ONLINE APPENDIX: FRONTIER KNOWLEDGE AND SCIENTIFIC PRODUCTION: EVIDENCE FROM THE COLLAPSE OF INTERNATIONAL SCIENCE

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Carlo Schwarz
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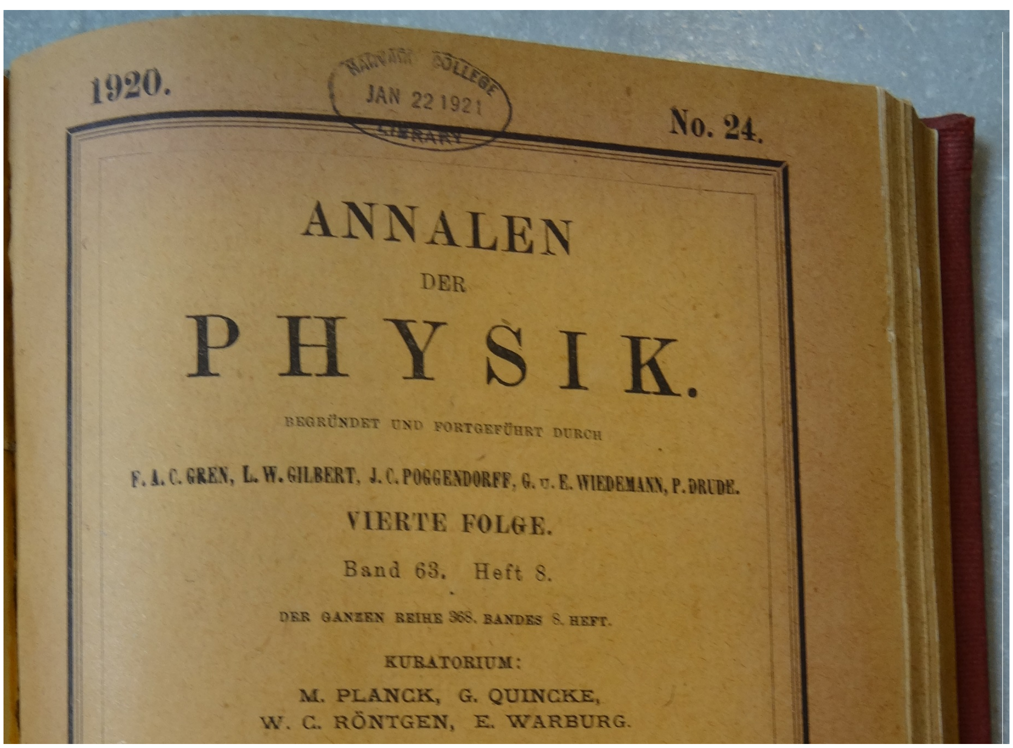
A Appendix Tables and Figures

A.1. Appendix Figures

Figure A.1:
Example of Entry Stamp from Harvard Library



Notes: The stamp at the top of the page indicates the arrival date of this issue of the *Annalen der Physik* at the Harvard library.

Figure A.2:
SAMPLE PAGE OF MINERVA

Cambridge (Massachusetts, Ver. St. A.).

HARVARD UNIVERSITY (1636).

Geschichte, Verfassung, Organisation, Aufnahme, Grade, Gebühren:.

JAHRESHAUSHALT. Vermögen nach d. Ausweis von 1912: $ 25752720.39. Privatschenkungen 1912: $ 932409.21 nebst $ 771772.20 zum sofortigen Gebrauch. Gesamteinnahmen einschliessl. »gifts for immediate use« (1911/12): $ 2930752.89, Gesamtausgaben $ 2503658.03, Ausgaben für Unterrichtszwecke (Gehälter, usw.) $ 1292344.28; Stipendien u. Preise, usw. $ 192001.81.

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.*

Notes: A sample page from *Minerva - Handbuch der Gelehrten Welt* (see section III. for details).

Figure A.3:
THE WORLD OF SCIENCE IN 1914

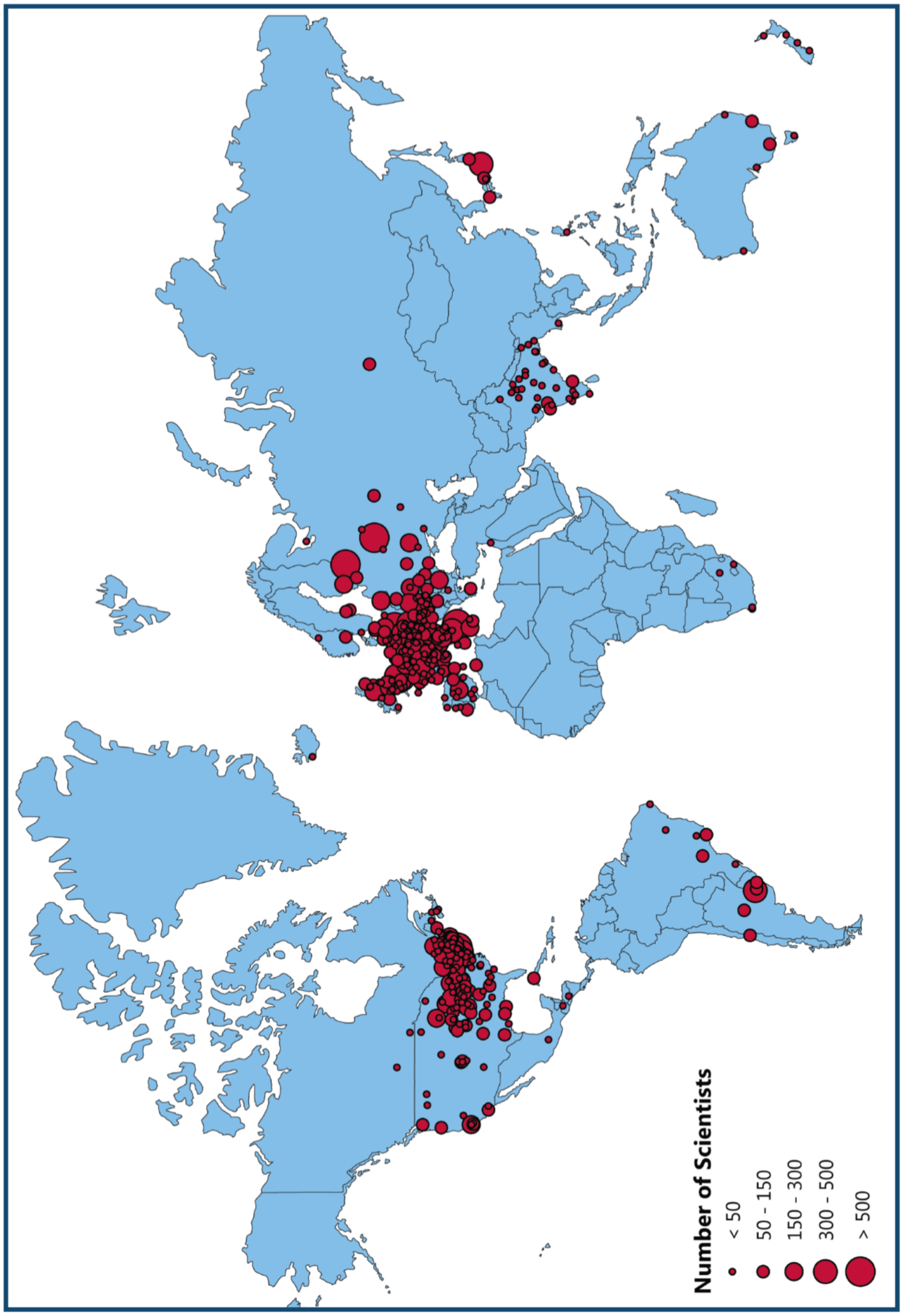
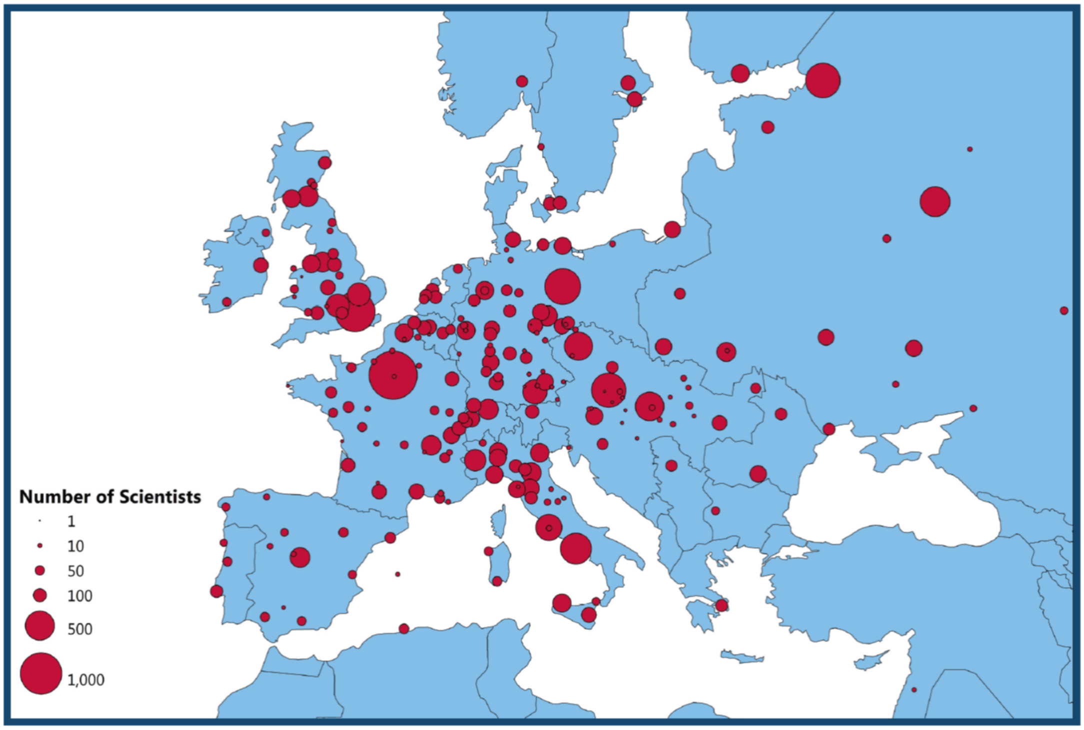
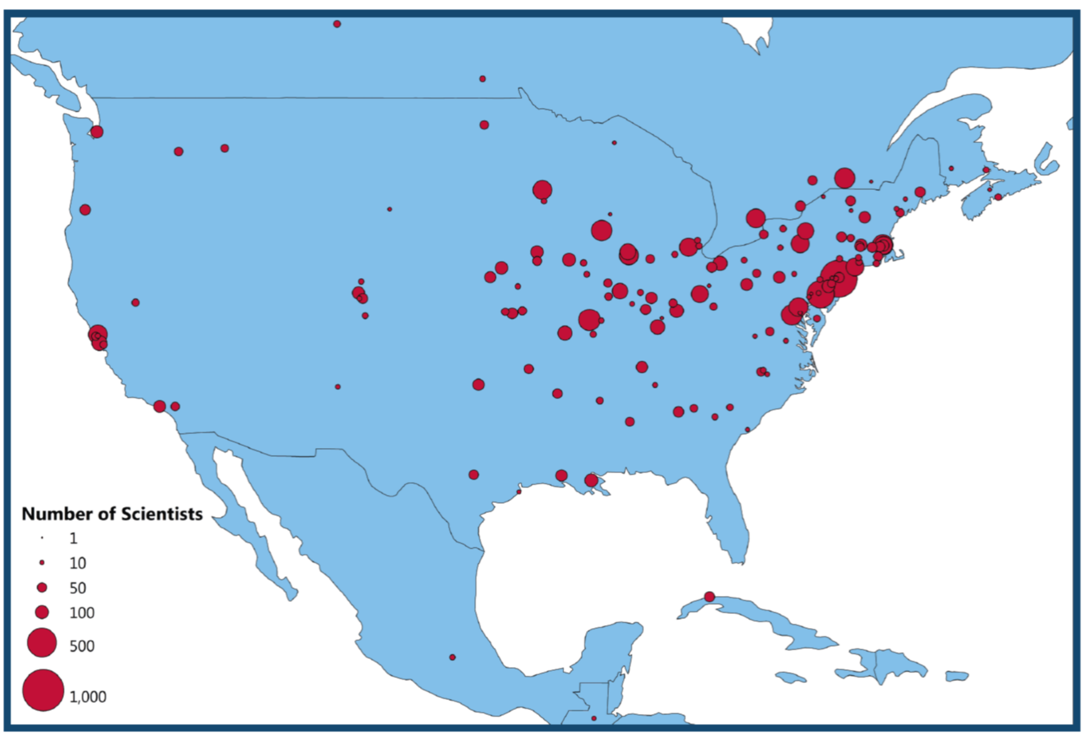


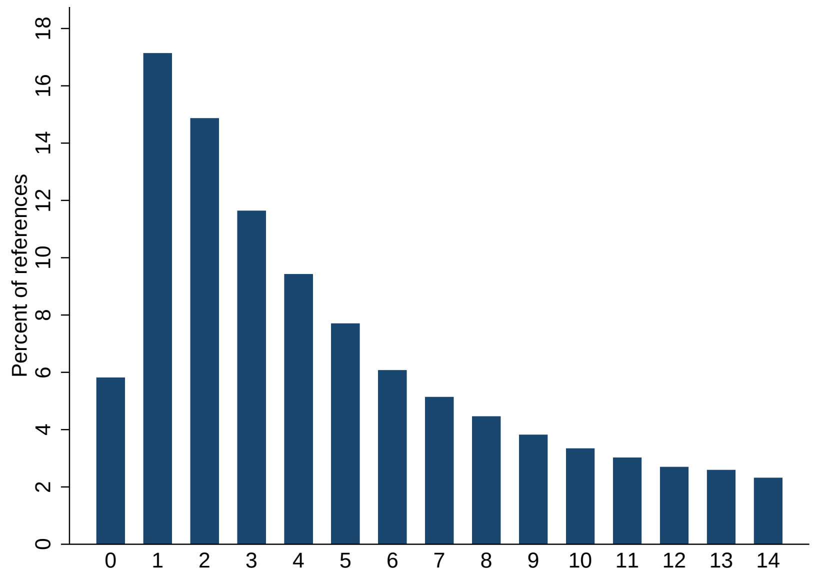
Figure A.4:
THE WORLD OF SCIENCE IN 1914





Notes: The map shows the total number of professors in all fields by city in 1914. Dot sizes are proportional to the number of professors. The scientist census data were collected by the authors from *Minerva - Handbuch der Gelehrten Welt* (see section III. for details).

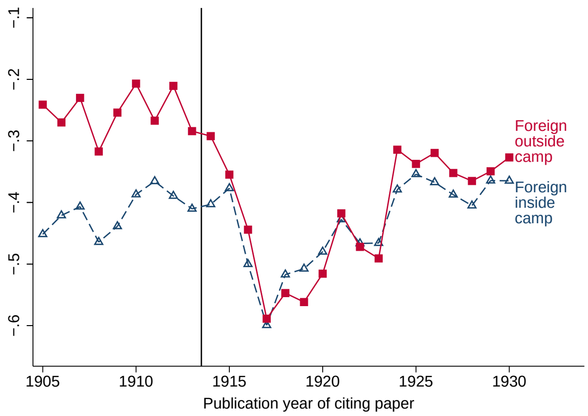
Figure A.5:
DISTRIBUTION OF REFERENCE AGE



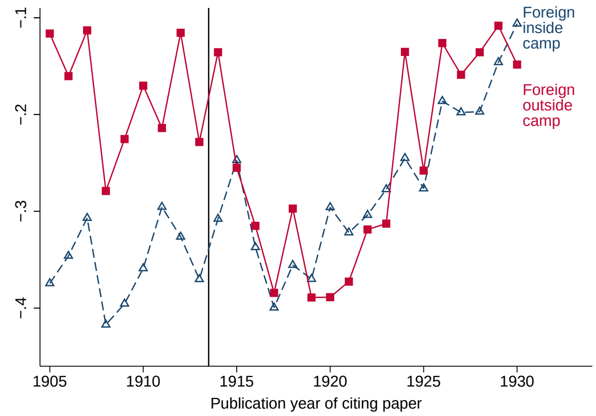
Notes: The Figure plots the percent of references that were published *X* years (*X* is plotted on the horizontal axis) before the citing paper. For example, 6% percent of references were published the same year as the citing paper and 17% of references were published one year before the citing paper. The distribution of reference age is computed for all citing papers published in our 160 top journals between 1905 and 1930. Only references that were published at most 14-years before the citing paper are considered for this calculation. The publication and citation data are from *ISI - Web of Science* (see section III. for details).

Figure A.6:
International Citation Shares Relative to Home: Robustness Checks

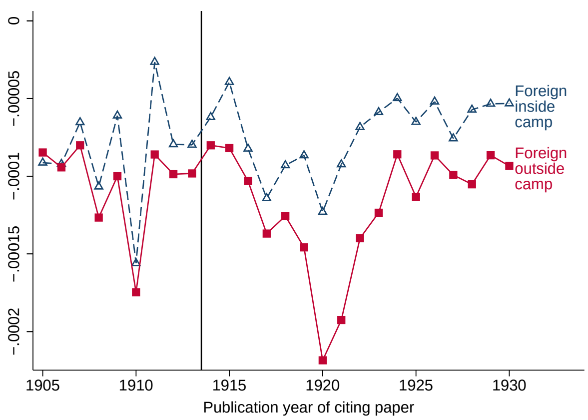
(a) Citing Scientists with University Position by 1914



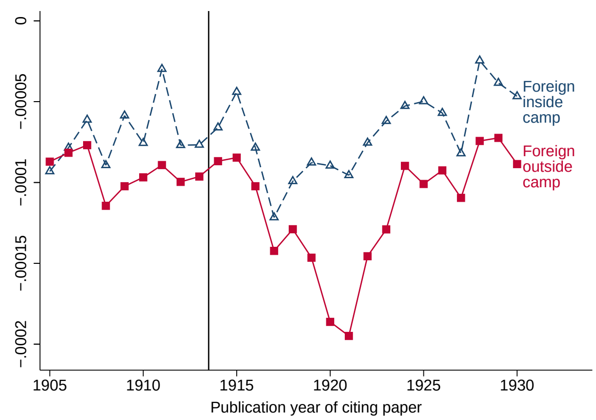
(b) Citing and Cited Scientists with University Position by 1914



(c) Citing and Cited Authors with University Position by 1914 and Normalize Shares



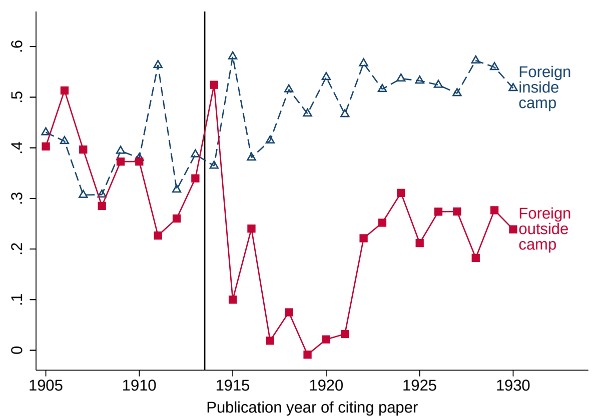
(d) Additionally Restrict Sample to Six Countries with Largest Scientific Output



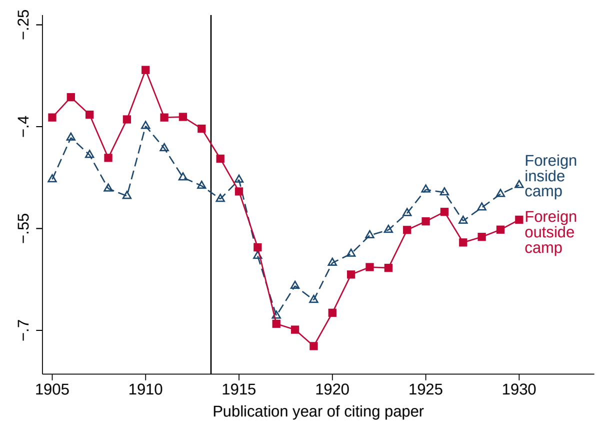
Notes: Panel (a) plots parameter estimates of regression (2) for citing authors with a university position by 1914. Panel (b) plots parameter estimates for citing scientists with a university position by 1914 and only considers citations to research published by scientists with a university position by 1914. In addition to the previous restrictions, panel (c) plots parameter estimates for a regression with normalized citation shares as the dependent variable. We normalize citation shares by the number of potentially citeable papers in each camp. Panel (d) plots parameter estimates where we further restrict the sample of citing and cited scientists to those from the six largest scientific countries in our data (USA, Germany, UK, Canada, Austria, and Hungary). In all panels, the "Foreign outside camp" line reports point estimates (ω_τ) that measure citation shares to research from outside the camp, relative to research from home. The "Foreign inside camp" line reports point estimates (ι_τ) that measure citation shares to research from foreign scientists inside the camp, relative to research from home. In all panels, we count citations to recent research, i.e. research published in the preceding five years. For example, the first dot (1905) measures relative citation shares to research published between 1901 and 1905, and so on. The data were collected by the authors and combine scientist census data from *Minerva - Handbuch der Gelehrten Welt* and publication and citation data from *ISI - Web of Science* (see section III. for details).

Figure A.7:
International Citation Shares Relative to Home: Additional Robustness Checks

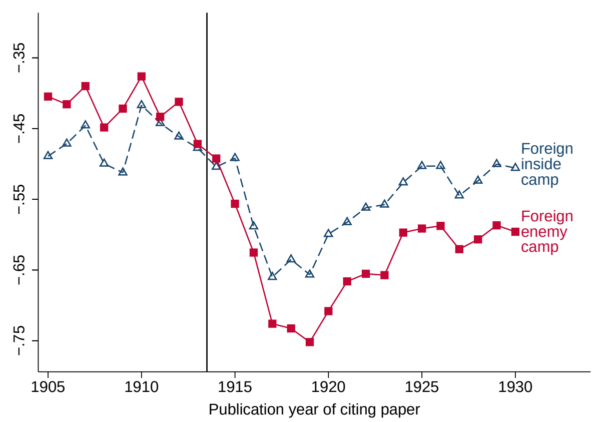
(a) Excluding U.S., German, and British Citing Papers



(b) Excluding Chemistry Citing Papers



(c) Relative Citation Shares to Enemy papers

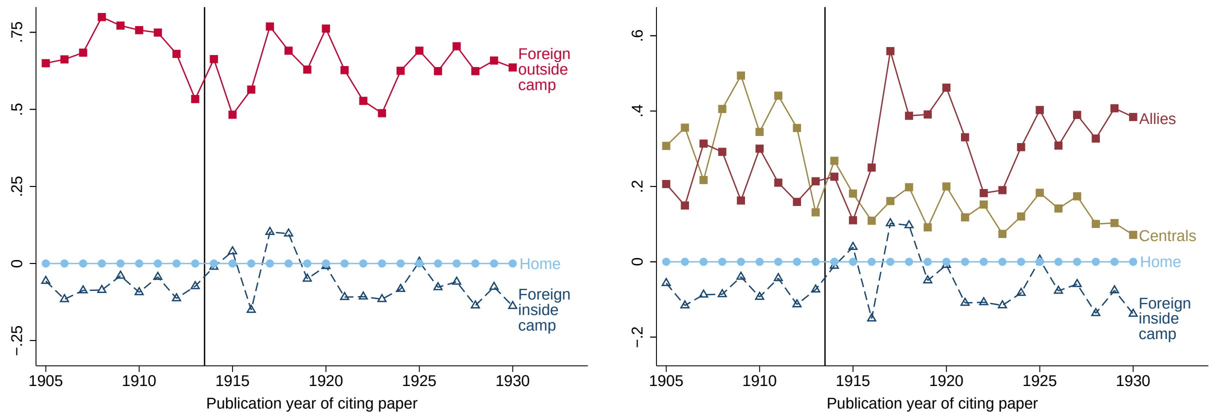


Notes: Panel (a) plots parameter estimates of regression (2), for a sample of papers published by scientists in smaller Allied or Central countries, i.e. scientists outside of the United States, Germany, and Britain. The "Foreign outside camp" line reports point estimates (ω_τ) that measure citation shares to research from outside the camp, relative to research from home. The "Foreign inside camp" line reports point estimates (ι_τ) that measure citation shares to research published by foreign scientists inside the camp, relative to research published at home. Panel (b) plots parameter estimates of regression (2), for a sample of papers that excludes papers published in chemistry journals. Panel (c) plots parameter estimates of a version of regression (2) in which the citation shares to research by scientists from outside the camp are further split into the share citing research from enemy countries and into the share citing research from other foreign countries (results not reported in the figure). In all panels, we focus on citations to recent research, i.e. research published in the preceding five years. For example, the first dot (1905) measures relative citation shares to research published between 1901 and 1905. The second dot (1906) measures relative citation shares to research published between 1902 and 1906, and so on. The data were collected by the authors and combine scientist census data from *Minerva - Handbuch der Gelehrten Welt* and publication and citation data from *ISI - Web of Science* (see section III. for details).

Figure A.8:
International Citation Shares Relative to Home: Neutral Scientists

(a) Relative Reliance on Foreign Work

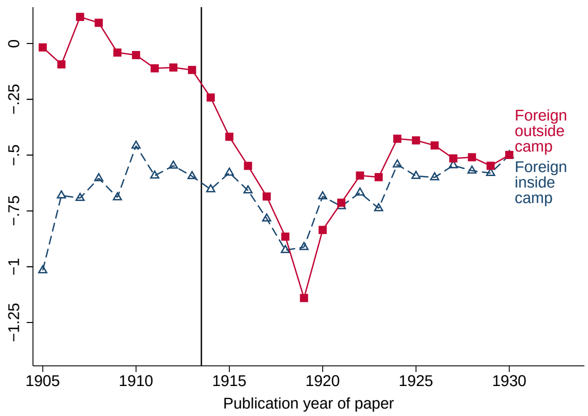
(b) Relative Reliance on Allied and Central Work



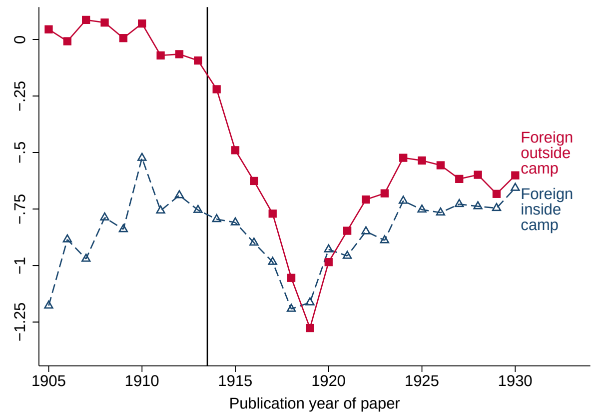
Notes: Each panel plots one set of parameter estimates of regression (2) for Neutral citing papers. In panel (a), the "Foreign outside camp" line reports point estimates (ω_τ) that measure citation shares to research from outside the Neutral camp, relative to research from home. The "Foreign inside camp" line reports point estimates (ι_τ) that measure citation shares to research from foreign scientists inside the Neutral camp, relative to research from home. In panel (b), the "Allies" line reports point estimates that measure citation shares to Allied research, relative to research from home. The "Centrals" line reports point estimates that measure citation shares to Central research, relative to research from home. The "Foreign inside camp" line reports point estimates that measure citation shares to research from foreign scientists inside the Neutral camp, relative to research from home. The regression also controls for citation shares to research by scientists from other countries. In both panels, we focus on citations to recent research, i.e. research published in the preceding five years. For example, the first dot (1905) measures relative citation shares to research published between 1901 and 1905, and so on. The data were collected by the authors and combine scientist census data from *Minerva - Handbuch der Gelehrten Welt* and publication and citation data from *ISI - Web of Science* (see section III. for details).

Figure A.9:
International Title Similarity Relative to Home: Excluding Chemistry Papers

(a) Similarity to Most Similar Title



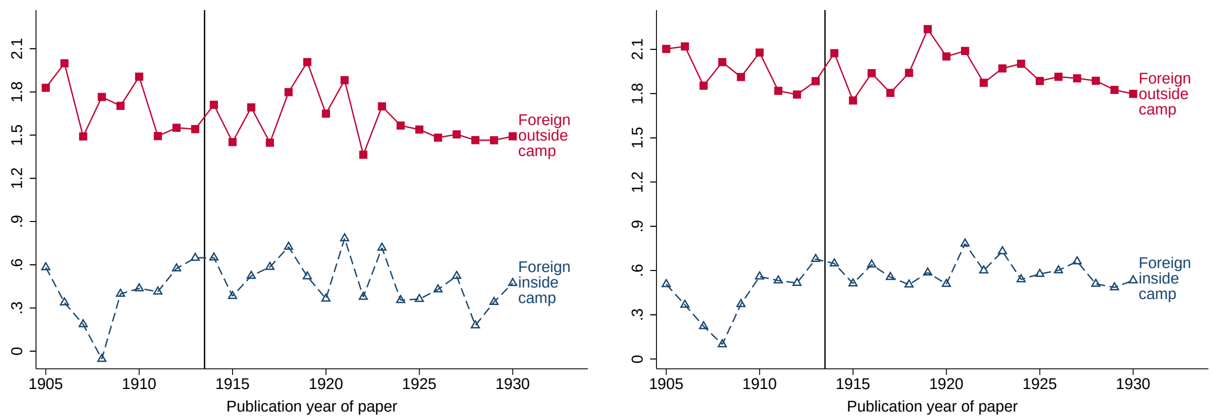
(b) Average Similarity to 5 Most Similar Titles



Notes: Each panel plots one set of parameter estimates of regression (2) where the dependent variable measures the standardized (i.e., mean 0 and standard deviation 1) LSA title similarity to papers by scientists from home, foreign countries inside the camp, and foreign countries outside the camp. In both panels, the sample of papers excludes papers published in chemistry journals. In panel (a), LSA title similarity is computed as the similarity to the most similar title from each camp. In panel (b), LSA title similarity is computed as the average similarity to the five most similar titles from each camp. The "Foreign outside camp" line reports point estimates (ω_τ) that measure the LSA title similarity to papers from outside the camp, relative to papers from home. The "Foreign inside camp" line reports point estimates (ι_τ) that measure the LSA title similarity to papers from foreign scientists inside the camp, relative to papers from home. We measure title similarity to recent papers, i.e. papers published in the preceding five years. For example, the first dot (1905) measures relative title similarity to papers published between 1901 and 1905. The data were collected by the authors and combine scientist census data from *Minerva - Handbuch der Gelehrten Welt* and publication and citation data from *ISI - Web of Science* (see section III. for details).

Figure A.10:
International Title Similarity Relative to Home: Neutral Scientists

(a) Similarity to Most Similar Title (b) Average of Similarity to 5 Most Similar Titles

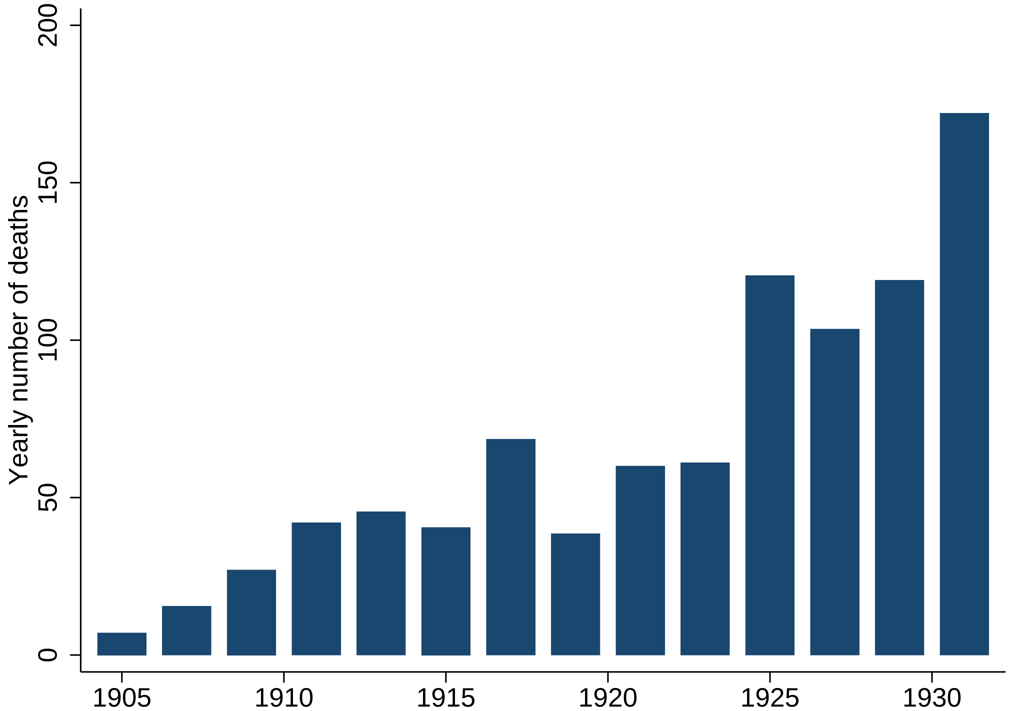


Notes: Each panel plots a set of parameter estimates of the equivalent of regression (2) for Neutral papers where the dependent variable measures the standardized (i.e., mean 0 and standard deviation 1) LSA title similarity. In panel (a), LSA title similarity is computed as the similarity to the most similar title from each camp. In panel (b), LSA title similarity is computed as the average similarity to the five most similar titles from each camp. The "Foreign outside camp" line reports point estimates (ω_τ) that measure the LSA title similarity to papers from outside the Neutral camp, relative to papers from home. The "Foreign inside camp" line reports point estimates (ι_τ) that measure the LSA title similarity to papers from foreign scientists inside the Neutral camp, relative to papers from home. In both panels, we focus on title similarity to recent papers, i.e. papers published in the preceding five years. For example, the first dot (1905) measures relative title similarity to research published between 1901 and 1905. The data were collected by the authors and combine scientist census data from *Minerva - Handbuch der Gelehrten Welt* and publication and citation data from *ISI - Web of Science* (see section III. for details).

Figure A.11:
Average Productivity of Scientists

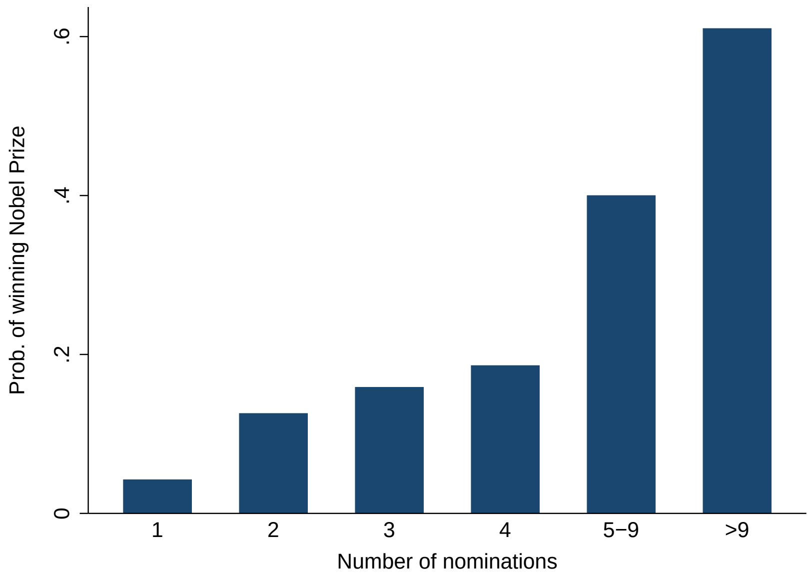
Notes: The Figure plots the average number of publications for the sample of 8,734 scientists used to estimate regression (3). The yearly number of publications of each scientist is measured by the number of publications in any of the top 160 journals in our data. The data were collected by the authors and combine scientist census data from *Minerva - Handbuch der Gelehrten Welt* and publication and citation data from *ISI - Web of Science* (see section III. for details).

Figure A.12:
Death Years of Scientists in Productivity Sample



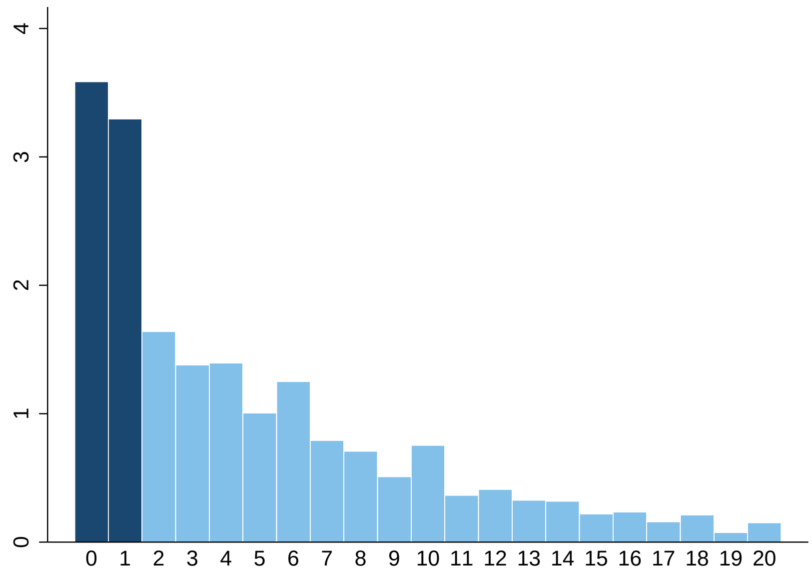
Notes: The Figure plots yearly deaths in two-year bins for scientists in the productivity sample. The data on deaths were collected by the authors from obituaries in *Science*, *Nature*, *Kürschners Deutscher Gelehrtenkalender*, *Sitzungsberichte der Preussischen Akademie*, and *Physikalische Zeitschrift* (see Appendix E.6. for details).

Figure A.13:
Probability of Winning Nobel Prize Depending on Number of Nominations



Notes: The Figure plots the probability of winning the Nobel Prize depending on the number of nominations. The number of nominations is the sum of nominations in year t and year $t-1$ if year t is a candidate's last nomination in the interval 1905 to 1945. The data were collected by the authors from Nobelprize.org (2014) and include 991 candidates for the Nobel Prize and 131 winners. The data contain 589 candidates with one nomination, 159 with two nominations, 63 with three nominations, 43 with four nominations, 80 with five to nine nominations, and 59 with more than nine nominations.

Figure A.14:
NOMINATIONS PER YEAR FOR EVENTUAL NOBEL PRIZE WINNERS



Notes: The Figure plots the average number of nominations per year for eventual Nobel Prize winners, relative to the year of the award. For example, the first bar from the left (0) shows that Nobel Laureates on average receive 3.6 nominations in the winning year. Similary, the second bar from the left (1) shows that Nobel Laureates receive on average 3.3 nominations the year before the winning year. The data were collected by the authors from Nobelprize.org (2014) and include 131 Nobel Prize winners.

A.2. Appendix Tables

Table A.1:
SUMMARY STATISTICS: SCIENTISTS

	Minerva 1900	*Minerva 1914*
Panel (a): Scholars from all fields		
Number of universities	569	973
Total number of university scholars	24,166	42,226
Scholars with name information	23,917	36,777
Panel (b): Scientists from all fields		
Total scientists (5 fields)	10,133	15,891
Medicine	5,413	8,829
Biology	1,486	2,353
Chemistry	1,317	2,077
Physics	1,167	1,626
Mathematics	1,062	1,440

Notes: Panel (a) reports the number of university professors in all fields. Panel (b) focuses on university professors in the five scientific fields used throughout the paper. The entry of "Total scientists (5 fields)" is smaller than the sum of the 5 fields below because some scientists work in multiple fields. The data were collected by the authors from two volumes (1900 and 1914) of *Minerva - Handbuch der Gelehrten Welt* (see section III. for details).

Table A.2:
Solvay Conferences in Physics: Allies and Centrals

	1911	1913	1921	1924	1927	1930
ALLIES	M. Brillouin (FR)	W. Barlow (UK)	C. Barkla (UK, ’17)	E. Bauer (FR)	W. Bragg (UK, ’15)	E. Bauer (FR)
	M. Curie (FR, ’03, ’11)	W. Bragg (UK, ’15)	W. Bragg (UK, ’15)	W. Bragg (UK, ’15)	L. Brillouin (FR)	L. Brillouin (FR)
	M. de Broglie (FR)	M. Brillouin (FR)	L. Brillouin (FR)	P. Bridgman (USA, ’46)	L. de Broglie (FR, ’29)	A. Cotton (FR)
	R. Goldschmidt (BE)	M. Curie (FR, ’03, ’11)	M. Brillouin (FR)	L. Brillouin (FR)	A. Compton (USA, ’27)	M. Curie (FR, ’03, ’11)
	É. Herzen (BE)	M. de Broglie (FR)	M. Curie (FR, ’03, ’11)	M. Brillouin (FR)	M. Curie (FR, ’03, ’11)	C. Darwin (UK)
	G. Hostelet (BE)	R. Goldschmidt (BE)	M. de Broglie (FR)	W. Broniewski (PL)	T. de Donder (BE)	T. de Donder (BE)
	J. Jeans (UK)	L. Gouy (FR)	É. Herzen (BE)	M. Curie (FR, ’03, ’11)	P. Dirac (UK, ’33)	P. Dirac (UK, ’33)
	P. Langevin (FR)	É. Herzen (BE)	P. Langevin (FR)	T. de Donder (BE)	R. Fowler (UK)	J. Errera (BE)
	J. Perrin (FR, ’26)	G. Hostelet (BE)	J. Larmor (UK)	E. Hall (USA)	É. Henriot (BE)	E. Fermi (ITA, ’38)
	H. Poincaré (FR)	J. Jeans (UK)	A. Michelson (USA, ’07)	É. Henriot (BE)	É. Herzen (BE)	É. Henriot (BE)
	E. Rutherford (UK, ’08)	P. Langevin (FR)	R. Millikan (USA, ’23)	É. Herzen (BE)	P. Langevin (FR)	É. Herzen (BE)
	E. Solvay (BE)	W. Pope (UK)	J. Perrin (FR, ’26)	P. Langevin (FR)	I. Langmuir (USA, ’32)	P. Kapitza (UK)
		E. Rutherford (UK, ’08)	O. Richardson (UK, ’28)	F. Lindemann (UK)	A. Piccard (BE)	P. Langevin (FR)
		J. J. Thomson (UK, ’06)	E. Rutherford (UK, ’08)	A. Piccard (BE)	O. Richardson (UK, ’28)	C. Manneback (BE)
		R. Wood (USA)	E. Solvay (BE)	O. Richardson (UK, ’28)	E. van Aubel (BE)	A. Piccard (BE)
			E. van Aubel (BE)	W. Rosenhain (UK)	J. Verschaffelt (BE)	O. Richardson (UK, ’28)
			P. Weiss (FR)	E. Rutherford (UK, ’08)	C. Wilson (UK, ’27)	J. Van Vleck (USA, ’77)
				E. van Aubel (BE)		J. Verschaffelt (BE)
				J. Verschaffelt (BE)		P. Weiss (FR)
CENTRALS	A. Einstein (AU, ’21)	E. Grüneisen (GE)			M. Born (GE, ’54)	P. Debye (GE, ’36)
	F. Hasenöhrl (AU)	F. Hasenöhrl (AU)			P. Debye (GE, ’36)	A. Einstein (GE, ’21)
	F. Lindemann (GE)	F. Lindemann (GE)			A. Einstein (GE, ’21)	W. Gerlach (GE)
	W. Nernst (GE, ’20)	W. Nernst (GE, ’20)			W. Pauli (GE, ’45)	W. Heisenberg (GE, ’32)
	M. Planck (GE, ’18)	H. Rubens (GE)			M. Planck (GE, ’18)	A. Sommerfeld (GE)
	H. Rubens (GE)	A. Sommerfeld (GE)				O. Stern (GE, ’43)
	A. Sommerfeld (GE)	W. Voigt (GE)				
	E. Warburg (GE)	E. Warburg (GE)				
	W. Wien (GE, ’11)	W. Wien (GE, ’11)				

Table A.2:
SOLVAY CONFERENCES IN PHYSICS: NEUTRALS AND REST

	1911	*1913*	*1921*	*1924*	*1927*	*1930*
NEUTRALS	M. Knudsen (DK) H. Lorentz (NE, '02) H. Onnes (NE, '13)	A. Einstein (SWZ, '21) H. Lorentz (NE, '02) M. Knudsen (DK) H. Onnes (NE, '13) J. Verschaffelt (NE) M. von Laue (SWZ, '14) P. Weiss (SWZ)	W. de Haas (NE) P. Ehrenfest (NE) M. Knudsen (DK) H. Lorentz (NE, '02) H. Onnes (NE, '13) K. Siegbahn (SWE, '24) J. Verschaffelt (NE) P. Zeeman (NE, '02)	P. Debye (SWZ, '36) G. de Hevesy (DK, '43) W. Keesom (NE) M. Knudsen (DK) H. Lorentz (NE, '02) H. Onnes (NE, '13) E. Schrödinger (SWZ, '33)	N. Bohr (DK, '22) P. Ehrenfest (NE) C. Guye (SWZ) W. Heisenberg (DK, '32)★ M. Knudsen (DK) H. Kramers (NE) H. Lorentz (NE, '02) E. Schrödinger (SWZ, '33)★	N. Bohr (DK, '22) B. Cabrera (SPA) W. de Haas (NE) B. Felipe (SPA) C. Guye (SWZ) M. Knudsen (DK) H. Kramers (NE) W. Pauli (SWZ, '45) P. Zeeman (NE, '02)
REST				A. Joffé (RUS)		J. Dorfman (RUS) P. Kapitsa (RUS, '78)

Notes: The Table reports delegates at each *Solvay Conference* in Physics between 1911 and 1930. In brackets, after the name, we report the country of residence at the moment of the conference and the year when a delegate won a Nobel prize. The data were collected by the authors from Mehra (1975) (see Appendix E.3. for details).
★ Even though classified as Neutrals in Mehra's data, Heisenberg and Schrödinger were de facto in the German system in 1927. Heisenberg had a joint appointment at the German University of Göttingen and the Danish University of Copenhagen and moved to a permanent position at the German University of Leipzig in 1927. Schrödinger moved to the German University of Berlin in 1927.

Table A.3:
List of Scientific Journals

Country	Field	Journal title
USA	General	American Journal of Science
USA	General	Proceedings of the National Academy of Sciences of the United States of America
USA	General	Proceedings of the American Academy of Arts and Sciences
USA	General	Review of Scientific Instruments
USA	General	Science
USA	Medicine	American Journal of Physiology
USA	Medicine	Archives of Pathology and Laboratory Medicine
USA	Medicine	Archives of Pathology
USA	Medicine	Contributions to Embryology
USA	Medicine	Journal of Experimental Medicine
USA	Medicine	Journal of Infectious Diseases
USA	Medicine	Journal of Urology
USA	Medicine	Journal of the American Medical Association
USA	Medicine	Medicine
USA	Medicine	New England Journal of Medicine
USA	Bio./Med.	Anatomical Record
USA	Bio./Med.	Endocrinology
USA	Bio./Med.	Genetics
USA	Bio./Med.	Journal of Clinical Endocrinology
USA	Bio./Med.	Journal of General Physiology
USA	Bio./Med.	Journal of Immunology
USA	Bio./Med.	Journal of Morphology
USA	Bio./Med.	Journal of Morphology and Physiology
USA	Bio./Med.	Physiological Reviews
USA	Bio./Med.	Proceedings of the Society for Experimental Biology and Medicine
USA	Biology	American Journal of Anatomy
USA	Biology	American Journal of Botany
USA	Biology	American Journal of Pathology
USA	Biology	American Naturalist
USA	Biology	Biological Bulletin
USA	Biology	Botanical Gazette
USA	Biology	Ecology
USA	Biology	Journal of Bacteriology
USA	Biology	Journal of Economic Entomology
USA	Biology	Journal of Experimental Zoology
USA	Biology	Journal of Medical Research
USA	Biology	Journal of Heredity
USA	Biology	Phytopathology
USA	Biology	Plant Physiology
USA	Biology	Quarterly Review of Biology

Table A.3:
LIST OF SCIENTIFIC JOURNALS

Country	Field	Journal title
USA	Pharmac.	Journal of Pharmacology and Experimental Therapeutics
USA	Biochem.	Journal of Biological Chemistry
USA	Biochem.	Stain Technology
USA	Chemistry	Chemical Reviews
USA	Chemistry	Industrial and Engineering Chemistry
USA	Chemistry	Industrial and Engineering Chemistry, Analytical Edition
USA	Chemistry	Journal of the American Chemical Society
USA	Chemistry	Organic Syntheses
USA	Chemistry	Transactions of the American Institute of Chemical Engineers
USA	Phys. Chem.	Journal of Physical Chemistry
USA	Physics	Journal of the Optical Society of America
USA	Physics	Journal of the Optical Society of America and review of scientific instruments
USA	Physics	Physical Review
USA	Physics	Review of Modern Physics
USA	Math. Phys.	Proceedings of the IRE
USA	Mathematics	American Journal of Mathematics
USA	Mathematics	Annals of Mathematical Statistics
USA	Mathematics	Annals of Mathematics
USA	Mathematics	Journal of the American Statistical Association
USA	Mathematics	Journal of the Franklin Institute
USA	Mathematics	Publications of the American Statistical Association
USA	Mathematics	Quarterly Publications of the American Statistical Association
USA	Mathematics	Transactions of the American Mathematical Society
UK	General	Nature
UK	General	Philosophical Magazine
UK	General	Proceedings of the Cambridge Philosophical Society
UK	General	Proceedings of the Royal Society of London
UK	Medicine	Journal of Anatomy
UK	Medicine	Journal of Pathology and Bacteriology
UK	Medicine	Lancet
UK	Medicine	Quarterly Journal of Medicine
UK	Bio./Med.	British Journal of Experimental Pathology
UK	Bio./Med.	Quarterly Journal of Experimental Physiology and Cognate Medical Sciences
UK	Bio./Med.	Quarterly Journal of Experimental Physiology
UK	Biology	Annals of Applied Biology
UK	Biology	Annals of Botany
UK	Biology	Annals of Eugenics
UK	Biology	Biological Reviews of the Cambridge Philosophical Society
UK	Biology	Biological Reviews and Biological Proceedings of the Cambridge Philos. Soc.
UK	Biology	British Journal of Experimental Biology
UK	Biology	Journal of Ecology

Table A.3:
List of Scientific Journals

Country	Field	Journal title
UK	Biology	Journal of Experimental Biology
UK	Biology	Journal of Genetics
UK	Biology	Philos. Trans. of the Royal Soc. of Lond. Ser. B, Cont. Papers of a Biolog. Charac.
UK	Biology	Philosoph. Transact. of the Royal Soc. of London Ser. B-Biol. Sciences
UK	Biology	Proceedings of the Zoological Society of London
UK	Biology	Proceedings of the Cambridge Philosophical Society-Biological Sciences
UK	Biology	Proceedings of the Royal Soc. of London Series B, Cont. Papers of a Biol. Charac.
UK	Biology	Proce. of the Zoological Society of London Series A-General and Experimental
UK	Biology	Proce. of the Zoolog. Soc. of London Series B-Systematic and Morphological
UK	Biology	Quarterly Journal of Microscopical Science
UK	Biochem.	Biochemical Journal
UK	Chemistry	Journal of the Chemical Society
UK	Chemistry	Transactions of the Faraday Society
UK	Physics	Astrophysical Journal
UK	Physics	Monthly Notices of the Royal Astronomical Society
UK	Physics	Proceedings of the Physical Society Of London
UK	Physics	Proceedings of the Physical Society
UK	Math. Phys.	Phil. Trans. of the Roy. Soc. of Lond. Ser. A, Cont. Pap. of a Math. or Phys. Char.
UK	Math. Phys.	Philos. Trans. of the Royal Society of London Series A-Math. and Phys. Sciences
UK	Math. Phys.	Proce. of the Roy. Soc. of Lon. Ser. A, Cont. Papers of a Math. and Phys. Char.
UK	Math. Phys.	Proce. of the Roy. Soc. of Lon. Ser. A-Math. and Phys. Sciences
UK	Mathematics	Biometrika
UK	Mathematics	Journal of the Royal Statistical Society
UK	Mathematics	Proceedings of the London Mathematical Society
Germany	General	Archiv für Experimentelle Pathologie und Pharmakologie
Germany	General	Hoppe-Seylers Zeitschrift fur Physiologische Chemie
Germany	General	Naturwissenschaften
Germany	General	Naunyn-Schmied. Archiv für Experiment. Pathologie und Pharmakologie
Germany	General	Sitzungsberichte der Königlich Preussischen Akademie der Wissenschaften
Germany	Medicine	Archiv für Patholog. Anatomie und Physiol. und für Klinische Medicin
Germany	Medicine	Journal für Psychologie und Neurologie
Germany	Medicine	Virch. Archiv für Patholog. Anato. und Physiol. und für Klinis. Medizin
Germany	Medicine	Zeitschrift für die Gesamte Neurologie und Psychiatrie
Germany	Bio./Med.	Archiv für Mikroskopische Anatomie
Germany	Bio./Med.	Archiv für Mikroskopische Anatomie und Entwicklungsgeschichte
Germany	Bio./Med.	Archiv für die Gesamte Physiologie des Menschen und der Tiere
Germany	Bio./Med.	Archiv für Mikroskopische Anatomie und Entwicklungsmechanik
Germany	Bio./Med.	Beitrage zur Pathologischen Anatomie und zur Allgemeinen Pathologie
Germany	Bio./Med.	Pflugers Archiv für die Gesamte Physiologie des Menschen und der Tiere
Germany	Bio./Med.	Wilhelm Roux' Archiv für Entwicklungsmechanik der Organismen

Table A.3:
LIST OF SCIENTIFIC JOURNALS

Country	Field	Journal title
Germany	Biology	Archiv für Entwicklungsmechanik der Organismen
Germany	Biology	Archiv für Experimentelle Zellforschung
Germany	Biology	Zeitschrift für Biologie
Germany	Biology	Zeitschrift für Wissenschaftliche Zoologie
Germany	Biochem.	Biochemische Zeitschrift
Germany	Chemistry	Berichte der Deutschen Chemischen Gesellschaft
Germany	Chemistry	Journal für Praktische Chemie-Leipzig
Germany	Chemistry	Justus Liebigs Annalen der Chemie
Germany	Chemistry	Kolloid Zeitschrift
Germany	Chemistry	Zeitschrift für Anorganische und Allgemeine Chemie
Germany	Chemistry	Zeitschrift für Elektrochemie
Germany	Chemistry	Zeitschrift für Elektrochemie und Angewandte Physikalische Chemie
Germany	Chemistry	Zeitschrift für Kristallographie
Germany	Chemistry	Zeitschrift für Krystallographie und Mineralogie
Germany	Chemistry	Zeitschrift für Anorganische Chemie
Germany	Phys. Chem.	Zeitschrift für Physikalische Chemie Stochiometrie und Verwandtschaftslehre
Germany	Phys. Chem.	Zeitsch. für Physik. Chem.-Abteil. A-Chem. Therm. Kinet. Elektroche. Eigens.
Germany	Phys. Chem.	Zeitsch. für Physik. Chem.-Abteil. B-Chem. der Elementarproz. Aufb. der Mater.
Germany	Physics	Annalen der Physik
Germany	Physics	Physikalische Zeitschrift
Germany	Physics	Zeitschrift für Physik
Germany	Math. Phys.	Sitzungsbe. der Preussi. Akad. der Wissensch. Physik.-Mathem. Klasse
Germany	Mathematics	Journal für die Reine und Angewandte Mathematik
Germany	Mathematics	Mathematische Annalen
Germany	Mathematics	Mathematische Zeitschrift
Germany	Mathematics	Zeitschrift für Angewandte Mathematik und Mechanik
France	General	Comptes Rendus Hebdomadaires des Seances de L'Academie des Sciences
France	Biology	Comptes Rendus des Seances de la Societe de Biologie et de ses Filiales
France	Chemistry	Annales de Chimie France
France	Phys. Chem.	Annales de Chemie et de Physique
France	Physics	Journal de Physique et le Radium
Netherlands	General	Proceedings of the Koninklijke Nederlandse Akademie van Wetenschappen
Netherlands	General	Proce. of the Koninkl. Nederlan. Akad. van Wetenschap. te Amsterdam
Netherlands	Chemistry	Recueil des Travaux Chimiques des Pays-Bas
Netherlands	Chemistry	Recueil des Travaux Chimiques des Pays-Bas et de la Belgique
Sweden	Bio./Med.	Hereditas
Sweden	Bio./Med.	Skandinavisches Archiv fur Physiologie
Sweden	Mathematics	Acta Mathematica
Switzerland	Chemistry	Helvetica Chimica Acta

Notes: The Table reports the 160 journals used in the analysis ordered by country and field. Journal data were collected by the authors from *ISI - Web of Science* (see section III. for details).

Table A.4:
SUMMARY STATISTICS: PUBLICATIONS BY JOURNAL COUNTRY

	(1)	(2)	(3)	(4)	(5)
	Share publications in journal country				
	U.S.A.	*U.K.*	*France*	*Germany*	*Others*
Allies:					
U.S.A.	**0.93**	0.04	0.00	0.03	0.00
U.K.	0.11	**0.83**	0.00	0.05	0.00
Canada	**0.71**	0.25	0.00	0.04	0.00
Japan	0.31	0.17	0.00	**0.51**	0.01
France	0.20	0.14	**0.38**	0.26	0.02
Italy	0.10	0.10	0.00	**0.79**	0.00
Australia	0.38	**0.57**	0.00	0.05	0.00
Poland	0.20	0.27	0.00	**0.48**	0.05
Ireland	0.34	**0.59**	0.00	0.07	0.00
Belgium	0.14	0.06	**0.64**	0.14	0.02
New Zealand	0.23	**0.73**	0.00	0.03	0.00
Romania	0.11	0.00	0.21	**0.68**	0.00
Brazil	0.00	0.11	0.00	**0.89**	0.00
South Africa	0.14	**0.71**	0.00	0.14	0.00
Greece	0.00	0.00	0.00	**1.00**	0.00
Portugal	**1.00**	0.00	0.00	0.00	0.00
Centrals:					
Germany	0.01	0.01	0.00	**0.98**	0.00
Austria	0.03	0.01	0.00	**0.95**	0.01
Hungary	0.05	0.01	0.00	**0.92**	0.01

Notes: The Table reports where scientists from each country published their papers. The data were collected by the authors and combine scientist census data from *Minerva - Handbuch der Gelehrten Welt* and publication and citation data from *ISI - Web of Science* (see section III. for details).

Table A.5:
International Citation Shares Relative to Home

	Par. Est.	*Std. Er.*		*Par. Est.*	*Std. Er.*
Foreign outside × 1905	-0.323	0.073	Foreign inside × 1905	-0.489	0.060
Foreign outside × 1906	-0.340	0.069	Foreign inside × 1906	-0.471	0.074
Foreign outside × 1907	-0.325	0.078	Foreign inside × 1907	-0.446	0.066
Foreign outside × 1908	-0.383	0.067	Foreign inside × 1908	-0.500	0.060
Foreign outside × 1909	-0.359	0.070	Foreign inside × 1909	-0.512	0.053
Foreign outside × 1910	-0.301	0.075	Foreign inside × 1910	-0.417	0.065
Foreign outside × 1911	-0.381	0.075	Foreign inside × 1911	-0.442	0.057
Foreign outside × 1912	-0.350	0.090	Foreign inside × 1912	-0.461	0.064
Foreign outside × 1913	-0.397	0.075	Foreign inside × 1913	-0.477	0.055
Foreign outside × 1914	-0.432	0.094	Foreign inside × 1914	-0.504	0.078
Foreign outside × 1915	-0.493	0.067	Foreign inside × 1915	-0.492	0.079
Foreign outside × 1916	-0.570	0.071	Foreign inside × 1916	-0.588	0.067
Foreign outside × 1917	-0.676	0.059	Foreign inside × 1917	-0.660	0.061
Foreign outside × 1918	-0.696	0.057	Foreign inside × 1918	-0.635	0.056
Foreign outside × 1919	-0.715	0.064	Foreign inside × 1919	-0.657	0.065
Foreign outside × 1920	-0.664	0.069	Foreign inside × 1920	-0.599	0.079
Foreign outside × 1921	-0.616	0.079	Foreign inside × 1921	-0.582	0.078
Foreign outside × 1922	-0.609	0.073	Foreign inside × 1922	-0.562	0.070
Foreign outside × 1923	-0.615	0.062	Foreign inside × 1923	-0.558	0.058
Foreign outside × 1924	-0.540	0.076	Foreign inside × 1924	-0.526	0.065
Foreign outside × 1925	-0.542	0.074	Foreign inside × 1925	-0.503	0.069
Foreign outside × 1926	-0.531	0.073	Foreign inside × 1926	-0.503	0.066
Foreign outside × 1927	-0.571	0.070	Foreign inside × 1927	-0.545	0.064
Foreign outside × 1928	-0.551	0.066	Foreign inside × 1928	-0.524	0.058
Foreign outside × 1929	-0.533	0.070	Foreign inside × 1929	-0.500	0.066
Foreign outside × 1930	-0.550	0.064	Foreign inside × 1930	-0.506	0.063
Paper FE			YES		
Observations			105,378		
Number of papers			35,126		

Notes: The table reports parameter estimates of regression (2). "Foreign outside" measures citation shares to research from outside the camp, relative to research from home. "Foreign inside" measures citation shares to research from foreign scientists inside the camp, relative to research from home. We count citations to recent research, i.e. research published in the preceding five years. For example, "Foreign outside × 1905" measures relative citation shares to research from outside the camp published between 1901 and 1905. Similarly, "Foreign outside in 1906" measures relative citation shares to research from outside the camp published between 1902 and 1906. Standard errors are clustered at the country-times-field level. The data were collected by the authors and combine scientist census data from *Minerva - Handbuch der Gelehrten Welt* and publication and citation data from *ISI - Web of Science* (see section III. for details).

Table A.6:
Changes in International Citations: By Camp

Dependent variable: *Citation Shares to recent research*	(1)	(2) AL citing papers	(3) CE citing papers
Foreign *outside* camp × WWI	-0.229***	-0.180***	0.047
	(0.034)	(0.030)	(0.037)
Foreign *outside* camp × Boycott	-0.258***	-0.211***	-0.192***
	(0.052)	(0.040)	(0.062)
Foreign *outside* camp × Post Boycott	-0.213***	-0.175***	-0.085
	(0.051)	(0.040)	(0.104)
Foreign *inside* camp × WWI	-0.148***	-0.156***	-0.011
	(0.045)	(0.039)	(0.037)
Foreign *inside* camp × Boycott	-0.164***	-0.153**	-0.160**
	(0.057)	(0.059)	(0.072)
Foreign *inside* camp × Post Boycott	-0.154**	-0.132**	-0.172
	(0.059)	(0.063)	(0.120)
Paper FE	YES	YES	YES
Camp FE	YES	YES	YES
Foreign *in/outside* time trends	YES	YES	YES
Observations	105,378	87,060	18,318
Number of citing papers	35,126	29,020	6,106
Within R-squared	0.335	0.429	0.186

Notes: Each column reports one set of parameter estimates of regression (1) for citing papers published between 1905 and 1930. Column (1) reports results for all Allied and Central citing papers in our sample. Column (2) reports results for Allied citing papers, only, and column (3) reports results for Central citing papers, only. In all columns, the dependent variable measures the share of references to research by scientists from home, foreign countries inside the camp, and foreign countries outside the camp. We count citations to recent research, i.e. research published in the preceding five years, e.g. 1901-1905 for citing papers published in 1905, 1902-1906 for citing papers published in 1906, and so on. The reference/omitted category is the citation share to research from home. Standard errors are clustered at the country-times-field level. Significance levels: *** p<0.01, ** p<0.05, and * p<0.1. The data were collected by the authors and combine scientist census data from *Minerva - Handbuch der Gelehrten Welt* and publication and citation data from *ISI - Web of Science* (see section III. for details).

Table A.7:
CHANGES IN INTERNATIONAL CITATIONS: INCLUDING SELF-CITATIONS IN HOME

Dependent variable:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Cit. Sh. to recent research	*All papers*		Frontier: 5%		Frontier: 3%		Frontier: 1%	
Foreign *outside* camp × Post 1914	-0.204***	-0.232***	-0.049***	-0.090***	-0.032***	-0.063***	-0.019***	-0.038***
	(0.032)	(0.035)	(0.015)	(0.019)	(0.012)	(0.012)	(0.005)	(0.006)
Foreign *inside* camp × Post 1914	-0.078**	-0.137***	-0.023*	-0.066***	-0.018*	-0.048***	-0.012**	-0.033***
	(0.038)	(0.044)	(0.013)	(0.020)	(0.010)	(0.012)	(0.005)	(0.006)
Paper FE	YES	YES	YES	YES	YES	YES	YES	YES
Camp FE	YES	YES	YES	YES	YES	YES	YES	YES
Non-frontier research interactions			YES	YES	YES	YES	YES	YES
Foreign *in/outside* time trends		YES		YES		YES		YES
Observations	116,229	116,229	232,458	232,458	232,458	232,458	232,458	232,458
Number of citing papers	38,743	38,743	38,743	38,743	38,743	38,743	38,743	38,743
Within R-squared	0.416	0.417	0.290	0.290	0.360	0.360	0.464	0.464

Notes: Each column reports one set of parameter estimates of regression (1) for citing papers published between 1905 and 1930. In columns (1)-(2) the dependent variable measures citation shares to research by scientists from home *inclusive* of self-citations, foreign countries inside the camp, and foreign countries outside the camp. In columns (3) to (8) the dependent variable measures citation shares to frontier and non-frontier research by scientists from home *inclusive* of self-citations, foreign countries inside the camp, and foreign countries outside the camp, i.e. six shares for each citing paper. In columns from (3) to (8) the Table only reports estimates for frontier research, although the regressions control for non-frontier times post 1914 indicators. For the results reported in columns (3)-(4), frontier research is defined as research that ended up in the top 5% of the subject-level citation distribution until today. Similarly, for the results reported in columns (5)-(6) (and (7)-(8)), frontier research is defined as research that ended up in the top 3% (1%) of the subject-level citation distribution until today. We count citations to recent research, i.e. research published in the preceding five years, e.g. 1901-1905 for citing papers published in 1905, 1902-1906 for citing papers published in 1906, and so on. The reference/omitted category in columns (1)-(2) (and (3) to (8)) is the citation share to (frontier) research from home *inclusive* of self-citations. Standard errors are clustered at the country-times-field level. Significance levels: *** p<0.01, ** p<0.05, and * p<0.1. The data were collected by the authors and combine scientist census data from *Minerva - Handbuch der Gelehrten Welt* and publication and citation data from *ISI - Web of Science* (see section III. for details).

Table A.8:
Changes in International Citations: Alternative Definitions of Recent Research

Dependent variable:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Citation Shares to recent research	Research published in previous 3 years				Research published in previous 10 years			
Foreign *outside* camp × Post 1914	-0.210***	-0.276***			-0.206***	-0.221***		
	(0.035)	(0.048)			(0.029)	(0.037)		
Foreign *outside* camp × WWI			-0.242***	-0.239***			-0.190***	-0.190***
			(0.029)	(0.042)			(0.023)	(0.033)
Foreign *outside* camp × Boycott			-0.232***	-0.226***			-0.234***	-0.233***
			(0.036)	(0.064)			(0.031)	(0.053)
Foreign *outside* camp × Post Boycott			-0.184***	-0.176***			-0.190***	-0.188***
			(0.045)	(0.064)			(0.038)	(0.054)
Foreign *inside* camp × Post 1914	-0.063	-0.152***			-0.077**	-0.127***		
	(0.040)	(0.055)			(0.035)	(0.045)		
Foreign *inside* camp × WWI			-0.110***	-0.152***			-0.096***	-0.116***
			(0.039)	(0.050)			(0.032)	(0.043)
Foreign *inside* camp × Boycott			-0.074*	-0.158**			-0.095**	-0.142**
			(0.042)	(0.063)			(0.038)	(0.062)
Foreign *inside* camp × Post Boycott			-0.039	-0.158**			-0.057	-0.128**
			(0.047)	(0.063)			(0.040)	(0.064)
Paper FE	YES	YES	YES	YES	YES	YES	YES	YES
Camp FE	YES	YES	YES	YES	YES	YES	YES	YES
Foreign *in/outside* time trends		YES		YES		YES		YES
Observations	83,160	83,160	83,160	83,160	117,486	117,486	117,486	117,486
Number of citing papers	27,720	27,720	27,720	27,720	39,162	39,162	39,162	39,162
Within R-squared	0.340	0.341	0.341	0.341	0.326	0.326	0.327	0.327

Notes: Each column reports one set of parameter estimates of regression (1) for citing papers published between 1905 and 1930. The dependent variable measures the share of references to research by scientists from home, foreign countries inside the camp, and foreign countries outside the camp. We focus on citations to recent research: in columns (1)-(4) research published in the preceding 3 years and in columns (5)-(8) research published in the preceding 10 years. The reference/omitted category is the citation share to research from home. Standard errors are clustered at the country-times-field level. Significance levels: $***$ p<0.01, $**$ p<0.05, and $*$ p<0.1. The data were collected by the authors and combine scientist census data from *Minerva - Handbuch der Gelehrten Welt* and publication and citation data from *ISI - Web of Science* (see section III. for details).

Table A.9:
INTERNATIONAL CITATIONS: ALL PRE-WWI COHORTS

Dependent variable: *Citation Shares to cohort*	(1) *1903-05*	(2) *1904-06*	(3) *1905-07*	(4) *1906-08*	(5) *1907-09*	(6) *1908-10*	(7) *1909-11*	(8) *1910-12*	(9) *1911-13*
Foreign *outside* camp × Post 1914	0.120***	0.0826***	0.0509*	0.0188	0.0429	0.0502	0.0354	0.0300	0.0422
	(0.0286)	(0.0276)	(0.0290)	(0.0257)	(0.0285)	(0.0310)	(0.0333)	(0.0302)	(0.0268)
Foreign *inside* camp × Post 1914	0.200***	0.179***	0.148***	0.117***	0.125***	0.119***	0.0980***	0.0814***	0.0737**
	(0.0509)	(0.0470)	(0.0373)	(0.0353)	(0.0308)	(0.0261)	(0.0249)	(0.0235)	(0.0286)
Paper FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Camp FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	18,870	19,896	21,963	24,735	27,081	28,254	29,358	31,242	32,445
Number of citing papers	6,290	6,632	7,321	8,245	9,027	9,418	9,786	10,414	10,815
Within R-squared	0.113	0.133	0.145	0.144	0.129	0.130	0.135	0.157	0.187

Notes: Each column reports one set of parameter estimates of regression (1) for citing papers published between the first year of the relevant cohort and 1930. The dependent variable measures the share of references to a three year cohort of research by scientists from home, foreign countries inside the camp, and foreign countries outside the camp. We measure citations to a *fixed cohort* of research published between 1903 and 1905 in column (1), between 1904 and 1906 in column (2), and so on. The reference/omitted category is the share of references to the relevant cohort of research from home. Standard errors are clustered at the country-times-field level. Significance levels: *** p<0.01, ** p<0.05, and * p<0.1. The data were collected by the authors and combine scientist census data from *Minerva - Handbuch der Gelehrten Welt* and publication and citation data from *ISI - Web of Science* (see section III. for details).

Table A.10:
CHANGES IN INTERNATIONAL CITATIONS: NEUTRALS

Dependent variable: *Neutral Cit. Sh. to recent research*	(1)	(2)	(3)	(4)
Foreign *outside* camp × Post 1914	-0.060	-0.074		
	(0.041)	(0.077)		
Allied camp × Post 1914			0.107**	0.010
			(0.052)	(0.068)
Central camp × Post 1914			-0.195***	-0.096
			(0.045)	(0.072)
Foreign *inside* camp × Post 1914	0.009	0.100*	0.009	0.100*
	(0.024)	(0.054)	(0.024)	(0.054)
Paper FE	YES	YES	YES	YES
Camp FE	YES	YES	YES	YES
Camp-specific time trends		YES		YES
Observations	5,865	5,865	9,775	9,775
Number of citing papers	1,955	1,955	1,955	1,955
Within R-squared	0.528	0.528	0.206	0.209

Notes: Each column reports one set of parameter estimates of regression (1) for Neutral citing papers published between 1905 and 1930. In columns (1) and (2) the dependent variable measures citation shares to research produced by scientists from home, foreign scientists inside the camp, and foreign scientists outside the camp. The dependent variable in columns (3) and (4) further splits the share of references to research from foreign scientists outside the camp into Allied, Central, and Other (not reported in the table). We count citations to recent research, i.e. research published in the preceding five years. The reference/omitted category is the Neutral citation share to research from home. Standard errors are clustered at the country-times-field level. Significance levels: *** p<0.01, ** p<0.05, and * p<0.1. The data were collected by the authors and combine scientist census data from *Minerva - Handbuch der Gelehrten Welt* and publication and citation data from the *ISI - Web of Science* (see section III. for details).

Table A.11:
The Similarity of Papers as Measured by Latent Semantic Analysis: Robustness Checks

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent variable:	Most similar title		Average 5 most similar titles		Most similar title		Average 5 most similar titles	
LSA Title Similarity to recent papers	300 Components				1000 Components			
Foreign *outside* camp × Post 1914	-0.426***		-0.564***		-0.506***		-0.634***	
	(0.091)		(0.117)		(0.095)		(0.136)	
Foreign *outside* camp × WWI		-0.438***		-0.561***		-0.501***		-0.618***
		(0.080)		(0.106)		(0.085)		(0.121)
Foreign *outside* camp × Boycott		-0.490***		-0.642***		-0.575***		-0.704***
		(0.110)		(0.134)		(0.107)		(0.152)
Foreign *outside* camp × Post Boycott		-0.378***		-0.510***		-0.459***		-0.591***
		(0.091)		(0.120)		(0.102)		(0.141)
Foreign *inside* camp × Post 1914	0.086		0.102		0.039		0.033	
	(0.155)		(0.189)		(0.147)		(0.190)	
Foreign *inside* camp × WWI		0.019		-0.023		-0.045		-0.087
		(0.150)		(0.178)		(0.131)		(0.174)
Foreign *inside* camp × Boycott		0.019		0.043		-0.005		-0.014
		(0.164)		(0.199)		(0.159)		(0.200)
Foreign *inside* camp × Post Boycott		0.154		0.184		0.096		0.104
		(0.155)		(0.191)		(0.147)		(0.194)
Paper FE	YES	YES	YES	YES	YES	YES	YES	YES
Camp FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	71,586	71,586	71,586	71,586	71,586	71,586	71,586	71,586
Number of citing papers	23,862	23,862	23,862	23,862	23,862	23,862	23,862	23,862
Within R-squared	0.144	0.146	0.214	0.216	0.174	0.175	0.242	0.243

Notes: Each column reports one set of parameter estimates of regression (1) for papers published between 1905 and 1930. The dependent variable measures the standardized (i.e., mean 0 and standard deviation 1) LSA title similarity to papers by scientists from home, foreign countries inside the camp, and foreign countries outside the camp. In columns (1)-(4) LSA title similarity is based on 300 components. In columns (5)-(8) LSA title similarity is based on 1000 components. In columns (1), (2), (5), and (6), LSA title similarity is computed as the similarity of the most similar title from each camp. In columns (3), (4), (7), and (8), LSA title similarity is computed as the average similarity of the five most similar titles from each camp. We compute the title similarity to recent papers, i.e. papers published in the preceding five years, e.g. 1901-1905 for papers published in 1905. The reference/omitted category is the LSA title similarity to papers from home. Standard errors are clustered at the country-times-field level. Significance levels: $***$ p<0.01, $**$ p<0.05, and $*$ p<0.1. The data were collected by the authors and combine scientist census data from *Minerva - Handbuch der Gelehrten Welt* and publication and citation data from *ISI - Web of Science* (see section III. for details).

Table A.12:
Yearly Effect on Publications

	Par. Est.	Std. Er.		Par. Est.	Std. Er.
Pre-war rel. on 1% front. *OUT*×1905	-0.937	1.238	Pre-war rel. on 1% front. *IN*×1905	-0.233	1.544
Pre-war rel. on 1% front. *OUT*×1906	-2.073	0.989	Pre-war rel. on 1% front. *IN*×1906	0.106	1.156
Pre-war rel. on 1% front. *OUT*×1907	-0.496	1.178	Pre-war rel. on 1% front. *IN*×1907	0.215	1.011
Pre-war rel. on 1% front. *OUT*×1908	-1.751	1.059	Pre-war rel. on 1% front. *IN*×1908	-0.062	0.921
Pre-war rel. on 1% front. *OUT*×1909	-0.711	0.792	Pre-war rel. on 1% front. *IN*×1909	1.960	0.602
Pre-war rel. on 1% front. *OUT*×1910	-1.490	0.705	Pre-war rel. on 1% front. *IN*×1910	-0.282	0.626
Pre-war rel. on 1% front. *OUT*×1911	-0.074	0.892	Pre-war rel. on 1% front. *IN*×1911	1.681	0.717
Pre-war rel. on 1% front. *OUT*×1912	-1.204	0.844	Pre-war rel. on 1% front. *IN*×1912	-0.848	0.589
Pre-war rel. on 1% front. *OUT*×1914	-2.111	0.862	Pre-war rel. on 1% front. *IN*×1914	0.371	0.452
Pre-war rel. on 1% front. *OUT*×1915	-3.499	1.030	Pre-war rel. on 1% front. *IN*×1915	0.660	1.056
Pre-war rel. on 1% front. *OUT*×1916	-3.109	0.913	Pre-war rel. on 1% front. *IN*×1916	-0.061	0.988
Pre-war rel. on 1% front. *OUT*×1917	-3.452	1.045	Pre-war rel. on 1% front. *IN*×1917	-0.655	1.225
Pre-war rel. on 1% front. *OUT*×1918	-3.192	0.834	Pre-war rel. on 1% front. *IN*×1918	-1.135	1.004
Pre-war rel. on 1% front. *OUT*×1919	-2.186	0.808	Pre-war rel. on 1% front. *IN*×1919	-0.299	0.811
Pre-war rel. on 1% front. *OUT*×1920	-2.417	0.805	Pre-war rel. on 1% front. *IN*×1920	-0.648	0.719
Pre-war rel. on 1% front. *OUT*×1921	-2.405	0.687	Pre-war rel. on 1% front. *IN*×1921	-1.040	0.669
Pre-war rel. on 1% front. *OUT*×1922	-2.732	0.965	Pre-war rel. on 1% front. *IN*×1922	-1.708	0.950
Pre-war rel. on 1% front. *OUT*×1923	-1.901	0.755	Pre-war rel. on 1% front. *IN*×1923	-0.485	0.640
Pre-war rel. on 1% front. *OUT*×1924	-2.173	0.895	Pre-war rel. on 1% front. *IN*×1924	-0.870	0.835
Pre-war rel. on 1% front. *OUT*×1925	-2.348	0.751	Pre-war rel. on 1% front. *IN*×1925	-1.120	0.832
Pre-war rel. on 1% front. *OUT*×1926	-2.937	1.019	Pre-war rel. on 1% front. *IN*×1926	-0.898	0.717
Pre-war rel. on 1% front. *OUT*×1927	-3.471	0.974	Pre-war rel. on 1% front. *IN*×1927	-0.788	1.054
Pre-war rel. on 1% front. *OUT*×1928	-2.805	0.969	Pre-war rel. on 1% front. *IN*×1928	-0.467	0.912
Pre-war rel. on 1% front. *OUT*×1929	-2.263	0.743	Pre-war rel. on 1% front. *IN*×1929	0.030	0.838
Pre-war rel. on 1% front. *OUT*×1930	-2.237	0.863	Pre-war rel. on 1% front. *IN*×1930	0.482	1.041
Scientist FE			YES		
Year FE			YES		
Pre-war reliance on non-frontier			YES		
Career age × field interactions			YES		
Observations			227,084		
Number of scientists			8,734		

Notes: The Table plots parameter estimates from regression (4). "Pre-war rel. on 1% front. *OUT*" reports point estimates ($\beta_{1\tau}$) that measure changes in yearly publications for scientists in field-country pairs that, in the pre-war period, relied on top 1% research from outside the camp, compared to scientists who relied on top 1% research from home. "Pre-war rel. on 1% front. *IN*" reports point estimates ($\beta_{2\tau}$) that measure changes in yearly publications for scientists in field-country pairs that, in the pre-war period, relied on top 1% research from foreign scientists inside the camp, compared to scientists who relied on top 1% research from home. Pre-war reliance on top 1% research is measured by pre-war citations to top 1% research at the field-country pair level. Top 1% research is defined as research that ended up in the top 1% of the subject-level citation distribution, counting citations until today. The regression also controls for pre-war reliance on non-frontier research from each camp interacted with year indicators. The data were collected by the authors and combine scientist census data from *Minerva - Handbuch der Gelehrten Welt* and publication and citation data from *ISI - Web of Science* (see section III. for details).

Table A.13:
EFFECT ON PUBLICATIONS: DIFFERENT COUNTRY-FIELD THRESHOLDS

	(1)	(2)
Dependent variable:	5 paper	10 paper
Number of publications	threshold	threshold
Panel A: Frontier measured by Top 1%		
Pre-war reliance on 1% frontier *OUT*	-1.727***	-1.872***
× Post 1914	(0.638)	(0.669)
Pre-war reliance on 1% frontier *IN*	-0.827	-0.850
× Post 1914	(0.736)	(0.772)
Within R-squared	0.062	0.062
Panel B: Frontier measured by Top 3%		
Pre-war reliance on 3% frontier *OUT*	-0.784***	-0.761**
× Post 1914	(0.282)	(0.306)
Pre-war reliance on 3% frontier *IN*	-0.363	-0.309
× Post 1914	(0.283)	(0.377)
Within R-squared	0.062	0.062
Panel C: Frontier measured by Top 5%		
Pre-war reliance on 5% frontier *OUT*	-0.380*	-0.265
× Post 1914	(0.220)	(0.245)
Pre-war reliance on 5% frontier *IN*	-0.152	-0.150
× Post 1914	(0.218)	(0.281)
Within R-squared	0.062	0.062
Scientist FE	YES	YES
Year FE	YES	YES
Pre-war reliance on non-frontier	YES	YES
Career age × field interactions	YES	YES
Observations	227,084	220,688
Number of scientists	8,734	8,488

Notes: Each column and each panel reports one set of parameter estimates of regression (3) for the panel of university scientists between 1905 and 1930. We show robustness to changing the minimum number of publications that scientists from a certain country-field pair published between 1905-1913 to compute the pre-war reliance on home and foreign research. In column (1), we report the baseline specification with the minimum number of pre-war publications equal to 5. In column (2), we increase the minimum number of pre-war publications to 10 and drop scientists in country-field pairs with fewer than 10 pre-war papers. The dependent variable measures the yearly number of publications in the 160 top journals in our data. "Pre-war reliance on frontier *OUT*" is the pre-war citation share to frontier research (1%, 3%, or 5%) from outside the camp. "Pre-war reliance on frontier *IN*" is the pre-war citation share to frontier research (1%, 3%, or 5%) from foreign countries inside the camp. The reference/omitted category is "Pre-war reliance on frontier *HOME*." Standard errors are clustered at the country-times-field level. Significance levels: *** p<0.01, ** p<0.05, and * p<0.1. The data were collected by the authors and combine scientist census data from *Minerva - Handbuch der Gelehrten Welt* and publication and citation data from *ISI - Web of Science* (see section III. for details).

Table A.14:
DEATH DURING WWI AND DEPENDENCE ON FOREIGN RESEARCH

Dependent variable:	(1)	(2)	(3)
Indicator for Death between 1914 and 1918	Frontier: 1%	Frontier: 3%	Frontier: 5%
Pre-war reliance on frontier *OUT*	0.117	0.027	-0.010
	(0.122)	(0.088)	(0.083)
Pre-war reliance on frontier *IN*	0.260	0.156	0.190
	(0.359)	(0.201)	(0.123)
Pre-war reliance on non-frontier	YES	YES	YES
Career age × field interactions	YES	YES	YES
Number of scientists	8,734	8,734	8,734
Within R-squared	0.013	0.014	0.015

Notes: Each column reports parameter estimates of a regression of an indicator variable that is equal to 1 if a scientist died between 1914 and 1918 and 0 otherwise on the pre-war reliance on frontier research from outside the camp and inside the camp for our sample of university scientists. "Pre-war reliance on frontier *OUT*" is the pre-war citation share to frontier research (1%, 3%, or 5%) from outside the camp. "Pre-war reliance on frontier *IN*" is the pre-war citation share to frontier research (1%, 3%, or 5%) from foreign countries inside the camp. The reference/omitted category is "Pre-war reliance on frontier *HOME*." Standard errors are clustered at the country-times-field level. Significance levels: $***$ p<0.01, $**$ p<0.05, and $*$ p<0.1. The data were collected by the authors and combine scientist census data from *Minerva - Handbuch der Gelehrten Welt*, publication and citation data from *ISI - Web of Science*, and obituary data from various sources (see Appendix section E.6. for details).

Table A.15:
EFFECT ON NOVEL SCIENTIFIC WORDS: ROBUSTNESS

	(1)	(2)	(3)	(4)	(5)	(6)
	Novel scientific words		Novel scientific words		Novel scientific words	
Dependent Variable:	5,000 stopwords		15,000 stopwords		36,662 stopwords	
Panel A: Frontier measured by Top 1%						
Pre-war reliance on 1% frontier *OUT*	-1.239**	-0.787**	-1.181***	-0.759**	-0.985**	-0.471*
× Post 1914	(0.471)	(0.354)	(0.430)	(0.316)	(0.394)	(0.276)
Pre-war reliance on 1% frontier *IN*	-0.852*	-0.875**	-0.996**	-1.007***	-0.894**	-0.866***
× Post 1914	(0.486)	(0.386)	(0.433)	(0.341)	(0.393)	(0.278)
Within R-squared	0.026	0.030	0.023	0.027	0.019	0.022
Panel B: Frontier measured by Top 3%						
Pre-war reliance on 3% frontier *OUT*	-0.332	-0.360*	-0.286	-0.348**	-0.243	-0.261
× Post 1914	(0.267)	(0.182)	(0.265)	(0.174)	(0.248)	(0.160)
Pre-war reliance on 3% frontier *IN*	-0.116	-0.150	-0.179	-0.207	-0.208	-0.227
× Post 1914	(0.230)	(0.175)	(0.217)	(0.159)	(0.195)	(0.137)
Within R-squared	0.026	0.030	0.023	0.027	0.019	0.022
Panel C: Frontier measured by Top 5%						
Pre-war reliance on 5% frontier *OUT*	-0.210	-0.297*	-0.162	-0.305*	-0.137	-0.240
× Post 1914	(0.205)	(0.170)	(0.205)	(0.159)	(0.200)	(0.150)
Pre-war reliance on 5% frontier *IN*	-0.133	-0.127	-0.160	-0.160	-0.178	-0.172
× Post 1914	(0.175)	(0.137)	(0.162)	(0.126)	(0.154)	(0.120)
Within R-squared	0.026	0.030	0.023	0.027	0.019	0.022
Scientist FE	YES	YES	YES	YES	YES	YES
Year FE	YES		YES		YES	
Pre-war reliance on non-frontier	YES	YES	YES	YES	YES	YES
Career age × field interactions	YES	YES	YES	YES	YES	YES
Camp × field × year FE		YES		YES		YES
Observations	227,084	227,084	227,084	227,084	227,084	227,084
Number of scientists	8,734	8,734	8,734	8,734	8,734	8,734

Notes: Each column and each panel reports one set of parameter estimates of regression (3) for the panel of university scientists between 1905 and 1930. In all columns, the dependent variable counts the number of novel words that appeared in the title of a scientific paper. "Pre-war reliance on frontier *OUT*" is the pre-war citation share to frontier research (1%, 3%, or 5%) from outside the camp. "Pre-war reliance on frontier *IN*" is the pre-war citation share to frontier research (1%, 3%, or 5%) from foreign countries inside the camp. The reference/omitted category is "Pre-war reliance on frontier *HOME*." Standard errors are clustered at the country-times-field level. Significance levels: *** p<0.01, ** p<0.05, and * p<0.1. The data were collected by the authors and combine scientist census data from *Minerva - Handbuch der Gelehrten Welt* and publication and citation data from *ISI - Web of Science*.

Table A.16:
Effect on Patent-Relevant Words: Robustness

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Dependent Variable:	Patent relevant words 5,000 stopwords		Patent relevant words 15,000 stopwords		Patent relevant words 36,662 stopwords		Patent relevant words not winsorized		Patent relevant words patents counted once		Patent relevant words all patents, 1920-79	
Panel A: Frontier measured by Top 1%												
Pre-war reliance on 1% frontier *OUT*	-0.916**	-0.968***	-1.218***	-1.319***	-0.808***	-0.723**	-0.564**	-0.984***	-1.058***	-1.135***	-1.079***	-1.050***
× Post 1914	(0.366)	(0.315)	(0.340)	(0.287)	(0.289)	(0.281)	(0.232)	(0.213)	(0.349)	(0.293)	(0.364)	(0.312)
Pre-war reliance on 1% frontier *IN*	-0.272	-0.436	-0.774***	-0.944***	-0.574**	-0.655***	-0.353*	-0.663***	-0.533*	-0.642**	-0.548*	-0.590**
× Post 1914	(0.336)	(0.266)	(0.237)	(0.211)	(0.280)	(0.242)	(0.193)	(0.167)	(0.300)	(0.256)	(0.315)	(0.273)
Within R-squared	0.016	0.020	0.014	0.017	0.010	0.013	0.001	0.003	0.015	0.019	0.019	0.022
Panel B: Frontier measured by Top 3%												
Pre-war reliance on 3% frontier *OUT*	-0.356*	-0.517***	-0.456**	-0.692***	-0.355*	-0.442**	-0.314**	-0.539***	-0.399**	-0.631***	-0.378*	-0.566***
× Post 1914	(0.193)	(0.163)	(0.218)	(0.170)	(0.194)	(0.175)	(0.129)	(0.126)	(0.198)	(0.155)	(0.213)	(0.188)
Pre-war reliance on 3% frontier *IN*	0.015	-0.001	-0.204	-0.224*	-0.195	-0.245*	-0.121	-0.127*	-0.118	-0.134	-0.068	-0.074
× Post 1914	(0.183)	(0.153)	(0.174)	(0.127)	(0.191)	(0.141)	(0.093)	(0.076)	(0.184)	(0.146)	(0.190)	(0.160)
Within R-squared	0.016	0.020	0.014	0.017	0.010	0.013	0.001	0.003	0.015	0.019	0.019	0.022
Panel C: Frontier measured by Top 5%												
Pre-war reliance on 5% frontier *OUT*	-0.323**	-0.431***	-0.323*	-0.581***	-0.239	-0.393***	-0.230**	-0.450***	-0.335**	-0.546***	-0.317*	-0.502***
× Post 1914	(0.150)	(0.156)	(0.172)	(0.150)	(0.155)	(0.139)	(0.102)	(0.141)	(0.156)	(0.145)	(0.172)	(0.183)
Pre-war reliance on 5% frontier *IN*	-0.074	-0.081	-0.164	-0.196**	-0.195	-0.241**	-0.062	-0.091	-0.143	-0.172	-0.104	-0.117
× Post 1914	(0.131)	(0.108)	(0.124)	(0.093)	(0.137)	(0.113)	(0.093)	(0.084)	(0.137)	(0.107)	(0.141)	(0.118)
Within R-squared	0.016	0.020	0.014	0.017	0.010	0.013	0.001	0.003	0.015	0.019	0.019	0.022
Scientist FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES		YES		YES		YES		YES		YES	
Pre-war reliance on non-frontier	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Career age × field interactions	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Camp × field × year FE		YES		YES		YES		YES		YES		YES
Observations	227,084	227,084	227,084	227,084	227,084	227,084	227,084	227,084	227,084	227,084	227,084	227,084
Number of scientists	8,734	8,734	8,734	8,734	8,734	8,734	8,734	8,734	8,734	8,734	8,734	8,734

Notes: Each column and each panel reports one set of parameter estimates of regression (3) for the panel of university scientists. In columns (1)-(8), the dependent variable counts the number of times a novel word published in a scientific paper in year t was used in the text of patents granted by the U.S. Patent Office in years $t+15$ and $t+30$. In columns (9)-(10), the dependent variable counts the number of patents in which a novel word published in a scientific paper in year t was used by patents granted in years $t+15$ and $t+30$. In columns (11) and (12), the dependent variable counts the number of times a novel word published in a scientific paper was used in the text of any patent granted between the publication date of the paper (or 1920 if the paper was published earlier) and 1979. In columns (1)-(6) and (9)-(12), the dependent variable is winsorized at the 99th percentile. "Pre-war reliance on frontier *OUT*" is the pre-war citation share to frontier research (1%, 3%, or 5%) from outside the camp. "Pre-war reliance on frontier *IN*" is the pre-war citation share to frontier research (1%, 3%, or 5%) from foreign countries inside the camp. The reference/omitted category is "Pre-war reliance on frontier *HOME*." Standard errors are clustered at the country-times-field level. Significance levels: ∗∗∗ $p<0.01$, ∗∗ $p<0.05$, and ∗ $p<0.1$. The data were collected by the authors and combine scientist census data from *Minerva - Handbuch der Gelehrten Welt*, publication and citation data from *ISI - Web of Science*, and patent data from the *U.S. Patent Office* (see section III. for details).

B Additional Results Section 3

B.1. Heterogeneity Allied and Central Papers

We also explore heterogeneity in effects on citation shares between Allied and Central citing papers. We find that the results are stronger for Allied citing papers than for Central citing paper during WWI. During the boycott, the interruption of knowledge flows had an almost symmetric effect on citation shares in the two camps (appendix Table A.6, columns 2 and 3).

B.2. Robustness Checks on International Knowledge Flows

The main results in section IV.A. are estimated on the full sample of papers. The sample includes papers by scientists with a university position by 1914 and papers by other scientists if they reported a university affiliation in the paper (see section III. for details). If new citing scientists had different research practices that resulted in different citation patterns, then the entry of citing scientists who reported an affiliation in the paper could potentially affect our findings. To test for this possibility, we restrict the sample of citing scientists to those with a university position by 1914. The initial decline in the share of references quoting research from outside the camp was similar to the decline in the full sample; the recovery during the mid-1920s, however, was stronger (appendix Figure A.6, panel a).

For the results reported in appendix Figure A.6, panel (a), we investigate citations of established scientists and consider references to any research, independently of whether the research was produced by established scientists or by other scientists. If other scientists worked on different topics and entered the sample at differential rates across camps, the changes in citation patterns could be driven by the changing composition of research produced at home or abroad. We test for this possibility by investigating changes in citation shares of established scientists and by considering only references to research by other established scientists. The relative decline of references to research from *outside* the camp was similar to that of the full sample, but there was full recovery in these citation shares toward the end of the sample period (appendix Figure A.6, panel b). The relative decline of references to research from foreign scientists *inside* the camp was smaller for this sample, and exhibited a stronger pre-trend. Differently from the citation patterns reported for the full sample of scientists (Figure IV), established scientists went back to their pre-war citation behavior. This suggests that researchers that entered science during the war and the boycott were permanently less international than the established scientists.

Finally, we investigate how changes in the number of papers that were produced in each camp affected the citation patterns. For this test, we normalize the citation shares by the total number of potentially citeable papers produced in each camp. We divide the citation shares to research from home by the number of potentially citeable papers produced at home. Similarly, we normalize the citation shares to foreign research produced inside the camp and outside the camp with the number of potentially citeable papers in the two camps.[45] The normalized citation shares to research from outside the camp fell after 1914, particularly during the early boycott years (Figure A.6, panel c). By the mid-1920s, the normalized shares fully recovered. The normalized citation shares to research from foreign scientists inside the camp also fell, but less sharply than the outside-camp shares. In any given year, scientists in small countries did not publish many papers in one of the 160 top journals. As a result, the normalized citation shares to research from home (the excluded category in the regression) fluctuated substantially for the smaller countries, leading to relatively large variability of the results plotted in Figure A.6, panel (c). We therefore re-estimate the regressions with the normalized citation shares for the six countries with the largest scientific output in our data. The results are indeed less volatile and confirm the previous findings (Figure A.6, panel d).[46]

B.3. The Effect of WWI and the Boycott on Relative Citations of Neutrals

Our data also allow us to investigate the effect of WWI and the boycott on citation patterns of Neutrals by estimating equations (1) and (2) for Neutral papers. For these, foreign inside camp research was produced in other Neutral countries and foreign outside camp research was produced outside the Neutral camp.

Not surprisingly, citation shares to research from outside the camp were always very high because none of the Neutral countries was very large, and hence Neutral scientists relied on research from the leading scientific nations. After 1914, there was only a small, but not significant, decline in the citation shares to research from outside the camp. There was no decline in the citation shares to foreign research from inside the camp (appendix Figure A.8, panel (a) and appendix Table A.10 columns 1 and 2).

The citation shares to research from outside the camp can be divided into the citation shares to Allied, Central, and other research. During the war and the boycott, Neutral papers increased the citation shares to Allied research and decreased the citation shares to Central research (appendix Figure A.8, panel (b) and appendix Table A.10 columns 3 and 4). These results are consistent with historical anecdotes that Neutral scientists could still attend Allied conferences and that Germany

[45]We compute the normalized citation shares to research produced at home as: $(\frac{c_{Home}}{C_{Total}} \times \frac{1}{N_{Home}})$, where N_{Home} is the number of potentially citeable papers produced at home in the five years preceding the publication of the citing paper. Similarly, we compute the normalized shares $(\frac{c_{Foreign-IN}}{C_{Total}} \times \frac{1}{N_{Foreign-IN}})$ and $(\frac{c_{Foreign-OUT}}{C_{Total}} \times \frac{1}{N_{Foreign-OUT}})$. The normalized shares can be interpreted as the probability that a reference quotes a randomly selected paper produced in a certain camp. As we divide the citation shares by thousands of potentially citeable papers, the measure has a lower scale than before.

[46]In further robustness checks, we show that the results also hold when we restrict the sample to citing papers of scientists from small scientific countries and when we separate citation shares to research from outside the camp into the shares to research from enemy countries, Neutral countries, and other countries (appendix Figure A.7)

restricted the delivery of scientific journals even to Neutral countries during WWI (Reinbothe, 2006, pp. 116).

C Appendix Latent Semantic Analysis

Latent Semantic Analysis is a machine learning technique which was developed for information retrieval in search queries (Deerwester et al., 1990). In search queries, it is important to accurately judge the semantic relationships between words and documents to provide coherent search results. LSA has been shown to be reliable in many other task involving word/text similarity (Landauer, Foltz, and Laham, 1998). What makes these similarity tasks challenging is that there are many different ways to express the same idea. LSA "learns" the relationships between words. LSA accomplishes this by using Truncated Singular Value Decomposition, which reduces the dimensionality of the semantic space.

LSA requires a document-term-matrix A with dimensions $D \times V$ as input. V is the number of unique terms, i.e. words, in the vocabulary and D is the number of documents, i.e. paper titles. A contains a row for each document, while the columns contain the term counts. Defining $f_{d,v}$ as the number of times term v appears in document d, the matrix A is given by:

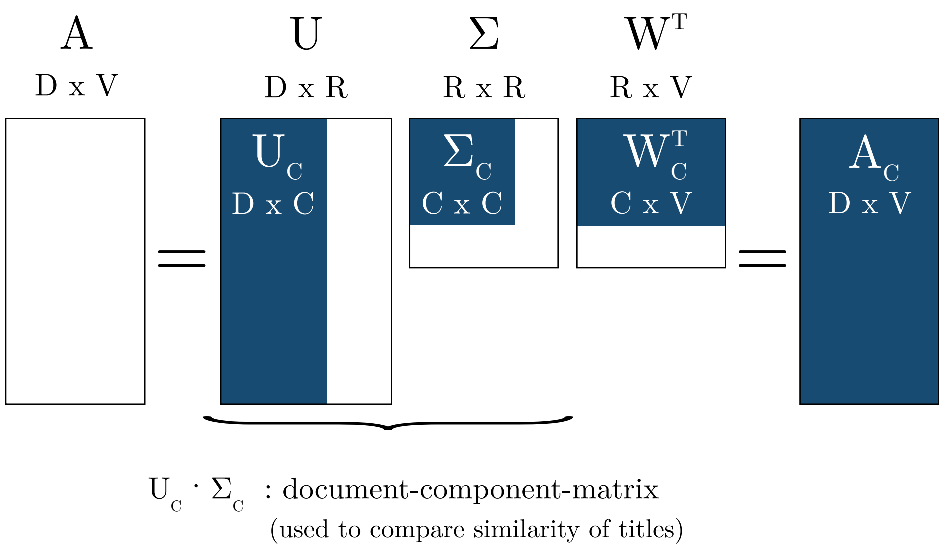
$$\underbrace{A}_{D\times V} = \begin{pmatrix} f_{1,1} & \cdots & f_{1,d} \\ \vdots & \ddots & \vdots \\ f_{d,1} & \cdots & f_{d,v} \end{pmatrix}$$

To improve the performance of LSA, we re-weigh the entries in A using term frequency–inverse document frequency (tf-idf). Tf-idf re-weighting replaces $f_{d,v}$ by $tf - idf(f_{d,v}) = \left(1 + \log(f_{d,v})\right) \cdot \left(\log\left(\frac{1+D}{1+d_v}\right) + 1\right)$, where d_v is the number of documents term v appears in at least once. This step decreases the weights of words which appear frequently in all documents D, since these words contribute little to the meaning of documents.[47]

LSA decomposes matrix A with $rank(A) = R$ into three matrices such that $A = U\Sigma W^T$, where U is a $D \times R$ orthogonal matrix, W^T is a $R \times V$ orthogonal matrix, and Σ is a $R \times R$ diagonal matrix. LSA truncates the dimensions of the matrices until U becomes U_C of dimension $D \times C$, Σ becomes Σ_C of dimension $C \times C$, and W^T becomes W_C^T of dimension $C \times V$ (see appendix Figure C.1).

[47] Theoretically, one could compare the similarity between two titles using just the individual word frequencies or tf-idf scores in each title. Differently from LSA, the use of word-frequencies would ignore relationships between words.

Figure C.1:
LSA Graphical Representation



Notes: The Figure is a modification of the graphic in Martin and Berry (2007)

C is the user-chosen number of components, which is chosen on the basis of the size of the vocabulary. During the truncation process, LSA removes rows and columns associated with the smallest values in the matrix Σ. This gives the best rank-C approximation A_C of the original matrix A. The output of LSA is $U_C\Sigma_C$, a $D \times C$ document-component matrix that is used to compare the similarity of documents.

LSA reduces the components of the semantic space to the C most important ones and therefore uncovers latent semantic connections between words.[48]

For our main results, we choose $C = 500$ components. For most applications, $100 \leq C \leq 1000$ leads to good results (Martin and Berry, 2007). Our results are robust to using either 300 or 1000 components. To implement LSA, we use Python machine learning library *scikit learn (Pedregosa et al., 2011).*

D Stylized Example of Identifying Variation for Productivity Regressions

The identifying variation to estimate regression equation (3) relies on field-country level differences in citations to research from home, foreign countries inside the camp, and outside the camp.

[48]The LSA process is conceptually similar to a principal component analysis for regressions. Instead of reducing the number of regressors, it reduces the number of components in semantic space.

D.1. Model with Scientist Fixed Effects

The estimation of the baseline model (equation (3)) with scientist fixed effects only requires field-country level differences in output as a source of variation (for an example, see Panel B of Table D.1; the example abstracts from the distinction between frontier and non-frontier research and from the distinction between fields in each country).[49] It is easily observable that countries differ substantially in the amount of research that they produce, especially frontier research.[50]

D.2. Model with Scientist Fixed Effects and Camp-times-Field-times-Year Fixed Effects

The estimation of β_2 in the augmented model that additionally includes camp-times-field-times-year fixed effects only requires the field-country level differences in output described above (see Panel B of Table D.1). Cross-country frictions to knowlege flows within fields, which occur even in normal times, can be exploited to estimate β_1 in the augmented model. Specifically, frictions to knowledge flows within the camp and differential output across countries (within fields) lead to within camp variation in citation shares to research from outside the camp (see Panel C of Table D.1).[51]

Examples of such frictions, that occur even in normal times, are differences in languages, travel costs to attend seminars and conferences (e.g. Table II), and journal subscriptions that favored locally produced journals.

[49] The sum of all scientist fixed effects in a field-country pair are perfectly collinear to a field-country pair fixed effect.

[50] Only in the unrealistic case that all field-country pairs produced the same number of papers in the pre-war period, and knowledge travelled freely across countries, all field-country pairs would have the same citation shares to pre-war research and there would be no variation to estimate equation (3) (see Panel A of Table D.1).

[51] Panel D of Table D.1 shows the more realistic case of frictions both within and between camps. These frictions change pre-war citation shares, but are not necessary to introduce within-camp variation in citations shares to research from outside the camp. Any additional friction that varies at the country level (within fields) would introduce further within-camp variation in pre-war citation shares.

Table D.1: Stylized Example of Identifying Variation in Productivity Regressions

Panel A: Same output, no frictions

	Number of pre-war papers produced	Pre-war research cited by:				Resulting citation shares		
		U.S. biologists	U.K. biologists	German biologists	Austrian biologists	Home	Fout	Foin
USA biology	5	5	5	5	5	0.25	0.5	0.25
UK biology	5	5	5	5	5	0.25	0.5	0.25
Germany biology	5	5	5	5	5	0.25	0.5	0.25
Austria biology	5	5	5	5	5	0.25	0.5	0.25

Panel B: Different output, no frictions

	Number of pre-war papers produced	Pre-war research cited by:				Resulting citation shares		
		U.S. biologists	U.K. biologists	German biologists	Austrian biologists	Home	Fout	Foin
USA biology	10	10	10	10	10	0.40	0.40	0.20
UK biology	5	5	5	5	5	0.20	0.40	0.40
Germany biology	5	5	5	5	5	0.20	0.60	0.20
Austria biology	5	5	5	5	5	0.20	0.60	0.20

Panel C: Different output, frictions within the same camp

	Number of pre-war papers produced	Pre-war research cited by:				Resulting citation shares		
		U.S. biologists	U.K. biologists	German biologists	Austrian biologists	Home	Fout	Foin
USA biology	10	10	$10 \cdot 0.6 = 6$	10	10	0.43	0.43	0.13
UK biology	5	$5 \cdot 0.6 = 3$	5	5	5	0.24	0.48	0.29
Germany biology	5	5	5	5	$5 \cdot 0.6 = 3$	0.22	0.65	0.13
Austria biology	5	5	5	$5 \cdot 0.6 = 3$	5	0.22	0.65	0.13

Panel D: Different output, frictions both within and between camps

	Number of pre-war papers produced	Pre-war research cited by:				Resulting citation shares		
		U.S. biologists	U.K. biologists	German biologists	Austrian biologists	Home	Fout	Foin
USA biology	10	10	$10 \cdot 0.6 = 6$	$5 \cdot 0.6 = 3$	$5 \cdot 0.6 = 3$	0.53	0.32	0.16
UK biology	5	$5 \cdot 0.6 = 3$	5	$5 \cdot 0.6 = 3$	$5 \cdot 0.6 = 3$	0.29	0.35	0.35
Germany biology	5	$5 \cdot 0.6 = 3$	$5 \cdot 0.6 = 3$	5	$5 \cdot 0.6 = 3$	0.29	0.53	0.18
Austria biology	5	$5 \cdot 0.6 = 3$	$5 \cdot 0.6 = 3$	$5 \cdot 0.6 = 3$	5	0.29	0.53	0.18

Notes: The Table shows a stylized example of the identifying variation exploited to estimate equation (3). Panels C and D assume a proportional friction of $f = 0.6$. The results are qualitatively similar with any proportional friction $f \in (0, 1)$.

E Further Details on Data

E.1. Further Details on Journal Delay Data

We collect data on entry stamps from the Harvard library for four international journals. Two Central journals, the *Zeitschrift für Analytische Chemie* and the *Annalen der Physik*, and two Allied journals, the British journal *Nature*, and the French journal *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*. Appendix Table E.1, column 2, reports the volumes and issues for which we obtain entry stamps from the Harvard library. Sometimes two issues within a volume were published at the same time (e.g. no. 3 and 4) and hence they only have one entry stamp and one publication date. In very rare cases, the entry stamp is so blurred that the entry date is not legible.

At Harvard, we collect 61 (legible) entry stamps for the *Zeitschrift für Analytische Chemie*, 145 for the *Annalen der Physik*, 161 for *Nature*, and 28 for the *Comptes Rendus*.

Table E.1: Data Sources Journal Delays

(1) Year reported in Figure (2)	(2) Volume(s) at Harvard	(3) Issues with stamps at Harvard	(4) Issues with stamp at Heidelberg	(5) Publication Dates
Panel (a): Zeitschrift für Analytische Chemie				
1910	49	all		10/27/1909 to 10/15/1910
1913	52	all		10/30/1912 to 09/17/1913
1917	56	all		11/30/1916 to 01/05/1918
1919	58	all		01/20/1919 to 01/22/1920
1921	60	all		12/15/1920 to 10/06/1921
1923	62	all		09/30/1922 to 05/20/1923
1927	71	all		04/14/1927 to 08/23/1927
Panel (b): Annalen der Physik				
1910	31-33	all	33:1	12/30/1909 to 12/20/1910
1913	40-42	all	40:1, 41:1, 42:1	12/31/1912 to 12/23/1913
1917	52-54	all	52:1, 53:1, 54:1	02/15/1917 to 04/26/1918
1919	58-60	all		01/17/1919 to 12/19/1919
1921	64-66	all	64:1-2, 65:1, 66:1	01/20/1921 to 12/20/1921
1923	70-72	all	70:1, 71:1, 72:1	01/18/1923 to 11/??/1923
1927	82-84	all	82:1, 83:1, 84:1	12/16/1926 to 01/13/1928
Panel (c): Nature				
1910	83	all		03/03/1910 to 06/30/1910
1913	91	all		03/06/1913 to 08/28/1913
1917	99	all		03/01/1917 to 08/30/1917
1919	103	all		03/06/1919 to 08/28/1919
1921	107	all		03/03/1921 to 08/25/1921
1923	111	all		01/06/1923 to 06/30/1923
1927	119	all		01/01/1927 to 03/26/1927
Panel (d): Comptes Rendus				
1910	150-151	1, 23, 10, 21		01/03/1910 to 11/21/1910
1913	156-157	7, 23, 8, 21		02/17/1913 to 11/24/1913
1917	164-165	7, 22, 8, 25		02/12/1917 to 12/17/1917
1919	168-169	3, 14, 26, 18		01/20/1919 to 11/03/1919
1921	172-173	2, 23, 15, 24		01/10/1921 to 12/12/1921
1923	176-177	10, 4, 19, 25		03/05/1923 to 12/17/1923
1927	184-185	7, 23, 7, 23		02/14/1927 to 12/05/1927

Notes: The Table reports volumes, issues, and publication dates for four international scientific journals. In contrast to all other issues, the last two 1923 issues in the *Annalen der Physik* only reported the month but not the day of publication. For these two issues, we set the publication dates to the middle of the month. The data were collected by the authors from the Harvard Library and the Library of the University of Heidelberg.

Depending on the journal and issue, either the publication date or editorial deadline is reported for each issue. The *Zeitschrift für Analytische Chemie* always reports editorial deadlines, the *Annalen der Physik* reports publication dates until 1923 and editorial deadlines in 1927, and *Nature* and the *Comptes Rendus* always reports publication dates. To make entry dates comparable across journals and over time, we assume that editorial deadlines were 14 days before the publication date of the journal.

We calculate average arrival delays as the difference between the arrival date (as measured by the entry stamp) and the publication date and average these delays for each year (1910, 1913, 1917, 1919, 1921, 1923, 1927) and journal.

Because of the way that journals were bound at Heidelberg, entry stamps are only preserved for the first issue of each volume for the *Annalen der Physik* at Heidelberg (see appendix Table E.1, column 4). When we report differences between arrival delays for the *Annalen der Physik* at Harvard and Heidelberg, we only use issue numbers that were available in both libraries.

E.2. Further Details on the ICM Proceedings, 1897-1932

We collect data on the number of delegates at all *International Congresses of Mathematicians* (ICMs) from 1897 until 1932 from historical volumes of the ICM Proceedings, available at http://www.math-union.org/home/. After each congress, the local organizers edited one or more volumes of ICM Proceedings summarizing the main information regarding the conference. The historical ICM Proceedings were written in the official language of the host country, e.g., German for the 1904 ICM held in Heidelberg and Italian for the 1908 ICM held in Rome. Among other information, the volumes report the full list of participants at each congress. This list contains the professional address of each participant. From this address, we obtain the number of delegates by countries reported in Table II.

E.3. Further Details on the Solvay Conferences in Physics

We collect data on the participants of every *Solvay Conference* in Physics from 1911 (first edition) until 1930 from Mehra (1975). For each conference, Mehra (1975) reports a historic picture of the participants during the event with the corresponding names and professional addresses (at the moment of the event). We use this information on the country for Figure II and appendix Table A.2. In some of the historic pictures in Figure II, only a subset of all conference participants appear.

E.4. Further Details on Linking Scientist Censuses with Papers, Citations, and Nobel Prize Nominations

Further Details on the Censuses of University Scientists for 1900 and 1914 As described in the main text, we digitize two historical censuses of all university scientists in the world from the 1900 and 1914 volumes of *Minerva–Handbuch der Gelehrten Welt.* Because the formatting of early volumes of *Minerva* makes the use of Optical Character Recognition software infeasible, all names and specializations are typed in by hand with the help of research assistants. The data list 569 universities in the year 1900 and 973 universities in the year 1914 (appendix Table A.1, panel a). Across all fields, the data contain 24,166 professors in 1900 and 42,226 professors in 1914.[52] A few universities, mostly smaller and less well-known institutions, only reported the number of professors but not their names. The data therefore contain names of 23,917 professors in 1900 and 36,777 professors in 1914 (appendix Table A.1, panel a). In the five scientific fields we study in our analysis, the data contain 10,133 scientists in 1900 and 15,891 scientists in 1914 (appendix Table A.1, panel b).

Further Details on Selection of Journals From the 263 journals available in the ISI Century of Science database (http://wokinfo.com/products_tools/backfiles/cos/), which covers journals published before WWII, we download all journals apart from journals that mostly publish engineering research (e.g. *Proceedings of the Institute of Radio Engineers*), specialized medicine (e.g. *American Journal of Insanity*), or Geology (e.g. *Soil Science*), resulting in 184 journals. The *Web of Science* does not include papers for publication years before 1930 for 23 of these journals, mostly because the journals were founded after 1930. This results in 161 journals with valid data between 1905 and 1930. Finally, one journal (Zoologiska Bidrag fran Uppsala) published only 40 papers between 1905 and 1930 and none was published by the university scientists in our sample.

Further Details on Obtaining Full information on all References The publication and citation data from the Web of Science have the following structure:

Table E.2: Example Data Structure Web of Science

Citing paper	**References**
Citing paper 1 (full information)	reference 1 (partial information)
Citing paper 1 (full information)	reference 2 (partial information)
Citing paper 1 (full information)	reference 3 (partial information)
Citing paper 1 (full information)	reference 4 (partial information)
Citing paper 2 (full information)	reference 1 (partial information)
Citing paper 2 (full information)	reference 2 (partial information)
Citing paper 2 (full information)	reference 3 (partial information)
⋮	⋮

As indicated in the table presented above, the Web of Science reports only partial information for each reference. Instead of including the full reference with all authors and complete journal information, each reference lists at most five items: the first author, the publication year of the reference, an abbreviation of the journal name, the volume of the journal, and the first page of the article.

We obtain complete references, including a full list of referenced scientists, their affiliations (if available), and the total number of citations received by the reference, by merging the full infor-

[52]We use the term professor to refer to individuals who were the equivalent of assistant professors, associate professors, or full professors. We thank Clément de Chaisemartin, Henrik Kleven, Katrine Loken, Ioana Marinescu, Sharun Mukand, and Matti Sarvimäki for help with classifying university positions in various countries.

mation from all papers in our data to the references. To improve the quality of this match, we first correct spelling inconsistencies in the abbreviated name of the referenced journal.[53]

References abbreviate journal names, such as the *Proceedings of the National Academy of Sciences of the United States of America* (PNAS) in various ways, such as "p natl acad sci usa," "p nat ac us," and with dozens of other abbreviations. We manually standardize around 2,000 different ways of spelling the abbreviated names of referenced journals.

Further Details on Assigning Countries to Citing Papers and References As described in the main text, we assign countries to scientists and references in a three step hierarchical process. First, we use the country information from the affiliation reported in papers that list affiliations. Second, we use the country information from the two scientist censuses, first using the 1914 data and then the 1900 data. Third, we expand the country information for scientists with identical names within the corresponding cited or citing journal.

In the first step of our country assignment, we use the affiliation reported in papers that list affiliations.

In the second step of our country assignment, we match the country information of the scientist censuses to the Web of Science data. To maximize the quality of this match, we match on the last name, the initials, and the research field in a two-step process. First, we match on last name, all initials, and research field; second, we match previously unmatched papers on the basis of last name, first initial, and research field. Some scientists reported up to three research fields in the scientist census data, e.g. biology and medicine. Some journals also published research from multiple fields. We map scientist fields into journal fields as follows:

Table E.3: Mapping Journal Fields to Scientist Fields

Journal field	Journal Example	Scientists with the following fields are matched to papers in respective journals
Medicine	Lancet	Medicine
Medicine/Biology	Pflugers Archiv fur die Gesamte Physiologie des Menschen und der Tiere	Medicine, Biology
Medicine/Biology/Chemistry	Archiv fur Experimentelle Pathologie und Pharmakologie	Medicine, Biology, Chemistry
Medicine/Chemistry	Journal of Pharmacology And Experimental Therapeutics	Medicine, Chemistry
Biology	Annals of Applied Biology	Biology
Biochemistry	Biochemical Journal	Biology, Chemistry
Chemistry	Angewandte Chemie	Chemistry
Physical Chemistry	Journal of Physical Chemistry	Chemistry, Physics
Physics	Physical Review	Physics
Mathematical Physics	Sitzungsberichte der Preussischen Akademie Physikalisch-Mathematische Klasse	Physics, Mathematics
Mathematics	Acta Mathematica	Mathematics
General Science	Nature	Medicine, Biology, Chemistry, Physics, Mathematics

Scientists with a single research field in the scientist census data, e.g. physics, are matched with all articles in journals that publish some research in physics, i.e. physics, general science, mathematical physics, and physical chemistry. Scientists with multiple fields in the scientist census data, e.g.

[53]References may not merge during this step for two reasons: first, the reference was not published in one of the 160 journals in our data and, second, some items in the reference are misspelled. In our sample, we obtain full information on 62 percent of recent references. Because we need to measure the country and quality of references for our analysis, we focus on papers with full reference information.

mathematics and physics, are matched to all articles that publish some research in mathematics or physics.

The match with the scientist census data is done hierarchically. First, we match scientists from the Web of Science data to the scientists from the 1914 census, as 1914 is in the middle of our sample period. Scientists who do not merge with the 1914 census are matched to the 1900 census.

In the third step of our country assignment, we expand the country information for scientists with identical names within the corresponding citing or cited journal.

Further Details on the Nobel Nomination Data As described in the main text, we collect data on all nominees for the Nobel Prize from Nobelprize.org (2014). The data contain 993 individuals who were nominated for a Nobel Prize for the first time between 1905 and 1945. To identify winners and the period when winners worked on their Nobel prize winning research, we merge these data with the data on Nobel Prize winners from Jones and Weinberg (2011).

We determine the main nomination field (physics, chemistry, or medicine/physiology) of each nominee by counting the number of nominations in each field. The main nomination field is the field for which a candidate obtained most nominations. E.g. if a scientist received five nominations in physics and one in chemistry, we defined his main nomination field as physics.

We then merge the nominees to all papers in our list of 160 journals from the Web of Science for the publication years 1900 to 1940. To improve the quality of this match, and to reduce the probability of false positives, we only match publications in journal fields that corresponded to likely publication patterns of scientists in certain fields. E.g. we only match publications in physics, general science, mathematical physics, physical chemistry, and chemistry to individuals who received the majority of their nominations for the physics prize.

For six nominees, the last name and the initials of the first name were not unique, e.g. "Paul Weiss" and "Pierre Weiss" were both nominated for a prize between 1905 and 1945. To minimize the probability of false positives, we do not match these individuals if they work in the same field. Three of the six, however, worked in different fields, e.g. "Paul Weiss" was predominately nominated for the medicine prize and "Pierre Weiss" was predominately nominated for the physics prize. We match these three scientists to a very strict definition of journal fields. E.g. we only match them to physics journals (but not general science and other journals if they were physicists).

Further Details on Novel Scientific Words and their Application in U.S. Patents We measure how the interruption of international knowledge flows impacted the introduction of novel scientific words in the titles of academic papers. We define a novel word as a word that did not appear in any paper title before and that appears in at least one paper afterwards. To identify novel words, we use the full set of 462,871 papers that were published in any of the 160 top journals between 1900 until 1940, independently of whether the paper was published by a scientist in our sample of university scientists. To avoid that common words are included in this novel word count, we preemptively remove 10,000 frequent English words as well as all numbers from the data.

The word list is based on the 10,000 most frequent words in the English books found on Project Gutenberg on 16th April 2006. This word list is available at https://en.wiktionary.org/wiki/Wiktionary:Frequency_lists#English. As the Project Gutenberg word list does neither contain all verb forms (i.e. conjugations) nor necessarily singular and plural forms of nouns (e.g. it only contains scatter but not scatters), we also remove the equivalent forms of verbs and nouns. The results are robust to excluding only 5,000 or all 36,662 frequent words reported from Project Gutenberg as of April, 16, 2006. This allows us to count the number of novel words which appear in the titles of the papers published by any of the university scientists in our sample between 1905 and 1930. If a novel word first appears in more than one paper in one year, we count this word for all papers in that year.

We also measure whether the novel scientific words were applied in patents. We obtain digitalized versions of U.S. patents for grant years 1920 to 1979 from the web page of the United States Patent Office (https://www.uspto.gov/). The data are in plain text format and were created by optical character recognition (OCR). As a result the texts may contain recognition errors.

We first split the text file into individual patents using the string "*** BRS DOCUMENT BOUNDARY ***" as a marker for a new patent record. We extract the grant date of the patent using the marker "AISD." We extract the patent text between the markers "United States Patent Office" and "AISD." In total, we use over 65 different regular expressions to account for possible misspellings of "United States Patent Office." The final data contain over 2.5 million patents with a total of more than 7.5 billion words. For 17,754 patents (0.7 percent of all patents) the OCR quality does not allow us to extract the relevant information and we drop them from the sample.

We use these data to count the number of times a novel scientific word appeared in patents that were granted between year $t + 15$ and $t + 30$, where t corresponds to the publication year of the scientific paper that introduced a novel word. As an example, for a paper that introduced a novel word in 1905, we search patents granted between 1920 and 1935.

E.5. Further Details on War Intensity Data

Data on war intensity come from Mougel 2011, *1914-1918 online: International Encyclopedia of the First World War*, and *Wikipedia*.

We create an indicator for whether a country experienced any combat by checking the battlefronts of WWI combining information from *Wikipedia:*

1. https://en.wikipedia.org/wiki/Western_Front_(World_War_I)

2. https://en.wikipedia.org/wiki/Italian_Front_(World_War_I)

3. https://en.wikipedia.org/wiki/Romania_during_World_War_I

4. https://en.wikipedia.org/wiki/History_of_Poland_during_World_War_I

5. https://en.wikipedia.org/wiki/History_of_South_Africa_(1910%E2%80%9348)

6. https://en.wikipedia.org/wiki/Eastern_Front_(World_War_I)#/media/File:Map_Treaty_of_Brest-Litovsk-en jpg

7. https://en.wikipedia.org/wiki/Balkans_Campaign_(World_War_I)

8. https://en.wikipedia.org/wiki/Middle_Eastern_theatre_of_World_War_I,

and *1914-1918 online International Encyclopedia of the First World War:*

9. http://encyclopedia.1914-1918-online.net/article/greece

10. http://encyclopedia.1914-1918-online.net/article/warfare_1914-1918_new_zealand.

Data on total WWI-deaths and civilian deaths come from Mougel (2011), who compiles deaths by country for project REPERES. Mougel (2011) lists total deaths per capita and the total number of civilian deaths. We convert civilian deaths into civilian deaths per capita by dividing them by the total population. Mougel (2011) reports deaths by country in the borders of 1914. In our analysis, we separately analyze Ireland and the the rest of the United Kingdom; and Austria and Hungary. We obtain country-specific measures of WWI-deaths for Ireland, Austria, and Hungary from Wikipedia (https://en.wikipedia.org/wiki/World_War_I_casualties).

E.6. Further Details on Obituaries

We collect data on obituaries from *Science*, *Nature*, *Physikalische Zeitschrift, Sitzungsberichte der Preussischen Akademie der Wissenschaften*, *and Kürschners Deutscher Gelehrtenkalend*er.

For *Science,* we record deaths announcements as reported in the "Notes and News" and "Obituary" sections between 1905 and 1930. We download the full text of all the "Notes and News" sections as PDFs from *JSTOR* and search for key phrases such as "deaths are announced," "regret to learn of the death" or "regret also to record the death" to identify death announcements. Research assistants then record death annoucements from the surrounding text. Additionally, we hand collect information on death announcements as reported in the "Obituary" sections of *Science*.

For *Nature,* we record all death announcements from the "News" and "Obituary" sections published between 1905 and 1930. Research assistants individually checked the titles in all "News" sections and manually record death announcements. In the "Obituary" sections the title and the first paragraph contain the information on the deceased scientist that we record manually. Additional obituaries are introduced by the paragraph "We regret to announce the following deaths."

For *Physikalische Zeitschrift* we obtain the full text from *hathitrust.org* for the years 1905 to 1922, and from print versions of the journal for the years 1923 to 1930. In both cases we manually record death announcements from the "Personalien" sections.

For *Sitzungsberichte der Preussischen Akademie der Wissenschaften*, we download the full text and search for paragraphs containing the phrase "durch den Tod“ and "starb" for the year 1905 to 1922. Research assistants then record death announcements from these paragraphs.

For *Kürschners Deutscher Gelehrtenkalender* we manually digitize death announcements from the list of deceased scientists published in three volumes of the *Gelehrtenkalender* (1926, 1928/29, and 1931) .

In all cases we collect the name, the date of death and, if available, the specialization of the deceased scientist. If no specific death date is given, we use the year of the publication as an upper bound for the year of death.

Between 1905 and 1930, the five sources published 6,507 obituaries, reporting on 5,435 unique individuals. We hand-check obituaries to harmonize spellings of names and year of death across sources. In the next step, we remove obituaries on clergymen and military personnel. Finally, we retain the 3,084 obituaries that report deaths of scientists in the five fields of our main analysis (mathematics, physics, chemistry, biology, and medicine). Of these, 1,856 can be merged to the scientists in our sample, indicating that the scientist passed away between 1905 and 1930.