Herd Behavior in Occupational Choice*

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Abstract

In this paper we examine why many professional labor markets are disturbed by cycles in the supply of new workers. We present a model where cycles in labor supply are a consequence of herd behavior in occupational choice. We also present evidence from nearly 150 West German labor markets which supports the herd behavior model of labor supply cycles.

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1 Introduction

In many professional labor markets, as for example that for engineers, the supply of new workers follows a cyclical time path: periods when the supply of labor is high in these markets alternate with periods when it is low (Freeman and Leonard 1978, Drost 2002). Cycles in labor supply are problematic because wages seldom are perfectly flexible; therefore labor supply cycles tend to translate into a cyclical sequence of surplus phases when many workers are unemployed and shortage phases when many jobs are vacant. Moreover, when this type of sequence occurs in a market that is essential for research and development, the repeated shortage of R&D workers leads to a slowdown in economic growth: the annual growth rate of the United States, for instance, is reduced by 0.2 to 0.6 percentage points in any year in which 500 thousand R&D jobs cannot be filled with qualified professionals (Romer 2000). Motivated by these problems, we will present a theoretical model in this paper that can explain labor supply cycles. We will also present empirical evidence which supports the model.

Our model differs from previous ones in the way it determines the supply of new workers available in a given professional labor market. In the model developed by Zarkin (1982, 1983, 1985) the supply of new workers depends on the wages workers expect to earn in this market, where wage expectations are assumed to be rational. Since there is evidence that even personnel executives in large firms tend to badly forecast future salaries (Leonard 1982), the assumption of rational wage expectations is quite doubtful, though. In the model developed by Freeman (1971, 1972, 1975a, 1975b, 1976a, 1976b) the supply of new workers depends on wage expectations as well, but this time expectations are assumed to be myopic and not rational. Even the assumption of myopic wage expectations could be too ambitious, however, because it seems that only a minority of students is able to accurately rank different occupations by starting salary (Betts 1996). In our model we therefore take the position that workers have only vague wage expectations, if any, and this lack of information induces them just to enter the labor markets they expect to be entered by many other workers (according to the maxim that it cannot be wrong what many others do). The supply of new workers thus is determined by some sort of herd behavior in our model, a type of behavior which is not unusual in low-information environments.

Before we go into the details, let us first give a short overview of our theoretical model and the empirical test on it. The model is based on two assumptions, the first of which is that the number of new workers entering a professional labor market in some year t is increasing with the number of new workers expected to enter this market in that year (assumption of herd behavior in occupational choice). The second assumption of the model is that the expectation about the number of new workers entering a market in t is derived by extrapolation from the number of new workers entering the market in $t-1$ and $t-2$ (assumption of extrapolative expectations about occupational choice). As these two assumptions imply, the number of new workers entering a market in t depends on the number of new workers entering the market in $t-1$ and the number of new workers entering the market in $t-2$. The dynamics of the supply of new workers in a professional labor market thus is governed by a difference equation of order two, and as we will show in this paper, the time path solving this difference equation is determined by complex roots so that the path is characterized by cyclical ups and downs.

The empirical test of our model is based on three special properties of the difference equation: the coefficient of the lag-one term is larger than 0 and smaller than 2, the coefficient of the lag-two term is larger than -1 and smaller than 0, and the relation between the lag-one and the lag-two coefficient is equal to -2. To find out whether these properties can be validated empirically, we analyze time series data on the supply of new workers in nearly 150 West German professional labor markets. For each of these markets, we estimate an autoregressive process of order two, so obtaining estimates for the lag-one and the lag-two coefficient as well as for the relation between them. According to these estimates, there is indeed an overwhelming number of markets with cycles in the supply of new workers where the lag-one coefficient is larger than 0 and smaller than 2, the lag-two coefficient is larger than -1 and smaller than 0, and the relation between the two coefficients is in the neighborhood of -2. Some central predictions of the herd behavior model thus turn out to be correct, suggesting that we are on the right track when using the model to explain the cyclical behavior of worker supply observed in many professional labor markets. — In what follows, we will first present the theoretical model (section 2), then we will present the empirical evidence (section 3).

2 The Model

In our model we examine how the supply of new workers in a professional labor market $i \in \{1, 2, ..., N\}$ evolves over time $t \in \{1, 2, ...\}$, where any time period corresponds to one year. We denote the number of new workers who supply labor in market i at time t with $n_{i,t}$ and assume, for simplicity, that $n_{i,t}$ is a continuous variable. We think of this variable as being composed of a trend $n^*_{i,t}$ and a residual $n_{i,t}/n^*_{i,t}$: $n_{i,t} = n^*_{i,t} \cdot n_{i,t}/n^*_{i,t}$. The trend component $n^*_{i,t}$ is an exogenous variable and assumed to be a log-linear function of time. The residual component $n_{i,t}/n^*_{i,t}$ is endogenous and interpreted as the de-trended number of new workers entering market i at time t. The de-trended number of new workers is the variable we concentrate on in the rest of this paper. We want to explain why this number is cyclical over time and develop an explanation which is based on two assumptions.

The first assumption is that there is herd behavior in occupational choice. Because new workers have no or only very poor information about the pecuniary and nonpecuniary differences between occupations, they consider it best simply to imitate the occupational decisions of other new workers. Of course, when they make their choice of career, new workers do not know how the other ones will decide, and so all they can do is imitating the expected behavior of the others. The de-trended number of new workers entering market i at time t thus is an increasing function of the corresponding expected number $(n_{i,t}/n_{i,t}^*)^e$. Formally, the positive relation between these two numbers can be expressed as

$$\frac{n_{i,t}}{n_{i,t}^*} = h_i\left(\left(\frac{n_{i,t}}{n_{i,t}^*}\right)^e\right), \tag{1}$$

where h_i is a function of $(n_{i,t}/n_{i,t}^*)^e$ on $n_{i,t}/n_{i,t}^*$ with $h_i(1) = 1$ and $0 < h_i' < 1$. By imposing the condition $h_i(1) = 1$, we express that the de-trended number of new workers is one whenever corresponding expected number is; this condition is necessary to ensure that $n_{i,t}/n_{i,t}^*$ has a stationary state (see below). By requiring $h_i' > 0$, we indicate that the de-trended number of new workers is increasing with the expected number; this condition serves to introduce the herding effect into the model. By setting $h_i' < 1$, finally, we impose an upper bound to the herding effect; this upper bound is necessary to ensure that the stationary state of $n_{i,t}/n_{i,t}^*$ is stable (see below). Note that there is an index i being associated with the function h_i; this index indicates that the relation between the actual and the expected de-trended number of new workers need not be the same across professional labor markets — and it will not be the same, as the evidence presented in section 3 will show.

The second assumption our model is based on is that expectations about the de-trended number of new workers are derived by extrapolation from former de-trended numbers. If new workers observe that the de-trended number of new workers entering market i was rising in the past, then they will expect that the rise goes on; if, however, they observe that it was falling, then they will expect the fall to be continued. Expectations about the de-trended number of new workers are therefore derived according to the equation

$$\left(\frac{n_{i,t}}{n_{i,t}^*}\right)^e = \frac{n_{i,t-1}}{n_{i,t-1}^*} \cdot \frac{n_{i,t-1}}{n_{i,t-1}^*} \div \frac{n_{i,t-2}}{n_{i,t-2}^*}, \tag{2}$$

which states that the expected value of $n_{i,t}/n_{i,t}^*$ is equal to the past value of $n_{i,t}/n_{i,t}^*$ times the past growth factor of $n_{i,t}/n_{i,t}^*$. The reason why we model expectations this way is that other common ways to model expectations will not result in a cyclical pattern of $n_{i,t}/n_{i,t}^*$. Assume, for example, that expectations about the de-trended number of new workers are formed myopically so that $(n_{i,t}/n_{i,t}^*)^e = n_{i,t-1}/n_{i,t-1}^*$. Then combining this equation with equation (1) results in $n_{i,t}/n_{i,t}^* = h_i\left(n_{i,t-1}/n_{i,t-1}^*\right)$ with $h_i' > 0$, implying that the time path of $n_{i,t}/n_{i,t}^*$ is monotonic and not cyclical. Assume, as an alternative, that expectations about the de-trended number of new workers are formed rationally so that $(n_{i,t}/n_{i,t}^*)^e = n_{i,t}/n_{i,t}^*$. Then combining this equation with equation (1) yields

$n_{i,t}/n^*_{i,t} = h_i\left(n_{i,t}/n^*_{i,t}\right)$, a static equation implying that the time path of $n_{i,t}/n^*_{i,t}$ does not exhibit any dynamics at all.

The assumptions of herd behavior expressed in equation (1) and of extrapolative expectations expressed in equation (2) are the only assumptions our model is based on. By taking them together, we obtain the reduced form of the model

$$\frac{n_{i,t}}{n^*_{i,t}} = h_i\left(\left(\frac{n_{i,t-1}}{n^*_{i,t-1}}\right)^2 \div \frac{n_{i,t-2}}{n^*_{i,t-2}}\right), \tag{3}$$

a nonlinear difference equation of order two, which determines the dynamic behavior of $n_{i,t}/n^*_{i,t}$. Before we start to examine the dynamics, however, let us first analyze the stationary state of $n_{i,t}/n^*_{i,t}$. The stationary-state value of $n_{i,t}/n^*_{i,t}$ follows from the fact that the number of new workers $n_{i,t}$ must be equal to its trend component $n^*_{i,t}$ in the stationary state; so the de-trended number of new workers must be equal to one in the stationary state, or $n_{i,t}/n^*_{i,t} = 1$. Note that the stationary state will exist if and only if $h_i(1^2 \div 1) = 1$; this is the reason why we have imposed the condition $h_i(1) = 1$ on the function of h_i.

We are now going to examine the dynamics of $n_{i,t}/n^*_{i,t}$, but because the difference equation in (3) is nonlinear, we restrict the analysis to the local dynamics in the neighborhood of the stationary state. To begin with, we log-linearize the difference equation in (3) around the stationary state, so obtaining

$$\log\left(\frac{n_{i,t}}{n^*_{i,t}}\right) = 2 \cdot h'_i(1) \cdot \log\left(\frac{n_{i,t-1}}{n^*_{i,t-1}}\right) - h'_i(1) \cdot \log\left(\frac{n_{i,t-2}}{n^*_{i,t-2}}\right), \tag{4}$$

where log denotes the natural logarithm. This equation is a linear difference equation of order two which determines the local dynamics of $\log(n_{i,t}/n^*_{i,t})$, and because it is linear, we can analyze it by applying the usual methods. Before we will do this, we want to draw the reader's attention to three special features of this equation, however. Note first that, because we have assumed h'_i to satisfy the inequality $0 < h'_i < 1$ (otherwise there would be no herding or the model would be unstable, see below), the coefficient of the lag-one term of the equation, $2 \cdot h'_i(1)$, is larger than 0 and smaller than 2. Note second that, due to the same inequality, the coefficient of the lag-two term of the equation, $-h'_i(1)$, is larger than -1 and smaller than 0. Note finally that the relation between the lag-one coefficient $2 \cdot h'_i(1)$ and the lag-two coefficient $-h'_i(1)$ is equal to -2. If the model presented here is true, these three features of the difference equation should be observed in the majority of professional labor markets that exhibit cycles in the supply of new workers. We can therefore use the difference equation to evaluate the model empirically, which is exactly what we will do in the following section.

For the time being we stick to the theoretical analysis, however, and determine the time path of $\log(n_{i,t}/n^*_{i,t})$ that solves the difference equation in (4). This time path is $\log(n_{i,t}/n^*_{i,t}) = c_1 \cdot r_1^t + c_2 \cdot r_2^t$, where $c_{1,2}$ are constants which can be specified by initial conditions and $r_{1,2}$ are characteristic roots which can be derived from the characteristic equation $r^2 - 2 \cdot h_i'(1) \cdot r + h_i'(1) = 0$. As the solution of the characteristic equation, $r_{1,2} = h_i'(1) \pm \sqrt{h_i'(1) \cdot (h_i'(1) - 1)}$, shows, the time path of $\log(n_{i,t}/n_{i,t}^*)$ will be unstable if $h_i'(1) > 1$, a case that cannot be observed in practise; to avoid this problem, we have chosen $h_i'(1) < 1$ as one of the properties of h_i. With $h_i'(1) < 1$, the characteristic roots are complex conjugates, and this implies that we can apply De Moivre's theorem and some elementary trigonometry to the time path $\log(n_{i,t}/n_{i,t}^*) = c_1 \cdot r_1^t + c_2 \cdot r_2^t$, so being able to express it as

$$\log\left(\frac{n_{i,t}}{n_{i,t}^*}\right) = k_1 \cdot \left(\sqrt{h_i'(1)}\right)^t \cdot \cos\left(k_2 + \arccos\left(\sqrt{h_i'(1)}\right) \cdot t\right), \qquad (5)$$

where $k_{1,2}$ are functions of the constants $c_{1,2}$. As we can see by expressing the time path in this way, there are cyclical fluctuations in the motion of $\log(n_{i,t}/n_{i,t}^*)$ and, thus, in the motion of $n_{i,t}/n_{i,t}^*$. The herd behavior model can therefore explain why the de-trended number of new workers is cyclical over time.

By having shown that our model is able to explain cycles in the supply of new workers, we have made our main point. One additional point is worth mentioning, however, and this point refers to the question how the intensity of herd behavior affects the cyclicity of labor supply. As equation (5) shows, the damping factor $1/\sqrt{h_i'(1)}$ of labor supply cycles is decreasing and the period $2 \cdot \pi / \arccos(\sqrt{h_i'(1)})$ of labor supply cycles is increasing with the intensity $h_i'(1)$ of the herding effect. Labor markets where the herding effect is strong are therefore characterized by strong supply cycles — and, thus, by serious employment and growth problems —, while labor markets where the herding effect is weak do only exhibit weak supply cycles. Due to this linkage between the intensity of herd behavior on the one hand and the cyclicity of labor supply on the other hand, we should examine whether and, if yes, why herd behavior is more intense in some and less intense in other markets. This problem will be tackled in another paper, however; in this paper we will continue with an empirical evaluation of the model, instead.

3 The Evidence

As we have indicated above, we will evaluate the herd behavior model of labor supply cycles by empirically checking whether the lag-one coefficient, the lag-two coefficient, and the ratio of the two lag coefficients from the difference equation in (4) are indeed element of $(0, 2)$, $(-1, 0)$, and $\{-2\}$. In order to carry out this check, we will run an OLS regression and estimate the autoregressive process

$$\log\left(\frac{n_{i,t}}{n_{i,t}^*}\right) = a_i \cdot \log\left(\frac{n_{i,t-1}}{n_{i,t-1}^*}\right) + b_i \cdot \log\left(\frac{n_{i,t-2}}{n_{i,t-2}^*}\right) + u_{i,t} \qquad (6)$$

for a large number of professional labor markets i, so obtaining estimates for the lag-one coefficient a_i, the lag-two coefficient b_i, and their ratio a_i/b_i, with $u_{i,t}$ being a stochastic error term satisfying the conditions of the classical linear regression model. Having obtained these estimates, we will examine in how many markets where the characteristic roots $a_i/2 \pm \sqrt{a_i^2/4 + b_i}$ of the autoregressive process are complex so that the time path of $\log(n_{i,t}/n^*_{i,t})$ is cyclical the lag-one coefficient a_i is situated in the interval $(0, 2)$, the lag-two coefficient b_i is element of the interval $(-1, 0)$, and the coefficient ratio a_i/b_i is found in a small interval around the number -2, say $(-3, -1)$. If the number of markets characterized by these properties turns out to be large, we will take this result as evidence supporting the model presented in the last section.

To estimate the autoregressive process specified in equation (6) for a large number of professional labor markets, we need time-series cross-section data on the logarithmic de-trended number of new workers $\log(n_{i,t}/n^*_{i,t})$ and, hence, on the number of new workers $n_{i,t}$ the logarithmic de-trended number is derived from. Before we can examine where to obtain these data, we have to answer the question which is the optimal way of measuring the number of new workers in the context of our model. Because the model focuses on occupational choice, which is more or less equivalent to educational choice in the case of professional occupations, it appears to be best to measure the number of workers newly entering a labor market by the number of freshmen newly enrolling in the field of study corresponding to the market. Time-series cross-section data on this number can be obtained from the Federal Statistical Office Germany: though this institution does not provide very detailed data on the enrollment of freshmen in its publications, it is ready to provide an exhaustive data set on freshmen enrollment on request. The data set that was provided to us consists of semiannual time series on the number of freshmen enrolling at German universities for 278 fields of study, with the longest series covering the period between summer term 1972 and winter term 2000/2001.

Due to various statistical problems, we cannot use the time series provided by the Federal Statistical Office directly in our empirical analysis. A first problem is that the time series refer to enrollment at West German universities until summer term 1992 and to enrollment at West as well as East German universities afterwards; as a consequence, we can only use the sub-series ending in summer term 1992 in the empirical analysis. A second problem is that winter enrollment is much larger than summer enrollment in most fields so that there are considerable seasonal fluctuations in the series provided by the Statistical Office; we therefore have to convert the sub-series ending in summer term 1992 from a semiannual to an annual frequency before they can be analyzed empirically. As a third problem, there are several among the converted sub-series that do not cover the whole period between 1972 and 1991; these series have to be omitted from the empirical analysis because they are too short for a reliable estimation of the lag-one coefficient a_i and the lag-two coefficient b_i. A fourth problem, finally, is

Table 1: Data I

i	Field	*i*	Field
1	Shop/technology	75	Catholic theology and religious studies
2	Mining	76	Philosophy
3	Smelting and foundry engineering	77	Religion
4	Mine surveying	78	Archeology
5	Chemical engineering	79	History
6	Printing and reproduction technology	80	Library science
7	Power engineering (excluding electrical engineering)	81	Media studies and communication science
8	Light engineering	82	General literary studies
9	Industrial and production engineering	83	General linguistics and Indogermanic languages and literature
10	Medical technology	84	Byzantine studies
11	Glass and ceramics technology	85	Greek
12	Plastics technology	86	Latin
13	Mechanical engineering	87	German language and literature
14	Metallurgy	88	Dutch language and literature
15	Engineering physics	89	Nordic/Scandinavian languages and literatures (Nordic philology, individual languages n.o.i.b.n.)
16	Textiles and clothing technology	90	American studies/literature
17	Process engineering	91	English language and literature
18	Materials sciences	92	French language and literature
19	Electrical and electronic engineering	93	Italian language and literature
20	Vehicular engineering	94	Portuguese language and literature
21	Aerospace engineering	95	Romance languages and literatures (Romance philology, individual languages n.o.i.b.n.)
22	Navigation	96	Spanish language and literature
23	Naval architecture	97	Finno-Ugric languages and literatures
24	Architecture	98	Russian language and literature
25	Interior decorating	99	Slavic languages and literatures (Slavic philology)
26	Regional planning	100	Egyptology
27	Civil engineering	101	African languages and literatures
28	Surveying (geodesy)	102	Arabic language and literature
29	Mathematics	103	Non-European languages and cultures in Southeast Asia, Oceania, and the Americas
30	Computer science	104	Hebrew language and literature
31	Astronomy and astrophysics	105	Indology
32	Physics	106	Islamic studies
33	Biochemistry	107	Japanology
34	Chemistry	108	Oriental and Old Oriental language and literature
35	Food chemistry	109	Chinese and Korean languages and literatures
36	Pharmacy	110	Central Asian languages and cultures
37	Anthropology (human biology)	111	Ethnology
38	Biology	112	Folklore
39	Geology/paleontology	113	Psychology
40	Geophysics	114	Education
41	Meteorology	115	Education of the blind and visually handicapped
42	Mineralogy	116	Education of pupils with learning disorders
43	Oceanography	117	Education of the deaf and hard-of-hearing
44	Geography	118	Education of the mentally handicapped and slow learners
45	Economic and social geography	119	Education of the physically handicapped
46	Medicine (general medicine)	120	Education of pupils with learning disabilities
47	Dental medicine	121	Special education
48	Veterinary medicine	122	Speech pathology
49	Landscape architecture	123	Education of the emotionally disturbed
50	Agriculture	124	Sports and physical education
51	Brewing and beverage technology	125	Art education
52	Horticulture	126	Art and art history
53	Food technology	127	Fine and graphic arts
54	Dairy farming	128	Sculpture
55	Viticulture and vinting	129	Painting
56	Silviculture	130	Commercial art
57	Wood industry	131	Graphic design and communication design
58	Domestic science and nutrition	132	Textile design
59	Elementary school social studies education	133	Handicrafts
60	Political science	134	Performing and dramatic arts, directing
61	Social studies	135	Motion pictures and television
62	Social sciences	136	Dramaturgy
63	Sociology	137	Conducting
64	Social work	138	Instrumental music
65	Social-welfare education	139	Church music
66	Law	140	Composition
67	Public administration	141	Music education
68	Labor and business studies	142	Music studies and history
69	Business administration	143	Sound engineer
70	Economics		
71	Economics education		
72	Economic sciences		
73	Industrial engineering		
74	Protestant theology and religious studies		

n.o.i.b.n. = not otherwise indexed by name (in the original list received by the Federal Statistical Office Germany)

Table 2: Data II

i	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
1	51	48	59	75	46	42	35	34	25	16	13	13	8	7	8	5	11	6	28	74
2	66	50	125	236	278	370	321	345	362	395	405	506	385	287	244	182	120	91	176	125
3	99	119	159	239	304	234	216	198	241	319	320	454	375	288	316	261	305	315	279	222
4	2	1	3	21	14	26	28	25	20	10	20	15	11	11	7	8	8	2	3	4
5	1241	1277	911	1026	1153	1003	599	455	513	692	1105	1375	1062	1170	1204	1349	1391	1512	1643	1618
6	102	117	94	125	93	94	132	192	152	132	189	273	243	232	261	313	330	292	316	314
7	87	128	132	160	186	221	250	357	255	244	193	268	318	299	308	358	388	425	436	468
8	260	326	554	666	709	590	494	527	639	692	912	932	958	991	1019	1061	1086	1158	1084	1131
9	58	88	51	276	344	431	423	464	865	1149	1418	1712	1607	1457	1624	1677	1696	1865	1907	1906
10	165	163	135	89	78	77	127	144	158	230	224	245	248	274	289	325	318	287	328	358
11	38	49	69	74	89	83	57	46	25	38	45	53	48	48	54	76	79	62	87	68
12	54	66	76	97	108	88	83	84	65	95	108	125	149	180	191	223	270	248	234	205
13	7278	7851	8310	9268	10571	9896	9395	8978	8738	11169	13701	14500	12715	11787	12263	13788	14542	16407	17178	15505
14	82	47	55	61	55	53	74	75	69	43	30	34	37	18	15	21	45	50	59	74
15	244	401	378	413	414	410	396	361	354	384	489	587	529	517	488	616	808	867	879	857
16	277	279	220	325	367	342	378	346	373	477	508	677	563	647	582	616	614	605	603	593
17	687	739	645	903	1098	874	1096	969	849	1213	1313	1380	1310	1188	1203	1280	1406	1727	1754	1665
18	123	79	75	137	190	149	139	167	243	279	387	407	406	365	445	492	580	614	642	506
19	8428	9511	9962	10140	11552	10147	9313	8947	8440	10859	13394	15150	13361	12379	13063	14525	15980	16831	15494	14064
20	168	205	177	221	223	237	275	335	344	375	463	625	482	487	509	548	661	733	685	758
21	120	202	219	253	265	219	328	539	482	562	564	639	640	646	654	640	894	984	839	748
22	187	129	121	115	141	136	204	187	193	143	123	126	94	91	114	87	77	70	34	84
23	135	176	150	193	249	224	217	194	211	182	179	134	196	224	224	227	242	236	229	295
24	3197	4171	4069	3661	3808	3929	3960	4608	5187	5500	5344	5057	5289	5045	4759	4859	5228	5416	5519	5092
25	124	229	290	269	348	366	248	353	630	780	849	741	855	736	749	786	756	689	630	680
26	21	75	101	74	115	145	236	235	216	242	226	198	243	247	249	258	276	285	272	277
27	4738	5079	4852	4797	5439	4954	4379	4557	4654	5767	6119	7276	6624	4910	4095	4298	4759	6122	8218	9511
28	764	1030	1082	1232	1278	1225	1050	1060	1174	1171	1324	1391	1248	1022	857	715	744	786	802	930
29	10255	9666	9960	7928	7475	5730	5078	4143	4242	4863	4934	5213	4454	3865	4180	4821	5847	6501	7814	7139
30	741	1051	1147	1515	1536	1644	2060	2765	3510	4051	4904	6062	6264	6185	6288	6816	8207	8453	8475	7571
31	35	22	19	29	32	24	11	16	16	13	26	15	12	17	16	12	11	8	14	9
32	3556	3357	3528	3443	3633	3175	3146	3012	3432	4156	5094	6460	5661	5167	5150	5623	5707	5739	6354	5470
33	65	52	52	52	66	76	101	109	98	98	92	116	105	125	133	137	147	150	157	179
34	4343	4290	4430	5011	4972	4962	4727	4077	5332	6948	7827	7731	7565	6517	6199	6351	6990	7134	7494	6655
35	413	264	143	126	107	126	208	159	211	240	240	243	252	244	229	251	255	276	264	238
36	1179	1010	1038	1190	1210	1458	1662	1734	1847	1824	1811	1832	1895	1862	1889	1930	1792	1716	1724	1657
37	12	9	1	18	24	9	6	5	48	62	61	45	65	57	69	67	67	64	46	56
38	3592	3556	3700	3242	3327	4236	5002	4825	5093	4924	4623	4812	4916	4874	4879	5026	5117	5103	5385	5111
39	628	695	842	1625	749	762	723	779	1012	1173	1070	967	808	757	751	857	810	909	1038	971
40	78	84	122	323	213	183	165	139	138	179	239	328	319	275	235	188	207	178	250	221
41	167	216	301	497	179	171	158	105	125	167	178	254	242	187	150	150	175	219	269	228
42	236	290	293	517	336	285	290	274	296	453	672	624	696	455	366	297	301	331	373	342
43	61	55	56	145	58	48	61	34	41	64	52	46	55	60	56	73	72	78	59	66
44	1604	1605	1908	1440	1385	1580	1877	1979	2301	2322	2560	2365	1973	1785	1813	2151	2486	2875	3368	3215
45	14	12	16	6	11	17	23	7	9	6	23	38	29	35	71	81	79	105	97	123
46	3721	3939	3867	4241	5252	6515	7407	8023	8919	8455	7651	7355	7624	7838	8250	9254	9422	9254	8179	7327
47	615	677	697	735	807	950	1140	1191	1244	1234	1248	1267	1212	1240	1345	1457	1568	1534	1513	1445
48	485	461	456	498	508	653	663	757	914	742	744	667	693	684	657	725	801	778	841	848
49	375	438	407	487	416	495	594	628	663	679	694	665	661	704	684	717	709	719	812	805
50	1030	1386	1651	2078	1919	2027	2275	2341	2430	2414	2366	2276	2444	2347	2292	2105	1904	1924	1884	1798
51	84	82	115	141	137	130	118	111	130	112	126	124	118	125	119	128	146	166	195	207
52	163	194	300	300	306	353	341	392	423	431	437	451	420	536	526	515	533	479	451	446
53	174	249	268	243	221	198	261	206	211	208	291	416	383	343	388	426	602	640	620	571
54	14	18	33	28	31	33	31	30	31	31	30	32	29	24	36	27	26	29	34	27
55	23	17	32	45	56	68	56	52	63	65	65	85	54	84	80	83	97	129	97	108
56	172	360	450	363	343	393	425	480	460	575	569	598	623	706	559	489	634	552	554	635
57	98	130	125	222	233	247	34	41	37	35	30	37	30	25	39	32	32	36	36	37
58	1472	1477	1502	1663	1612	1639	1653	1592	1476	1583	1562	1654	1524	1511	1408	1382	1477	1321	1282	1332
59	47	86	80	65	60	42	43	34	33	257	156	135	156	138	151	278	409	589	920	604
60	730	775	784	748	829	774	810	847	1138	1450	1585	1901	1739	1592	1731	2011	2062	2278	2647	2612
61	434	362	471	339	209	178	246	264	312	288	202	109	82	58	71	125	197	239	395	281
62	819	853	1088	814	1113	1216	1229	1199	1502	1811	1889	1961	1594	1473	1439	1524	1575	1824	2007	1882
63	1543	1581	1494	1462	1430	1165	1032	978	1224	1406	1308	1232	1112	884	956	1030	1021	1359	1815	2071
64	6549	6927	7104	6691	6501	6945	6277	5652	3814	3749	3741	3347	2651	2496	2217	2124	2239	2319	2471	3111
65	163	253	478	339	403	487	2385	3297	2880	2803	2811	2629	2416	2183	2319	2415	2632	2695	3163	3649
66	7331	8756	10502	10284	9783	9423	10057	10886	12248	14718	13931	13263	11481	9547	9835	10315	12466	12392	13870	16948
67	2	1614	971	1241	2797	3533	4118	5931	8090	4079	3659	3162	3224	3648	3855	4501	4613	4838	4179	4917
68	264	193	236	191	213	121	179	190	170	170	76	74	75	127	91	90	69	80	31	64
69	5935	5164	4761	4799	6533	6532	7123	8326	9821	10936	12783	15286	15502	15931	18370	21344	22365	18149	23445	19029
70	2308	2162	2174	1918	3021	2590	2028	2148	3134	4060	4915	3789	3313	3330	3454	3622	3698	4458	3580	5125
71	639	811	885	778	530	646	747	710	684	619	506	389	491	375	447	632	718	804	907	866
72	5149	5889	5403	5577	6754	6157	6703	6092	7327	5140	9164	9994	9420	8799	9951	11708	12524	10229	13203	11690

Table 2: Data II (continued)

i	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
73	2282	3125	3274	3169	2143	2008	1521	1126	1382	1671	1898	2368	2157	2040	2191	2348	2864	2559	2686	3119
74	1034	1227	1538	2227	2088	2430	2320	2108	2193	2429	2706	2771	2256	1754	1552	1487	1525	1464	1599	1372
75	886	961	1107	1940	1974	2087	1815	1779	1755	1809	1929	1764	1466	1181	1136	1146	1170	1152	1313	1178
76	887	833	959	1828	1400	1052	1107	1183	1673	1903	2131	2517	2246	1925	1932	1948	2017	2086	2249	2205
77	23	17	26	38	51	47	69	51	73	60	107	93	89	64	84	66	58	83	106	110
78	80	112	135	307	340	261	260	257	305	413	461	532	488	463	466	451	363	393	343	382
79	2455	2236	2407	2388	2294	2068	2393	2273	2606	2876	2655	3186	3067	2923	2966	2826	2810	3067	3375	3263
80	173	192	303	196	206	217	262	249	318	474	512	488	551	534	485	502	525	514	463	489
81	232	400	483	371	288	459	442	418	383	421	482	355	356	352	337	358	494	480	543	561
82	8	12	37	170	77	101	87	112	148	259	440	564	616	490	470	459	598	597	660	662
83	93	189	237	211	202	160	168	191	238	328	535	556	557	757	758	786	849	765	1044	1122
84	5	2	7	4	7	7	9	6	5	8	21	22	30	35	29	39	38	56	50	58
85	20	17	24	53	56	53	63	65	78	81	95	110	76	76	76	93	87	82	107	84
86	145	185	276	420	365	354	461	442	467	626	548	490	433	312	287	298	356	347	470	468
87	13208	13052	14109	10766	9919	9071	9705	9531	10884	11945	10843	9399	9641	9310	9381	10171	11226	12181	14218	13931
88	1	1	4	6	7	8	7	8	19	13	21	28	32	33	28	19	16	28	38	45
89	6	10	12	21	28	17	32	34	48	54	95	84	88	95	99	97	96	123	147	136
90	15	25	34	76	77	74	84	112	150	176	223	307	359	397	403	358	388	385	423	462
91	7054	6590	6822	5661	5592	4911	5075	4268	4576	4696	4117	3940	3802	3329	3430	3852	4081	4672	5604	5713
92	2195	2248	2522	2192	1918	1766	1628	1237	1329	1323	1053	975	943	809	785	822	991	1147	1320	1311
93	22	26	25	34	51	62	95	109	140	194	288	232	266	292	300	255	249	240	191	243
94	2	7	3	3	21	17	22	33	33	49	54	12	9	29	33	20	28	17	23	20
95	307	331	433	445	542	537	651	889	1070	1393	1860	1996	2039	1958	1947	1959	1683	1792	1803	1823
96	58	57	87	111	146	192	207	179	304	334	347	377	357	364	298	277	339	329	334	287
97	3	8	9	11	8	9	11	10	7	15	15	19	18	22	20	17	18	25	27	24
98	170	211	181	203	217	208	212	140	136	171	175	149	124	123	107	139	164	221	218	165
99	185	168	217	249	217	206	155	182	217	221	327	387	435	391	421	460	532	597	487	333
100	14	14	23	26	35	28	33	25	66	69	78	109	134	103	130	147	119	159	170	167
101	6	6	10	19	17	12	13	14	19	33	40	67	101	62	54	68	62	41	62	60
102	3	4	2	12	18	11	21	11	14	15	24	55	72	46	45	44	42	40	71	39
103	21	30	35	50	28	48	33	20	19	22	46	72	75	95	90	101	92	70	93	82
104	2	2	7	7	11	12	2	12	16	19	25	28	33	24	26	36	37	29	38	29
105	27	28	39	44	51	34	47	44	44	72	83	113	95	75	81	77	78	82	116	106
106	6	9	5	20	38	30	17	29	33	53	81	116	119	86	112	114	134	145	126	147
107	9	15	10	24	17	22	18	25	39	56	93	180	267	295	286	254	228	260	219	279
108	44	48	62	97	72	60	66	54	69	84	109	108	119	109	101	102	90	108	130	121
109	67	82	85	120	126	111	86	127	204	199	224	295	354	645	651	578	447	353	213	177
110	2	5	2	1	1	1	1	4	10	12	10	17	13	14	14	6	6	10	23	43
111	156	167	197	289	319	345	413	440	569	655	545	443	406	376	394	385	386	431	378	389
112	7	27	49	85	83	72	91	65	115	137	206	124	143	116	105	95	90	112	95	104
113	1022	1016	949	1055	1115	1675	2215	2251	2248	2329	2250	2204	2245	2306	2262	2352	2371	2275	2277	2246
114	5161	5294	4175	3166	2894	3776	3519	3387	3331	3785	3693	3436	3388	2901	2710	3060	3211	3515	4270	5370
115	14	16	46	16	15	18	32	40	29	38	26	14	19	17	13	21	28	22	30	39
116	72	147	263	78	40	52	63	70	46	41	24	16	20	19	15	15	21	15	26	24
117	31	43	70	21	23	22	48	52	71	75	77	82	67	42	25	64	82	98	75	113
118	56	139	221	125	91	140	330	317	354	362	425	349	301	176	186	201	238	257	309	308
119	80	134	224	103	63	94	207	211	181	234	170	135	122	86	91	96	86	114	164	175
120	203	359	776	275	197	230	374	357	314	345	282	232	213	171	108	151	174	274	309	321
121	54	91	106	61	48	59	116	120	109	114	107	217	176	137	112	160	167	210	228	190
122	1	9	213	118	75	97	180	155	209	193	238	150	106	120	158	178	158	135	161	185
123	56	53	103	38	24	30	59	70	60	76	52	59	56	46	42	47	48	56	75	44
124	2709	2946	2990	2823	2832	2858	3162	3270	3114	2881	2387	1979	1763	1418	1493	1769	2004	2069	2584	2327
125	1210	1107	992	1565	842	845	930	1014	788	801	799	610	524	467	451	542	658	708	795	521
126	539	633	985	1597	937	992	1218	1133	1386	1620	1691	1700	1754	1676	1730	1665	1611	1451	1409	1363
127	868	875	745	417	308	353	517	520	588	571	523	423	397	402	408	461	439	505	400	400
128	19	18	17	26	25	20	23	35	32	34	35	23	26	19	25	27	37	58	55	30
129	39	92	90	97	66	60	100	82	94	73	86	78	86	74	81	59	63	76	86	78
130	221	91	63	49	37	40	28	13	17	13	18	17	18	27	25	22	33	44	45	27
131	1643	1778	1663	1917	2019	2164	1830	1820	1530	1407	1457	1595	1421	1297	1395	1323	1249	1336	1366	1420
132	381	328	259	295	186	209	232	241	214	292	301	269	271	204	209	237	253	253	335	307
133	356	295	323	253	203	117	143	119	64	53	62	46	19	11	11	12	11	50	54	64
134	366	293	271	275	265	271	336	243	235	261	246	222	240	235	261	256	244	237	271	222
135	39	33	18	17	18	41	41	38	19	14	20	15	13	13	14	15	18	15	19	19
136	105	146	177	294	213	285	324	311	303	381	393	381	310	260	240	233	220	571	384	448
137	13	13	19	10	9	16	23	22	18	17	16	11	12	12	15	15	21	11	20	15
138	841	724	761	855	720	849	972	907	1000	955	936	963	1029	1028	891	904	1022	954	1080	949
139	39	50	55	94	60	72	82	86	80	92	99	97	90	93	70	79	87	56	56	54
140	18	17	26	24	22	28	31	29	37	33	34	30	33	31	25	23	28	33	26	40
141	1077	981	1095	1148	1252	1306	1480	1479	1437	1409	1547	1273	1157	1012	988	1062	1147	1202	1158	943
142	194	199	358	430	469	443	487	450	573	664	881	1045	1089	1046	1029	956	929	839	971	898
143	28	28	24	25	30	9	12	14	10	22	5	12	9	9	14	6	7	2	4	7

Table 3: Results I

i	a_i	b_i	a_i/b_i	$a_i^2/4+b_i$	i	a_i	b_i	a_i/b_i	$a_i^2/4+b_i$
1	0.9320	−0.1418	−6.5747	0.0754	73	1.1001	−0.4061	−2.7090	−0.1035
2	0.9141	−0.2412	−3.7903	−0.0323	74	1.1487	−0.4180	−2.7480	−0.0881
3	0.9050	−0.3825	−2.3661	−0.1777	75	1.0057	−0.3699	−2.7188	−0.1171
4	0.6683	−0.1471	−4.5449	−0.0354	76	0.6564	−0.4007	−1.6380	−0.2930
5	1.1075	−0.5338	−2.0748	−0.2271	77	0.3718	0.1515	2.4539	0.1860
6	0.2722	−0.4546	−0.5987	−0.4361	78	0.9617	−0.3488	−2.7576	−0.1175
7	0.5559	−0.0534	−10.4157	0.0239	79	0.3149	0.0832	3.7862	0.1080
8	0.9403	−0.6512	−1.4441	−0.4301	80	0.6198	−0.0529	−11.7222	0.0432
9	0.5357	0.1622	3.3020	0.2340	81	0.4571	−0.3098	−1.4754	−0.2576
10	1.0031	−0.4716	−2.1267	−0.2201	82	0.6923	−0.2907	−2.3816	−0.1709
11	0.8140	−0.2600	−3.1303	−0.0944	83	0.9259	−0.3857	−2.4007	−0.1714
12	0.9284	−0.3225	−2.8789	−0.1070	84	0.1471	0.1958	0.7511	0.2012
13	0.9300	−0.8178	−1.1371	−0.6016	85	0.7250	−0.1961	−3.6970	−0.0647
14	1.0657	−0.4464	−2.3872	−0.1625	86	0.9665	−0.3347	−2.8874	−0.1012
15	0.8168	−0.3000	−2.7227	−0.1332	87	1.0163	−0.3933	−2.5841	−0.1351
16	0.3995	0.0955	4.1831	0.1354	88	0.6097	−0.1911	−3.1910	−0.0981
17	0.1922	−0.2720	−0.7068	−0.2627	89	0.4182	0.1773	2.3591	0.2210
18	0.6625	−0.5602	−1.1826	−0.4505	90	1.0625	−0.3254	−3.2654	−0.0432
19	0.9839	−0.6832	−1.4403	−0.4411	91	1.0829	−0.2370	−4.5701	0.0562
20	0.3872	−0.0913	−4.2410	−0.0538	92	1.2904	−0.5075	−2.5429	−0.0912
21	0.6575	−0.1834	−3.5845	−0.0754	93	1.1816	−0.3239	−3.6480	0.0251
22	0.2662	0.2240	1.1883	0.2417	94	0.5297	−0.0217	−24.3997	0.0484
23	0.4417	0.0051	86.0516	0.0539	95	1.3417	−0.4746	−2.8271	−0.0246
24	0.8583	−0.2466	−3.4802	−0.0625	96	0.9287	−0.1717	−5.4090	0.0439
25	0.9397	−0.2744	−3.4251	−0.0536	97	0.2445	−0.1564	−1.5631	−0.1415
26	0.8621	−0.0944	−9.1312	0.0914	98	0.8552	−0.3989	−2.1437	−0.2161
27	1.2667	−0.8495	−1.4911	−0.4484	99	1.0006	−0.4995	−2.0030	−0.2493
28	1.1900	−0.4753	−2.5035	−0.1213	100	0.2555	0.1109	2.3041	0.1272
29	1.3097	−0.5248	−2.4955	−0.0960	101	0.8856	−0.3612	−2.4517	−0.1652
30	1.2706	−0.3625	−3.5051	0.0411	102	0.3132	0.0100	31.3040	0.0345
31	−0.0595	−0.3742	0.1590	−0.3733	103	0.7115	−0.1562	−4.5548	−0.0296
32	0.9969	−0.4278	−2.3302	−0.1794	104	0.0643	−0.1021	−0.6302	−0.1010
33	0.6777	−0.2286	−2.9642	−0.1138	105	0.4719	−0.0951	−4.9644	−0.0394
34	1.0368	−0.5784	−1.7926	−0.3096	106	0.4973	−0.2059	−2.4147	−0.1441
35	0.7675	−0.3449	−2.2252	−0.1977	107	0.6755	0.0846	7.9839	0.1987
36	1.1889	−0.3783	−3.1426	−0.0249	108	0.6115	−0.3674	−1.6645	−0.2739
37	0.1980	−0.3227	−0.6138	−0.3128	109	1.3271	−0.6388	−2.0776	−0.1985
38	0.9082	−0.3991	−2.2753	−0.1929	110	0.9640	−0.5045	−1.9105	−0.2722
39	0.2332	−0.2347	−0.9940	−0.2211	111	1.2711	−0.4968	−2.5586	−0.0929
40	0.6685	−0.3560	−1.8776	−0.2443	112	0.8454	−0.1589	−5.3205	0.0198
41	0.6618	−0.3121	−2.1208	−0.2026	113	1.3292	−0.5646	−2.3543	−0.1229
42	0.8237	−0.2662	−3.0945	−0.0966	114	1.0573	−0.6047	−1.7486	−0.3252
43	0.1437	−0.0717	−2.0050	−0.0665	115	0.3067	−0.1817	−1.6880	−0.1582
44	0.9529	−0.4895	−1.9467	−0.2625	116	0.6625	−0.4602	−1.4397	−0.3504
45	0.4308	−0.0385	−11.1854	0.0079	117	0.4815	−0.2442	−1.9721	−0.1862
46	1.6086	−0.8281	−1.9425	−0.1812	118	0.9013	−0.3626	−2.4856	−0.1595
47	1.4733	−0.6813	−2.1624	−0.1387	119	0.7876	−0.5031	−1.5655	−0.3480
48	0.7072	−0.0415	−17.0338	0.0835	120	0.6440	−0.4462	−1.4432	−0.3425
49	0.3966	0.2939	1.3497	0.3332	121	0.4609	−0.5663	−0.8139	−0.5132
50	1.2067	−0.3578	−3.3726	0.0062	122	0.6578	−0.3741	−1.7586	−0.2659
51	0.8591	−0.3650	−2.3539	−0.1805	123	0.3886	−0.3685	−1.0546	−0.3307
52	0.6872	−0.1926	−3.5690	−0.0745	124	1.3149	−0.6295	−2.0887	−0.1973
53	0.7694	−0.3221	−2.3884	−0.1741	125	0.4065	−0.0500	−8.1303	−0.0087
54	0.0865	−0.0829	−1.0441	−0.0810	126	0.5678	−0.2438	−2.3288	−0.1632
55	0.2615	−0.0454	−5.7582	−0.0283	127	0.9439	−0.5881	−1.6049	−0.3654
56	0.5985	−0.2024	−2.9575	−0.1128	128	0.5932	−0.3795	−1.5632	−0.2915
57	0.6093	−0.0791	−7.7060	0.0137	129	0.1527	−0.1230	−1.2415	−0.1172
58	0.4313	0.0113	38.1864	0.0578	130	0.9427	−0.1675	−5.6285	0.0547
59	0.5385	−0.1523	−3.5367	−0.0798	131	0.6557	−0.1657	−3.9557	−0.0583
60	0.9281	−0.4294	−2.1614	−0.2141	132	0.4023	−0.0634	−6.3459	−0.0229
61	1.3071	−0.6911	−1.8913	−0.2640	133	1.0817	−0.3743	−2.8902	−0.0818
62	0.5215	0.0259	20.1202	0.0939	134	0.0649	−0.1817	−0.3571	−0.1806
63	1.3430	−0.7524	−1.7850	−0.3015	135	0.7306	−0.4554	−1.6045	−0.3219
64	1.2269	−0.4939	−2.4842	−0.1176	136	0.3443	0.1009	3.4129	0.1305
65	0.9493	−0.2674	−3.5498	−0.0421	137	0.1911	−0.0832	−2.2967	−0.0741
66	1.1808	−0.6173	−1.9128	−0.2687	138	0.1449	0.0302	4.7948	0.0355
67	0.8596	0.0799	10.7651	0.2646	139	0.4444	0.1551	2.8644	0.2045
68	−0.0949	−0.0307	3.0906	−0.0284	140	0.2546	0.1243	2.0480	0.1405
69	0.5286	0.0250	21.1191	0.0949	141	1.0664	−0.4082	−2.6121	−0.1240
70	0.4675	−0.3332	−1.4032	−0.2785	142	0.9282	−0.3067	−3.0263	−0.0913
71	0.9171	−0.2619	−3.5023	−0.0516	143	−0.2902	−0.0992	2.9243	−0.0782
72	−0.1596	−0.0553	2.8863	−0.0489					

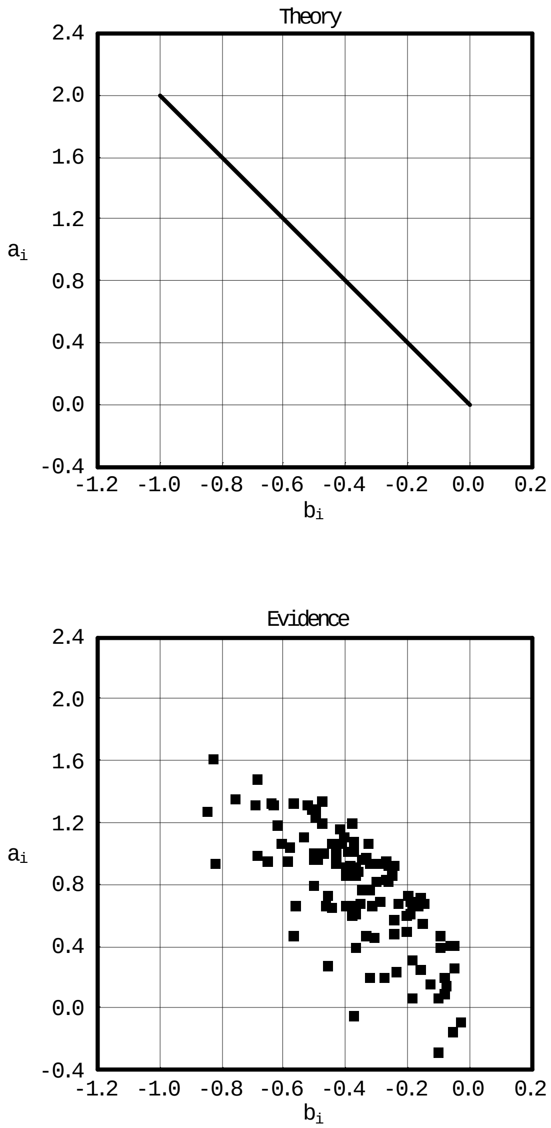

Figure 1: Results II

that some of the remaining series include zero enrollment numbers in one year or other; because computing $\log(n_{i,t}/n^*_{i,t})$ from $n_{i,t}$ is only possible when data are nonzero, we are forced to exclude these series from the empirical analysis as well. After processing the data in this way, we are left with a sample which is documented in tables 1 and 2: it consists of time series for 143 fields of study, with each series being composed of annual data ranging from 1972 to 1991.

When we transform the data for $n_{i,t}$ included in our sample into logarithms $\log(n_{i,t})$, remove a linear least-squares trend $\log(n^*_{i,t})$, and use the resulting data for $\log(n_{i,t}/n^*_{i,t}) = \log(n_{i,t}) - \log(n^*_{i,t})$ to estimate the autoregressive process specified in equation (6) for each field, we obtain the results documented in table 3. As the table shows, there are 108 out of 143 fields where $a_i^2/4 + b_i$ is negative so that $a_i/2 \pm \sqrt{a_i^2/4 + b_i}$ is complex and the time path of $\log(n_{i,t}/n^*_{i,t})$ is cyclical. In 104 and, thus, in 96 percent of these fields the lag-one coefficient a_i is situated in the theoretically predicted interval $(0, 2)$; this is an empirical result which strongly supports the herd behavior model of labor supply cycles. In 108 and, thus, in 100 percent of the fields the lag-two coefficient b_i is element of the theoretically predicted interval $(-1, 0)$, a result that provides even stronger support for the herd behavior model. In 74 and, thus, in 69 percent of the fields the coefficient ratio a_i/b_i is found in the interval $(-3, -1)$ and, hence, in some neighborhood of the theoretically predicted value -2, another result that supports the model to be evaluated. All in all, we find that the empirical results documented in table 3 confirm the theoretical predictions of the herd behavior model, a finding that becomes even more evident when we regard the two diagrams which are depicted in figure 1.

The upper diagram depicted in the figure shows those combinations of a_i and b_i which conform to the theoretical predictions of the herd behavior model: because $a_i \in (0, 2)$, $b_i \in (-1, 0)$, and $a_i/b_i = -2$, they all lie on a straight line joining the points $(0, 0)$ and $(-1, 2)$. The lower diagram shows the combinations of a_i and b_i which conform to the empirical results listed in table 3: since the herd behavior model can only be applied to fields where the motion of $\log(n_{i,t}/n^*_{i,t})$ is cyclical, we have omitted all combinations that refer to non-cyclical fields from the diagram. As we can see by comparing the diagrams, most of the combinations observed empirically are in the close neighborhood of the combinations predicted theoretically; while the theoretical combinations are located on the line $a_i = -2 \cdot b_i$ (for $-1 < b_i < 0$), the empirical combinations are located near the OLS regression line $a_i = -1.9931 \cdot b_i$ (with $R^2 = 0.4794$), which is almost identical. Given this coincidence of the empirical and theoretical results, we are confident to be on the right track when using the herd behavior model to explain the cyclical behavior of worker supply observed in many professional labor markets.

We have now reached the end of this section, but before finishing it, we will briefly return to a point already discussed at the end of section 2: the relationship between the intensity of herd behavior on the one hand and the cyclicity of labor supply on the other hand. Returning to this point is worthwhile because we have numbers for the intensity of herding effects now; since $h'_i(1) = a_i/2$ — this equation follows from equations (4) and (6) —, the results in table 3 imply that herding effects range between 0.0322 in Hebrew language and literature and 0.8043 in general medicine. When we insert these numbers into the formulas for the damping factor and the period of labor supply cycles, $1/\sqrt{h'_i(1)}$ and $2 \cdot \pi / \arccos(\sqrt{h'_i(1)})$, we find that the cycles arising in Hebrew have a damping factor of 5.5762 and a period of 4.5187 years, whereas the damping factor and the period of the cycles arising in medicine are 1.1151 and 13.7106 years. In the field with the weakest herding effect, Hebrew, cycles are therefore extremely weak and should not give rise to any remarkable problems; in the field with the strongest herding effect, medicine, cycles are extraordinarily strong, however, and give rise to serious economic problems whenever wages are not perfectly flexible in the medical labor market. It is therefore quite important to find out why herding effects differ across fields or markets, a question which we will examine in our next paper.

4 Conclusion

In this paper we have examined the question why the supply of new workers exhibits periodic ups and downs in a large number of professional labor markets, a phenomenon which may have serious consequences for employment and economic growth. We have proceeded from the assumption that new workers have only poor information about occupational alternatives when making their choice of career, and this assumption distinguishes our approach from other ones where new workers are assumed to be well informed about present or even future wages. Drawing upon the observation that people who have to make a decision without having enough information tend to imitate each other, we have presented a model with herd behavior in occupational choice where herding, when combined with one other assumption, leads to a cyclical behavior of the supply of new workers. Apart from this model, we have also presented empirical evidence, which strongly supports the herd behavior explanation of labor supply cycles.

At the end of this paper let us briefly describe our next project, the explanation of differences in the intensity of herd behavior across professional labor markets, and sketch our preliminary theoretical and empirical results. As it stands by now, our theoretical model attributes differences in the intensity of herd behavior to differences in the size of labor markets: while in large markets a change in the number of new workers easily becomes public so that a herding effect can start, in small markets a change in the number of new workers may stay unnoticed and a herding effect cannot arise. The empirical evidence seems to confirm this relationship: using the same data we have used in this paper, we find that there is indeed a positive relation between the intensity of the herding effect on the one hand and the size of a labor market on the other hand. Of course, these results are purely preliminary; whether they will bear closer examination will only be known when our coming project is finished.

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