age of 35. Notably too, there is no evidence of a discrete change in any measure of style around the time when the typical academic would obtain job security (academic tenure), 5-8 years post-Ph.D., even in the 1970s cohort when publication lags were shorter and thus could not introduce possibly large errors into the comparisons of the timing of and numbers of publications.

While allowing a function-free view of the sentiment-age relationships, the estimates in Figures 1a-1c cannot allow for other characteristics (of authors and articles) that might determine the style in which the articles are written, most importantly, the date of publication. The top panel of Table 2 thus presents linear estimates relating the deviations in sentiment (the z^*_{iaj}) to Ph.D.-age, holding all the covariates constant: gender, native English-speaker, page-length, journal indicators, *JEL* group, and decade of publication. The standard errors of the parameter estimates are clustered on authors. The estimates essentially reproduce the results in Figures 1a-1c, including a statistically significant positive effect of age on POSN, and a statistically significant decline with age on CONP, no doubt arising from the significant sharp drop observed in Figure 1c among the oldest authors. These results imply that, as authors age, they write less dismally, in an even more questioning manner, and with an increasingly backward-looking emphasis. The bottom panel includes author fixed effects, thus adjusting for any

[14]Receiving a Ph.D. in economics at age 28 is fairly precocious: The average age during most of the sample period hovered around 31 (Scott and Siegfried, 2008); but it is conceivable that the more successful researchers are those who finished their degrees more quickly than average.

personal idiosyncrasies in style. The signs of all three estimates remain the same, with the impacts of age on positivity (present orientation) remaining statistically significantly positive (negative).[15]

The right-hand side of each panel in Table 2 presents the same estimates but only including authors in the 1970s cohort. This restriction allows concentration on a group whose backgrounds and professional life experiences were probably more homogeneous than those of the entire sample. The estimates in the upper-right panel are similar in magnitude in most cases to those for the entire sample, although with a sample size only 28 percent of that in the entire group, their standard errors are larger. The fixed-effects estimates are much smaller than those for the entire sample, but they still show the positive positivity-age relationship, and the negative relationships of the other two sentiments to age. The overall conclusion from Figures 1 and Table 2 is that there is some evidence that sentiment changes, all else equal, as authors continue writing and top-level publishing, becoming more positive and less present-oriented.

The estimates of the impact of being a native English-speaker on style are striking: Natives write less positively, with less certainty, and with less present/future orientation than do leading economists whose mother tongue is not English. To the extent that style affects scholarly impact, which we examine in the next section, these effects are important. They are also fairly large, amounting to differences in the full sample (the 1970s cohort) of -0.12 (-0.24), -0.25 (-0.42) and -0.19 (-0.30) standard deviations in the three measures of sentiment. That the estimated differences are smaller in the full sample than in the 1970s cohort might reflect the rise of English as a second language worldwide.

We know that writing style differs by sub-field, but another question is whether the impact of age on style differs by sub-field as well. Separating the more and perhaps less formal *JEL* groups, so that the former is the first three of the five aggregated *JEL* categories, the latter the final two aggregates, we re-estimate the models in Table 2 for the two groups separately. Except for POSN, for which the age gradient is significantly more positively sloped in the less formal groups, there are no significant differences in this estimate between the two pairs of *JEL* groups. In the estimates for the 1970s cohort there are no significant differences for any of the sentiment measures.

[15]There are no significant differences by *JEL* code in the impacts of age on any of the measures of sentiment. Also, adding a quadratic in age suggested that the relationships of age to the sentiment measures are essentially linear.

With co-authorship increasing steadily over the half-century of our sample (Hollis, 2001; Hamermesh, 2013), perhaps the results simply reflect correlations of style with the number of co-authors. Adding the number of co-authors to the models in the panels on the left-hand side of Table 2 hardly changes the estimated effects of author's age on writing style. Adding the same measure to the estimates based on the 1970s cohort has similarly small effects. Additional coauthors, however, do make writing styles more positive, more certain, and less present-oriented, both in the full sample and in the 1970s cohort. Similarly, restricting the sample to sole-authored articles does not alter the conclusions: Those parameter estimates on Ph.D.-age in Table 2 that were statistically significant remain so with the same sign.

One might be concerned that, with so many authors having only five entries in the sample, the results arise from the characteristics of the least successful among this group of very successful scholars. As robustness checks, we re-estimate the equations discussed above, first restricting the sample to exclude the 24 percent of authors (13 percent of articles) with "only" five publications, then excluding the 68 percent with fewer than 10 publications (46 percent of articles). The results with the first exclusion yield uniformly larger (in absolute value) effects than those shown for the entire sample in Table 2. With the even stricter exclusion, the effects of age on the deviations of POSN and CONP from style norms become slightly larger, perhaps because the most prolific authors, those with ten or more publications in the sample, stake out their stylistic identities later in their careers than other authors.

Figures 2a-2c show local polynomial smoothed representations of the relation between age and the z^{*2}_{iaj} –the squared deviations of the sentiment measures from their decadal/sub-field norms. The results are even clearer than in Figures 1a-1c: Deviations from the norms of positivity (actually, mostly negativity) fall with age; those with certainty (actually, mostly tentativeness) rise with age, while there is no relation of the squared deviations of present-orientation to Ph.D.-age over most of the range (although the squared departures fall significantly within the small sample of very senior authors).

Table 3 presents the same models as in Table 2, with the same additional controls and the same sample restrictions, describing the determinants of the z^{*2}_{iaj}. The estimates for the entire sample suggest that only deviations from contemporaneity are affected by age (rise with age); deviations from norms of positivity and certainty are not related to age; but the fixed-effects estimates, which include page length, journal, and *JEL*

controls, demonstrate that increasing age leads to significant increases in the departure of sentiment along all three dimensions from decadal/sub-field averages. Once we account for author fixed effects, we observe that, as authors age, their writing increasingly differs from that of others working at the same time and in the same areas—they become more unusual. Restricting the sample to the 1970s cohort strengthens this conclusion: The estimates for all three measures of sentiment depart increasingly and significantly from the time/sub-field norm as authors in the 1970s cohort aged.[16] The writing of scholars in economics becomes increasingly idiosyncratic —both more or less positively, both more or less certainly, and both more or less present-oriented—as they gain experience.[17]

Most of the estimated impacts of age on the deviations of sentiment and the squared deviations of sentiment from norms are statistically significant for the full sample, although not for the 1970s cohort. Based on the fixed-effects estimates for the entire sample (the 1970s cohort), a two standard-deviation increase in age leads to changes in the z^*_{iaj} of 0.14 (0.03), -0.05 (-0.03), and -0.10 (-0.06) standard deviations for POSN, CERT, and CONP respectively. For the z^{*2}_{iaj} the effects are 0.09 (0.12), 0.25 (0.17), and 0.13 (0.20) standard deviations. Age is related to sentiment—significantly so for the squared deviations of departures from norm—and the impacts of age on the sizes of the departures, positive or negative, from decadal/sub-field norms are not tiny.

The results on the impact of native English-speaking on departures from norms are less clear-cut than their impact on the levels of style, but there is some evidence that native English-speakers depart less from field/decadal norms in positivity and certainty than those authors whose mother tongue is not English. On contemporaneity, on the other hand, native English-speakers' writing styles differ more from the norms of their time and sub-specialty. In terms of the size of these effects, in the full sample (the 1970s cohort) they range from

[16]As with the estimates in Table 2, we examine the robustness of the estimated effects on the z^{*2}_{iaj} by adding a measure of the number of coauthors on each article. These additions do not alter any conclusions about the relationship between age and style. Nor is the presence of additional coauthors associated with greater departures from any of the style norms. Similarly, the inferences remain the same if we restrict the sample to sole-authored articles.
We also examine the robustness of the estimated effects to restrictions on the sample by excluding its less successful members. We impose successive restrictions on the sample, initially excluding authors with only 5 entries, then those with fewer than 10 entries. Examining only the fixed effects estimates for the 1970s cohort, both restrictions increase the absolute values of the point estimates on $POSN^2$ and $CONP^2$, reduce that for $CERT^2$.

[17]We re-estimated all the models discussed in this section, replacing indicators of the *JEL* group with the raw *JEL* classifications, and replacing the decadal indicators with the indicators of the year of publication. Neither of these changes altered the general conclusions drawn from the estimates shown in the tables.

-0.01 (-0.15) standard-deviation differences in POSN and CERT, to a 0.12 (0.16) standard deviation difference in CONP.

IV. Age, Style, and Citations

We measure the scholarly impact of articles by the number of subsequent citations received. We recognize the imperfections in this measure, but: 1) It is a relatively objective measure; 2) It correlates well with various outcomes, including salaries and departmental/institution rankings (Hamermesh, 2018); 3) It correlates well with subjective evaluations by teams of economists (Checchi *et al*., 2021); and 4) Although imperfect, citations are the standard metric used in the literature describing academic contributions. We use citation counts from Scopus, but we were only able to obtain them for 63.9 percent of the 12,812 observations. Accordingly, we obtained citation counts from Google Scholar for another 35.5 percent.[18] All the citation data are cumulative through August 2021. Google Scholar is much less restrictive than Scopus and the more commonly used Web of Science (Hamermesh, 2018). The average citation count of the one-third of the sample with Google Scholar data is thus 677 (s.d. = 2,082), while that from Scopus is 199 (s.d. = 440).[19] To make the measures of citations commensurate, for each observation for which citations were taken from Google Scholar we create $CITES^{*}$= 199.44*CITES/677.02 where CITES are citations to the article and the adjustment is based on the sample means of citations from the two sources. We set $CITES^{*}$=CITES for those articles with data from Scopus.[20]

Consider first the local polynomial fits of $CITES^{*}$ to Ph.D.-age, shown in Figure 3a for the entire sample and in Figure 3b for the 1970s cohort. While the relationship is very imprecise at the extremes of Ph.D.-age (below age 0 and above age 35), there is eventually a clear negative relationship between citations and Ph.D.-age. Moreover, the decline with age is substantial; Figure 3a shows that going from age 0 to 35 cuts the estimated citations to an article by nearly half.

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[18]We were unable to obtain citation counts for 0.6 percent of the observations and hence exclude them from the analyses in this section, resulting in a usable sub-sample of 12,738 observations (and the same 1,389 distinct authors in the full sample, 359 in the 1970s cohort).

[19]Authors of articles whose citations are from Scopus are much younger than other authors (average Ph.D. 10.1 versus 14.9) which results from the fact that younger authors have published more recently and that articles with Googe Scholar citation counts are disproportionately (97 percent) from the earliest three decades of our sample.

[20]All the results in this section were reproduced on the separate samples with Scopus data or Google Scholar data, with no departures from the implications of the results tabled here.

The difficulties with these figures are that they do not account for growth in the number of journals citing economics articles, nor for the length of time over which a study could accumulate citations by August 2021. We thus estimate models similar to those presented in Tables 2 and 3, including in all the equations each author's Ph.D.-age and all three measures of sentiment (and controlling in each equation for the number of *AER*-equivalent pages, native English-speaker and gender, and an indicator of whether the citation measure is from Scopus or Google Scholar). Because it takes time for citations to accrue, and because the number of citing journals may have increased, we control for individual years of publication rather than decade; because the distribution of citations is highly skewed, all estimates are produced using median (LAD) regressions, and, as before, standard errors are clustered on authors.

The top panel of Table 4 presents the estimated impacts of sentiment, age, and native English-speaker on subsequent citations, first for the entire sample (left) and then for the 1970s cohort (right). The estimates in Columns (1) and (3) show that increased age directly and statistically significantly reduces subsequent citations, as implied by the Figures. Also, however, articles written in more positive, more certain, and more contemporary styles than the decadal/field norms generate fewer citations. For the entire sample all the impacts are highly significant statistically, while even for the much smaller 1970s cohort the impact of CERT is statistically significantly negative.

Figures 3a and 3b suggested the possible presence of a nonlinear relation between Ph.D.-age and CITES*. To examine this possibility conditional on all the controls (most important, year of publication), we add a quadratic term in Ph.D.-age to the estimates, with the results shown in Columns (2) and (4) of the upper part of Table 4.[21] For the full sample and for the 1970s cohort the quadratic terms are statistically significant. In the full sample the results suggest that citations decrease with author's age until 43 years past the Ph.D., i.e., over 99.1 percent of articles. In the 1970s cohort, the responses of CITES* to age initially rise with age, turning negative 15 years past the Ph.D. (and are thus negative for 34 percent of the articles in this sub-sample). For a large fraction of

[21]For the fewer than one percent of articles published before the author completed the Ph.D., the measure is set equal to 0. As another control we added the position of each article in its issue, in particular, whether it was the lead article. While being placed first increased an article's citations (as in the experimental evidence in Coupé *et al*., 2010), it altered the coefficient estimate on Ph.D.-age by less than 1 in the third significant digit.

publications in these top journals, articles penned by older authors receive less attention from other scholars than the authors received at the peak of their careers.[22]

While positive deviations of all three measures of sentiment reduce citations significantly or nearly so, the more important question is how large these reductions are. Taking simultaneous two-standard deviation increases in sentiment scores, based on the estimates in the upper panel of Table 4 in Column (1) (Column 3), these increases reduce citations by 10 (5) percent, or 0.03 (0.02) standard deviations. Writing in a more positive, more certain, or more present-oriented way than others publishing at the same time and in the same sub-field reduces the scholarly impact of one's articles, although the effects are not large.

The bottom panel in Table 4 produces analogous results for the z^{*2}_{iaj}, the adjusted squared deviation measures, which we present exactly as in the upper panel—separately for the full sample and the 1970s cohort sub-sample, and without and then with a quadratic term in Ph.D.-age. The squared deviations of the sentiment measures from the prevailing norms are only weakly statistically significant, with bigger departures from the norm of positivity increasing citations, but with a decrease in citations among articles whose departure from norms along the dimension of certainty is greater.

Does writing in a style that departs further—in either direction—from that of other scholars lead to more or less eventual scholarly impact? Taking the estimates from Column (1) (Column 3) of this lower panel, we calculate the effect of simultaneous two standard-deviation increases in each z^{*2}_{iaj} on an article's citations. These departures generate a net reduction of 2 citations, a one-percent drop, equivalent to less than 0.01 standard deviations of citations. Departures in either direction from style norms reduce citations, but by extremely little, with similarly very small impacts for the 1970s cohort.

While doubling the number of authors on an article does not double its citations, it does increase them (Hamermesh, 2018). Since we showed above that co-authorship hardly changes the impact of age on writing style, failure to include the number of authors in these estimates will not bias the estimated impacts here. Adding the number of authors to the models presented in Table 4 thus barely alters the results, with some estimates rising

[22]In terms of the epigraph to this article, one interpretation is that they do bring forth fruit in old age, but that it is not so succulent as the fruit that they brought forth earlier (or at least not so succulent to the tastes of younger scholars).

slightly in absolute value, some falling, and with those that are statistically significant in Table 4 remaining so.[23] The effect of additional authors is positive and statistically significant, but far less than in proportion to the number of authors.

Another potential problem is that more senior authors are more likely to have published more articles in the sample. If so, and if having published more articles makes additional articles better cited, either because of reputational effects or simply because those who publish more top-level articles do more important work, the estimated effects shown in Table 4 may be biased. Age at publication and number of articles are correlated but not very highly—r = 0.11 in the entire sample, r = 0.15 in the 1970s cohort.

To examine this possibility, we re-estimated the models in Table 4, adding for each observation the number of "Top 5" articles that the author had previously published and its interaction with age. The estimated effects of the z^*_{iaj} and z^{*2}_{iaj} on citations do not change very much, with all of them increasing slightly in absolute value from those shown in the Tables. The citations-age gradient becomes flatter the more articles the author has previously published in these journals. Most interesting, those who had published more in these journals receive more citations to their current publication than otherwise identical authors. We cannot determine whether this treatment reflects higher-quality work or reputational ("Matthew") effects (Merton, 1968). Suffice it to note that the negative impact of age on citations is implicitly reduced for authors who are the more successful among the highly successful scholars in this sample.

We can decompose the total effect of age on citations using the estimates in the upper panels of Tables 2 and 4 as:

$$(3) \qquad dCITES^*/dAGE = \partial CITES^*/\partial AGE \,\big|_{z^*ij} + [\partial CITES^*/\partial z^*_{iaj} \,\big|_{AGE} \cdot \partial z^*_{iaj}/\partial AGE],$$

the sum of the direct effect, the first term, and the indirect effect, the bracketed term. We calculate the effect on citations of a two standard-deviation increase in Ph.D.-age in the whole sample. As a fraction of mean citations,

[23]Restricting the samples, first to those with more than five entries, then to those with ten or more entries, also does not qualitatively alter the results. Even for the 1970s cohort, for which the second restriction cuts the sample to only 2,187 observations, the parameter estimates retain their signs, and the statistically significant negative estimates for CERT in Table 4 remain so.

the impacts are reductions of 3.0 percent, which equals 0.02 standard deviations in citations (with only two percent of the impact working through the indirect effect in (3)). The effects are similar in the 1970s cohort. Scholarly recognition decreases with author's age, but only a small part of the decrease is due to changes in writing style with age.

We can only speculate about why there are fewer citations to articles published at the same time and in the same sub-field by older scholars and why they eventually decrease as scholars age. One possibility is that already-established authors are favored by editors, who publish their papers even if the work is not quite so important as that of more junior authors or as that of their own earlier work (although some evidence points against this kind of favoritism at one journal along dimensions other than age, Blank, 1991).[24] No doubt other, perhaps even testable explanations are consistent with this surprising finding.

We can replace the z^*_{iaj} by the z^{*2}_{iaj} in (3) to calculate the indirect effects of age on citations through departures from stylistic norms, using the estimates in the upper panel of Table 3 and the bottom panel of Table 4. The decomposition differs little from that above, with a slightly larger total effect. The indirect effects again constitute no more than two percent of the total.

The estimated impacts of being a native-English speaker are all significantly positive, in both the full sample and in the 1970s cohort. All else equal, including the objective measures of their writing style, in the estimates in the full sample (the 1970s cohort) native English-speakers receive about 4 (5) percent more citations to their articles than a non-native speaker. With evidence that the sentiments in articles written by native English-speakers are less positive, less certain, and more past oriented, we can also decompose the effect of being a native English-speaker on citations into its indirect effects (through sentiment) and its direct effect, again combining estimates in Tables 2 and 4. The total impact of the lesser positivity, certainty, and present-orientation of native English-speakers is an increase in citations of 0.03 standard deviations, half due to the indirect impact through the differences in the sentiments expressed, half to the direct effect. The impacts in the 1970s cohort are of similar

[24]Testing this idea by including an interaction with an indicator of whether the author had recently published in a particular journal shows, if anything, that an article is better-cited (although not significantly) if s/he has published recently there. This is not consistent with editors publishing relatively inferior papers by authors whom they had published before and supports the findings of Brogaard *et al* (2014).

magnitude. Moreover, the differences in citations between native-English speakers and others are essentially independent of author's age.

One might suppose that the impacts of sentiment on citations, and of the deviations in sentiment from decade/field norms, arise because of in-group behavior—people writing similarly with similar outlooks—and the general importance of citation networks (Goyal *et al*., 2006). We cannot test this possibility completely, but in-group behavior may be more likely at the two university-sponsored journals (*JPE* and *QJE*) than at the other three journals. Restricting the analysis to these three produces only tiny changes in the parameter estimates in Table 4. By inference, this admittedly fairly weak test suggests that citation networks are not generating the results relating style to citations.

V. The Style of Genius: Are Superstars Different from Stars?

The sample of 1,389 highly productive economists includes 54 economists who had won a Nobel Prize before 2023, who account for 899 of the 12,812 articles in the sample. They typically received this accolade late in their careers—at an average Ph.D.-age of 38—so that most of their top-flight publications were behind them by that point.[25] (Offer and Söderberg, 2016, present a history and analysis of the Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel.) These 54 laureates are much more productive than others in the sample, averaging 24 articles in this data set.

We expand the estimates presented in Tables 2-4 by adding an indicator of Nobelists and interacting it with Ph.D.-age in describing the measures of style and also with the style measures in the equations describing citations. This allows us to examine both whether Nobelists' behavior differs from that of other star publishers and whether it changes differentially from that of other publishers. Re-estimating the previously estimated equations allows discovering whether style contributes to achieving the very pinnacle of academic success and how the determinants of that achievement change as scholars age.

Table 5 produces estimates of the impact of Ph.D.-age and Nobel status on the vectors of the z^* and the z^{*2}. Each of the six equations also includes the same set of control variables that was included in the main estimates

[25]Of the 899 articles in this sample that they authored, only 71 were published more than 14 months after they received the Prize. Four of the 54 Nobelists in the original sample account for 36 of these articles. Top-flight post-Prize academic publishing is quite rare.

shown in Tables 2 and 3. In inferring the differences between Nobelists and other star publishers, note that the mean of Ph.D.-age at publication among Nobelists is 18.46 years. Thus, for example, the average difference between them and others in CERT is (-0.0644 + 0.001585*18.46) = -0.0351 (s.d. = 0.0093): Nobelists' style exhibits significantly less certainty than that of other star authors. This example suggests that writing in a more tentative style distinguishes one's scholarship and might provide the scope for subsequent researchers to accord it the attention that helps to generate the distinction of a Nobel Prize.

None of the other z^* differs significantly between Nobelists and others on average. Among the z^{*2}, only for $POSN^2$ is there even a weakly significant difference (t = -1.79), with Nobelists' styles differing less along this dimension from the time-sub-field norms than of other researchers. A similar lesser difference exists for $CERT^2$, but not for $CONP^2$. Taking all three results together, there is some very weak evidence that Nobel Prize-winning economists adhere more to current stylistic norms than do other scholars.

The estimates in Table 2 for the entire sample provided some evidence that the positivity of writing styles increases with age (although the result was much weaker in the data for the 1970s cohort). The Nobel laureates write in a style that becomes more certain with age much more quickly than the writing styles of other authors, and becomes much less contemporary with age than that of others. Although the sample excludes addresses—includes only what are viewed as scientific articles—perhaps being a laureate allows the scholar a license to be more certain of his/her conclusions and to focus more on the past.[26]

Table 5 shows that the certainty of Nobel laureates' writing styles differs increasingly and significantly with age from that of other authors. We saw above that, over their entire careers, the certainty of their writing departs less from style norms than others'; but having produced work that leads to a Nobel Prize apparently may give future Prize-winners the feeling of a license to be more "different" in terms of their certainty about their results. Nobelists' contemporaneity of style also departs increasingly with age from others' style. Given that most Nobel citations mention work that at least began to be published very early in a laureate's career, one cannot

[26]With only 9 percent of Nobel laureates' articles published after receipt of the Prize, and with a very high positive correlation of age of receipt with Ph.D.-age, we cannot distinguish between the effect of receipt *per se* and that of Ph.D.-age in these data.

conclude that the departures from norms of the certainty and contemporaneity of their writing style are what generate their award.

Since our focus in this section is on what differentiates Nobelists from other highly successful economists, Table 6 presents estimates that allow inferring whether their citations are determined differently from those of other authors. The equations also include the same control variables as before plus main effects in the vectors z^* and z^{*2}. Because of the skewness of citations and the likelihood that laureates' articles are more heavily cited than others', we present estimates at five quantiles—10, 25, 50, 75, and 90.

With the mean Ph.D.-age at publication among laureates being 18.46, the estimates in Table 6 unsurprisingly show that at each of these quantiles Nobelists receive more citations than others: Their research, even their less-cited work, attracts more attention from other scholars than that of other economists publishing in these leading outlets. More interesting, comparing these differences to the citations to non-Nobelists' work shows that Nobelists' citations are more than double those to others' work at each quantile: The entire distribution of their citations, other things equal, is shifted rightward roughly by a factor of two.

The estimates show that at each quantile citations to Nobelists are dropping significantly more rapidly with age than those of other scholars. The results in Section V demonstrated this decline generally; but the decline among Nobelists is over twice as rapid at the median. Their citations never converge to those of other scholars, however, at any of the quantiles estimated.

These results show how style matters differently between Nobelists and others. The vector of six interactions is statistically significant at the median and at the 90th percentile, and approaches usual standards of statistical significance at the two lowest quantiles tabulated. Taking two standard-deviation increases in each z^* and z^{*2}, the net difference in style leads to somewhat lower citations among Nobelists than others, entirely through the net negative impact of the z^{*2}—their departures from norms of style. Put differently, departures from norms have a negative effect on citations generally, one that is even more negative for Nobelists than for others.

Nobel Prize winners—superstars—are different from mere star publishers. Of course, their work is more highly cited. Like others, however, their work attracts less notice from other scholars when it is published later in their careers; and the diminution of attention—citations—among Nobelists is more rapid than that among other economists. Their style of writing differs from others'—it has a significantly more tentative tone. The marginal

impact of an increased lack of certainty in style on scholars' attention to their work, however, is less than among non-winners.

VI. Conclusions and Speculations

This is the first broad-scale study linking the style of scholarly writing to the success of individual scholars over their careers. Using analyses of the textual styles of 50 years of economics research papers in five major journals, coupled with information on the articles' subsequent citations and their authors' demographic characteristics, particularly their Ph.D.-age, we have shown that departures of writing style from stylistic norms within a sub-field in economics at the time of authorship generate less scholarly attention to an article. Deviations in style increase with authors' ages, especially among the most influential of these star academics—Nobel laureates, contributing a small part of the decline in attention to articles that are produced by older authors, which we also document.

We stress that all our conclusions are based on a sample of the very top researchers in economics, and that we cannot infer from this selected sample whether similar changes with age occur in the careers of less successful Ph.D. economists in the same cohorts. With that caveat in mind, we have documented one possible source of the well-known slowdown of top-flight scholarly activity with age—the decreasingly warm reception paid by other scholars, due in small part to changes in the style of writing as a scholar ages.

Perhaps the most important implication of these results for scholarly work is the need for editors of scholarly journals to pay even more attention than has apparently been paid in the past to the content of articles that are submitted for publication. That older authors' articles receive less subsequent scholarly attention than do otherwise similar articles by less senior authors suggests that impact-maximizing editors should be less favorable to authors who are already highly successful publishers. This implication underlies a more general recommendation: Simply having demonstrated one's *bona fides* as a leader in a field does not mean that one's subsequent contributions will be as substantial as those that established one's reputation. Expertise must be based on the watchword, "what have you done lately?", in academic publishing and in the application of expertise in society more generally.

One might also consider the implications of this research for scientific innovation. If writing differently from the norm is penalized (in the sense of receiving less attention), does this imply that "going with the flow" is

better than being a “disrupter”? A recent publication (Park *et al*., 2023) shows that innovation in the sciences has been decreasing across a range of scientific disciplines. Perhaps our research provides a glimpse of evidence of the same thing also happening within economics and of possible reasons for its occurrence. Future research investigating the implications of increasingly similar writing styles on innovative ideas and research developments would be very worth pursuing.

REFERENCES

Scott Baker, Nicholas Bloom, and Steven Davis, "Economic Policy Uncertainty," *Quarterly Journal of Economics*, 131 (Nov. 2016): 1593-1636.

Rebecca Blank, "The Effects of Double-Blind versus Single-Blind Reviewing: Experimental Evidence from the *American Economic Review*," *American Economic Review*, 81 (Dec. 1991): 1041-67.

George Borjas and Kirk Doran, "Prizes and Productivity: How Winning the Fields Medal Affects Scientific Output Prizes and Productivity," *Journal of Human Resources*, 50 (Summer 2015): 728-58.

Jonathan Brogaard, Joseph Engelberg, and Christopher Parsons, "Networks and Productivity: Causal Evidence from Editor Rotations," *Journal of Finance*, 111 (Jan. 2014): 251-70.

Daniele Checchi, Alberto Ciolfi, Gianni De Fraja, Irene Mazzotta, and Stefano Verzillo, "Have You Read This? An Empirical Comparison of the British REF Peer Review and the Italian VQR Bibliometric Algorithm," *Economica*, 88 (Oct. 2021): 1107-29.

Tom Coupé, Victor Ginsburgh, and Abdul Noury, "Are Leading Papers of Better Quality? Evidence from a Natural Experiment?" *Oxford Economic Papers*, 62 (2010): 1-11.

Arthur Diamond, "What Is a Citation Worth," *Journal of Human Resources*, 21 (Spring 1986): 200-15.

Matthew Gentzkow, Bryan Kelly, and Matt Taddy, "Text as Data," *Journal of Economic Literature*, 57 (Sept. 2019): 535-74.

Nils Goldschmidt and Benedikt Szmrecsanyi, "What Do Economists Talk About? A Linguistic Analysis of Published Writing in Economic Journals," *American Journal of Economics and Sociology*, 66 (April 2007): 335-78.

Sanjeev Goyal, Marco van der Leij, and José Luis Moraga-González, "Economics: An Emerging Small World," *Journal of Political Economy*, 114 (April 2006): 403-12.

Daniel Hamermesh, "Six Decades of Top Economics Publishing: Who and How?" *Journal of Economic Literature*, 51 (March 2013): 162-72.

----------, "Citations in Economics: Measurement, Uses, and Impacts," *Journal of Economic Literature*, 56 (March 2018): 115-56.

----------, George Johnson, and Burton Weisbrod, "Scholarship, Citations, and Salaries: Economic Rewards in Economics," *Southern Economic Journal*, 49 (Oct. 1982): 472-81.

---------- and Gerard Pfann, "Reputation and Earnings: The Roles of Quantity and Quality in Academe," *Economic Inquiry*, 50 (Jan. 2012): 1-16.

James Heckman and Sidharth Moktan, "Publishing and Promotion in Economics: The Tyranny of the `Top 5'," *Journal of Economic Literature* 58 (June 2020): 419-70.

Aidan Hollis, "Co-authorship and the Output of Academic Economists," *Labour Economics*, 8 (September 2001): 503–30.

Alphonse G. Holtmann and Alan Bayer, "Determinants of Professional Income among Recent Recipients of Natural Science Doctorates," *Journal of Business*, 43 (Oct. 1970): 410-18.

Cornelius Houk, "Statistical Analysis of Genesis Sources," *Journal for the Study of the Old Testament*, 27 (Sept. 2002): 75-99.

Anthony Kenny, *A Stylometric Study of the New Testament*. New York: Oxford University Press, 1986.

Lea-Rachel Kosnik, "Who Are the More Dismal Economists? Gender and Language in Academic Economics Research," American Economic Association, *Papers and Proceedings*, 112 (May 2022a): 592-6.

----------, "More Evidence on Gender and Language in Academic Economics Research," Unpublished Paper, University of Missouri—St. Louis, 2022b.

Harvey Lehman, *Age and Achievement*. Princeton, NJ: Princeton University Press, 1953.

Sharon Levin and Paula Stephan, "Research Productivity over the Life Cycle: Evidence for Academic Scientists," *American Economic Review*, 81 (March 1991): 114-32.

Stephan Ludwig, Ko de Ruyter, Mike Friedman, Elisabet Brüggen, Martin Wetzels, and Gerard Pfann, "More than Words; The Influence of Affective Content and Linguistic Style Matches in Online Review on Conversion Rates," *Journal of Marketing*, 77 (Jan. 2013): 87-103.

Colin Martindale, *The Clockwork Muse: The Predictability of Artistic Change*. New York: Basic Books, 1990.

Deirdre McClosky, *The Rhetoric of Economics*. Madison: Univ. of Wisconsin Press, 1998.

Robert Merton, "The Matthew Effect in Science," *Science*, 159 (Jan. 5, 1968).

Frederick Mosteller and David Wallace, "Inference in an Authorship Problem," *Journal of the American Statistical Association*, 58 (June 1963): 275-309.

Avner Offer and Gabriel Söderberg, *The Nobel Factor: The Prize in Economics, Social Democracy, and the Market Turn.* Princeton, NJ: Princeton University Press, 2016.

William Olney, "English Proficiency and Labor Market Performance: Evidence from the Economics Profession," *Economic Inquiry*, 55 (Jan. 2017): 202-22.

Andrew Oswald, "An Examination of the Reliability of Prestigious Scholarly Journals: Evidence and Implications for Decision-Makers," *Economica*, 74 (Feb. 2007): 21-31.

Michael Park, Erin Leahey, and Russell Funk, "Papers and Patents Are Becoming Less Disruptive Over Time," *Nature*, 613 (January 2023): 138-44.

James Pennebaker and Lori Stone, "Words of Wisdom: Language Use over the Life Span," *Journal of Personality and Social Psychology*, 85 (2003): 291-301.

----------, Ryan Boyd, Kayla Jordan, and Kate Blackburn, *The Development and Psychometric Properties of LIWC2015*. Austin, TX: University of Texas at Austin, 2015.

Charles Scott and John Siegfried, "American Economic Association Universal Academic Questionnaire Summary Statistics," American Economic Association, *Papers and Proceedings*, 102 (May 2012): 631–4.

Bruce Weinberg and David Galenson, "Creative Careers: The Life Cycles of Nobel Laureates in Economics," *De Economist*, 167 (2019): 221-39.

Table 1. Descriptive Statistics of the Sample of Articles, Authors, and Sentiments.

Articles (N=9,280)

JEL Group:	**%**	**Decade**	**%**	**Pages—Mean (s.d.)**
Theory and methodology	22.1	1969-78	16.7	11.92 (6.80)
Microeconomics, industrial organization	25.9	1979-88	22.7	14.41 (6.62)
Macroeconomics, international, financial	25.6	1989-98	19.4	19.80 (7.84)
Public, health/education, labor	15.3	1999-2008	21.0	25.79 (8.96)
Other	11.1	2009-18	20.2	34.70 (11.02)
	100.0		100.0	

Authors

	Entire sample (N=1,389)	**1969-1978 cohort (N=359)**
	%	**%**
N articles: 5	24.2	22.5
6-9	43.7	38.2
10-19	26.6	32.6
20+	5.5	6.7
	100.0	100.0

Sentiment –Mean (s.d.) Articles (N=9,280)

	Raw	**Deviation**	**Deviation^2**
POSN	-0.228 (0.188)	0.004 (0.184)	0.034 (0.048)
CERT	-0.357 (0.171)	-0.006 (0.169)	0.029 (0.051)
CONP	0.725 (0.133)	0.002 (0.129)	0.017 (0.047)

Table 2. Relationship of Relative Style to Ph.D. Age[a]

	Entire sample, 12,812 articles, 1,389 authors			1970s Cohort, 3,562 articles, 359 authors		
Dep. Var./100 :	*POSN*	*CERT*	*CONP*	*POSN*	*CERT*	*CONP*
Years past Ph.D.	0.1001	-0.0073	-0.0531	0.0520	-0.0458	-0.0253
	(0.0288)	(0.0262)	(0.0278)	(0.0451)	(0.0422)	(0.0353)
English native	-2.2567	-4.2898	-2.4986	-4.4827	-7.1728	-3.7187
	(0.6079)	(5.5049)	(0.4636)	(1.2633)	(1.0875)	(0.6904)
R^2	0.016	0.028	0.055	0.035	0.044	0.080
			Author fixed effects[b]			
Years past Ph.D.	0.1387	-0.0423	-0.0656	0.0283	-0.0237	-0.0338
	(0.0580)	(0.0525)	(0.0354)	(0.0380)	(0.0352)	(0.0229)
R^2	0.286	0.307	0.461	0.299	0.294	0.448
			Mean (s.d.)			
Years past Ph.D.		12.97			12.89	
		(9.48)			(10.27)	

[a]Standard errors in parentheses, clustered on authors. Additional covariates included are *AER*-equivalent page count and indicators of decade of publication, journal, JEL group, native English-speaker, and gender. Decade of publication is excluded from the estimates for the 1970s cohort.

[b]Excludes indicators of gender and English-speaker.

Table 3. Relationship of Squared Style Deviation to Ph.D. Age[a]

	Entire sample, 12,812 articles, 1,389 authors			1970s Cohort, 3,562 articles, 359 authors		
Dep. Var.:	$POSN^2$	$CERT^2$	$CONP^2$	$POSN^2$	$CERT^2$	$CONP^2$
Years past Ph.D./100	-0.0052	0.0044	0.0253	0.0426	0.0452	0.0435
	(0.0066)	(0.0066)	(0.0101)	(0.0114)	(0.0113)	(0.0177)
English native	-0.0591	-0.5454	0.4536	-0.7404	-0.8662	0.7007
	(0.1384)	(0.1368)	(0.1112)	(0.3313)	(0.2990)	(0.1824)
R^2	0.014	0.020	0.030	0.027	0.033	0.050
			Author fixed effects[b]			
Years past Ph.D./100	0.0220	0.0685	0.0311	0.0292	0.0480	0.0409
	(0.0162)	(0.0170)	(0.0144)	(0.0109)	(0.0126)	(0.0088)
R^2	0.192	0.202	0.322	0.212	0.204	0.327

[a]Standard errors in parentheses, clustered on authors. Additional covariates included are *AER*-equivalent page count and indicators of decade of publication, journal, JEL group, native English-speaker, and gender. Decade of publication is excluded from the estimates for the 1970s cohort.

[b]Excludes indicators of gender and English-speaker.

Table. 4. Relationship of Citations to Relative Style and Ph.D. Age, LAD Estimates[a]

	Entire sample 12,738 articles, 1,389 authors		1970s cohort, 3,531 articles, 359 authors[b]	
POSN	-11.51	-12.08	1.04	-0.21
	(4.59)	(4.65)	(7.56)	(7.29)
CERT	-25.43	-26.15	-20.73	-24.31
	(4.71)	(4.72)	(7.06)	(7.91)
CONP	-26.91	-27.64	-7.00	-8.29
	(9.95)	(10.10)	(13.41)	(14.20)
Years past Ph.D.	-0.615	-1.142	-0.455	4.313
	(0.121)	(0.287)	(0.230)	(0.546)
Years past^2	--------	0.0134	-------	-0.144
		(0.0067)		(0.016)
English Native	5.66	4.78	7.89	6.28
	(2.72)	(2.80)	(3.46)	(3.69)
Pseudo-R^2	0.046	0.046	0.016	0.026

Table 4, cont.

$POSN^2$	33.92	34.24	35.10	8.88
	(19.09)	(20.79)	(21.07)	(23.24)
$CERT^2$	-11.70	-9.99	4.88	2.68
	(10.39)	(10.80)	(9.69)	(8.98)
$CONP^2$	-47.14	-49.15	-18.21	-10.84
	(27.90)	(28.28)	(20.95)	(23.12)
Years past Ph.D.	-0.649	-1.018	-0.479	4.287
	(0.127)	(0.305)	(0.235)	(0.539)
Years past Ph.D. ^{2}	--------	0.0098	-------	-0.144
		(0.0071)		(0.016)
English Native	7.74	7.61	10.13	9.14
	(2.73)	(2.79)	(3.27)	(3.68)
Pseudo-R^2	0.044	0.044	0.016	0.025
CITES* : Mean	199.40		180.50	
(s.d.)	(508,86)		(522.16)	

[a]Standard errors clustered on authors. Equations also include *AER*-equivalent pages, indicators of gender, *JEL* group, and year of publication.

Table 5. Coefficient Estimates on the Nobelist Indicator Describing Measures of Sentiment N=12,812)[a]

Dep. Var.:	POSN	CERT	CONP	$POSN^2$	$CERT^2$	$CONP^2$
Years past Ph.D./100	0.0837	0.0047	-0.0277	-0.0011	-0.0025	0.0129
	(0.0321)	(0.0282)	(0.0277)	(0.0072)	(0.0069)	(0.0089)
Nobel	0.0140	-0.0644	0.0215	-0.0035	-0.0089	-0.0087
	(0.0191)	(0.0138)	(0.0165)	(0.0054)	(0.0033)	(0.0050)
Years past Ph.D.	0.0192	0.1585	-0.1626	-0.0096	0.0400	0.0720
xNobel/100	(0.0616)	(0.0607)	(0.0752)	(0.0172)	(0.0209)	(0.0385)
R^2	0.023	0.036	0.063	0.019	0.026	0.037
Non-Nobelists:						
Mean	0.0022	-0.0032	0.0027	0.0343	0.0288	0.0162
SD	(0.1852)	(0.1697)	(0.1274)	(0.0486)	(0.0517)	(0.0444)

[a]Standard errors clustered on authors. Equations also include *AER*-equivalent pages, indicators of native English-speaker, gender, journal, *JEL* group, and year of publication.

Table 6. Coefficient Estimates on the Nobelist Indicator, Quantile Regressions on Citations N=12,738 articles, 54 Nobelists, 1,335 non-Nobelists)[a]

	Centile				
Ind. Var.:	10	25	50	75	90
Years past Ph.D.	-0.2553	-0.5100	-0.8037	-1.2756	-2.1730
	(0.0474)	(0.0667)	(0.1262)	(0.2659)	(0.5758)
Nobel	23.395	41.400	107.284	334.579	852.959
	(5.173)	(11.213)	(28.154)	(49.774)	(180.051)
Years past Ph.D.xNobel	-0.4968	-0.4910	-1.0911	-5.6685	-15.3968
	(0.2028)	(0.3173)	(0.8236)	(1.4534)	(3.1860)
Interactions with Nobel:					
POSN	10.851	14.954	-12.111	-29.812	-428.488
	(12.557)	(19.928)	(34.093)	(152.210)	(319.021)
CERT	1.562	-3.113	-26.990	-194.904	-442.516
	(9.173)	(15.603)	(34.746)	(346.220)	(366.932)
CONP	-23.261	12.927	69.156	-34.621	-361.302
	(26.247)	(33.396)	(72.881)	(249.795)	(380.630)
$POSN^2$	10.753	-72.267	-142.808	-237.042	-79.038
	(43.365)	(65.835)	(105.097)	(827.936)	(945.607)
$CERT^2$	-37.709	-161.434	-449.910	-241.377	264.558
	(34.064)	(81.271)	(130.767)	(1113.62)	(572.183)
$CONP^2$	-3.252	68.380	49.279	-236.166	-1104.104
	(43.172)	(43.111)	(102.984)	(586.503)	(534.402)
R^2	0.045	0.052	0.064	0.077	0.079
p-value on z^*, z^{*2} Interactions (F6, 12,700)	0.098	0.062	0.014	0.203	<0.001
Citations (non-Nobel)	10	27	70	181	400

[a]Standard errors clustered on authors. Equations also include the main effects of the z^* and z^{*2}, *AER*-equivalent pages, indicators of native English-speaker, gender, journal, *JEL* group, and year of publication.

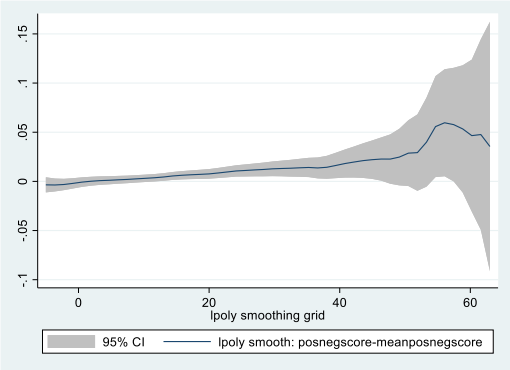

Figure 1a. Local Polynomial Smoothed Relation of Adjusted +/- Sentiment to Ph.D. Age, "Top 5" Journals, 1969-2018 (N = 12,812)

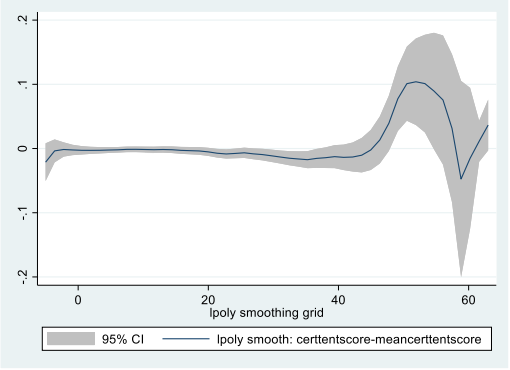

Figure 1b. Local Polynomial Smoothed Relation of Adjusted Certainty to Ph.D. Age, "Top 5" Journals, 1969-2018 (N = 12,812)

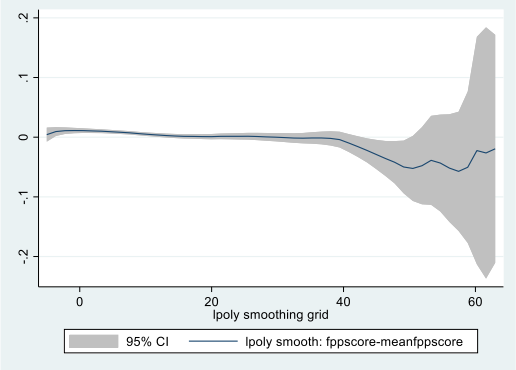

Figure 1c. Local Polynomial Smoothed Relation of Adjusted Present Orientation to Ph.D. Age, "Top 5" Journals, 1969-2018 (N = 12,812)

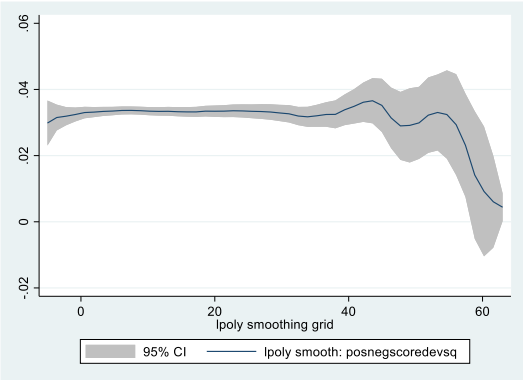

Figure 2a. Local Polynomial Smoothed Relation of Squared Adjusted +/- Sentiment to Ph.D. Age, "Top 5" Journals, 1969-2018 (N = 12,812)

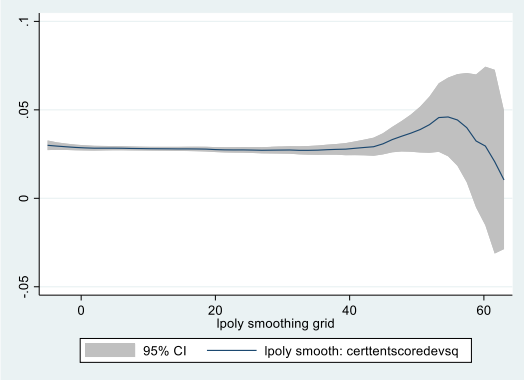

Figure 2b. Local Polynomial Smoothed Relation of Squared Adjusted Certainty Sentiment to Ph.D. Age, "Top 5" Journals, 1969-2018 (N = 12,812)

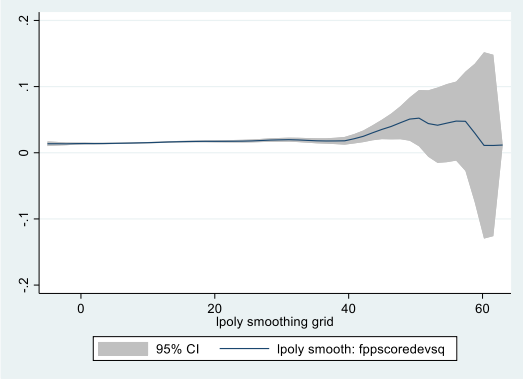

Figure 2c. Local Polynomial Smoothed Relation of Squared Adjusted Present Orientation to Ph.D. Age, "Top 5" Journals, 1969-2018 (N = 12,812)

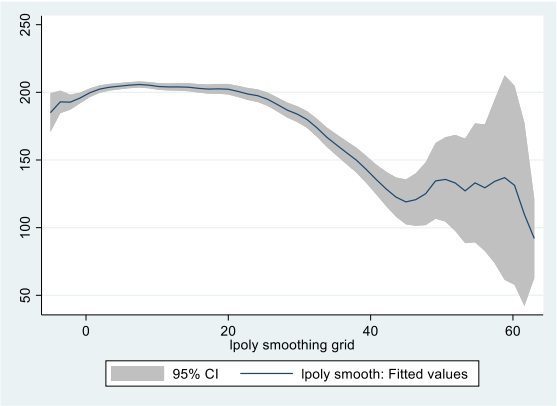

Figure 3a. Local Polynomial Smoothed Relation of Adjusted Citations (for Year of Publication Citations Measure) to Ph.D. Age, "Top 5" Journals, 1969-2018 (N = 12,738)

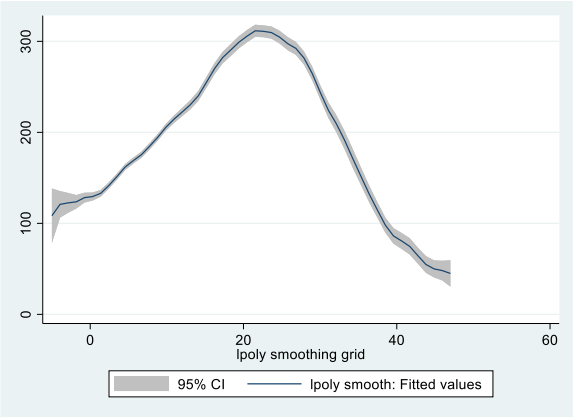

Figure 3b. Local Polynomial Smoothed Relation of Adjusted Citations (for Year of Publication and Citations Measure) to Ph.D. Age, 1969-78 Cohort, "Top 5" Journals, 1969-2018 (N = 3,531)

Table A1. Examples of Positive and Negative Words in Text

Positive	Negative
optimal	low
satisfy*	bad
good	afraid
efficien*	without
incentive	cannot
consistent	negative
no doubt	lack of
perfect	poor
unique	no information
improve*	reject*

Table A.2. Examples of Certain and Tentative Words in Text

Certainty	Tentativeness
always	almost
clearly	depending
correct	doubtfully
definitely	generally
every time	might
invariably	sometimes
irrefutably	sort of
truly	suppose
undeniably	unclear
wholly	vaguely

Table A3. Examples of Contemporary and Past Verbs in Text

Contemporary	Past
admit	admitted
arrives	arrived
follows	followed
happens	happened
manage	managed
knows	knew
ranks	ranked
sees	saw
trusts	Trusted
wants	Wanted

Table B1. Journal Style Scores, Adj. for JEL Code and Year, 1969-2018, N = 9,280[a]

	POSN	*CERT*	*CONP*
AER	-------	-------	-------
ETRCA	0.0439	0.0369	0.0565
	(0.0059)	(0.0054)	(0.0040)
JPE	0.0073	0.0094	0.0013
	(0.0060)	(0.0055)	(0.0041)
QJE	0.0043	-0.0136	0.0056
	(0.0061)	(0.0056)	(0.0042)
REStud	0.0448	0.0414	0.0629
	(0.0061)	(0.0056)	(0.0042)
R^2	0.017	0.018	0.047
Range	[-1, 0.45]	[-1, 1]	[-0.529, 1]

[a]Includes indicators for individual years and main *JEL* codes.

Table B2. Correlation Matrices of Journal Style Scores Adjusted for JEL Code and Year, 1969-2018

Sample Period and Size

	1969-2018, N = 12,812			**1969-78 Cohort, N = 3,562**	
	CERT	*CONP*		*CERT*	*CONP*
POSN	0.086	0.127	*POSN*	0.083	0.106
CERT	-------	0.122	*CERT*	-------	0.115
	$CERT^2$	$CONP^2$		$CERT^2$	$CONP^2$
$POSN^2$	0.069	0.055	$POSN^2$	0.065	0.056
$CERT^2$	-------	0.049	$CERT^2$	-------	-0.001