International Knowledge Flows: Evidence from the Collapse of International Science in the Wake of WWI

Alessandro Iaria (CREST)
Fabian Waldinger (University of Warwick)*

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Abstract

We analyze international knowledge flows as measured by citations in scientific papers. To separate knowledge flows from other cross-country differences, we investigate a large and sudden shock during WWI and the subsequent boycott of scientists from Central countries. The boycott increased citation penalties toward enemy countries by around 100%, indicating a substantial reduction in international knowledge flows. Additional results show that our findings are not driven by discrimination against enemy papers but rather by a genuine reduction in knowledge flows, and that some knowledge that was produced during the boycott never reached the enemy camp. We also provide suggestive evidence that the collapse of international science affected the world-wide production of Nobel Prize worthy ideas.

Introduction

Ideas are key in advancing technological progress and economic growth (e.g., Romer, 1990). Many technological breakthroughs follow from ideas that have been developed by scientists engaged in basic research. In contrast to technology, where knowledge is protected by intellectual property

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rights or secrecy, scientists are keen to disseminate knowledge and claim priority through publication (Merton 1957, Partha and David, 1994, and Stephan, 2010). The diffusion of scientific knowledge can only occur if scientists are aware of prior knowledge and if the costs of accessing it are not prohibitive (Mokyr, 2005).

We measure international knowledge flows with citations in academic papers. Cross-country differences in citation patterns, however, do not only reflect differences in access to knowledge but also other forms of cross-country heterogeneity, such as a differential specialization of scientists. To isolate knowledge flows from other differences, we rely on a sudden and sharp change to international knowledge flows that affected the entire scientific community in the wake of World War I (WWI).

WWI was the first war that was waged on an industrial scale and all major war participants enlisted some of their most prominent scientists to help with the war effort. Scientists developed poisonous agents for gas warfare, new explosives, and trench mortars. Chemical warfare, in particular, attracted some of the best minds. The German chemical war effort was led by Nobel Laureate Fritz Haber who enlisted the help of no less than seven other Nobel Laureates as well as other prominent chemists and physicists to develop new chemical agents (Van der Kloot, 2004). In Allied countries, the French chemical war effort was led by Victor Grignard who had received the chemistry Nobel Prize in 1912. The US effort also enlisted a number of prominent scientists including the future president of Harvard University James Bryant Conant.

During the war, many scientists, in particular from Germany, issued statements in support of their home country's military actions. In the most infamous document, the so-called "Manifesto of the 93," 93 German intellectuals declared their support for Germany's military actions, including the killing of Belgian civilians and the destruction of Leuven with its famous university library (Professors of Germany, 1919). The document was signed by 14 current of future Nobel Laureates, including Max Planck, Paul Ehrlich, and Wilhelm Röntgen, and widely distributed in Germany and abroad. The document produced a strong reaction from Allied scientists, including a letter published in Nature by the British chemistry Nobel Laureate William Ramsay that suggested "restrictions of the Teutons" for the post-war period (Ramsay, 1914).

The brutality of the war, the involvement of scientists in the development of weapons, and the public support of the war by many scientists created bitter feelings between the scientific camps in Allied (USA, UK, France, Canada, Japan, and others) and Central countries (Germany, Austria, Hungary, Bulgaria, and the Ottoman Empire). To punish the scientific community in Central countries for its aggressive support of the war, scientists from Allied countries organized a boycott at its expenses.[1] During a conference held by the world's oldest scientific academy, the

[1]The scientific boycott was not the only measure against the Central countries. US patents of Central firms, for example, were licensed at lower than market rates to US firms and increased patenting of US firms in technology areas with licencing (Moser and Voena, 2012).

Royal Society, prominent scientists from Allied countries in 1918 announced that:

> "…the Allied Nations are forced to declare that they will not be able to resume personal relations in scientific matters with their enemies until the Central Powers can be readmitted into the concert of civilized nations." [quoted in Lehto, 1998, p. 18.]

The boycott lasted from the end of the war until 1926. Scientists from Central countries were no longer allowed to attend international conferences, many Allied scientific associations excluded their foreign members from Central countries, fewer scientists published their findings in journals of the opposing camp, and international efforts to reference the world-wide scientific literature (International Catalog of Scientific Literature) were discontinued (Reinbothe, 2006).

The boycott interrupted international knowledge flows between Allied and Central nations. Scientists from Allied countries suddenly faced much higher barriers to access knowledge from Germany, a country whose scientists had received more than 40 percent of Nobel prizes in physics and chemistry in the pre-war period. Similarly, scientists from Central countries faced higher barriers to access knowledge from Allied countries; in particular from the UK (20 percent of Nobel prizes), France (15 percent of Nobel prizes), and the rising scientific power United States. Neutral countries (e.g., Switzerland, Netherlands, and the Scandinavian countries) were invited to join the Allied scientific organizations in the post-war period and decided to do so to avoid scientific isolation. After a few years, scientists from Neutral countries shouldered for the re-admittance of Central scientists into the international scientific community. While these proposals were initially rejected by the Allied countries, the boycott was officially terminated in June 1926. The boycott was strictly enforced during the first years after the war, but even before 1926 it became less and less binding over time (Kerkhoff, 1940). In 1928, the eminent German mathematician David Hilbert was honored to deliver the opening address of the International Congress of Mathematicians in Bologna, Italy. He proclaimed:

> "It makes me very happy that after a long, hard time all the mathematicians of the world are represented here. This is as it should be and as it must be for the prosperity of our beloved science. It is a complete misunderstanding of our science to construct differences according to peoples and races… For mathematics, the whole cultural world is a single country." [quoted in Reid, 1970, p. 188.]

We estimate how much WWI and the boycott reduced international knowledge flows by analyzing international citation patterns in five scientific fields: medicine, biology, chemistry, physics, and mathematics. Readily downloadable publication and citation data, such as data from the ISI Web of Science, usually lack address information for authors and cited references for the historical period studied in this paper. As country information is essential to study international citation

flows, we construct a new dataset of all university scientists in the world in 1900 and 1914. These data contain names, scientific specializations, and university, and thus country affiliation. For our analysis, we combine the scientist data with downloadable data on more than 260,000 articles citing almost 2 million references from over 150 journals from the ISI Web of Science.

Using these data, we construct two measures of international knowledge flows. Independently of the time period, papers from all scientific camps are significantly less likely to cite recent papers from enemy camps, relative to papers from their own camp. The citation penalty against papers from enemy camps increased during WWI and in particular during the early boycott years, when international scientific collaborations of Centrals and Allies were most severely interrupted. Citation penalties against Neutrals increased substantially less and the increase was often not significantly different from the pre-WWI period.

Compared to the pre-WWI period, Central papers increased their citation penalty against recent Allied papers by more than 120% during the early boycott years. During the later boycott years, the citation penalty against Allied papers was still more than 30% higher than in the pre-WWI period. After the end of the boycott, the citation penalty against Allied papers reverted back to its pre-WWI levels. The citation penalty of Central papers against Neutral papers, however, vanished during WWI and did not significantly increase during the boycott years.

Compared to the pre-WWI period, Allied papers increased their citation penalty against recent Central papers by more than 40% during WWI and by almost 80% during the early boycott years. During the later boycott years the citation penalty against Central papers was still more than 50% higher than in the pre-WWI period. After the end of the boycott, the citation penalty against Central papers reverted back to its pre-WWI levels. The citation penalty of Allied papers against Neutral papers increased by around 30% during the war and did not significantly increase during the boycott years.

Additional results indicate that these changes in citation patterns during WWI and the boycott were not driven by discrimination against enemy papers but rather by increased costs of accessing knowledge from the enemy camp. Unlike citations to recent enemy papers, where we find sharp increases in citation penalties in the wake of WWI, citation penalties to enemy papers that were published in the pre-WWI period did not increase during the war and boycott years.

We also explore the long-run effects of reduced knowledge flows between enemy camps. We find that some Allied knowledge that was produced during the early boycott years did not manage to reach Central scientists. For the long-run analysis, we focus on relative citations to different cohorts of papers. We find that Allied work that was published before WWI initially received relatively fewer citations from Central papers than Central work. This citation penalty towards pre-WWI Allied work shrank relatively quickly. Allied work that was published during WWI, initially received relatively fewer citations from Central papers than Central work. The Central

citation penalty towards WWI Allied work, however, was more persistent and lasted for about 15 years, largely beyond the end of the boycott. Allied work that was published in the early boycott years, initially received substantially fewer citations from Central papers. This larger citation penalty towards early-boycott Allied work was more persistent and continued for longer after the end of the boycott.

Central work that was published before WWI initially received relatively fewer citations from Allied papers than Allied work. The citation penalty towards pre-WWI Central work was always small. Central work that was published during WWI initially received relatively fewer citations from Allied papers than Allied work. The citation penalty towards WWI Central papers, however, was slightly more persistent than in the pre-WWI period. After a few years, though, WWI Central papers were cited at similar rates as pre-WWI Central papers. Central work that was published in the early boycott years, initially received substantially fewer citations from Allied papers. This larger citation penalty towards early-boycott Central papers was also slightly more persistent than in the pre-WWI period, but after a few years early-boycott and pre-WWI Central papers were cited at at similar rates.

In conclusion, we provide suggestive evidence that the interruption of knowledge flows from enemy camps affect the world-wide production of Nobel Prize worthy ideas. Using data from Jones and Weinberg (2011) that report the period during which Nobel laureates were working on their Nobel prize winning work, we find that fewer Nobel Prize worthy ideas were produced during WWI. This drought of Nobel Prize worthy ideas continued until four years after the war. Of course, this pattern may just be driven by the physical destruction caused by WWI. We find, however, that the post-war drought following WWI lasted for longer than that following WWII, suggesting that the interruption of knowledge flows during WWI and the boycott indeed affected the production of path-breaking scientific ideas.

Prior work has shown that patent citations are more likely to come from the same country, state, and city as the cited patent (Jaffe, Trajtenberg, and Henderson, 1993). These barriers to receiving patent citations are particularly strong at country borders (Thompson and Fox-Kean, 2005), suggesting that such borders are indeed important barriers to knowledge flows. Country borders, however, can become more or less permeable over time. While Western-to-Communist book translations were very rare during the Cold-War period, they increased massively after the Collapse of the Soviet Union (Abramitzky and Sin, 2014). We investigate international knowledge flows measured by citations in academic papers. Despite the fact, that academic publishing is geared towards free exchange of scientific knowledge, we find strong barriers to international knowledge flows that become less permeable in the wake of WWI.

Our findings highlight the effect of scientific institutions (such as conferences and referencing archives) on international knowledge flows. Related work has shown that intellectual property

rights, such as copyrights and patents, affect knowledge flows. A fall in copyrights of German scientific books during WWII increased US citations to these books (Biasi and Moser, 2015). Similarly, patent protection for certain human genes reduced follow-on innovation building on these genes (Williams, 2013). Patent protection of genetically engineered mice reduced follow-on work based on these mice (Murray, Aghion, Dewatripont, Kolev, and Stern, 2009).

1 WWI and Scientific Collaboration

WWI affected international scientific collaboration because, on the one hand, many international conferences were cancelled during the war. On the other hand, WWI also saw scientists becoming actively involved in the development of weaponsand holding openly hostile positions against enemy countries. After the moral and physical destruction of the Great War, scientists from Allied countries organized a boycott against scientists from Central countries that further obstructed international scientific collaborations. The following section summarizes the historical events that led to the collapse of international science.

Scientists and the Development of Weapons during WWI

WWI was the first war waged on an industrial scale in which all major participants enlisted some of their most prominent scientists to help in the effort. Scientists developed poisonous agents for gas warfare, new explosives, and trench mortars.

The German gas warfare effort was led by Fritz Haber (Nobel Prize Winner, 1918) who assembled a team that included, among others, the seven Nobel Laureates James Franck, Gustav Hertz, Otto Hahn, Walter Nernst, Emil Fischer, Heinrich Wieland, and Richard Willstätter to develop new poisonous gases (Van der Kloot, 2004). The French gas warfare effort was led by Victor Grignard who had received the Nobel Prize in Chemistry in 1912. In the United States chemical weapons were developed by a team of prominent scientists that included the future president of Harvard University James Bryant Conant.

In August 1914, French troops used tear gas filled shells and hand grenades to attack the German troops (Trumpener, 1975). In the first large-scale attack near Ypres, Belgium, the Germans used chlorine gas against the French on April 22^{nd}, 1915. The greenish cloud poisonous gas killed around 5,000 French soldiers and wounded 15,000. In the following months, the British and French armies not only developed countermeasures but also used chlorine in their own attacks. Until the end of the war in 1918, both Allies and Centrals developed new poisonous agents such as phosgene (introduced in 1915) and mustard gas (introduced by the Germans in 1917). Overall, gas killed around 91,000 soldiers during the war. Compared to a total of 16 million war casualties, the number of gas victims was relatively low. Nonetheless, the "mysterious" nature of gas spread

great fear among soldiers and made this new weapon a symbol of a war that became dependent on scientific discoveries.

Public documents in support of war

As soon as the war had started, scientists of both camps issued statements that showed their support for the war. In the most infamous document, the so-called "Manifesto of the 93," 93 German intellectuals declared their support for Germany's military actions, including the killing of Belgian civilians and the destruction of Leuven with its famous university library. The document was widely distributed on October 4^{th}, 1914, and translated into 14 languages (see Professors of Germany (1919) for an English translation of the document). The signatories included 14 current or future Nobel Laureates, such as the chemist Fritz Haber, the inventor of chemotherapy Paul Ehrlich, and the inventor of X-rays Wilhelm Röntgen. Two weeks later, 3,000 German university teachers endorsed a declaration that "…Europe's culture depends on the victory of the German military" (Reinbothe, 2006, p. 99). The British chemistry Nobel Laureate William Ramsay published a reply to the manifesto in Nature and stated that "their ideal […] is to secure world supremacy for their race, […] 'Deutschland über Alles in der Welt"' (Ramsay, 1914). A similar reply was published by the French Académie des Sciences.

Exclusion of Central Scientists from Allied Scientific Associations

Already during the war, many Allied scientific associations excluded (honorary) members from Central countries. Eminent scholars, such as the Nobel Laureates Adolf von Baeyer, Walter Nernst, or Richard Willstätter were excluded from the American Chemical Society, the British Chemical Society, and the French Societé Chimique. Many other Allied scientific associations followed suit (Rheinbothe, 2006).

The Boycott of Scientists from Central Countries

The participation in the war effort of scientists from all countries, and in particular Germany, embittered the international scientific community. As early as October, 1914, William Ramsay writing in Nature suggested "restrictions of the Teutons" (Ramsay, 1914). In the following year, Allied scientists continued to discuss potential sanctions against Central scientists. In correspondence with Arthur Schuster, the Secretary of the Royal Society, Gaston Darboux and his successor Émile Picard, the Permanent Secretaries of the French Académie des Sciences, suggested to break all scientific links with Central scientists (Letho, 1998, p. 16).

In October 1918, even before the Armistice of November 1918 that ended WWI, scientists from eight Allied countries called a conference at the premises of the Royal Society in London, which

paved the way for the boycott of Central scientists.

At a conference in Brussels, over 200 scientists from 12 Allied countries founded the International Research Council (IRC).[2] The IRC replaced the International Association of Academies that had been dominated by four German scientific academies. IRC statutes explicitly excluded the former Central countries, but thirteen formerly neutral countries were invited to join as members (Kevles, 1971, p. 58). While the Neutrals were initially put off by the strong anti-Central bias of the IRC, they accepted the invitation to avoid scientific isolation (Lehto, 1998, p. 21). As voting rights in the IRC depended on population counts (including colonies), the IRC was effectively controlled by the large Allied countries: USA, UK, and France.

As international scientific relations were now organized under the auspices of the IRC, the international scientific community was divided into four different camps (Table 1). To facilitate international relations in each scientific field, a number of subject-specific Unions were established under the IRC.[3] The exclusion of scientists from Central countries was implemented in most Allied scientific associations and organizing committees of international scientific meetings, even if they were not officially affiliated with the IRC or its Unions (Schroeder-Gudehus, 1973).

After a short time, the Neutral countries lobbied for the deletion of political membership restrictions in the IRC statutes. At the general assembly of the IRC in 1922, Sweden proposed to invite the formerly Central countries to the IRC. At that time, the proposal was rejected by a large majority of Allied countries (Letho, 1998, p. 38). In the following years, the position of the Allied countries softened, in particular in the United States and Great Britain. In 1921, for example, the American Mathematical Society re-established foreign membership and explicitly mentioned German mathematicians as eligible (Lehto, p. 31). As a result of the more general policy of détente in the mid-1920s, with Germany being invited to join the League of Nations, for example, the boycott was officially terminated in June 1926 and Germany, Austria, Hungary, and Bulgaria were invited to join the IRC and its Unions (Letho, 1998, p. 40).

The strength of the boycott declined over time. While it was strictly enforced during the first years after the war, it became less and less enforced until it was officially terminated in 1926. During the early years of the boycott, scientists from Central countries were effectively banned from attending international conferences, for example. In 1919 German scientists did not attend a single international scientific conference. In 1920, around 85 percent of international conferences took place without German scientists. Between 1921 and 1923 about 60 percent of conferences

[2]In humanities and social sciences the equivalent of the IRC, the so-called International Union of Academies was founded in 1919.

[3]The International Union of Biological Science, the International Union of Pure and Applied Chemistry, the International Astronomical Union, the International Union of Geodesy and Geophysics were founded in 1919, the International Mathematical Union in 1920, and the International Union of Pure and Applied Physics, and the International Geographical Union in 1922.

took place without German scientists. In 1924 and 1925 still close to 50 percent of international conferences were not attended by German scientists. From 1926 onwards, fewer than 15 percent of all conferences took place without German scientists (Kerkhoff, 1940).

Attendance records of the International Congresses of Mathematicians (ICMs), that we have collected from the International Mathematical Union, demonstrate the effects of the boycott of central scientists (Table 2). In the pre-war period, Germany always sent large delegations to the ICMs. Because of the outbreak of the war, the 1916 congress that was planned in Stockholm was cancelled. In a symbolic move, the 1920 congress was organized in Strasbourg, in the Alsace region that Germany annexed from France after the 1870 war and that France recaptured during WWI. German mathematicians were not invited. They were also not invited to the Toronto congress in 1924. By 1928, the boycott was over and Germany sent the second largest delegation after the host nation to the congress in Bologna.

2 Data

2.1 Scientist Data

We collected a new dataset of all university scientists in the world, because downloadable publication data do not usually report country information of authors and of cited references. The data on all university scientists in the world come from the 1900 and 1914 volumes of "Minerva–Handbuch der Gelehrten Welt." Minerva was published since 1889 and used to be the most comprehensive world-wide listing of university professors. As these data are only available as printed books (in German), we digitize all 1,000 pages in the 1900 volume and all 1,500 pages in the 1914 volume (with the help of our great research assistants).

The data list 565 universities in the year 1900 and 966 universities in the year 1914, indicating the exceptional growth of the university sector during this period (Table 3, Panel A).[4] Each university entry lists all full-time faculty of any level of seniority (i.e., all university ranks from the equivalent of assistant professors to full professors, in the following we refer to all of these scholars as professors, see Appendix Figure A.1 for a sample page of Minerva). The entries are very complete for all major universities. Across all fields the data contain 24,090 professors in 1900 and 42,112 professors in 1914. A few universities, mostly smaller and less well-known institutions, report only some of their faculty by name but mention the number of additional faculty members not listed explicitly. Our full data therefore contain names of 23,841 professors in 1900 and 36,738 professors in 1914 (Table 3, Panel A). Figure 1 shows the distribution of scientists across

[4]Newly founded universities are usually listed with a delay of about 10-15 years unless the new universities start with large faculties. Newly founded universities are usually not very research active in the first years since their inception.

the globe. The map clearly illustrates the concentration of scientific activity in the United States and Western Europe (for a closer look at the two regions, see Figure 2). We focus our empirical analysis on five scientific fields: medicine, biology, chemistry, physics, and mathematics. Scientists in these fields already published the majority of their research in academic journals during the time period studied in this paper. At that time, researchers in other fields usually published their major research in books. In the sciences the publishing process at the time was very similar to today. Our data contain 10,040 scientists in 1900 and 15,790 scientists in 1914 across the five fields (Table 3, Panel B).[5]

Already in 1900, US universities boasted the largest number of scientists. They were followed by German universities, which were still the main centers of scientific excellence (Table 3, Panel C). The total number of scientists increased in all countries between 1900 and 1914, and was particularly pronounced in the United States.

2.2 Publication and Citation Data

To analyze changes in citation behavior, we collected all 260,090 publications in 151 science journals from the ISI Web of Science for publication years between 1905 and 1930. As the Web of Science has better coverage of Western, and in particular English-speaking journals, our set of journals includes many journals edited in the United States, Germany, and the United Kingdom, and a smaller number of journals edited in France, Netherlands, Switzerland, and Russia (see Appendix Tables A.1 and A.2 for the full list of journals).[6] As we analyze changes in citation patterns over time, and include camp fixed effects in our regressions, a larger set of US, UK, or German journals does not bias our results.

The 260,090 original papers cite almost 2 million references to work published after 1900. The Web of Science reports references in abbreviated form. Instead of the full reference with all authors and complete journal information, each reference in the Web of Science lists at most five items: the first author, the publication year of the reference, the journal name in abbreviated form, the volume of the journal, and the first page of the article. Many references do not even report these five items, either because the reference is incomplete in the original paper or because

[5] Minerva lists the exact specialization (often in native languages) for each scientist. So mathematicians would list "Algebra,""Number Theory,"and several other specializations in many languages. We recoded thousands of these exact specializations into 32 fields (such as the five scientific fields: medicine, biology, chemistry, physics, and mathematics; but also all other fields like: engineering, theology, law, and so on).

[6] The ISI Web Science digitized journals from the historical period in the early 2000s. The digitization effort included all historical journals that contained at least five papers that had received more than 100 post-WWII citations or journals that had received more than 1,500 post-WWII citations overall (see http://wokinfo.com/products_tools/backfiles/cos/ for more details). As post-WWII citations were measured from a set of journals that concentrates on Western journals, and in particular English-speaking journals, the historical set of journals has a better coverage for US, UK, and German journals.

the reference cites a non-standard publications such as government records or books. We obtain complete references, including a full list of referenced authors, by using the five items reported above to merge the 2 million cited references with our 260,090 original papers (that include the full list of authors for each paper).[7] Our final reference data therefore contain the full list of authors for each reference that can be merged to one of our 260,090 original papers.

For the historical period studied in this paper, only few articles in the Web of Science list precise address information for each author, primarily because historical science journals frequently listed authors without reporting their university or address. As our analysis of international citation flows crucially depends on knowing the country of both authors and cited references, we use the scientist data described above, and address information contained in some articles, to assign countries to authors and cited references.

We construct two measures for the country of each author and cited reference. The first country measure only uses information from our scientist data to assign countries. For this measure we merge our scientist data to each citing author and each author in the full list of references. The second country measure combines the country information from our scientist data with address information listed in one of the 260,090 original papers from the Web of Science. For both measures, we then calculate the "nationality" of each paper and its references as the fraction of citing authors and referenced authors from each country. A paper (reference) exclusively written by authors from the United States, for example, counts as one US paper (reference). A paper (reference) written by one US author and one Canadian author, counts as 0.5 US papers and 0.5 Canadian papers.

While the first country measure only uses the scientist data to assign countries, the second measure combines the scientist data with the address information. Consequently, in most cases the second measure assigns a country to a larger share of papers (Tables 4 and 5, columns 1 and 2). Compared to journals from other countries, US journals are more likely to list addresses of authors. When we use both the scientist data and the address information, we therefore identify about three times as many US papers as when we just use the scientist data. As German journals do not usually report addresses, the difference between the two country measures is smaller for German papers (Table 4, columns 1 and 2). If these differences were fixed over time, they would not invalidate our identification strategy. Because US science grew at a much faster rate and because address information mostly comes from US journals, we prefer to use only the scientist data to assign countries in our main results. Nonetheless, we show that results are robust to using the alternative country assignment rule.

Our data indicate that authors from countries with large scientific communities usually pub-

[7] We also merge references that only contain four of the five items if they uniquely identify one of the 260,090 papers in our data.

lish in journals from their own country. US scientists mostly publish in US journals, UK scientists in UK journals, French scientists in French journals, and German scientists in German journals (Table 4, columns 3 to 8). As smaller scientific countries have few prestigious journals, scientists from these countries often publish their best articles in foreign journals.

Finally, we present summary statistics for the set of papers and references we use in our main analysis. Of the 260,090 original papers, 245,510 report the name of the author, while the remaining papers do not report author names (Table 6, Panel A). We are able to assign a country to at least one author for 139,157 papers if we use both the scientist data and the address information, or for 71,417 papers if we use only the scientist data. Of the papers for which we can assign a country to at least one author, we are able to assign the country of at least one reference for 64,563 (scientist and address data) or 20,814 (scientist data) papers. As we explain in more detail below, our final analysis is carried out on papers that cite references that were originally published in one of the 151 journals for which we collect all 260,090 papers published between 1905 and 1930. With this sample restriction, we are left with 47,699 (scientist and address data) or 13,151 (scientist data) papers. Panel B of Table 6 summarizes the references (published after 1900) that are cited in these papers.

3 Measuring Knowledge Flows and Empirical Strategy

3.1 Measuring Knowledge Flows

We measure international knowledge flows in terms of paper-level probabilities of citing articles produced by different scientific camps. The production of new scientific papers builds on the ideas and the knowledge encapsulated in existing papers. We consider the references cited by a paper as inputs used in its production. In this sense, our measures capture the extent to which production of papers in a scientific camp relies on the knowledge produced abroad.

Before presenting our measures of knowledge flows, we introduce some notation. We index individual papers from the Allies by $a = 1, \ldots, N_A$, from the Centrals by $ce = 1, \ldots, N_{CE}$, from the Neutrals by $ne = 1, \ldots, N_{NE}$, and from the Rest by $r = 1, \ldots, N_R$. We refer to the total number of citations given by a paper (i.e., its references) by C. For example, C_{ce} is the total number of references cited by the Central paper ce. Importantly, we exclude self–citations from C, since they do not represent any flow of knowledge. We partition the total number of citations given by a paper into the numbers of citations given to each scientific camp. For instance, C_a is partitioned into $c_{a\to A}$, $c_{a\to CE}$, $c_{a\to NE}$, and $c_{a\to R}$: the number of citations given by paper a to Allied papers, to Central papers, to Neutral papers, and to Rest papers, respectively. For simplicity, in the remaining part of this section we limit our exposition to Allied and Central papers.

We propose two measures of knowledge flows. Each Central paper *ce* can cite any Allied paper *a* only once (i.e., paper *ce* would not list paper *a* twice among its references). In addition, paper *ce* could, in principle, cite *all* the N_A Allied papers, but instead only cites $c_{ce \to A}$ of them. By randomly selecting a paper from the Allied lot, there are N_A *potentially citeable papers* (i.e., possible different Allied papers to be cited). Of these potentially citeable Allied papers, paper *ce*'s chances of having cited the randomly drawn paper are $c_{ce \to A}$. Our first measure of knowledge flows is the probability that Central paper *ce* cites *a randomly selected* Allied paper:

$$\text{Measure 1, } \textbf{Citation Levels (CL)}: \quad \Pr\left[\text{paper } ce, \text{ rand. sel. A paper}\right] = c_{ce \to A} \times \frac{1}{N_A}.$$

We normalize our citation levels measure by the number of a camp's potentially citeable papers since our aim is to make comparisons across scientific camps over a 30-year time period. Indeed, if the number of potentially citeable papers produced by each scientific camp were differentially changing over time (e.g., one camp producing relatively more papers than the others), then straight comparisons of the number of citations given to each camp could just reflect differences in the "supply" of papers. The normalization guarantees that comparing citation levels across scientific camps over time will indeed capture changes in citing behaviour.

Our second measure of knowledge flows is the probability that a citation from the Central paper *ce* be given to *a randomly selected* Allied paper:

$$\text{Measure 2, } \textbf{Citation Shares (CS)}: \quad \Pr\left[ce \text{ citation, rand. sel. A paper}\right] = \frac{c_{ce \to A}}{C_{ce}} \times \frac{1}{N_A}.$$

Our citation shares measure differs from the citation levels measure by a further normalization: the division by the total number of citations given by paper *ce*, C_{ce}. The normalization by C_{ce} shifts the focus of the measure from the paper "as a whole" to the individual citations given by the paper: the citation levels measure is the likelihood that the paper "as a whole," which can give many citations, cites a randomly selected Allied paper, while the citation shares measure is the likelihood that each of the paper's citations be given to a randomly selected Allied paper. We introduce this further normalization because our citation levels measure is sensitive to changes in the total number of citation, which can vary over time independently of changes in the flows of knowledge. Such changes can occur because of evolving citation conventions over time. Citation conventions at the beginning of the 20^{th} century were very different from today's. Albert Einstein's famous 1905 paper on electrodynamics, for example, explicitly mentioned the contributions of James C. Maxwell seven times, but did not "cite" any of Maxwell's works (e.g., his famous

1865 paper "Dynamical theory of the electromagnetic field"). Einstein probably considered it to be obvious which of Maxwell's works he was referring to.

As detailed in the next section, in our empirical analysis we study relative changes in citation levels and shares across scientific camps over time. Table 7 reports the average levels of our two measures for each combination of cit*ing*-cit*ed* scientific camp. Averages are computed over the entire period of our data, the years between 1905 and 1930. Panel A of Table 7 displays averages for the citation levels measure, while panel B presents averages for the citation shares measure.

The rows of Table 7 list the scientific camps of the citing paper's authors, while the columns list the scientific camps of the referenced authors. The entries of Table 7 are "small" because they represent probabilities of rare events: given the thousands of potentially citeable papers published every year in medicine, biology, chemistry, physics, and mathematics by each scientific camp, the likelihood of citing any one specific paper is indeed "small." Table 7 highlights the between-camp citation penalties mentioned earlier: authors from each scientific camp are more likely to cite within-camp rather than between-camp papers. This pattern is robust across measures: the diagonal entries of both Panels are substantially larger than the off-diagonal ones. Moreover, Central and Neutral papers are on average more likely to cite each other rather than Allied papers. Similarly, Allied papers are on average more likely to cite other Allied papers rather than Central and Neutral papers. This pattern is driven by countries such as Switzerland (especially the German-speaking Zurich) and Sweden, which belonged to the Neutral camp but were traditionally "close" to German science.

3.2 Empirical Strategy

We investigate changes in citation behavior of papers during WWI and the boycott by analyzing citation flows to papers from home and enemy camps. Specifically, we analyze how Central papers cite the work of Central and Allied authors and how these relative citations change between the pre-WWI period and the WWI/boycott period. Similarly, we analyze changes in relative citations given by Allied papers.

We illustrate our empirical methodology with some simplified two-camp, two-period examples. Suppose there were only two Central papers, one published in the pre-WWI period (paper ce published in year t) and one published in the WWI/boycott period (paper ce' published in year t'). In our examples, these papers only cite references from the Central and the Allied camps. Then, from the perspective of Central papers, the relative change in citation levels across scientific camps between t and t' is:

$$DiD_{CL} = \left(\frac{c_{ce'\to CE}}{N_{CE,t'}} - \frac{c_{ce'\to A}}{N_{A,t'}}\right) - \left(\frac{c_{ce\to CE}}{N_{CE,t}} - \frac{c_{ce\to A}}{N_{A,t}}\right) \quad (1)$$

A *positive* value of DiD_{CL} represents a *relative increase*, from period t to period t', in the use of Central knowledge by Central papers. We construct the analogous DiD measure for the citation shares. In the example below, we assume that $N_{A,\tau} = N_{CE,\tau} = N$, $\tau = t$ and t', and ignore the normalization by the number of potentially citeable papers, N.

Example 1: Changes in Citation Levels and Citation Shares

	Citation Levels (CL)		*Citation Shares (CS)*	
	pre-WWI paper ce	WWI/boycott paper ce'	pre-WWI paper ce	WWI/boycott paper ce'
Cites to Centrals	$c_{ce\to CE} = \mathbf{1}$	$c_{ce'\to CE} = \mathbf{2}$	$\frac{c_{ce\to CE}}{C_{ce}} = \mathbf{0.25}$	$\frac{c_{ce'\to CE}}{C_{ce'}} = \mathbf{0.50}$
Cites to Allied	$c_{ce\to A} = \mathbf{3}$	$c_{ce'\to A} = \mathbf{2}$	$\frac{c_{ce\to A}}{C_{ce}} = \mathbf{0.75}$	$\frac{c_{ce'\to A}}{C_{ce'}} = \mathbf{0.50}$
Diff. paper ce'	$2 - 2 = \mathbf{0}$		$0.50 - 0.50 = \mathbf{0.00}$	
Diff. paper ce	$1 - 3 = \mathbf{-2}$		$0.25 - 0.75 = \mathbf{-0.50}$	
$N \times DiD$	$0 - (-2) = \mathbf{2}$		$0.00 - (-0.50) = \mathbf{0.50}$	

Example 1 illustrates a situation in which both DiD_{CL} and DiD_{CS} are positive: the total number of references in both papers is constant, $C_{ce} = C_{ce'} = 4$, but the paper published in the WWI/boycott period cites one additional Central paper and one fewer Allied paper. Because $C_{ce} = C_{ce'}$, the additional Central citation comes at the expense of fewer Allied citations. Hence, both measures DiD_{CL} and DiD_{CS} are positive and indicate a relative increase in the use of Central knowledge by Central papers. If the total number of citations change over time, measure DiD_{CL} will not just be a rescaled version of DiD_{CS}.

More precisely, the relationship between DiD_{CL} and DiD_{CS} can be expressed as:

$$\begin{aligned} DiD_{CL} &= C_{ce'}\left(\frac{c_{ce'\to CE}}{C_{ce'}N_{CE,t'}} - \frac{c_{ce'\to A}}{C_{ce'}N_{A,t'}}\right) - C_{ce}\left(\frac{c_{ce\to CE}}{C_{ce}N_{CE,t}} - \frac{c_{ce\to A}}{C_{ce}N_{A,t}}\right) \\ &= C_{ce'}DiD_{CS} + (C_{ce'} - C_{ce})\left(\frac{c_{ce\to CE}}{C_{ce}N_{CE,t}} - \frac{c_{ce\to A}}{C_{ce}N_{A,t}}\right). \end{aligned} \tag{2}$$

Relationship (2) makes clear that, when the total number of citations given by papers does not change over time (i.e., $C_{ce} = C_{ce'}$), then the relative change in citation levels over time will just be a rescaling of the relative change in citation shares over time (i.e., $DiD_{CL} = C_{ce'}DiD_{CS}$). As a consequence, as long as $C_{ce} = C_{ce'}$, the two measures will lead to similar conclusions: both DiD_{CL} and DiD_{CS} will either be positive or negative (or zero). However, if the total number of citations given by papers changes from period t to period t', then DiD_{CL} and DiD_{CS} may qualitatively disagree.

We now discuss two examples that highlight the differences between DiD_{CL} and DiD_{CS}.

Example 2: CITATION LEVELS CHANGE BUT SHARES DO NOT

	Citation Levels (CL)		*Citation Shares (CS)*	
	pre-WWI paper ce	WWI/boycott paper ce'	pre-WWI paper ce	WWI/boycott paper ce'
Cites to Centrals	$c_{ce\to CE} = \mathbf{3}$	$c_{ce'\to CE} = \mathbf{6}$	$\frac{c_{ce\to CE}}{C_{ce}} = \mathbf{0.75}$	$\frac{c_{ce'\to CE}}{C_{ce'}} = \mathbf{0.75}$
Cites to Allied	$c_{ce\to A} = \mathbf{1}$	$c_{ce'\to A} = \mathbf{2}$	$\frac{c_{ce\to A}}{C_{ce}} = \mathbf{0.25}$	$\frac{c_{ce'\to A}}{C_{ce'}} = \mathbf{0.25}$
Diff. paper ce'	$6 - 2 = \mathbf{4}$		$0.75 - 0.25 = \mathbf{0.50}$	
Diff. paper ce	$3 - 1 = \mathbf{2}$		$0.75 - 0.25 = \mathbf{0.50}$	
$N \times DiD$	$4 - 2 = \mathbf{2}$		$0.50 - 0.50 = \mathbf{0}$	

In the second example, Central authors *exactly double* the number of citations to each scientific camp and, consequently, also double the total number of citations. In this example, and similar cases, the citation levels measure DiD_{CL} is sensitive to proportional changes in the number of citations given, while the citation shares measure DiD_{CS} is not.[8] Example 3 illustrates the behavior of our two measures when the same number of citations is added to the count of each scientific camp.

Example 3: CITATION SHARES CHANGE BUT LEVELS DO NOT

	Citation Levels (CL)		*Citation Shares (CS)*	
	pre-WWI paper ce	WWI/boycott paper ce'	pre-WWI paper ce	WWI/boycott paper ce'
Cites to Centrals	$c_{ce\to CE} = 4$	$c_{ce'\to CE} = \mathbf{5}$	$\frac{c_{ce\to CE}}{C_{ce}} = \mathbf{0.80}$	$\frac{c_{ce'\to CE}}{C_{ce'}} = \mathbf{0.71}$
Cites to Allied	$c_{ce\to A} = \mathbf{1}$	$c_{ce'\to A} = \mathbf{2}$	$\frac{c_{ce\to A}}{C_{ce}} = \mathbf{0.20}$	$\frac{c_{ce'\to A}}{C_{ce'}} = \mathbf{0.29}$
Diff. paper ce'	$5 - 2 = \mathbf{3}$		$0.71 - 0.29 = \mathbf{0.42}$	
Diff. paper ce	$4 - 1 = \mathbf{3}$		$0.80 - 0.20 = \mathbf{0.60}$	
$N \times DiD$	$3 - 3 = \mathbf{0}$		$0.42 - 0.60 = \mathbf{-0.18}$	

In example 3, Central authors increase the number of citations given to each scientific camp by one and the total number of citations by two. This underlines that the citation shares measure is sensitive to additive transformations in the number of citations, while the citation levels measure is not.

Our empirical strategy builds on the examples discussed so far, generalizing the analysis to four scientific camps (i.e., Allies, Centrals, Neutrals, and Rest) and to a time period of 26 years, from 1905 to 1930. Specifically, we have four observations for each paper i published in year t (i): citation levels to Allied papers ($y_{i,A} \equiv c_{i\to A}/N_A$), citation levels to Central papers ($y_{i,CE} \equiv$

[8] In other words, DiD_{CS} is homogeneous of degree 0 (or scale invariant) to the number of citations given, while DiD_{CL} is not.

$c_{i\to CE}/N_{CE}$), citation levels to Neutral papers ($y_{i,NE} \equiv c_{i\to NE}/N_{NE}$), and citation levels to Rest papers ($y_{i,R} \equiv c_{i\to R}/N_R$). Similarly, we have four citation shares observations for each paper: $y_{i,camp} \equiv c_{i\to camp}/\left(N_{camp}C_i\right)$, $camp$ =Allied, Centrals, Neutrals, and Rest. For each of the two measures of knowledge flows, we estimate three regressions: one for relative citations of Allied papers, one for relative citations of Central papers, and one for relative citations of Neutral papers. For instance, the citation levels regression for Central papers is:

$$\begin{aligned} y_{i,camp} &= \sum_{\tau=1905}^{1930} \alpha_\tau \times 1\left[camp = \text{Allied}\right] \times 1\left[t\left(i\right) = \tau\right] \\ &+ \sum_{\tau=1905}^{1930} \nu_\tau \times 1\left[camp = \text{Neutral}\right] \times 1\left[t\left(i\right) = \tau\right] \\ &+ \sum_{\tau=1905}^{1930} \rho_\tau \times 1\left[camp = \text{Rest}\right] \times 1\left[t\left(i\right) = \tau\right] \\ &+ \text{Paper}FE_i + \epsilon_{i,camp}, \end{aligned} \tag{3}$$

where $1\left[\cdot\right]$ is the indicator function (1 when the event in brackets realizes, 0 otherwise) and PaperFE_i is a paper-specific fixed effect. Parameter α_τ represents the difference in citations to Allied papers, compared to Central papers (the omitted category) in year $t\left(i\right) = \tau$. Similarly, ν_τ and ρ_τ represent the difference in citations to Neutral and Rest papers. The paper-specific fixed effects control for the inherently different propensities to cite of papers from different fields and published in different years. In the estimation of the standard errors, we cluster at the level of the paper. Our main results then plot the evolution of α_τ and ν_τ over time.

For the main results, we compute $y_{i,camp}$ over a time interval of 5 years: from $t\left(i\right) - 4$, the fourth year prior to the publication year of paper i, until $t\left(i\right)$, the publication year of paper i. For example, in the citation shares regressions, where $y_{i,camp} \equiv c_{i\to camp}/\left(C_i N_{camp}\right)$, we compute $c_{i\to camp}$ as the number of citations given by paper i to any $camp$ paper published in the 5-year period going from $t\left(i\right) - 4$ to $t\left(i\right)$. Similarly, C_i is computed as the total number of citations to any paper published in the 5-year period going from $t\left(i\right) - 4$ to $t\left(i\right)$, and N_{camp} is the total number of papers published by $camp$ in the 5-year period going from $t\left(i\right) - 4$ to $t\left(i\right)$.

In addition to providing graphical evidence of changes in relative citations during WWI and the boycott, we estimate a variant of regression (3) in order to test whether these changes are statistically significant. As for specification (3), we estimate three "testing" regressions: one for Allied papers, one for Central papers, and one for Neutral papers. As an example, the testing regression for Central papers is:

$$
\begin{aligned}
y_{i,camp} \quad = \quad & \\
& \alpha_1 \times 1\left[camp = \text{Allied}\right] \; + \; \alpha_2 \times 1\left[camp = \text{Allied}\right] \times 1\left[t\left(i\right) = \text{WWI}\right] \\
+ \quad & \alpha_3 \times 1\left[camp = \text{Allied}\right] \times 1\left[t\left(i\right) = \text{Early BCT}\right] \; + \; \alpha_4 \times 1\left[camp = \text{Allied}\right] \times 1\left[t\left(i\right) = \text{Late BCT}\right] \\
+ \quad & \nu_1 \times 1\left[camp = \text{Neutral}\right] \; + \; \nu_2 \times 1\left[camp = \text{Neutral}\right] \times 1\left[t\left(i\right) = \text{WWI}\right] \\
+ \quad & \nu_3 \times 1\left[camp = \text{Neutral}\right] \times 1\left[t\left(i\right) = \text{Early BCT}\right] \; + \; \nu_4 \times 1\left[camp = \text{Neutral}\right] \times 1\left[t\left(i\right) = \text{Late BCT}\right] \\
+ \quad & \text{Rest Interactions} \; + \; \text{Paper}FE_i \; + \; \epsilon_{i,camp}.
\end{aligned}
\tag{4}
$$

Instead of yearly effects, regression (4) includes indicators for each camp and interactions of these with indicators for WWI, early boycott (i.e., Early BCT), and late boycott (i.e., Late BCT). Parameters α_1 and ν_1 measure persistent citation penalties towards Central papers over the whole 26-year period. Parameters α_2 and ν_2 measure whether WWI—on top of any persistent citation penalty—caused additional changes in relative citations. Analogously, α_3, α_4, ν_3, and ν_4 measure whether the boycott further increased citation penalties towards foreign camps. We then test whether α_2, ν_2, α_3, ν_3, α_4, and ν_4 are significantly different from 0.

4 The Effect of WWI and the Boycott on International Knowledge Flows

4.1 Citation Shares

We analyse the effect of WWI and the boycott on international knowledge flows by estimating variants of equation (3). All results reported below are based on regressions that estimate relative citation probabilities compared to the home camp (the omitted category in the underlying regressions). The first set of results uses the citation shares measure as dependent variable to estimate the effect of WWI and the boycott on international knowledge flows.

Citations in Central Papers

We first estimate how citation shares of Central papers change over time and plot estimated regression coefficients in Figure 3 (Appendix Table A.3 for results of the underlying regression). In all years between 1905 and 1930, Central papers cite significantly fewer recent Allied papers, relative to recent Central papers. While the citation penalty towards Allied papers decreases in

the pre-WWI period, it starts to increase during the war and becomes particularly pronounced during the early boycott years. By 1922, the citation penalty towards Allied papers starts falling and recovers to pre-war levels by the end of the boycott in 1926 (Figure 3, Panel A). In most pre-WWI years, Central papers also cite fewer Neutral papers, relative to Central papers (the citation penalty is significantly different from 0 for about half of the pre-WWI years, see Appendix Table A.3). The citation penalty towards Neutral papers is always smaller than the citation penalty towards Allied papers. During the war, the citation penalty towards Neutral papers disappears, but it reappears during the early boycott years, and quickly bounces back to pre-war levels (Figure 3, Panel B).

We also test whether the increase in citation penalties during WWI and the boycott are statistically significantly by estimating equation (4). Central papers cite significantly fewer Allied papers compared to Central papers, independently of the time period. The probability that Central citations quote Allied papers is 0.000089 lower than the probability that they quote Central papers (Table 8, column 1, significant at 1%). During the war, the citation penalty towards Allied papers does not significantly change. In the early boycott years, the citation penalty increases by 0.000115; an increase of around 125 percent compared to the pre-WWI period (Table 8, column 1, significant at 1%).[9] In the late boycott years, the citation penalty towards Allied papers is still higher by 0.000034; an increase of around 37 percent (Table 8, column 1, significant at 1%). Allowing the post-boycott estimates to be different from the pre-war ones does not substantially change the results (Table 8, column 2). Controlling for camp-specific time trends leads to slightly larger increases of citation penalties during the boycott (Table 8, columns 3 and 4). Central papers also cite significantly fewer Neutral papers, compared to Central papers, independently of the time period. The probability that Central citations quote Neutral papers is 0.000043 lower than the probability that they quote Central papers (Table 8, column 1, significant at 1%). During the war, the citation penalty towards Neutral papers disappears and is similar to pre-war levels during and after the boycott.

Citations in Allied Papers

The next set of results investigates changes of citation shares in Allied papers. In all years between 1905 and 1930, Allied papers cite significantly fewer recent Central papers, relative to recent Allied papers (Figure 4, Panel A and Appendix Table A.4). The citation penalty towards Central papers increases during the war and becomes particularly pronounced during the early boycott years. By 1923, the citation penalty towards Central papers starts falling and recovers to pre-war levels

[9] The pre-WWI citation penalty towards Allied papers is 0.000092 (see first coefficient of column 2 in Table 8. A coefficient of -0.000115 on the interaction of Allied $\times$ Early Boycott is thus an increase of $(0.000115/0.000092) \cdot 100 = 125\%$.

by the end of the boycott in 1926 (Figure 4, Panel A). In most pre-WWI years, Allied papers cited fewer recent Neutral papers, relative to Allied papers (the citation penalty is significantly different from 0 in all but one pre-war years, see Appendix Table A.4). During the war, the citation penalty towards Neutral papers also increases, but starts to recover during the early boycott years and quickly reaches its pre-war levels (Figure 4, Panel B).

We also test whether these changes are significantly different from 0 by estimating the equivalent of equation (4), but with the Allied camp as the omitted category. Allied papers cite significantly fewer Central papers compared to Central papers, independently of the time period. The probability that Allied citations quote Central papers is 0.000064 lower than the probability that they quote Allied papers (Table 9, column 1, significant at 1%). During the war, the citation penalty towards Central papers increases by 0.000021, an increase of about 36 percent compared to the pre-WWI period (Table 9, column 1, significant at 1%). In the early boycott years, the citation penalty increases by 0.000042, an increase of around 71 percent compared to the pre-WWI period (Table 9, column 1, significant at 1%). In the late boycott years, the citation penalty towards Central papers is still higher by 0.000025, an increase of around 42 percent (Table 9, column 1, significant at 1%). Allowing the post-boycott estimates to be different from the pre-war ones slightly magnifies the increase in citation penalties during WWI and the boycott. Controlling for camp-specific time trends leaves results almost unchanged (Table 9, columns 3 and 4). Allied papers also cite significantly fewer Neutral papers, compared to Allied papers, independently of the time period. The probability that Allied citations quote Neutral papers is 0.000064 lower than the probability that they quote Allied papers (Table 9, column 1, significant at 1%). During the war, the citation penalty towards Neutral papers significantly increases, and remains lower during the early boycott years, even though this latter effect is only significant at the 10% level. By the late boycott years, the citation penalty towards Neutral papers is similar to its pre-war levels.

Citations in Neutral Papers

We also analyze changes of citation shares in Neutral papers. As we observe fewer Neutral papers than Central or Allied papers, results are less precise. During most pre-WWI years Neutral papers cite as many Central papers as Neutral ones. During the war, the citation penalty towards Central papers significantly increases (Figure 5 and Table 10) with further increases during the early boycott years. During the late boycott years, the citation penalty towards Central papers declines and quickly reaches its pre-war levels. Relative citation penalties towards Allied papers are larger than towards Central papers, but they evolve very similarly over time. These results suggest that Neutrals were indeed "neutral" and suffered from reduced knowledge flows from both Allies and Centrals.

Overall, the results indicate that WWI and the boycott significantly reduced knowledge flows

to enemy camps. It is important to note that the results are unlikely to be driven by changes in the quality of WWI or boycott papers, because such changes should affect citations from all camps in the same direction. If Central papers, for example, became relatively better, they should attract relatively more citations from both Central and Allied papers. We do not find such patterns. Both Central and Allied papers cite relatively more within-camp papers during WWI and the boycott.

4.2 Robustness of Main Results

Citation Levels

The results in the previous section use citation shares as dependent variable for the underlying regressions. For robustness, we re-estimate equations (3) and (4) using the citation levels measure as dependent variable. As in the previous section, the estimates underlying our Figures are reported in the Appendix.

For Central papers, results with citation levels as dependent variable are similar to the previous ones. Central papers always cite fewer Allied papers, relative to Central papers. The citation penalty towards Allied papers increases during the later stages of the war, and in particular during the early boycott years (Figure 6, Panel A). Compared to the pre-WWI period, we estimate a 64 percent increase in the citation penalty during the early boycott years and a 21 percent increase during the late boycott years (Table 11, column 1, significant at 1% and 5%, respectively). We estimate slightly smaller effects when we allow the post-boycott coefficient to differ from the pre-war one (Table 11, column 2). In most years, Central papers cite fewer Neutral papers. During the war, the citation penalty towards Neutral papers vanishes, only to reappear during the early boycott years, and to finally return to its pre-war levels (Figure 6, Panel B and Table 11, column 1: only the increase during the war is significant at the 5% level).

Results with the alternative dependent variable are also similar for Allied papers. Allied papers always cite fewer Central papers, relative to Allied papers. The citation penalty towards Central papers increases during the war, and in particular during the early boycott years (Figure 7, Panel A). Compared to the pre-WWI period, we estimate a 56 percent increase in the citation penalty during the war, a 107 percent increase during the early boycott years, and a 16 percent increase during the late boycott years (Table 12, column 1: significant at 1%, 1%, and 10%, respectively). We estimate slightly smaller effects when we allow the post-boycott coefficient to differ from the pre-war one and when we allow for camp-specific time trends (Table 12). Allied papers also cite fewer Neutral papers, independently of the time period. During the war, the citation penalty towards Neutral papers increases and further increases during the early boycott years, before it reaches its pre-war levels during the late boycott years (Figure 7, Panel B and Table 12). Citation penalties towards Neutral papers are always slightly lower than those towards Central papers.

For Neutral papers, results with the alternative dependent variable are also similar. Citation penalties towards both camps increase during the war and in particular during the early boycott years, before they recover in the late boycott period (Figure 8 and Table 13).

Using Alternative Country Assignment

The following tests indicate that our results are not driven by the method of assigning countries to authors. In our main results, we assign countries only relying on the scientist data, since we want to avoid potential biases caused by a differentially changing propensity to report addresses in papers. By using both addresses reported in papers and in the scientist data, however, we can assign countries to a larger share of papers and references. The following robustness checks are performed by using the citation shares measure as dependent variable of regressions (3) and (4), as in our main results.

For Central papers, the alternative way of assigning countries does not substantially change results. As opposed to the pre-war period, the citation penalty towards Allied papers increases by 102 percent during the early boycott years and by 25 percent during the late boycott years (Table 14, column 1, significant at 1%; see also Table A.9 and Figure A.2 in the appendix). The citation penalty towards Neutral papers also increases during the early boycott years, but this increase is not significant in most specifications (Table 14).

For Allied papers, the results also remain similar. The citation penalty towards Central papers increases by 38 percent during the war, by 45 percent during the early boycott, and by 18 percent during the late boycott (Table 15, column 1, significant at 1%: see also Table A.10 and Figure A.3 in the appendix). Allowing the post-boycott coefficient to differ from pre-war levels affects the results since citation penalties towards Central papers substantially decline during the late 1920s (see Appendix Figure A.3). This decline in citation penalties is driven by a large increase in the number of papers published by an increasing number of US scientists. As US scientists are not able to keep up to date with every paper that gets published in the United States, the probability of citing any particular US paper falls, relative to citing any particular Central paper.[10] Camp-specific time trends allow us to separate the effect of WWI and the boycott from these underlying trends (Table 15, columns 3 and 4).

We confirm most of the previous findings also for Neutral papers. Citation penalties towards both Central and Allied papers increase during WWI, and remain slightly higher during the boycott, although the latter effect is only significant in some specifications (Table 16; see also Table A.11 and Figure A.4 in the appendix).

[10]The large increase in the number of US papers has a smaller effect on relative citation patterns in Central and Neutral papers, because citations from foreign camps focus on a smaller number of papers.

5 Knowledge Flows or Discrimination?

The previous results show that relative citations to enemy camps decreased during WWI and the boycott. This decrease may either be driven by a genuine disruption of knowledge flows or by "discrimination" against enemy papers. Authors may still have known the relevant enemy papers, but may have avoided citing them in order to punish scientists from enemy countries. As we cannot measure whether scientists were aware of the existence of certain papers, we test for discrimination against enemy papers by investigating citation patterns towards pre-war papers. These papers were published in a period during which there were no particular barriers to knowledge flows. Consequently, if the decrease in relative citations with respect to recent enemy papers were due to discrimination, we should observe also the pre-war enemy papers to attract relatively fewer citations.

We first investigate relative citations to pre-war papers using the citation shares measure. Unlike the main results, where we measured a 5-year moving average of citations to the different camps, we now measure citations to papers published between 1900 and 1913.[11] We then investigate how citations to these papers change over time by estimating the equivalent of equation (3) but with a redefined dependent variable. Regression estimates are reported in the appendix, while we present their graphical counterpart in the following figures. Figures are drawn on the same scale as our earlier ones to facilitate comparisons.

In all years, Central papers cite significantly fewer pre-war Allied papers, compared to pre-war Central papers (Figure 9). Over time, pre-war Allied knowledge reaches Central authors, and citation penalties towards pre-war Allied papers almost disappear. More importantly, we see no obvious dip in citations to pre-war Allied papers during WWI and the boycott. If discrimination against Allied papers affected pre-1913 papers and post-1913 papers to the same extent, then these results would suggest that our main findings are not driven by discrimination. There are also no obvious dips in citations to pre-war Neutral papers (Figure 9).

Similarly, in all years Allied papers cite significantly fewer pre-war Central papers than pre-war Allied papers (Figure 10). While there is a small dip in citations towards pre-war Central papers during the early boycott years, the dip is orders of magnitude smaller than in our main specification, suggesting that our main results are not driven by discrimination. There are no obvious dips in citations to pre-war Neutral papers (Figure 10).

After a short time period, Neutral papers cite pre-war Allied papers and pre-war Central pa-

[11] In the analysis so far, we have defined $c_{ce\to A}$ as a 5-year moving average of Central citations to Allied papers. Differently, in the current section we define $c_{ce\to A}$ as follows. For 1905, $c_{ce\to A}$ counts the number of citations in Central papers quoting Allied papers published between 1900 and 1905. For 1906, $c_{ce\to A}$ counts all citations in Central papers quoting Allied papers published between 1900 and 1906, and similarly for all years until 1913. For all post-1913 years, $c_{ce\to A}$ counts all citations in Central papers quoting Allied papers published between 1900 and 1913. $c_{ce\to CE}$, $c_{ce\to NE}$, $c_{ce\to R}$, and total citations C_{CE} are defined accordingly. We apply analogous definitions for Allied and Neutral papers.

pers at similar rates. There is no obvious dip in Neutral citations towards neither Allied nor Central papers during WWI and the boycott (Figure 11).

Overall, these findings suggest that discrimination against enemy papers is not driving the citation patters in our main results. For robustness, we show that equivalent results hold also for the citation levels measure, confirming that discrimination is not driving those results either (Appendix Figures A.5, A.6, and A.7).

6 Did Knowledge Eventually Get Through?

In this section we explore whether, long after the end of the boycott, enemy knowledge produced during WWI and the boycott eventually reached foreign camps. So far, we have shown that WWI and the boycott temporarily increased the costs of circulating knowledge among foreign scientific camps. On the one hand, it may be that WWI and the boycott only had short-run effects on knowledge flows: after the end of the boycott, when barriers to knowledge flows returned to their pre-WWI levels, those papers published during the war and the boycott eventually got through and reached the enemy camp. On the other hand, it may be that WWI and the boycott actually had further reaching consequences on the international circulation of knowledge: what if those papers published during the war and the boycott had, forever after, a lower chance of being cited by the enemy camp? What if some of the knowledge produced during the war and the boycott went "unnoticed" by the enemy camp even long after the end of the boycott?

We investigate these long-run effects by analysing long-term citation patterns to enemy papers published in different periods of time (i.e., cohorts). Specifically, we plot long-run relative citations to the following cohorts of papers: two pre-war cohorts (1905-1907 and 1908-1910), one WWI cohort (1916-1918), one early boycott cohort (1919-1921), and one post-boycott cohort (1926-1928). These cohorts are examples for each of the time periods covered by our data, adjacent cohorts exhibit similar patterns. If WWI and the boycott only had short-run implications for international knowledge flows, then differences in relative citations of pre-war and post-boycott papers with respect to WWI and boycott papers would tend to vanish with time.

For each of the five cohorts of papers, we estimate a version of equation (3) in which the dependent variable measures citations to papers published during the three years of the respective cohort.[12] To improve the clarity of our figures, we estimate two-yearly rather than yearly coeffi-

[12] As an example, consider the 1905-1907 cohort. In 1905, $c_{ce \to A}$ counts the number of citations in Central papers (published in 1905) towards Allied papers that were published in 1905. In 1906, $c_{ce \to A}$ counts the number of citations in Central papers (published in 1906) toward Allied papers that were published between 1905 and 1906. In 1907, $c_{ce \to A}$ counts the number of citations in Central papers (published in 1907) toward Allied papers that were published between 1905 and 1907. In 1908, $c_{ce \to A}$ counts the number of citations in Central papers (published in 1908) toward Allied papers that were published between 1905 and 1907, and so on. $c_{ce \to CE}$, $c_{ce \to NE}$, $c_{ce \to R}$, and total citations C_{CE} are defined accordingly. While the coefficients that measure citation penalties towards Neutral and Rest papers are

cients. Our regressions include observations from the year the cited papers were published until 1932.[13]

Central papers initially cite relatively fewer recent Allied papers, compared to recent Central papers, independently of the time period (Figure 12). In the pre-WWI period, relative citation penalties towards Allied papers quickly diminish within a couple of years since publication. During WWI, the initial citation penalty also diminishes in the first years, but relative citations to Allied papers remain sensibly lower until the late 1920s. By the early 1930s, however, the citation penalty towards Allied papers from the WWI-cohort has disappeared. The early-boycott cohort starts off with a much deeper citation penalty that, similarly to the other cohorts, tends to diminish after the first years since publication. Differently from the other cohorts of papers, however, the citation penalty for the early-boycott papers does not disappear until the early 1930s. In addition, the post-boycott cohort shows a very similar pattern to the pre-WWI cohorts. These pieces of evidence suggest that some of the Allied knowledge produced during the early-boycott period may have never reached Central authors.

Allied papers cite relatively fewer pre-WWI papers from Central authors, compared to papers from Allied authors. The pre-WWI citation penalties, however, are relatively minor. Furthermore, Central knowledge seems to reach Allied authors very quickly: pre-WWI Central papers do not exhibit large citation penalties in the first years after publication. Allied citation patterns change during WWI. Initial citation penalties towards WWI Central papers increase, and citation penalties remain slightly higher than for the pre-WWI cohorts. During the mid-1920s, citation penalties towards WWI-cohort Central papers are similar to citation penalties towards pre-WWI cohorts. Initial citation penalties during the early-boycott period are larger. Nonetheless, citation penalties recover quickly and by the mid-1920s citation penalties towards early-boycott papers are similar to penalties towards pre-WWI papers. These results suggest that WWI and the boycott affected knowledge flows from Central to Allied authors in the short- to medium-run, but possibly not in the long-run. Central knowledge produced during the war and the boycott eventually reached the Allied camp, but with a longer delay than the Central knowledge produced in the pre-WWI period. Citation patterns towards the post-boycott cohort look relatively similar to those towards the pre-WWI cohort.

not plotted, they are always included in the underlying regressions.

[13] We end the long-run analysis in 1932 because the dismissal of scientists in Nazi Germany (in 1933) caused a significant reshuffling of scientists from Germany to Allied countries (Waldinger (2012) and Moser, Voena, and Waldinger, 2014).

7 Did the Interruption of Knowledge Flows Affect World Scientific Progress?

To conclude our analysis, we gather suggestive evidence of whether the interruption of knowledge flows influenced world-wide scientific progress. In particular, we investigate how WWI and the boycott affected the production of major scientific breakthroughs, as measured by Nobel Prize worthy discoveries. Jones and Weinberg (2011) report the years when physics, chemistry, and medicine/physiology Nobel Laureates produced their prize-winning discoveries.[14] On average, Nobel Laureates received the Nobel Prize around 13 years after carrying out the Prize winning research.[15] While the Nobel Foundation chose not to award some science prizes in certain years, at least one prize continued to be awarded in every year throughout WWI. The statutes of the Nobel Foundation state "[I]f none of the works under consideration is found to be of … importance … the prize money should be reserved until the following year …" (Nobel Foundation, 2014).[16] Because prizes are usually awarded with a relatively long delay, we do not expect that fewer prizes awarded during WWI would affect the timing of Nobel Prize winning research.

To provide suggestive evidence of how the interruption of knowledge flows affected the production of award winning research, we plot histograms of the number of Nobel Laureates who work on their prize winning discoveries in two year bins (Figure 14, Panel A). The vertical line indicates the beginning of WWI in 1914. Because the Nobel Prize was only introduced in 1901, and because later prizes were often split among up to three scientists, the number of Nobel Laureates who work on their prize winning work increases before 1914.[17] With the onset of the war begins a period of meagre in terms of path-breaking scientific ideas: fewer future Nobel Laureates produced, in this period, their prize winning work. This drought in the production of Nobel Prize worthy ideas continued for years after the end of WWI. Only after 1922 the number of scientists who were working on their Nobel Prize worthy ideas started increasing again.

The drought in the production of Nobel Prize worthy ideas was not likely to be caused uniquely by an interruption of international knowledge flows, but also by the general disruption caused by WWI. In an attempt to control for the general disruption induced by "a" world war, we plot an additional histogram with an extended time period, until 1960 (Figure 14, Panel B). The vertical

[14] We thank Ben Jones and Bruce Weinberg for generously sharing their data. The data report the year of the most important work or the midpoint if a range of years was identified as the most important period (see Jones and Weinberg (2011) for details).

[15] This calculation is based on the data from Jones and Weinberg (2011) for Nobel Laureates who received their prize before 1960. The 25^{th} percentile received the Prize seven years after carrying out the research, while the 75^{th} percentile received it 17 years later.

[16] "The Nobel Foundation – Special regulations." Nobelprize.org. Nobel Media AB 2014. Accessed the 20^{th} of March 2015. <http://www.nobelprize.org/nobel_organizations/nobelfoundation/statutes-kva.html>

[17] Later prizes were more often shared because scientists became more specialized over time, which caused an increase in the importance of teams for scientific production (e.g., Jones (2009) and Wuchty, Jones, and Uzzi, 2007).

lines indicate the start and the end of WWI and of WWII. Despite the fact that destruction and disruption during WWII was on a much wider scale than during WWI, the drought in the production of Nobel Prize worthy ideas was larger during WWI than during WWII, suggesting that the interruption of knowledge flows in the wake of WWI indeed affected world-wide scientific progress.

8 Conclusion

We show that WWI and the subsequent boycott of scientists from Central countries reduced international knowledge flows, as measured by citations to foreign work. During WWI and the boycott, scientists from Central countries cited fewer recent Allied papers, compared to Central papers. Scientists from Allied countries cited fewer recent Central papers. Both camps also reduced citations toward towards Neutrals, but to a lesser extent. These results are robust to using different measures of international knowledge flows and different methods of assigning countries to authors and references.

By comparing the main results with citation patterns towards pre-1913 papers, we show that these changing citation patterns reflect true changes in knowledge flows and not just discrimination against the scientific output of enemy camps.

By the end of the boycott, international flows of recently produced knowledge were re-established. However, we also investigate the possibility that WWI and the boycott had further reaching, long-run effects. We show that some Central knowledge that was produced during the boycott indeed never reached Allied scientists, even several years after the end of the boycott. Differently, even though Allied knowledge that was produced during the boycott did not reach Central scientists for many years, it eventually went through the enemy camp by the early 1930s.

Finally, to investigate whether the interruption of international knowledge flows affected scientific progress, we analyze data on Science Nobel Laureates. We show that fewer Nobel Laureates worked on their prize winning work during WWI and the early boycott years. This suggests that the interruption of international knowledge flows slowed down the production of scientific breakthroughs and highlights the importance of knowledge sharing for scientific progress.

References

[1] R. Abramitzky and I. Sin, *Book translations as idea flows: The effects of the collapse of communism on the diffusion of knowledge*, Journal of the European Economic Association **12** (2014), no. 6, 1453–1520.

[2] B. Biasi and P. Moser, *The impact of access on science evidence from the wwii book republication program*, Working Paper (2015).

[3] A. B. Jaffe, M. Trajtenberg, and R. Henderson, *Geographic localization of knowledge spillovers as evidenced by patent citations*, Quarterly Journal of Economics **108** (1993), no. 3, 577–598.

[4] B. F. Jones, *The burden of knowledge and the "death of the renaissance man": Is innovation getting harder?*, Review of Economic Studies **76** (2009), no. 1, 283–317.

[5] B. F. Jones and B. A. Weinberg, *Age dynamics in scientific creativity*, Proceedings of the National Academy of Sciences **108** (2011), no. 47, 18910–18914.

[6] K. Kerkhof, *Das versailler diktat und die deutsche wissenschaft: Ein beitrag zur geschichte der internationalen organisationen*, Monatshefte für Auswärtige Politik **7** (1940), no. 11, 836–850.

[7] D. J. Kevles, *"into hostile political camps": The reorganization of international science in world war i*, Isis **62** (1971), no. 1, 47–60.

[8] O. Lehto, *Mathematics without borders: a history of the international mathematical union–with 55 illustrations*, Springer Science & Business Media, 1998.

[9] R. K. Merton, *Priorities in scientific discovery: a chapter in the sociology of science*, American sociological review **22** (1957), no. 6, 635–659.

[10] J. Mokyr, *The intellectual origins of modern economic growth*, The Journal of Economic History **65** (2005), no. 2, 285–351.

[11] P. Moser, A. Voena, and F. Waldinger, *German jewish emigres and u.s. invention*, American Economic Review **104** (2014), no. 10, 3222–3255.

[12] F. Murray, P. Aghion, M. Dewatripont, J. Kolev, and S. Stern, *Of mice and academics: Examining the effect of openness on innovation*, National Bureau of Economic Research (2009).

[13] Professors of Germany, *To the civilized world*, The North American Review **210** (1919), no. 765, 284–287.

[14] D. Partha and P. A. David, *Toward a new economics of science*, Research policy **23** (1994), no. 5, 487–521.

[15] W. Ramsay, *Germany's aims and ambitions*, Nature **94** (1914), no. 2346, 137–139.

[16] The Nobel Foundation-Special Regulations, *Nobelprize.org. nobel media ab 2014.*

[17] C. Reid, *David hilbert*, Springer Verlag, New York, 1970.

[18] R. Reinbothe, *Deutsch als internationale wissenschaftssprache und der boykott nach dem ersten weltkrieg*, Peter Lang, 2006.

[19] P. M. Romer, *Endogenous technological change*, Journal of Political Economy **98** (1990), no. 5, S71–S102.

[20] B. Schroeder-Gudehus, *Challenge to transnational loyalties: International scientific organizations after the first world war*, Science studies **3** (1973), no. 2, 93–118.

[21] P. E. Stephan, *The economics of science*, Handbook of the Economics of Innovation **1** (2010), 217–273.

[22] P. Thompson and M. Fox-Kean, *Patent citations and the geography of knowledge spillovers: A reassessment*, American Economic Review **95** (2005), no. 1, 450–460.

[23] U. Trumpener, *The road to ypres: The beginnings of gas warfare in world war i*, The Journal of modern history **47** (1975), no. 3, 460–480.

[24] W. Van der Kloot, *April 1915: Five future nobel prize–winners inaugurate weapons of mass destruction and the academic–industrial–military complex*, Notes and Records of the Royal Society **58** (2004), no. 2, 149–160.

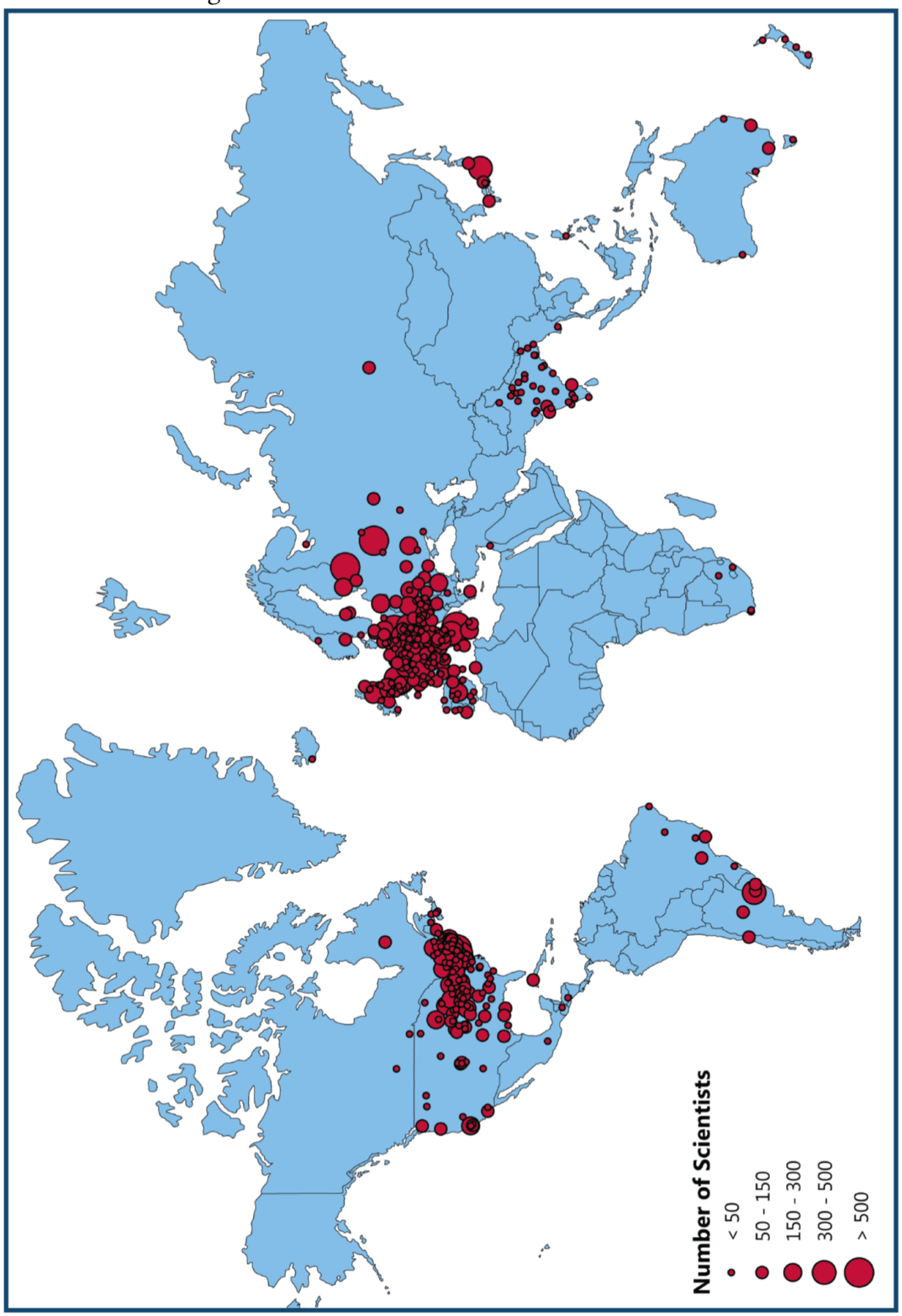
[25] F. Waldinger, *Peer effects in science: Evidence from the dismissal of scientists in nazi germany*, Review of Economic Studies **79** (2012), no. 2, 838–861.

[26] H. L. Williams, *Intellectual property rights and innovation: Evidence from the human genome*, Journal of Political Economy **121** (2013), no. 1, 1–27.

[27] S. Wuchty, B. F. Jones, and B. Uzzi, *The increasing dominance of teams in production of knowledge*, Science **316** (2007), no. 5827, 1036–1039.

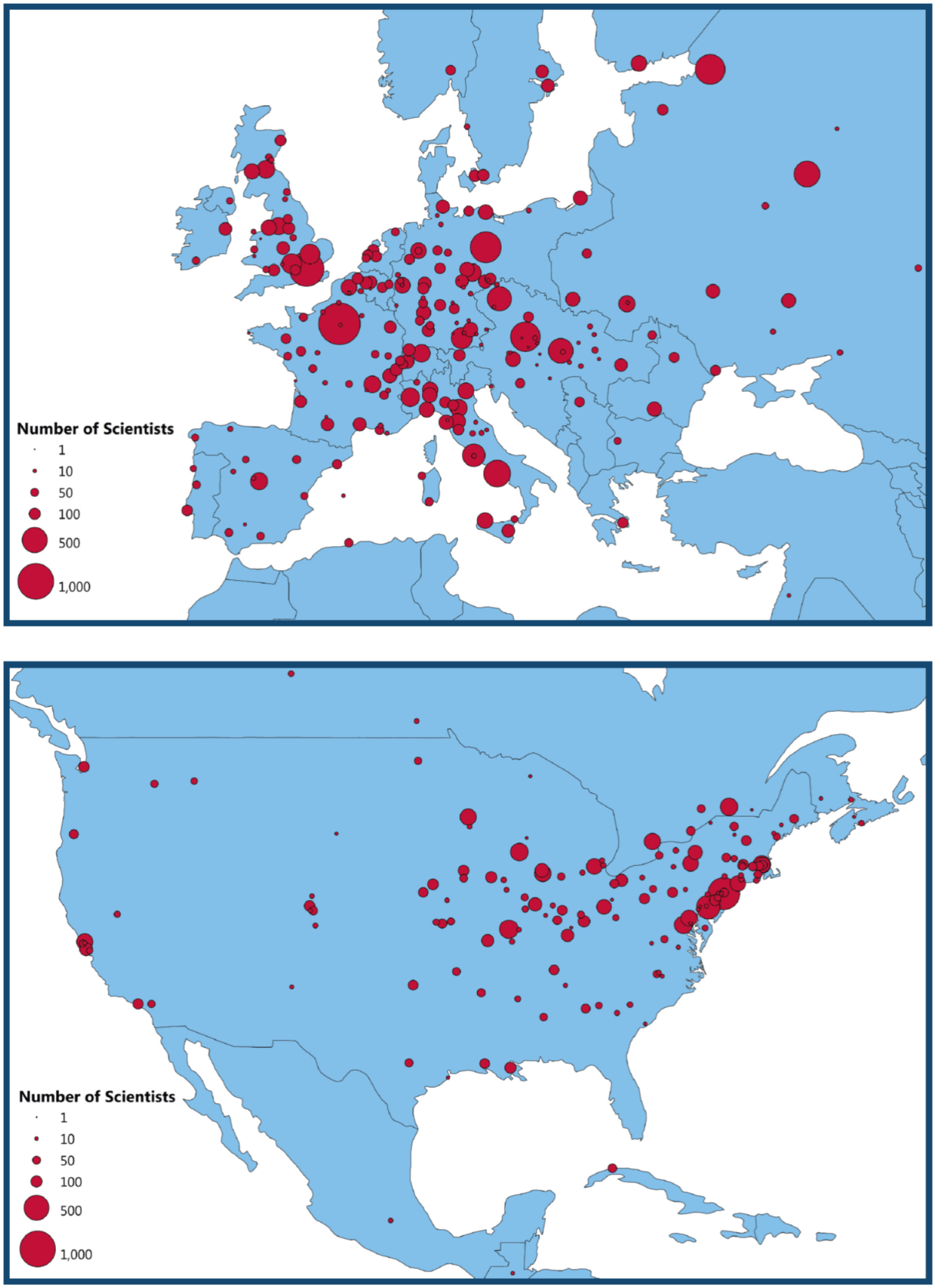
Figures

Figure 1: The World of Science in 1914



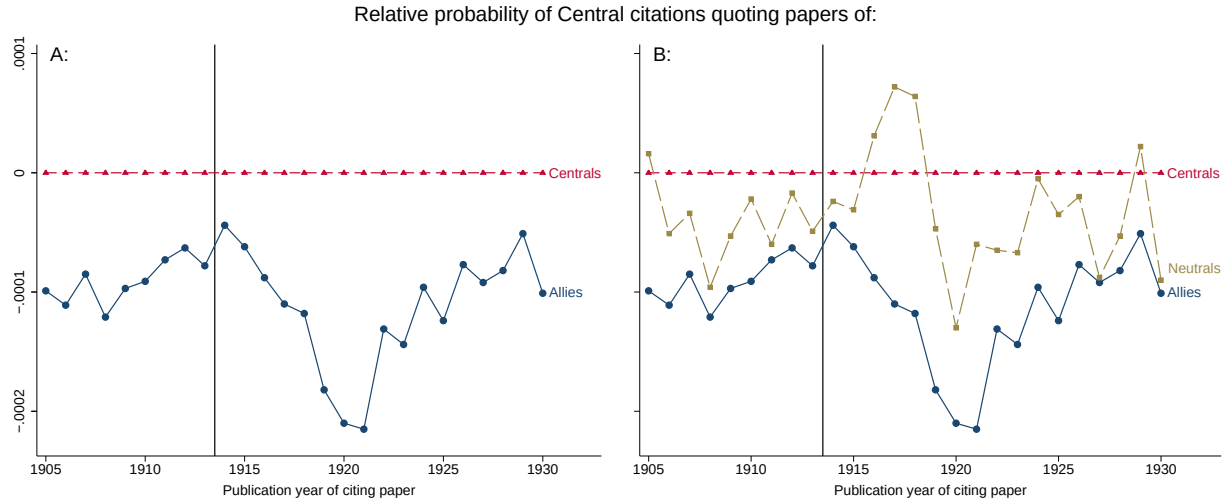
Source: Minerva–Handbuch der Gelehrten Welt.

Figure 2: The World of Science in 1914



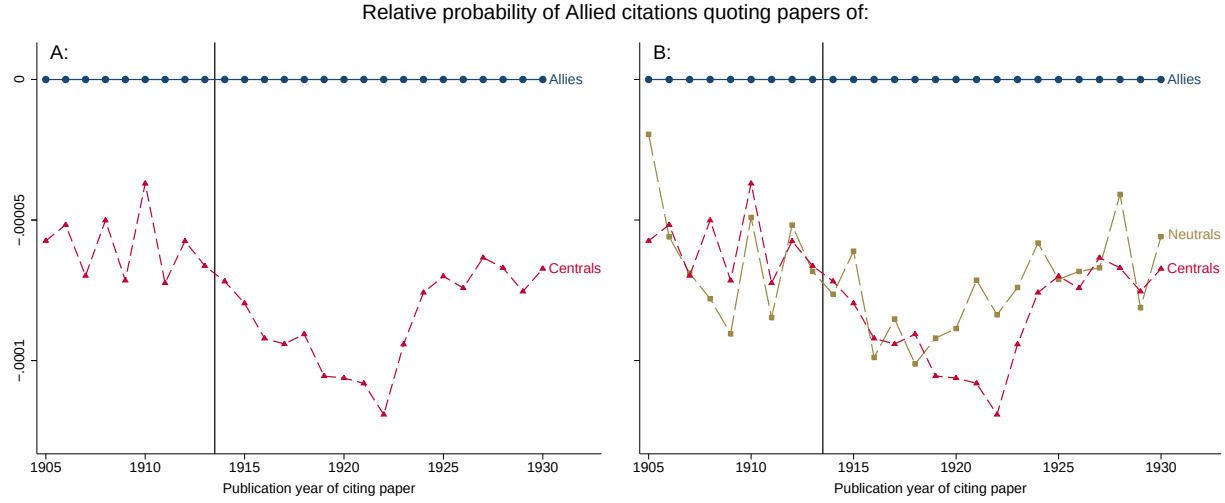
Source: Minerva–Handbuch der Gelehrten Welt.

Figure 3: Relative Citations of Central Papers: Citation Shares



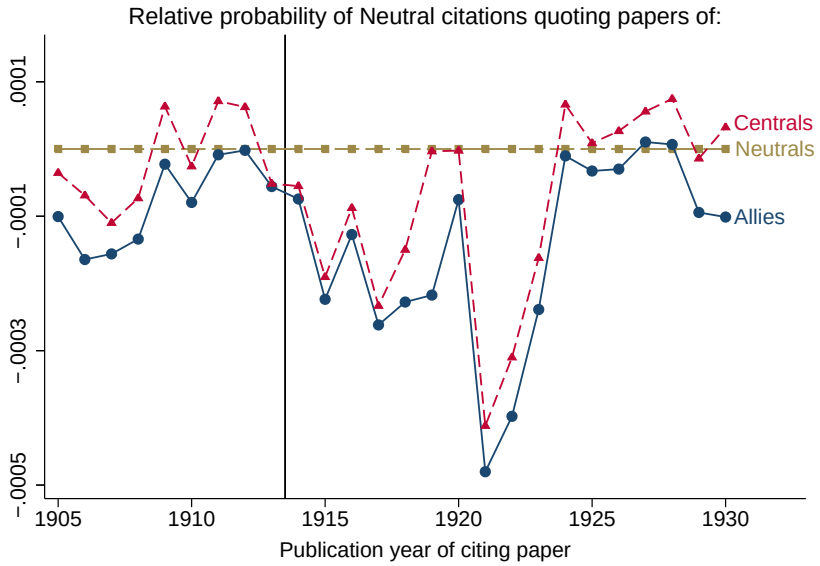
Notes: The Figures plot the estimates of the parameters from regression (3) using "citation shares" as dependent variable. A complete report of the estimation results is in Appendix Table A.3.

Figure 4: Relative Citations of Allied Papers: Citation Shares



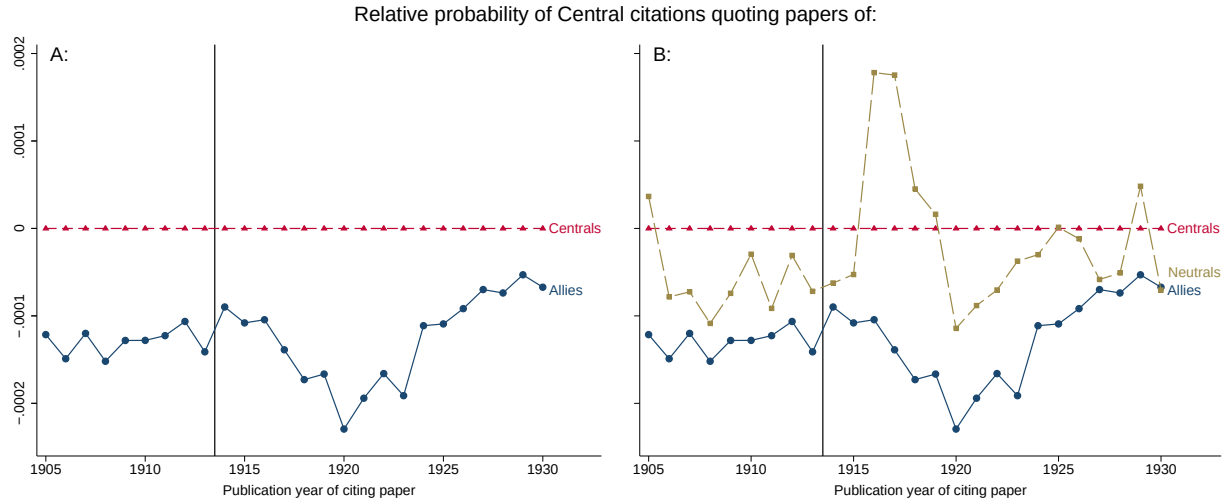
Notes: The Figures plot the estimates of the parameters from regression (3) using "citation shares" as dependent variable. A complete report of the estimation results is in Appendix Table A.4.

Figure 5: Relative Citations of Neutral Papers: Citation Shares



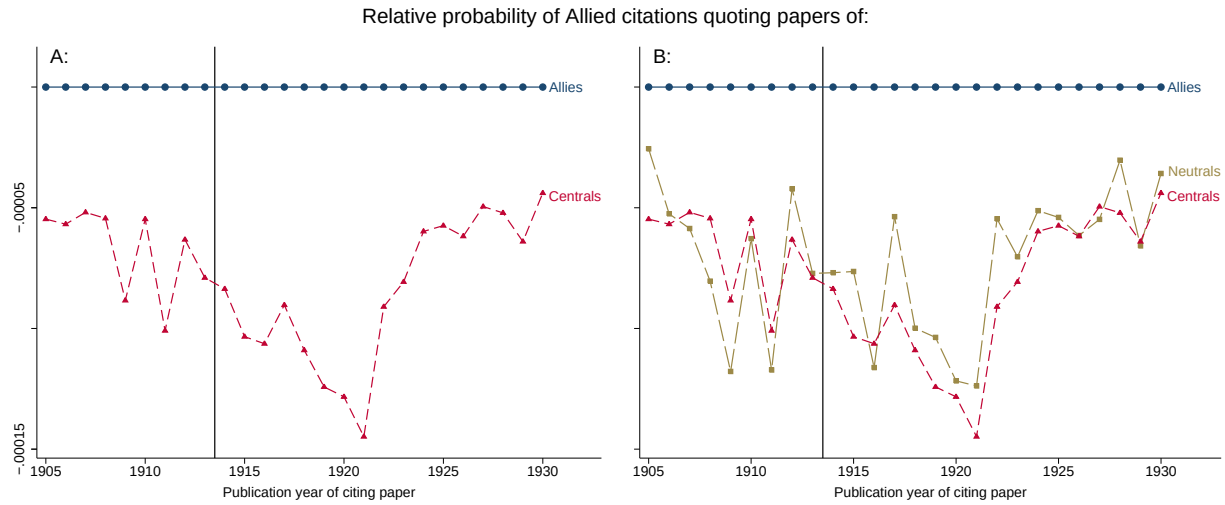
Notes: The Figure plots the estimates of the parameters from regression (3) using "citation shares" as dependent variable. A complete report of the estimation results is in Appendix Table A.5.

Figure 6: Relative Citations of Central Papers: Citation Levels



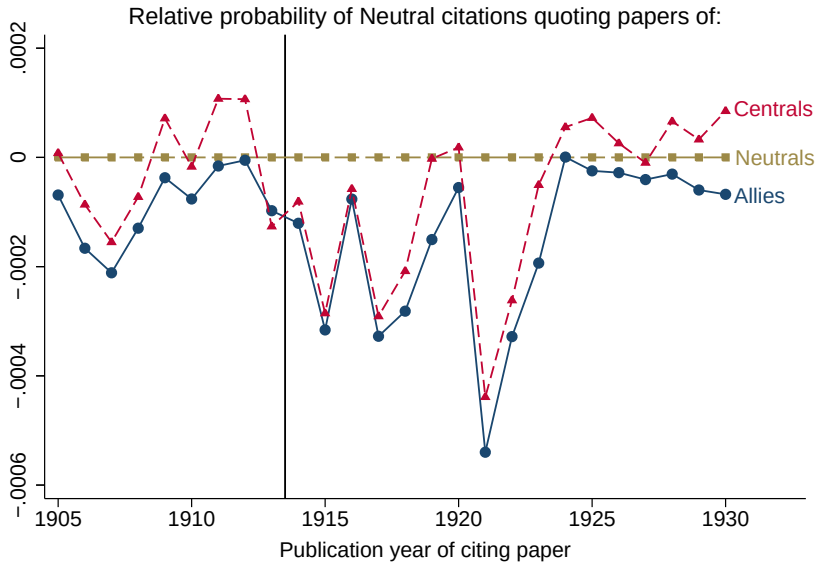
Notes: The Figures plot the estimates of the parameters from regression (3) using "citation levels" as dependent variable. A complete report of the estimation results is in Appendix Table A.6.

Figure 7: Relative Citations of Allied Papers: Citation Levels



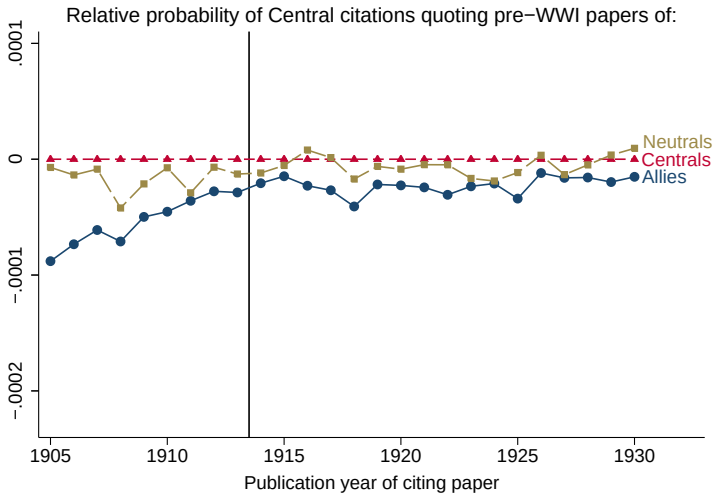
Notes: The Figures plot the estimates of the parameters from regression (3) using "citation levels" as dependent variable. A complete report of the estimation results is in Appendix Table A.7.

Figure 8: Relative Citations of Neutral Papers: Citation Levels



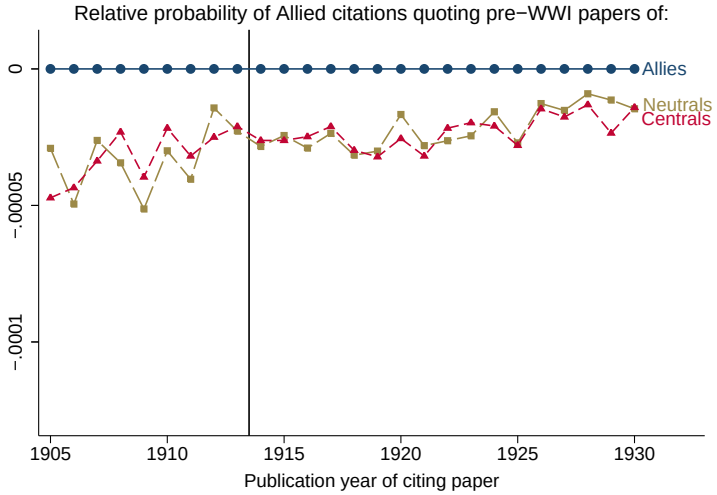
Notes: The Figure plots the estimates of the parameters from regression (3) using "citation levels" as dependent variable. A complete report of the estimation results is in Appendix Table A.8.

Figure 9:
Relative Citations of Central Papers: Citation Shares w.r.t. Pre–WWI Papers



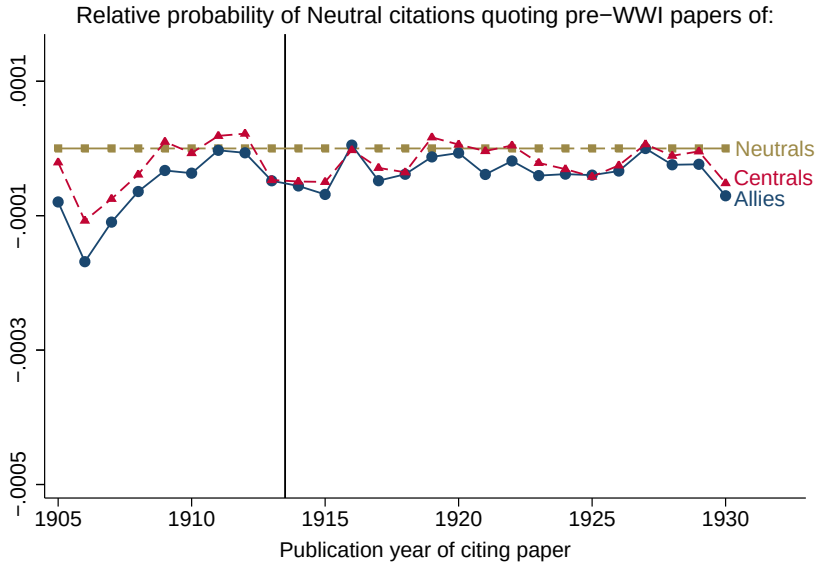
Notes: The Figure plots the estimates of the parameters from regression (3) using "citation shares" as dependent variable. Citation shares are computed only with respect to cited papers that were published between 1900 and 1913. A complete report of the estimation results is in Appendix Table A.12.

Figure 10:
Relative Citations of Allied Papers: Citation Shares w.r.t. Pre–WWI Papers



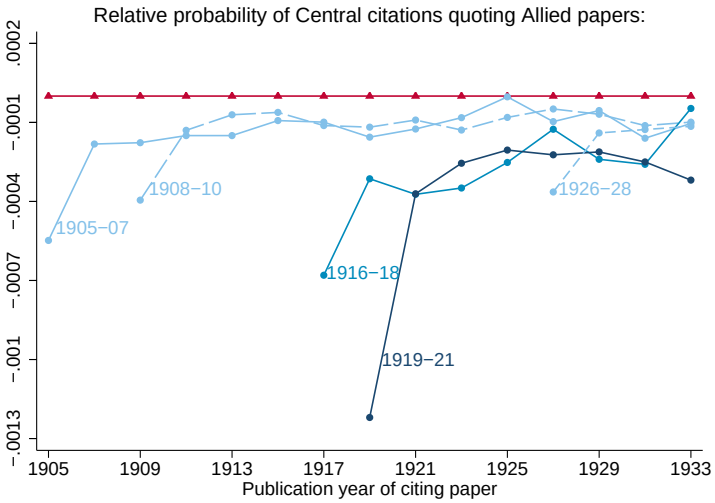
Notes: The Figure plots the estimates of the parameters from regression (3) using "citation shares" as dependent variable. Citation shares are computed only with respect to cited papers that were published between 1900 and 1913. A complete report of the estimation results is in Appendix Table A.13.

Figure 11:
Relative Citations of Neutral Papers: Citation Shares w.r.t. Pre–WWI Papers



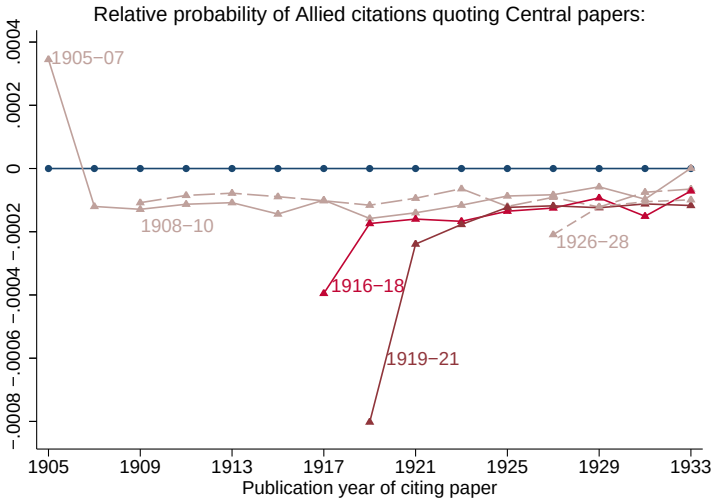
Notes: The Figure plots the estimates of the parameters from regression (3) using "citation shares" as dependent variable. Citation shares are computed only with respect to cited papers that were published between 1900 and 1913. A complete report of the estimation results is in Appendix Table A.14.

Figure 12:
Long–Run Effects: Relative Citations of Central Papers w.r.t. Allied Papers



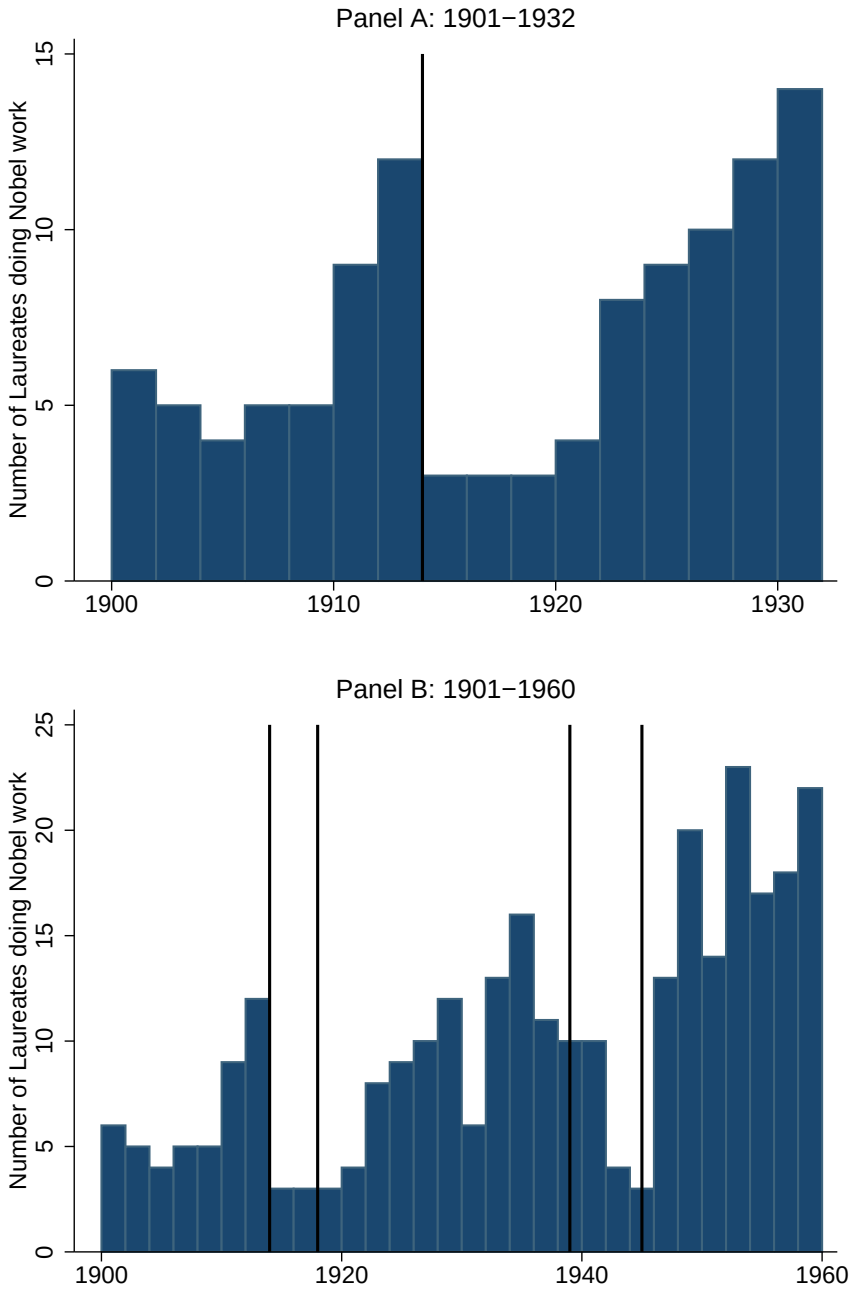
Notes: The Figure plots the estimates of the parameters from regression (3) using "citation shares" as dependent variable. Each cohort of papers (e.g., 1905-1907) corresponds to a line, and each line plots the estimates from a separate regression. In each of the five regressions, citation shares are computed only with respect to cited papers that were published in that specific time interval (e.g., 1905-1907).

Figure 13:
Long–Run Effects: Relative Citations of Allied Papers w.r.t. Central Papers



Notes: The Figure plots the estimates of the parameters from regression (3) using "citation shares" as dependent variable. Each cohort of papers (e.g., 1905-1907) corresponds to a line, and each line plots the estimates from a separate regression. In each of the five regressions, citation shares are computed only with respect to cited papers that were published in that specific time interval (e.g., 1905-1907).

Figure 14: Timing of Science Nobel Laureates' Prize Winning Work



Source: Jones and Weinberg (2011). *Notes:* The Figures plot histograms of the number of (Science) Nobel Laureates who were working on their prize winning discoveries in two year bins. The vertical line in Panel A indicates the beginning of WWI. The vertical lines in Panel B indicate the beginning and ending of WWI and WWII.

Tables

Table 1: Scientific Camps during the Boycott

Allies	*Centrals*	*Neutrals*	*Rest*
USA	Germany	Switzerland	Russia / U.S.S.R.
UK	Austria	Netherlands	China
France	Hungary	Sweden	Finland
Canada	Bulgaria	Denmark	New Zealand
Japan	Ottoman E. / Turkey	Norway	Portugal
Italy		Czechoslovakia	
Belgium		Argentina	
Australia		Chile	
Rumania		Spain	
Poland		Mexico	
Brazil		Siam / Thailand	
South Africa			
Greece			

Notes: The Table reports the list of countries that constituted each scientific camp in the aftermath of WWI Within each scientific camp, countries are ordered in terms of scientific output.

Table 2: Attendance to International Mathematical Congresses (IMCs)

Year	*Location*	*Delegates from:*							
		Germany	*Switzerland*	*France*	*USA*	*Canada*	*UK*	*Italy*	*Others*
1897	Zurich	53	68	29	7	0	3	25	57
1900	Paris	26	7	93	19	1	12	23	69
1904	Heidelberg	204	13	29	19	1	8	14	108
1908	Rome	174	18	92	27	1	33	213	142
1912	Cambridge (UK)	70	10	45	87	5	270	41	181
1916	Stockholm	*Cancelled*							
1920	Strasbourg	0	12	112	15	1	11	7	99
1924	Toronto	0	5	45	270	118	93	15	80
1928	Bologna	106	48	91	76	7	64	412	312
1932	Zurich	142	185	89	102	2	49	81	203

Source: Proceedings of the International Congresses of Mathematicians.

Table 3: Summary Statistics about Scientists

Panel A: Scholars from all fields	*Minerva 1900*	*Minerva 1914*
Total number of universities	565	966
Total number of university scholars	24,090	42,113
Scholars with name information	23,841	36,738

Panel B: Scientists from all fields	*Minerva 1900*	*Minerva 1914*
Total scientists (5 fields)	10,040	15,790
Medicine	5,341	8,762
Biology	1,489	2,339
Chemistry	1,309	2,058
Physics	1,147	1,630
Mathematics	1,067	1,435

Panel C: Scientists by country (largest countries)	*Minerva 1900*		*Minerva 1914*	
	#	*% of all*	*#*	*% of all*
USA	1,676	16.7	3,293	20.9
Germany	1,495	14.9	2,128	13.5
Italy	1,174	11.7	1,961	12.4
UK	865	8.6	1,381	8.8
France	1,021	10.2	1,309	8.3
Austria–Hungary	817	8.1	1,304	8.3
Russia	784	7.8	1,142	7.2
Switzerland	315	3.1	421	2.7
Spain	238	2.4	301	1.9
Japan	94	0.9	283	1.8
Canada	201	2.0	238	1.5

Source: Scientist data digitized from Minerva (1900 and 1914). *Notes:* In Panel B "Total scientists (5 fields)" is smaller than the sum of the 5 fields below because some scientists work on more than one field.

Table 4: Distribution of Allied and Central Papers by Journal Country

Author country	(1) Country information based on: Address and Scientist data	(2) Country information based on: Scientist data	(3) Percent publications in journal country: USA	(4) UK	(5) France	(6) Germany	(7) Netherlands	(8) Others
Allies:								
USA	73,314	24,293	**81.7**	13.0	0.3	4.6	0.1	0.2
UK	19,053	11,921	16.8	**78.2**	0.1	2.7	0.2	1.9
France	3,317	2,443	3.2	2.4	**87.6**	5.6	0.4	0.8
Canada	1,742	1,047	**53.1**	42.0	0.0	3.8	0.0	1.1
Japan	834	342	24.2	13.6	0.6	**59.4**	0.4	1.8
Italy	695	660	9.5	13.0	5.2	**70.8**	0.6	0.9
Belgium	601	299	4.5	2.0	**65.2**	6.2	22.1	0.0
Australia	372	446	19.9	**78.0**	0.2	1.8	0.0	0.1
Rumania	213	145	0.7	0.7	**74.5**	24.1	0.0	0.0
South Africa	32	55	**50.9**	44.5	0.0	2.7	0.0	1.8
Greece	17	16	0.0	0.0	0.0	**100.0**	0.0	0.0
Brazil	84	9	**41.2**	35.3	11.8	11.8	0.0	0.0
Serbia	0	0	0.0	0.0	0.0	0.0	0.0	0.0
Poland	169	0	0.0	0.0	0.0	0.0	0.0	0.0
Centrals:								
Germany	22,509	18,938	2.7	0.9	0.3	**95.0**	0.5	0.5
Austria	2,423	2,104	6.9	1.8	1.6	**87.7**	1.7	0.4
Hungary	1,300	1,111	10.0	0.9	0.6	**86.8**	0.3	1.4
Bulgaria	28	3	0.0	0.0	0.0	**100.0**	0.0	0.0
Turkey	9	0	0.0	0.0	0.0	0.0	0.0	0.0

Sources: Scientist data digitized from Minerva (1900 and 1914). Publication data from the ISI Web of Science, collection "Century of Science" for publication years between 1905 and 1930.

Table 5: Distribution of Neutral and Rest Papers by Journal Country

Author country	*(1)* *Country information based on:* *Address and Scientist data*	*(2)* *Scientist data*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*
			Percent publications in journal country					
			USA	*UK*	*France*	*Germany*	*Netherlands*	*Others*
Neutrals:								
Switzerland	3,061	2810	3.4	0.9	7.2	**71.5**	0.6	16.5
Netherlands	2,659	2031	3.2	5.4	0.5	31.4	**59.4**	0.1
Sweden	1,239	787	6.3	2.7	2.8	**74.6**	1.3	12.4
Denmark	548	325	10.5	9.8	0.9	**67.4**	0.6	10.8
Norway	261	181	5.5	20.5	0.6	**70.1**	1.7	1.7
Argentina	189	130	10.8	0.4	13.8	**75.0**	0.0	0.0
Spain	53	6	0.0	0.0	**72.7**	27.3	0.0	0.0
Chile	113	4	30.8	23.1	0.0	**46.2**	0.0	0.0
Czechoslovakia	201	0	0.0	0.0	0.0	0.0	0.0	0.0
Mexico	11	0	0.0	0.0	0.0	0.0	0.0	0.0
Thailand	0	0	0.0	0.0	0.0	0.0	0.0	0.0
Rest:								
Others	2,767	1,162	21.9	**69.9**	3.0	4.9	0.2	0.2
Russia	1,097	523	24.0	5.2	3.4	**65.6**	1.2	0.6
China	287	0	0.0	0.0	0.0	0.0	0.0	0.0
Finland	296	141	1.4	1.4	0.0	**47.7**	3.6	45.9
New Zealand	207	99	35.9	**58.0**	4.0	1.0	0.0	1.0
Portugal	42	30	3.3	13.3	**80.0**	3.3	0.0	0.0

Sources: Scientist data digitized from Minerva (1900 and 1914). Publication data from the ISI Web of Science, collection "Century of Science" for publication years between 1905 and 1930.

Table 6: Summary Statistics about Papers and their References

Panel A: Papers published 1905–1930	*(1)* *Country information based on:* *Address and Scientist data*	*(2)* *Scientist data*
All papers	260,090	
+ author not anonymous	345,510	
+ country of citing author known	139,157	71,417
+ country of referenced author known	64,563	20,814
+ removing self cites	62,581	20,297
+ references in journal list	47,699	13,151
Panel B: References (published after 1900) in these papers		
All references	1,967,552	
+ author not anonymous	1,937,836	
+ country of citing author known	1,158,100	551,997
+ country of cited author known	317,552	63,854
+ country of cited author known	300,659	62,259
+ references in journal list	173,285	28,994

Sources: Scientist data digitized from Minerva (1900 and 1914). Publication data from the ISI Web of Science, collection "Century of Science" for publication years between 1905 and 1930.

Table 7: Summary statistics about Citation Levels and Citation Shares

	Cited Papers		
	(1)	*(2)*	*(3)*
	Allied	Centrals	Neutrals
Citing Papers	*Panel A: Citation Levels (CL)*		
Allied	**0.000104**	0.000042	0.000034
Centrals	0.000033	**0.000147**	0.000094
Neutrals	0.000027	0.000107	**0.000133**
Citing Papers	*Panel B: Citation Shares (CS)*		
Allied	**0.000101**	0.000049	0.000043
Centrals	0.000031	**0.000157**	0.000125
Neutrals	0.000024	0.000125	**0.000165**

Notes: The Table reports the average of our two measures of knowledge flows for each combination of citing-cited scientific camp. Averages are computed over the entire period of our data, the years between 1905 and 1930. Panel A displays averages for the citation levels measure, while Panel B presents averages for the citation shares measure.

Table 8: Relative Citations of Central Papers: Citation Shares

Central citations to:	*(1)*	*(2)*	*(3)*	*(4)*
Allied papers	-0.000089***	-0.000092***	-0.001554**	-0.005267**
	(0.000003)	(0.000003)	(0.000746)	(0.002375)
Allied × WW1	0.000014	0.000016*	0.000012	-0.000001
	(0.000009)	(0.000009)	(0.000009)	(0.000012)
Allied × Early Boycott	-0.000115***	-0.000112***	-0.000120***	-0.000142***
	(0.000017)	(0.000017)	(0.000017)	(0.000022)
Allied × Late Boycott	-0.000034***	-0.000031***	-0.000041***	-0.000070***
	(0.000009)	(0.000009)	(0.000010)	(0.000020)
Allied × Post Boycott		0.000011		-0.000040
		(0.000008)		(0.000025)
Neutral papers	-0.000043***	-0.000042***	0.000146	-0.000317
	(0.000006)	(0.000007)	(0.001404)	(0.005116)
Neutral × WW1	0.000054***	0.000054***	0.000054***	0.000053**
	(0.000020)	(0.000020)	(0.000020)	(0.000024)
Neutral × Early Boycott	-0.000032	-0.000033	-0.000031	-0.000034
	(0.000036)	(0.000036)	(0.000036)	(0.000046)
Neutral × Late Boycott	0.000001	0.000001	0.000002	-0.000001
	(0.000018)	(0.000018)	(0.000019)	(0.000042)
Neutral × Post Boycott		-0.000002		-0.000005
		(0.000014)		(0.000051)
Rest interacted with time periods	YES	YES	YES	YES
Paper FE	YES	YES	YES	YES
Camp time trends			YES	YES
Observations	12,016	12,016	12,016	12,016
Number of papers	3,004	3,004	3,004	3,004
R-squared	0.010554	0.011705	0.011092	0.012839

Notes: The Table reports the estimation results from regression (4) using "citation shares" as dependent variable. Countries are The omitted category (i.e., the "0" taken as reference) is the citation share with respect to papers published by the home camp. Standard errors are clustered at the paper level. *** indicate a parameter estimate significantly different from 0 at the 1%, ** at the 5%, and * at the 10%.

Table 9: Relative Citations of Allied Papers: Citation Shares

Allied citations to:	*(1)*	*(2)*	*(3)*	*(4)*
Central papers	-0.000064***	-0.000059***	0.000938*	0.000059
	(0.000002)	(0.000003)	(0.000495)	(0.002049)
Central × WW1	-0.000021***	-0.000026***	-0.000023***	-0.000026***
	(0.000004)	(0.000005)	(0.000004)	(0.000008)
Central × Early Boycott	-0.000042***	-0.000047***	-0.000042***	-0.000047***
	(0.000006)	(0.000006)	(0.000006)	(0.000013)
Central × Late Boycott	-0.000025***	-0.000030***	-0.000022***	-0.000029*
	(0.000005)	(0.000005)	(0.000005)	(0.000015)
Central × Post Boycott		-0.000010**		-0.000009
		(0.000005)		(0.000020)
Neutral papers	-0.000064***	-0.000065***	-0.000127	0.002237
	(0.000004)	(0.000005)	(0.000749)	(0.003293)
Neutral × WW1	-0.000020***	-0.000019***	-0.000020***	-0.000012
	(0.000006)	(0.000007)	(0.000006)	(0.000012)
Neutral × Early Boycott	-0.000021*	-0.000020*	-0.000021*	-0.000007
	(0.000011)	(0.000012)	(0.000011)	(0.000020)
Neutral × Late Boycott	-0.000008	-0.000007	-0.000008	0.000010
	(0.000009)	(0.000009)	(0.000009)	(0.000025)
Neutral × Post Boycott		0.000002		0.000024
		(0.000007)		(0.000031)
Rest interacted with time periods	YES	YES	YES	YES
Paper FE	YES	YES	YES	YES
Camp time trends			YES	YES
Observations	16,408	16,408	16,408	16,408
Number of Papers	4,102	4,102	4,102	4,102
R-squared	0.020552	0.020608	0.020558	0.021534

Notes: The Table reports the estimation results from regression (4) using "citation shares" as dependent variable. The omitted category (i.e., the "0" taken as reference) is the citation share with respect to papers published by the home camp. Standard errors are clustered at the paper level. *** indicate a parameter estimate significantly different from 0 at the 1%, ** at the 5%, and * at the 10%.

Table 10: Relative Citations of Neutral Papers: Citation Shares

Neutral citations to:	*(1)*	*(2)*	*(3)*	*(4)*
Central papers	0.000005	-0.000012	-0.005646*	-0.018219
	(0.000014)	(0.000018)	(0.003116)	(0.013400)
Central × WW1	-0.000138***	-0.000121***	-0.000138***	-0.000184***
	(0.000041)	(0.000043)	(0.000041)	(0.000055)
Central × Early Boycott	-0.000181**	-0.000165*	-0.000195**	-0.000270**
	(0.000091)	(0.000092)	(0.000092)	(0.000117)
Central × Late Boycott	-0.000075*	-0.000059	-0.000099**	-0.000197*
	(0.000041)	(0.000043)	(0.000043)	(0.000113)
Central × Post Boycott		0.000047		-0.000133
		(0.000029)		(0.000128)
Allied papers	-0.000062***	-0.000073***	-0.004402	-0.020723*
	(0.000013)	(0.000016)	(0.002752)	(0.012095)
Allied × WW1	-0.000109***	-0.000098**	-0.000109***	-0.000169***
	(0.000038)	(0.000040)	(0.000038)	(0.000051)
Allied × Early Boycott	-0.000217***	-0.000206***	-0.000227***	-0.000325***
	(0.000077)	(0.000078)	(0.000077)	(0.000101)
Allied × Late Boycott	-0.000075**	-0.000064*	-0.000093**	-0.000221**
	(0.000037)	(0.000039)	(0.000039)	(0.000101)
Allied × Post Boycott		0.000031		-0.000172
		(0.000026)		(0.000116)
Rest interacted with time periods	YES	YES	YES	YES
Paper FE	YES	YES	YES	YES
Camp time trends			YES	YES
Observations	2,832	2,832	2,832	2,832
Number of papers	708	708	708	708
R-squared	0.018183	0.018933	0.019754	0.021695

Notes: The Table reports the estimation results from regression (4) using "citation shares" as dependent variable. The omitted category (i.e., the "0" taken as reference) is the citation share with respect to papers published by the home camp. Standard errors are clustered at the paper level. *** indicate a parameter estimate significantly different from 0 at the 1%, ** at the 5%, and * at the 10%.

Table 11: Relative Citations of Central Papers: Citation Levels

Central citations to:	*(1)*	*(2)*	*(3)*	*(4)*
Allied papers	-0.000112***	-0.000131***	-0.005880***	-0.002961
	(0.000005)	(0.000006)	(0.000886)	(0.004693)
Allied × WW1	-0.000002	0.000017	-0.000004	0.000007
	(0.000016)	(0.000017)	(0.000016)	(0.000024)
Allied × Early Boycott	-0.000084***	-0.000066***	-0.000100***	-0.000082**
	(0.000023)	(0.000023)	(0.000023)	(0.000038)
Allied × Late Boycott	-0.000028**	-0.000010	-0.000055***	-0.000031
	(0.000013)	(0.000014)	(0.000014)	(0.000041)
Allied × Post Boycott		0.000059***		0.000031
		(0.000010)		(0.000050)
Neutral papers	-0.000050***	-0.000059***	-0.002920*	-0.000263
	(0.000008)	(0.000009)	(0.001583)	(0.006894)
Neutral × WW1	0.000086**	0.000095***	0.000085**	0.000095**
	(0.000033)	(0.000034)	(0.000033)	(0.000038)
Neutral × Early Boycott	-0.000018	-0.000009	-0.000026	-0.000010
	(0.000039)	(0.000039)	(0.000039)	(0.000058)
Neutral × Late Boycott	0.000018	0.000028	0.000005	0.000026
	(0.000022)	(0.000023)	(0.000023)	(0.000058)
Neutral × Post Boycott		0.000030*		0.000028
		(0.000016)		(0.000071)
Rest interacted with time periods	YES	YES	YES	YES
Paper FE	YES	YES	YES	YES
Camp time trends			YES	YES
Observations	16,620	16,620	16,620	16,620
Number of papers	4,155	4,155	4,155	4,155
R-squared	0.007333	0.007842	0.007622	0.008440

Notes: The Table reports the estimation results from regression (4) using "citation levels" as dependent variable. The omitted category (i.e., the "0" taken as reference) is the citation share with respect to papers published by the home camp. Standard errors are clustered at the paper level. *** indicate a parameter estimate significantly different from 0 at the 1%, ** at the 5%, and * at the 10%.

Table 12: Relative Citations of Allied Papers: Citation Levels

Allied citations to:	*(1)*	*(2)*	*(3)*	*(4)*
Central papers	-0.000060***	-0.000068***	-0.001366**	0.001727
	(0.000003)	(0.000005)	(0.000607)	(0.002710)
Central × WW1	-0.000038***	-0.000030***	-0.000035***	-0.000024*
	(0.000006)	(0.000007)	(0.000006)	(0.000012)
Central × Early Boycott	-0.000073***	-0.000064***	-0.000072***	-0.000054***
	(0.000011)	(0.000012)	(0.000011)	(0.000019)
Central × Late Boycott	-0.000011*	-0.000003	-0.000013**	0.000010
	(0.000006)	(0.000007)	(0.000006)	(0.000022)
Central × Post Boycott		0.000014**		0.000032
		(0.000006)		(0.000028)
Neutral papers	-0.000059***	-0.000072***	-0.002200***	0.001505
	(0.000003)	(0.000006)	(0.000718)	(0.003572)
Neutral × WW1	-0.000026***	-0.000013	-0.000021**	-0.000007
	(0.000009)	(0.000010)	(0.000009)	(0.000016)
Neutral × Early Boycott	-0.000058***	-0.000045***	-0.000057***	-0.000036
	(0.000014)	(0.000014)	(0.000014)	(0.000024)
Neutral × Late Boycott	0.000001	0.000015	-0.000002	0.000026
	(0.000009)	(0.000010)	(0.000009)	(0.000030)
Neutral × Post Boycott		0.000023***		0.000038
		(0.000007)		(0.000036)
Rest interacted with time periods	YES	YES	YES	YES
Paper FE	YES	YES	YES	YES
Camp time trends		YES		YES
Observations	31,112	31,112	31,112	31,112
Number of Papers	7,778	7,778	7,778	7,778
R-squared	0.011520	0.011536	0.011565	0.011832

Notes: The Table reports the estimation results from regression (4) using "citation levels" as dependent variable. The omitted category (i.e., the "0" taken as reference) is the citation share with respect to papers published by the home camp. Standard errors are clustered at the paper level. *** indicate a parameter estimate significantly different from 0 at the 1%, ** at the 5%, and * at the 10%.

Table 13: Relative Citations of Neutral Papers: Citation Levels

Neutral citations to:	*(1)*	*(2)*	*(3)*	*(4)*
Central papers	0.000008	-0.000017	-0.006653**	-0.020428
	(0.000017)	(0.000024)	(0.003356)	(0.016048)
Central × WW1	-0.000182***	-0.000157***	-0.000177***	-0.000230***
	(0.000055)	(0.000057)	(0.000055)	(0.000074)
Central × Early Boycott	-0.000187**	-0.000161*	-0.000197**	-0.000281**
	(0.000093)	(0.000095)	(0.000093)	(0.000128)
Central × Late Boycott	-0.000017	0.000009	-0.000039	-0.000149
	(0.000037)	(0.000041)	(0.000039)	(0.000130)
Central × Post Boycott		0.000058*		-0.000145
		(0.000033)		(0.000160)
Allied papers	-0.000070***	-0.000089***	-0.005025*	-0.016159
	(0.000015)	(0.000022)	(0.002970)	(0.014652)
Allied × WW1	-0.000145***	-0.000126**	-0.000141**	-0.000184***
	(0.000055)	(0.000057)	(0.000055)	(0.000069)
Allied × Early Boycott	-0.000209**	-0.000190**	-0.000216***	-0.000284**
	(0.000083)	(0.000084)	(0.000082)	(0.000114)
Allied × Late Boycott	-0.000027	-0.000008	-0.000044	-0.000133
	(0.000030)	(0.000034)	(0.000031)	(0.000120)
Allied × Post Boycott		0.000043		-0.000117
		(0.000030)		(0.000148)
Rest interacted with time periods	YES	YES	YES	YES
Paper FE	YES	YES	YES	YES
Camp time trends			YES	YES
Observations	4,220	4,220	4,220	4,220
Number of papers	1,055	1,055	1,055	1,055
R-squared	0.015442	0.015874	0.016160	0.016710

Notes: The Table reports the estimation results from regression (4) using "citation levels" as dependent variable. The omitted category (i.e., the "0" taken as reference) is the citation share with respect to papers published by the home camp. Standard errors are clustered at the paper level. *** indicate a parameter estimate significantly different from 0 at the 1%, ** at the 5%, and * at the 10%.

Table 14:
Relative Citations of Central Papers: Citation Shares (Address + Scientist Data)

Central citations to:	*(1)*	*(2)*	*(3)*	*(4)*
Allied papers	-0.000074***	-0.000083***	-0.002668***	-0.009045***
	(0.000002)	(0.000002)	(0.000335)	(0.001530)
Allied × WW1	-0.000003	0.000006	-0.000002	-0.000025***
	(0.000006)	(0.000006)	(0.000006)	(0.000008)
Allied × Early Boycott	-0.000085***	-0.000076***	-0.000090***	-0.000129***
	(0.000010)	(0.000010)	(0.000010)	(0.000014)
Allied × Late Boycott	-0.000021***	-0.000013***	-0.000031***	-0.000082***
	(0.000004)	(0.000005)	(0.000005)	(0.000013)
Allied × Post Boycott		0.000022***		-0.000068***
		(0.000003)		(0.000016)
Neutral papers	-0.000039***	-0.000042***	-0.001139*	-0.002840
	(0.000003)	(0.000005)	(0.000664)	(0.003175)
Neutral × WW1	0.000014	0.000018	0.000015	0.000008
	(0.000012)	(0.000012)	(0.000012)	(0.000015)
Neutral × Early Boycott	-0.000031	-0.000027	-0.000034*	-0.000044
	(0.000020)	(0.000020)	(0.000020)	(0.000027)
Neutral × Late Boycott	-0.000012	-0.000009	-0.000017**	-0.000030
	(0.000008)	(0.000009)	(0.000008)	(0.000026)
Neutral × Post Boycott		0.000010		-0.000018
		(0.000007)		(0.000032)
Rest interacted with time periods	YES	YES	YES	YES
Paper FE	YES	YES	YES	YES
Camp time trends			YES	YES
Observations	20,804	20,804	20,804	20,804
Number of papers	5,201	5,201	5,201	5,201
R-squared	0.017186	0.017349	0.017559	0.019215

Notes: The Table reports the estimation results from regression (4) using "citation shares" as dependent variable. Countries are assigned to papers and to their references on the basis of both the address information reported in the publication data (i.e., Web of Science) and the scientist data (i.e., Minerva). to The omitted category (i.e., the "0" taken as reference) is the citation share with respect to papers published by the home camp. Standard errors are clustered at the paper level. *** indicate a parameter estimate significantly different from 0 at the 1%, ** at the 5%, and * at the 10%.

Table 15:
Relative Citations of Allied Papers: Citation Shares (Address + Scientist data)

Allied citations to:	*(1)*	*(2)*	*(3)*	*(4)*
Central papers	-0.000032***	-0.000055***	-0.003086***	-0.003576***
	(0.000000)	(0.000001)	(0.000133)	(0.000403)
Central × WW1	-0.000021***	0.000001	-0.000008***	-0.000010***
	(0.000001)	(0.000001)	(0.000001)	(0.000002)
Central × Early Boycott	-0.000025***	-0.000002	-0.000018***	-0.000021***
	(0.000001)	(0.000001)	(0.000001)	(0.000002)
Central × Late Boycott	-0.000010***	0.000013***	-0.000008***	-0.000012***
	(0.000001)	(0.000001)	(0.000001)	(0.000003)
Central × Post Boycott		0.000029***		-0.000005
		(0.000001)		(0.000004)
Neutral papers	-0.000027***	-0.000057***	-0.004023***	-0.003770***
	(0.000001)	(0.000002)	(0.000188)	(0.000675)
Neutral × WW1	-0.000022***	0.000008***	-0.000005***	-0.000004
	(0.000001)	(0.000002)	(0.000002)	(0.000003)
Neutral × Early Boycott	-0.000023***	0.000007***	-0.000014***	-0.000013***
	(0.000002)	(0.000002)	(0.000002)	(0.000004)
Neutral × Late Boycott	-0.000007***	0.000024***	-0.000005***	-0.000003
	(0.000001)	(0.000002)	(0.000001)	(0.000005)
Neutral × Post Boycott		0.000038***		0.000003
		(0.000002)		(0.000007)
Rest interacted with time periods	YES	YES	YES	YES
Paper FE	YES	YES	YES	YES
Camp time trends			YES	YES
Observations	110,316	110,316	110,316	110,316
Number of Papers	27,579	27,579	27,579	27,579
R-squared	0.012790	0.013205	0.013232	0.013237

Notes: The Table reports the estimation results from regression (4) using "citation shares" as dependent variable. Countries are assigned to papers and to their references on the basis of both the address information reported in the publication data (i.e., Web of Science) and the scientist data (i.e., Minerva). The omitted category (i.e., the "0" taken as reference) is the citation share with respect to papers published by the home camp. Standard errors are clustered at the paper level. *** indicate a parameter estimate significantly different from 0 at the 1%, ** at the 5%, and * at the 10%.

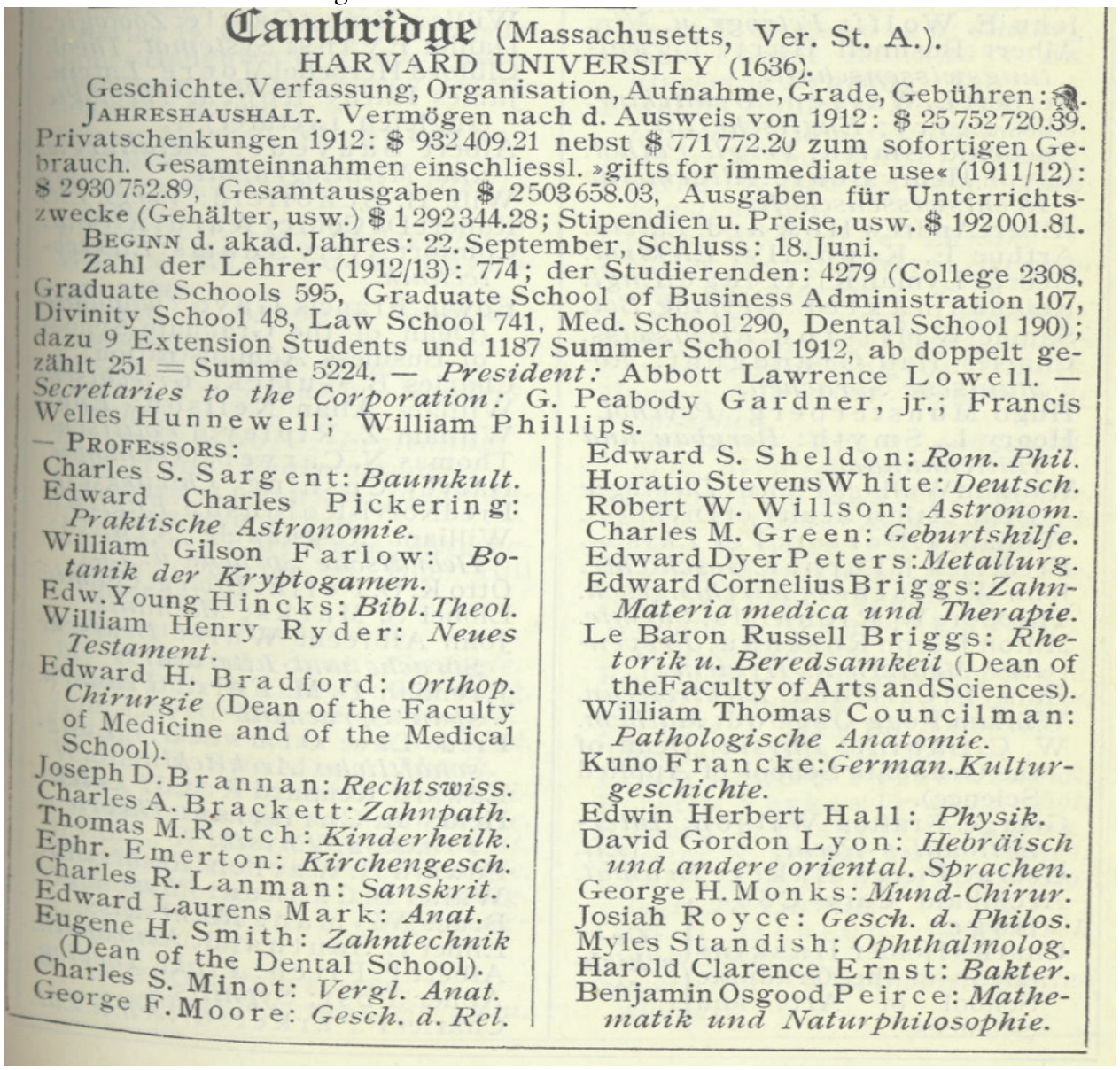
Table 16:
Relative Citations of Neutral Papers: Citation Shares (Address + Scientist Data)

Neutral citations to:	*(1)*	*(2)*	*(3)*	*(4)*
Central papers	-0.000041***	-0.000025*	0.001821	-0.011612
	(0.000007)	(0.000014)	(0.001634)	(0.007460)
Central × WW1	-0.000066***	-0.000082***	-0.000071***	-0.000123***
	(0.000024)	(0.000027)	(0.000025)	(0.000034)
Central × Early Boycott	-0.000032	-0.000048	-0.000033	-0.000115**
	(0.000032)	(0.000034)	(0.000032)	(0.000052)
Central × Late Boycott	-0.000026*	-0.000042**	-0.000024	-0.000131**
	(0.000015)	(0.000019)	(0.000015)	(0.000058)
Central × Post Boycott		-0.000026		-0.000140*
		(0.000016)		(0.000072)
Allied papers	-0.000071***	-0.000074***	-0.001356	-0.017246**
	(0.000006)	(0.000012)	(0.001483)	(0.006774)
Allied × WW1	-0.000064***	-0.000061**	-0.000060***	-0.000122***
	(0.000022)	(0.000025)	(0.000023)	(0.000031)
Allied × Early Boycott	-0.000049*	-0.000047	-0.000049*	-0.000146***
	(0.000028)	(0.000030)	(0.000028)	(0.000046)
Allied × Late Boycott	-0.000024*	-0.000021	-0.000026*	-0.000153***
	(0.000014)	(0.000017)	(0.000014)	(0.000053)
Allied × Post Boycott		0.000004		-0.000166**
		(0.000014)		(0.000065)
Rest interacted with time periods	YES	YES	YES	YES
Paper FE	YES	YES	YES	YES
Camp time trends			YES	YES
Observations	6,972	6,972	6,972	6,972
Number of papers	1,743	1,743	1,743	1,743
R-squared	0.019834	0.020161	0.020168	0.020686

Notes: The Table reports the estimation results from regression (4) using "citation shares" as dependent variable. Countries are assigned to papers and to their references on the basis of both the address information reported in the publication data (i.e., Web of Science) and the scientist data (i.e., Minerva). The omitted category (i.e., the "0" taken as reference) is the citation share with respect to papers published by the home camp. Standard errors are clustered at the paper level. *** indicate a parameter estimate significantly different from 0 at the 1%, ** at the 5%, and * at the 10%.

Appendix Figures

Figure A.1: Sample page of Minerva



Cambridge (Massachusetts, Ver. St. A.).
HARVARD UNIVERSITY (1636).

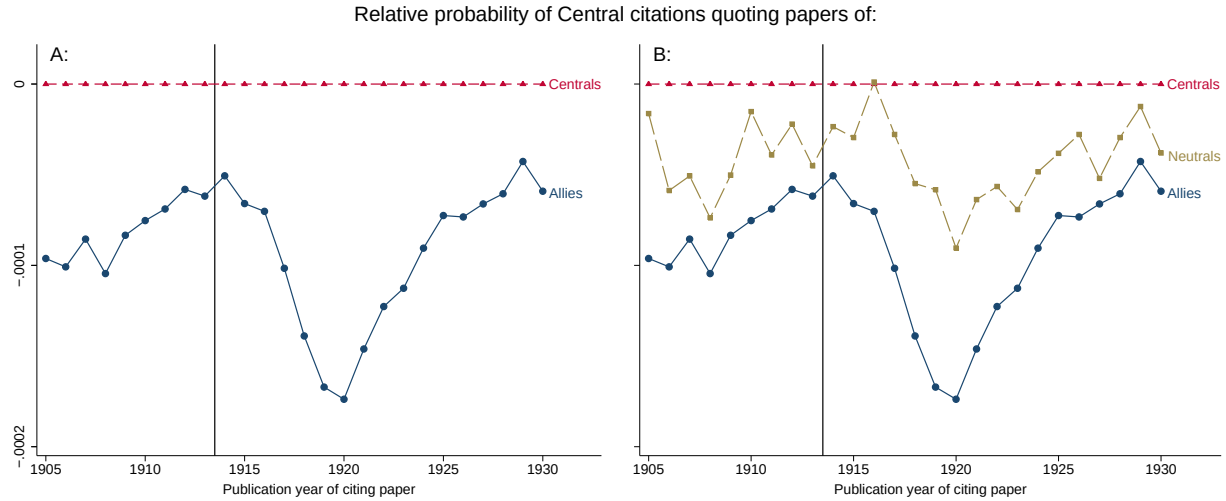
Geschichte. Verfassung, Organisation, Aufnahme, Grade, Gebühren: [illegible].
Jahreshaushalt. Vermögen nach d. Ausweis von 1912: $ 25 752 720.39. Privatschenkungen 1912: $ 932 409.21 nebst $ 771 772.20 zum sofortigen Gebrauch. Gesamteinnahmen einschliessl. »gifts for immediate use« (1911/12): $ 2 930 752.89, Gesamtausgaben $ 2 503 658.03, Ausgaben für Unterrichtszwecke (Gehälter, usw.) $ 1 292 344.28; Stipendien u. Preise, usw. $ 192 001.81.
Beginn d. akad. Jahres: 22. September, Schluss: 18. Juni.
Zahl der Lehrer (1912/13): 774; der Studierenden: 4279 (College 2308, Graduate Schools 595, Graduate School of Business Administration 107, Divinity School 48, Law School 741, Med. School 290, Dental School 190); dazu 9 Extension Students und 1187 Summer School 1912, ab doppelt gezählt 251 = Summe 5224. — *President:* Abbott Lawrence Lowell. — *Secretaries to the Corporation:* G. Peabody Gardner, jr.; Francis Welles Hunnewell; William Phillips.

— Professors:

Charles S. Sargent: *Baumkult.*
Edward Charles Pickering: *Praktische Astronomie.*
William Gilson Farlow: *Botanik der Kryptogamen.*
Edw. Young Hincks: *Bibl. Theol.*
William Henry Ryder: *Neues Testament.*
Edward H. Bradford: *Orthop. Chirurgie* (Dean of the Faculty of Medicine and of the Medical School).
Joseph D. Brannan: *Rechtswiss.*
Charles A. Brackett: *Zahnpath.*
Thomas M. Rotch: *Kinderheilk.*
Ephr. Emerton: *Kirchengesch.*
Charles R. Lanman: *Sanskrit.*
Edward Laurens Mark: *Anat.*
Eugene H. Smith: *Zahntechnik* (Dean of the Dental School).
Charles S. Minot: *Vergl. Anat.*
George F. Moore: *Gesch. d. Rel.*
Edward S. Sheldon: *Rom. Phil.*
Horatio Stevens White: *Deutsch.*
Robert W. Willson: *Astronom.*
Charles M. Green: *Geburtshilfe.*
Edward Dyer Peters: *Metallurg.*
Edward Cornelius Briggs: *Zahn-Materia medica und Therapie.*
Le Baron Russell Briggs: *Rhetorik u. Beredsamkeit* (Dean of the Faculty of Arts and Sciences).
William Thomas Councilman: *Pathologische Anatomie.*
Kuno Francke: *German. Kulturgeschichte.*
Edwin Herbert Hall: *Physik.*
David Gordon Lyon: *Hebräisch und andere oriental. Sprachen.*
George H. Monks: *Mund-Chirur.*
Josiah Royce: *Gesch. d. Philos.*
Myles Standish: *Ophthalmolog.*
Harold Clarence Ernst: *Bakter.*
Benjamin Osgood Peirce: *Mathematik und Naturphilosophie.*

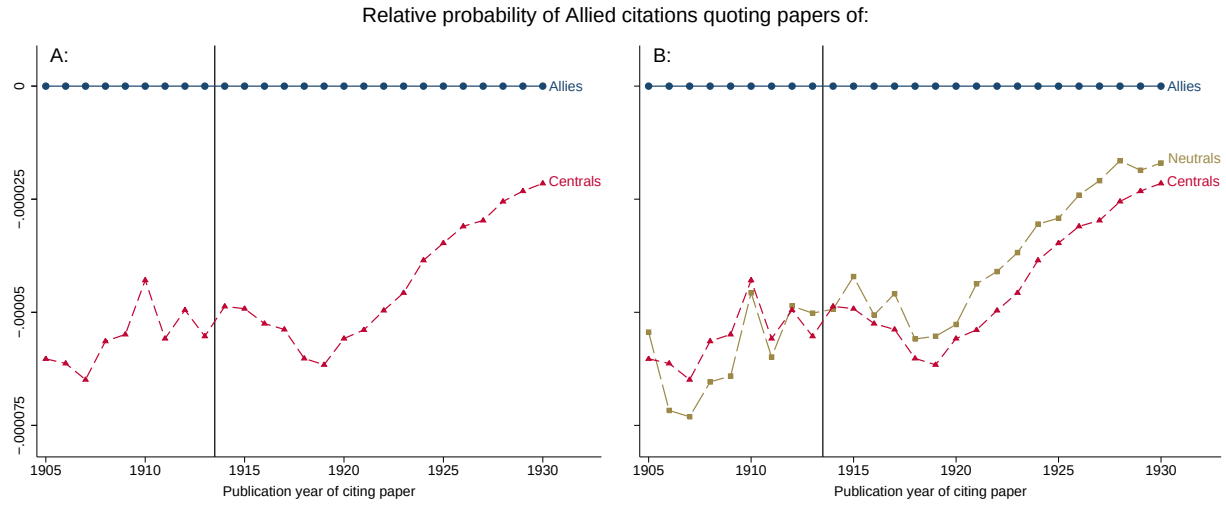
Source: Minerva–Handbuch der Gelehrten Welt.

Figure A.2:
Relative Citations of Central Papers: Citation Shares (Address + Scientist Data)



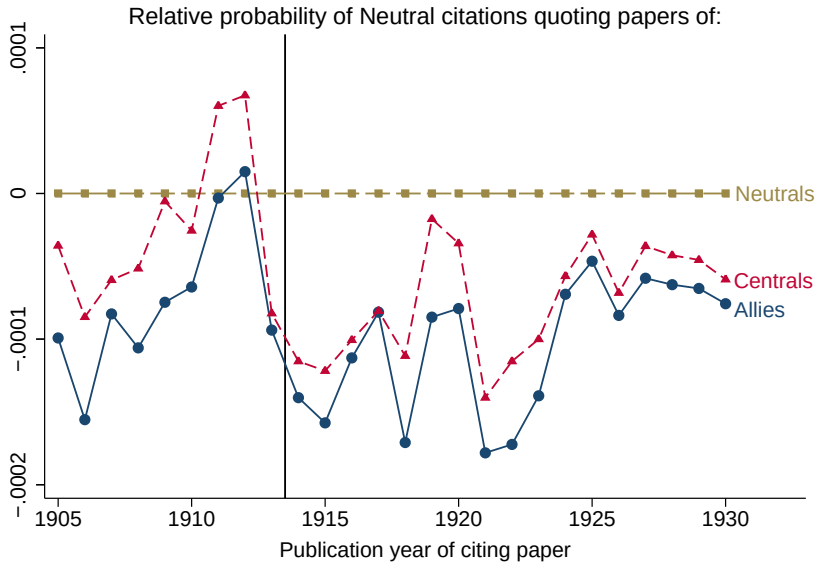
Notes: The Figures plot the estimates of the parameters from regression (3) using "citation shares" as dependent variable. Countries are assigned to papers and to their references on the basis of both the address information reported in the publication data (i.e., Web of Science) and the scientist data (i.e., Minerva). A complete report of the estimation results is in Appendix Table A.9.

Figure A.3:
Relative Citations of Allied Papers: Citation Shares (Address + Scientist Data)



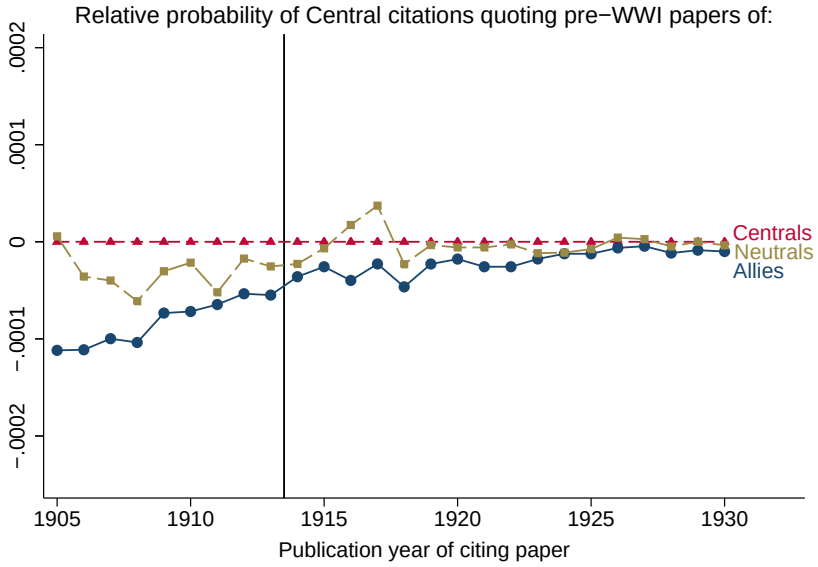
Notes: The Figures plot the estimates of the parameters from regression (3) using "citation shares" as dependent variable. Countries are assigned to papers and to their references on the basis of both the address information reported in the publication data (i.e., Web of Science) and the scientist data (i.e., Minerva). A complete report of the estimation results is in Appendix Table A.10.

Figure A.4:
Relative Citations of Neutral Papers: Citation Shares (Address + Scientist Data)



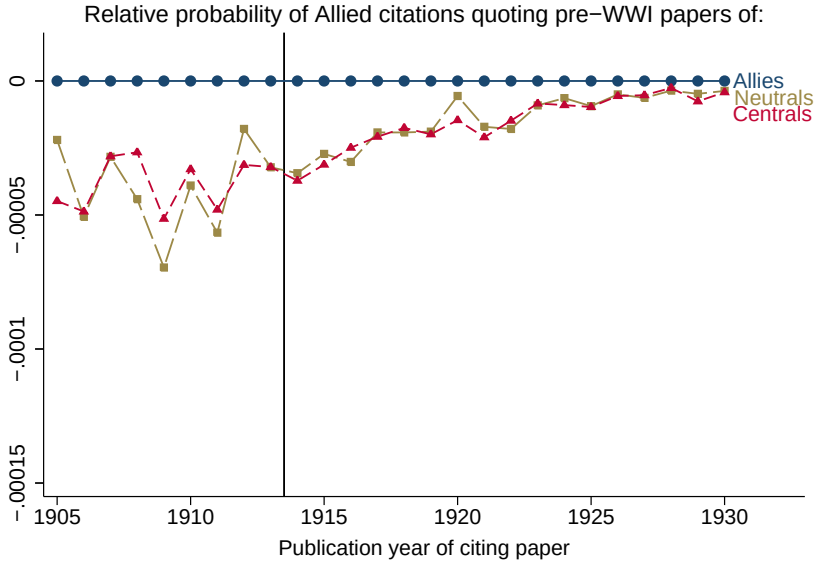
Notes: The Figure plots the estimates of the parameters from regression (3) using "citation shares" as dependent variable. Countries are assigned to papers and to their references on the basis of both the address information reported in the publication data (i.e., Web of Science) and the scientist data (i.e., Minerva). A complete report of the estimation results is in Appendix Table A.11.

Figure A.5:
Relative Citations of Central Papers: Citation Levels w.r.t. Pre–WWI Papers



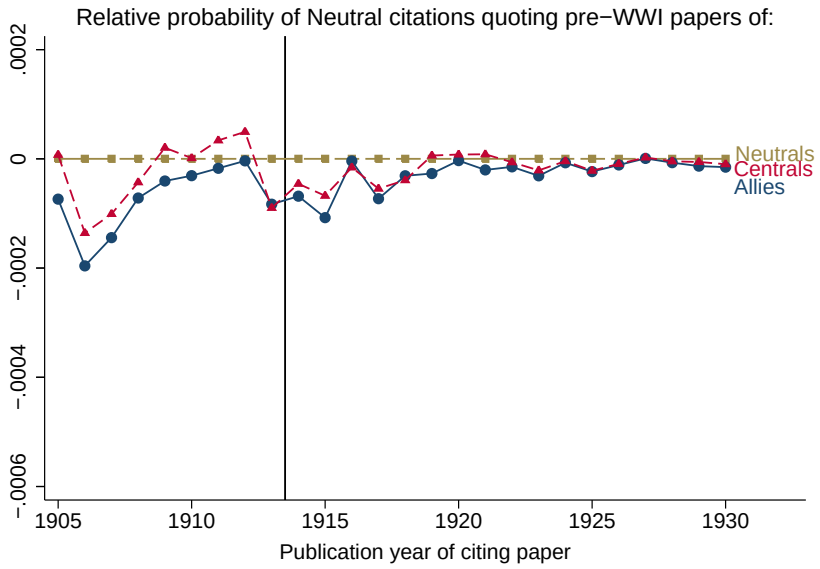
Notes: The Figures plot the estimates of the parameters from regression (3) using "citation levels" as dependent variable. Citation levels are computed only with respect to cited papers that were published between 1900 and 1913.

Figure A.6:
Relative Citations of Allied Papers: Citation Levels w.r.t. Pre–WWI Papers



Notes: The Figures plot the estimates of the parameters from regression (3) using "citation levels" as dependent variable. Citation levels are computed only with respect to cited papers that were published between 1900 and 1913.

Figure A.7:
Relative Citations of Neutral Papers: Citation Levels w.r.t. Pre–WWI Papers



Notes: The Figure plots the estimates of the parameters from regression (3) using "citation levels" as dependent variable. Citation levels are computed only with respect to cited papers that were published between 1900 and 1913.

Appendix Tables

Table A.1: List of Scientific Journals (A–J)

Acta Mathematica	Chemical Reviews
American Journal of Anatomy	Comptes Rendus des Seances de la Societe de Biologie et de ses Filiales
American Journal of Botany	Comptes Rendus Hebdomadaires des Seances de L'Academie des Sciences
American Journal of Mathematics	Contributions to Embryology
American Journal of Pathology	Ecology
American Journal of Physiology	Endocrinology
American Journal of Science	Genetics
American Naturalist	Helvetica Chimica Acta
Anatomical Record	Hereditas
Annalen der Physik	Hoppe–Seylers Zeitschrift fur Physiologische Chemie
Annales de Chemie et de Physique	Industrial and Engineering Chemistry
Annales de Chimie France	Journal de Physique et le Radium
Annals of Applied Biology	Journal fur die Reine und Angewandte Mathematik
Annals of Botany	Journal fur Praktische Chemie–Leipzig
Annals of Eugenics	Journal fur Psychologie und Neurologie
Annals of Mathematical Statistics	Journal of Anatomy
Annals of Mathematics	Journal of Bacteriology
Archiv fur die Gesamte Physiologie des Menschen und der Tiere	Journal of Biological Chemistry
Archiv fur Entwicklungsmechanik der Organismen	Journal of Clinical Endocrinology
Archiv fur Experimentelle Pathologie und Pharmakologie	Journal of Ecology
Archiv fur Experimentelle Zellforschung	Journal of Economic Entomology
Archiv fur Mikroskopische Anatomie	Journal of Experimental Biology
Archiv fur Mikroskopische Anatomie und Entwicklungsgeschichte	Journal of Experimental Medicine
Archiv fur mikroskopische Anatomie und Entwicklungsmechanik	Journal of Experimental Zoology
Archives of pathology	Journal of General Physiology
Archives of Pathology and Laboratory Medicine	Journal of Genetics
Astrophysical Journal	Journal of Heredity
Beitrage zur Pathologischen Anatomie und zur Allgemeinen Pathologie	Journal of Immunology
Berichte der Deutschen Chemischen Gesellschaft	Journal of Infectious Diseases
Biochemical Journal	Journal of Medical Research
Biochemische Zeitschrift	Journal of Morphology
Biological Bulletin	Journal of Morphology and Physiology
Biological Reviews and Biological Proceedings of the Cambridge Philosophical Society	Journal of Pathology and Bacteriology
Biometrika	Journal of Pharmacology and Experimental Therapeutics
Botanical Gazette	Journal of Physical Chemistry
British Journal of Experimental Biology	Journal of the American Chemical Society
British Journal of Experimental Pathology	Journal of the American Medical Association

Source: Publication data from the ISI Web of Science, collection "Century of Science" for publication years between 1905 and 1930.

Table A.2: List of Scientific Journals (J–Z)

Journal of the American Statistical Association	Proceedings of the Royal Society of London, Series A, Math. and Physics
Journal of the Chemical Society	Proceedings of the Royal Society of London, Series B, Biology
Journal of the Franklin Institute	Proceedings of the Society for Experimental Biology and Medicine
Journal of the Optical Society of America	Proceedings of the Zoological Society of London
Journal of the Optical Society of America and Review of Scientific Instruments	Publications of the American Statistical Association
Journal of the Royal Statistical Society	Quarterly Journal of Experimental Physiology
Journal of Urology	Quarterly Journal of Medicine
Justus Liebigs Annalen der Chemie	Quarterly Journal of Microscopical Science
Kolloid Zeitschrift	Quarterly Publications of the American Statistical Association
Lancet	Recueil des Travaux Chimiques des Pays–Bas
Mathematische Annalen	Recueil des Travaux Chimiques des Pays–Bas et de la Belgique
Mathematische Zeitschrift	Review of Scientific Instruments
Medicine	Reviews of Modern Physics
Monthly Notices Of The Royal Astronomical Society	Science
Nature	Sitzungsberichte der Preussischen Akademie der Wissenschaften Physik.–Mathem. Klasse
Naturwissenschaften	Sitzungsberichte ker Koniglich Preussischen Akademie der Wissenschaften
Naunyn–Schmiedebergs Archiv fur Experimentelle Pathologie und Pharmakologie	Skandinavisches Archiv fur Physiologie
New England Journal of Medicine	Stain technology
Organic Syntheses	Transactions of The American Institute of Chemical Engineers
Pflugers Archiv fur die Gesamte Physiologie des Menschen und der Tiere	Transactions of The American Mathematical Society
Philosophical Magazine	Transactions of the Faraday Society
Philosophical Transactions of the Royal Society of London, Series A, Math. and Physics	Virchows Archiv fur Pathologische Anatomie und Physiologie und fuer Klinische Medizin
Physical Review	Wilhelm Roux' Archiv fur Entwicklungsmechanik der Organismen
Physikalische Zeitschrift	Zeitschrift fur Angewandte Mathematik und Mechanik
Physiological Reviews	Zeitschrift fur Anorganische Chemie
Phytopathology	Zeitschrift fur Anorganische und Allgemeine Chemie
Plant Physiology	Zeitschrift fur Biologie
Proceedings of the American Academy of Arts and Sciences	Zeitschrift fur die Gesamte Neurologie und Psychiatrie
Proceedings of the American Academy of Arts and Sciences	Zeitschrift fur Elektrochemie und Angewandte Physikalische Chemie
Proceedings of the Cambridge Philosophical Society	Zeitschrift fur Kristallographie
Proceedings of the Cambridge Philosophical Society–Biological Sciences	Zeitschrift fur Krystallographie und Mineralogie
Proceedings of the IRE	Zeitschrift fur Physik
Proceedings of the Koninklijke Nederlandse Akademie van Wetenschappen te Amsterdam	Zeitschrift fur Physikalische Chemie Stochiometrie und Verwandtschaftslehre
Proceedings of the London Mathematical Society	Zeitschrift fur Physikalische Chemie, Abteilung A, Chem. Thermod. Kinetik Elektrochemie Eigensc.
Proceedings of the Physical Society	Zeitschrift fur Physikalische Chemie, Abteilung B, Chemie der Elementarpr. Aufbau der Materie
Proceedings of The Physical Society of London	Zeitschrift fur Wissenschaftliche Zoologie
Proceedings of the Royal Society of London	Zoologiska Bidrag fran Uppsala

Source: Publication data from the ISI Web of Science, collection "Century of Science" for publication years between 1905 and 1930.

Table A.3:
Relative Citation Shares of Central Papers – Parameter Estimates for Figure 3

	Param. Est.	*Std. Err.*		*Param. Est.*	*Std. Err.*
Allied × 1905	-0.0000985	0.0000105	Neutral × 1905	0.0000165	0.0000287
Allied × 1906	-0.0001111	0.0000108	Neutral × 1906	-0.0000507	0.0000249
Allied × 1907	-0.0000852	0.0000100	Neutral × 1907	-0.0000338	0.0000212
Allied × 1908	-0.0001206	0.0000081	Neutral × 1908	-0.0000954	0.0000147
Allied × 1909	-0.0000965	0.0000088	Neutral × 1909	-0.0000530	0.0000186
Allied × 1910	-0.0000914	0.0000085	Neutral × 1910	-0.0000220	0.0000195
Allied × 1911	-0.0000727	0.0000104	Neutral × 1911	-0.0000597	0.0000158
Allied × 1912	-0.0000629	0.0000101	Neutral × 1912	-0.0000167	0.0000208
Allied × 1913	-0.0000779	0.0000092	Neutral × 1913	-0.0000488	0.0000163
Allied × 1914	-0.0000437	0.0000126	Neutral × 1914	-0.0000235	0.0000213
Allied × 1915	-0.0000620	0.0000198	Neutral × 1915	-0.0000305	0.0000387
Allied × 1916	-0.0000881	0.0000180	Neutral × 1916	0.0000305	0.0000435
Allied × 1917	-0.0001102	0.0000242	Neutral × 1917	0.0000717	0.0000651
Allied × 1918	-0.0001177	0.0000316	Neutral × 1918	0.0000643	0.0000708
Allied × 1919	-0.0001819	0.0000337	Neutral × 1919	-0.0000467	0.0000659
Allied × 1920	-0.0002097	0.0000341	Neutral × 1920	-0.0001299	0.0000617
Allied × 1921	-0.0002146	0.0000225	Neutral × 1921	-0.0000600	0.0000559
Allied × 1922	-0.0001305	0.0000204	Neutral × 1922	-0.0000653	0.0000365
Allied × 1923	-0.0001440	0.0000165	Neutral × 1923	-0.0000670	0.0000346
Allied × 1924	-0.0000959	0.0000147	Neutral × 1924	-0.0000050	0.0000321
Allied × 1925	-0.0001236	0.0000135	Neutral × 1925	-0.0000346	0.0000306
Allied × 1926	-0.0000773	0.0000141	Neutral × 1926	-0.0000196	0.0000275
Allied × 1927	-0.0000918	0.0000166	Neutral × 1927	-0.0000875	0.0000220
Allied × 1928	-0.0000824	0.0000145	Neutral × 1928	-0.0000526	0.0000245
Allied × 1929	-0.0000509	0.0000160	Neutral × 1929	0.0000225	0.0000323
Allied × 1930	-0.0001013	0.0000175	Neutral × 1930	-0.0000900	0.0000275
Rest interacted with years			YES		
Paper FE			YES		
Observations			12,016		
Number of papers			3,004		

Notes: The Table reports the estimation results from regression (3) using "citation shares" as dependent variable. The omitted category (i.e., the "0" taken as reference) is the citation share with respect to papers published by the home camp. Standard errors are clustered at the paper level.

Table A.4:
Relative Citation Shares of Allied Papers – Parameter Estimates for Figure 4

	Param. Est.	*Std. Err.*		*Param. Est.*	*Std. Err.*
Central × 1905	-0.0000574	0.0000159	Neutral × 1905	-0.0000195	0.0000318
Central × 1906	-0.0000517	0.0000152	Neutral × 1906	-0.0000560	0.0000219
Central × 1907	-0.0000698	0.0000119	Neutral × 1907	-0.0000689	0.0000185
Central × 1908	-0.0000501	0.0000119	Neutral × 1908	-0.0000780	0.0000113
Central × 1909	-0.0000715	0.0000095	Neutral × 1909	-0.0000905	0.0000093
Central × 1910	-0.0000370	0.0000100	Neutral × 1910	-0.0000491	0.0000134
Central × 1911	-0.0000724	0.0000081	Neutral × 1911	-0.0000847	0.0000092
Central × 1912	-0.0000575	0.0000081	Neutral × 1912	-0.0000518	0.0000136
Central × 1913	-0.0000663	0.0000082	Neutral × 1913	-0.0000683	0.0000116
Central × 1914	-0.0000718	0.0000072	Neutral × 1914	-0.0000764	0.0000093
Central × 1915	-0.0000796	0.0000068	Neutral × 1915	-0.0000611	0.0000142
Central × 1916	-0.0000921	0.0000062	Neutral × 1916	-0.0000989	0.0000079
Central × 1917	-0.0000941	0.0000075	Neutral × 1917	-0.0000852	0.0000125
Central × 1918	-0.0000906	0.0000111	Neutral × 1918	-0.0001012	0.0000109
Central × 1919	-0.0001055	0.0000097	Neutral × 1919	-0.0000920	0.0000157
Central × 1920	-0.0001062	0.0000100	Neutral × 1920	-0.0000886	0.0000179
Central × 1921	-0.0001081	0.0000086	Neutral × 1921	-0.0000714	0.0000208
Central × 1922	-0.0001192	0.0000066	Neutral × 1922	-0.0000837	0.0000182
Central × 1923	-0.0000942	0.0000078	Neutral × 1923	-0.0000740	0.0000155
Central × 1924	-0.0000758	0.0000092	Neutral × 1924	-0.0000582	0.0000166
Central × 1925	-0.0000700	0.0000087	Neutral × 1925	-0.0000711	0.0000124
Central × 1926	-0.0000742	0.0000075	Neutral × 1926	-0.0000683	0.0000114
Central × 1927	-0.0000634	0.0000078	Neutral × 1927	-0.0000670	0.0000107
Central × 1928	-0.0000670	0.0000069	Neutral × 1928	-0.0000409	0.0000134
Central × 1929	-0.0000754	0.0000069	Neutral × 1929	-0.0000812	0.0000084
Central × 1930	-0.0000673	0.0000075	Neutral × 1930	-0.0000559	0.0000127
Rest interacted with years			YES		
Paper FE			YES		
Observations			16,408		
Number of papers			4,102		

Notes: The Table reports the estimation results from regression (3) using "citation shares" as dependent variable. The omitted category (i.e., the "0" taken as reference) is the citation share with respect to papers published by the home camp. Standard errors are clustered at the paper level.

Table A.5:
Relative Citation Shares of Neutral Papers – Parameter Estimates for Figure 5

	Param. Est.	*Std. Err.*		*Param. Est.*	*Std. Err.*
Allied × 1905	-0.0001005	0.0000641	Central × 1905	-0.0000355	0.0000698
Allied × 1906	-0.0001644	0.0000726	Central × 1906	-0.0000690	0.0000857
Allied × 1907	-0.0001561	0.0000685	Central × 1907	-0.0001099	0.0000737
Allied × 1908	-0.0001340	0.0000616	Central × 1908	-0.0000732	0.0000658
Allied × 1909	-0.0000226	0.0000284	Central × 1909	0.0000633	0.0000311
Allied × 1910	-0.0000795	0.0000472	Central × 1910	-0.0000258	0.0000510
Allied × 1911	-0.0000086	0.0000299	Central × 1911	0.0000713	0.0000336
Allied × 1912	-0.0000020	0.0000296	Central × 1912	0.0000624	0.0000348
Allied × 1913	-0.0000558	0.0000443	Central × 1913	-0.0000517	0.0000456
Allied × 1914	-0.0000744	0.0000481	Central × 1914	-0.0000551	0.0000490
Allied × 1915	-0.0002236	0.0000805	Central × 1915	-0.0001904	0.0000852
Allied × 1916	-0.0001272	0.0000787	Central × 1916	-0.0000877	0.0000860
Allied × 1917	-0.0002617	0.0001161	Central × 1917	-0.0002333	0.0001187
Allied × 1918	-0.0002277	0.0000987	Central × 1918	-0.0001499	0.0001119
Allied × 1919	-0.0002173	0.0001512	Central × 1919	-0.0000034	0.0001972
Allied × 1920	-0.0000753	0.0001068	Central × 1920	-0.0000024	0.0001220
Allied × 1921	-0.0004801	0.0001189	Central × 1921	-0.0004119	0.0001388
Allied × 1922	-0.0003977	0.0001096	Central × 1922	-0.0003100	0.0001256
Allied × 1923	-0.0002388	0.0000882	Central × 1923	-0.0001620	0.0000998
Allied × 1924	-0.0000103	0.0000415	Central × 1924	0.0000662	0.0000493
Allied × 1925	-0.0000327	0.0000390	Central × 1925	0.0000088	0.0000422
Allied × 1926	-0.0000299	0.0000444	Central × 1926	0.0000267	0.0000505
Allied × 1927	0.0000104	0.0000368	Central × 1927	0.0000558	0.0000421
Allied × 1928	0.0000068	0.0000297	Central × 1928	0.0000746	0.0000361
Allied × 1929	-0.0000944	0.0000542	Central × 1929	-0.0000141	0.0000619
Allied × 1930	-0.0001012	0.0000526	Central × 1930	0.0000323	0.0000651
Rest interacted with years			YES		
Paper FE			YES		
Observations			2,832		
Number of papers			708		

Notes: The Table reports the estimation results from regression (3) using "citation shares" as dependent variable. The omitted category (i.e., the "0" taken as reference) is the citation share with respect to papers published by the home camp. Standard errors are clustered at the paper level.

Table A.6:
Relative Citation Levels of Central Papers – Parameter Estimates for Figure 6

	Param. Est.	*Std. Err.*		*Param. Est.*	*Std. Err.*
Allied × 1905	-0.0001214	0.0000165	Neutral × 1905	0.0000366	0.0000362
Allied × 1906	-0.0001490	0.0000180	Neutral × 1906	-0.0000783	0.0000293
Allied × 1907	-0.0001200	0.0000155	Neutral × 1907	-0.0000725	0.0000233
Allied × 1908	-0.0001519	0.0000137	Neutral × 1908	-0.0001086	0.0000208
Allied × 1909	-0.0001281	0.0000146	Neutral × 1909	-0.0000742	0.0000245
Allied × 1910	-0.0001280	0.0000186	Neutral × 1910	-0.0000295	0.0000301
Allied × 1911	-0.0001226	0.0000205	Neutral × 1911	-0.0000914	0.0000281
Allied × 1912	-0.0001064	0.0000184	Neutral × 1912	-0.0000309	0.0000347
Allied × 1913	-0.0001411	0.0000295	Neutral × 1913	-0.0000719	0.0000266
Allied × 1914	-0.0000898	0.0000252	Neutral × 1914	-0.0000624	0.0000347
Allied × 1915	-0.0001080	0.0000345	Neutral × 1915	-0.0000527	0.0000515
Allied × 1916	-0.0001044	0.0000264	Neutral × 1916	0.0001782	0.0000964
Allied × 1917	-0.0001388	0.0000468	Neutral × 1917	0.0001754	0.0001186
Allied × 1918	-0.0001729	0.0000557	Neutral × 1918	0.0000451	0.0000872
Allied × 1919	-0.0001665	0.0000490	Neutral × 1919	0.0000162	0.0000889
Allied × 1920	-0.0002294	0.0000451	Neutral × 1920	-0.0001143	0.0000790
Allied × 1921	-0.0001941	0.0000299	Neutral × 1921	-0.0000882	0.0000459
Allied × 1922	-0.0001660	0.0000312	Neutral × 1922	-0.0000704	0.0000459
Allied × 1923	-0.0001912	0.0000311	Neutral × 1923	-0.0000374	0.0000520
Allied × 1924	-0.0001112	0.0000210	Neutral × 1924	-0.0000300	0.0000330
Allied × 1925	-0.0001092	0.0000179	Neutral × 1925	0.0000013	0.0000373
Allied × 1926	-0.0000917	0.0000190	Neutral × 1926	-0.0000119	0.0000364
Allied × 1927	-0.0000699	0.0000161	Neutral × 1927	-0.0000584	0.0000198
Allied × 1928	-0.0000738	0.0000147	Neutral × 1928	-0.0000509	0.0000246
Allied × 1929	-0.0000530	0.0000162	Neutral × 1929	0.0000482	0.0000408
Allied × 1930	-0.0000672	0.0000151	Neutral × 1930	-0.0000705	0.0000185
Rest interacted with years			YES		
Paper FE			YES		
Observations			16,620		
Number of papers			4,155		

Notes: The Table reports the estimation results from regression (3) using "citation levels" as dependent variable. The omitted category (i.e., the "0" taken as reference) is the citation share with respect to papers published by the home camp. Standard errors are clustered at the paper level.

Table A.7:
Relative Citation Levels of Allied Papers – Parameter Estimates for Figure 7

	Param. Est.	*Std. Err.*		*Param. Est.*	*Std. Err.*
Central × 1905	-0.0000547	0.0000158	Neutral × 1905	-0.0000256	0.0000259
Central × 1906	-0.0000568	0.0000140	Neutral × 1906	-0.0000525	0.0000203
Central × 1907	-0.0000519	0.0000112	Neutral × 1907	-0.0000586	0.0000130
Central × 1908	-0.0000544	0.0000145	Neutral × 1908	-0.0000804	0.0000134
Central × 1909	-0.0000884	0.0000177	Neutral × 1909	-0.0001178	0.0000148
Central × 1910	-0.0000547	0.0000115	Neutral × 1910	-0.0000628	0.0000142
Central × 1911	-0.0001009	0.0000150	Neutral × 1911	-0.0001172	0.0000143
Central × 1912	-0.0000632	0.0000093	Neutral × 1912	-0.0000422	0.0000193
Central × 1913	-0.0000790	0.0000184	Neutral × 1913	-0.0000772	0.0000179
Central × 1914	-0.0000836	0.0000109	Neutral × 1914	-0.0000769	0.0000183
Central × 1915	-0.0001034	0.0000109	Neutral × 1915	-0.0000764	0.0000198
Central × 1916	-0.0001063	0.0000107	Neutral × 1916	-0.0001162	0.0000108
Central × 1917	-0.0000903	0.0000102	Neutral × 1917	-0.0000537	0.0000239
Central × 1918	-0.0001090	0.0000142	Neutral × 1918	-0.0000999	0.0000166
Central × 1919	-0.0001242	0.0000151	Neutral × 1919	-0.0001037	0.0000188
Central × 1920	-0.0001283	0.0000156	Neutral × 1920	-0.0001217	0.0000177
Central × 1921	-0.0001448	0.0000229	Neutral × 1921	-0.0001238	0.0000297
Central × 1922	-0.0000910	0.0000092	Neutral × 1922	-0.0000546	0.0000218
Central × 1923	-0.0000807	0.0000125	Neutral × 1923	-0.0000703	0.0000162
Central × 1924	-0.0000598	0.0000116	Neutral × 1924	-0.0000512	0.0000140
Central × 1925	-0.0000574	0.0000075	Neutral × 1925	-0.0000540	0.0000112
Central × 1926	-0.0000618	0.0000091	Neutral × 1926	-0.0000615	0.0000100
Central × 1927	-0.0000495	0.0000068	Neutral × 1927	-0.0000548	0.0000083
Central × 1928	-0.0000521	0.0000062	Neutral × 1928	-0.0000303	0.0000102
Central × 1929	-0.0000640	0.0000122	Neutral × 1929	-0.0000658	0.0000103
Central × 1930	-0.0000439	0.0000063	Neutral × 1930	-0.0000358	0.0000088
Rest interacted with years			YES		
Paper FE			YES		
Observations			31,112		
Number of papers			7,778		

Notes: The Table reports the estimation results from regression (3) using "citation levels" as dependent variable. The omitted category (i.e., the "0" taken as reference) is the citation share with respect to papers published by the home camp. Standard errors are clustered at the paper level.

Table A.8:
Relative Citation Levels of Neutral Papers – Parameter Estimates for Figure 8

	Param. Est.	*Std. Err.*		*Param. Est.*	*Std. Err.*
Allied × 1905	-0.0000688	0.0000559	Central × 1905	0.0000080	0.0000626
Allied × 1906	-0.0001663	0.0000800	Central × 1906	-0.0000863	0.0000872
Allied × 1907	-0.0002113	0.0000942	Central × 1907	-0.0001551	0.0000990
Allied × 1908	-0.0001296	0.0000741	Central × 1908	-0.0000723	0.0000709
Allied × 1909	-0.0000372	0.0000459	Central × 1909	0.0000715	0.0000472
Allied × 1910	-0.0000761	0.0000560	Central × 1910	-0.0000169	0.0000623
Allied × 1911	-0.0000157	0.0000367	Central × 1911	0.0001075	0.0000513
Allied × 1912	-0.0000052	0.0000395	Central × 1912	0.0001066	0.0000551
Allied × 1913	-0.0000976	0.0000816	Central × 1913	-0.0001263	0.0000798
Allied × 1914	-0.0001206	0.0000667	Central × 1914	-0.0000808	0.0000665
Allied × 1915	-0.0003159	0.0001297	Central × 1915	-0.0002854	0.0001317
Allied × 1916	-0.0000763	0.0000661	Central × 1916	-0.0000577	0.0000714
Allied × 1917	-0.0003275	0.0001794	Central × 1917	-0.0002908	0.0001535
Allied × 1918	-0.0002815	0.0001448	Central × 1918	-0.0002081	0.0001471
Allied × 1919	-0.0001504	0.0001079	Central × 1919	-0.0000023	0.0001359
Allied × 1920	-0.0000552	0.0001007	Central × 1920	0.0000183	0.0001181
Allied × 1921	-0.0005398	0.0001493	Central × 1921	-0.0004387	0.0001680
Allied × 1922	-0.0003281	0.0001006	Central × 1922	-0.0002616	0.0001066
Allied × 1923	-0.0001935	0.0000715	Central × 1923	-0.0000504	0.0000796
Allied × 1924	0.0000006	0.0000233	Central × 1924	0.0000555	0.0000343
Allied × 1925	-0.0000246	0.0000323	Central × 1925	0.0000724	0.0000641
Allied × 1926	-0.0000279	0.0000451	Central × 1926	0.0000259	0.0000479
Allied × 1927	-0.0000406	0.0000611	Central × 1927	-0.0000097	0.0000596
Allied × 1928	-0.0000306	0.0000495	Central × 1928	0.0000659	0.0000517
Allied × 1929	-0.0000597	0.0000360	Central × 1929	0.0000329	0.0000386
Allied × 1930	-0.0000676	0.0000328	Central × 1930	0.0000850	0.0000632
Rest interacted with years			YES		
Paper FE			YES		
Observations			4,220		
Number of papers			1,055		

Notes: The Table reports the estimation results from regression (3) using "citation levels" as dependent variable. The omitted category (i.e., the "0" taken as reference) is the citation share with respect to papers published by the home camp. Standard errors are clustered at the paper level.

Table A.9:
Relative Citation Shares of Central Papers – Parameter Estimates for Figure A.2 (Address + Scientist Data)

	Param. Est.	*Std. Err.*		*Param. Est.*	*Std. Err.*
Allied × 1905	-0.0000962	0.0000076	Neutral × 1905	-0.0000163	0.0000195
Allied × 1906	-0.0001008	0.0000078	Neutral × 1906	-0.0000587	0.0000171
Allied × 1907	-0.0000855	0.0000070	Neutral × 1907	-0.0000507	0.0000140
Allied × 1908	-0.0001045	0.0000057	Neutral × 1908	-0.0000738	0.0000117
Allied × 1909	-0.0000834	0.0000062	Neutral × 1909	-0.0000502	0.0000127
Allied × 1910	-0.0000753	0.0000061	Neutral × 1910	-0.0000152	0.0000146
Allied × 1911	-0.0000689	0.0000075	Neutral × 1911	-0.0000391	0.0000143
Allied × 1912	-0.0000581	0.0000073	Neutral × 1912	-0.0000221	0.0000151
Allied × 1913	-0.0000618	0.0000063	Neutral × 1913	-0.0000451	0.0000107
Allied × 1914	-0.0000506	0.0000079	Neutral × 1914	-0.0000235	0.0000148
Allied × 1915	-0.0000659	0.0000123	Neutral × 1915	-0.0000295	0.0000258
Allied × 1916	-0.0000702	0.0000114	Neutral × 1916	0.0000011	0.0000260
Allied × 1917	-0.0001016	0.0000164	Neutral × 1917	-0.0000278	0.0000356
Allied × 1918	-0.0001389	0.0000191	Neutral × 1918	-0.0000549	0.0000387
Allied × 1919	-0.0001671	0.0000232	Neutral × 1919	-0.0000583	0.0000447
Allied × 1920	-0.0001738	0.0000198	Neutral × 1920	-0.0000905	0.0000372
Allied × 1921	-0.0001461	0.0000133	Neutral × 1921	-0.0000637	0.0000259
Allied × 1922	-0.0001227	0.0000114	Neutral × 1922	-0.0000565	0.0000215
Allied × 1923	-0.0001126	0.0000093	Neutral × 1923	-0.0000692	0.0000167
Allied × 1924	-0.0000905	0.0000069	Neutral × 1924	-0.0000484	0.0000129
Allied × 1925	-0.0000725	0.0000062	Neutral × 1925	-0.0000382	0.0000109
Allied × 1926	-0.0000733	0.0000058	Neutral × 1926	-0.0000278	0.0000116
Allied × 1927	-0.0000661	0.0000057	Neutral × 1927	-0.0000520	0.0000086
Allied × 1928	-0.0000605	0.0000054	Neutral × 1928	-0.0000295	0.0000097
Allied × 1929	-0.0000427	0.0000056	Neutral × 1929	-0.0000124	0.0000101
Allied × 1930	-0.0000591	0.0000054	Neutral × 1930	-0.0000380	0.0000090
Rest interacted with years			YES		
Paper FE			YES		
Observations			20,804		
Number of papers			5,201		

Notes: The Table reports the estimation results from regression (3) using "citation shares" as dependent variable. Countries are assigned to papers and to their references on the basis of both the address information reported in the publication data (i.e., Web of Science) and the scientist data (i.e., Minerva). The omitted category (i.e., the "0" taken as reference) is the citation share with respect to papers published by the home camp. Standard errors are clustered at the paper level.

Table A.10:
Relative Citation Shares of Allied Papers – Parameter Estimates for Figure A.3 (Address + Scientist Data)

	Param. Est.	*Std. Err.*		*Param. Est.*	*Std. Err.*
Central × 1905	-0.0000603	0.0000068	Neutral × 1905	-0.0000544	0.0000117
Central × 1906	-0.0000613	0.0000056	Neutral × 1906	-0.0000717	0.0000064
Central × 1907	-0.0000649	0.0000043	Neutral × 1907	-0.0000731	0.0000053
Central × 1908	-0.0000564	0.0000044	Neutral × 1908	-0.0000654	0.0000044
Central × 1909	-0.0000549	0.0000039	Neutral × 1909	-0.0000641	0.0000044
Central × 1910	-0.0000429	0.0000039	Neutral × 1910	-0.0000457	0.0000058
Central × 1911	-0.0000558	0.0000028	Neutral × 1911	-0.0000599	0.0000036
Central × 1912	-0.0000495	0.0000027	Neutral × 1912	-0.0000486	0.0000044
Central × 1913	-0.0000553	0.0000019	Neutral × 1913	-0.0000502	0.0000036
Central × 1914	-0.0000487	0.0000020	Neutral × 1914	-0.0000493	0.0000030
Central × 1915	-0.0000492	0.0000020	Neutral × 1915	-0.0000421	0.0000042
Central × 1916	-0.0000525	0.0000014	Neutral × 1916	-0.0000506	0.0000022
Central × 1917	-0.0000538	0.0000014	Neutral × 1917	-0.0000459	0.0000032
Central × 1918	-0.0000602	0.0000009	Neutral × 1918	-0.0000559	0.0000023
Central × 1919	-0.0000616	0.0000009	Neutral × 1919	-0.0000553	0.0000027
Central × 1920	-0.0000558	0.0000015	Neutral × 1920	-0.0000527	0.0000026
Central × 1921	-0.0000539	0.0000014	Neutral × 1921	-0.0000437	0.0000031
Central × 1922	-0.0000496	0.0000013	Neutral × 1922	-0.0000410	0.0000029
Central × 1923	-0.0000457	0.0000010	Neutral × 1923	-0.0000368	0.0000024
Central × 1924	-0.0000385	0.0000010	Neutral × 1924	-0.0000305	0.0000020
Central × 1925	-0.0000347	0.0000009	Neutral × 1925	-0.0000292	0.0000016
Central × 1926	-0.0000310	0.0000008	Neutral × 1926	-0.0000241	0.0000016
Central × 1927	-0.0000297	0.0000007	Neutral × 1927	-0.0000209	0.0000015
Central × 1928	-0.0000255	0.0000007	Neutral × 1928	-0.0000165	0.0000015
Central × 1929	-0.0000232	0.0000007	Neutral × 1929	-0.0000186	0.0000013
Central × 1930	-0.0000215	0.0000006	Neutral × 1930	-0.0000170	0.0000012
Rest interacted with years			YES		
Paper FE			YES		
Observations			110,316		
Number of papers			27,579		

Notes: The Table reports the estimation results from regression (3) using "citation shares" as dependent variable. Countries are assigned to papers and to their references on the basis of both the address information reported in the publication data (i.e., Web of Science) and the scientist data (i.e., Minerva). The omitted category (i.e., the "0" taken as reference) is the citation share with respect to papers published by the home camp. Standard errors are clustered at the paper level.

Table A.11:
Relative Citation Shares of Neutral Papers – Parameter Estimates for Figure A.4 (Address + Scientist Data)

	Param. Est.	*Std. Err.*		*Param. Est.*	*Std. Err.*
Allied × 1905	-0.0000992	0.0000501	Central × 1905	-0.0000358	0.0000553
Allied × 1906	-0.0001553	0.0000519	Central × 1906	-0.0000848	0.0000593
Allied × 1907	-0.0000827	0.0000423	Central × 1907	-0.0000594	0.0000444
Allied × 1908	-0.0001060	0.0000447	Central × 1908	-0.0000515	0.0000486
Allied × 1909	-0.0000747	0.0000315	Central × 1909	-0.0000054	0.0000355
Allied × 1910	-0.0000642	0.0000337	Central × 1910	-0.0000255	0.0000363
Allied × 1911	-0.0000031	0.0000212	Central × 1911	0.0000602	0.0000247
Allied × 1912	0.0000150	0.0000111	Central × 1912	0.0000674	0.0000172
Allied × 1913	-0.0000938	0.0000331	Central × 1913	-0.0000823	0.0000334
Allied × 1914	-0.0001402	0.0000372	Central × 1914	-0.0001152	0.0000398
Allied × 1915	-0.0001575	0.0000537	Central × 1915	-0.0001218	0.0000585
Allied × 1916	-0.0001129	0.0000446	Central × 1916	-0.0001006	0.0000461
Allied × 1917	-0.0000815	0.0000445	Central × 1917	-0.0000806	0.0000448
Allied × 1918	-0.0001710	0.0000569	Central × 1918	-0.0001115	0.0000650
Allied × 1919	-0.0000849	0.0000575	Central × 1919	-0.0000175	0.0000698
Allied × 1920	-0.0000790	0.0000375	Central × 1920	-0.0000342	0.0000456
Allied × 1921	-0.0001781	0.0000467	Central × 1921	-0.0001402	0.0000525
Allied × 1922	-0.0001723	0.0000382	Central × 1922	-0.0001152	0.0000437
Allied × 1923	-0.0001389	0.0000306	Central × 1923	-0.0001000	0.0000345
Allied × 1924	-0.0000692	0.0000197	Central × 1924	-0.0000567	0.0000210
Allied × 1925	-0.0000465	0.0000149	Central × 1925	-0.0000282	0.0000165
Allied × 1926	-0.0000837	0.0000165	Central × 1926	-0.0000682	0.0000181
Allied × 1927	-0.0000582	0.0000155	Central × 1927	-0.0000361	0.0000176
Allied × 1928	-0.0000626	0.0000146	Central × 1928	-0.0000424	0.0000164
Allied × 1929	-0.0000652	0.0000138	Central × 1929	-0.0000456	0.0000157
Allied × 1930	-0.0000757	0.0000146	Central × 1930	-0.0000590	0.0000161
Rest interacted with years			YES		
Paper FE			YES		
Observations			6,972		
Number of papers			1,743		

Notes: The Table reports the estimation results from regression (3) using "citation shares" as dependent variable. Countries are assigned to papers and to their references on the basis of both the address information reported in the publication data (i.e., Web of Science) and the scientist data (i.e., Minerva). The omitted category (i.e., the "0" taken as reference) is the citation share with respect to papers published by the home camp. Standard errors are clustered at the paper level.

Table A.12:
Relative Central Citation Shares w.r.t. Pre–WWI Papers: Parameter Estimates for Figure 9

	Param. Est.	*Std. Err.*		*Param. Est.*	*Std. Err.*
Allied × 1905	-0.0000880	0.0000082	Neutral × 1905	-0.0000071	0.0000211
Allied × 1906	-0.0000734	0.0000071	Neutral × 1906	-0.0000136	0.0000174
Allied × 1907	-0.0000611	0.0000054	Neutral × 1907	-0.0000086	0.0000135
Allied × 1908	-0.0000710	0.0000041	Neutral × 1908	-0.0000421	0.0000091
Allied × 1909	-0.0000498	0.0000041	Neutral × 1909	-0.0000213	0.0000089
Allied × 1910	-0.0000453	0.0000035	Neutral × 1910	-0.0000074	0.0000086
Allied × 1911	-0.0000359	0.0000041	Neutral × 1911	-0.0000290	0.0000064
Allied × 1912	-0.0000277	0.0000036	Neutral × 1912	-0.0000069	0.0000077
Allied × 1913	-0.0000287	0.0000030	Neutral × 1913	-0.0000128	0.0000060
Allied × 1914	-0.0000207	0.0000039	Neutral × 1914	-0.0000119	0.0000066
Allied × 1915	-0.0000147	0.0000057	Neutral × 1915	-0.0000054	0.0000105
Allied × 1916	-0.0000229	0.0000049	Neutral × 1916	0.0000079	0.0000115
Allied × 1917	-0.0000268	0.0000061	Neutral × 1917	0.0000014	0.0000137
Allied × 1918	-0.0000408	0.0000051	Neutral × 1918	-0.0000171	0.0000134
Allied × 1919	-0.0000218	0.0000065	Neutral × 1919	-0.0000062	0.0000131
Allied × 1920	-0.0000226	0.0000059	Neutral × 1920	-0.0000086	0.0000112
Allied × 1921	-0.0000243	0.0000048	Neutral × 1921	-0.0000047	0.0000095
Allied × 1922	-0.0000307	0.0000046	Neutral × 1922	-0.0000048	0.0000107
Allied × 1923	-0.0000234	0.0000051	Neutral × 1923	-0.0000166	0.0000085
Allied × 1924	-0.0000210	0.0000050	Neutral × 1924	-0.0000188	0.0000082
Allied × 1925	-0.0000340	0.0000057	Neutral × 1925	-0.0000115	0.0000132
Allied × 1926	-0.0000119	0.0000050	Neutral × 1926	0.0000034	0.0000099
Allied × 1927	-0.0000161	0.0000063	Neutral × 1927	-0.0000133	0.0000087
Allied × 1928	-0.0000158	0.0000058	Neutral × 1928	-0.0000049	0.0000109
Allied × 1929	-0.0000197	0.0000052	Neutral × 1929	0.0000036	0.0000117
Allied × 1930	-0.0000152	0.0000061	Neutral × 1930	0.0000094	0.0000134
Rest interacted with years			YES		
Paper FE			YES		
Observations			13,672		
Number of papers			3,418		

Notes: The Table reports the estimation results from regression (3) using "citation shares" as dependent variable. Citation shares are computed only with respect to cited papers that were published between 1900 and 1913. The omitted category (i.e., the "0" taken as reference) is the citation share with respect to papers published by the home camp. Standard errors are clustered at the paper level.

Table A.13:
Relative Allied Citation Shares w.r.t. Pre–WWI Papers: Parameter Estimates for Figure 10

	Param. Est.	*Std. Err.*		*Param. Est.*	*Std. Err.*
Central × 1905	-0.0000472	0.0000123	Neutral × 1905	-0.0000291	0.0000221
Central × 1906	-0.0000435	0.0000099	Neutral × 1906	-0.0000495	0.0000133
Central × 1907	-0.0000337	0.0000076	Neutral × 1907	-0.0000262	0.0000131
Central × 1908	-0.0000231	0.0000065	Neutral × 1908	-0.0000344	0.0000084
Central × 1909	-0.0000396	0.0000044	Neutral × 1909	-0.0000513	0.0000038
Central × 1910	-0.0000217	0.0000044	Neutral × 1910	-0.0000300	0.0000052
Central × 1911	-0.0000319	0.0000034	Neutral × 1911	-0.0000404	0.0000025
Central × 1912	-0.0000250	0.0000030	Neutral × 1912	-0.0000143	0.0000063
Central × 1913	-0.0000211	0.0000029	Neutral × 1913	-0.0000228	0.0000040
Central × 1914	-0.0000262	0.0000026	Neutral × 1914	-0.0000284	0.0000033
Central × 1915	-0.0000262	0.0000025	Neutral × 1915	-0.0000244	0.0000040
Central × 1916	-0.0000248	0.0000027	Neutral × 1916	-0.0000290	0.0000036
Central × 1917	-0.0000211	0.0000031	Neutral × 1917	-0.0000236	0.0000045
Central × 1918	-0.0000298	0.0000031	Neutral × 1918	-0.0000316	0.0000042
Central × 1919	-0.0000322	0.0000029	Neutral × 1919	-0.0000301	0.0000044
Central × 1920	-0.0000255	0.0000033	Neutral × 1920	-0.0000167	0.0000065
Central × 1921	-0.0000319	0.0000024	Neutral × 1921	-0.0000281	0.0000046
Central × 1922	-0.0000217	0.0000035	Neutral × 1922	-0.0000263	0.0000042
Central × 1923	-0.0000197	0.0000038	Neutral × 1923	-0.0000245	0.0000042
Central × 1924	-0.0000209	0.0000034	Neutral × 1924	-0.0000157	0.0000065
Central × 1925	-0.0000280	0.0000032	Neutral × 1925	-0.0000271	0.0000046
Central × 1926	-0.0000146	0.0000043	Neutral × 1926	-0.0000127	0.0000069
Central × 1927	-0.0000176	0.0000038	Neutral × 1927	-0.0000152	0.0000065
Central × 1928	-0.0000131	0.0000043	Neutral × 1928	-0.0000091	0.0000076
Central × 1929	-0.0000235	0.0000035	Neutral × 1929	-0.0000114	0.0000079
Central × 1930	-0.0000141	0.0000042	Neutral × 1930	-0.0000146	0.0000060
Rest interacted with years			YES		
Paper FE			YES		
Observations			15,044		
Number of papers			3,761		

Notes: The Table reports the estimation results from regression (3) using "citation shares" as dependent variable. Citation shares are computed only with respect to cited papers that were published between 1900 and 1913. The omitted category (i.e., the "0" taken as reference) is the citation share with respect to papers published by the home camp. Standard errors are clustered at the paper level.

Table A.14:
Relative Neutral Citation Shares w.r.t. Pre–WWI Papers: Parameter Estimates for Figure 11

	Param. Est.	*Std. Err.*		*Param. Est.*	*Std. Err.*
Allied × 1905	-0.0000796	0.0000511	Central × 1905	-0.0000207	0.0000561
Allied × 1906	-0.0001685	0.0000517	Central × 1906	-0.0001074	0.0000611
Allied × 1907	-0.0001096	0.0000386	Central × 1907	-0.0000750	0.0000421
Allied × 1908	-0.0000641	0.0000305	Central × 1908	-0.0000388	0.0000317
Allied × 1909	-0.0000328	0.0000172	Central × 1909	0.0000099	0.0000191
Allied × 1910	-0.0000368	0.0000192	Central × 1910	-0.0000069	0.0000209
Allied × 1911	-0.0000028	0.0000130	Central × 1911	0.0000187	0.0000133
Allied × 1912	-0.0000065	0.0000130	Central × 1912	0.0000220	0.0000149
Allied × 1913	-0.0000481	0.0000190	Central × 1913	-0.0000470	0.0000191
Allied × 1914	-0.0000558	0.0000213	Central × 1914	-0.0000492	0.0000214
Allied × 1915	-0.0000684	0.0000222	Central × 1915	-0.0000498	0.0000239
Allied × 1916	0.0000049	0.0000135	Central × 1916	-0.0000024	0.0000133
Allied × 1917	-0.0000480	0.0000235	Central × 1917	-0.0000289	0.0000255
Allied × 1918	-0.0000384	0.0000244	Central × 1918	-0.0000355	0.0000254
Allied × 1919	-0.0000126	0.0000196	Central × 1919	0.0000165	0.0000226
Allied × 1920	-0.0000068	0.0000178	Central × 1920	0.0000058	0.0000192
Allied × 1921	-0.0000387	0.0000202	Central × 1921	-0.0000039	0.0000233
Allied × 1922	-0.0000186	0.0000244	Central × 1922	0.0000044	0.0000270
Allied × 1923	-0.0000404	0.0000208	Central × 1923	-0.0000215	0.0000227
Allied × 1924	-0.0000382	0.0000253	Central × 1924	-0.0000308	0.0000264
Allied × 1925	-0.0000397	0.0000241	Central × 1925	-0.0000420	0.0000241
Allied × 1926	-0.0000336	0.0000252	Central × 1926	-0.0000252	0.0000251
Allied × 1927	-0.0000001	0.0000176	Central × 1927	0.0000063	0.0000180
Allied × 1928	-0.0000243	0.0000220	Central × 1928	-0.0000109	0.0000236
Allied × 1929	-0.0000236	0.0000281	Central × 1929	-0.0000044	0.0000313
Allied × 1930	-0.0000704	0.0000350	Central × 1930	-0.0000516	0.0000380
Rest interacted with years			YES		
Paper FE			YES		
Observations			3,012		
Number of papers			753		

Notes: The Table reports the estimation results from regression (3) using "citation shares" as dependent variable. Citation shares are computed only with respect to cited papers that were published between 1900 and 1913. The omitted category (i.e., the "0" taken as reference) is the citation share with respect to papers published by the home camp. Standard errors are clustered at the paper level.