

Statistics 101 for (Wannabe) Economists*

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Comments Welcome!

VERY PRELIMINARY!!!!!!!!!!!!

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Introduction

While pursuing graduate studies in economics, most PHD students silently hope to publish one day an article in an economics journal. Some even dream of submitting to a top journal. But to what extent are these hopes and dreams realistic¹?

Similarly, according to Hansen (1991), “the main task of PHD students is to demonstrate their ability to do independent research that contributes to economic knowledge”. But does the average PHD student succeeds in this? A survey by Hansen (1991) shows that only 21% of the dissertation supervisors found that most or all of the recent dissertations were significant contributions to economic knowledge. The author comments on this observation by noting “Though all dissertations presumably represent contributions to economic knowledge, the adjective ‘significant’ in the survey question may have colored the responses and produces the seemingly low figure”.

To get a clearer view on these issues, we merged the names contained in the “List of Doctoral Dissertations in Political Economy in American Universities and Colleges” with the Econlit-database. Assuming that each publication in an economics journal means an addition to the economic knowledge, we will be able to answer both questions.

¹ In a recent paper Stock and Siegfried look at the salaries of economist. An alternative title could thus be: “So You Want to Earn a Ph.D. in Economics: How Much Do You Think You'll Publish”?

Data and Data Problems.

Since 1904, the American Economic Association collects lists with the names of the people that successfully defended a dissertation in ‘Political Economy’. In addition to the name, the year of graduation, the university that issued the degree and an indicator for the subfield is given².

We used this information from the 68th list (academic year 1970-1971) and the 79th list (academic year 1981-1982) and further used the records in Econlit (from 1987 onwards this information has been included in Econlit) for the years 1988 and 1993³.

These names were then connected with the names of the authors of the journal articles in Econlit (also the Econlit names had to be standardized (see Coupé(2000))).

A drawback of this way of working is that there might be cases where two economists have the same name and hence, will be considered as one person. At the other side it is possible that some authors are not given credit for an article because names were misspelled, abbreviated or because one person uses two different names⁴. Note however that these two sources of errors are balancing each other as one tends to increase the number of articles written while the other decreases the number of articles written.

A second problem is that Econlit doesn’t include all journals in which the PHD’s might have published. Still, Econlit covers a wide (but changing) range of economics journals, increasing over time from 179 (1969) to 555 (1998).

While one should keep in mind these sources of errors, we think that our data are the best available to get a clearer picture of the “homo oeconomicus”⁵.

² In some cases, the branch campus of the university wasn’t mentioned, f.e. U MI rather than U MI Ann Arbor. In those cases we attributed the PHD to the biggest branch campus.

³ The Economic Journal has similar lists for UK dissertations. However, the UK lists do not give the full first name which makes connecting names to the Econlit database much more difficult. In addition, less important US journals seem more likely to be included in Econlit.

⁴ An extreme example is Donald McCloskey who changed to Deirdre McCloskey.

⁵ Gibbons and Fish (1988) and Hutchinson and Zivney (1995) also studied the publishing behavior of economists. Collins et al. (2000) made rankings of economics departments on the basis of the production of their graduates.

Findings

What is the percentage of PHD-student that published? Table 1 tries to answer this. The first column gives the percentage of PHD's that can be found in Econlit (as a (co) author of a journal article). The second column takes the percentage that published between t-1 and t+5, where t is the year of graduation, the third column extends this period until t+10. The fourth column does again take the period t-1 until t+5 but takes only those 88 journals into account that have been included from 1969 onwards. This last column will thus be the one that is most fit to comparisons over time.

Table1: % publishing.

PHDYEAR	69 – 98	t-1 until t+5	t-1 until t+10	t-1 until t+5 (88 js)
1970/1971 (804,196)	59.2	42.4	51	32.1
1981/1982 (718,255)	54.3	43.9	48.6	30.2
1988(780,313)	58.3	48.1	57.6	28.2
1993 (1067,432)	55.7	53.1	–	25.2

Between brackets are the number of PHDs and the number of journals included in Econlit at the time of PHD.

The first column indicates that somewhere around 60% of our sample has ever published. Note that this 60% corresponds closely to Hansens' (1991, p1083) 40% of new PHDs that take non-academic jobs. This could indicate that PHDs that enter a non-academic job have little incentives to get their PHD research published. However, one can as well claim that those with a 'bad' dissertation leave the academic sector...

When looking at the 'thesis'-interval of 7 year, this percentage is even lower suggesting that slightly less then 50% actually publish parts of their thesis. Looking at the 88 journals for which we have 30 years of observations (and that include most of the major journals) we see that there are less and less economists that published in these journals (within 5 years after their PHD had been granted). One reason for this decline could be that the some of these 88 journals have, in the eyes of the new PHD's, declined in importance and have been replaced by other journals (the Journal

of Public Economics, the Journal of Economic Perspectives and the European Economic Review are examples of journals that aren't included). Alternatively, one could see this as a sign of a decrease in quality of recent PHDs or of an increased number of competitors for a restricted amount of space.

Also interesting to know is how much those that succeeded in publishing at least once did published over their career. Table 2 uses similar time-periods as table 1 but now gives the median number of articles (proportionally weighted for coauthorship and conditional on having published at least once in the period under consideration).

Table 2: median number of articles published.

PHDYEAR	69 – 98	t-1 until t+5	t-1 until t+10	t-1 until t+5 (88 js)
1970/1971 (804,196)	3	1.8	2	1.5
1981/1982 (720,255)	3	1.5	2.3	1
1988(780,313)	3	1.5	2.5	1
1993 (1056,432)	1.5	1.5	-	1

Between brackets are the number of PHDs and the number of journals included in Econlit at the time of PHD.

Table 2 shows that even if one publishes, chances are small that you will publish a lot. Of the 1970 PHDs the median is three (whole) articles over the whole career, the mean being a lot higher at 6.4 articles⁶. If we look at the 7 year interval, we see that over time there's a slight decline of the median number of articles published (conditional on publishing) but the twelve years interval shows the reverse.

In addition to the question whether one will publish at all, it's also interesting to know whether one has a chance to publish in one of the major journals. To look at this we computed the statistics of column 1 and 2 but using only the publications in *Econometrica*, the *Journal of Political Economy*, the *American Economic Review* and the *Quarterly Journal of Economics*.

Table 3: % publishing in four top journals.

PHDYEAR	%, 69 – 98	%, t-1 until t+5	%, t-1 until t+10	#, t-1 until t+5
1970/1971 (804,196)	14.4	10.2	12.4	1
1981/1982 (718,255)	10.7	7.5	9.6	0.83
1988(780,313)	9.4	6.5	8.5	1
1993 (1067,432)	5.5	5	-	1

Between brackets are the number of PHDs and the number of journals included in Econlit at the time of PHD.

Publishing in one of the four top journals is even a more rare occasion as only about 1 out of 10 PHDs succeeded in it. Note that we observe again a decline over time in the chance to publish while the median number of articles published when one publishes remains fairly constant.

Of course, so far we computed statistics for our sample. To give them an interpretation as general ‘chances to publish’ we need to judge to what extent our sample is representative for the whole population. To get a idea on this issue, we compare the numbers with the numbers from the NSF survey. Table 3 gives for each year under consideration the number of PHD’s on the list of the AEA and the number of PHD degrees issued in that year according to the NCED IPEDS survey⁷’ (from webcaspar).

Table 4: number of economics PHD degrees: NCED list versus AEA list.

Year	NCED	AEA LIST ⁸
1970	879	791
1981	865	676
1988	920	746
1993	1,014	1009

⁶ We will come back on this skewedness of the distribution of publications below.

⁷ Of course, this is also a survey but one that should be close to covering the whole population. Note that both the AEA survey and the NCED survey are surveys of graduate institutions so individual students are not needed as a source of information.

⁸ Excluded here are the Canadian PHDs of the AEA list.

As one can see there are some differences but both numbers are reasonably close which can be seen as an indication that our sample is a relatively large part of the population which implies that it's not that risky to interpret our percentages as (unconditional) probabilities⁹. At the other side, when looking at the distribution of graduates over different universities there are some clear differences: some PHD of the AEA-list cannot be found in the counts (by university) of the NSF and some of the PHDs of the NSF list cannot be found in the AEA-list.

Of course, conditional probabilities can even be more informative. Therefore we look at the performance per university so as to see whether graduates of different universities have different publishing probabilities. Of course, one should beware of the fact that the number of PHDs on which the statistics are based are small (and hence the impact of possible errors substantial) and for one year only! Table 5 gives, for those universities that had 10 or more PHDs in 1970, the percentage of 1970 Phd's that published in all journals and the percentage that published in one of the 4 top journals.

Table 5: University-rankings, 1970 data.

University	#phds	% all journals	%top journals
U Chicago	18	94.4	50.0
Princeton U	14	85.7	35.7
U Harvard	32	81.3	37.5
U WI Madison	19	78.9	26.3
U Stanford	23	78.3	39.1
Purdue U in	42	73.8	14.3
Boston College	11	72.7	9.1
U IL Urbana Ch	14	71.4	0.0
U PA	24	70.8	16.7
Washington State U	16	68.8	0.0
Northwestern U	12	66.7	41.7
MI State U	55	63.6	3.6
U MN Twin Cities	24	58.3	20.8
U Ca Berkeley	57	57.9	15.8
Columbia U	19	57.9	21.1
Cornell U	35	57.1	8.6
U NC Chapel Hill	13	53.8	0.0
U CO Denver	15	53.3	6.7
Duke U	17	52.9	11.8
U MO St Louis	12	50.0	0.0

⁹ At the other side, when looking at the distribution of graduates over different universities there are some clear differences: of the 1068 PHD according to the AEA-list, 279 can't be found in the counts (by university) of the NSF and 225 of the NSF list cannot be found in the AEA-list. Note that the same is true when comparing the NCED counts with those of yet another survey (by the NSF).

U TX Austin	10	50.0	10.0
IA State U	14	42.9	0.0
U FL	14	42.9	0.0
U MI Ann Arbor	18	38.9	5.6
KS State U	13	38.5	7.7
U Southern CA	14	35.7	14.3
U AL	23	34.8	0.0
IN U Purdue U	11	27.3	0.0
U OR	12	25.0	8.3
OH State U	13	7.7	0.0

One can see that there's a large variation over universities ranging from an 'almost sure to publish' university (Chicago) to an 'almost sure not to publish' university (OH State U¹⁰). Note further that there seems to be a link with the 'research-reputation' of the university as Chicago, Princeton, Harvard and Stanford are generally found at the top of the economics departments rankings. So one can use economics as a prime example of the effects of the quality of education: better universities seem to give a higher chance on 'professional success'. At the same time it is an excellent example of the difficulties to reveal this relationship as those universities are also able to attract the better students¹¹. Note further that the gap between the students of these top schools (now Northwestern included) and the others is even bigger when looking at the percentage publishing in the top journals¹².

Next, we look at the 7 year interval t-1 until t+5 for each of the 4 years.

Table 6: University-rankings, 7-year interval data.

University	1970	1981	1988	1993	#PHDs	Average
Princeton U	57	92	86	82	64	79.7
MIT	80	69	64	90	89	75.3
U CA Santa Barbara	100	100	75	50	12	75.0
Brown U	67	67	83	67	27	74.1
U British Columbia	100	56	100	71	21	71.4
U VA	83	82	0	73	31	71.0
U Rochester	71	63	-	73	26	69.2
Northwestern U	50	80	33	100	44	65.9
U Stanford	57	75	55	72	81	65.4
U Chicago	72	-	75	54	73	64.4
U Harvard	66	50	17	72	95	64.2
U MN Twin Cities	46	70	58	55	108	58.3

¹⁰ Based on the data for 1970, below we show that it does better when taking some subsequent years.

¹¹ MIT is not included because there were only 4 MIT graduates in the 68th list.

¹² Of course, part of this might be explained by an insider bias (see also Coupé 2000).

U IA	60	25	75	50	21	57.1
U Ca Berkeley	37	53	77	74	133	56.4
U IL Urbana Champaign	43	47	1	1	96	56.3
U PA	50	100	61	57	66	56.1
UCLA	40	70	48	60	61	55.7
Columbia U	53	50	55	62	70	55.7
Lehigh U, PA	0	0	0	75	11	54.5
U NC Chapel Hill	38	80	43	57	37	54.1
U WI Madison	68	35	35	47	110	52.7
Cornell U	46	60	63	48	88	51.1
Johns Hopkins U	67	50	50	44	26	50.0
Purdue U in	48	85	37	40	89	49.4
Washington State U	50	22	50	64	42	47.6
NC State U	50	31	50	60	30	46.7
Duke U	29	67	33	63	37	45.9
Boston College	45	100	33	50	29	44.8
TX A&M U	43	25	27	100	27	44.4
U WA	50	70	40	29	45	44.4
Clark U	50	33	33	50	14	42.9
George Washington U	50	60	0	33	31	41.9
MI State U	42	38	26	73	106	41.5
U MI Ann Arbor	17	58	29	73	83	41.0
NYU	60	38	33	38	45	40.0
Southern Methodist U	100	50	20	33	13	38.5
SUNY Binghamton	33	57	0	43	21	38.1
Syracuse U, NY	40	0	60	33	16	37.5
PA State U	22	33	40	43	30	36.7
IA State U	36	29	50	33	63	34.9
Temple U	100	33	0	33	12	33.3
OH State U	8	56	29	32	61	32.8
U SC	67	26	30	43	56	32.1
Rutgers U NJ	50	50	25	0	19	31.6
KS State U	15	67	33	100	20	30.0
Claremont Graduate Schl	50	25	17	20	21	28.6
U OR	8	67	33	0	23	21.7
U Notre Dame IN	11	40	20	9	30	16.7

We took only those universities for which we have for observations in each of the 4 years, plus Chicago and Rochester. Average is the sum of the number of phds over these 4 years divided by the sum of the number of PHD's that published.

One can again see that some universities give on average a higher chance to publish than do others. Note however that even within universities the variability is fairly high. To check whether the decline we observed in the chance to publish for new PHDs is due to a changing composition of the universities in the sample we computed

the weighted average quality of the PHDs (using 93-NRC ratings). This average quality however remained fairly stable over time (3.22 – 3.08 -3.14 –3.22)¹³.

To check whether the chance to publish is related to the quality of the department as measured by the 1993 NRC research rating (which varies between 0 and 5), we ran a simple regression resulting in

$$\text{Average chance to publish} = 0.215 + 0.091 * \text{NRC-rating} \quad (n=43)$$

$$(0.051) \quad (0.015) \quad R^2_{\text{adj}}=0.51$$

So a PHD from a 5 NRC-rated department has more than twice the chance to publish of a PHD from a 1 NRC-rated department.

Additional Statistics

Next we look at the three stylized facts concerning the distribution of scientific output (see David (1994)): skewness, persisting hierarchies and increasing concentration.

First, the distribution of scientific production tends to be very skewed to the left. Some articles have tested whether this ‘Lotka’s law’ is also valid for economics (Cox and Chung (1991), Chung and Cox (1990), Chung and Puelz (1992), Coupé(2000)). Lotka’s law states that about 60% of the authors publishes only once and that the number of authors that publishes n papers equals the number of authors that only publish once divided by n squared. (So $a_n = a_1/n^2$). Until now, this law has been tested by taking all people that have published in a certain year or time-period, which implies that several generations of economists are mixed. Here we will test whether this law holds when one takes the publications of one generation of economists over their whole career.

First, note that our 58.9% of publishing PHDs are very close to Lotka’s 60% -rule for the number of one time publishers. However, the number that published at least one whole article (so after controlling for co-authorship) in our sample is only 41.5%!

Table 8: Lotka’s law. $\log(a_n/a_1) = \alpha + c * \log(n) + \epsilon$

	#article (n=1-34)	t-stat	#articles-co-authors (n=1-26)	t-stat
α	0.37	1.6	0.42	1.7
C	-1.23	-14.5	-1.37	-14.2

¹³ The number of phds from not ranked universities evolved too: 53-94-62-99.

Hence, our lifetime data indicate a much higher concentration than is usually found for mixed generations data.

This brings us to the second stylized fact, the persistence of rankings: somebody publishing a lot in one period is also likely to publish a lot in the next period.

Table 9: the top 10 producers over the period 1969-1998.

	Name	#articles all journals	Name	#articles top 4 journals
1	Frenkel,-jacob-a.	64.8	Heckman,-james-j.	21.1
2	Friedman,-Benjamin-n.	64	Frenkel,-jacob-a.	14.5
3	Brada,-josef-c.	59.7	Parsons,-donald-O.	13.5
4	Schmidt,-Peter	55.8	Ashenfelter,-orley-c.	12.3
5	Tower,-edward	54	Schmidt,-Peter	10.8
6	Sandler,-todd	52.7	Browning,-edgar-K.	10
7	Gilbert,-robert-A.	49.3	Friedman,-Benjamin-n.	10
8	Browning,-edgar-K.	49	Griffin,-james-M.	10
9	Heckman,-james-j.	48.3	Ehrlich,-isaac	9.8
10	Deardorff,-alan-v.	39.8	Darby,-Michael-r.	8.7

Very remarkable is that James Heckman (Nobel 2000) is not only in the top 10 of the number of articles, he also published the most articles in our 4 top reviews! Note moreover that those that produce a lot also produce a lot of quality articles as 5 economists are both in the top 10 for the number of articles as in the top 10 for the high quality articles.

The next table looks at whether these 10 people were continuously at the top or rather concentrated their publications in one period.

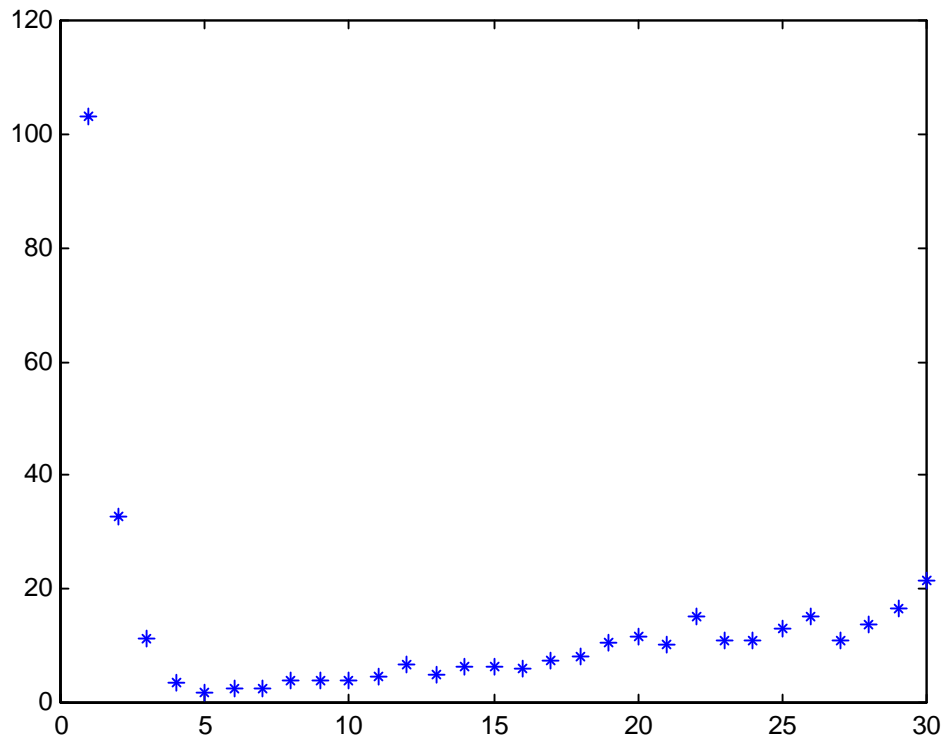
Table 10: rank of top 10 publishers over time.

69-98	Name	69-73	74-78	79-83	84-88	89-93	94-98
1	Frenkel,-jacob-a.	5	6	1	1	14	110
2	Friedman,-Benjamin	99	3	2	5	2	9
3	Brada,-josef-c.	16	9	7	8	1	2
4	Schmidt,-Peter	9	1	10	14	8	10
5	Tower,-edward	2	7	4	2	24	17
6	Sandler,-todd	41	11	14	3	4	3
7	Gilbert,-robert-A.	26	16	3	4	6	12
8	Browning,-edgar-K.	28	2	35	7	13	18
9	Heckman,-james-j.	260	12	40	6	3	1
10	Deardorff,-alan-v.	46	21	12	10	18	4

Note that our top 10 producers have been consistently among the top producers of their cohort, confirming the stylized fact of persisting hierarchies.

The third stylized fact claims that inequality grows over time. Allison et al (1982) use the following inequality measure: $C=(\text{stdev}-\text{mean})/(\text{mean}^2)$. For a sample of chemists and biochemists, they indeed found that this statistic rises over time. Fig 1 plots the evolution of this statistic using our economist sample

Figure 1 : inequality over time.



How can such an evolution be explained? One reason might be that those that proved to be good get more research money and that in this way they can increase their advantage (cumulative advantage). To get a first glance on this, we matched the publication data with the grant data from the NSF. We have information on all NSF ‘Economics’ grants from 1989 onwards. 12 people in our sample got a grant from the NSF between 89 and 98 (date at which grant began!). If we look at their rank (based on the number of publications until 88), 7 are within the top 60 so it is clear that the more you publish the more chance you get a NSF grant. Still, 4 people are not in the top 100. (Note that 473 people published but only 235 people published between 1985 and 1989).

Table 11: NSF grants and publishing.

Name	Rank 69-88	Amount of NSF money	Number of grants	Rank 69-88
Bewley,-truman	41	286300	3	41
Cox,-james-c.	86	303300	4	86
Edwards,-linda-n.	114	33180	1	114
Ehrenberg,-ronald-G.	10	3210	1	10
Heckman,-james-j.	20	944630	5	20
Honig,-marjorie-h.	169	99140	2	169
Johnson,-william-g.	196	78390	1	196
Loehman,-Edna-t.	198	72800	2	198
Maccini,-Louis-J.	57	64830	1	57
Sandler,-todd	13	134480	2	13
Schmidt,-Peter	2	466500	3	2
Witte,-Ann-D.	29	179910	1	29

The amount of money is weighted for the number of co-investigators, the number of grants is not.

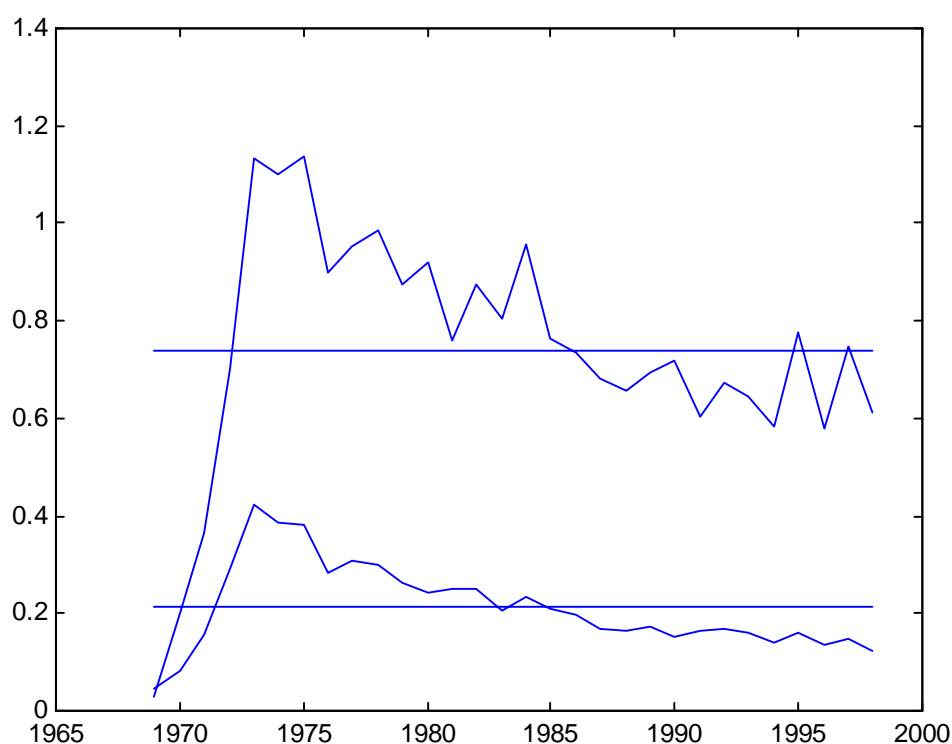
Not only is it more likely to get a grant when having published a lot in the past, also the amount of money you get seems to be higher.

The Life Cycle of an Economist.

How long can one expect to be active as a researcher? Few people publish before they finish their PHD, about 3 years after the PHD 21% of the PHD's will publish and then the chance of publishing in a given year declines about 0.5% a year with about 7% publishing an article 28 years after finishing their PHD. Still, about 20% of the class of 70/71 has published something between 1994 and 1998. If we take the 6 five year periods between 1969 and 1998, 70 people published in each interval, 42 people in 5 periods, 57 in 4 periods, 56 in three periods, 98 in two periods and 149 in only one period.

To get an idea whether output declines as one gets older, figure 2 plots the evolution of the average production of the phds that published at least once, with a horizontal line indicating the average annual production over the life (comparing to this average is equivalent to getting rid of fixed effects).

Figure 2: the life cycle of the economist



One can see a clear hump-shape, with the maximum around 1973 and an above average production from 1972 to 1985. If we look only at the ‘continuous publishers’ (those publishing in each of the six 5 year periods between 1969 and 1998), we get a similar pattern though the drop is less violent¹⁴.

Conclusions

Before deciding whether or not to do a PHD in economics, one should be aware of the following facts:

- Only about half of those finishing their PHD will publish at least part of their PHD thesis. And less than one out of five can expect to publish one day in one of the four top journals.
- Even for those that succeed in publishing, it is unlikely that they will publish a lot.

¹⁴ Traditionally one looks at the past production of a sample of profs that are active at the end of the sample period (Oster and Hamermesh (1998), Goodwin and Sauer(1995)). This means that one looks at those people that were likely to be productive in the beginning (to become prof one tends to need publications) and that remained prof afterwards which might should shift the life cycle curve upwards. Here we have a true cohort! Note that by taking all people we do not control for economists that died.

- There's a huge variation in the 'chance to publish' of graduates of different universities. The higher the scholarly quality of the faculty (as measured by the NRC-ratings), the more likely it is that the graduates will publish.

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Appendix

List of all time journals

- 2 Accounting-Review
- 13 American-Economic-Review
- 14 American-Economist
- 16 American-Journal-of-Agricultural-Economics
- 17 American-Journal-of-Economics-and-Sociology
- 25 Antitrust-Bulletin
- 41 Aussenwirtschaft
- 45 Australian-Economic-Papers
- 48 Australian-Journal-of-Agricultural-Economics
- 50 Banca-Nazionale-del-Lavoro-Quarterly-Review
- 60 Bulletin-for-International-Fiscal-Documentation
- 61 Bulletin-of-Economic-Research
- 66 Business-History-Review
- 72 Canadian-Journal-of-Agricultural-Economics
- 102 De-Economist
- 112 Eastern-European-Economics
- 114 Econometrica
- 121 Economia-Internazionale
- 124 Economica
- 133 Economic-Development-and-Cultural-Change
- 134 Economic-Geography
- 136 Economic-Inquiry
- 138 Economic-Journal
- 142 Economic-Record
- 164 Ekonomiska-Samfundets-Tidskrift
- 205 Federal-Reserve-Bank-of-St.-Louis-Review
- 206 Federal-Reserve-Bulletin
- 209 Finance-and-Development
- 223 Foreign-Affairs
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