THE MATTHEW EFFECT DEFINED AND TESTED FOR THE 100 MOST PROLIFIC ECONOMISTS

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Abstract

The Matthew effect has that often-cited papers/authors are cited more often. I use the statistical theory of the growth of firms to test whether the fame of papers and authors indeed exhibits increasing returns to scale, and confirm this hypothesis for the 100 most prolific economists.

Key words

Matthew effect, increasing returns to scale, citation analysis

JEL Classfication

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1. Introduction

To those that have shall be given. Merton (1968) coined the term “Matthew effect” for the phenomenon that fame breeds fame, that often-cited papers get cited more often, and that influential authors gain more influence. The reasons are intuitive. Famous works are easily noted; and authority lends weight to an argument. See Strevens (2006). There is abundant anecdotic support for the Matthew effect, but a rigorous empirical test fails. This paper contributes to that.

Previous studies (e.g., Brown, 2004) have defined and estimated a Matthew indicator, which equals the number of citations in excess of the number of citations that would be expected on the basis of the journal impact factor. Bonitz *et al*. (1997, 1999; see also

Bonitz, 2005) measure this for countries, and finds empirical support for the Matthew effect. However, this indicator cannot be used for individual authors or papers. Certain papers and certain authors are quoted more often that others because they are higher quality or more relevant. The Matthew effect holds that an already influential paper or author is cited more often. This paper defines a test for the Matthew effect for the papers of a single author; and for authors within a single discipline.

A mathematician or physicist would refer to the Matthew effect as a positive feedback. An economist would call the Matthew effect increasing returns to scale. I borrow from the latter literature. Simon (1955) shows that, if one considers a number of firms of different size, and those firms grow all at the same rate, then the size distribution of those firms will converge to Gibrat's Law. That is, the log of the firm size is proportional to the log of the rank. Gibrat's Law is also known as Zipf's Law (generalised), and the distribution is the Pareto or Lotka distribution. See Egghe (2005).

Ijiri and Simon (1974) show that if larger firms grow proportionally faster (slower) than small firms, then the size distribution is more (less) curved than the Pareto distribution. They also designed an empirical test. Estimate

(1) $$\ln(size) = \alpha + \beta \ln(rank) + \gamma \ln^2(rank)$$

If γ is significantly smaller (greater) than zero, there are increasing (decreasing) returns to scale.

Walls (1997) and Hand (2001) apply this to box office receipts, and Maddison (2004) to Broadway shows. Here, I look at papers and authors. I define and compute within- and between-author Matthew effects. For the within-author Matthew effect, I check whether citations to a paper are affected by the number of previous citations to that paper, using Equation (1). As this is done per author, this automatically controls for "author quality". For the between-author effect, I estimate whether citations to an author are affected by the number of previous citations to that author.

Section 2 presents the data and methods. Section 3 shows the results. Section 4 concludes.

2. Data and Methods

The 100 most prolific economists were identified from *IDEAS/REPEC*, using the "number of distinct works" in May 2007.[1] As *IDEAS/REPEC* still has only a poor coverage of citations, publication and citation data for these 100 economists were downloaded from the *ISI Web of Science*. See Table A1.

Table 1 shows some of the characteristics of the authors. IDEAS/REPEC includes working papers, which may not be published (yet) in a journal covered by the Web of Science, so the number of publications is higher in IDEAS/REPEC that in the Web of Science.[2] The number of papers varies between 12 and 204. The year of first publication varies between 1942 and 1995; and the number of papers published per year ranges

[1] See http://ideas.repec.org/top/top.person.dnbworks.html for the latest ranking.
[2] This led to the exclusion of Nicholas Cox and Carmen Guisan.

between 0.5 and 7.5. The number of cited papers varies between 12 and 164, and the lowest fraction of cited paper is 46%. The total number of citations ranges from 60 to 10,373. Four economists in the sample have citation numbers over 10,000: Joseph Stiglitz, Robert Engle, James Heckman, and Andrei Shleifer. It should be noted that Shleifer is some 20 years younger than Stiglitz, and 10 years younger than Engle and Heckman. The number of citations per year ranges from 2 to 436. The number of citations per paper ranges from 2 to 125, when averaged over authors. The most-cited paper is Engle and Granger (1987), with 3,438 citations. The number of citing papers ranges from 57 to 7,492, and the citations per citing paper from 1.01 to 1.91. The number of citing papers, excluding self-citations, ranges from 54 to 7,402. The self-citation rate – the number of self-citing papers over the number of papers – ranges from 8% to 85%. The h-index ranges from 8 to 52, and the h-index per year from 0.2 to 2.3. On a more qualitative scale, the list of economists includes various Nobel laureates and candidates, but also people previously unknown to the current author. Thus, the assembled authors are very different in all aspect but one: They have published a sufficient number of papers to estimate a within-author Matthew effect.

I estimate a within-author Matthew effect, and a between-author Matthew effect. For the within-author Matthew effect, I estimate Equation (1) where "size" is the number of citations per paper. For the between-author Matthew effect, I estimate Equation (1) where "size" is the number of citations, the number of citations per paper, the number of citing papers, and the number of citing papers corrected for self-citations.

3. Results

Figure 1 shows the results for the within-author Matthew effect. If there were no Matthew effect, we would expect that 5 out of 100 authors have an estimate for the γ parameter in Equation (1) that is significantly different from zero. Instead, 99 authors have a γ that differs from zero at the 5% significance level, and 97 at the 1% significance level. The estimated γ varies between -0.08 and -0.65. The average estimate is -0.301 with a standard deviation of 0.003.

Self-citations induce other-citations (Aksnes, 2003). A one-point increase in the self-citation rate leads to 44 additional citations, with a standard deviation of 11. However, there is no significant relationship between self-citation and the estimated strength of the Matthew effect. Medoff (2006) shows that the total number of self-citations to previous papers does not affect the number of citations to a current paper. These findings suggest that other-citations discriminate for paper quality and relevance, but self-citations do not.

The Matthew effect as defined and estimated here is not correlated to the number of papers or citations either. However, the Matthew effect is stronger (i.e., γ is more negative) for authors with higher h-indices, citations per paper, and citation per year.

Table 2 shows the between-author Matthew effect for four alternative measures of influence. Regardless of whether one looks at total citations, citations per paper, number of citing papers, or number of citing papers excluding self-citations, the estimated γ parameter is negative, and highly significant.

Applying Equation (1) to all 6883 cited papers leads to an estimated γ of -0.228, with a standard deviation of 0.002, again highly significant.

4. Discussion and conclusion

In this paper, I apply Simon's (1955) theory of the growth of firms to analyse citations to papers. I find that often-cited papers are cited more often, and that often-cited authors are cited more often. This implies that there are "increasing returns to scale" in influence, and that Merton's (1968) Matthew effect is real.

It would be good to test this for other disciplines. The results confirm that it is a hard journey from being an unknown upstart to a famous economist. The fact that fame breeds fame implies that citations alone are not a good criterion of quality. Because of positive feedback loop in influence, in the middle of "quality distribution", some papers and authors are propelled to fame, while other, equally good papers and authors linger in obscurity.

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Table 1. Characteristics of the 100 economists.

	mean	st dev	Min	max
Papers (IDEAS/REPEC)	143	38	107	295
Papers (Web of Science)	84	40	12	204
Papers/year	2.77	1.27	0.46	7.47
Cited papers	68	33	12	164
Fraction non-cited	0.20	0.11	0.00	0.54
Citations	1936	2266	60	10373
Citations/year	60.3	69.3	2.3	435.7
Citations/paper	21	21	2	125
Citing papers	1475	1639	57	7492
Citations/citing paper	1.28	0.18	1.01	1.91
Citing papers excl. self-citations	1430	1626	54	7402
Self-citation rate	0.51	0.18	0.08	0.85
h-index	19	10	5	52
h-index/year	0.63	0.34	0.16	2.26
Year of first publication	1976	10	1942	1995

Table 2. The between-author Matthew effect for four different measures of influence.

	Estimate	Standard deviation
Citations	-0.2175	0.0071
Citations per paper	-0.3787	0.0103
Citing papers	-0.2595	0.0093
Citing papers excl. self-citations	-0.2501	0.0091

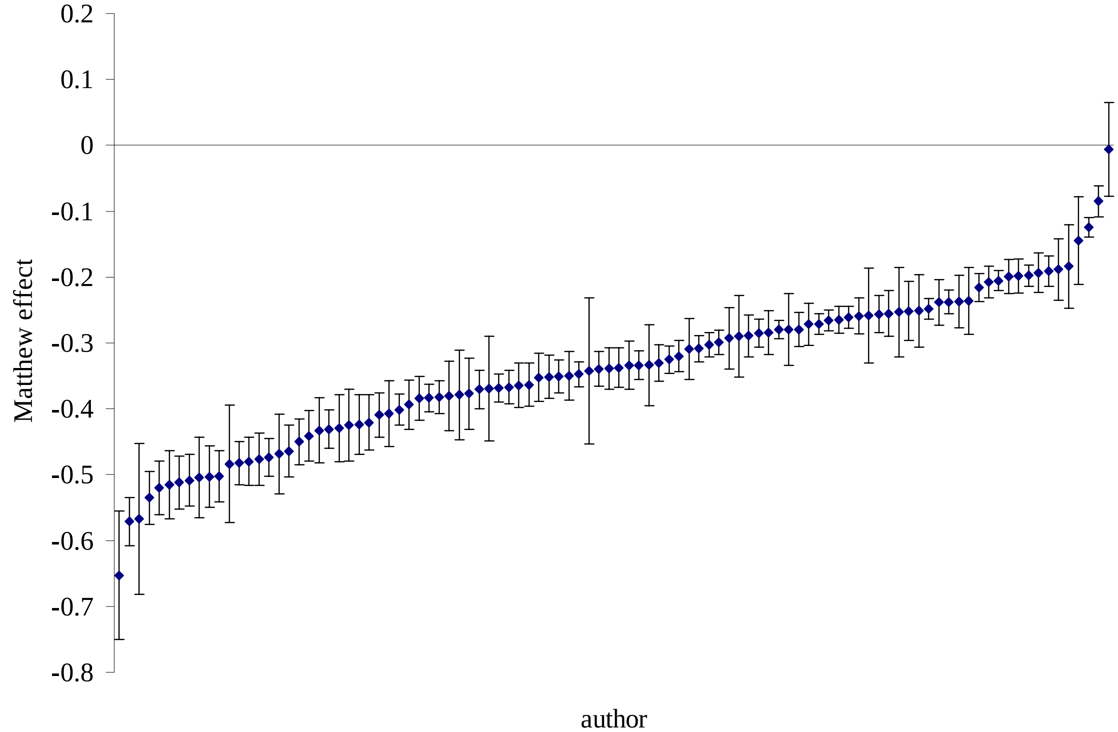

Figure 1. The estimated within-author Matthew effect for the 100 selected authors. The range is the 67% confidence interval.

Table A1. The 100 most prolific economists according to IDEAS/REPEC (I/R), May 2007, and their publication and citation data according to the Web of Science (WoS).

Name	Papers			Citations	Citing papers		h	Oldest	alpha		beta		gamma	
	I/R	WoS	cited		all	w.o. self		paper	mean	s.d.	mean	s.d	mean	s.d.
Joseph E. Stiglitz	295	190	183	13565	10657	10509	53	1966	6.24	0.25	0.48	0.15	-0.26	0.02
Peter C.B. Phillips	261	160	128	7405	4122	3992	34	1974	6.70	0.14	0.06	0.09	-0.28	0.01
Stephen J. Turnovsky	257	169	150	1972	1421	1291	24	1967	3.24	0.21	1.03	0.13	-0.31	0.02
Martin Shubik	255	149	103	1205	998	935	17	1957	4.51	0.14	0.26	0.10	-0.27	0.02
Barry Julian Eichengreen	241	101	78	800	705	674	15	1980	3.84	0.16	0.41	0.12	-0.29	0.02
Martin S. Feldstein	211	186	164	5473	4222	4122	40	1967	4.33	0.27	1.32	0.16	-0.40	0.02
M. Hashem Pesaran	208	92	85	2361	1736	1665	25	1973	4.76	0.20	0.71	0.15	-0.37	0.03
Sebastian Edwards	198	78	63	1202	1022	983	18	1982	4.58	0.24	0.44	0.19	-0.35	0.04
John Whalley	194	130	92	1335	1117	1049	17	1973	4.94	0.19	-0.17	0.14	-0.19	0.02
Jean-Jacques Laffont	191	160	135	2838	2104	2003	29	1972	4.43	0.22	0.82	0.14	-0.33	0.02
Bruno S. Frey	184	140	123	2216	1672	1586	27	1969	3.95	0.20	1.07	0.13	-0.38	0.02
Richard B. Freeman	184	96	80	2757	2235	2199	27	1973	4.35	0.25	1.30	0.18	-0.48	0.03
Dermot James Hayes	182	62	39	635	421	399	13	1987	4.42	0.26	0.02	0.24	-0.28	0.05
Werner Gueth	181	79	48	853	650	613	11	1982	5.67	0.13	-1.15	0.11	-0.09	0.02
Jason Shogren	180	154	119	1360	839	728	19	1987	4.01	0.18	0.39	0.11	-0.24	0.02
James J. Heckman	179	138	116	10081	7492	7402	41	1972	6.41	0.30	0.48	0.20	-0.34	0.03
David A. Peel	177	189	121	769	605	549	11	1973	4.19	0.14	-0.28	0.09	-0.12	0.01
Christopher F Baum	177	28	15	104	103	99	5	1977	3.36	0.24	-0.33	0.34	-0.34	0.11
Jeffrey Alexander Frankel	174	69	62	2125	1745	1707	24	1979	4.73	0.27	1.14	0.21	-0.54	0.04
Bruce Alan Babcock	172	40	34	449	356	338	14	1990	3.07	0.26	1.12	0.26	-0.50	0.06
Jean Tirole	169	120	112	5068	3817	3728	46	1981	3.82	0.36	1.81	0.24	-0.50	0.04
William Poole	166	44	27	551	525	515	8	1967	5.19	0.24	-1.07	0.26	-0.14	0.07

Andrew Hughes Hallett	165	27	17	60	57	54	5	1982	2.17	0.17	0.25	0.22	-0.38	0.07
Laurence J. Kotlikoff	165	58	49	1370	1057	1027	18	1977	4.90	0.22	0.63	0.19	-0.46	0.04
James Poterba	161	12	12	250	242	239	8	1982	4.12	0.16	0.06	0.25	-0.48	0.09
J. Scott Armstrong	157	74	65	2146	1902	1858	19	1970	5.40	0.37	-0.12	0.29	-0.25	0.05
Carl Chiarella	157	55	29	162	141	118	7	1966	3.29	0.18	-0.04	0.19	-0.31	0.05
John C. Quiggin	156	119	94	1217	1010	936	16	1979	4.70	0.22	-0.12	0.15	-0.20	0.03
Helen H. Jensen	155	26	16	99	96	94	7	1982	2.64	0.23	0.79	0.31	-0.65	0.10
Mark P. Taylor	154	99	91	1815	1158	1100	24	1987	4.48	0.16	0.67	0.11	-0.35	0.02
Alan B. Krueger	152	67	62	3024	2487	2454	27	1988	5.27	0.25	0.79	0.20	-0.44	0.04
Lawrence H Summers	150	110	96	5644	4689	4646	39	1980	4.98	0.31	1.33	0.22	-0.48	0.04
Wolfgang Karl Haerdle	150	86	74	2057	1437	1377	24	1984	4.79	0.20	0.54	0.15	-0.33	0.03
Clive W. J. Granger	149	136	104	8792	6652	6575	36	1957	6.43	0.27	0.37	0.18	-0.34	0.03
Christian S. Gourieroux	147	56	45	1075	960	939	14	1980	5.16	0.18	0.11	0.16	-0.38	0.03
John Christopher Beghin	145	39	26	153	125	107	8	1990	2.72	0.18	0.46	0.20	-0.38	0.05
Marcel Boyer	145	39	31	243	202	179	8	1975	3.17	0.25	0.34	0.25	-0.33	0.06
Robin W. Boadway	141	68	61	778	646	618	15	1973	3.86	0.24	0.54	0.19	-0.33	0.04
Jere Richard Behrman	141	113	99	1617	1101	1019	24	1964	3.74	0.21	0.83	0.14	-0.32	0.02
Ronald MacDonald	140	92	69	696	505	452	14	1983	3.97	0.12	0.22	0.09	-0.26	0.02
Michael McAleer	139	123	87	708	494	419	15	1979	4.34	0.13	-0.14	0.09	-0.20	0.02
Joshua Aizenman	139	64	50	364	304	266	10	1981	3.60	0.16	0.09	0.14	-0.26	0.03
Bennett McCallum	137	83	69	1706	1399	1340	24	1967	4.33	0.21	0.95	0.16	-0.43	0.03
Paul A. Samuelson	136	204	152	4848	4229	4140	33	1942	5.39	0.20	0.54	0.12	-0.30	0.02
Lars E.O. Svensson	136	94	84	2397	1679	1623	23	1976	4.29	0.27	1.05	0.19	-0.41	0.03
Richard J. Arnott	134	73	67	1311	1031	987	22	1977	3.87	0.24	1.09	0.18	-0.45	0.03
Olivia S. Mitchell	134	35	25	442	372	359	14	1980	3.44	0.39	1.07	0.44	-0.57	0.11

David F. Hendry	134	93	82	3534	2248	2172	26	1966	5.76	0.19	0.38	0.14	-0.35	0.02
Rudiger Dornbusch	132	96	71	2552	2215	2192	22	1971	5.67	0.23	0.22	0.18	-0.36	0.03
Andrei Shleifer	131	111	107	10022	6309	6219	52	1985	5.12	0.36	1.60	0.24	-0.51	0.04
Stephen P. Jenkins	130	56	49	628	541	522	14	1982	3.82	0.21	0.62	0.18	-0.39	0.04
David Neumark	130	94	78	1444	1106	1040	20	1988	4.49	0.24	0.34	0.18	-0.27	0.03
David M. Newbery	130	53	44	642	524	499	12	1970	4.62	0.21	-0.22	0.19	-0.24	0.04
Robert F. Engle	129	83	73	10373	7429	7363	32	1972	7.36	0.34	-0.15	0.25	-0.29	0.05
Robert J. Barro	127	97	83	9501	6978	6915	40	1970	6.07	0.41	1.16	0.29	-0.52	0.05
Daniel L. Thornton	127	35	26	219	199	182	7	1980	4.18	0.25	-1.23	0.27	-0.01	0.07
Jeffrey Marc Wooldridge	126	39	30	765	695	678	13	1988	4.94	0.31	-0.02	0.32	-0.37	0.08
Andre de Palma	126	92	71	1203	819	749	19	1981	4.20	0.21	0.68	0.16	-0.37	0.03
Ngo Van Long	124	94	56	319	303	284	9	1973	3.38	0.13	0.03	0.11	-0.22	0.02
Philippe Michel	124	86	60	398	361	332	10	1972	3.84	0.17	-0.15	0.13	-0.20	0.03
David B. Audretsch	124	81	68	1851	1246	1188	19	1987	5.29	0.18	0.26	0.14	-0.34	0.03
Richard S.J. Tol	122	64	48	525	326	279	13	1993	3.32	0.16	0.98	0.14	-0.47	0.03
Robert D. Tollison	122	182	137	1412	1183	1122	18	1968	4.25	0.16	0.19	0.10	-0.21	0.02
Philip Hans Franses	121	142	105	695	545	481	14	1989	3.31	0.14	0.44	0.10	-0.25	0.02
Daron Acemoglu	121	59	54	1559	1163	1122	22	1993	4.55	0.28	0.98	0.23	-0.50	0.05
David Matthew Levinson	120	41	24	142	119	101	7	1994	3.50	0.15	-0.52	0.18	-0.19	0.05
Bruce D. Smith	119	114	89	1129	731	677	18	1975	3.67	0.27	0.80	0.19	-0.35	0.03
W. Kip Viscusi	118	163	146	3394	2267	2145	31	1972	4.37	0.20	0.79	0.12	-0.30	0.02
Stephen M. Miller	118	76	57	586	522	495	12	1973	4.05	0.13	0.28	0.11	-0.33	0.02
Thomas J. Sargent	118	84	76	3516	2690	2641	27	1967	5.59	0.25	0.50	0.19	-0.36	0.03
Murray C. Kemp	117	129	98	917	782	732	16	1956	4.00	0.13	0.33	0.09	-0.27	0.02
Alberto Alesina	117	72	61	2832	2083	2030	27	1979	4.89	0.26	1.16	0.21	-0.52	0.04

Carl Walsh	116	52	44	605	519	495	12	1972	4.77	0.18	-0.32	0.16	-0.26	0.03
Michael David Bordo	115	63	45	400	352	330	9	1975	4.03	0.14	-0.08	0.13	-0.26	0.03
James Tobin	114	103	63	3133	2909	2896	22	1950	6.19	0.25	0.02	0.19	-0.35	0.04
David A. Hennessy	114	61	28	196	171	147	6	1995	3.67	0.19	-0.34	0.20	-0.24	0.05
Myrna Wooders	114	45	37	458	255	220	11	1978	3.78	0.19	0.55	0.19	-0.42	0.04
Andrew Rose	113	64	56	1476	1206	1184	22	1981	4.30	0.25	1.11	0.20	-0.51	0.04
William A. Brock	113	60	53	1904	1578	1544	21	1969	4.58	0.21	1.24	0.18	-0.57	0.04
Frederick (Rick) van der Ploeg	113	80	68	567	469	432	12	1980	3.51	0.22	0.42	0.17	-0.29	0.03
John M. Hartwick	112	66	52	1335	1192	1170	15	1971	5.88	0.14	-0.67	0.12	-0.21	0.02
Stijn Claessens	112	42	34	568	466	453	13	1988	4.59	0.27	-0.37	0.27	-0.18	0.06
Rik Hafer	112	40	32	304	273	263	10	1977	3.75	0.30	-0.08	0.30	-0.26	0.07
Daniel Hamermesh	112	103	80	1219	1016	967	18	1966	3.88	0.16	0.82	0.12	-0.37	0.02
William Arnold Barnett	112	58	39	920	481	444	18	1962	4.31	0.29	0.75	0.27	-0.47	0.06
Ray C. Fair	111	59	54	1586	1397	1360	21	1970	4.83	0.31	0.65	0.26	-0.43	0.05
Jaime A.P. de Melo	110	52	48	398	339	321	10	1977	3.37	0.18	0.33	0.16	-0.28	0.03
Lester Ingber	110	52	41	1266	751	707	19	1965	5.17	0.31	-0.01	0.28	-0.29	0.06
Eric S. Maskin	110	74	70	3169	2630	2593	28	1978	5.16	0.32	0.83	0.25	-0.42	0.05
Walter Erwin Diewert	109	62	57	2195	1740	1688	20	1971	5.47	0.31	0.41	0.25	-0.41	0.05
Stephen John Nickell	109	78	70	2467	2012	1974	25	1974	4.81	0.35	0.90	0.27	-0.43	0.05
Timothy J. Besley	108	62	54	1390	1150	1117	22	1988	4.25	0.33	0.88	0.27	-0.42	0.05
Olivier Blanchard	108	75	64	3566	3164	3138	28	1977	5.64	0.36	0.51	0.29	-0.38	0.05
Eric Ghysels	108	59	46	669	542	510	15	1980	3.82	0.21	0.86	0.19	-0.48	0.04
Gilles Saint-Paul	108	34	23	338	312	304	9	1992	4.41	0.22	-0.42	0.25	-0.25	0.07
Avinash Kamalakar Dixit	107	91	84	3891	3431	3396	27	1969	6.25	0.24	-0.28	0.17	-0.19	0.03
Walter Bossert	107	69	56	415	249	206	11	1986	3.41	0.16	0.31	0.13	-0.28	0.03
Philip Arestis	107	62	40	237	192	162	8	1976	3.33	0.17	-0.02	0.16	-0.24	0.03

Ping Wang	107	52	42	371	307	273	10	1990	3.77	0.23	0.01	0.21	-0.25	0.05
John Roemer	107	77	60	648	518	484	15	1976	3.50	0.16	0.75	0.13	-0.38	0.02

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