Peer Effects in Science

Evidence from the Dismissal of Scientists in Nazi Germany

Online Appendix

Fabian Waldinger (University of Warwick)

July 5, 2011

1 Appendix 1: Identification Robustness Checks

This section provides additional details on the robustness checks summarized at the end of section 6.2. in the main paper. As outlined in the main text, using the dismissals as instrumental variables relies on the assumption that the dismissals only affected scientists' productivity through its effect on the researchers' peer group. In the following discussion, I investigate potential concerns which may bias the IV coefficients in the direction of not finding an effect.

One may worry that the dismissals changed the incentive structure for stayers in the affected departments. Researchers in departments with many dismissals may have had an incentive to work harder to obtain one of the free chairs within the department. Their incentives could also be affected in the opposite direction if they lost an important mentor who was fostering their career. In order to address this concern I regress a promotion indicator on the dismissal variables and the same controls as in the regressions proposed before. The coefficients on the dismissal variables are very small and none of them is significantly different from 0 (Table A8, columns 1 and 2). This suggests that changing incentives are unlikely to affect my findings.

Extremely few scientists who were not dismissed left the German universities during the time period studied in this paper, mainly for two reasons. First, "[m]any hoped that the Nazi regime had reached its peak and that it was only a matter of time before it would go the way of the many previous weak and short-lived Weimar coalitions." (Hentschel, 1996). Second, Germany was still the leading country for scientific research, particularly in the minds of German academics. Nonetheless, any such voluntary resignations could potentially bias my findings, as those who were exempted from being dismissed but voluntarily resigned may have done so because the departmental colleagues with whom they interacted most were being deported. If this were the case, it would tend to bias my results towards not finding peer effects. To explore this concern I regress an indicator for leaving the sample on the dismissal variables. Reassuringly, the probability that a scientist leaves the sample is unrelated to the dismissals (Table A8, columns 3 and 4).

Another worry is that departments with more ardent Nazi supporters would increase their productivity because they received more research funding or other privileges. This would threaten the identification strategy if the number of Nazi supporters was correlated with the number of dismissals. Looking at the number of party members to investigate this concern would not be informative because the vast majority of university researchers eventually joined the Nazi party. In November 1933, 839 university professors (out of more than 10,000 professors in Germany) signed the "Commitment of Professors at the German Universities (...) to Adolf Hitler and the National Socialist State..." This list signalled the professors' support of the new government and was widely publicized in newspapers. Most people signing the list were strong supporters of the Nazi regime and would therefore have benefited from any differential treatment. I regress a dummy for signing the support list on the dismissal variables and other controls. The coefficients on the dismissal variables are all small and none of them is significantly different from 0, indicating that strong support of the Nazi party was not different in departments with dismissals (Table A8, columns 5 and 6).

The identification strategy might also be invalidated if the Nazi government increased funding of affected departments to counteract negative dismissal effects. Salaries for university employees were paid by the states and were closely linked to the position of the researcher. They hardly changed over the time period and certainly not differentially across different departments. Scientists could apply for funding of individual research projects. The main provider of research grants in the 1920s and 1930s was the "Emergency Association of German Science" (Notgemeinschaft der Deutschen Wissenschaft) which was jointly funded by the state and donations from private companies.[1] The grants were approved by a panel of specialists based on the quality of the grant proposal and each grant covered costs for experiments, such as materials or expensive equipment. Unfortunately, there is no consistent yearly data on supported scientists. Nonetheless, I obtained comparable data on scientists who received funding for two years: the academic year 1928/1929 before the dismissal and for 1937/1938 after the dismissal. The data is relatively coarse as the reports only state whether a scientist received funding from the Notgemeinschaft but not how much he received. To check whether funding patterns changed after the dismissal, I regress an indicator of receiving funding on the dismissal variables on the sample of stayers in the two years. The coefficients for chemistry and mathematics are very small and not significantly different from 0 indicating that changes in funding are not related to the dismissal (Table A8, columns 7 and 8). The coefficient on "dismissal induced fall in peer quality" for physics is negative indicating that stayers in departments with high quality dismissals received less funding after the dismissals. The coefficient on the number of dismissals is positive and significant in the specification without university fixed effects. A possible increase in funding in departments with a larger number of dismissals will mostly likely be counteracted by the decrease due to a fall in average quality. There is therefore little worry that compensatory funding can explain my results.

Even if the probability of receiving a grant was unrelated to changes in peer quality, the amount awarded to scientists in affected departments might have increased. Deichmann (2001) provides funding levels for the most funded chemists during the post dismissal period. While I cannot replicate the previous analysis looking at changes in funding I can analyse whether chemists in affected departments received higher funding amounts after 1933. I regress the amount of funding in 1000 Reichsmark on the dismissal variables. The results suggest that chemists in departments with many and high quality dismissals received less post 1933 funding than chemists in unaffected departments. This would bias my findings towards finding positive peer effects.

[1] The Notgemeinschaft was renamed in "Deutsche Gemeinschaft zur Erhaltung und Förderung der Forschung" in 1937 and is still the main funding source for individual researchers in Germany under the name "Deutsche Forschungsgemeinschaft".

2 Appendix 2: Data Sources

This section provides further details on the sources of all data that has been used in the paper.

2.1 Data on Dismissed Scholars

As outlined in the main text, the primary data source to identify dismissed scientists is the List of Displaced German Scholars (1937). It contains about 80 percent of the dismissed considered in this paper. Figure A6 below shows a sample page from the physics section of the list including four scientists who had already received the Nobel Prize or who were to receive it after 1937.

To obtain a complete picture of all dismissals, I complement this information with information on dismissals from a number of secondary sources. The main additional source is the "Biographisches Handbuch der deutschsprachigen Emigration nach 1933 - Vol. II : The arts, sciences, and literature". The compilation of the handbook was initiated by the "Institut für Zeitgeschichte München" and the "Research Foundation for Jewish Immigration New York". Published in 1983, it contains short biographies of artists and university researchers who emigrated from Nazi Germany.[2]

In addition to these two main data sources, I obtain further information on dismissals from data compiled by historians who have studied individual subjects during the Nazi era. Beyerchen (1977) included a list of dismissed physicists in his book about the physics community in Nazi Germany. Deichmann (2001) compiled an extensive list of dismissed chemists and Siegmund-Schultze (1998) published a list of dismissals in his book on mathematicians in the Nazi era. I combine the data from the various sources to compile the complete list of all dismissed scientists.

My list of dismissals also contains a few researchers who were initially exempted from being dismissed but resigned voluntarily. The vast majority of them would have been dismissed due to the racial laws of 1935 and were therefore only anticipating their dismissal. All of these voluntary resignations were directly caused by the discriminatory policies of the Nazi regime.

2.2 Data on all Scientists at German Universities between 1925 and 1938

Data on all university scientists come from semi-official University Calendars. The university calendar was published by J.A. Barth. He collected official university calendars from all German universities and compiled them into one volume. Originally named "Deutscher Universitätskalender". It was renamed into "Kalender der deutschen Universitäten und technischen Hochschulen" in 1927/1928. From 1929/1930 it was renamed into "Kalender der Deutschen Universitäten und Hochschulen". In 1933 it was again renamed into "Kalender der reichsdeutschen Universitäten und Hochschulen".

[2] Kröner (1983) extracted a list of all dismissed university researchers from the handbook. I use Kröner's list to append my list of all dismissed scholars.

The University Calendar lists all lectures held by each scholar in a given department. If a researcher was not lecturing in the relevant semester he was still listed under the heading "not lecturing". From this list of lectures I infer the subject of each researcher to construct yearly faculty lists of all physics, chemistry, and mathematics departments.

I extract all researchers who were at least Privatdozent from the calendar. This includes in ascending order Privatdozenten, extraordinary professors, and chaired professors. Privatdozenten were usually not civil servants. Universities employed different types of extraordinary professors at the time. First, they could be either civil servants (beamteter Extraordinarus) or not have the status of a civil servant (nichtbeamteter Extraordinarius). Universities also distinguished between extraordinary extraordinary professors (ausserplanmäßiger Extraordinarus) and planned extraordinary professors (planmäßiger Extraordinarius). Chaired/ordinary profesors were always civil servants.

2.3 Dismissal Date

It is crucial to assign each dismissed scientist the correct dismissal date. Dismissed researchers who were not civil servants (Privatdozenten and some extraordinary professors) all disappear from the University Calendar between winter semester 1932/1933 and winter semester 1933/1934. Some of the dismissed researchers who were civil servants (ordinary Professors and some extraordinary professors), however, were still listed in the calendars even after they were dismissed. The original law forced civil servants of Jewish origin into early retirement. As they remained on the states' payroll some universities still listed them in the university calendar even though they were not allowed to teach or do research anymore. In many cases the calendar reported that they had been placed into early retirement according to the "Law for the Restoration of the Professional Civil Service". Using the University Calendar to infer the correct dismissal year may therefore be problematic. My list of dismissals, however, includes the exact year after which somebody was barred from teaching and researching at a German university. I therefore use the dismissal data to determine the actual dismissal date and not the date a dismissed scholar disappeared from the University Calendars.

2.4 Data on Specialization of Scientists

The data on specialization of scientists were collected from seven volumes of "Kürschers Deutscher Gelehrtenkalender". I consulted the volumes published in 1925, 1926, 1928/29, 1931, 1935, 1940/41, and 1950.

The editors of each volume obtained their data by sending out questionnaires to researchers asking them to provide information on their scientific career. Physicists, for example, would then specify whether they work on theoretical, experimental, technical or astrophysics. I use this information to ascertain a scientist's specialization. Because of the blurred boundaries of specialisations in mathematics a lot of mathematicians did not specify their specialization. In those cases I infer the specialization from the main publications they list in the "Gelehrtenkalender".

As outlined in the main text, about 10 percent of scientists did not list their specialization in the "Gelehrtenkalender" or were not listed altogether. For these scientists I conduct an internet search to obtain their specialization.

2.5 Publication Data

Journals from the Web of Science

The journals included in the Web of Science for the 1900 to 1944 period are very high quality journals. In 2004, Thomson Scientific extended the "Web of Science" backwards to include the major journals between 1900 and 1944. To decide which journals to cover for this period they judged their importance by later citations (cited between 1945 and 2004). For more details on the process see http://wokinfo.com/products_tools/backfiles/cos.

I download all German speaking science journals contained in the "Web of Science" for the years 1925 to 1938. I then add the leading international general science journals. Furthermore, I add non-German top specialist journals which were suggested by historians of science as important outlets for the German scientific community. The relevant chemistry journals were suggested by Ute Deichmann and John Andraos who work on chemistry in the early 20th century. Additional journals for mathematics were suggested by Reinhard Siegmund-Schultze and David Wilkins who are specialists in the history of mathematics.

A very small number of contributions in the top journals were letters to the editor or comments. I restrict my analysis to contributions classified as "articles" as they provide a cleaner measure for a researcher's productivity.

Merging Publication Data to Scientists

As the "Web of Science" only reports last names and the initial of the first name for each author there are some cases where I cannot unambiguously match researchers and publications. In these cases I assign the publication to the researcher whose subject is most closely related to the field of the journal in which the article was published. In the very few cases where this assignment rule is still ambiguous between two scientists I assign each researcher half of the (citation weighted) publications.

Another problem is the relatively large number of misspellings of authors' names. All articles published between 1925 and 1938 were published on paper. In order to include these articles into the electronic database Thomson Scientific employees scanned all articles published in the historically most relevant journals. The scanning was error prone and thus lead to misspellings of some names. As far as I discovered these misspellings I have manually corrected them.

Publication Measures

For each scientist I calculate two yearly productivity measures. Publications and citation weighted publications counting the number of times a certain article was cited in the first 50 years after publication. The following simple example illustrates the construction of the citation weighted publications measure. Suppose a researcher published two top journal articles in 1932. One is cited 5 times the other 7 times in any journal covered by the Web of Science in the 50 years after its publication. The researcher's citation weighed publications measure for 1932 is then 5+7=12.

2.6 Data on Current Scientists and Economists

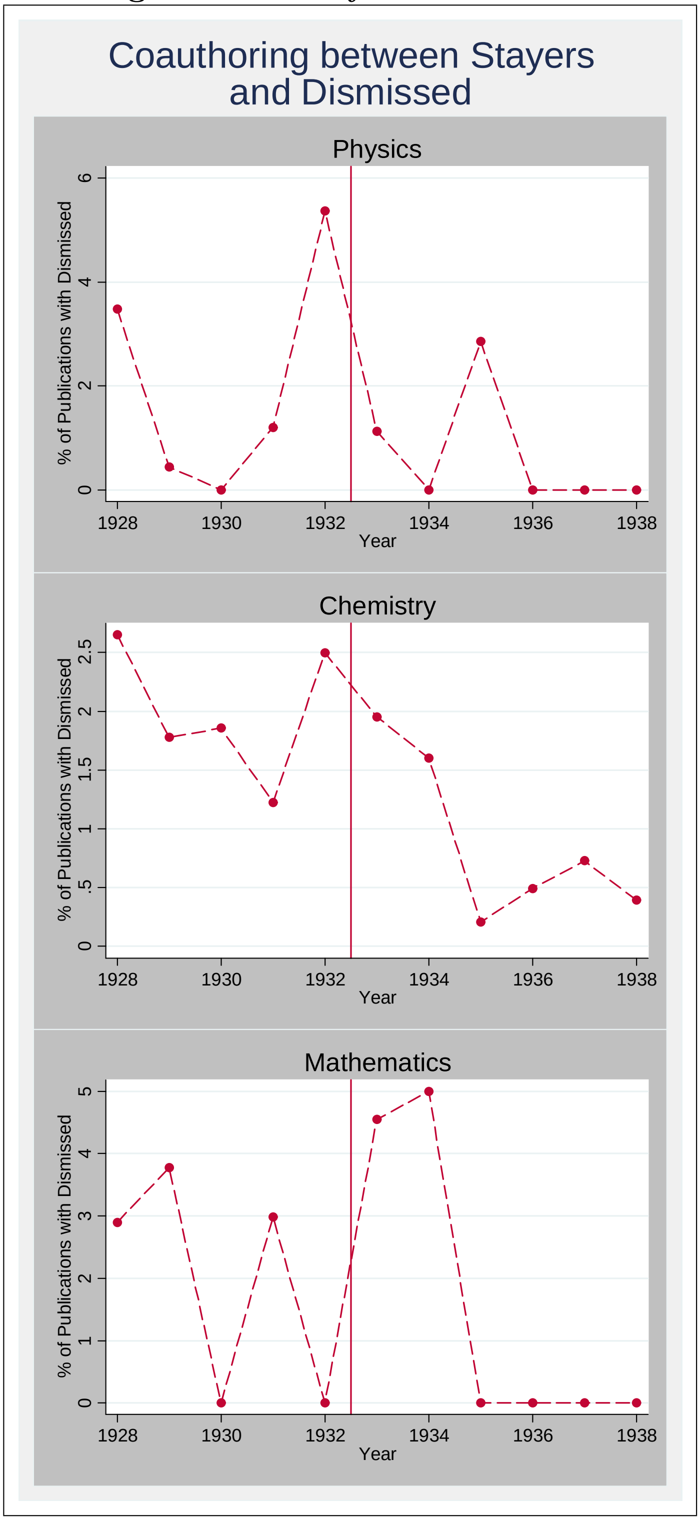
The data presented in Table A1 come form a dataset that I have constructed for this paper. It contains all tenured scientists in top 10 departments in the United States and Germany today. For comparison reasons I also obtain all economists in top 10 departments in the two countries. The ranking of top departments for the United States are obtained from "US News" (see http://grad-schools.usnews.rankingsandreviews.com/best-graduate-schools/top-science-schools) while the rankings for German departments are obtained from CHE (e.g. http://www.che.de

/downloads/CHE_Forschungsranking_ Physik_2009.pdf). The list of top 10 departments is available upon request. I then download complete faculty rosters (as of December 2010) for each of the departments from department websites focusing on tenured faculty. The dataset contains 476 physicists, 341 chemists, 456 mathematicians, and 349 economists from U.S. top departments. For the Germany it contains 449 physicists, 347 chemists, 332 mathematicians, and 218 economists.

I then merge top publications between 2000 and 2010 to these scientists using data from the ISI Web of Science focusing on current top journals. A current journal ranking for science subjects was obtained from SCImago. (2007). SJR — SCImago Journal & Country Ranking and includes the top 10 journals for each subject plus the top general science journals relevant for the subject (e.g. Nature and Science) (the full list of current top journals is available from the author upon request). For economics the top journals include the top five journals (American Economic Review, Econometrica, Journal of Political Economy, Quarterly Journal of Economics, and Review of Economic Studies).

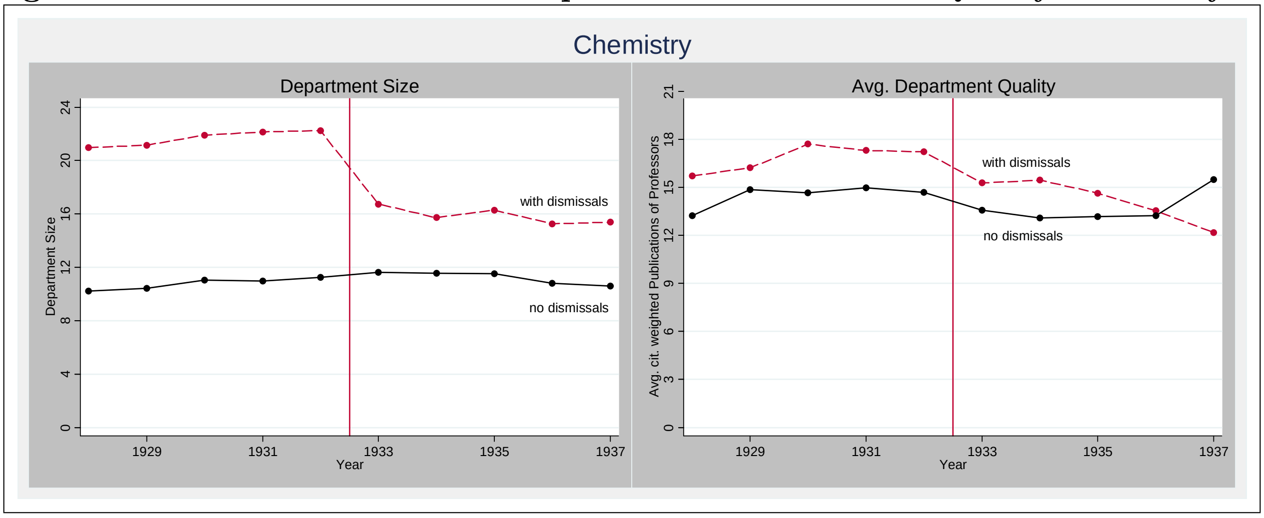
3 Appendix 3: Additional Figures and Tables

Figure A1: Coauthoring between Stayers and Dismissed Scientists



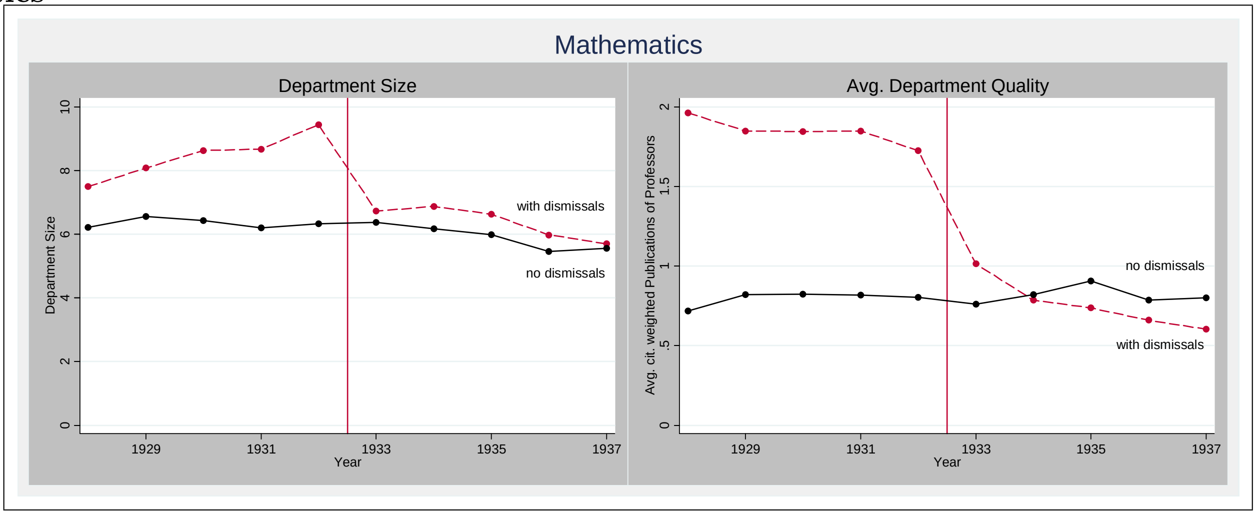
Note: The top panel reports the percentage of publications that physicists who stayed in Germany coauthored with dismissed scientists in each year. Corresponding percentages are reported for chemistry in the middle panel and mathematics in the bottom panel.

Figure A2: Effect of Dismissal on Department Size and Peer Quality Chemistry



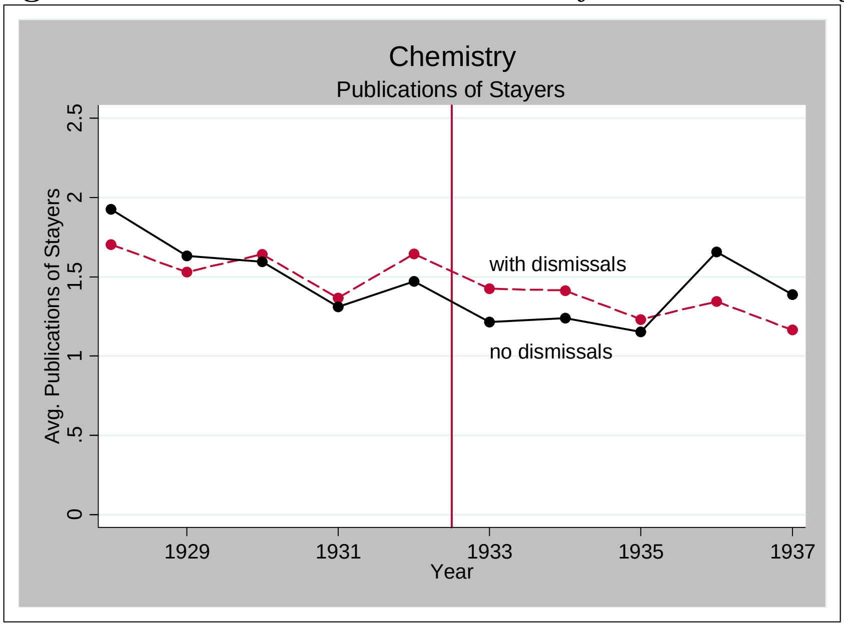
Note: The left hand panel reports average department size in departments with (dashed line) and without dismissals (solid line) respectively. The right hand panel reports average department quality in the two sets of departments. Department quality is measured by the department mean of average citation weighted publications in top journals between 1925-1938. See section 4.1. for details.

Figure A3: Effect of Dismissal on Department Size and Peer Quality Mathematics



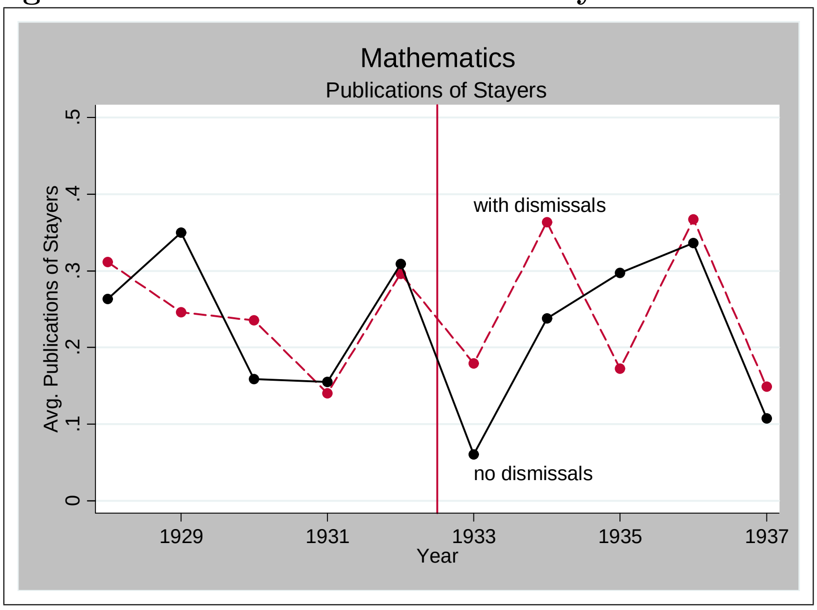
Note: The left hand panel reports average department size in departments with (solid line) and without dismissals (dashed line) respectively. The right hand panel reports average department quality in the two sets of departments. Department quality is measured by the department mean of average citation weighted publications in top journals between 1925-1938. See section 4.1. for details.

Figure A4: Effect of Dismissal on Stayers in Chemistry



Note: The Figure reports average yearly publications in top journals of stayers in affected (dashed line) and unaffected (solid line) departments respectively.

Figure A5: Effect of Dismissal on Stayers in Mathematics



Note: The Figure reports average yearly publications in top journals of stayers in affected (dashed line) and unaffected (solid line) departments respectively.

Figure A6: Sample Page from List of Displaced German Scholars

Physics

BEER, Dr. Arthur P., Researcher; b. 1900., married, 1 child. (English, French, Czech.) 1928/33: Researcher Universitätssternwarte, Breslau, and Deutsche Sternwarte, Hamburg. since 1934: Researcher Solar Physics Observatory, Cambridge University. SPEC.: *Astronomy; Astro- and Geo-Physics.* Temp.

BERG, Dr. Wolfgang, F., Assistant; b. 03., married. (English, French.) 1930/33: Assistant Physikalisches Institut, Berlin University; 1934/36: Researcher Physical Lab., Manchester University; since 1936: Industrial Activity, London. SPEC.: *Experimental Physics. Fluorescence of Atoms and Molecules; Structure and Deformation of Crystals; X-Ray Methods.* Temp.

BERGSTRÄSSER, Dr. Martin, Assistant; b. 02., married. (English, French.) 1927/33: Assistant Technische Hochschule, Dresden; 1933/34: Assistant Deutsche Versuchsanstalt für Luftfahrt, Berlin. SPEC.: *Technical Physics; Testing of Materials; Solidity; Mechanics.* Unpl.

BETHE, Dr. Hans, Privatdozent; b. 06., single. (English.) Till 1933: Privatdozent Göttingen University; 1934/35: Researcher Bristol University; since 1935: Cornell University, Ithaca (N.Y.). SPEC.: *Theoretical Physics. Quantum Mechanics.* Perm.

BIEL, Dr. Erwin, Privatdozent; b. 99., married, 1 child. (English, French, Italian.) Till 1929: Assistant Geographisches Institut, Vienna University; 1929/33: Climatologist Meteorologisches Observatorium, Breslau; 1932/33: Privatdozent Breslau University. SPEC.: *Geo-Physics; Climatology.* Unpl.

BLOCH, Dr. Felix, Privatdozent; b. 05., single. (English.) Till 1933: Privatdozent and Assistant Physikalisches Institut, Leipzig University; since 1933: Prof. Stanford University, California. SPEC.: *Theoretical Physics; Atomic Physics.* Perm.

BOAS, Dr. Walter, Assistant; b. 04., single. (English, French.) 1928/32: Researcher Kaiser Wilhelm Institut für Metallforschung, Berlin; 1933/35: Assistant Fribourg University; since 1936: Researcher Physikalisches Institut, Technische Hochschule, Zürich. SPEC.: *Technical Physics; Metallography; Plasticity and Structure of Metals; X-Rays.* Unpl.

BOEHM, Dr. Gundo, Assistant. Till 1933: Assistant Physikalisches Institut, Freiburg University. SPEC.: *Micellar Structure of Muscles.* Unpl.

BORN, Dr. Max, o. Professor; b. 82., married, 3 children. (English.) 1915/19: a.o. Prof. Berlin University; 1919/21: o. Prof. Frankfurt University; 1921/33: o. Prof. Göttingen University; 1933/35: Lecturer Cambridge University; since 1936: Prof. Edinburgh University. SPEC.: *Theoretical Physics; Quantum Theory; Atomic Structure; Optics; Mathematical Physics.* Perm.

BURSTYN, Dr. Walther, a.o. Professor; b. 77., married. (English, French.) 1920/33: a.o. Prof. Technische Hochschule, Berlin. SPEC.: *Technical Physics.* Unpl.

BYK, Dr. Alfred, a.o. Professor; b. 78., married, 2 children. (English, French, Italian, Dutch.) 1905: Privatdozent Technische Hochschule, Berlin; 1909/33: Privatdozent, later a.o. Prof. Berlin University and Technische Hochschule. SPEC.: *Mathematical Physics; Theoretical Electrotechnics; Quantum Theory; Boundaries of Physics and Chemistry.* Unpl.

COHN-PETERS, Dr. H. Jürgen, Researcher; b. 07. Till 1933: Researcher Berlin University; since 1934: U.S.S.R. SPEC.: *Experimental Physics. High Tension.* Perm.

DEMBER, Dr. Alexis, Assistant; b. 12., single. (English, French.) since 1935: Assistant Physical Institute, Istanbul University. SPEC.: *Electrolytes; Photoelectricity.* Temp.

DEMBER, Dr. Harry, o. Professor; b. 82., married, 2 children. (English, French, Spanish, Turkish.) 1909/33: Privatdozent, later o. Prof. Technische Hochschule, Dresden; and Director Physikalisches Institut; since 1933; o. Prof. Istanbul University and Director Physical Institute. SPEC.: *Cathode and X-Rays; Photo-Electricity; Atmospheric Optics; Atmospheric Electricity.* Perm.

DUSCHINSKY, Dr. F., Assistant; b. 07., single. (French, Italian, Spanish, Dutch.) 1933: Assistant Kaiser Wilhelm Institut für Physik, Berlin; since 1934: Assistant Brussels University. SPEC.: *Experimental Physics; Fluorescence; Molecular Spectra; Optics; High Frequency Technics.* Temp.

EHRENBERG, Dr. Werner, Assistant; b. 01., single. (English, French.) 1924/27: Assistant Kaiser Wilhelm Institut für Faserstoffchemie, Berlin; 1928/30: Researcher Berlin University and Technische Hochschule, Stuttgart; 1930/33: Assistant Technische Hochschule, Stuttgart; since 1935: Electric and Musical Industries, Ltd., Hayes (Middlesex). SPEC.: *Experimental Physics. X-Rays; Cathode Rays; Cosmic Radiation.* Perm.

EINSTEIN, Dr. Albert, o. Professor; b. 79., married. (English.) 1913/33: o. Prof. Berlin University and Director Kaiser Wilhelm Institut für Physik; 1921 Nobel Prize; since 1934: Prof. Institute for Advanced Study, Princeton (N.J.).

EISENSCHITZ, Dr. Robert, Researcher; b. 93., married. (English, French.) 1924/27: Researcher Allgemeine Elektrizitätsgesellschaft, Berlin; 1927/33: Researcher Kaiser Wilhelm Institut für Physikalische Chemie und Elektrochemie, Berlin; since 1934: Researcher Royal Institution, London. SPEC.: *Theoretical and Experimental Physics; Spectroscopy; Viscosity; Application of Physical Theories to Chemical Problems.* Temp.

95

Squares were added by the author to highlight the researchers who had already received the Noble prize or were to receive it after 1936.

Table A1: Collaborations Science Departments 2000-2010

	(1)	(2)	(3)	(4)	(5)
	Physics		Chemistry	Mathematics	Economics
Sample	Full Sample	without particle accelerator	Full Sample	Full Sample	Full Sample
Panel A: Germany 2000-2010					
# of Researchers in top 10 departments 2010	449	382	347	332	218
Avg. yearly publications 2000-2010 (top journals)	2.46	2.39	1.02	0.02	0.03
Average publications (citation weighted)	77.1	73.3	32.4	0.2	0.8
% coauthored	98.6	98.4	97.7	82.6	85.9
% coauthored with faculty (top 10 departments)	37.6	28.8	15.1	4.7	2.8
% coauthored with faculty (same uni)	19.2	16.6	11.0	2.3	0
Panel B: USA 2000-2010					
# of Researchers in top 10 departments 2010	476	402	341	456	349
Avg. yearly publications 2000-2010 (top journals)	6.34	4.14	2.09	0.13	0.31
Average publications (citation weighted)	152.6	116.3	88.0	1.9	8.1
% coauthored	98.9	98.1	97.6	75.2	82.9
% coauthored with faculty (top 10 departments)	60.5	22.3	12.7	21.2	29.5
% coauthored with faculty (same uni)	33.2	7.7	9.9	3.1	9.9

Note: The table reports collaboration patters for scientists and economists in current top 10 departments in Germany and the United States. Publications are publications between 2000 and 2010 in top journals. See appendix 2 for details on data sources.

Table A2: Specializations

Physics		Chemistry		Mathematics	
Specialization	% scientists in speciali-zation	Specialization	% scientists in speciali-zation	Specialization	% scientists in speciali-zation
Experimental Physics	47.4	Organic Chemistry	26.2	Analysis	46.4
Theoretical Physics	22.3	Physical Chemistry	23.2	Applied Mathematics	36.2
Technical Physics	22.0	Technical Chemistry	19.1	Geometry	31.7
Astronomy	15.0	Anorganic Chemistry	18.2	Algebra	20.1
		Pharmacology	10.1	Number Theory	13.8
		Medical Chemistry	7.7	Metha Mathematics	5.4
		Biochemistry	6.7	Topology	4.9
				Foundations of Mathematics	4.5

Note: The table reports specializations of historical scientists. Percentages add to more than 100 because some physicists and chemists have two specializations. Mathematicians have up to four specializations.

Table A3: Top Journals

Journal Name	Published in
General Journals	
Naturwissenschaften	Germany
Sitzungsberichte der Preussischen Akademie der Wissenschaften Physikalisch Mathematische Klasse	Germany
Nature	UK
Proceedings of the Royal Society of London A (Mathematics and Physics)	UK
Science	USA
Physics	
Annalen der Physik	Germany
Physikalische Zeitschrift	Germany
Physical Review	USA
Chemistry	
Berichte der Deutschen Chemischen Gesellschaft	Germany
Biochemische Zeitschrift	Germany
Journal für Praktische Chemie	Germany
Justus Liebigs Annalen der Chemie	Germany
Kolloid Zeitschrift	Germany
Zeitschrift für Anorganische Chemie und Allgemeine Chemie	Germany
Zeitschrift für Elektrochemie und Angewandte Physikalische Chemie	Germany
Zeitschrift für Physikalische Chemie	Germany
Journal of the Chemical Society	UK
Mathematics	
Journal für die reine und angewandte Mathematik	Germany
Mathematische Annalen	Germany
Mathematische Zeitschrift	Germany
Zeitschrift für angewandte Mathematik und Mechanik	Germany
Acta Mathematica	Sweden
Proceedings of the London Mathematical Society	UK

Note: The table list all historical top journals used in the analysis. See data section and data appendix for details.

Table A4: Top Researchers 1925-1932 (Citation weighted Publications Measure)

Name	University beginning of 1933	First Special-ization	Second Special-ization	Third Special-ization	Avg. Cit weighted Publ.	Avg. Publ.	Nobel Prize	Dis-missed 33-34
Physics								
Fritz London	Berlin	Theo. Phy.			149.3	1.3		yes
Lother Nordheim	Göttingen	Theo. Phy.			110.0	0.7		yes
Gerhard Herzberg	Darmstadt TU	Exp. Phy.			78.0	2.0	yes	
Carl Ramsauer	Berlin TU	Exp. Phy.			75.6	3.0		
Max Born	Göttingen	Theo. Phy.			62.5	1.3	yes	yes
Hans Falkenhagen	Köln	Theo. Phy.			57.5	1.9		
Arnold Sommerfeld	München	Theo. Phy.			44.4	1.8		
Eugen Wigner	Berlin TU	Theo. Phy.			44.3	0.5	yes	yes
Heinrich Kuhn	Göttingen	Exp. Phy.	Theo. Phy.		42.0	4.0		yes
Harry Dember	Dresden TU	Exp. Phy.			40.8	1.0		yes
Karl Herzfeld		Theo. Phy.			33.7	1.3		
Richard Gans	Königsberg	Exp. Phy.			29.4	1.6		
Walter Gerlach	München	Exp. Phy.			29.1	3.1		
Wolfgang Pauli		Theo. Phy.			28.0	3.8	yes	
Max Wien	Jena	Exp. Phy.			25.4	2.0		
Werner Heisenberg	Leipzig	Theo. Phy.			25.3	1.0	yes	
Ludwig Prandtl	Göttingen	Tech. P.			23.3	1.1		
Fritz Kirchner	München	Exp. Phy.			22.5	2.5		
Johannes Malsch	Köln	Exp. Phy.			22.0	1.5		
Emil Rupp	Berlin TU	Exp. Phy.			21.4	5.2		yes
Chemistry								
Werner Kuhn	Karlsruhe TU	Physical C.			262.0	7.0		
Max Bergmann	Dresden TU	Organic C.	Biochem.		250.2	6.8		yes
Karl Lohmann	Heidelberg	Medical C.			224.0	6.0		
Ernst Bergmann	Berlin	Physical C.			223.3	17.0		yes
Carl Neuberg	Berlin	Biochem.			184.9	15.1		
Carl Wagner	Jena	Physical C.			177.5	5.0		
Otto Meyerhof	Heidelberg	Medical C.			176.3	5.8	yes	
Otto Ruff	Breslau TU	Anorganic C.			133.4	7.2		
Wolfgang Ostwald	Leipzig	Anorganic C.			127.0	8.6		
Hermann Staudinger	Freiburg	Organic C.			126.8	8.5	yes	
Gustav Tammann	Göttingen	Physical. C.			118.4	19.0		
Michael Polanyi	Berlin TU	Physical. C.			116.8	5.6		yes
Max Volmer	Berlin TU	Physical. C.			114.0	4.2		
Karl Freudenberg	Heidelberg	Organic C.			111.8	7.0		
Ulrich Hofmann	Berlin TU	Anorganic C.	Physical C.		109.0	6.0		
Richard Johann Kuhn	Heidelberg	Physical C.	Medical C.		92.1	8.0	yes	
Max Trautz	Heidelberg	Physical C.			91.9	5.3		
Wilhelm Klemm	Hannover TU	Anorganic. C.			91.4	5.2		
Mathematics								
Johann von Neumann	Berlin	Applied Math	Foundations	Analysis	36.3	1.5		yes
Richard Courant	Göttingen	Analysis	Applied Math		22.3	1.3		yes
Richard von Mises	Berlin	Applied Math	Analysis		15.6	0.9		yes
Heinz Hopf		Algebra	Topology	Geometry	13.3	1.3		
Paul Epstein	Frankfurt	Geometry	Number Th.	Algebra	11.5	0.6		
Oskar Perron	München	Algebra	Analysis		10.6	1.5		
Willy Prager	Göttingen	Applied Math			10.0	0.4		yes
Gabiel Szegö	Königsberg	Applied Math	Geometry		9.4	1.4		yes
Werner Rogosinski	Königsberg	Number Th.	Analysis		9.1	0.6		
Wolfgang Krull	Erlangen	Algebra			8.9	1.4		
Erich Rothe	Breslau TU	Analysis	Applied Math		8.0	1.0		yes
Hans Peterssonn	Hamburg	Number Th.	Analysis		8.0	2.0		
Adolf Hammerstein	Berlin	Number Th.	Analysis		8.0	0.5		
Alexander Weinstein	Breslau TU	Applied Math			6.3	0.7		yes
Erich Kamke	Tübingen	Number Th..	Foundations	Analysis	6.3	0.8		
Hellmuth Kneser	Greifswald	Applied Math	Analysis	Topology	6.3	0.6		
Bartel van der Waerden	Leipzig	Algebra	Geometry		5.8	1.8		
Max Müller	Heidelberg	Analysis			5.3	0.3		
Richard Brauer	Königsberg	Algebra			5.0	0.6		yes
Leon Lichtenstein	Leipzig	Analysis	Applied Math		4.9	1.5		yes

Note: The table lists top scientists according to their pre-dismissal average of citation weighted publications. The university in 1933 is missing for researchers, who retired before before 1933.

Table A5: Reduced Form Poisson Regression

	(1)	(2)	(3)	(4)	(5)	(6)
	Physics		Chemistry		Mathematics	
Dependent Variable:	Publi-cations	Cit. weigt. Pubs	Publi-cations	Cit. weigt. Pubs	Publi-cations	Cit. weigt. Pubs
Dismissal Induced Fall	1.066	1.058	1.007	1.012	1.050	0.621
in Peer Quality	(1.226)	(0.466)	(0.502)	(0.339)	(0.259)	(1.147)
Number Dismissed	0.954	1.024	0.985	0.979	0.893	0.985
	(0.805)	(0.151)	(1.193)	(1.031)	(1.660)	(0.139)
Age Dummies	yes	yes	yes	yes	yes	yes
Year Dummies	yes	yes	yes	yes	yes	yes
Individual FE	yes	yes	yes	yes	yes	yes
Observations	2261	2261	3584	3584	1538	1538
# of researchers	258	258	413	413	183	183
Log Quasi-Likelyhood	-1389.38	-8513.19	-4269.86	-28665.83	-672.63	-2465.51

**significant at 1% level *significant at 5% level (All standard errors clustered at the university level)

Note: Each column reports results from a different regression. The dependent variable *Publications* is the sum of a scientist's publications in top journals in a given year. The alternative dependent variable *Citation Weighted Publications* is the sum of subsequent citations (in the first 50 years after publication) to articles published in top journals by a scientist in a given year. Explanatory variables are defined as follows. *Dismissal induced Fall in Peer Quality* is 0 for all scientists until 1933. In 1934 it is equal to (Avg. quality of peers in department before dismissal) - (Avg. quality of peers | not dismissed in 1933) if this number > 0. From 1935 onwards it is equal to (Avg. quality of peers in department before dismissal) - (Avg. quality of peers | not dismissed between 1933 and 1934) if this number is > 0. The variable remains 0 for all other scientists. For scientists in departments with above average quality dismissals "Dismissal induced Fall in Peer Quality" is therefore positive after 1933. *Number dismissed* is equal to 0 for all scientists until 1933. In 1934 it is equal to the number of dismissals in 1933 in a scientist's department. From 1935 onwards it is equal to the number of dismissals between 1933 and 1934 in a scientist's department. Estimates are displayed as incidence rate ratios. A coefficient of 1 would indicate no effect of the dismissal. The coefficient reported in the first line of column 1 indicates that publications increased by 6.6 percent for a one unit fall in peer quality. The effect is not significant. The absolute value of z-statistics (clustered at the university level) is reported in parentheses.

Table A6: Placebo Dismissal (Moving Dismissal to 1930)

	(1)	(2)	(3)
	Physics	Chemistry	Mathematics
Dependent Variable:	Publications	Publications	Publications
Dismissal Induced Fall	-0.040	0.004	0.050
in Peer Quality	(0.034)	(0.019)	(0.057)
Number Dismissed	0.051	-0.003	-0.009
	(0.034)	(0.022)	(0.031)
Age Dummies	yes	yes	yes
Year Dummies	yes	yes	yes
Individual FE	yes	yes	yes
Observations	1314	2051	875
# of researchers	237	389	170
R-squared	0.485	0.727	0.357

**significant at 1% level *significant at 5% level (All standard errors clustered at the university level)

Note: The sample includes only the pre-dismissal years. The dismissal variables are moved 3 years ahead to simulate a hypothetical dismissal in 1930. The dependent variable *Publications* is the sum of a scientist's publications in top journals in a given year. Explanatory variables are defined as follows. *Dismissal induced Fall in Peer Quality* is 0 for all scientists until 1930. In 1931 it is equal to (Avg. quality of peers in department before dismissal) - (Avg. quality of peers | not dismissed in 1933) if this number > 0. From 1932 onwards it is equal to (Avg. quality of peers in department before dismissal) - (Avg. quality of peers | not dismissed between 1933 and 1934) if this number is > 0. The variable remains 0 for all other scientists. For scientists in departments with above average quality dismissals "Dismissal induced Fall in Peer Quality" is therefore positive after 1930. *Number dismissed* is equal to 0 for all scientists until 1930. In 1931 it is equal to the number of dismissals in 1933 in a scientist's department. From 1932 onwards it is equal to the number of dismissals between 1933 and 1934 in a scientist's department.

Table A7: Robustness Checks Main Results Instrumental Variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Omitting 33-34	Younger than 50	50 or Older	Large Departments	Small Departments	Good Departments	Bad Departments	Full Sample	Full Sample	Theoretical Physics
	Publications	Publications	Publications	Publications	Publications	Publications	Publications	Publications	Publications	Publications
Physics										
Peer Quality	0.004	-0.073	-0.021	-0.093	-0.017	-0.038	0.030	-0.059	-0.104	-0.110
	(0.036)	(0.055)	(0.078)	(0.119)	(0.039)	(0.029)	(0.036)	(0.044)	(0.109)	(0.161)
Department Size	-0.019	0.070	0.026	0.071	0.139	0.009	-0.127	0.053	0.110	0.039
	(0.038)	(0.049)	(0.073)	(0.110)	(0.105)	(0.026)	(0.296)	(0.051)	(0.093)	(0.103)
Observations	*1866*	*1203*	*1058*	*1156*	*1105*	*1356*	*905*	*2261*	*2261*	*464*
# of researchers	*256*	*181*	*147*	*149*	*147*	*170*	*121*	*258*	*258*	*50*
EV Statistic	*5.5*	*5.3*	*4.9*	*3.3*	*4.7*	*10.4*	*0.3*	*10.9*	*6.5*	*2.0*
Chemistry										
Peer Quality	-0.010	-0.014	-0.008	-0.019	0.054	0.004	-0.080*	-0.011	0.040	
	(0.015)	(0.022)	(0.021)	(0.012)	(0.114)	(0.022)	(0.036)	(0.014)	(0.036)	
Department Size	0.027	0.017	0.009	0.017	0.697	0.023	0.022	0.018	0.012	
	(0.014)	(0.018)	(0.019)	(0.011)	(1.180)	(0.023)	(0.023)	(0.010)	(0.029)	
Observations	*2926*	*1825*	*1759*	*1814*	*1770*	*1819*	*1765*	*3584*	*3584*	
# of researchers	*410*	*265*	*241*	*236*	*220*	*234*	*224*	*413*	*413*	
EV Statistic	*65.6*	*26.9*	*51.7*	*58.4*	*1.2*	*39.0*	*18.4*	*78.3*	*20.5*	
Mathematics										
Peer Quality	-0.028	-0.044	0.033	-0.016	-0.008	-0.032	7.523	-0.017	0.007	
	(0.035)	(0.033)	(0.026)	(0.027)	(0.083)	(0.020)	(11.207)	(0.026)	(0.031)	
Department Size	0.045	0.056	-0.014	0.031	0.011	0.035	-1.389	0.031	0.011	
	(0.048)	(0.028)	(0.040)	(0.028)	(0.069)	(0.026)	(2.290)	(0.027)	(0.020)	
Observations	*1256*	*899*	*639*	*858*	*680*	*709*	*829*	*1538*	*1538*	
# of researchers	*183*	*125*	*97*	*116*	*101*	*95*	*116*	*183*	*183*	
EV Statistic	*12.8*	*31*	*18.2*	*56.7*	*4,7*	*25.1*	*0*	*68.8*	*72.1*	
Age Dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Year Dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Individual FE	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Department FE								yes	yes	
Dep. specific. Time Trends									yes	

**significant at 1% level *significant at 5% level (All standard errors clustered at the university level)

Note: Each column and horizontal panel (Physics, Chemistry, Mathematics) reports results from a separate IV regression. The dependent variable *Publications* is the sum of a scientist's publications in top journals in one year. Explanatory variables are defined as follows. *Peer Quality* is calculated as the mean of the average productivity of a scientist's peers. *Department Size* measures the number of peers in a scientist's department. I instrument for peer quality and department size with the dismissals. Specifications using different samples are reported in each column. Large departments are departments above median department size. Good departments are departments above median quality.

Table A8: Identification Robustness Checks

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Probability of Promotion		Leave Sample		Signing Support List for Hitler		Receiving Notgemeinschaft Funding		Post 1933 Funding Levels	
Dependent Variable:	Promotion Dummy	Promotion Dummy	Leave Sample	Leave Sample	Signing List	Signing List	Funding Dummy	Funding Dummy	Total Funding in 1000 RM	Total Funding in 1000 RM
Physics										
Dismissal Induced Fall	-0.010	-0.007	0.007	0.009	0.027	0.048	-0.062**	-0.068**	-	-
in Peer Quality	(0.008)	(0.007)	(0.009)	(0.009)	(0.018)	(0.035)	(0.015)	(0.016)		
Number Dismissed	0.013	0.009	-0.010	-0.011	-0.025	-0.019	0.037*	0.038	-	-
	(0.008)	(0.007)	(0.008)	(0.008)	(0.015)	(0.023)	(0.018)	(0.021)		
Observations	*2261*	*2261*	*2337*	*2337*	*202*	*202*	*347*	*347*		
# of researchers	*258*	*258*	*258*	*258*	*0.041*	*0.604*	*228*	*228*		
R-Squared	*0.722*	*0.755*	*0.199*	*0.206*	*202*	*202*	*0.696*	*0.794*		
Mean of dependent variable	*0.75*	*0.75*	*0.03*	*0.03*	*0.07*	*0.07*	*0.08*	*0.08*		
Chemistry										
Dismissal Induced Fall	0.003	0.001	0.002	0.002	-0.006	0.000	0.004	0.006	-0.751*	-2.526**
in Peer Quality	(0.003)	(0.002)	(0.001)	(0.001)	(0.004)	(0.001)	(0.009)	(0.010)	(0.314)	(0.112)
Number Dismissed	-0.003	-0.003	0.001	0.001	-0.005	-0.000	-0.005	-0.006	0.153	-0.794**
	(0.002)	(0.002)	(0.001)	(0.001)	(0.003)	(0.001)	(0.013)	(0.015)	(0.298)	(0.149)
Observations	*3584*	*3584*	*3690*	*3690*	*332*	*332*	*567*	*567*	*332*	*332*
# of researchers	*413*	*413*	*413*	*413*	*332*	*332*	*367*	*367*	*332*	*332*
R-Squared	*0.764*	*0.787*	*0.205*	*0.209*	*0.054*	*0.498*	*0.670*	*0.713*	*0.025*	*0.098*
Mean of dependent variable	*0.73*	*0.73*	*0.03*	*0.03*	*0.05*	*0.05*	*0.12*	*0.12*	*8.82*	*8.82*
Mathematics										
Dismissal Induced Fall	-0.006	-0.020	-0.011	0.002	-0.015	0.039	-0.002	-0.005	-	-
in Peer Quality	(0.032)	(0.028)	(0.016)	(0.018)	(0.045)	(0.117)	(0.009)	(0.020)		
Number Dismissed	0.011	0.019	0.006	0.004	-0.003	-0.027	0.001	0.003	-	-
	(0.016)	(0.017)	(0.006)	(0.006)	(0.031)	(0.065)	(0.006)	(0.012)		
Observations	*1538*	*1538*	*1596*	*1596*	*144*	*144*	*244*	*244*		
# of researchers	*183*	*183*	*183*	*183*	*144*	*144*	*161*	*161*		
R-Squared	*0.779*	*0.822*	*0.184*	*0.200*	*0.037*	*0.641*	*0.548*	*0.599*		
Mean of dependent variable	*0.75*	*0.75*	*0.04*	*0.04*	*0.13*	*0.13*	*0.004*	*0.004*		
Age Dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Year Dummies	yes	yes	yes	yes			yes	yes		
Individual FE	yes	yes	yes	yes			yes	yes		
University FE		yes		yes		*yes*		yes		*yes*

**significant at 1% level *significant at 5% level (All standard errors clustered at the university level)

Note: Each column and horizontal panel (Physics, Chemistry, Mathematics) reports results from a separate IV regression. The dependent variable in columns 1 and 2 is an indicator for being promoted in a given year. In columns 3 and 4 the dependent variable is an indicator for leaving the sample in that year. In columns 5 and 6 the dependent variable is an indicator for signing the list in support of Hitler and the Nazi regime. In columns 7 and 8 the dependent variable is an indicator for receiving funding from the Notgemeinschaft in that year. In columns 9 and 10 the dependent variable measures total funding amounts a chemist received after 1933 from the Notgemeinschaft or the chemical industry. Explanatory variables are defined as follows. *Dismissal induced Fall in Peer Quality* is 0 for all scientists until 1933. In 1934 it is equal to (Avg. quality of peers in department before dismissal) - (Avg. quality of peers | not dismissed in 1933) if this number > 0. From 1935 onwards it is equal to (Avg. quality of peers in department before dismissal) - (Avg. quality of peers | not dismissed between 1933 and 1934) if this number is > 0. The variable remains 0 for all other scientists. For scientists in departments with above average quality dismissals "Dismissal induced Fall in Peer Quality" is therefore positive after 1933. *Number dismissed* is equal to 0 for all scientists until 1933. In 1934 it is equal to the number of dismissals in 1933 at a scientist's department. From 1935 onwards it is equal to the number of dismissals between 1933 and 1934 in a scientist's department.

Table A9: First Stages Specialization Level Peers

	(1)	(2)	(3)	(4)	(5)	(6)
	Physics		Chemistry		Mathematics	
Dependent Variable:	Specialization Peer Quality	# Specialization Peers	Specialization Peer Quality	# Specialization Peers	Specialization Peer Quality	# Specialization Peers
Dismissal Induced Fall	-0.788**	0.0345	-0.913**	0.0291	-0.385	-0.293**
in Specialization Peer Quality	(0.269)	(0.0447)	(0.0899)	(0.0194)	(0.660)	(0.105)
Number Dismissed in	0.341	-0.894**	0.639	-1.031**	-0.275	-0.344
Specialization	(0.275)	(0.133)	(1.097)	(0.0895)	(0.416)	(0.177)
Age Dummies	yes	yes	yes	yes	yes	yes
Year Dummies	yes	yes	yes	yes	yes	yes
Individual FE	yes	yes	yes	yes	yes	yes
Observations	2257	2257	3567	3567	1538	1538
# of researchers	256	256	405	405	183	183
R-squared	0.56	0.88	0.67	0.9	0.64	0.83
Cragg-Donald EV Statistic	*81.80*		*73.69*		*0.23*	

**significant at 1% level *significant at 5% level (All standard errors clustered at the university level)

Note: Odd columns report the first stage regression for peer quality in a scientist's specialization and department. Even columns report the first stage regression for the number of peers in the scientist's specialization and department. The dependent variable *Specialization Peer Quality* is measured as the mean of the average productivity of a scientist's specialization level peers present in the department in a given year. The dependent variable *# Specialization Peers* measures the number of peers in the scientist's specialization and department. Explanatory variables are defined as follows. *Dismissal induced Fall in Specialization Peer Quality* is 0 for all scientists until 1933. In 1934 it is equal to (Avg. quality of peers in specializition and department before dismissal) - (Avg. quality of peers in specialization and department | not dismissed in 1933) if this number > 0. From 1935 onwards it is equal to (Avg. quality of peers in specialization and department before dismissal) - (Avg. quality of peers in specialization and department | not dismissed between 1933 and 1934) if this number is > 0. The variable remains 0 for all other scientists. *Number Dismissed in Specialization* is equal to 0 for all scientists until 1933. In 1934 it is equal to the number of dismissals in 1933 in a scientist's specialization and department. From 1935 onwards it is equal to the number of dismissals between 1933 and 1934 in a scientist's specialization and department.

Table A10: First Stages High Quality Peers

	(1)	(2)	(3)
	Physics	Chemistry	Mathematics
Dependent Variable:	# of Peers in Quality Group	# of Peers in Quality Group	# of Peers in Quality Group
Number of Dismissals	-0.685**	-0.995**	-0.537**
	(0.049)	(0.088)	(0.052)
First Stage F-Statistic	*195.5*	*126.7*	*104.8*
Number of Top 50th Percentile Dismissals	-0.955**	-0.938**	-0.706**
	(0.0615)	(0.0493)	(0.0726)
First Stage F-Statistic	*241.1*	*362.6*	*94.4*
Number of Top 25th Percentile Dismissals	-0.723**	-1.003**	-0.767**
	(0.0351)	(0.0454)	(0.0348)
First Stage F-Statistic	*423.7*	*488.6*	*485.8*
Number of Top 10th Percentile Dismissals	-0.749**	-1.097**	-0.996**
	(0.138)	(0.249)	(0.158)
First Stage F-Statistic	*29.6*	*19.4*	*39.6*
Number of Top 5th Percentile Dismissals	-0.649**	-1.311**	-1.129**
	(0.0457)	(0.457)	(0.167)
First Stage F-Statistic	*201.6*	*8.2*	*46.0*
Age Dummies	yes	yes	yes
Year Dummies	yes	yes	yes
Individual FE	yes	yes	yes
Observations	2261	3584	1538

**significant at 1% level *significant at 5% level (All standard errors clustered at the university level)

Note: Each column and horizontal panel reports results from a different first stage regression.The dependent variable *# of Peers in Quality Group* measures the number of peers of a certain quality in the department. For regressions reported in the first horizontal panel the dependent variable is the number of peers in a scientists department. In the second horizontal panel the dependent variable is the number of peers in the top 50th percentile in a scientist's departments and so on. Explanatory variables are defined as follows. In the first horizontal panel *Number dismissed* is equal to 0 for all scientists until 1933. In 1934 it is equal to the number of dismissals in 1933 at a scientist's department. From 1935 onwards it is equal to the number of dismissals between 1933 and 1934 in a scientist's department. In the second panel *Number of Top 50th Percentile Dismissals* is equal to 0 for all scientists until 1933. In 1934 it is equal to the number of dismissals in 1933 in the scientist's department who were of above median quality. From 1935 onwards it is equal to the number of dismissals between 1933 and 1934 who were of above median quality. Explanatory variables in the other horizontal panels are defined accordingly. Percentiles are calculated using pre-dismissal productivities.