E C O N O M I C S B U L L E T I N

Publications over the Academic Life−cycle: Evidence for Academic Economists

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Abstract

It is widely assumed that the productivity of academic specialists declines with academic age. This paper provides empirical evidence of this phenomenon among economists using a panel data set from the departments of nine major midwestern universities.

We would like to thank Jeffrey Wooldridge, David Neumark, Jeff Biddle, Charles Ballard for their helpful comments on various versions of this research.
Citation: Baser, Onur and Elda Pema, (2004) "Publications over the Academic Life−cycle: Evidence for Academic Economists." *Economics Bulletin,* Vol. 1, No. 1 pp. 1−8
Submitted: January 29, 2004. **Accepted:** February 3, 2004.
URL: http://www.economicsbulletin.com/2004/volume1/EB−04A10001A.pdf

1 Introduction

Anecdotal evidence, supported by professional awards, produce assumption that productivity is a function of age. Economists have studied the occupational behaviors of individuals in a life-cycle human capital investment framework after Gary Becker (1962) and Theodore Schultz (1963) paved the way for this kind of research. According to these studies, extensive research and publishing early in a career represents an investment in human capital which makes possible higher future salaries; later rewards are thus an incentive for early productivity.

Despite the existence of several significant sociological studies (Bayer and Dutton, 1977; Cole, 1979), economists have not thoroughly investigated the research productivity of scientists over the academic life-cycle. The economists Diamond (1986), Levin and Stephan (1991) examine the productivity decline in academics in general. Oster and Hamermesh (1998) use a sample of over two-hundred economists in top research institutions to show that productivity declines very sharply with age. In this study we take a comprehensive approach to the estimation of productivity decline by analyzing in concert citation by others, publication totals, journal reputation and experience.

2 Methodology

We construct a panel data set of major midwestern economics departments for the 1991-1992, 1995-1996 and 1998-1999 academic years. A combination of faculty *vitas* and the Econlit database provided data on research activity. [1]

The reputation of researchers is often measured by number of citations received. Such measures of reputation have proved problematic, however, since citation tallies often include self-citations and often credit only the first author in a co-authored publication. Recent changes in the way citations are recorded allow us to avoid both problems. Our study collects citations from the ISI-Web of Science site and draws from the Social Sciences Citation Index database. [2]

[1] The universities considered are University of Indiana-Bloomington, University of Illinois at Urbana-Champaign, University of Iowa, Michigan State University, The Ohio State University, Purdue University, University of Michigan, University of Minnesota, and University of Wisconsin-Madison.

[2] Efforts are made to account for every citation per scholar by searching both *with* and *without* the middle initial. Due to personal preferences or recording practices, the ratio of author citations *without* the middle initial to citations *with* middle initial vary widely. A note of caution therefore to future researchers: using one of either search criterion is likely to underestimate the citation counts for at least

Using accounts of 800 journals compiled since 1998 by the Social Science Citation Index (excluding medical, psychology, and some law journals) we rank journals according to number of citations following the example of Liebowitz and Palmer (1984). This allows us to calculate the weights of individual journals.

Publications which are measured as number of pages per author, are sorted into three categories. The category “Total Articles in Journals” includes articles appearing in all academic journals- national, regional, and specialty journals. Comments and replies, but not reviews and corrections, are tallied. “Other Publications” includes books, textbooks, edited books, articles in collective volumes, book chapters, book reviews, government documents, conference proceedings and working papers. “Non-ranked publications” includes articles published in journals that receive a weight of zero in the citation-based ranking.

To construct a publication index we first multiply the number of pages per person by the weight of the journal in which the article is published and then sum this product over all publications.

In the same fashion as previous studies, we measure experience as years since award of highest degree.[3] The inclusion of a quadratic term capture diminishing effects of experience. We control for possible gender differences by including a female variable; for quality of education by including a Top 10[4] variable ; and for administrative duties by including a department-chair[5] variable. We also control for department-specific factors by including university dummies but since some of the variation of interest may be lost with this inclusion, we reported the results with and without these indicators.

In addition, we try to capture academic life-cycle trends in research by attending to different professorial ranks to account for different publications schedules in different ranks.

The model, which uses publication index as a right hand side variable, is estimated by the pooled ordinary least square method. In a few instances we

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a substantial part of the sample. When excluding the middle initial, the risk of including citations of faculty with the same name is reduced by considering the journal in which the cited work is published as well as address. Most cited works include the institutional address of the researcher, and by using *vitas* we are able to distinguish relevant addresses.

[3] Virtually all the economists in the sample had a Ph.D.

[4] We combined several published rankings of economics department to construct a list of 10 universities considered to be the best.

[5] This variable takes a value of one if an individual has served as a department chair on a given time interval.

incorporate measures of volume of research on the right-hand side to control for the effect of learning through research.

With count data, such as total citations, it is better to model population regression directly and ensure positivity for any value of explanatory variables and parameter values. Nonlinear least squares (NLS) is not ideal for count data models: NLS is relatively inefficient unless there is homoskedasticity and all of the standard distributions for count data imply heteroskedasticity. Most popular count models for count data are the Poisson and negative binomial regressions. Various specification tests have been proposed in the context of these two model. We applied conditional mean specification tests and conditional variance specification test (see Wooldridge (1997) for details). We start with the Poisson regression but both goodness-of fit statistics from the Poisson regression itself and a likelihood ratio test after negative binomial regression asserts that the data are not Poisson. We find evidence of overdispersion and use negative binomial model. Following Wooldridge (1997), standard errors that account for the clustering has been estimated.

3 Findings

The regression results in table 1 show that the quality-weighted publication measure and citation counts display an academic life-cycle pattern. Both measures increase with experience but at diminishing rates, as demonstrated by the negative square term. The second regression incorporates measures of research volume to control for human capital accumulation through the learning that takes place during research. The results from this regression do not significantly differ from the first with respect to the life-cycle effect, suggesting that learning on the job does not affect productivity.

Total citations is more directly linked than publication index to individual performance since the publication index accounts for quality through the journals rather than the articles themselves. Research quality thus measured displays a academic life-cycle profile that is consistent with the one displayed by the publication index.

The above models assume that the publication schedules are similar for the three grade levels (assistant professor, associate professor, and professor)–a not entirely accurate assumption if we maintain the life-cycle hypothesis. Most people advance through these ranks over the life-cycle rather than start and finish their careers in the same rank. Therefore, we expect the effect of experience to manifest itself in different patterns in each rank. As table 2 shows, diminishing productivity of age persists only for associated professors.

4 Conclusion

This study has documented the hypothesized positive but diminishing impact of academic age on research productivity.

The diminishing effect of experience on research variables is quite strong and is quite robust to the productivity measures used for estimation. After approximately 20 years of experience economics faculty are predicted to publish fewer pages and/or deliver lower overall quality of research than the average faculty member.

There are other factors which are not accounted for in our regressions and which may affect productivity. Thus, for example the proliferation of academic journals in recent years may confound our measures of published research and citation counts. Also, changes in compensation structures in academia and/or external business-cycle considerations may account for varying time and resources devoted to research over the course of a career.

One extension to this study would estimate a cohort effect. Another informative extension would estimate some measure of decreased relevance of early research (depreciation) due to the progress of knowledge in the field of economics.

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Table 1: Regression Results

Explanatory Variables	OLS Dependent Variable: Publication Index (1)		(2)		NBREG Dependent Variable: Total Citations (1)		(2)	
Experience	3.707	3.119	1.561	0.865	0.118	0.081	0.076	0.050
	(0.671)*	(0.678)*	(0.505)*	(0.463)*	(0.028)*	(0.029)*	(0.028)*	(0.029)*
$(\text{Experience})^2$	-0.082	-0.071	-0.037	-0.022	-0.002	-0.002	-0.002	-0.001
	(0.0176)*	(0.018)*	(0.013)*	(0.012)*	(0.001)*	(0.001)*	(0.001)*	(0.001)*
Chair	1.668	4.657	4.325	6.124	0.201	0.229	0.370	0.392
	(8.533)	(11.140)	(5.747)	(6.757)	(0.289)	(0.336)	(0.235)	(0.232)
Female	-18.245	-23.803	-8.754	-10.069	-0.209	-0.195	0.300	0.344
	(3.244)*	(4.524)*	(3.271)*	(2.655)*	(0.357)	(0.401)	(0.399)	(0.439)
Top10	-1.678	-13.767	-4.861	-12.053	0.021	-0.267	0.110	-0.045
	(5.359)	(5.365)*	(3.582)	(3.803)*	0.246	(0.237)	(0.245)	(0.271)
Total Article Pages			0.210	0.245			0.005	0.005
			(0.025)*	(0.030)*			(0.002)*	(0.001)*
Total Other Pages			-0.007	-0.007			0.0002	0.0003
			(0.008)	(0.012)			(0.0003)	(0.0003)
Total Non-Ranked Pages			-0.323	-0.391			-0.001	-0.003
			(0.06)*	(0.075)*			(0.003)	(0.002)*
Department Dummies	Yes	No	Yes	No	Yes	No	Yes	No
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-7.407	12.364	-7.864	5.765	4.232	4.588	3.591	3.999
	6.540	(4.610)*	(4.758)***	(3.163)**	(0.382)*	(0.313)*	(0.324)*	(0.293)*
Observations	675	675	666	666	678	678	660	660
R-square[&]	0.391	0.144	0.645	0.512	0.132	0.054	0.273	0.225

Note: Robust standard errors that account for the clustering in parantheses
*p-value <1%; **1%<p-value<5%; ***5%<p-value<10%
[&] Pseudo R-Square for negative binomail regression

Table 2: Regression Results by Grade-Level

OLS						
Explanatory Variables	Dependent Variable: Publication Index					
	Assistants		Associates		Professors	
Experience	-0.290	-0.585	3.527	2.815	1.479	0.726
	1.533	1.734	(1.017)*	(1.503)**	(1.338)	(1.517)
$(\text{Experience})^2$	0.217	0.234	-0.123	-0.118	-0.047	-0.035
	0.150	0.175	(0.033)*	(0.041)*	(0.028)	(0.031)
Female	-4.800	-6.418	-21.282	-25.512	-23.317	-25.663
	4.310	(2.588)**	(6.133)*	(4.962)*	(4.180)*	(9.869)*
Top10	1.989	0.938	9.185	-3.108	-1.960	-15.659
	4.871	5.834	9.009	7.410	8.982	(9.412)***
Department Dummies	Yes	No	Yes	No	Yes	No
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-0.451	5.502	-3.273	17.498	20.238	46.433
	4.823	3.632	8.709	(10.3034)***	(14.535)**	(16.366)*
Observations	82	82	135	135	452	452
R-square	0.603	0.541	0.450	0.156	0.398	0.132

Note: Robust standard errors that account for the clustering in parantheses
*p-value <1%; **1%<p-value<5%; ***5%<p-value<10%