Economics Research Collaboration Patterns Before and After COVID

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Abstract

We examine changes in collaboration patterns among economists before and after COVID. We compare economics working papers in common repositories from 2010 to 2023. Our analysis suggests that the number of authors per paper has increased, the percentage of papers with four or more authors has increased, yet the frequency of inter-institution collaboration has decreased. Some of these patterns persist beyond the COVID years. Our results suggest that while economics research had become more collaborative in the years leading up to COVID, COVID provided an additional significant boost to the depth and breadth of collaboration.

Keywords: collaboration, COVID, working papers

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1 Introduction

Every researcher experienced the immediate impact of COVID-19 on scientific research and collaboration. We all lived and experienced the pandemic, yet our understanding of its effects on our work remains limited. Some open questions from the pandemic include: Did overall research production change as a result of the pandemic? How did research collaboration patterns change before and after the pandemic? Did researchers collaborate less with their colleagues and more with external collaborators due to in-person activity restrictions? Were there different impacts on junior versus senior researchers and female and male researchers? Are these changes temporary or permanent? The answers to these questions have important implications for individual researchers, grant agencies, and the scientific community, as they help isolate the importance of in-person interactions in scientific collaboration.

To the best of our knowledge, *no paper has considered changes in scientific collaboration before and after COVID*, largely due to the lack of recent data on papers and author characteristics. We pull complementary information from several data sources to construct a unique database that allows us to address this question, including Microsoft Academic Graph (MAG), OpenAlex (OA), and Scopus. Our novel dataset compiles not only publications and working papers of economists, but also the time series of their affiliations. As an academic researcher can often move from one institution to another, accurately capturing changing affiliations is especially important in our study of collaboration patterns through time.

The post-COVID era has witnessed a notable surge in collaboration within the field of economics, exemplified by a noticeable uptick in the number of authors per paper. Several factors contribute to this trend. Firstly, the pandemic underscored the interconnectedness of global economies, prompting economists to adopt more collaborative approaches to tackle multifaceted challenges. Remote work arrangements necessitated by health protocols facilitated easier communication and collaboration among researchers, transcending geographical barriers. Moreover, the urgency of addressing unprecedented economic disruptions spurred interdisciplinary collaborations, drawing insights from fields such as public health, sociology, and psychology. Additionally, the proliferation of digital platforms and virtual conferences provided enhanced networking opportunities, fostering new collaborations and strengthening existing ones. However, counteracting forces may exist. For instance, while remote collaboration became more prevalent, the absence of face-to-face interactions could hinder the spontaneity and depth of brainstorming sessions, potentially inhibiting innovation. Moreover, disparities in access to technology and resources may have impeded collaboration for certain individuals or institutions, exacerbating existing inequalities within the academic

community. Despite these challenges, the overall increase in collaboration signals a positive shift towards a more interconnected and interdisciplinary approach to economic research in the wake of the COVID-19 pandemic.

The level of intra-institution collaboration within the field of economics can be influenced by various factors. Increased collaboration within institutions may result from initiatives promoting resource sharing, such as common databases or collaborative workspaces, as well as interdisciplinary projects that bridge economics with other disciplines. Additionally, incentive structures that recognize and reward collaborative efforts, along with supportive institutional environments, can encourage researchers to engage in intra-institution collaborations. Conversely, factors such as departmental silos, a competitive environment that prioritizes individual achievements, and communication barriers within the institution may hinder intra-institution collaboration. By addressing these factors and fostering a culture of collaboration, institutions can enhance intra-institutional cooperation, thereby facilitating collective knowledge creation and advancing research in economics.

The rest of the paper is organized as follows. Next section contains the most related literature. Section 2 discusses the potential channels of changes in collaboration. Section 3 describes the data. Section 4 describes the results, and Section 5 concludes.

1.1 Literature Review

Existing work relevant to our project focus on three things, salient trends in research collaboration, effects of COVID on general productivity, and differential effects of COVID on researchers with different household roles.

Lin et al. (2023) provide a plan to fill out the institutions from the Microsoft Academic Graph data. We expand upon their ideas to fill out the affiliations of the authors at the time of their writing. The exact procedure is discussed in detail in the data section.

There are studies on the effects COVID on behaviors in workplaces, including some of the authors' previous work (Butler and Jaffe, 2021; Bayhan et al., 2022; Ford et al., 2021; Yang et al., 2022; Dong et al., 2023). Trends on increasing research collaborations have been well-documented (Wuchty, Jones, and Uzzi, 2007), but how COVID affects the trend is not studied. Surveys of researchers suggest a gendered effect of COVID (King and Frederickson, 2021; Liu et al., 2022; Sinatra et al., 2024).

Heo et al. (2022) have a survey-based study. While studies suggested adverse impact of COVID-19 on scientific output and work routines for scientists, more evidence is required to understand detailed obstacles challenging scientists' work and productivity during the pandemic, including how different people are affected (e.g., by gender). This online survey-

based thematic analysis investigated how the pandemic affected scientists' perception of scientific and academic productivity in the science, technology, engineering, and mathematics (STEM) as well as medicine fields. The analysis examined if inequitable changes in duties and responsibilities for care-giving for children, family, and/or households exist between scientists who are mothers compared to scientists who are fathers or non-parents. The survey collected data from 2548 survey responses in six languages across 132 countries. Results indicate that many scientists suffered from delays and restrictions on research activities and administrations due to the lockdown of institutions, as well as increased workloads from adapting to online teaching environment.

Care-giving responsibility for children and family increased, which compromised time for academic efforts, especially due to the temporary shutdown of social supports. Higher percentages of female parent participants than male parent participants expressed such increased burdens indicating unequal divisions of care-giving between women and men. A range of physical and mental health issues was identified mainly due to overworking and isolation. Despite numerous obstacles, some participants reported advantages during the pandemic including the efficiency of online teaching, increased funding for COVID-related research, application of alternative research methodologies, and fluidity of the workday from not commuting. Findings imply the need for rapid institutional support to aid various academic activities and diminish gender inequity in career development among academicians, highlighting how crisis can exacerbate existing inequalities and how COVID affected the feasibility of individual vs. collaborative research.

Poulsen et al. (2022) and Sinatra et al. (2024) consider the impact of COVID on scientific collaboration. Böhm and Liu (2023) consider the productivity of astronomers in the first two years after COVID. Our project utilizes these results and perspective to document the effects of COVID on collaboration using a framework focusing on the cost of research.

2 Conceptual Framework

The COVID-19 pandemic has significantly impacted collaboration in many ways, making it hard to intuitively determine the overall the direction of its impact. We need a concrete framework through which we can analyze the different competing effects. (Heckman and Moktan, 2020) assert that solo-authored papers provide higher returns than multi-authored papers in tenure decisions. To the extent that this premise is true, the growth of multi-authored papers during COVID suggest that there may have been changes in both taste for collaboration and cost of collaboration.

Consider a naive random utility model (McFadden, 1974) in which the return to a solo-

authored paper is r_s and multi-authored paper is r_m. Similarly, let the per-author cost of production of that paper be c_s and c_m. Let ε_s and ε_m capture the individual's taste for collaboration as well as other psychic cost. Then an author i would prefer to write a multi-authored paper over a solo-authored paper if:

$$\underbrace{r_{m,i} - c_{m,i} + \varepsilon_{m,i}}_{v_{m,i}} > \underbrace{r_{s,i} - c_{s,i} + \varepsilon_{s,i}}_{v_{s,i}}.$$

The probability that author i prefers to collaborate is then

$$P(r_{m,i} - c_{m,i} - r_{s,i} + c_{s,i} > \varepsilon_{s,i} - \varepsilon_{m,i}).$$

Assuming that the returns of each type of papers and the distribution of individual preferences for collaborative work stay relatively constant before and after COVID [1], we can attribute any changes in the aggregate share of solo-authored papers post-COVID to changes in costs c_s and c_m. We hesitate to normalize the costs as COVID may have differential effects on them, even if through the same channel. We provide an overview of some of the challenges and opportunities of this unprecedented shock, which form the bases for our hypotheses regarding changes to research collaboration.

2.1 Immediate Impacts

The following are challenges that have increased the cost of collaboration.

Disruption of Research Activities. Field experiments came to a halt and in-person accesses to facilities are suspended. The overall shock of COVID decreased motivation for research work.

Strains on Funding and Resources. The pandemic led to financial strains for many funding agencies and research institutions. Some projects, especially those not directly related to COVID-19, experienced budget cuts or delays in funding.

Cancellation of Conferences and Meetings. The cancellation of academic conferences, workshops, and meetings limited researchers' opportunities for face-to-face interactions, which are often crucial for establishing and maintaining collaborative relationships.

The following are possible channels that have decreased the cost of collaboration.

[1] This is a strong assumption as it overlooks the nature of academic publication being a competitive process.

Aggregate Shift Towards Virtual Collaboration. The pandemic accelerated the adoption of virtual collaboration tools, allowing researchers to continue their collaborations through online platforms. Video conferences, cloud-based collaborative tools, and virtual events became the norm, making collaboration more accessible and freeing time that may have otherwise be spent on fixed cost such as commuting.

Increased Open Science and Data Sharing. There was a notable shift towards open science, with researchers sharing data and findings more freely and rapidly than before. Preprint servers saw a surge in usage, facilitating faster dissemination of research results and enabling collaborative efforts to build on emerging knowledge without the delays associated with traditional publishing.

2.2 Long-term Impact

Determining the long-term impact is difficult. The mass adaptation of new collaborative tools decreases the cost of collaboration, but researchers' outside options are different during and after the Work-From-Home era. Suppose that COVID caused an immediate shock to the feasibility of solo-authored papers (i.e., researchers simply do not have the mental resources to tackle a solo paper), which encouraged more researchers to collaborate. Those with a strong preference for solo work would revert to solo work once that option is feasible again. As such, whether the impact of COVID could be considered both as a trend shifter and as a gap in time where trends before and after are essentially independent from the patterns during COVID.

2.3 Main outcomes of interest

Combining the above perspectives, we focus on the effect of COVID-19 on academic research using the following outcomes.

Differences in manuscript output (compared to the pre-COVID period) : Given the sudden increase in the cost of research production, academic researchers could be less productive. However, the mass adaptation of collaborative tools can counteract the increase in cost and lead to increase in collaboration.

Differences in the share multi-authored papers : Collaboration became more accessible and perhaps popular due to the mass adaptation of collaborative tools, the added benefit of social interaction, and the changes in feasibility of single-authored papers.

Differences in the share of intra-institutional papers : Researchers could explore a more diverse set of collaborators, especially outside of their home institutions. Following the shift to work-from-home, researchers can be less discouraged to initiate collaboration that may have otherwise been limited by physical distances. However, the halt of in-person events can also further discourage researchers from forming of new collaborations, especially outside of their home institutions.

Reversion to pre-COVID levels : The effect of COVID on research collaboration was concentrated during the pandemic. If researchers simply adapted to these special times, any changes in collaboration patterns would only be temporary and perhaps separate from any pre-existing trend. On the other hand, the effect of COVID can persist beyond the COVID period as new collaboration modes and practices become commonplace.

3 Data

We limit out attention to the discipline with which we are most familiar - Economics. To document immediate changes in economics research outputs, we consider economics working papers from January 2010 through December 2023. We define working papers as those posted on SSRN, RePec, or NBER and authored by an economist during this period. An economist is defined as anyone who has authored a paper published in one of the top 64 economics journals (Econ64) since 2001.[2]

[2]We use the tiered list of journals by SUFE. This list is consistent with the lists from other journal rankings (Kalaitzidakis, Mamuneas, and Stengos, 2003; Heckman and Moktan, 2020). Tier 1: *American Economic Review, Econometrica, Journal of Political Economy, Quarterly Journal of Economics, Review of Economic Studies*; Tier 2: *Economic Journal, Games and Economic Behavior, International Economic Review, Journal of Development Economics, Journal of Econometrics, Journal of Economic History, Journal of Economic Theory, Journal of International Economics, Journal of Labor Economics, Journal of Monetary Economics, Journal of Public Economics, Journal of the European Economic Association, Quantitative Economics, Rand Journal of Economics, Review of Economics and Statistics, Theoretical Economics, American Economic Journal: Applied Economics, American Economic Journal: Economic Policy, American Economic Journal: Macroeconomics, American Economic Journal: Microeconomics*; Tier 3: *Econometric Theory, Experimental Economics, Journal of Applied Econometrics, Journal of Business & Economic Statistics, Journal of Economic Growth, Journal of Environmental Economics and Management, Journal of Health Economics, Journal of Human Resources, Journal of Industrial Economics, Journal of Law & Economics, Journal of Money, Credit and Banking, Journal of Urban Economics, Review of Economic Dynamics, American Journal of Agricultural Economics, AER/AEA Papers and Proceedings, Brookings Papers on Economic Activity, Canadian Journal of Economics, Economic History Review, Economic Theory, European Economic Review, Explorations in Economic History, Journal of Comparative Economics, Journal of Economic Behavior & Organization, Journal of Economic Dynamics & Control, Journal of Economic Education, Journal of Economic Literature, Journal of Economic Perspectives, Journal of Economics & Management Strategy, Journal of Mathematical Economics, Journal of Population Economics, Journal of Real Estate Finance and Economics, Journal of Regulatory Economics, Journal of Risk and Uncertainty, History of Political Economy, International Journal of Industrial Organization, Macroeconomic Dynamics,*

We define pre-COVID and post-COVID as before and after April 1, 2020, respectively. Because of the coarse dating of some papers (e.g., papers are dated to the first of a month or January 1 of a year, this is discussed further in section 3.3) as well as the time needed to incubate an economics paper, we frequently use working papers in 2021 to 2023 as those produced post-COVID. We define *intra-institutional papers* as those in which all authors share one affiliation. A paper's *major affiliation* is the affiliation with which the most number of authors are affiliated in the paper. For comparison, we sometimes take out the *COVID papers*, i.e., working papers with a title that includes the word "COVID."

3.1 Affiliation Data

To construct an author-affiliation-year record, we use OpenAlex data on journal articles published in Econ64 from January 2001 through December 2023. We collected affiliation data of economists using affiliations attached to economists' top64 journal publications. This choice stemmed from the fact that affiliations from repositories (SSRN, RePEc, etc.) often only retain the latest affiliation information, as opposed to the concurrent affiliation information[3]. Note that we exclude the affiliation records for NBER and IZA, due to the inter-institutional nature of these organizations.

Using this set of data from OpenAlex, we construct a yearly record of each economist's affiliation and fill in any gap in the record using the steps described below (Consider the case of a single author who was ever affiliated with institutions A, B, and C):

Step 1: For each author-affiliation pair, we record the first and last year that combination appears. We call these *maxyear* and *minyear*.

Affiliation	y2005	y2006	y2007	y2008	y2009	y2010	minyear	maxyear
A	1	1	.	.	.	.	2005	2006
B	.	1	1	.	.	1	2006	2010
C	.	1	.	.	1	1	2006	2010

Step 2: For every year that is between *maxyear* and *minyear* and missing a record, a manual fill for that author-affiliation pair is created.

Social Choice and Welfare.

[3]For example, suppose that author A was affiliated with institution I from 2005 to 2010 and institution J from 2011 to 2020. If author A posted a working paper on SSRN in 2008 (while in institution I), but MAG did not scrape the information until 2018, then it is more than likely that OpenAlex would record that this paper was published with author A from institution J instead of institution I.

Affiliation	y2005	y2006	y2007	y2008	y2009	y2010	minyear	maxyear
A	1	1	.	.	.	.	2005	2006
B	.	1	1	F	F	1	2006	2010
C	.	1	F	F	1	1	2006	2010

Step 3: For any given year, if there is record of any other affiliation for said author, then the filled records are removed.

Affiliation	y2005	y2006	y2007	y2008	y2009	y2010	minyear	maxyear
A	1	1	.	.	.	.	2005	2006
B	.	1	1	F	.	1	2006	2010
C	.	1	.	F	1	1	2006	2010

Step 4: For any given year that only has filled records, only the filled record that is closest to the last actual record is kept.

Affiliation	y2005	y2006	y2007	y2008	y2009	y2010	minyear	maxyear
A	1	1	.	.	.	.	2005	2006
B	.	1	1	F	.	1	2006	2010
C	.	1	.	.	1	1	2006	2010

These steps will yield the long-form of the data:

year	affiliation
2005	A
2006	A
2006	B
2006	C
2007	B
2008	B
2009	C
2010	B
2010	C

Note that our way of forward-filling to the latest publication year results in much missing data for authors who lack more recent publications. As such, any affiliation appearing in 2018 and on is filled forward up to 2023 if said author does not have more recent affiliations.

Finally, for year-authors whose affiliation is still missing, we are also including affiliation from working papers posted in 2018 and after, given that the original concern is that an old working paper would incorrectly be recorded with a more recent affiliation. The result is that around 2% of our paper-author-affiliation data has missing affiliation.

3.2 Paper-level Data

Our main analytic data is at the paper-level. The data includes paper title, date posted online, and ID/title of the paper paper. To understand how collaboration changed we should first look at the landscape of collaboration. Table B1 shows that the number of working papers have been slowly declining since 2016 with a significant jump in 2020, later followed by a significant decrease in 2023. The sharp decrease in 2023 is likely the result of incomplete data collection. As such, we focus our analysis on per-paper outcomes as well as %-of-paper outcomes. As of the writing of this draft, OpenAlex has just above 40,000 publications recorded for SSRN from 2023 while it has close to 120,000 publications recorded for SSRN from 2022. To that effect, we limit out discussion of point estimates for 2023.

Using the affiliation data described in 3.1, we obtain affiliation information for each working paper and construct the following variables:

- Number of authors in the paper
- Affiliation-HHI: This is the sum of squared proportion of authors in an affiliation. This variable is approximately the probability of choosing, at random, 2 authors who share an affiliation.
- Intra-affiliation: A binary variable that equals 1 if all authors share a common affiliation
- % Author in major affiliation, the affiliation with which the most number of authors are affiliated with in the paper
- Post COVID: A binary variable that equals 1 if the paper's posted date is after April 1, 2020
- % Authors in the papers who are US Affiliated
- Papers with at least 1 US affiliated author: A binary variable that equals 1 if any of the authors of the paper has an affiliation to an institution that is based in the US
- International collaboration: A binary variable that equals 1 if the authors as a whole are affiliated with institutions based in 2 or more countries
- Only US Author: A binary variable that equals 1 if all authors are affiliated with an institution based in the US

3.3 Challenges with the Data

Observable result of shock is delayed and spread-out: The biggest challenge to studying changes in collaboration pattern is that the result of any shock cannot be observed immediately. Consider the case where the advent of COVID on Apr. 1^{st} immediately inspires a new collaboration on an original project on Apr. 2^{nd}. It is almost surely impossible for such collaboration to have a working paper until much later. In fact, what we observe in working papers, even if they are all the result of COVID-inspired collaboration, would only at best be a subset of new collaborations. As such, any effects we find can only serve as a noisy estimate of changes in collaboration patterns.

Coarse dating of articles: Another challenge that we face is that the exact posted dates of a paper is often incorrect. Specifically, around 57% of the working papers are recorded as being posted in January, around 81% on the first of the month, and around 56% on January 1^{st}. This turns out to be a common way for publication databases to resolve incomplete date information. By observation of Microsoft Academic Graph, SCOPUS, and OpenAlex, the rule appears to be that if only the exact month is known, the paper is dated as posted on the 1^{st} of that month. Similarly, if only the exact year is known, the papers is dated as posted on January 1^{st} of that year. However, simply exclude papers recorded as posted in January or the first of the months is not a feasible option. Table B1 shows that papers over 90% of papers in 2022 and 2023 are recorded as posted in January and over 95% are recorded as posted on the first of the month. As a result, we choose to study our outcomes with only yearly trends and exclude the consideration of any monthly fixed-effects. Given this information, we perform a separate set of analysis where we exclude all papers from 2020 and 2023 and show that our main results are not sensitive to incorrect dating of articles during the post-COVID era.

4 Results

4.1 Positive Productivity Shock During COVID

The figure in Table B1 shows that the number of working papers have been slowly declining since 2016 with a significant but temporary jump in 2020. Number of papers returned to just below the level of 2019, providing some evidence of temporary changes in productivity and perhaps limited long-term impact.

4.2 More Collaboration After COVID

The first question we ask about collaboration patterns is "Has collaboration increased?" Using paper-month data, Figure A1 shows that the share of single-authored papers have steadily decreased by 40% by 2020, followed by some sizable fluctuations after 2020. To stylize any impact COVID may have had on the share of single-authored papers, we construct the counterfactual values post COVID using predicted values from pre-COVID quadratic yearly trend and month fixed-effects excluding January. At face value, the decreasing linear trend maintains throughout COVID with only step-wise fluctuations. This prompted the analysis in columns 1 and 2 of Table B3.

In panel A, we see a significant decrease in the share of single-authored papers in 2020, 2021, and 2022. Note that point estimates in the first 4 rows are deviations from what the yearly trend predicts. Although there is an immediate drop in single-authored papers when COVID happened, it is hard to distinguish whether such difference happened for collaborations that formed before or after COVID. On the other hand, the estimates for 2021 and 2022 are consistent with the story of a decrease in the cost of collaboration. This is further explored in panel B where we estimate the trends separately for pre-COVID and post-COVID. Results here indicate that the pre-COVID trend is essentially linear while the post COVID trend is convex with the initial slope almost twice as steep as pre-COVID.

During COVID, if researchers want to maintain the same output level (number of papers per year), they could substitute towards multi-authored papers. Naively, researchers working on a multi-authored projects can spend less time and energy on the project compared to if they were to work alone. On top of that, because of the sudden shift to remote work, the cost of collaborating can decrease when in-person meetings are no longer a constraint, however minor that was before COVID.

4.3 More Authors in Multi-Authored Papers After COVID

If the decrease in cost of collaboration is a salient channel, the same logic should apply to authors who already collaborate, leading to multi-authored papers also having more co-authors. Figure A5 shows that the shares of both single-authored papers and two-authored papers have been steadily decreasing. Figure A6 and shows that the share of multi-authored papers with 2 authors has been steadily decreasing with concomitant growth in the share of papers with 3 or 4 authors. Notably, the share of papers with 6 or more authors drastically increased between 2020 and 2022.

Table B4 estimates the changes post-COVID in the share of multi-authored papers having different number of authors. In panel A, the estimates for 2021 and 2022 suggests that not

only are there more multi-authored papers post-COVID, those papers have more authors as well, shifting from 2/3 authors to 4+ authors. Similarly in panel B, we see a sharp increase in the linear yearly trend post-COVID, although the second-order estimates suggest that the change may be diminishing after 2021/2022.

4.4 Increase of Intra-Institutional Collaboration After COVID

Columns 3 through 6 of Table B3 provides a confounding answer to whether the decrease in cost of collaboration incentivized more collaboration. The estimates for 2022 and 2023 suggest that collaboration becomes more concentrated within an institution, meaning that economists shifted towards collaboration with colleagues withing their own institution. One reason why this could happen is that the stoppage of in-person networking opportunities increased the cost of forming new connections outside of one's institution, resulting in more collaboration/connection with researchers that are within reach.

Our results in the next subsection suggest that limiting our attention to papers with two to five authors may rule out other confounding factors. Table B7 estimates panel A of Table B3 and shows that these effects are more concentrated in multi-authored papers with fewer authors. Such results are consistent with our hypotheses on the detrimental effects of suspending in-person events on forming new collaboration outside of one's own institution.

4.5 Differential Effects on International Collaboration by Number of Authors

We estimated Table B5 to examine whether the impact of COVID is different in the US than the rest of the world. Columns 1 and 2 suggest that during COVID, significantly fewer multi-authored papers include an US author. We show that these changes are driven by the large increase in concentration of single-country collaboration outside the US (columns 3 and 4) and only a small increase in international collaborations by US authors. Columns 7 and 8 suggest the possibility that only a set group of US authors collaborate internationally and their collaboration efforts were spread thinner during COVID.

Figure A7 and Figure A8 further suggest that the effects are different between papers with two to five authors and papers with six or more authors. Table Table B6 reportsthe estimates for these two sets of graphs. In the case of papers with two to five authors, there are more paper with at least 1 US authors in 2022 adn 2023, contrary to the case of papers with six or more authors. Share of papers with two to five authors also saw an increase in the share of international collaborations without US authors while the opposite is seen for papers with six or more authors.

Notably, while papers with two to five authors did not see much in post-COVID changes in international collaboration without US authors nor share of US authors in US-international collaboration, clear deviation from trend in both of these outcomes are seen in papers with six or more authors. This suggest that the uptick we saw in share of papers with six or more authors in Figure A6 is more complex than a simple change in cost; rather, this evidence suggests that the nature of papers with six or more authors drastically changed.

4.6 Results are Robust to the Inclusion of 2020 and 2023 Data

As discussed several times in this paper, our data on 2020 and 2023 have features that may be confounding to our results. In tables B8 through B12, we estimate panel A of tables B3 through B7 and show that our estimates remain consistent even excluding papers from 2020 or from both 2020 and 2023.

5 Conclusion

We provide the first analysis of the effects of COVID on collaboration patterns of economists using working papers posted between 2010 and 2023. We document effects that seem to strongly correlate with COVID and highlight potential channels that hope to inspire future studies. Using COVID as an exogenous and large-scale cost shifter, we show that cost of collaboration as well as individual preferences for collaborative work is an important channel for any studies on collaboration patterns.

Our future work will further explore how these effects differ between authors with different preferences for collaborative work (different $\varepsilon_s, \varepsilon_m$ distributions); namely, those who have many co-authors even before COVID and those who chose solo work during COVID. We will also separate the authors who are at different stages of their careers.

Regarding the issue of working paper author affiliations, we are exploring strategies to address the presence of missing affiliations in our dataset. One approach being considered is the categorization of such missing affiliations under a special "not affiliated" label, although we acknowledge that this may result in unusual or unexpected results in our analyses. An alternative solution is to exclude papers lacking affiliation information altogether to maintain the integrity and accuracy of our data. These considerations aim to refine our dataset and enhance the overall quality of our research findings.

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Appendix

A Graphs

Figure A1: % of Single-Authored Papers, 2010-2023

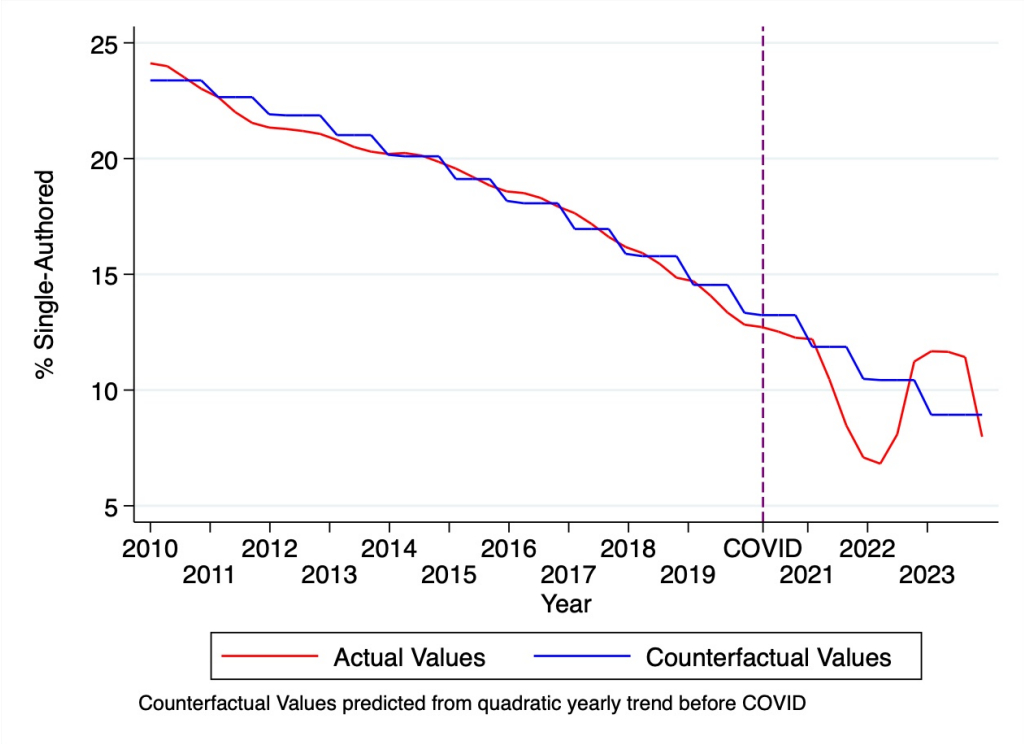


Figure A2: Affiliation HHI Among Multi-Authored Papers, 2010-2023

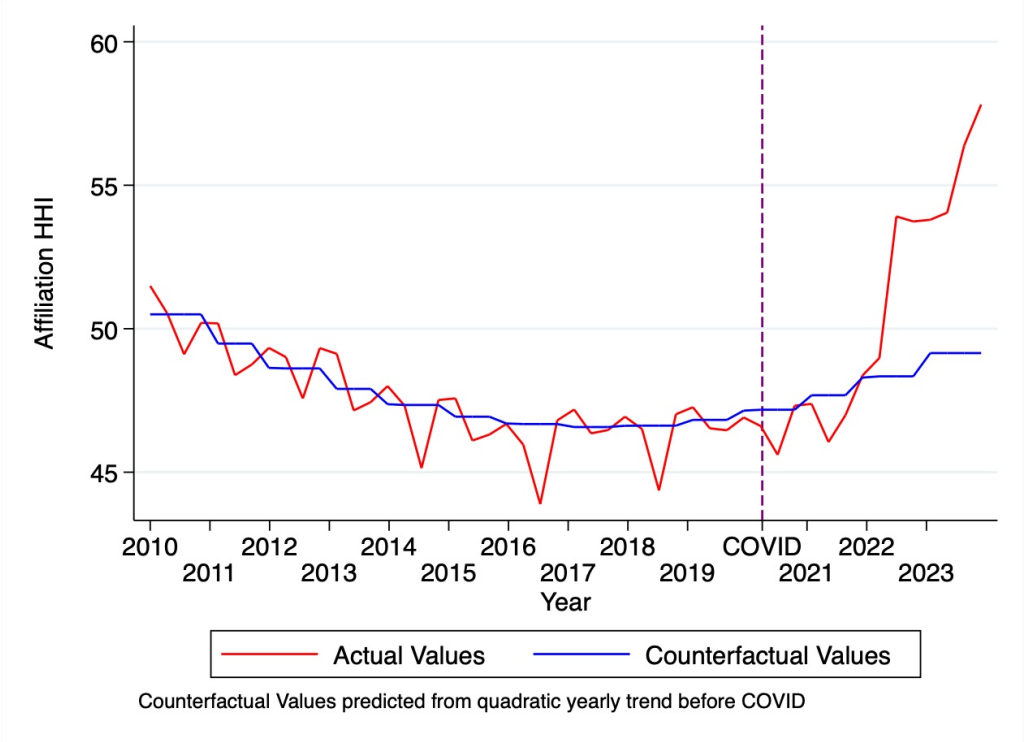


Figure A3: Percent of Intra-Affiliation Papers Among Multi-Authored Papers, 2010-2023

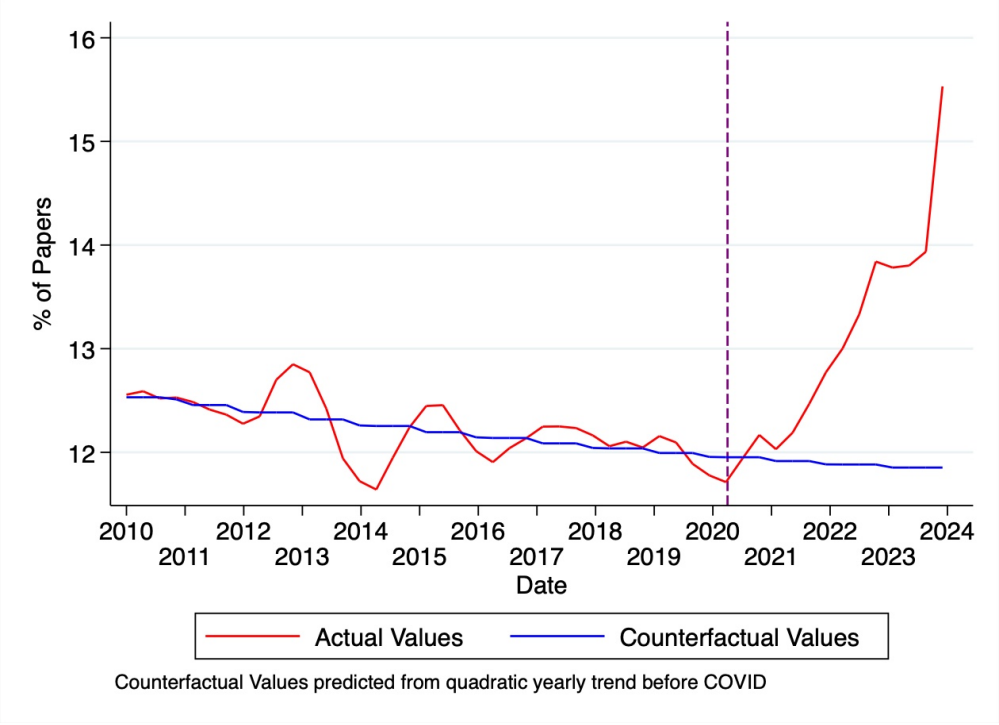


Figure A4: Percent of Authors from the Major Institution Among Multi-Authored Papers, 2010-2023

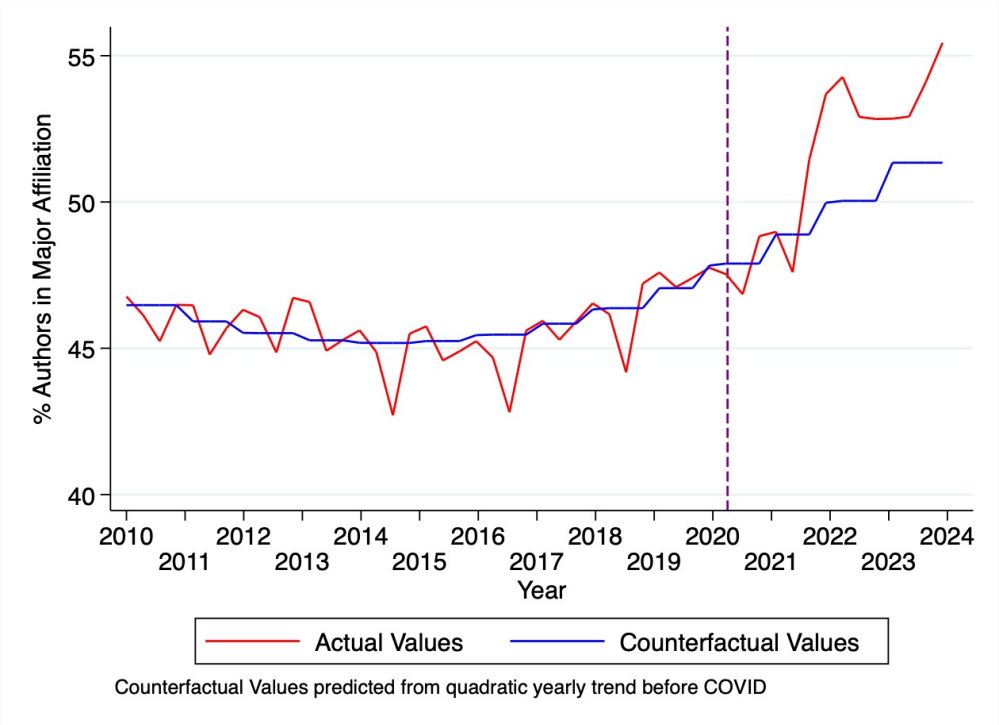
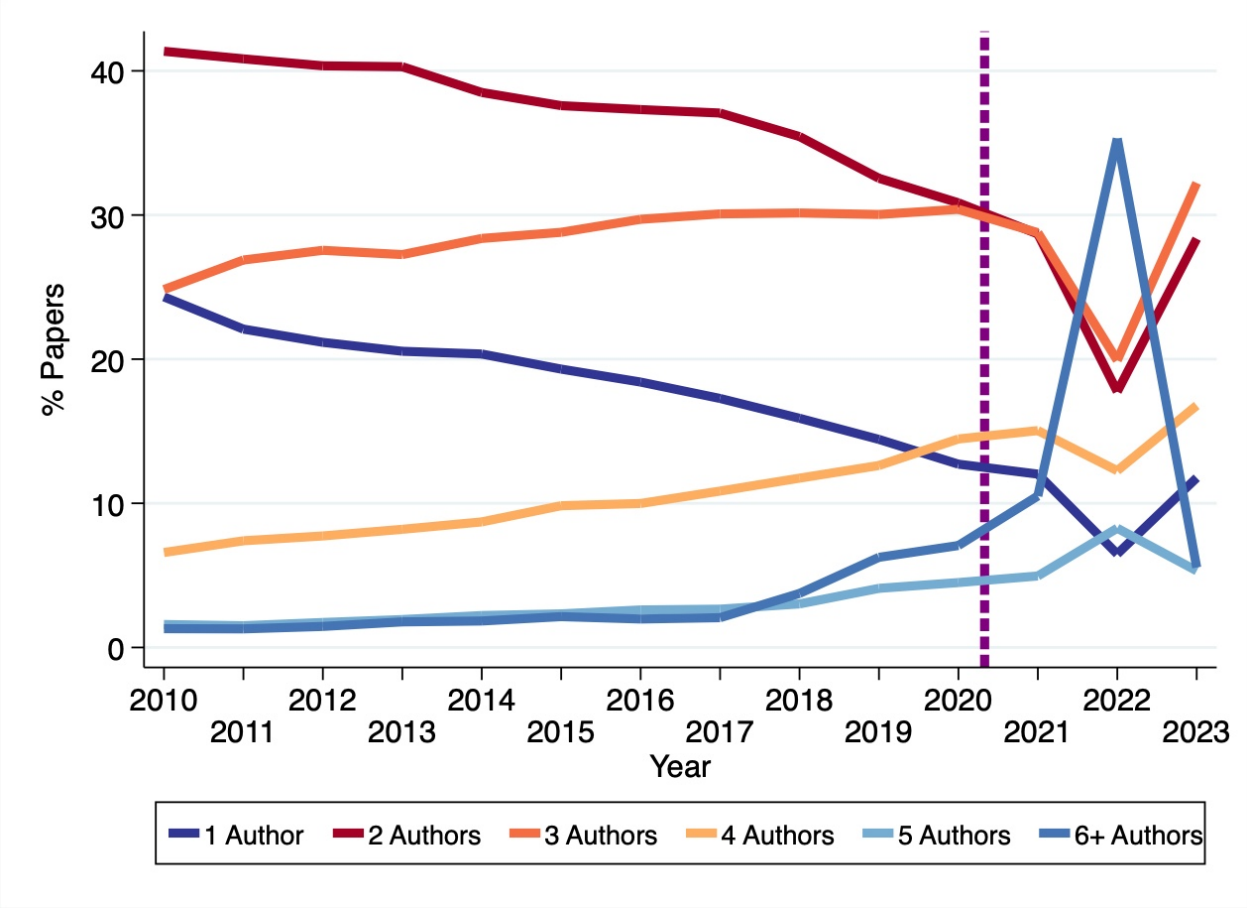


Figure A5: Percent of Papers with N Authors, Yearly Averages, 2010-2023



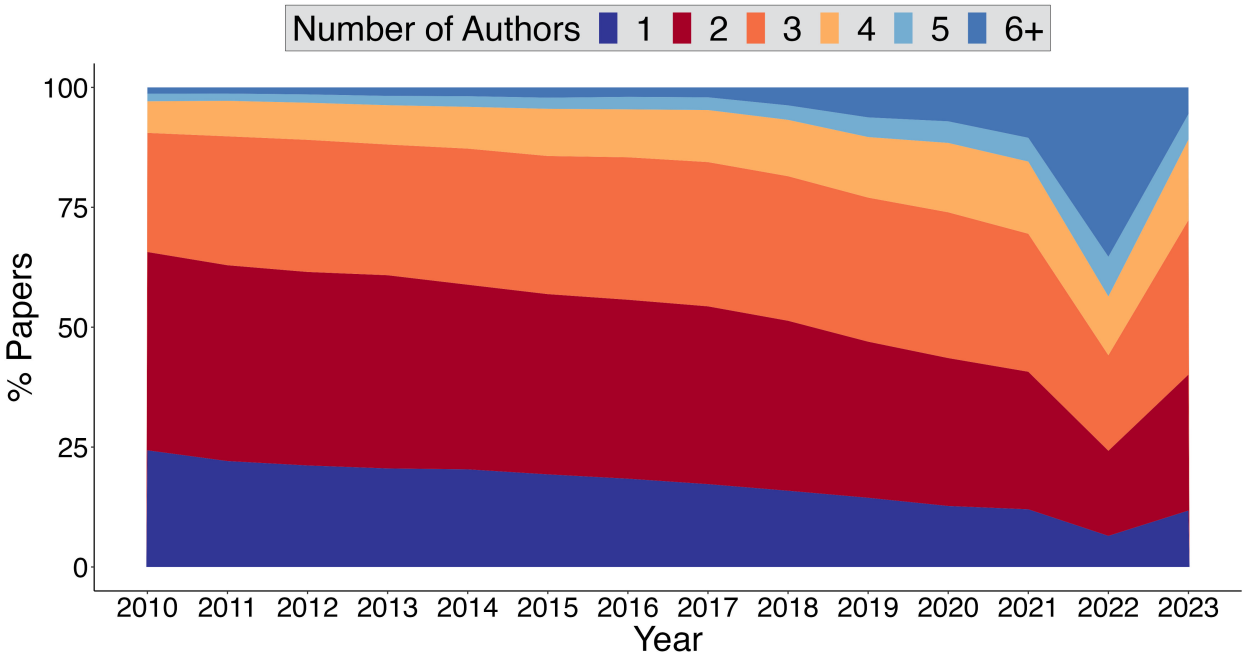
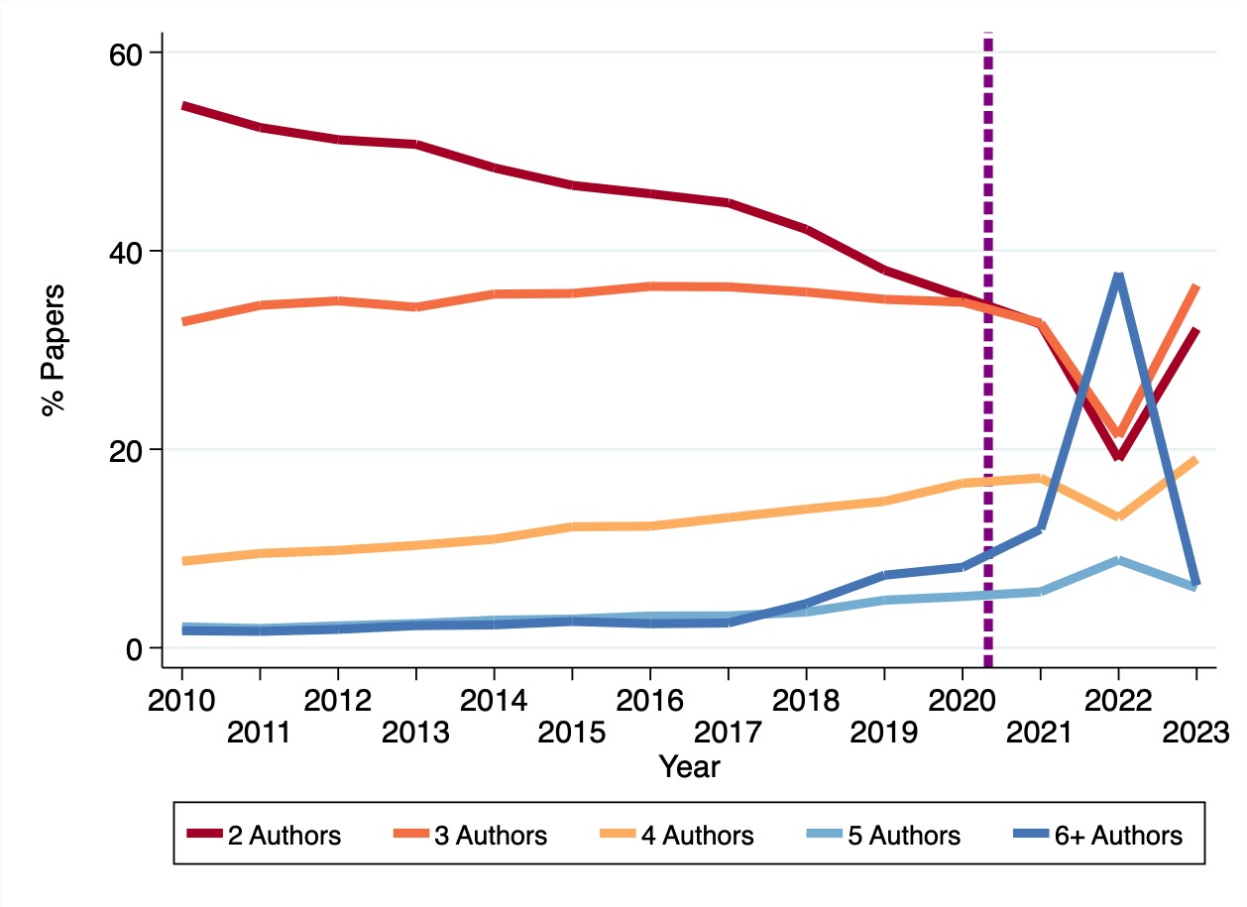


Figure A6: Percent of Papers with N Authors Among Multi-Authored Papers, Yearly Averages, 2010-2023



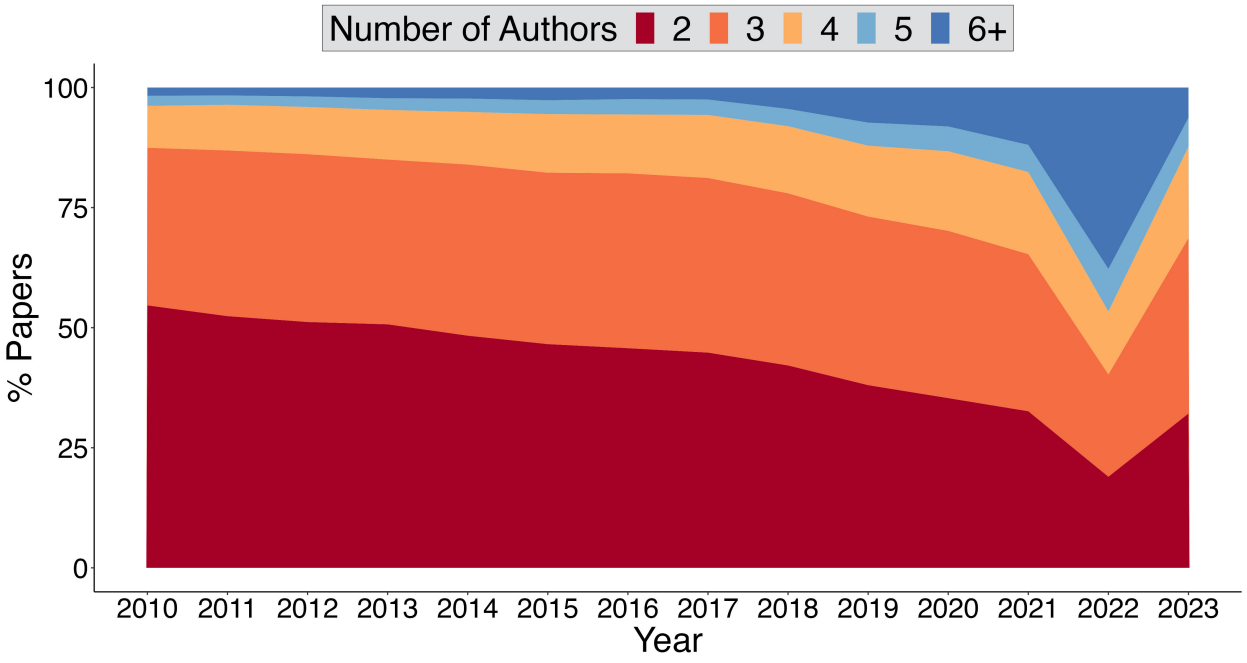
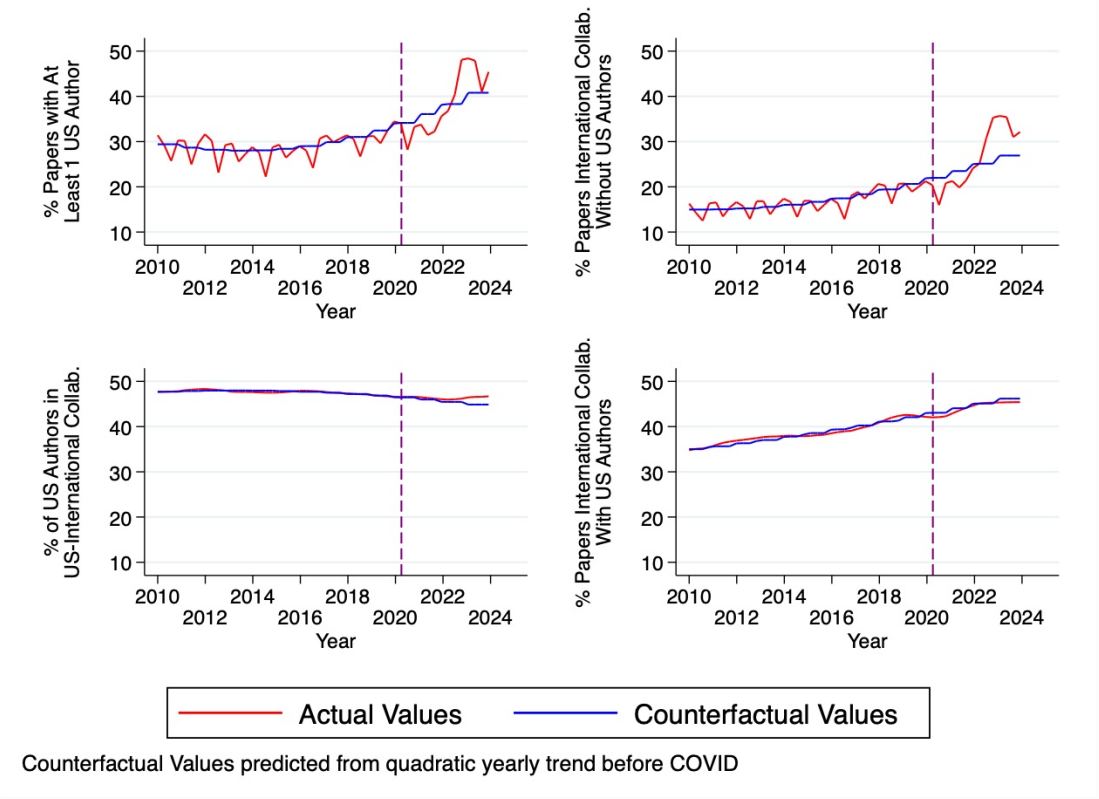
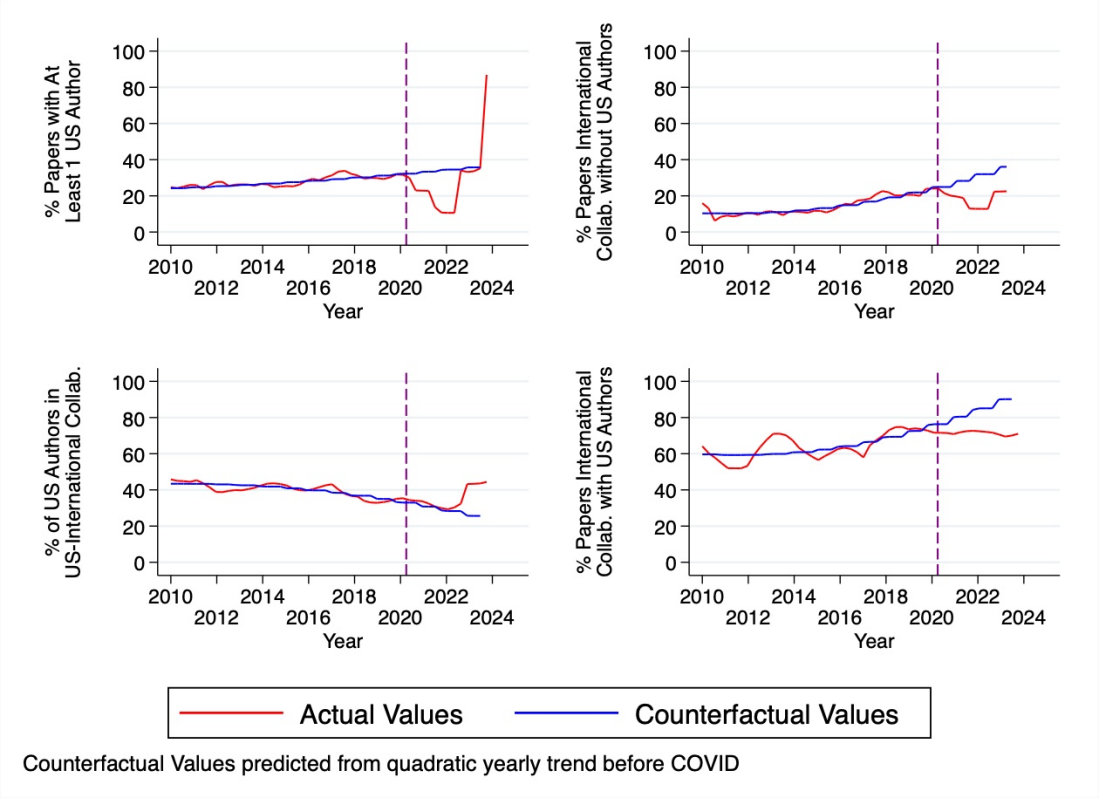


Figure A7: Trends in International Collaborations, 2-5 Authors, 2010-2023



Counterfactual Values predicted from quadratic yearly trend before COVID

Figure A8: Trends in International Collaborations, 6+ Authors, 2010-2023



Counterfactual Values predicted from quadratic yearly trend before COVID

B Tables

Table B1: Distribution of Papers Across Days, Months, and Years

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
1	81.0	81.7	81.9	80.2	79.1	77.7	76.8	77.3	79.1	78.5	81.6	84.4	96.1	95.4
2-10	5.4	5.2	5.0	5.6	6.2	6.4	7.1	7.3	5.9	6.2	5.3	5.1	1.1	1.5
11-20	6.4	6.2	6.3	7.0	6.8	7.3	7.8	7.1	7.7	7.2	6.3	5.1	1.2	1.6
21-31	7.2	6.9	6.8	7.3	7.9	8.6	8.4	8.3	7.3	8.1	6.7	5.4	1.6	1.5
Jan.	50.8	53.1	54.0	50.6	50.9	49.6	47.1	51.9	57.4	57.4	63.1	68.5	92.3	91.1
Feb.-Jun.	22.5	20.9	20.6	21.8	21.4	22.4	24.2	23.1	20.2	20.5	17.0	17.6	4.0	5.8
Jul.-Sep.	13.3	12.7	12.2	13.1	13.7	13.5	14.2	12.9	11.1	11.5	10.7	8.4	2.1	2.2
Oct.-Dec.	13.3	13.2	13.2	14.5	13.9	14.5	14.6	12.2	11.3	10.6	9.2	5.5	1.7	0.9
N Papers	32,392	33,730	33,699	33,149	33,376	32,926	33,377	30,924	29,468	28,456	33,336	26,904	27,767	11,342
Per-Month	2,699	2,810	2,808	2,762	2,781	2,743	2,781	2,577	2,456	2,371	2,778	2,242	2,314	945
%	7.7	8.0	8.0	7.9	7.9	7.8	7.9	7.4	7.0	6.8	7.9	6.4	6.6	2.7

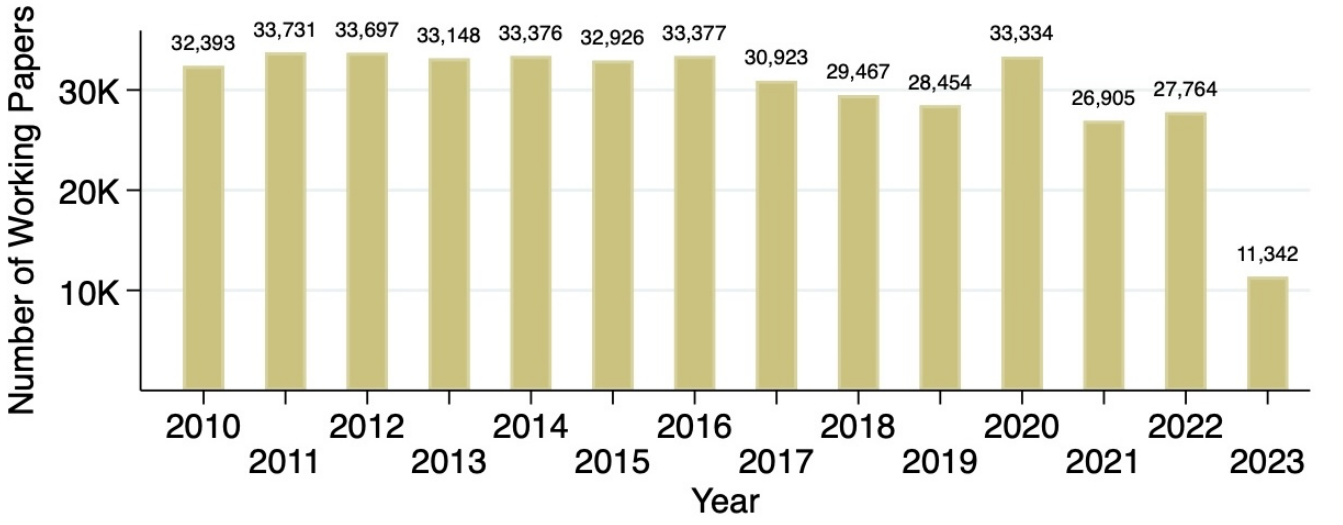


Table B2: Summary Statistics by Year

	(1)	(2)	(3)	(4)	(5)	(6)
	All Years	2010-2014	2015-2019	2020	2021/22	2023
		Pre-COVID		COVID Shock	During COVID	After COVID
% Single-Authored	17.4	21.7	16.4	12.7	9.2	11.8
Number of Papers	420,837	166,345	188,481	33,334	54,669	11,342
Among Multi-Authored Papers						
Affiliation HHI	41.4	40.6	40.8	41.9	46.8	48.3
% Intra-Affiliation	12.2	12.3	12.1	11.5	16.4	13.5
% Authors in Major Affiliation	47.0	45.7	46.3	47.9	53.5	52.8
Number of Authors	3.2	2.7	3.1	3.5	4.4	3.3
% 4 or More Authors	23.1	14.1	22.2	29.8	44.9	31.3
% 5 or More Authors	10.4	4.3	8.4	13.3	30.8	12.3
% 6 or More Authors	6.6	2.0	4.6	8.1	23.9	6.3
International Collaboration						
% Authors US Affiliated	21.3	20.8	21.7	23.1	19.9	32.5
% At Least 1 US Author	30.9	29.7	31.2	33.9	29.5	47.8
% International Collaboration	29.9	27.6	30.5	32.4	29.3	45.5
% Only US Author	12.6	12.5	12.9	13.5	11.7	18.3
Number of Papers	347,521	130,277	157,605	29,095	52,868	10,007

Table B3: Effects of COVID on Inter-Institutional Collaboration in Economics Working Papers, 2010-2023

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
			Multi-Authored Papers					
	% Single-Authored		Affiliation HHI		% **Intra**-Affiliation		% in Major Affiliation	
A. Individual Year Deviation From Trend								
Apr.-Dec. 2020	-1.35***	-0.80**	0.09	-1.14***	-0.32	-0.31	0.51*	-0.90***
	(0.35)	(0.37)	(0.33)	(0.34)	(0.36)	(0.37)	(0.30)	(0.31)
2021	-0.75***	0.16	1.26***	-0.82***	0.06	0.08	1.86***	-0.52*
	(0.24)	(0.31)	(0.22)	(0.28)	(0.25)	(0.32)	(0.21)	(0.27)
2022	-5.28***	-3.94***	4.40***	1.34***	0.42*	0.45	6.90***	3.38***
	(0.22)	(0.37)	(0.23)	(0.35)	(0.26)	(0.38)	(0.22)	(0.33)
2023	1.01***	2.84***	6.86***	2.64***	1.81***	1.86***	5.52***	0.69
	(0.35)	(0.54)	(0.30)	(0.47)	(0.38)	(0.55)	(0.28)	(0.44)
Yearly Trend	-1.01***	-1.34***	0.10***	0.86***	-0.07***	-0.07	0.16***	1.04***
	(0.02)	(0.08)	(0.02)	(0.07)	(0.02)	(0.08)	(0.02)	(0.06)
Yearly Trend^2		-0.03***		0.08***		-0.00		0.09***
		(0.01)		(0.01)		(0.01)		(0.01)
B. Before/After COVID Trends								
COVID Shock	-1.71***	1.03***	-0.68***	-1.46***	-0.58**	-0.19	0.42*	-2.09***
	(0.26)	(0.35)	(0.24)	(0.32)	(0.27)	(0.36)	(0.22)	(0.30)
Yearly Trend ×								
Before COVID	-1.01***	-1.34***	0.10***	0.86***	-0.07***	-0.07	0.16***	1.04***
	(0.02)	(0.08)	(0.02)	(0.07)	(0.02)	(0.08)	(0.02)	(0.06)
After COVID	-1.34***	-5.83***	2.56***	1.64***	0.57***	-0.20	2.57***	4.81***
	(0.13)	(0.40)	(0.12)	(0.39)	(0.14)	(0.44)	(0.11)	(0.36)
Yearly Trend^2 ×								
Before COVID		-0.03***		0.08***		-0.00		0.09***
		(0.01)		(0.01)		(0.01)		(0.01)
After COVID		1.48***		0.30**		0.26*		-0.74***
		(0.13)		(0.12)		(0.14)		(0.11)
N	420,837	420,837	347,521	347,521	347,521	347,521	347,521	347,521
Pre-COVID Mean	19.06	19.06	40.69	40.69	12.20	12.20	46.02	46.02

Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Affiliation HHI is approximately the probability that two randomly selected authors from the paper share an affiliation.

Table B4: Effects of COVID on Number of Authors Multi-Authored Economics Working Papers, 2010-2023

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	% 2 or 3 Authors		% 4 or 5 Authors		% 6 or More Authors		% 4 or More Authors		% 5 or More Authors	
A. Individual Year Deviation From Trend										
Apr.-Dec. 2020	-4.37***	-1.58***	3.94***	3.14***	0.44	-1.56***	4.37***	1.58***	2.40***	0.04
	(0.51)	(0.53)	(0.47)	(0.49)	(0.28)	(0.29)	(0.51)	(0.53)	(0.37)	(0.39)
2021	-7.01***	-2.30***	1.89***	0.55	5.12***	1.76***	7.01***	2.30***	6.07***	2.10***
	(0.36)	(0.44)	(0.32)	(0.39)	(0.23)	(0.28)	(0.36)	(0.44)	(0.28)	(0.34)
2022	-30.51***	-23.54***	0.15	-1.85***	30.36***	25.38***	30.51***	23.54***	34.25***	28.37***
	(0.36)	(0.53)	(0.31)	(0.47)	(0.32)	(0.39)	(0.36)	(0.53)	(0.34)	(0.44)
2023	-0.58	9.00***	2.27***	-0.47	-1.69***	-8.53***	0.58	-9.00***	-0.89**	-8.97***
	(0.51)	(0.73)	(0.48)	(0.67)	(0.27)	(0.40)	(0.51)	(0.73)	(0.36)	(0.51)
Yearly Trend	-1.55***	-3.29***	0.97***	1.47***	0.58***	1.82***	1.55***	3.29***	0.85***	2.32***
	(0.02)	(0.09)	(0.02)	(0.09)	(0.01)	(0.05)	(0.02)	(0.09)	(0.02)	(0.07)
Yearly Trend^2		-0.17***		0.05***		0.12***		0.17***		0.14***
		(0.01)		(0.01)		(0.00)		(0.01)		(0.01)
B. Before/After COVID Trends										
COVID Shock	-8.36***	7.19***	2.78***	3.56***	5.57***	-10.75***	8.36***	-7.19***	7.22***	-10.33***
	(0.39)	(0.52)	(0.35)	(0.47)	(0.24)	(0.31)	(0.39)	(0.52)	(0.30)	(0.40)
Yearly Trend ×										
Before COVID	-1.55***	-3.29***	0.97***	1.47***	0.58***	1.82***	1.55***	3.29***	0.85***	2.32***
	(0.02)	(0.09)	(0.02)	(0.09)	(0.01)	(0.05)	(0.02)	(0.09)	(0.02)	(0.07)
After COVID	-5.61***	-31.58***	0.17	-3.04***	5.44***	34.61***	5.61***	31.58***	6.05***	36.98***
	(0.21)	(0.65)	(0.18)	(0.58)	(0.14)	(0.45)	(0.21)	(0.65)	(0.17)	(0.54)
Yearly Trend^2 ×										
Before COVID		-0.17***		0.05***		0.12***		0.17***		0.14***
		(0.01)		(0.01)		(0.00)		(0.01)		(0.01)
After COVID		8.58***		1.06***		-9.64***		-8.58***		-10.22***
		(0.20)		(0.18)		(0.14)		(0.20)		(0.16)
N	347,521	347,521	347,521	347,521	347,521	347,521	347,521	347,521	347,521	347,521
Pre-COVID Mean	81.82	81.82	14.89	14.89	3.30	3.30	18.18	18.18	6.32	6.32

Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table B5: Effects of COVID on International Collaboration of Economics Working Papers, 2010-2023

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	% Papers with At Least 1 US Author		% International Collab. w/o US Author		% International Collab. w/ US Author		Share of US Authors in US-International Collab.	
Apr.-Dec. 2020	-4.36***	-6.55***	-5.35***	-6.71***	-6.16***	-6.83***	0.60	1.45***
	(0.50)	(0.53)	(0.52)	(0.56)	(1.04)	(1.08)	(0.53)	(0.55)
2021	-0.62*	-4.30***	-1.48***	-3.74***	0.23	-0.92	-0.41	1.07**
	(0.36)	(0.46)	(0.40)	(0.51)	(0.68)	(0.85)	(0.34)	(0.43)
2022	-6.15***	-11.60***	-4.54***	-7.86***	1.95***	0.22	-3.00***	-0.77
	(0.36)	(0.55)	(0.39)	(0.60)	(0.73)	(1.06)	(0.37)	(0.53)
2023	14.19***	6.70***	13.36***	8.80***	-0.66	-3.05**	1.24***	4.34***
	(0.56)	(0.80)	(0.73)	(0.97)	(0.86)	(1.37)	(0.41)	(0.66)
Yearly Trend	0.37***	1.74***	0.58***	1.41***	0.71***	1.15***	-0.26***	-0.83***
	(0.03)	(0.11)	(0.03)	(0.12)	(0.05)	(0.20)	(0.03)	(0.10)
Yearly Trend^2		0.13***		0.08***		0.04**		-0.06***
		(0.01)		(0.01)		(0.02)		(0.01)
N	347,521	347,521	240,163	240,163	107,358	107,358	51,408	51,408
Pre-COVID Mean	30.61	30.61	21.47	21.47	46.95	46.95	47.08	47.08

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table B6: Differential Effects on International Collaboration by Number of Authors, 2010-2023

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	% Papers with At Least 1 US Author		% International Collab. w/o US Author		% International Collab. w/ US Author		Share of US Authors in US-International Collab.	
A. Papers with Two to Five Authors								
Apr.-Dec. 2020	-4.16***	-6.48***	-5.90***	-7.26***	-5.37***	-5.49***	-0.10	0.36
	(0.52)	(0.55)	(0.54)	(0.58)	(1.07)	(1.11)	(0.51)	(0.53)
2021	0.63	-3.26***	-0.86**	-3.11***	-0.17	-0.38	-0.05	0.75*
	(0.39)	(0.49)	(0.43)	(0.54)	(0.71)	(0.89)	(0.32)	(0.40)
2022	3.86***	-1.87***	2.53***	-0.78	0.52	0.20	-1.03***	0.17
	(0.44)	(0.62)	(0.51)	(0.71)	(0.78)	(1.11)	(0.35)	(0.50)
2023	15.10***	7.25***	14.74***	10.22***	0.48	0.04	-0.04	1.62**
	(0.58)	(0.83)	(0.76)	(1.01)	(0.88)	(1.41)	(0.40)	(0.63)
Yearly Trend	0.37***	1.80***	0.58***	1.39***	0.54***	0.62***	-0.13***	-0.43***
	(0.03)	(0.11)	(0.03)	(0.12)	(0.06)	(0.21)	(0.02)	(0.09)
Yearly Trend^2		0.14***		0.08***		0.01		-0.03***
		(0.01)		(0.01)		(0.02)		(0.01)
N	324,467	324,467	221,823	221,823	102,644	102,644	48,131	48,131
Mean	30.66	30.66	21.61	21.61	46.27	46.27	47.55	47.55
B. Papers with Six or More Authors								
Apr.-Dec. 2020	-7.52***	-7.77***	1.30	-0.34	-19.04***	-20.92***	7.66**	8.48***
	(1.89)	(1.97)	(2.16)	(2.24)	(4.28)	(4.36)	(3.11)	(3.17)
2021	-10.12***	-10.63***	-6.04***	-9.41***	-2.86	-6.92**	0.93	2.77
	(1.15)	(1.59)	(1.22)	(1.67)	(2.28)	(2.98)	(1.62)	(2.12)
2022	-23.14***	-23.98***	-13.73***	-19.19***	-5.84***	-12.53***	-2.56*	0.52
	(1.02)	(2.04)	(1.08)	(2.10)	(2.21)	(3.90)	(1.54)	(2.76)
2023	-0.98	-2.20	-5.69**	-13.59***	-10.70***	-20.49***	12.78***	17.32***
	(2.18)	(3.36)	(2.34)	(3.47)	(3.74)	(6.04)	(2.57)	(4.23)
Yearly Trend	0.83***	1.08**	1.64***	3.20***	1.97***	3.93***	-1.21***	-2.12***
	(0.15)	(0.53)	(0.14)	(0.52)	(0.30)	(1.01)	(0.21)	(0.71)
Yearly Trend^2		0.03		0.17***		0.23**		-0.11
		(0.06)		(0.05)		(0.11)		(0.08)
N	23,054	23,054	18,340	18,340	4,714	4,714	3,277	3,277
Pre-COVID Mean	29.13	29.13	17.38	17.38	68.14	68.14	37.34	37.34

Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table B7: Effects of COVID on Inter-Institutional Collaboration in Economics Working Papers with 2-5 Authors, 2010-2023

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
			Multi-Authored Papers					
	% Single-Authored		Affiliation HHI		% **Intra**-Affiliation		% in Major Affiliation	
Apr.-Dec. 2020	-1.35***	-0.80**	0.22	-0.62*	0.04	-0.03	0.73**	-0.21
	(0.35)	(0.37)	(0.34)	(0.36)	(0.38)	(0.40)	(0.31)	(0.33)
2021	-0.75***	0.16	0.87***	-0.53*	0.24	0.13	1.35***	-0.22
	(0.24)	(0.31)	(0.23)	(0.30)	(0.27)	(0.34)	(0.22)	(0.28)
2022	-5.28***	-3.94***	6.67***	4.59***	3.14***	2.98***	7.28***	4.96***
	(0.22)	(0.37)	(0.26)	(0.37)	(0.33)	(0.44)	(0.24)	(0.35)
2023	1.01***	2.84***	8.19***	5.35***	2.58***	2.36***	6.93***	3.75***
	(0.35)	(0.54)	(0.31)	(0.48)	(0.41)	(0.58)	(0.29)	(0.45)
Yearly Trend	-1.01***	-1.34***	0.02	0.53***	-0.05**	-0.01	0.06***	0.63***
	(0.02)	(0.08)	(0.02)	(0.07)	(0.02)	(0.08)	(0.02)	(0.07)
Yearly Trend^2		-0.03***		0.05***		0.00		0.06***
		(0.01)		(0.01)		(0.01)		(0.01)
N	420,837	420,837	324,467	324,467	324,467	324,467	324,467	324,467
Pre-COVID Mean	19.58	19.58	41.05	41.05	12.46	12.46	46.27	46.27

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table B8: Effects of COVID on Inter-Institutional Collaboration in Economics Working Papers, 2010-2019,2021-2023

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
			Multi-Authored Papers					
	% Single-Authored		Affiliation HHI		% **Intra**-Affiliation		% in Major Affiliation	
A. Excluding Papers from 2020								
2021	-1.13***	-0.43	1.12***	-1.39***	-0.06	-0.62	2.01***	-0.88**
	(0.26)	(0.41)	(0.24)	(0.37)	(0.27)	(0.41)	(0.23)	(0.35)
2022	-5.71***	-4.73***	5.33***	1.79***	1.10***	0.31	7.94***	3.87***
	(0.24)	(0.51)	(0.25)	(0.47)	(0.28)	(0.52)	(0.23)	(0.44)
2023	0.53	1.83***	7.58***	2.86***	1.95***	0.91	6.53***	1.11*
	(0.37)	(0.71)	(0.32)	(0.62)	(0.40)	(0.70)	(0.30)	(0.58)
Yearly Trend	-0.96***	-1.18***	0.02	0.83***	-0.04	0.14	0.07***	1.00***
	(0.02)	(0.11)	(0.02)	(0.09)	(0.02)	(0.10)	(0.02)	(0.09)
Yearly Trend^2		-0.02**		0.07***		0.02*		0.08***
		(0.01)		(0.01)		(0.01)		(0.01)
N	387,503	387,503	318,426	318,426	318,426	318,426	318,426	318,426
Pre-COVID Mean	19.50	19.50	40.53	40.53	12.27	12.27	45.83	45.83
B. Excluding Papers from 2020 and 2023								
2021	-1.13***	-0.43	1.12***	-1.39***	-0.06	-0.62	2.01***	-0.88**
	(0.26)	(0.41)	(0.24)	(0.37)	(0.27)	(0.41)	(0.23)	(0.35)
2022	-5.71***	-4.73***	5.33***	1.79***	1.10***	0.31	7.94***	3.87***
	(0.24)	(0.51)	(0.25)	(0.47)	(0.28)	(0.52)	(0.23)	(0.44)
Yearly Trend	-0.96***	-1.18***	0.02	0.83***	-0.04	0.14	0.07***	1.00***
	(0.02)	(0.11)	(0.02)	(0.09)	(0.02)	(0.10)	(0.02)	(0.09)
Yearly Trend^2		-0.02**		0.07***		0.02*		0.08***
		(0.01)		(0.01)		(0.01)		(0.01)
N	376,161	376,161	308,419	308,419	308,419	308,419	308,419	308,419
Pre-COVID Mean	19.50	19.50	40.53	40.53	12.27	12.27	45.83	45.83

Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Affiliation HHI is approximately the probability that two randomly selected authors from the paper share an affiliation.

Table B9: Effects of COVID on Inter-Institutional Collaboration in Economics Working Papers with 2-5 Authors, 2010-2023

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
			Multi-Authored Papers					
	% Single-Authored		Affiliation HHI		% **Intra**-Affiliation		% in Major Affiliation	
A. Excluding Papers from 2020								
2021	-1.13***	-0.43	1.16***	-0.75**	0.12	-0.43	1.72***	-0.29
	(0.26)	(0.41)	(0.25)	(0.38)	(0.28)	(0.43)	(0.23)	(0.36)
2022	-5.71***	-4.73***	6.99***	4.31***	3.00***	2.23***	7.69***	4.87***
	(0.24)	(0.51)	(0.28)	(0.49)	(0.34)	(0.56)	(0.26)	(0.46)
2023	0.53	1.83***	8.55***	4.98***	2.42***	1.40*	7.38***	3.64***
	(0.37)	(0.71)	(0.33)	(0.63)	(0.42)	(0.73)	(0.31)	(0.59)
Yearly Trend	-0.96***	-1.18***	-0.02	0.59***	-0.03	0.14	0.01	0.65***
	(0.02)	(0.11)	(0.02)	(0.09)	(0.02)	(0.10)	(0.02)	(0.09)
Yearly Trend × Yearly Trend		-0.02**		0.05***		0.02*		0.06***
		(0.01)		(0.01)		(0.01)		(0.01)
N	387,503	387,503	297,730	297,730	297,730	297,730	297,730	297,730
Pre-COVID Mean	19.97	19.97	40.99	40.99	12.50	12.50	46.18	46.18
B. Excluding Papers from 2020 and 2023								
2021	-1.13***	-0.43	1.16***	-0.75**	0.12	-0.43	1.72***	-0.29
	(0.26)	(0.41)	(0.25)	(0.38)	(0.28)	(0.43)	(0.23)	(0.36)
2022	-5.71***	-4.73***	6.99***	4.31***	3.00***	2.23***	7.69***	4.87***
	(0.24)	(0.51)	(0.28)	(0.49)	(0.34)	(0.56)	(0.26)	(0.46)
Yearly Trend	-0.96***	-1.18***	-0.02	0.59***	-0.03	0.14	0.01	0.65***
	(0.02)	(0.11)	(0.02)	(0.09)	(0.02)	(0.10)	(0.02)	(0.09)
Yearly Trend × Yearly Trend		-0.02**		0.05***		0.02*		0.06***
		(0.01)		(0.01)		(0.01)		(0.01)
N	376,161	376,161	288,352	288,352	288,352	288,352	288,352	288,352
Pre-COVID Mean	19.97	19.97	40.99	40.99	12.50	12.50	46.18	46.18

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table B10: Effects of Work From Home on Number of Authors Multi-Authored Economics Working Papers, 2010-2023

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	% 2 or 3 Authors		% 4 or 5 Authors		% 6 or More Authors		% 4 or More Authors		% 5 or More Authors	
A. Excluding Papers from 2020										
2021	-8.47***	-3.28***	2.29***	0.74	6.18***	2.54***	8.47***	3.28***	7.22***	2.62***
	(0.37)	(0.54)	(0.33)	(0.48)	(0.23)	(0.32)	(0.37)	(0.54)	(0.28)	(0.39)
2022	-32.15***	-24.84***	0.59*	-1.60***	31.56***	26.43***	32.15***	24.84***	35.54***	29.07***
	(0.38)	(0.66)	(0.33)	(0.59)	(0.32)	(0.43)	(0.38)	(0.66)	(0.34)	(0.51)
2023	-2.40***	7.34***	2.76***	-0.15	-0.36	-7.18***	2.40***	-7.34***	0.54	-8.07***
	(0.53)	(0.89)	(0.49)	(0.81)	(0.27)	(0.47)	(0.53)	(0.89)	(0.37)	(0.61)
Yearly Trend	-1.36***	-3.03***	0.92***	1.42***	0.44***	1.61***	1.36***	3.03***	0.70***	2.18***
	(0.03)	(0.12)	(0.02)	(0.11)	(0.01)	(0.06)	(0.03)	(0.12)	(0.02)	(0.08)
Yearly Trend^2		-0.15***		0.05***		0.11***		0.15***		0.13***
		(0.01)		(0.01)		(0.01)		(0.01)		(0.01)
N	318,426	318,426	318,426	318,426	318,426	318,426	318,426	318,426	318,426	318,426
Pre-COVID Mean	82.70	82.70	14.43	14.43	2.87	2.87	17.30	17.30	5.77	5.77
B. Excluding Papers from 2020 and 2023										
2021	-8.47***	-3.28***	2.29***	0.74	6.18***	2.54***	8.47***	3.28***	7.22***	2.62***
	(0.37)	(0.54)	(0.33)	(0.48)	(0.23)	(0.32)	(0.37)	(0.54)	(0.28)	(0.39)
2022	-32.15***	-24.84***	0.59*	-1.60***	31.56***	26.43***	32.15***	24.84***	35.54***	29.07***
	(0.38)	(0.66)	(0.33)	(0.59)	(0.32)	(0.43)	(0.38)	(0.66)	(0.34)	(0.51)
Yearly Trend	-1.36***	-3.03***	0.92***	1.42***	0.44***	1.61***	1.36***	3.03***	0.70***	2.18***
	(0.03)	(0.12)	(0.02)	(0.11)	(0.01)	(0.06)	(0.03)	(0.12)	(0.02)	(0.08)
Yearly Trend^2		-0.15***		0.05***		0.11***		0.15***		0.13***
		(0.01)		(0.01)		(0.01)		(0.01)		(0.01)
N	308,419	308,419	308,419	308,419	308,419	308,419	308,419	308,419	308,419	308,419
Pre-COVID Mean	82.70	82.70	14.43	14.43	2.87	2.87	17.30	17.30	5.77	5.77

Standard errors in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table B11: Effects of COVID on International Collaboration of Economics Working Papers, 2010-2023

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	% Papers with At Least 1 US Author		% International Collab. w/o US Author		% International Collab. w/ US Author		Share of US Authors in US-International Collab.	
A. Excluding Papers from 2020								
2021	1.07***	-1.53***	-0.83**	-3.31***	0.38	-1.62	-0.98***	0.64
	(0.38)	(0.58)	(0.42)	(0.63)	(0.72)	(1.11)	(0.36)	(0.54)
2022	-4.25***	-7.90***	-3.81***	-7.30***	2.11***	-0.71	-3.64***	-1.34*
	(0.38)	(0.72)	(0.41)	(0.78)	(0.78)	(1.43)	(0.39)	(0.69)
2023	16.29***	11.43***	14.16***	9.53***	-0.48	-4.25**	0.53	3.61***
	(0.58)	(0.99)	(0.75)	(1.15)	(0.91)	(1.84)	(0.43)	(0.86)
Yearly Trend	0.16***	1.00***	0.50***	1.30***	0.69***	1.34***	-0.19***	-0.72***
	(0.03)	(0.14)	(0.03)	(0.15)	(0.06)	(0.28)	(0.03)	(0.13)
Yearly Trend × Yearly Trend		0.08***		0.07***		0.06**		-0.05***
		(0.01)		(0.01)		(0.02)		(0.01)
N	318,426	318,426	220,928	220,928	97,498	97,498	46,564	46,564
Mean	30.15	30.15	21.14	21.14	46.59	46.59	47.32	47.32
B. Excluding Papers from 2020 and 2023								
2021	1.07***	-1.53***	-0.83**	-3.31***	0.38	-1.62	-0.98***	0.64
	(0.38)	(0.58)	(0.42)	(0.63)	(0.72)	(1.11)	(0.36)	(0.54)
2022	-4.25***	-7.90***	-3.81***	-7.30***	2.11***	-0.71	-3.64***	-1.34*
	(0.38)	(0.72)	(0.41)	(0.78)	(0.78)	(1.43)	(0.39)	(0.69)
Yearly Trend	0.16***	1.00***	0.50***	1.30***	0.69***	1.34***	-0.19***	-0.72***
	(0.03)	(0.14)	(0.03)	(0.15)	(0.06)	(0.28)	(0.03)	(0.13)
Yearly Trend × Yearly Trend		0.08***		0.07***		0.06**		-0.05***
		(0.01)		(0.01)		(0.02)		(0.01)
N	308,419	308,419	215,708	215,708	92,711	92,711	44,077	44,077
Pre-COVID Mean	30.15	30.15	21.14	21.14	46.59	46.59	47.32	47.32

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table B12: Effects of COVID on International Collaboration of Economics Working Papers with 2-5 Authors, 2010-2023

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	% Papers with At Least 1 US Author		% International Collab. w/o US Author		% International Collab. w/ US Author		Share of US Authors in US-International Collab.	
A. Excluding Papers from 2020								
2021	2.33***	-0.42	-0.24	-2.71***	-0.34	-1.24	-0.41	0.26
	(0.40)	(0.60)	(0.44)	(0.66)	(0.75)	(1.15)	(0.34)	(0.51)
2022	5.78***	1.90**	3.22***	-0.24	0.33	-0.94	-1.44***	-0.49
	(0.46)	(0.78)	(0.53)	(0.86)	(0.82)	(1.48)	(0.37)	(0.65)
2023	17.24***	12.09***	15.51***	10.90***	0.27	-1.42	-0.50	0.77
	(0.59)	(1.02)	(0.78)	(1.19)	(0.93)	(1.88)	(0.42)	(0.83)
Yearly Trend	0.16***	1.04***	0.50***	1.28***	0.56***	0.85***	-0.08***	-0.30**
	(0.03)	(0.15)	(0.04)	(0.16)	(0.06)	(0.29)	(0.03)	(0.12)
Yearly Trend × Yearly Trend		0.08***		0.07***		0.03		-0.02*
		(0.01)		(0.01)		(0.03)		(0.01)
N	297,730	297,730	204,214	204,214	93,516	93,516	43,808	43,808
Pre-COVID Mean	30.21	30.21	21.30	21.30	46.05	46.05	47.68	47.68
B. Excluding Papers from 2020 and 2023								
2021	2.33***	-0.42	-0.24	-2.71***	-0.34	-1.24	-0.41	0.26
	(0.40)	(0.60)	(0.44)	(0.66)	(0.75)	(1.15)	(0.34)	(0.51)
2022	5.78***	1.90**	3.22***	-0.24	0.33	-0.94	-1.44***	-0.49
	(0.46)	(0.78)	(0.53)	(0.86)	(0.82)	(1.48)	(0.37)	(0.65)
Yearly Trend	0.16***	1.04***	0.50***	1.28***	0.56***	0.85***	-0.08***	-0.30**
	(0.03)	(0.15)	(0.04)	(0.16)	(0.06)	(0.29)	(0.03)	(0.12)
Yearly Trend × Yearly Trend		0.08***		0.07***		0.03		-0.02*
		(0.01)		(0.01)		(0.03)		(0.01)
N	288,352	288,352	199,412	199,412	88,940	88,940	41,468	41,468
Pre-COVID Mean	30.21	30.21	21.30	21.30	46.05	46.05	47.68	47.68

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$