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Recent Temporal Dynamics in Economics: Empirical Analyses of Annual Publications in Economic Fields

Abstract

Differences in annual publication counts may reflect the dynamic of scientific progress. Declining annual numbers of publications may be interpreted as missing progress in field-specific knowledge. In this paper, we present empirical results on dynamics of progress in economic fields (defined by JEL codes) based on a methodological approach introduced by Bornmann and Haunschild (2022). We focused on publications that have been published between 2012 and 2021 and identified those fields in economics with the highest dynamics (largest rates of change in paper counts). We found that the field with the largest paper output across the years is 'Economic Development'. The results reveal that the field-specific rates of changes are mostly similar. However, the two fields 'Production and Organizations' and 'Health' show point estimators which are clearly higher than the estimators for the other fields. We investigated the publications in 'Production and Organizations' and 'Health' in more detail.

JEL-Codes: A100, A120, A140.

Keywords: scientometrics, bibliometrics, dynamics of research fields, economics, JEL code.

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1 Introduction

Since the beginning of the modern science system, scientific activities show an increasing trend, most of the times and in most disciplines. An overview of studies reporting empirical results on the growth of science using annual numbers of publications (and the most recent empirical results) can be found in Bornmann and Mutz (2015) and Bornmann, Haunschild, and Mutz (2021). Understanding how a discipline evolves over time is interesting both from a historical and a recent perspective. For instance, the recent perspective might be useful for researchers planning research activities for coming years; the historical perspective might be interesting for scientific organizations reflecting on own developments. Developments within a discipline can be analyzed based on different approaches. Eminent researchers with a broad overview of a discipline could write about developments in the discipline in a narrative way. It may be an advantage of this approach that there is a deep understanding of the processes and activities in the discipline. The disadvantage may be that the overview would be written from a particular perspective (and may be biased). The individual view on the discipline could be broaden by asking experts in the discipline in a survey or Delphi study. The Delphi method is defined as follows: "The delphi technique provides for the systematic solicitation and collation of judgments on a particular topic through a set of carefully designed sequential questionnaires interspersed with summarized information and feedback of opinions derived from earlier responses" (van de Ven & Delbecq, 1974, p. 606). Surveys and Delphi studies are able to catch information and opinions from many experts, but the results may depend on the initial questionnaires sent to the experts. A potentially less biased alternative is the text-mining analysis of full papers via machine-learning algorithms (Kosnik, 2015; Popoff, Besada, Jansen, Cope, & Kanters, 2020). The disadvantage of this alternative is the necessity to have access to the full text of papers which is usually not possible for all papers published in a certain discipline.

In this study, we used a fourth approach for the analysis of developments in a discipline: the use of available disciplinary data from literature databases. Several databases exist (e.g., Web of Science, Clarivate, or Scopus, Elsevier) covering the literature from multiple disciplines or single disciplines. The databases contain many information that can be used for the empirical analyses such as keywords, abstracts, titles, and field classification schemes. The advantage of field classification schemes lies in their standardization and clear structure. Examples of established field categorization schemes are the Mathematical Reviews in mathematics, the Chemical Abstracts (CA) in chemistry and the Journal of Economic Literature (JEL) classification codes in economics. In order to investigate temporal developments in disciplines, one counts the number of publications in the fields belonging to the discipline over time.

This paper focuses on recent publication dynamics in economics. This discipline is specifically interesting since it covers a wide range of topics such as the distribution of the social product, unemployment, the organization of production, inflation, and class conflicts. Recent empirical results by Paldam (2021) on the methods used in economics show that the classical method is still to empirically perform regression analysis starting from theoretically-based research questions. The results of the study also point to changes in the discipline: "The fraction of theoretical papers has fallen by 26 pp (percentage points), while the fraction of papers using the classical method has increased by 15 pp" (p. 28). We investigate in this study whether there are also changes visible on the economics field level with varying dynamics over time. It is an advantage of the economic discipline that one can utilize the Journal of Economic Literature (JEL) classification codes for empirical analysis. JEL codes has been a well-established field-classification scheme for more than 50 years in the economics profession.

The development of topics, themes, and fields in economics has been analyzed so far in only a few previous studies. Kelly and Bruestle (2011) investigated how the distribution of JEL codes have evolved between 1969 and 2007. For 'Finance, Development, and Industrial Organization,' they found a rise in the share of total articles; the opposite trend appeared in

'Microeconomics, Macroeconomics, and Labor' (see also Hamermesh, 2013). Rath and Wohlrabe (2016) extended this analysis until 2013 using data from the RePEc (Research Papers in Economics) website. Their results reveal the largest increase for the field 'Agricultural and Natural Resource Economics, Environmental and Ecological Economics.' In this study, we continued this line of research by applying an advanced methodological approach developed by Bornmann and Haunschild (2022) to analyze recent temporal dynamics in economics based on the field level. We have focused on publications published between 2012 and 2021 and identified those fields in economics with the highest dynamics (largest rates of change in paper counts).

2 Methods

Fields in economics can be well-defined by JEL codes, which are assigned to almost every paper in the field. According to Cherrier (2017), JEL codes are an important field-classification scheme in economics: the codes provide a map of the discipline including the fields of the American Economic Association (AEA) website. Kosnik (2018) demonstrated that JEL codes reflect research areas in economics validly. On the aggregated level, JEL codes can be used to classify and describe research published by journals, researchers, institutions, and countries.

JEL codes are provided in EconLit, which is the one of the most comprehensive database covering economics literature. It contains meta-data for peer reviewed articles, working papers, PhD dissertations, books and book reviews, and collective volume articles. The database is maintained by the AEA. The meta-data comprises the JEL codes assigning economics fields. In its current form (since 1991), JEL codes – on the main categories level – are designed as "Exx", i.e. a letter plus two stages of subcategories indicated by numbers (see https://www.aeaweb.org/jel/guide/jel.php for additional information). JEL codes include 20 categories at the main level, which are listed in Table 1.

For this study, we extracted the meta-data for all peer reviewed papers published between 2012 and 2021 from the database in early October 2022.

Table 1. Main JEL codes and their code letters

Code letter	Category
A	General Economics and Teaching
B	History of Economic Thought, Methodology, and Heterodox Approaches
C	Mathematical and Quantitative Methods
D	Microeconomics
E	Macroeconomics and Monetary Economics
F	International Economics
G	Financial Economics
H	Public Economics
I	Health, Education, and Welfare
J	Labor and Demographic Economics
K	Law and Economics
L	Industrial Organization
M	Business Administration and Business Economics; Marketing; Accounting; Personnel Economics
N	Economic History
O	Economic Development, Innovation, Technological Change, and Growth
P	Economic Systems
Q	Agricultural and Natural Resource Economics; Environmental and Ecological Economics
R	Urban, Rural, Regional, Real Estate, and Transportation Economics
Y	Miscellaneous Categories
Z	Other Special Topics

Note. Table by the authors

The initial dataset for this study comprised 471,726 papers covering the period 2012 to 2021. Since 15,576 papers did not have any JEL code assigned, our analysis built upon 456,150 papers. Since authors usually assign more than one JEL code to their papers, the average number of assigned JEL-codes per paper is 4.1 in the dataset. Table 2 reports the corresponding distribution of assigned JEL codes per paper. Three or four JEL codes per paper is the most frequent choice by authors, approximately 40% of the papers have these numbers of JEL codes.

15% of the papers have two or five JEL codes, respectively. Around 34,800 papers (around 8%) only have one JEL code.

Table 2. Distribution of assigned JEL codes per paper

Number of JEL codes per paper	Frequency	Percent	Cumulative percent
1	34,778	7,6	7.6
2	63,003	13,8	21.4
3	86,853	19,0	40.5
4	88,914	19,5	60.0
5	75,580	16,6	76.5
6	55,703	12,2	88.7
7	51,319	11,3	100.0
Total	456,150	100	

Note. Table by the authors

Figure 1 presents the average number of JEL codes per paper over time since 1991. The figure shows a steady increase from about 1.9 in 1991 to 4.3 in 2021. Figure 1 and Table 2 can be interpreted in three different ways. First, authors assign codes today more in a more detailed manner than in the past. Second, as papers have become longer in economics (Card & DellaVigna, 2014) the topics covered for a paper might have increased over time implying the use of more JEL codes. Third, economics is becoming more interdisciplinary, with papers covering more fields within economics and fields closely related to economics.

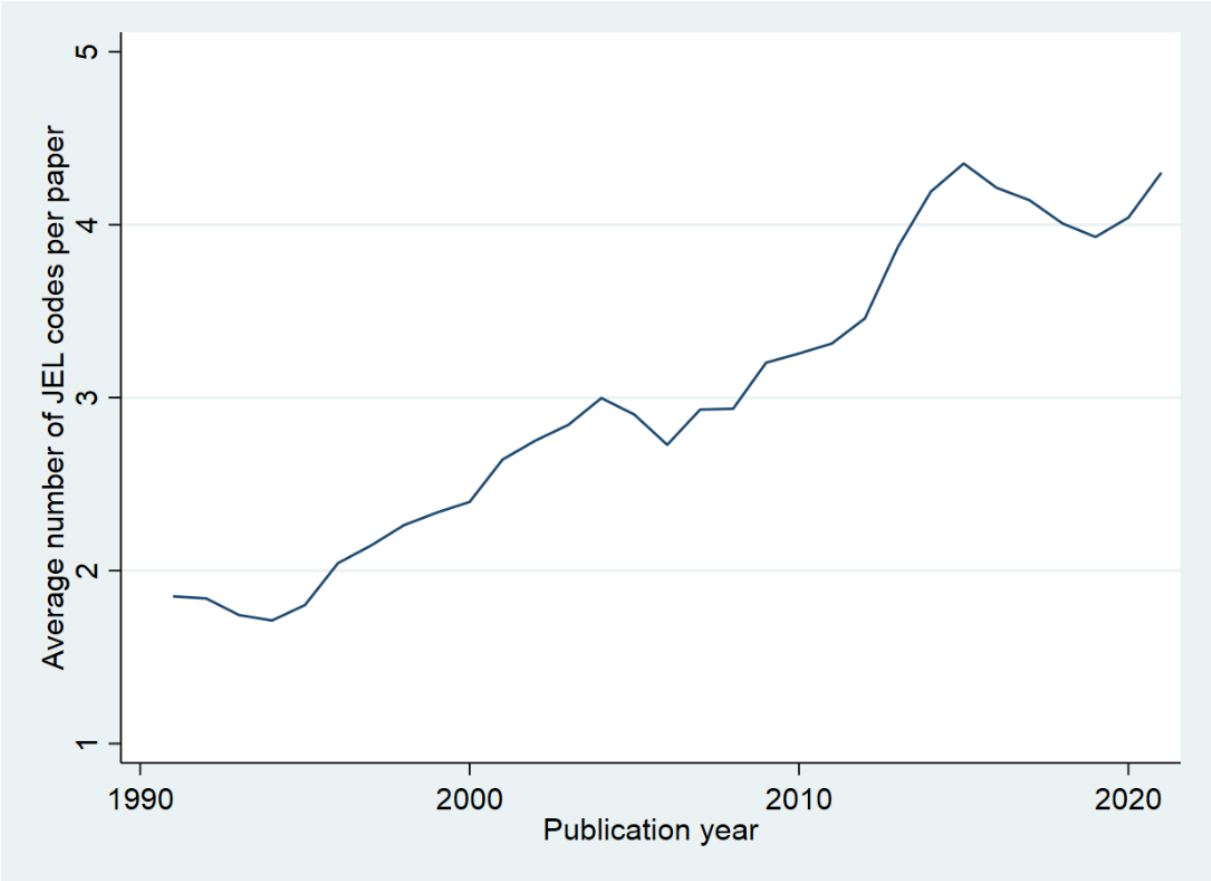

Figure 1. Average number of JEL codes per paper over time (figure by the authors)

We produced two datasets for our statistical analyses: the first dataset is based on full counting of papers where each paper has a weight of 1. The second dataset is based on fractional counting where each paper is divided by the number of JEL codes assigned. We used this additional dataset to investigate whether the categorization of one and the same paper to different JEL codes has an influence on the results (temporal dynamics in economic fields). In Section 3, we present the results that are based on full counting. The results based on fractional counting are in the Appendix (we found that both counting methods lead to similar results).

3 Results

We identified in this study economics fields with the largest rate of change across ten years (from 2012 to 2021). We were interested in finding an answer to the question which fields are characterized by (very) large growth rates in recent years.

3.1 Development of publication counts in economics

For framing the results to the economic fields in the following section, we start with presenting annual paper counts in economics (see Figure 2). We added a linear trend line in the figure that shows a decreasing trend between 2012 and 2021. One should consider in the interpretation of the trend that the trend is based on rather small numbers: the difference between 2012 and 2021 is only about 3,500 articles.

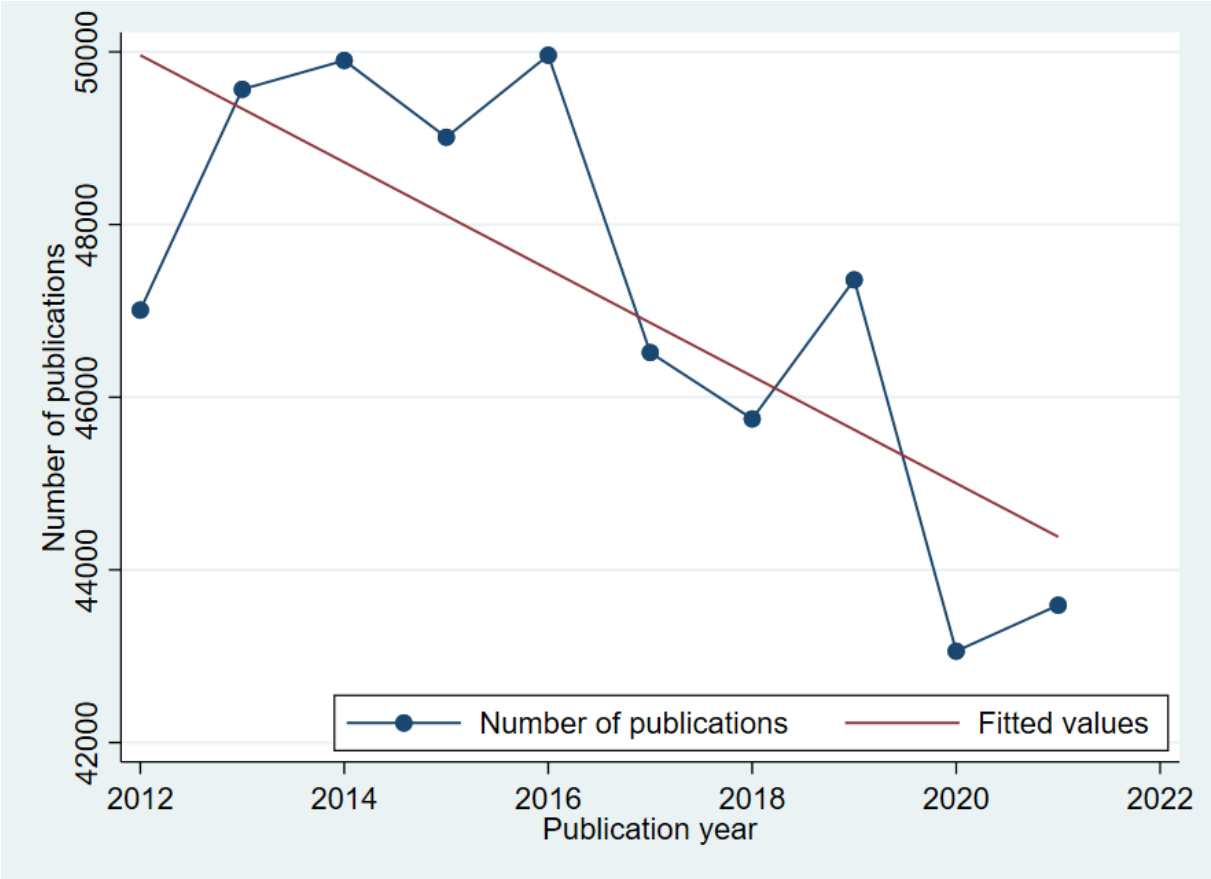

Figure 2. Annual changes in the number of publications in economics (figure by the authors)

One possible reason for the decreasing trend in economics might be the changing coverage of journals in the EconLit database. Figure 3 plots the number of covered journals in EconLit and the average number of papers per journal. The figure shows that the number of journals dropped from about 1,360 in 2015 to 978 in 2021. An explanation for the decreasing

trend might be the substantial delay in filling the EconLit database in recent years. We hold the substantial delay for a plausible explanation, since there is an increase in the average number of papers per journal observable that do not agree with the results in Figure 2.

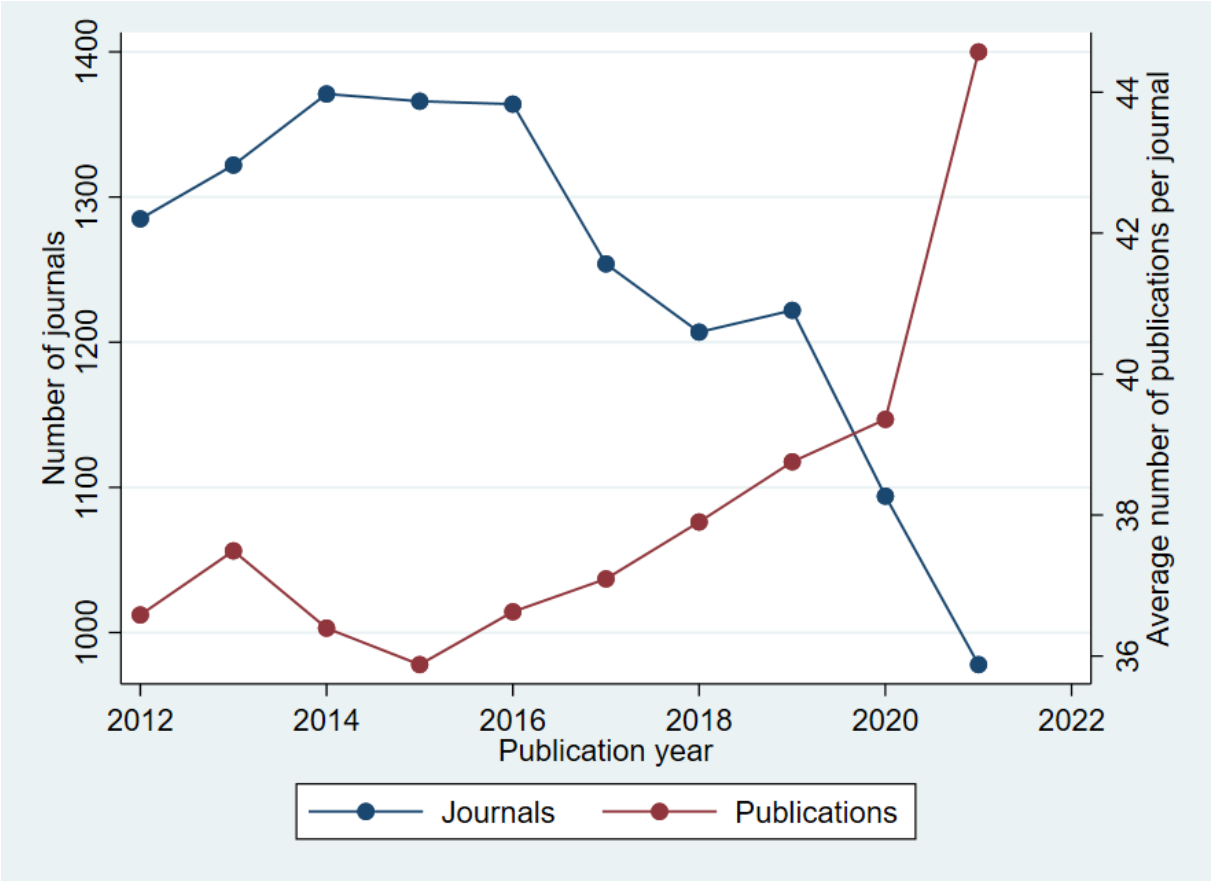

Figure 3. Average number of publications per journal and covered journals per year in EconLit (figure by the authors)

3.2 Development of publication counts in economics fields

Figure 4 shows the number of papers in the economics fields, defined by the two-digit (e.g., A1) JEL classifications, stratified by publication year. Each dot in the figure stands for a field outside of adjacent values. These values are most extreme values within the 1.5 interquartile range of the nearest quartile (Tukey, 1977). The results reveal that several outliers exist, i.e., fields with many more papers than the other fields. The field with the

largest paper output across the years is ‘Economic Development’. In the interpretation of the results, it should be considered that papers are multiply counted since they are assigned to more than one JEL code. ‘Economic Development’ is an important field, but also an umbrella field with which many papers find a connection.

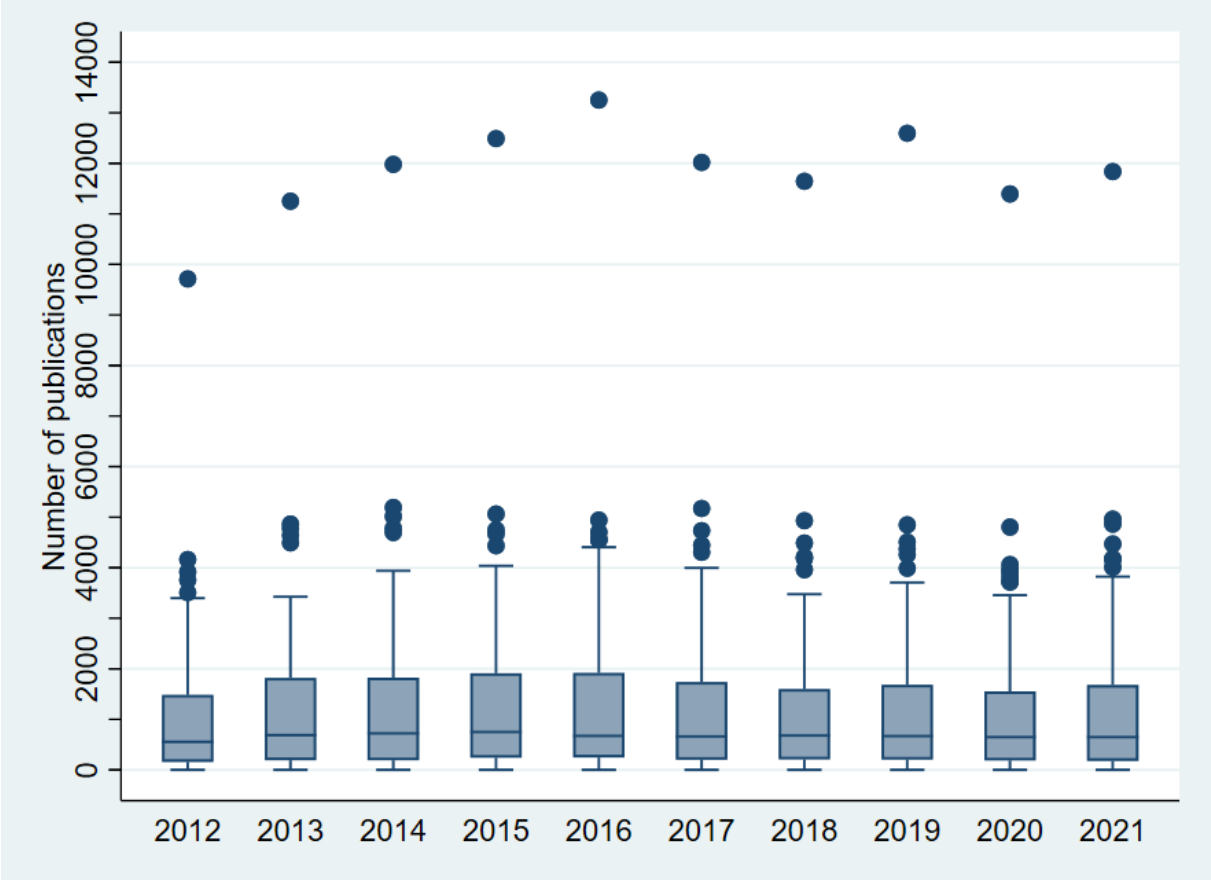

Figure 4. Box plots for the number of papers in economic fields by publication year (figure by the authors)

Table 3 presents key figures for the annual numbers of papers. The large differences between the means and medians can be interpreted as large differences between economic fields. The medians and means are increasing until 2015. In the following years, there is no trend visible.

Table 3. Key figures for the number of publications in economic fields stratified by publication year

Publication year	Mean	Median	Standard deviation	Minimum	Maximum
2012	980.14	555	1,245.43	0	9,714
2013	1,147.81	687	1,451.96	0	11,252
2014	1,241.07	722	1,561.00	0	11,981
2015	1,274.43	750	1,585.17	0	12,491
2016	1,262.58	671	1,623.94	0	13,253
2017	1,171.61	663	1,511.83	0	12,020
2018	1,140.16	679	1,459.66	0	11,646
2019	1,168.01	669	1,530.92	0	12,596
2020	1,093.93	648	1,425.37	0	11,395
2021	1,165.26	647	1,519.38	0	11,838

Note. Table by the authors

To investigate how the change of paper counts in economic fields occurs across the years, we calculated growth-curve models. Figure 4 and Table 3 only show the results from year to year considering the whole paper set. Since we are interested in how the single economic fields change from year to year, we analyzed the within-field change by calculating the mean and variability in annual change. To produce the data for the statistical analyses, we calculated the differences in the number of papers between the publication years for every economic field. For example,

Table 4 presents the numbers for the field ‘Prices, Business Fluctuations, and Cycles’. As the differences to the previous publication years for the field reveal, there is a decreasing trend in most of the years.

Table 4. Number of papers assigned to ‘Prices, Business Fluctuations, and Cycles’ over ten publication years

Publication year	Number of papers	Difference to previous year (absolute)	Difference to previous year (in percent)
2012	2,459	-	
2013	2,824	365	14.84
2014	3,058	234	8,29
2015	2,928	-130	-4.25

2016	2,789	-139	-4.75
2017	2,388	-401	-14.38
2018	2,185	-203	-8.50
2019	2,077	-108	-4.94
2020	1,912	-165	-7.94
2021	2,057	145	7.58

Note. Table by the authors

The mean, median, standard deviation, minimum, and maximum of the annual differences are shown in Table 5 for all economic fields. The distributions of the differences (separated by publication years) are shown in Figure 5.

Table 5. Key figures for the annual differences for all economic fields

Publication year	Mean	Median	Standard deviation	Minimum	Maximum
2013	167.67	101	239.18	-318	1,538
2014	93.26	37	181.57	-407	729
2015	33.36	7	142.68	-516	553
2016	-11.84	-9	133.65	-498	762
2017	-90.98	-46	175.95	-1233	623
2018	-31.44	-9	98.27	-380	268
2019	27.84	3	127.85	-407	950
2020	-74.08	-37	201.95	-1201	1,062
2021	71.33	20	159.39	-143	1,133

Note. Table by the authors

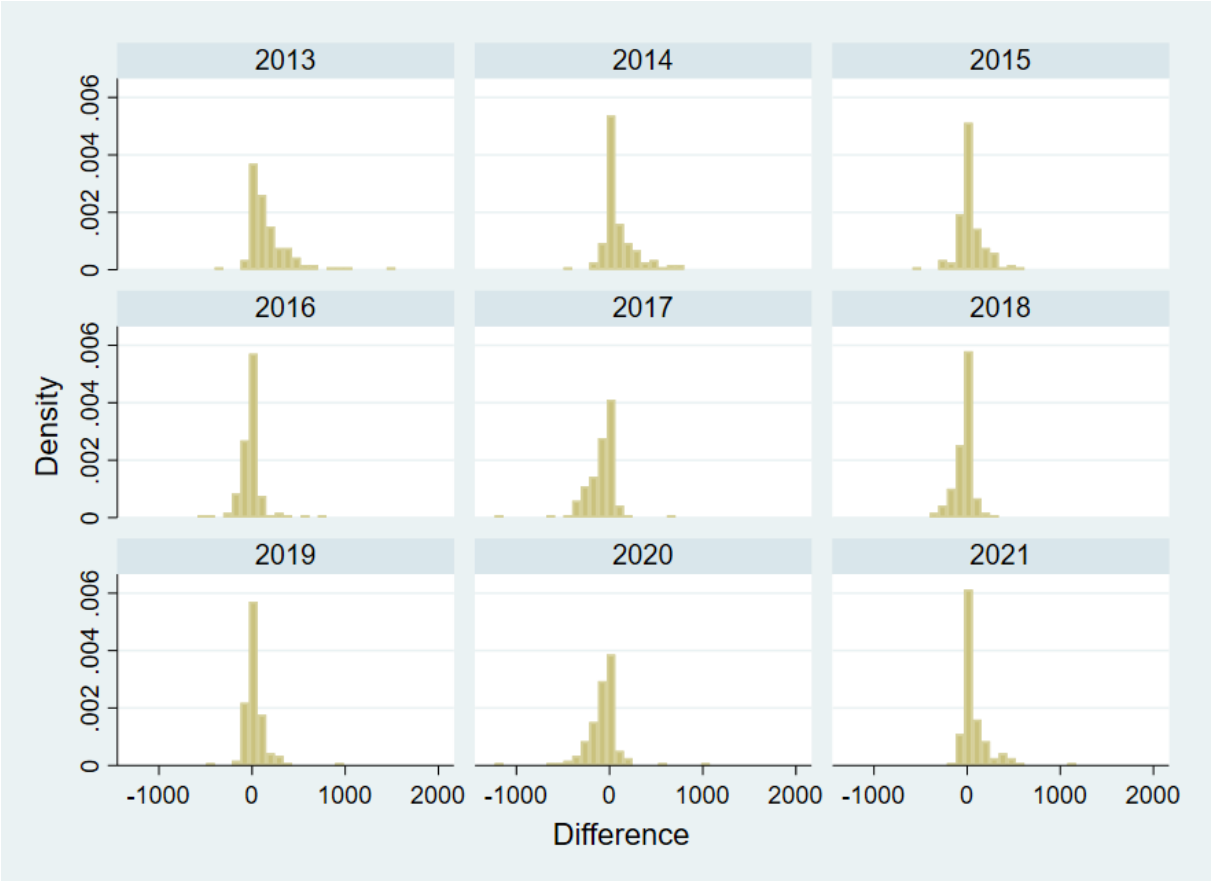

Figure 5. Histograms of annual changes in the number of publications (figure by the authors)

The distributions in Figure 5 reveal that the annual differences are mostly small, but some differences are very large. The mean differences in the publication years are negative in four out of nine cases (see Table 5): after 2015, the mean differences are negative with two exceptions (after positive mean differences in subsequent years). The key figures in Table 5 indicate that the development of publication counts across time is quite different rather than consistent.

According to Baldwin (2019), for studying change, the statistical analyses of only two time points are not sufficient. The previous results do not reveal how paper counts change over the complete range of years within economic fields. Change over the entire time range will be targeted therefore in the following statistical analyses. Figure 6 and Figure 7 include spaghetti plots for the number of publications in the economic fields over time. As the plots

show in both figures, the fields vary in their pattern of change. It appears that hardly any field exists with constant numbers. The numbers of papers decrease in some fields and increase in others. This observation agrees to the mean differences reported above. In some fields, the numbers of papers oscillate within the ten years considered here.

Figure 6 and Figure 7 also show the total across all fields: the graphs confirm the previous result that some fields are concerned by significantly more papers than the other fields. Furthermore, the starting points (intercepts) of the fields in paper counts and their types of changes (slopes) vary considerably.

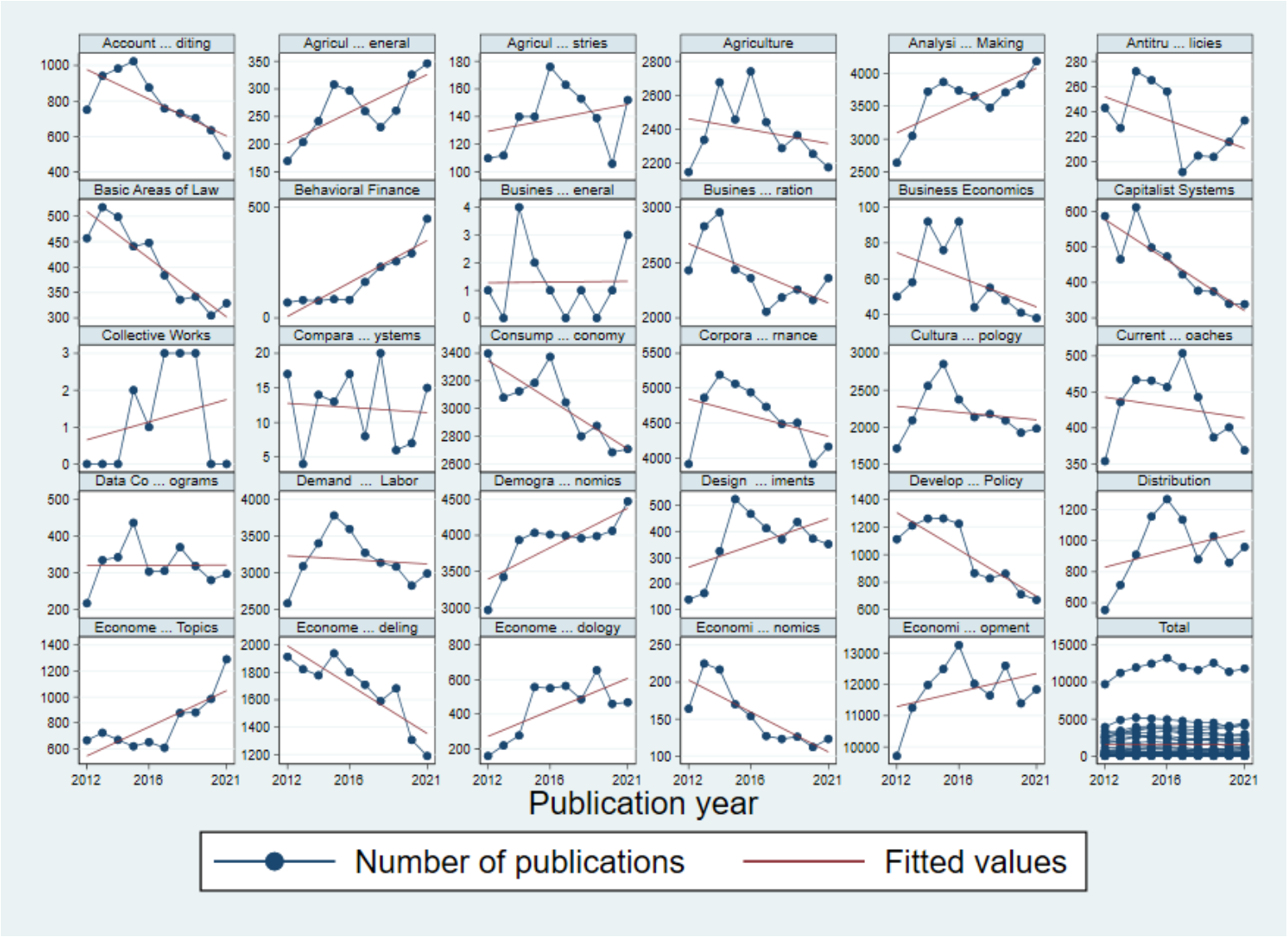

Figure 6. Spaghetti plots showing annual changes in the number of publications for all economic fields (part 1, figure by the authors)

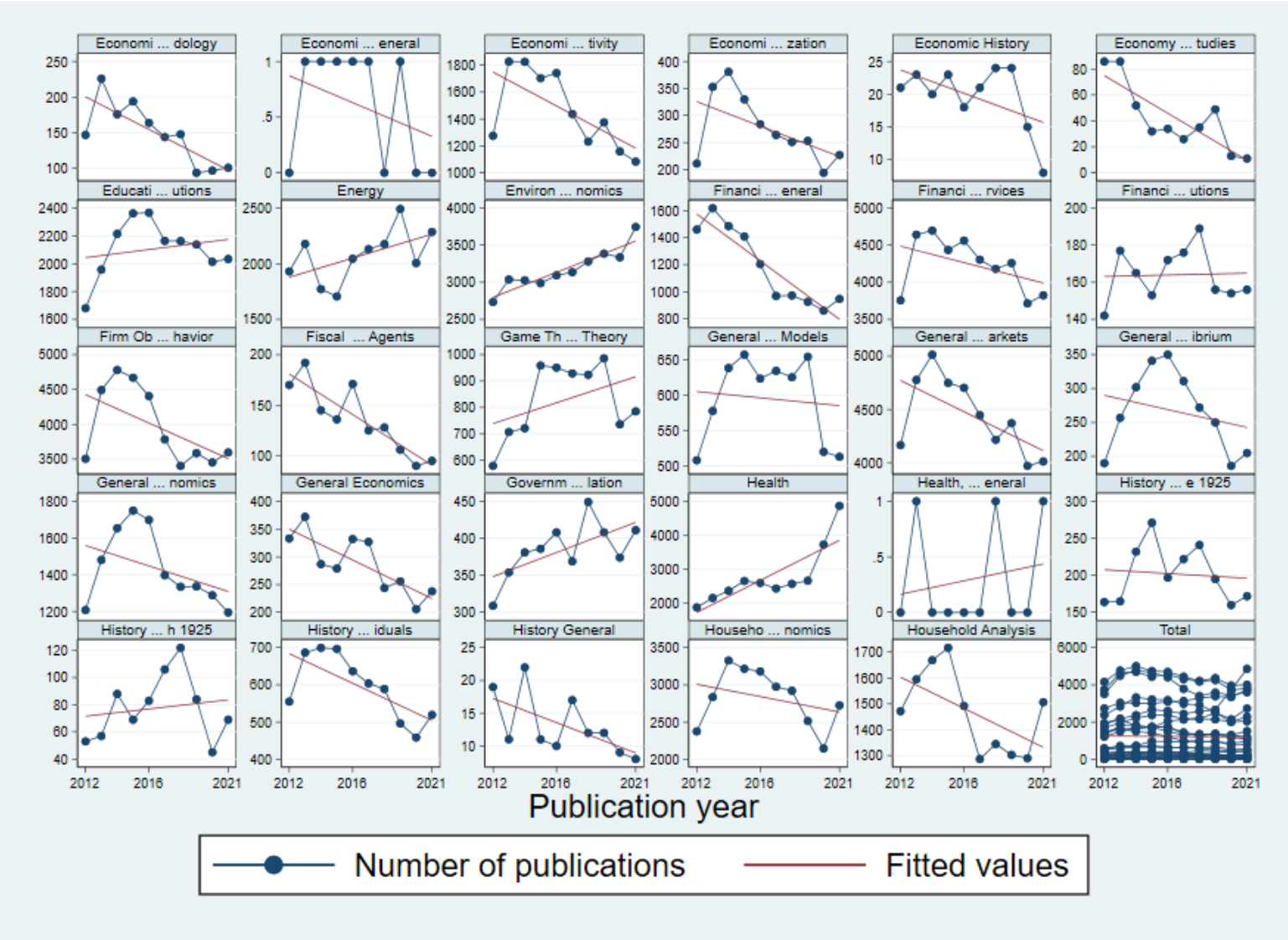

Figure 7. Spaghetti plots showing annual changes in the number of publications for all economic fields (part 2, figure by the authors)

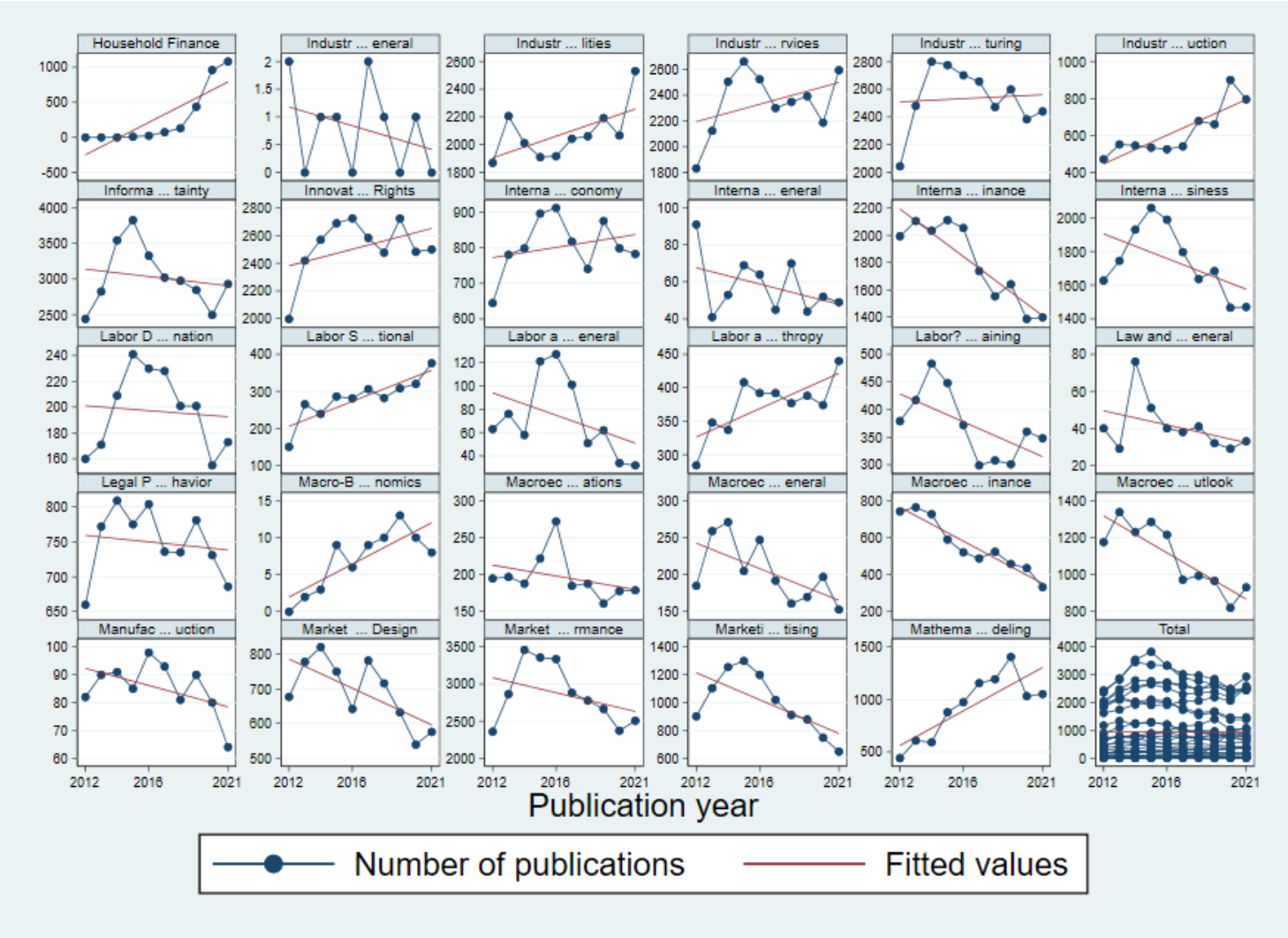

Figure 8. Spaghetti plots showing annual changes in the number of publications for all economic fields (part 3, figure by the authors)

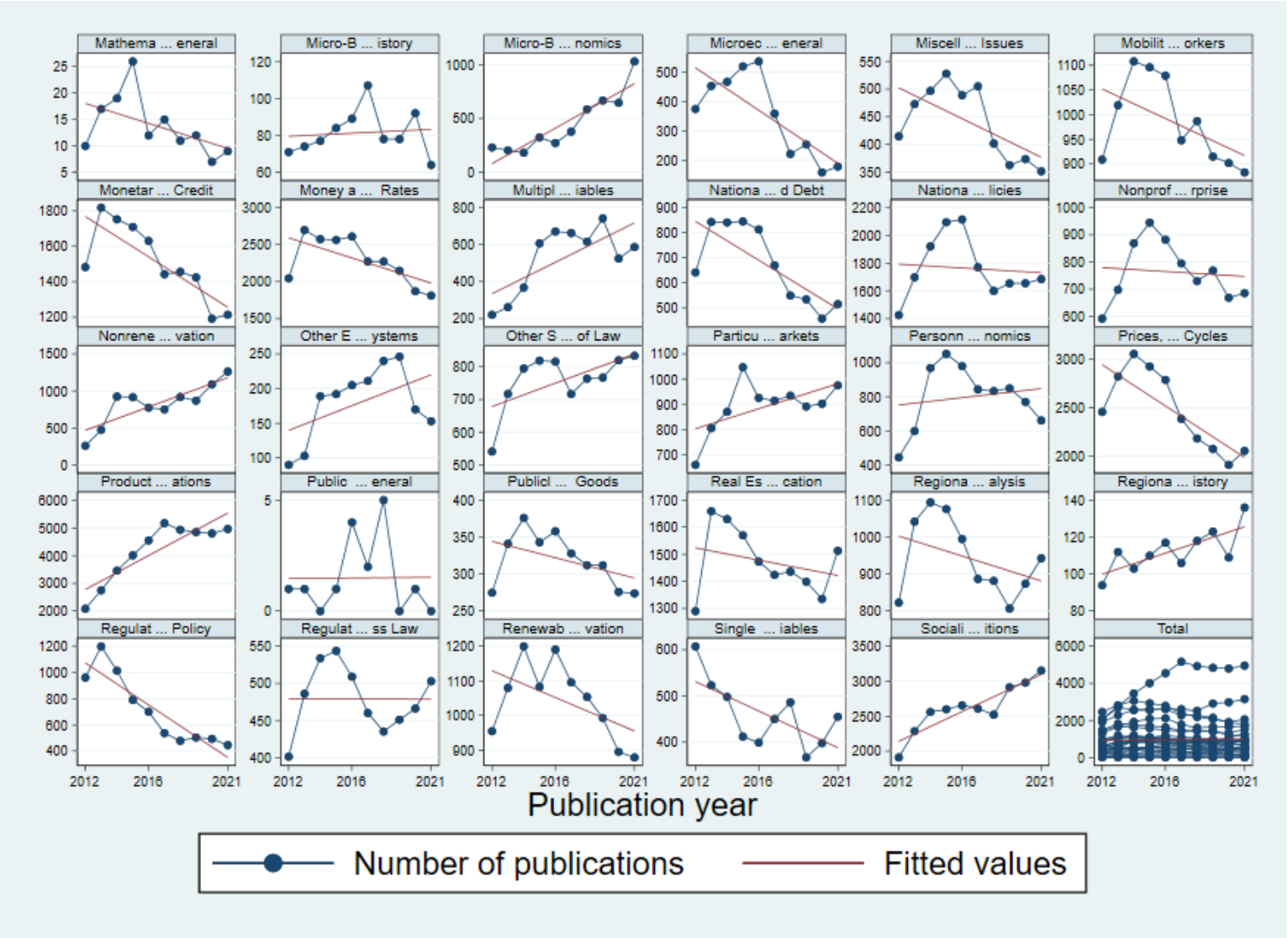

Figure 9. Spaghetti plots showing annual changes in the number of publications for all economic fields (part 4, figure by the authors)

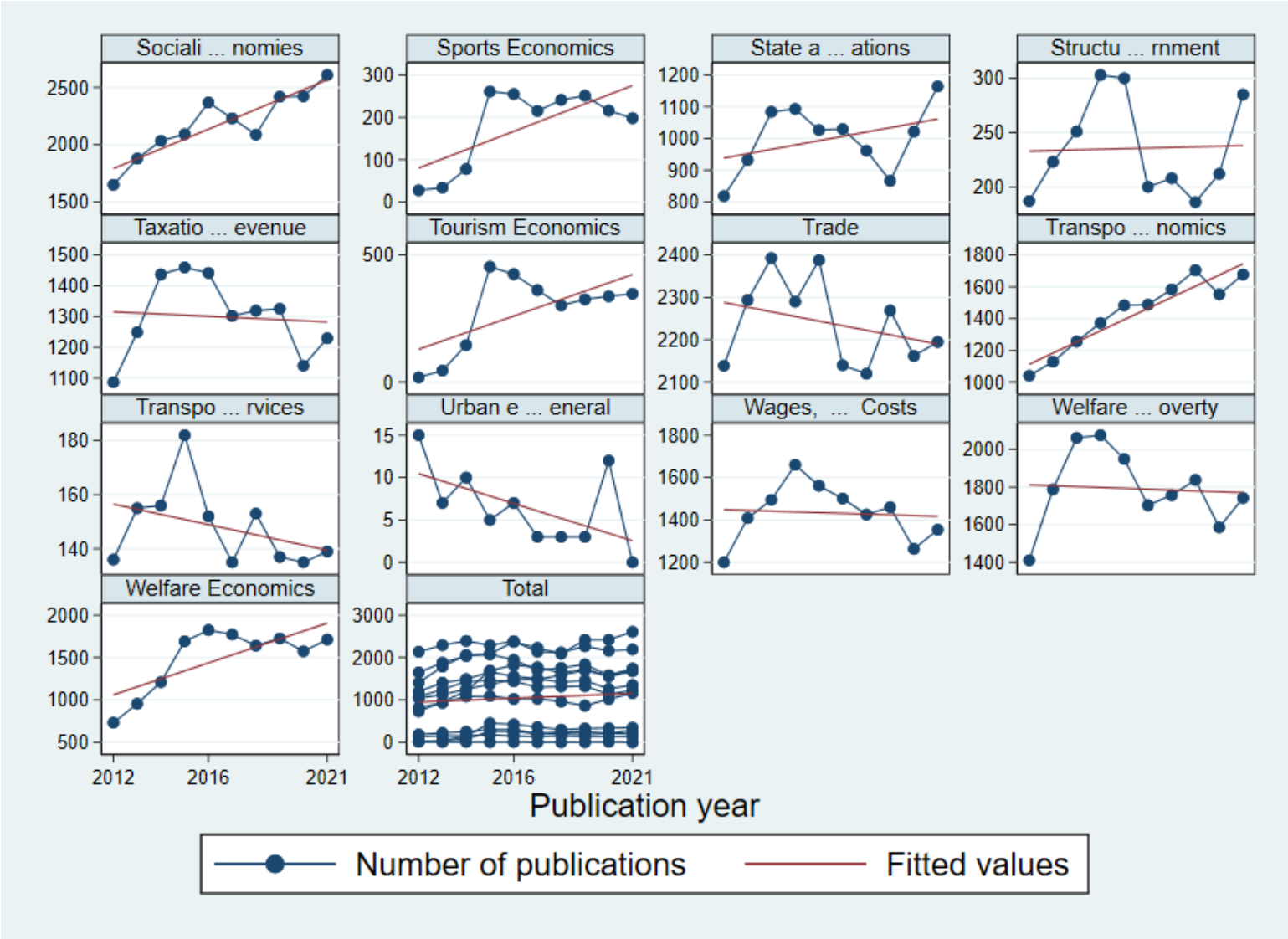

Figure 10. Spaghetti plots showing annual changes in the number of publications for all economic fields (part 5, figure by the authors)

We investigated the variability in the intercepts and slopes by estimating changes in the number of papers for each economic field. We computed a regression analysis for the number of papers for each field and collected (analyzed) the intercepts and slopes from the regression models. We fitted an ordinary least squares regression for each field with number of papers as dependent and time values (transformed publication years) as independent variable

$$P_i = b_0 + b_1 T_i + e_i$$

whereby i is the index for the time unit, P is the number of papers, T is the time value (transformed publication years), and e is the error in prediction. The time variable 'publication year' is between 2012 and 2021. The intercept in the regression model is the expected number of papers when the time variable equals 0. Since 'publication year' in our dataset does not contain this value, we transformed the variable: 2012 received the value 0 and 2021 the value 9, i.e., T_i = 'publication year' minus 2012. The transformation makes b_0 the expected value of the number of papers at the baseline (i.e., the first year in this study: 2012).

We performed the regression model for each economic field and saved the intercepts and slopes from each regression to investigate the variability in their relationships.

Table 6. Key figures for the intercepts and slopes from the regression models

Variable	N	Mean	Standard deviation	Minimum	Maximum
Intercept	129	1,152.78	1,455.87	-247.05	11,288.85
Slope	129	2.60	55.13	-106.28	306.42

Note. Table by the authors

Table 6 presents key figures for the intercepts and slopes from the 129 regression models. The expected number of papers at the baseline (publication year 2012) – the intercept – ranges from -247.05 to 11,288.85. The rate of change for the increase in publication years – the slope – ranges from -106.28 to 306.42. The mean rate of change is positive with about 2.6.

We tested whether intercept (number of papers in 2012) and slope (rate of annual changes) are correlated. One could imagine that small fields are concerned by higher rates of changes than large fields. Our results reveal that intercept and slope values are not correlated with $r = 0.01$. The fitted line in Figure 11 indicates that high numbers of papers in economic fields are not related to high rates of annual changes with increasing paper counts.

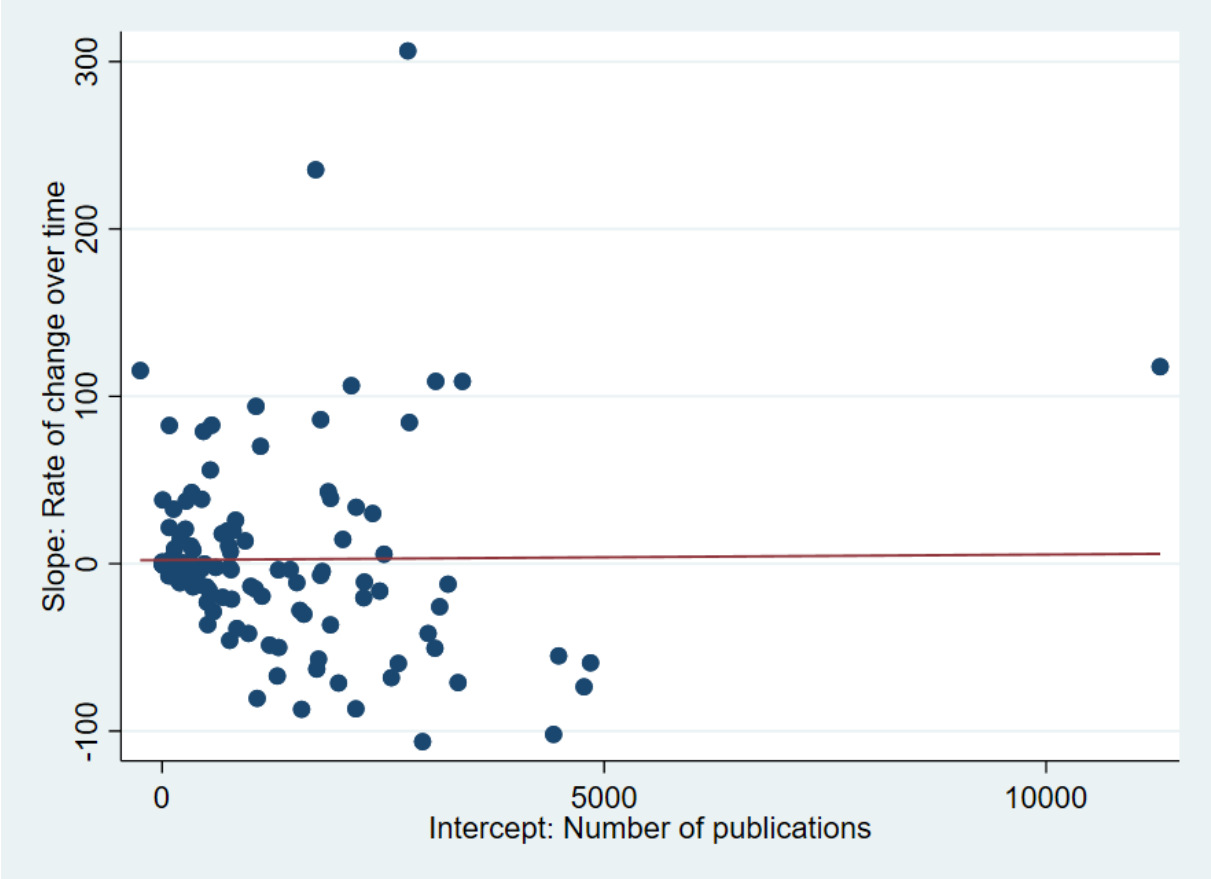

Figure 11. Scatterplot of field-specific intercepts and slopes (figure by the authors)

Following Acock (2018), we computed robust standard errors in the regression models. If the requirements of OLS regression models are not fulfilled (e.g., the distributions of the included variables do not follow the normal distribution), robust standard errors should be computed. Robust standard errors result from the variance-covariance matrix estimation of the standard errors using the sandwich estimator.

Figure 12 presents the variability in the rate of changes across economic fields with 95% confidence intervals. The rates of change in the figure are ranked from low to high on slope. The results reveal that rates of changes are similar; there is not any main economic field with noticeable higher rates of change (see the colors of the main fields in the figure). The two fields 'Production and Organizations' and 'Health' show positive point estimators that are clearly higher than the estimators for the other fields. In addition, the 95% confidence interval of 'Production and Organizations' does not overlap with the confidence intervals of most other fields. Since 'Production and Organizations' and 'Health' show the highest point estimates of the rate of change, we (exemplarily) discuss these fields in the following in more detail. We were interested in the topics of these fields.

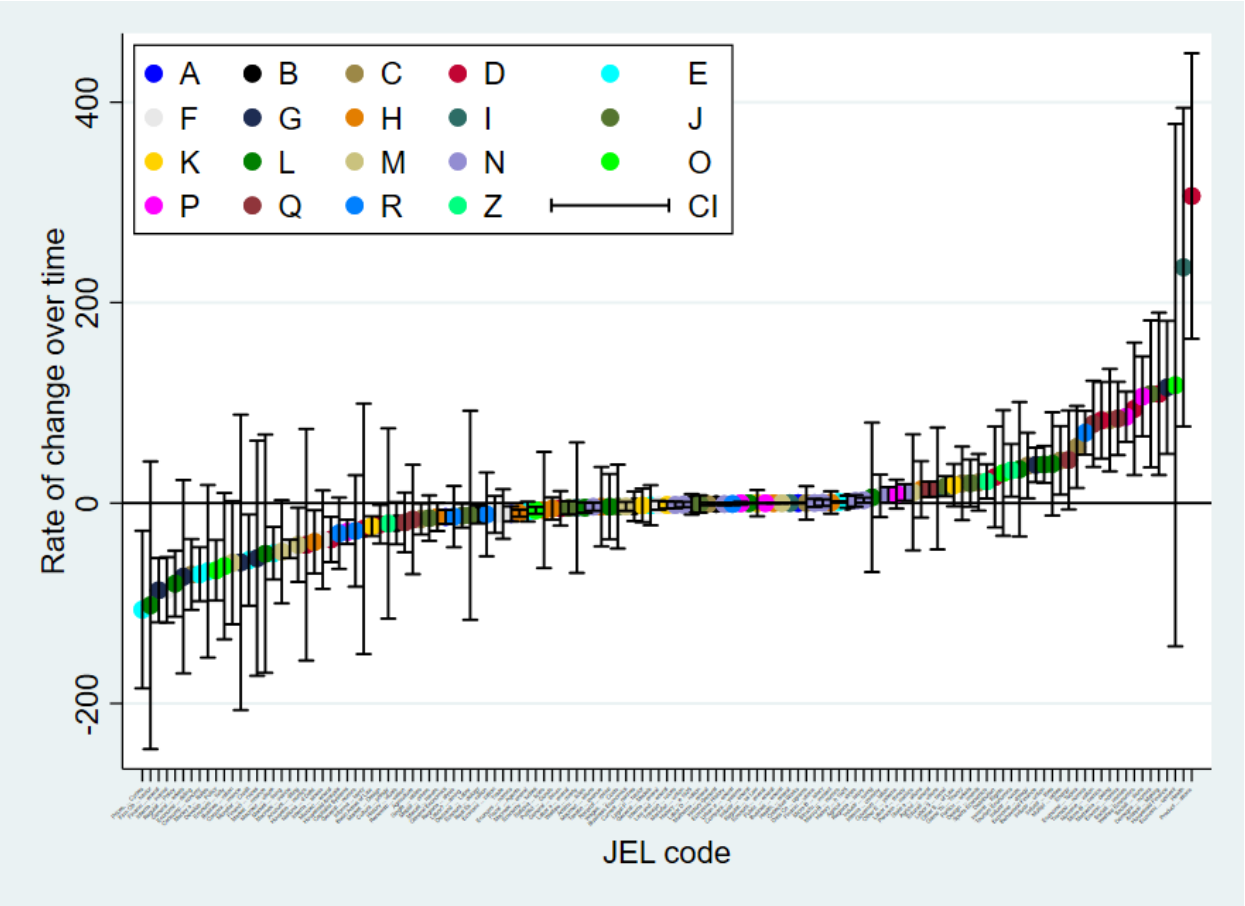

Figure 12. Variability in the rate of change across economic fields (the colors reflect economic main fields: A=General Economics and Teaching, B=History of Economic Thought, Methodology, and Heterodox Approaches, C=Mathematical and Quantitative Methods, D=Microeconomics, E=Macroeconomics and Monetary Economics, F=International Economics, G=Financial Economics, H=Public Economics, I=Health, Education, and Welfare, J=Labor and Demographic Economics, K=Law and Economics, L=Industrial Organization, M=Business Administration and Business Economics, Marketing, Accounting, Personnel Economics, N=Economic History, O=Economic Development, Innovation, Technological Change, and Growth, P=Economic Systems, Q=Agricultural and Natural Resource Economics, Environmental and Ecological Economics, R=Urban, Rural, Regional, Real Estate, and Transportation Economics, Z=Other Special Topics, figure by the authors)

3.3 Publication counts in 'Production and Organizations' (D2)

We investigated the publications in 'Production and Organizations' (D2) regarding their third level JEL codes (see Section 3.2). Between 2012 and 2021, 41,578 papers were assigned to this JEL code (second level). Table 7 presents the third level JEL codes for 'Production and Organizations' and the corresponding paper numbers. We discarded the JEL codes 'General' and 'Other' from the analyses, since these codes do not allow field-specific statements.

Table 7. Number and percent of papers in third level JEL codes belonging to 'Production and Organizations'

JEL code (third level)	Number of papers	Percent of papers
Firm Behavior: Empirical Analysis	20,576	45.45
Production • Cost • Capital • Capital, Total Factor, and Multifactor Productivity • Capacity	12,604	27.84
Intertemporal Firm Choice: Investment, Capacity, and Financing	4,360	9.63
Firm Behavior: Theory	4,081	9.01
Organizational Behavior • Transaction Costs • Property Rights	3,306	7.30
Crowd-Based Firms	342	0.76
Total	45,269	100

Note. Table by the authors

We also investigated the third level JEL codes in Table 7 over time. The results are presented in Figure 13 and Figure 14. The spaghetti plot in Figure 13 is based on third level JEL codes. Figure 14 reveals the results of 6 regression models based on data on the CTs level (publication counts and time values) as input. The results of the regression analyses reveal that the JEL code 'Firm Behavior: Empirical Analysis' shows the most dynamic trend over time.

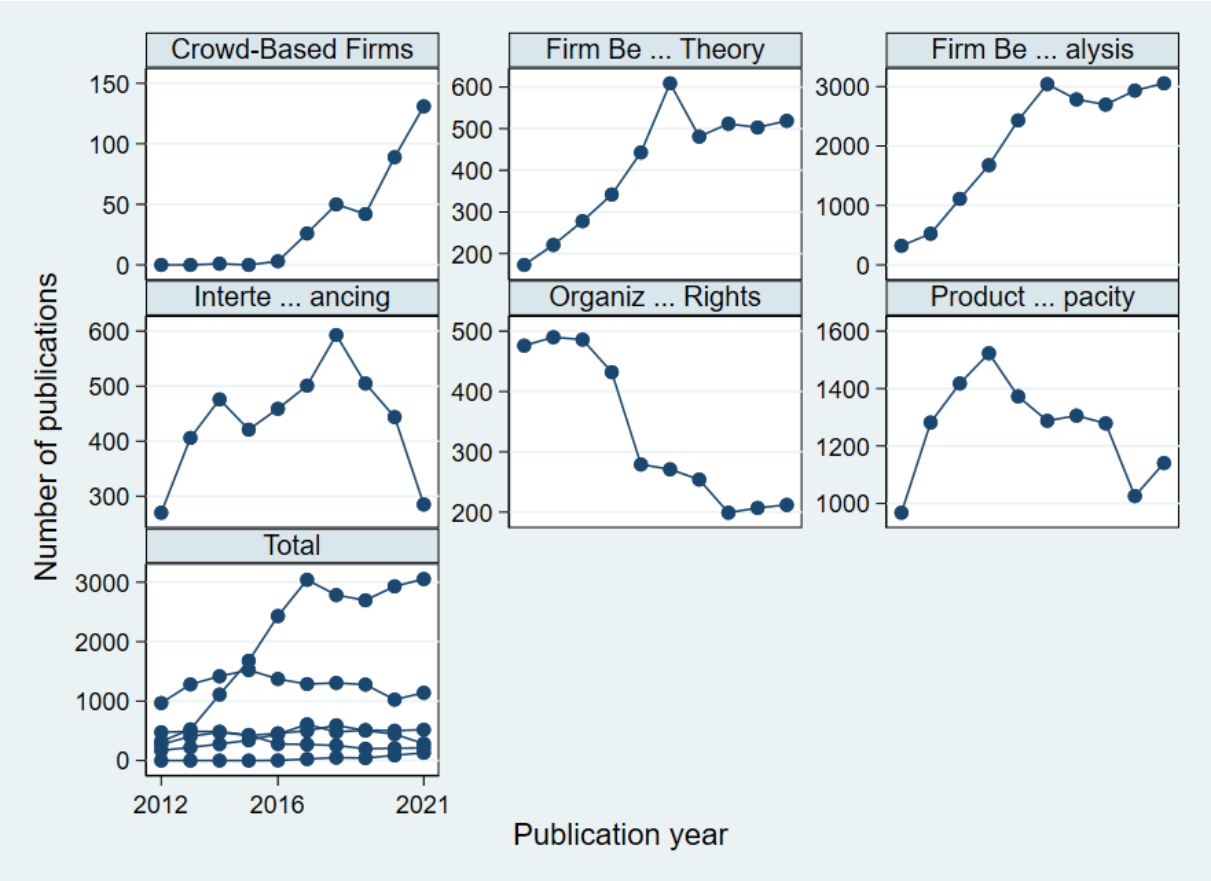

Figure 13. Spaghetti plot showing annual changes in the number of papers for the third level JEL codes within 'Production and Organizations' (D2, figure by the authors)

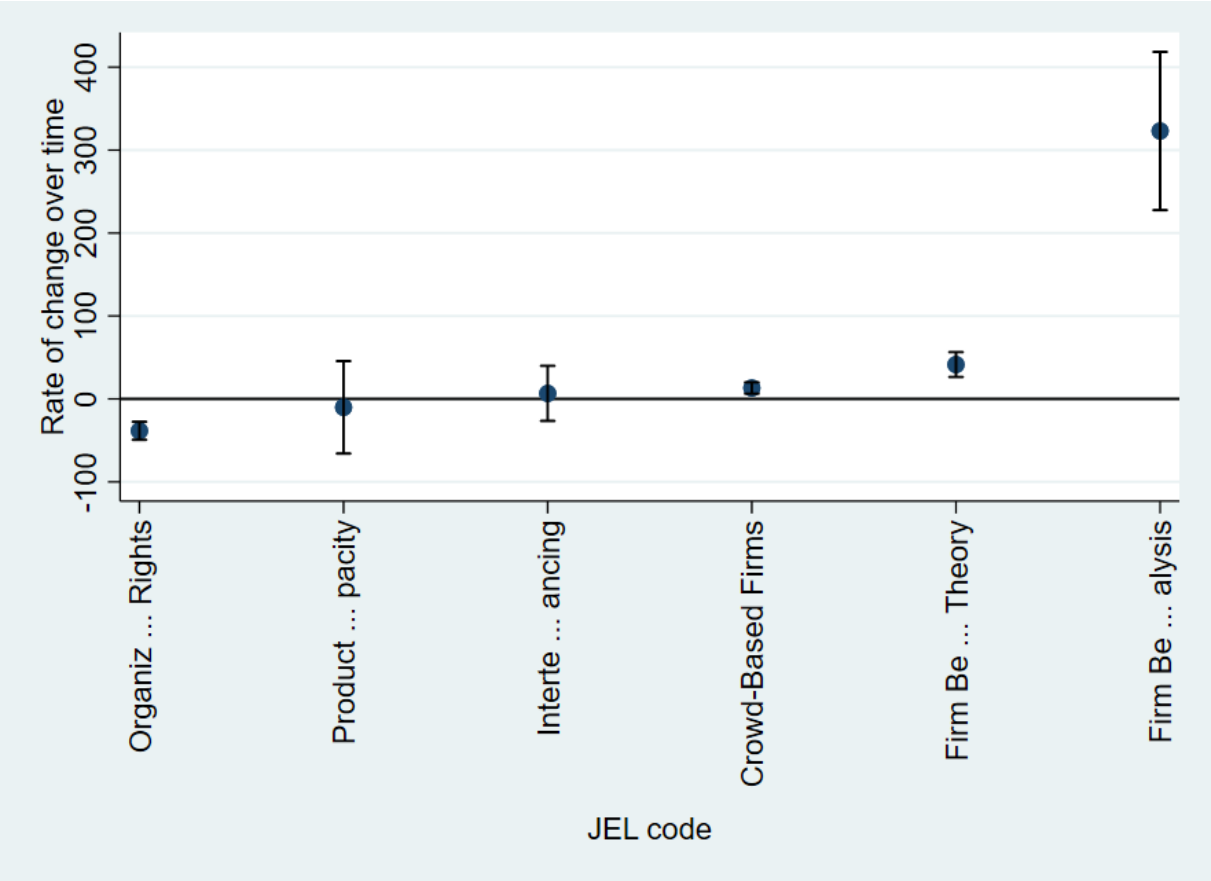

Figure 14. Variability in the rate of change across the third level JEL codes within 'Production and Organizations' (D2, figure by the authors)

To get an idea of the topics covered in 'Production and Organizations', we set up a word cloud (see Figure 15) using the titles of all papers published in 2020 and 2021. The cloud shows that the topics cover a wide range of firm behavior such as productivity, performance, and innovation.

Figure 15. Word cloud for the field ‘Production and Organizations’ (D2) based on titles for articles published in 2020 and 2021 (figure by the authors)

In a second analysis, we investigated the JEL codes that have been assigned to papers besides ‘Production and Organizations’ to receive further hints for the topics in ‘Production and Organizations’. Table 8 reports the Co-JEL codes (in absolute and relative numbers). The table shows that many papers are related to ‘Industrial Organization’, which is natural as it deals with firm behavior in and on (competitive) markets. Furthermore, ‘Financial Economics’ (G) and general issues concerning economic development (‘Economic Development, Innovation, Technological Change, and Growth’) are topics that are often associated with ‘Production and Organizations’.

Table 8. Co-JEL codes for ‘Production and Organizations’ (D2) for 2020 and 2021

JEL Code	Field	Absolute number	In percent
A	General Economics and Teaching	2	0.0
B	History of Economic Thought, Methodology, and Heterodox Approaches	75	0.3
C	Mathematical and Quantitative Methods	765	3.1
D	Microeconomics		
E	Macroeconomics and Monetary Economics	540	2.2
F	International Economics	1,286	5.1
G	Financial Economics	4,249	17.0
H	Public Economics	543	2.2
I	Health, Education, and Welfare	489	2.0
J	Labor and Demographic Economics	1,151	4.6
K	Law and Economics	399	1.6
L	Industrial Organization	5,860	23.4
M	Business Administration and Business Economics; Marketing; Accounting; Personnel Economics	2,494	10.0
N	Economic History	126	0.5
O	Economic Development, Innovation, Technological Change, and Growth	3,602	14.4

P	Economic Systems	1,442	5.8
Q	Agricultural and Natural Resource Economics; Environmental and Ecological Economics	1,048	4.2
R	Urban, Rural, Regional, Real Estate, and Transportation Economics	621	2.5
Y	Miscellaneous Categories	0	0.0
Z	Other Special Topics	373	1.5
	Total	25,065	100

Note. Table by the authors

3.4 Publication counts in 'Health' (I1)

We also analyzed the papers in 'Health' (second level JEL codes) (see Section 3.2) with respect to third level JEL codes. Between 2012 and 2021, 27,960 papers were assigned to 'Health'. We discarded the JEL codes 'General' and 'Other' from the analyses, since the codes do not allow field-specific statements. The JEL codes and the corresponding number of papers are shown in Table 9.

Table 9. Number and percent of papers in third level JEL codes belonging to 'Health'

JEL code (third level)	Number of papers	Percent of papers
Health Behavior	18,167	40.98
Government Policy • Regulation • Public Health	10,587	23.88
Analysis of Health Care Markets	8,837	19.94
Health Insurance, Public and Private	3,451	7.79
Health and Economic Development	1,799	4.06
Health and Inequality	1,487	3.35
Total	44,328	100

Note. Table by the authors

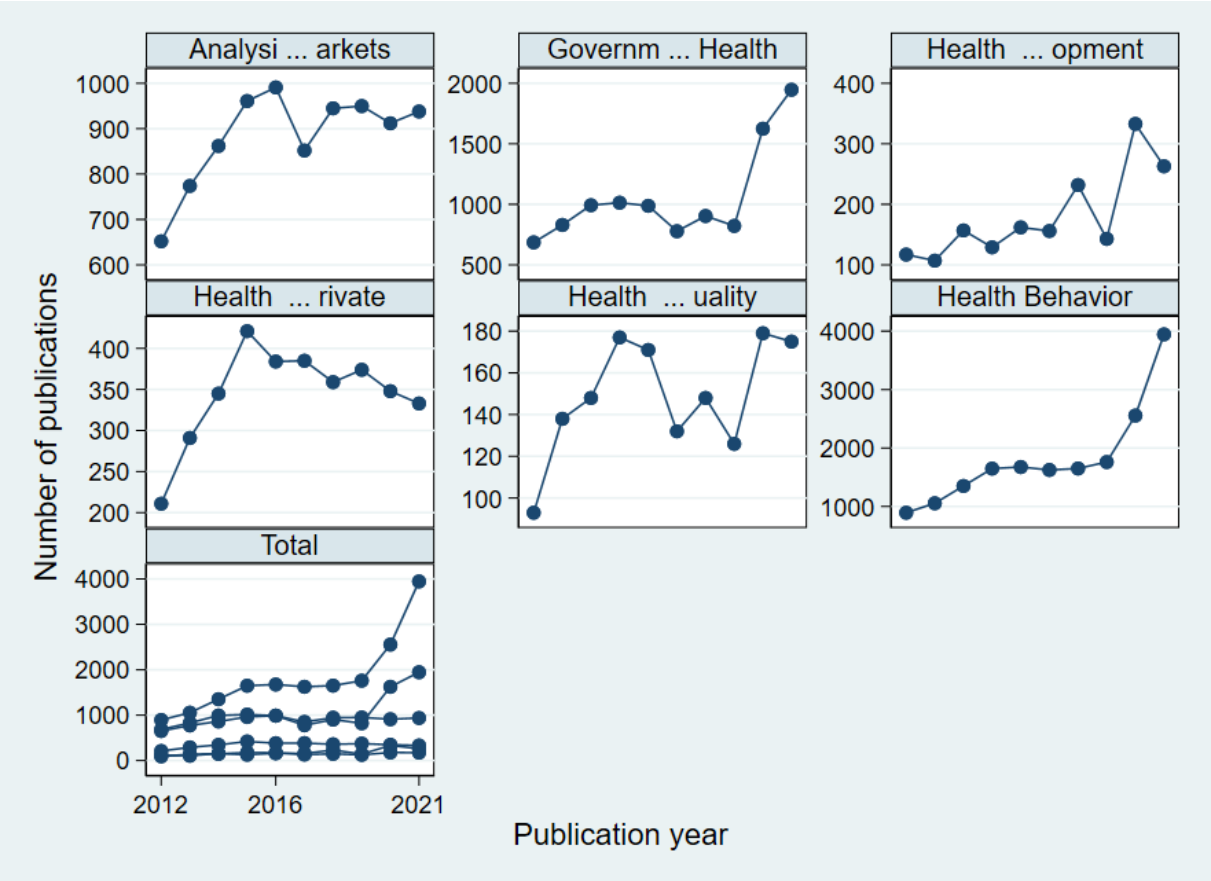

Figure 16. Spaghetti plot showing annual changes in the number of papers for the third level JEL codes belonging to 'Health' (I1, figure by the authors)

We also analyzed the third level JEL codes within 'Health' (I1) over time. The results are shown in Figure 16 and Figure 17. Figure 16 is a spaghetti plot – similar to the plot presented in Figure 6 representing economics as a whole. Figure 17 shows – similar to Figure 12 – the results of 6 regression models using the third level JEL code data (paper counts and time values) as input. The results of the regression analyses reveal that the JEL code 'Health behavior' has the most dynamic trend over time. This pattern can be largely explained by the Corona pandemic, which started in early 2020. The onset of the crises triggered an immediate output of papers dealing with health issues (Bürgi & Wohlrabe, 2022; Kruger, Maturana, & Nickerson, 2023; Thomson, Mosier, & Worosz, 2023). In 2020 and 2021, there are 3,966

papers (about 5% of all papers in these years) including at least one of the words ‘pandemic’, ‘Corona’ or ‘COVID’ in the abstract.

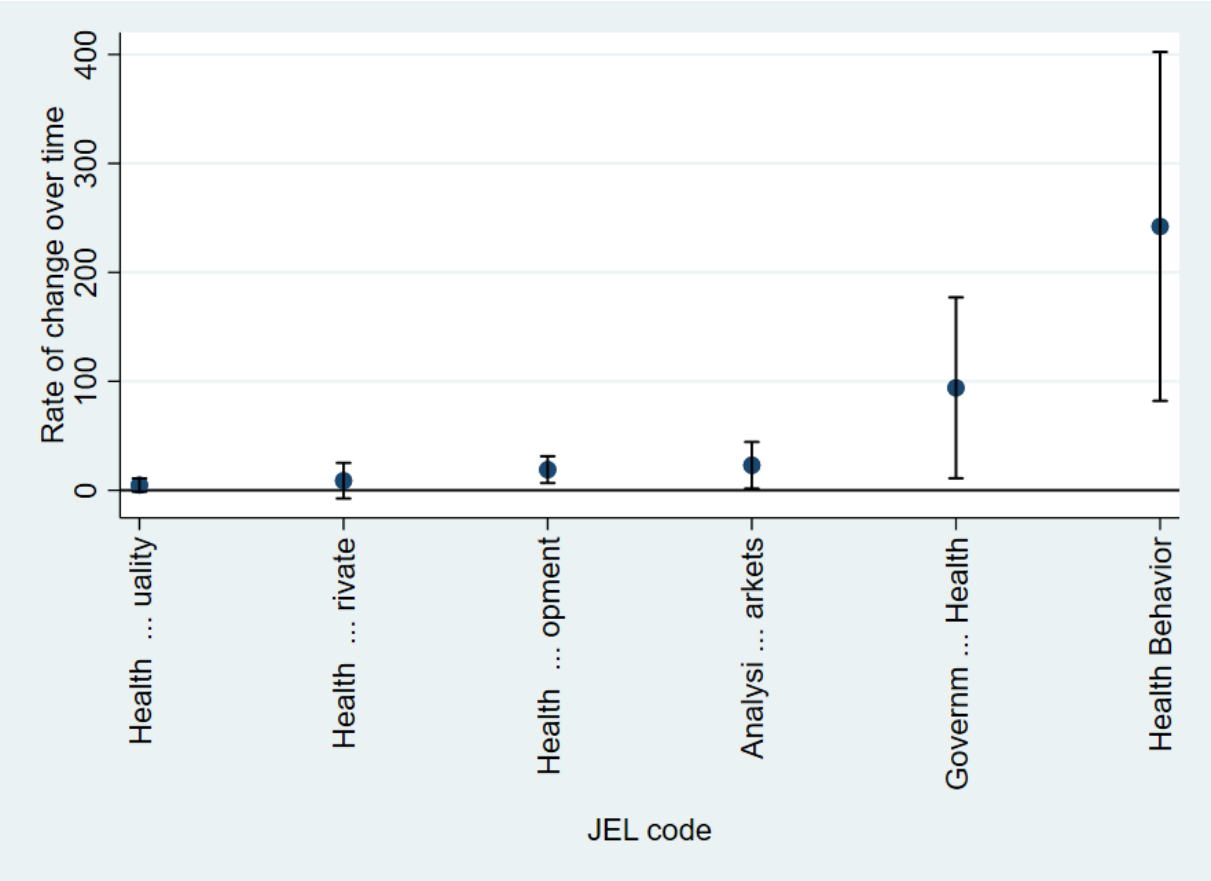

Figure 17. Variability in the rate of change across the third level JEL codes belonging to ‘Health’ (I1, figure by the authors)

The word cloud in Figure 18 confirms that the Corona pandemic was a dominant topic in health related papers in economics.

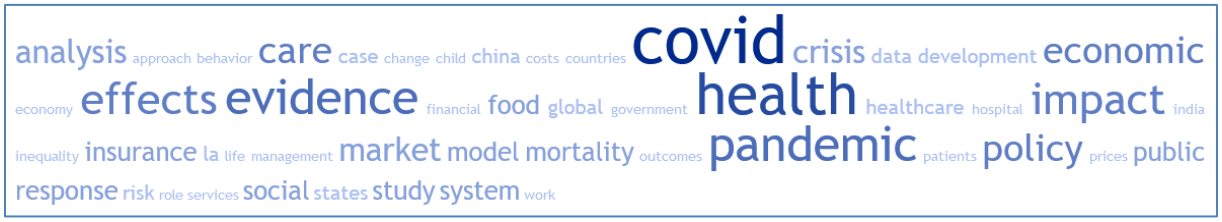

Figure 18. Word cloud for the field ‘Health’ (I1) based on titles for papers published in 2020 and 2021 (figure by the authors)

The Co-JEL codes in

Table 10 reveal a more even distribution of ‘Health’ related papers over the range of JEL codes compared to the distribution of ‘Production and Organizations’ related papers. The largest shares are for ‘Labor and Demographic Economics’ and ‘Economic Development, Innovation, Technological Change, and Growth’ covering mainly the consequences and impact of the pandemic both on the micro and macro level.

Table 10. Co-JEL codes for Health (I1) for 2020 and 2021

JEL Code	Field	Absolute number	In percent
A	General Economics and Teaching	32	0.2
B	History of Economic Thought, Methodology, and Heterodox Approaches	81	0.4
C	Mathematical and Quantitative Methods	652	3.5
D	Microeconomics	2,288	12.4
E	Macroeconomics and Monetary Economics	946	5.1
F	International Economics	500	2.7
G	Financial Economics	1,418	7.7
H	Public Economics	1.971	10.7
I	Health, Education, and Welfare		
J	Labor and Demographic Economics	2,822	15.3
K	Law and Economics	361	2.0
L	Industrial Organization	1,517	8.2
M	Business Administration and Business Economics; Marketing; Accounting; Personnel Economics	329	1.8
N	Economic History	160	0.9
O	Economic Development, Innovation, Technological Change, and Growth	2,672	14.5
P	Economic Systems	671	3.6
Q	Agricultural and Natural Resource Economics; Environmental and Ecological Economics	1,136	6.2
R	Urban, Rural, Regional, Real Estate, and Transportation Economics	564	3.1
Y	Miscellaneous Categories	3	0.0
Z	Other Special Topics	320	1.7
		18,443	100

Note. Table by the authors

4 Discussion

Several approaches exist to analyze the developments of disciplines. Individual experts in the discipline may explain the developments in a narrative text, or many experts are asked about their opinions about the developments (e.g., in a Delphi study). Although many researchers and science policy managers combine scientometrics with research evaluation

(evaluation of departments and institutions, allocation of research funds or hiring of researchers; Aksnes, Langfeldt, & Wouters, 2019), scientometrics methods can also be used for the analyses of disciplinary developments: one of the main aims of scientometrics is to advance the knowledge on the development of science (van Raan, 2019) or to identify and quantify trends in science (Belter, 2018). The development of science can not only be investigated for the whole (global) endeavor (Bornmann et al., 2021; Bornmann & Mutz, 2015), but also within certain disciplines, fields, and topics (Fu & Waltman, 2022). The narrower focus on disciplines, fields, and topics is a necessary additional perspective to the whole picture since "global science is becoming more modular" (Miao et al., 2022).

Field-specific analyses of science have a long tradition beginning perhaps with the 'hierarchy of the sciences' theory by Auguste Comte in the 19th century (Cole, 1983). The theory proposes that science progresses from natural science (including simple subjects) to social sciences (including complex subjects) (Miao et al., 2022). Recent analyses of science have other foci by dealing with hot topics (Fang, Costas, Tian, Wang, & Wouters, 2020), research fronts (Szomszor, Pendlebury, & Rogers, 2020), or the comparison of field-specific developments. For example, Singh, Barme, Ward, Tupikina, and Santolini (2022) used preprints from the arXiv repository to investigate 175 fields (physics, mathematics, computer science, quantitative biology, and quantitative finance) in their early and late phases. They found that "the early phase of a field is characterized by disruptive works mixing of cognitively distant fields written by small teams of interdisciplinary authors, while late phases exhibit the role of specialized, large teams building on the previous works in the field" (Singh et al., 2022). The results by Chu and Evans (2021) based on Web of Science data show that "if too many papers are published in short order [in a certain field], new ideas cannot be carefully considered against old, and processes of cumulative advantage cannot work to select valuable innovations".

In this study, we applied a methodological approach introduced by Bornmann and Haunschild (2022) to analyze temporal dynamics in economics based on fields defined by JEL codes. We were interested to identify those economic fields with the highest dynamics in recent years. Similar studies have been published by Ilgisonis, Pyatnitskiy, Tarbeeva, Aldushin, and Ponomarenko (2022) in biomedicine and by Kelly and Bruestle (2011) as well as Rath and Wohlrabe (2016) in economics. It is specific for these studies that they used well-established field-classification schemes (MeSH terms, CA sections or JEL codes) to analyze trends and dynamics in a specific discipline. The current study focusing on economics found 'Economic Development' as the field with the largest paper output across the years. The results further revealed that the field-specific rates of changes are similar in many cases. Only two economic fields have noticeable higher rates of changes: 'Production and Organizations' and 'Health'. Both fields have positive point estimators that are clearly higher than the estimators for the other fields. This result does not correspond to the results by Rath and Wohlrabe (2016): for the years 2007 to 2013, the authors found an increasing trend for another field in economics: 'Agricultural and Natural Resource Economics, Environmental and Ecological Economics'.

This study has some limitations, which have been highlighted already in the study by Bornmann and Haunschild (2022) on chemistry (using the same methods):

(1) The study is based on papers published in journals. Other possible forms of communicating research (e.g., blogs, presentations or working papers) are not considered (Baumann & Wohlrabe, 2020; van den Besselaar & Sandström, 2020).

(2) We used unweighted counts of papers. For van Raan (2005), "journal articles …are not equivalent elements in the scientific process; they differ widely in importance" (p. 2). Future studies may focus therefore on methods that consider differences in papers. For example, journal metrics could be used, since – on average – the more important papers may be found in the more reputable journals.

(3) In this study, we used a mono-disciplinary database (EconLit). The focus on mono-disciplinary databases may lead to a possible neglect of inter-disciplinary research in the bibliometric analysis.

(4) This study is mainly based on linear regression models. Other statistical methods may be also relevant in future studies such as segmented regression models. Here, the temporal distribution can be partitioned into segments, and linear regression models can be applied per segment (see, e.g., Bornmann & Mutz, 2015).

These limitations should be considered either in the interpretation of trend analyses or in the design of future studies. In every analysis, one should have in mind that the statistical analysis is only one step in the investigation of temporal dynamics. The empirical results should always be interpreted against the backdrop of expert knowledge in a subsequent step. We would like to encourage future trend analyses in other disciplines than biomedicine, chemistry or economics. According to Kelly and Bruestle (2011), these studies are important for "strategic planning, publication strategy, and curriculum design" (p. 658). In these studies, it might be interesting to analyze how trends are affected by the behavior of researchers in the discipline. For example, Buehling (2021) shows that rankings of economists are able to shape research topic trends in the discipline.

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Appendix

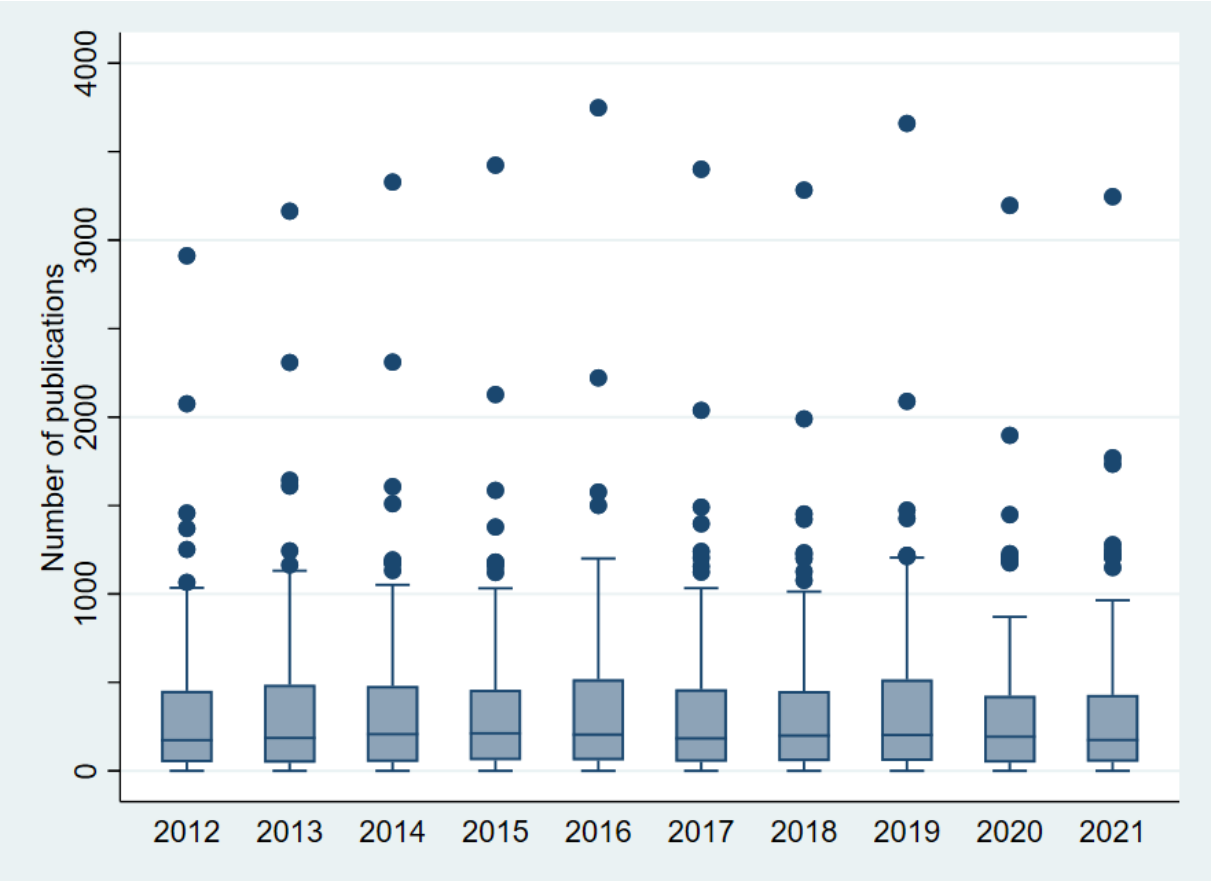

Figure 19. Box plots for the number of papers in economic fields by publication year (using fractionally counted numbers of papers, figure by the authors)

Table 11. Key figures for the number of publications in economic fields stratified by publication year (using fractionally counted numbers of papers)

Publication year	Mean	Median	Standard deviation	Minimum	Maximum
2012	330.67	173.57	426.63	0	2911.97
2013	353.64	185.90	461.24	0	3163.84
2014	356.47	207.51	470.61	0	3328.67
2015	352.75	212.17	462.63	0	3424.07
2016	361.46	205.04	490.10	0	3748.48
2017	338.85	183.75	456.48	0	3400.99
2018	339.71	199.25	448.80	0	3283.22
2019	352.57	202.85	476.35	0	3659.86
2020	320.55	192.76	432.29	0	3196.48
2021	324.14	174.07	442.72	0	3245.98

Note. Table by the authors

Table 12. Number of papers assigned to ‘Prices, Business Fluctuations, and Cycles’ over ten publication years (using fractionally counted numbers of papers)

Publication year	Number of papers	Difference to previous year (absolute)	Difference to previous year (in percent)
2012	636.36	-	-
2013	682.49	46.13	7.25
2014	704.08	21.58	3.16
2015	671.73	-32.34	-4.59
2016	673.19	1.46	0.22
2017	585.12	-88.07	-13.08
2018	540.25	-44.86	-7.67
2019	537.82	-2.43	-0.45
2020	463.70	-74.13	-13.78
2021	488.07	24.37	5.26

Note. Table by the authors

Table 13. Key figures for the annual differences for all economic fields (using fractionally counted numbers of papers)

Publication year	Mean	Median	Standard deviation	Minimum	Maximum
2013	22.97	8.42	50.28	-113.21	251.88
2014	2.83	0.00	47.07	-194.18	164.83
2015	-3.72	-1.17	45.65	-183.57	136.13
2016	8.71	0.24	45.58	-102.24	324.41
2017	-22.61	-11.40	52.12	-347.49	151.13
2018	0.86	0.58	30.63	-117.76	118.63
2019	12.86	2.05	45.01	-112.21	376.64
2020	-32.02	-15.54	74.90	-463.39	357.96
2021	3.60	-0.30	41.10	-126.70	285.12

Note. Table by the authors

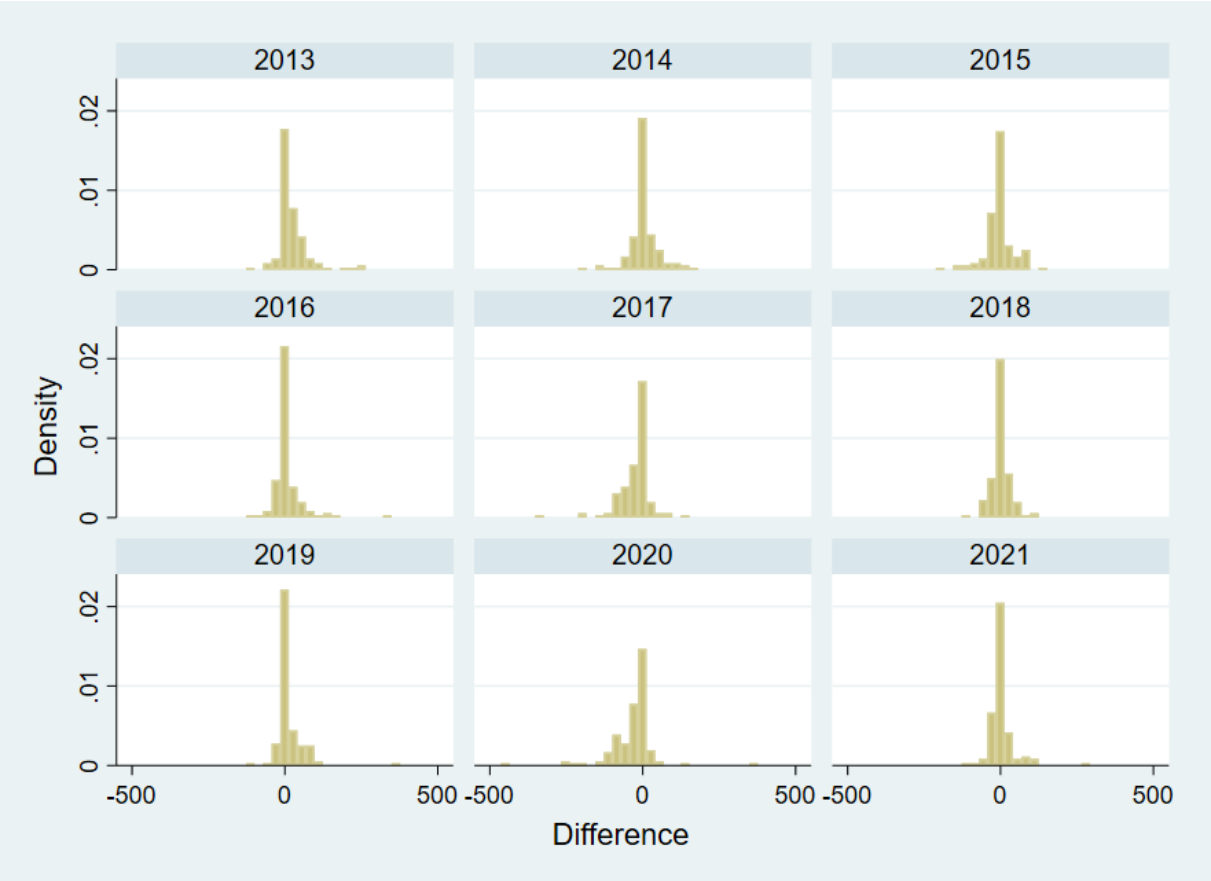

Figure 20. Histograms of annual changes in the number of publications (using fractionally counted numbers of papers, figure by the authors)

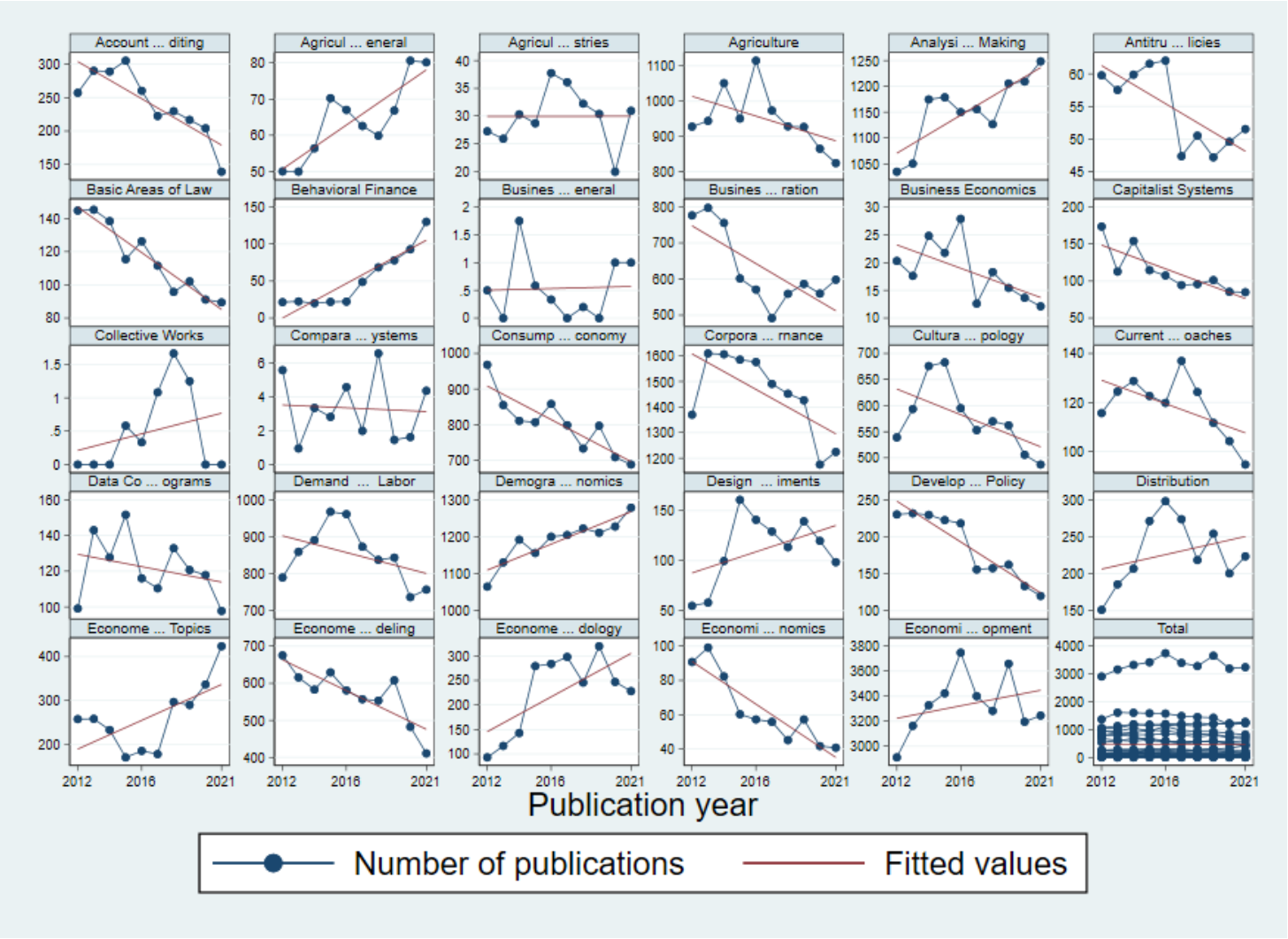

Figure 21. Spaghetti plots showing annual changes in the number of publications for all economic fields (part 1, using fractionally counted numbers of papers, figure by the authors)

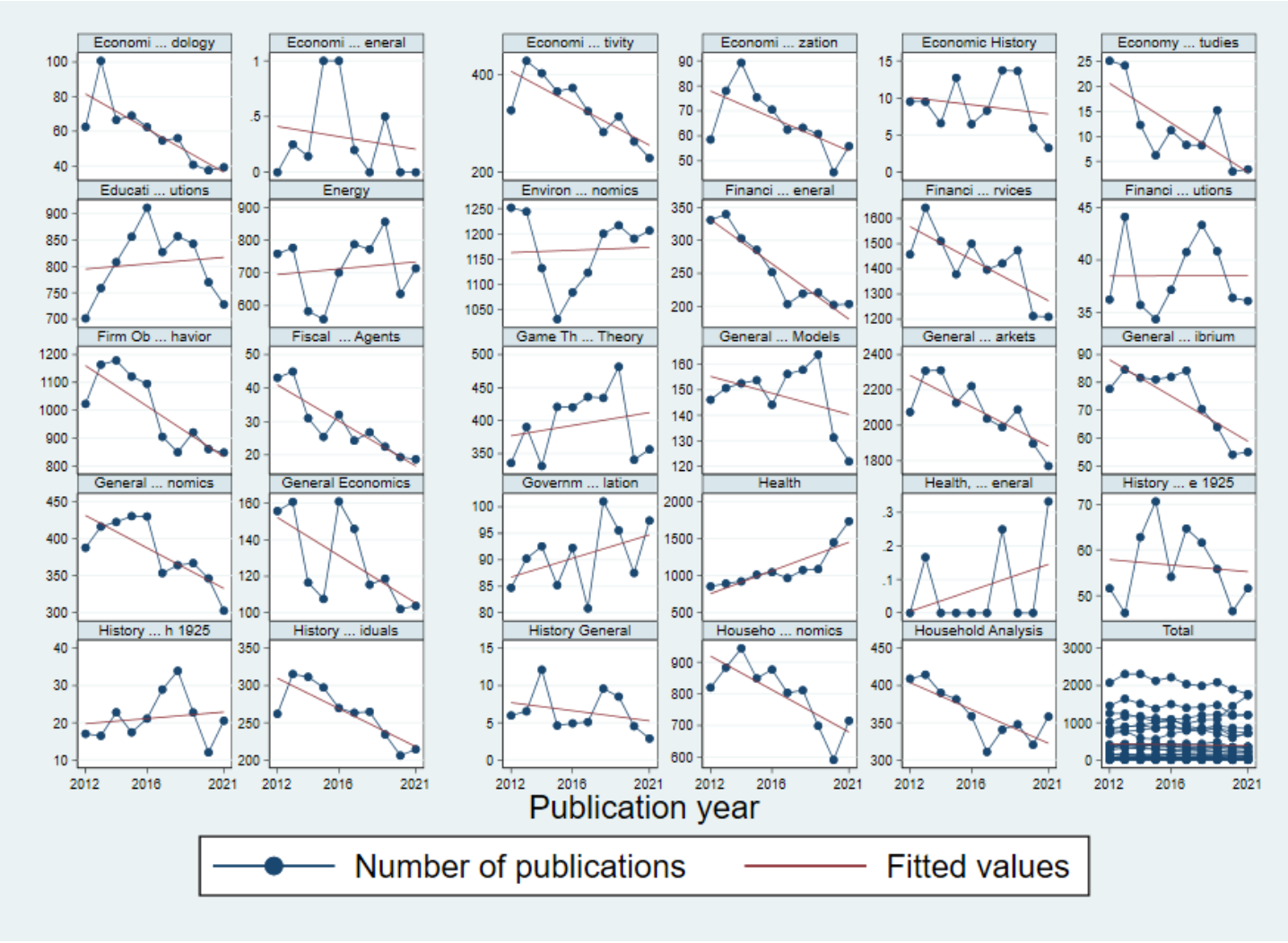

Figure 22. Spaghetti plots showing annual changes in the number of publications for all economic fields (part 2, using fractionally counted numbers of papers, figure by the authors)

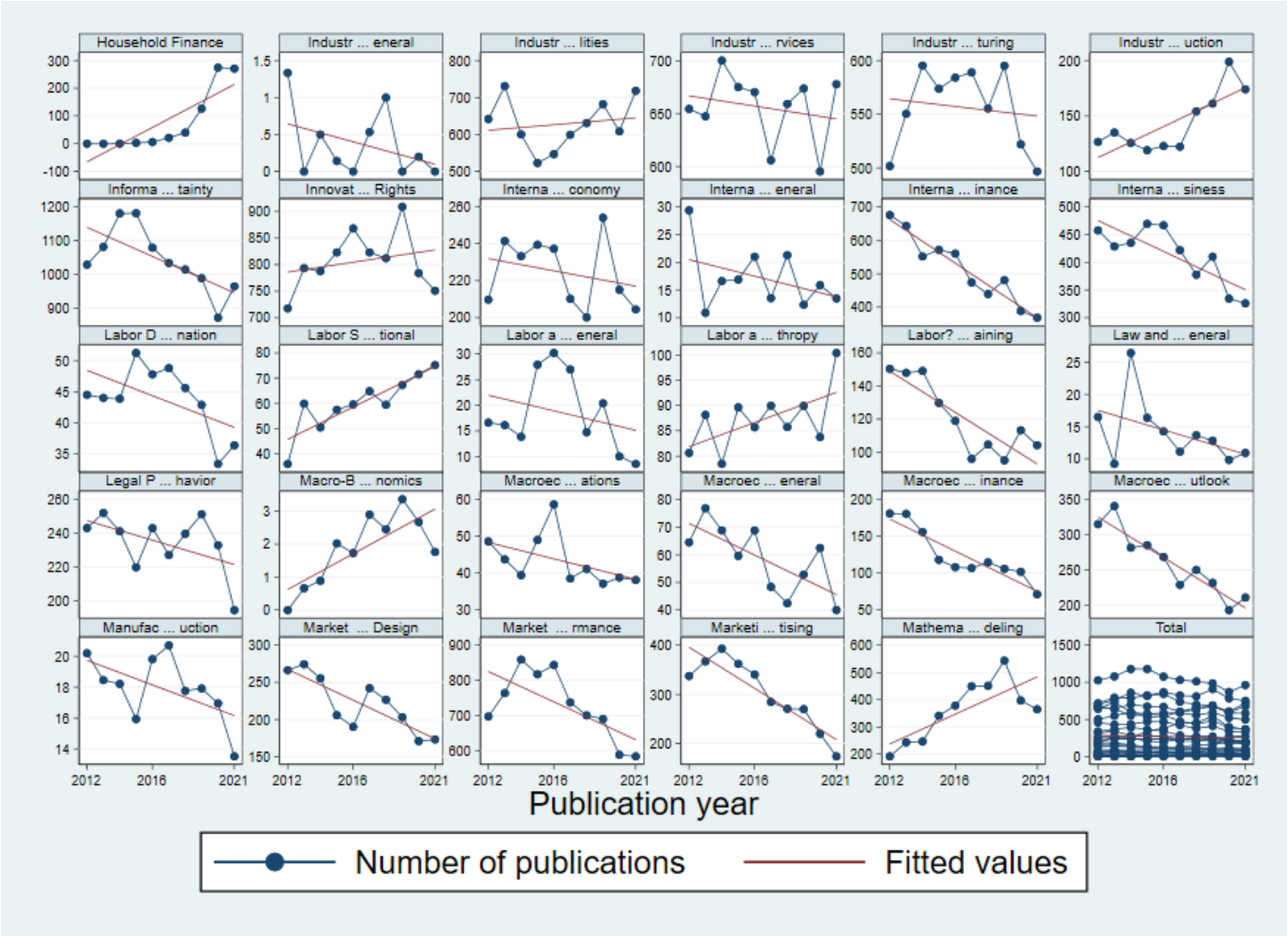

Figure 23. Spaghetti plots showing annual changes in the number of publications for all economic fields (part 3, using fractionally counted numbers of papers, figure by the authors)

Figure 24. Spaghetti plots showing annual changes in the number of publications for all economic fields (part 4, using fractionally counted numbers of papers, figure by the authors)

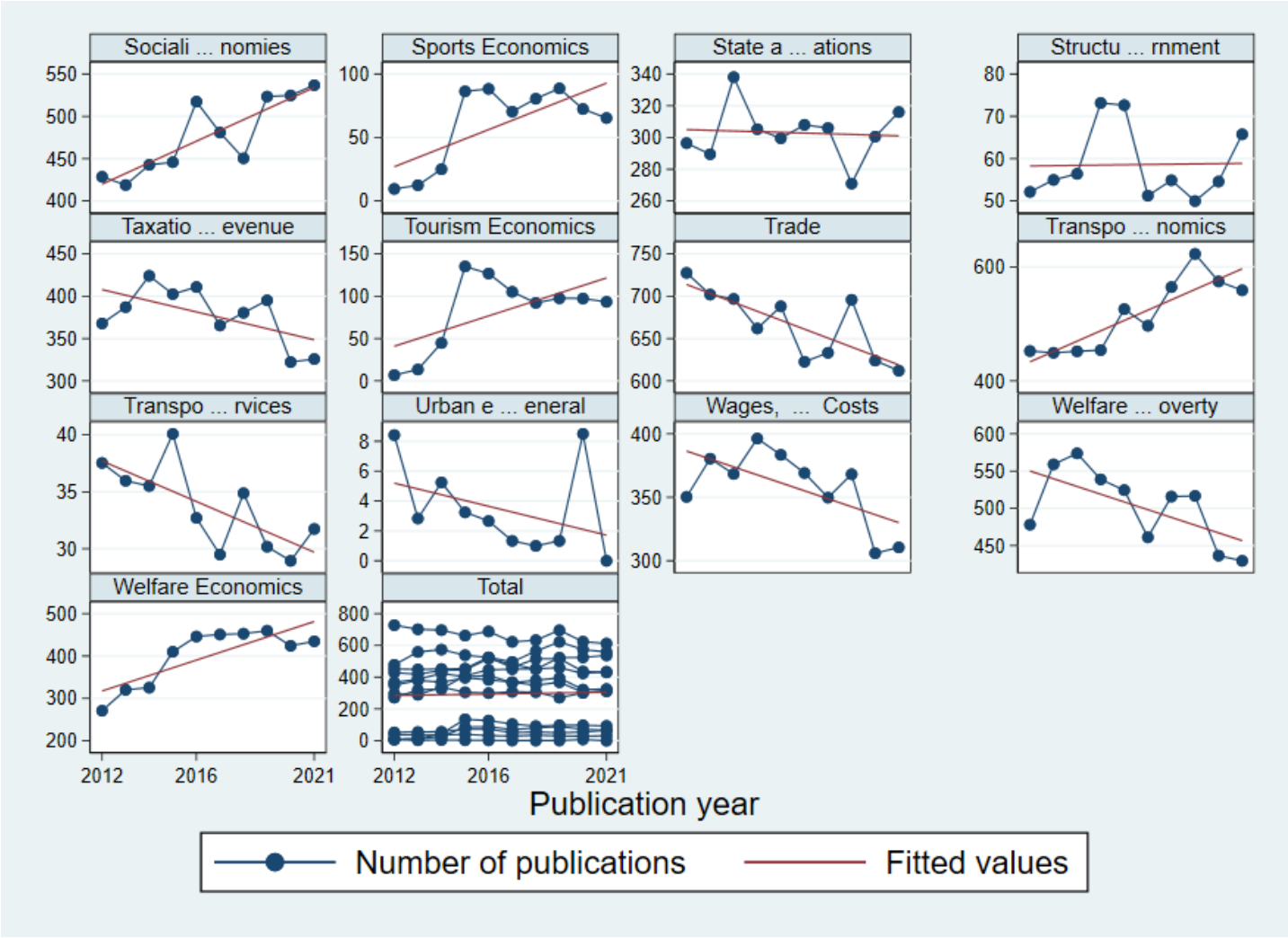

Figure 25. Spaghetti plots showing annual changes in the number of publications for all economic fields (part 5, using fractionally counted numbers of papers, figure by the authors)

Table 14. Key figures for the intercepts and slopes from the regression models (using fractionally counted numbers of papers)

Variable	N	Mean	Standard deviation	Minimum	Maximum
Intercept	129	353.22	461.85	-65.09	3223.98
Slope	129	-2.25	15.66	-44.44	76.92

Note. Table by the authors

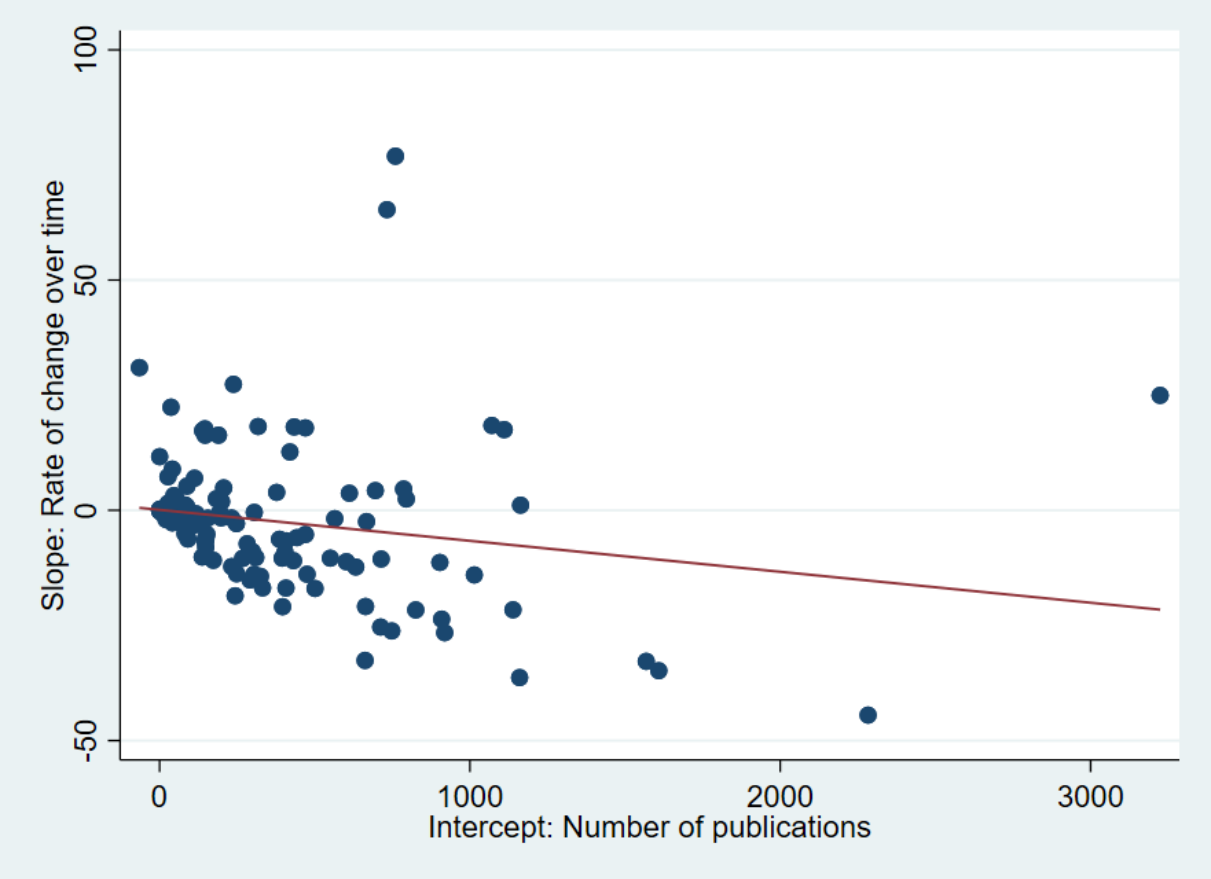

Figure 26. Scatterplot of field-specific intercepts and slopes (using fractionally counted numbers of papers, figure by the authors)

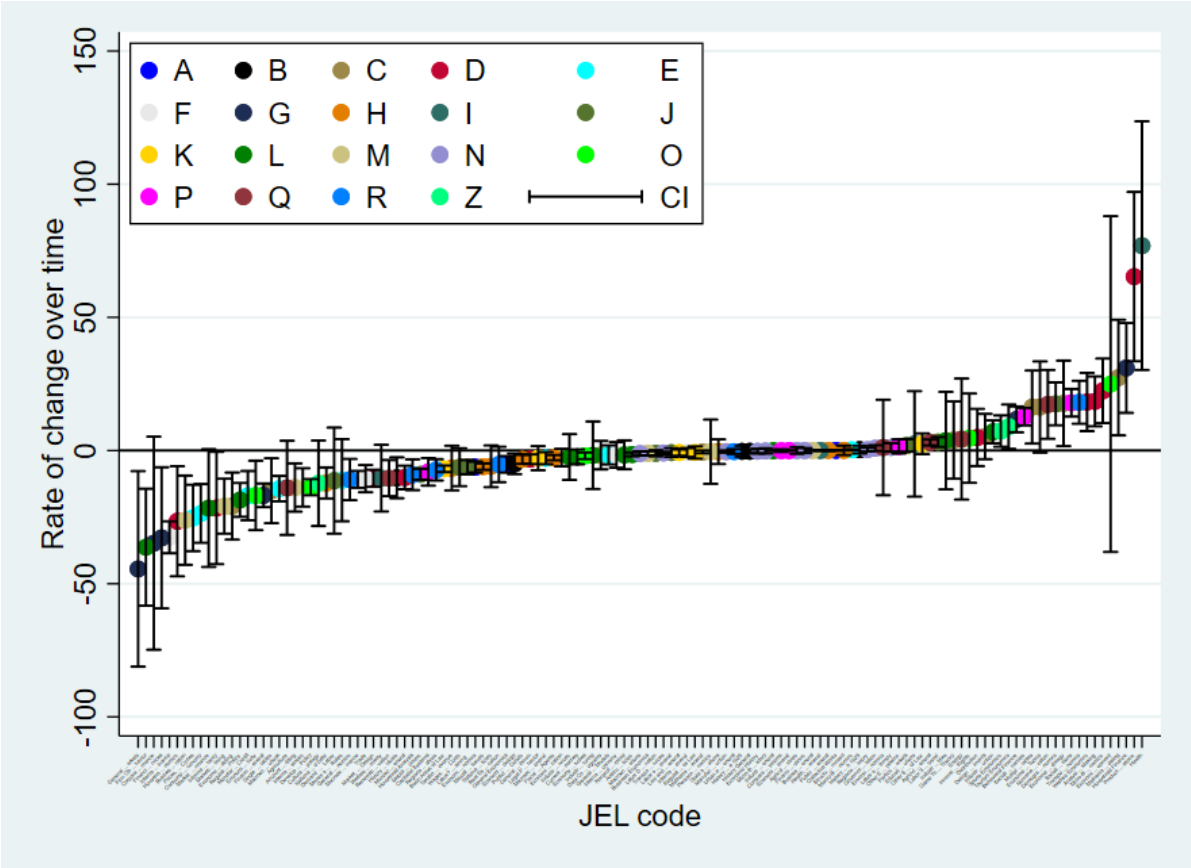

Figure 27. Variability in the rate of change across economic fields (using fractionally counted numbers of papers, the colors reflect economic main fields: A=General Economics and Teaching, B=History of Economic Thought, Methodology, and Heterodox Approaches, C=Mathematical and Quantitative Methods, D=Microeconomics, E=Macroeconomics and Monetary Economics, F=International Economics, G=Financial Economics, H=Public Economics, I=Health, Education, and Welfare, J=Labor and Demographic Economics, K=Law and Economics, L=Industrial Organization, M=Business Administration and Business Economics, Marketing, Accounting, Personnel Economics, N=Economic History, O=Economic Development, Innovation, Technological Change, and Growth, P=Economic Systems, Q=Agricultural and Natural Resource Economics, Environmental and Ecological Economics, R=Urban, Rural, Regional, Real Estate, and Transportation Economics, Z=Other Special Topics, figure by the authors).