ONLINE APPENDIX

EFFECTS OF COPYRIGHTS ON SCIENCE.
EVIDENCE FROM THE WWII BOOK REPUBLICATION PROGRAM

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TABLE A1 – SUMMARY STATISTICS, BRP BOOKS

	N	Mean	St. Dev.	Median	Min	25 pctile	75 pctile	Max
All BRP books								
Original p	271	42.79	179.57	11.15	2.00	6.60	19.15	2000.00
BRP p	283	19.41	41.77	7.50	2.00	3.20	12.50	400.00
Δp	271	24.97	21.33	21.87	-38.89	7.89	40.00	90.00
Chemistry								
Original p	216	51.18	200.34	11.70	2.00	4.50	22.95	2000.00
BRP p	228	22.43	46.00	8.50	2.00	5.00	15.78	400.00
Δp	216	24.34	21.39	21.76	-38.89	7.52	39.55	90.00
Mathematics								
Original p	55	9.84	5.77	8.00	3.40	6.00	11.75	32.65
BRP p	55	6.88	4.32	5.75	2.50	3.75	8.75	25.60
Δp	55	27.44	21.11	23.47	0.00	9.72	66.09	74.14

Notes: Means, standard deviations, and median prices for 283 books with German-owned US copyrights that were licensed to US publishers under the 1942 BRP. The variable Δp measures the percentage decline in price, calculated as the difference between the original price and the BRP price, divided by the original price. Price data collected from records of the Alien Property Custodian (1942).

Author	Title	Publication Year	Citations 1920-1941	Citations 1942-1970	Field
Courant, R. & D. Hilbert	*Methoden der Mathematischen Physik*	1931	8	235	Mathematics
Becker, R.	*Ferromagnetismus*	1939	10	232	Chemistry
Alexandroff, P. & H. Topf, H.	*Topologie*	1935	6	235	Mathematics
Nevanlinna, R.	*Eindeutige Analytische Funktionen*	1936	6	230	Mathematics
Waerden, B.	*Moderne Algebra*	1931	11	195	Mathematics
Saccardo, P.	*Sylloge Fungorum Omnium Hucusque Cognitorum... curante Alex*	1881	59	141	Chemistry
Hansen, M.	*Der Aufbau der Zweistofflegierungen*	1936	25	172	Chemistry
Doetsch, G.	*Theorie und Anwendung der Laplace-Transformation*	1937	7	169	Mathematics
Clar, E.	*Aromatische Kohlenwasserstoffe: Polycyclische Systeme*	1942	0	166	Chemistry
Speiser, A.	*Die Theorie der Gruppen von Endlicher Ordnung*	1937	2	112	Mathematics

Notes: Citations refer to citations to BRP books by English-language citations.

Author	Title	Publication Year	Citations 1920-1941	Citations 1942-1970	Field
Leser, Conrad	*Invariantentheorie Algebraische Formen*	1939	0	41	Mathematics
Huber, Wilhelm	*Zur Kenntnis der Sulfuration Aromatischen Amine nach dem sogennanten "Backprozess"*	1932	0	34	Chemistry
Motzkin, Theodor	*Zur Theorie der Linearen Ungleichungen*	1936	0	34	Mathematics
Warschawski, Stefan	*Das Randverhalten der Ableitung der Abbildungsfunktion bei Konformer Abbildung*	1932	0	34	Chemistry
Stiefel, Edward	*Richtungsfelder und Fernparallelism in n-Dimensionalen Mannigfaltigkeiten*	1936	2	31	Chemistry
Hofmann, Albert	*Über den Enzymatischen Abbau des Chitins und Chitosans*	1929	3	17	Mathematics
Jungen, Reinwald	*Sur les series de Taylor n'ayant que des singularités algébrico-logarithmiques sur leur cercle de convergence*	1932	2	17	Mathematics
Muller, Hans.	*Zur Theorie der elektrischen Ladung und der Koagulation der Kolloide*	1928	6	13	Chemistry
Halpern, Ada	*Etude de certains potentiels logarithmiques*	1937	0	19	Mathematics
Gutzeit, Grégoire	*Sur une méthode d'analyse qualitative rapide des cations et anions les plus usuels*	1930	3	13	Mathematics

Notes: Citations refer to citations to Swiss books by English-language citations.

TABLE A4 – CHANGES IN PRICE AND IN CITATION FOR THE TOP FIVE RESEARCH FIELDS,
BRP AND SWISS BOOKS IN MATHEMATICS (TOP) AND CHEMISTRY (BOTTOM)

| | BRP Books | | | | | Swiss Books | | |
| | Price | | Citations | | N | | Citations | | N |
	Original	Δp	Pre-1941	Post-1941			Pre-1941	Post-1941	
Mathematics									
General Mathematics	12.43	19.94	0.422	1.743	14		0.020	0.112	4
Geometry	7.78	14.40	0.038	0.330	12		0.022	0.112	17
Algebra	9.00	8.06	0.262	0.990	7		0.014	0.119	13
Set Theory	10.06	15.95	0.512	2.695	6		0.048	0.072	13
Analysis	10.02	10.57	0.324	1.965	5		0.009	0.162	16
Chemistry									
Compounds	31.80	12.86	0.255	0.441	58		0.013	0.059	74
Organic Chemistry	268.60	18.53	0.536	0.508	28		0.000	0.057	6
Metals	16.82	9.74	0.294	0.696	27		0.050	0.060	4
Electrochemistry	17.02	9.48	0.200	0.520	14		0.049	0.045	10
Analytical Chemistry	14.86	16.32	0.165	0.299	12		0.049	0.138	5

Notes: Research fields for 283 BRP and 247 Swiss books in the US National Union Catalog. Research fields are constructed based on topic codes in Alien Property Custodian (1942) and the *Katalog* (vols. 1921-1939 and 1931-1940) of the Swiss National Library.

	1920-41	1942-1970	Difference
All (N=283)	0.281	0.479	0.197***
	(0.784)	(1.372)	(0.025)
English	0.263	0.566	0.303***
	(0.775)	(1.654)	(0.042)
Other languages	0.300	0. 391	0. 092***
	(0.793)	(1.006)	(0.026)
Difference	-0.036	0.174***	0.211***
	(0.027)	(0.021)	(0.049)
Chemistry (N=228)	0.306	0.384	0.078***
	(0.838)	(1.088)	(0.023)
English	0.274	0.414	0.140***
	(0.814)	(1.251)	(0.037)
Other languages	0.337	0.354	0.016
	(0.860)	(0.895)	(0.027)
Difference	-0.063	0.060***	0.124***
	(0.033)	(0.019)	(0.046)
Mathematics (N=55)	0.204	0.872	0.667***
	(0.574)	(2.138)	(0.077)
English	0.230	1.195	0.965***
	(0.633)	(2.661)	(0.135)
Other languages	0.179	0.549	0.369***
	(0.509)	(1.363)	(0.070)
Difference	0.050	0.647***	0.596***
	(0.041)	(0.075)	(0.152)

Notes: Means and standard deviations (in parentheses) of the number of new scientific publications (including articles and books) that cite a BRP book i per year t between 1920 and 1970. *English* are citations by English-language authors; *other languages* are citations by authors in other languages that cite the same books. To construct data on citations from different languages, we first collected citations from Google Scholar (available at http://scholar.google.com, accessed July 1st - September 25th, 2014), and then manually assigned all citing publications to their publication language.

TABLE A6 – OLS, EFFECTS OF BRP ON CITATIONS BY ENGLISH VS. OTHER LANGUAGE AUTHORS AND TO BRP VS SWISS BOOKS

DEPENDENT VARIABLE IS THE INVERSE HYPERBOLIC SINE OF CITATIONS PER BOOK AND YEAR

	(1)	(2)	(3)	(4)	(5)	(6)
English	-0.032	-0.030	-0.030			
	(0.022)	(0.022)	(0.022)			
English x post	0.073***	0.080***	0.080***			
	(0.024)	(0.023)	(0.024)			
BRP						0.080
						(0.056)
BRP x post				0.141***	0.126**	0.150***
				(0.037)	(0.042)	(0.043)
Citation year FE	Yes	Yes	Yes	Yes	Yes	Yes
Book FE	Yes	Yes	No	Yes	Yes	No
Field * cit. year FE	No	Yes	No	No	Yes	No
Publ. year & subj. FE	No	No	Yes	No	No	Yes
R-squared	0.374	0.423	0.124	0.541	0.605	0.200
N	19,680	19,162	19,162	9,365	9,213	9,365
Pre-1942 Mean	0.263	0.268	0.268	0.283	0.282	0.283

Standard errors in parentheses are clustered at the book level.

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

Notes: The dependent variable is defined as $ln(c_{it} + (c_{it}^2 + 1)^{0.5})$, where c_{it} *is* citations to book *i* per year *t* between 1920 and 1970. In columns 1-3, the indicator *English* equals 1 for citations by *English-language* authors; the control group are citations to the same books from authors in other languages. In columns 4-6, the dependent variable is the log of English-language citations, the indicator *BRP* equals 1 for 213 books that were licensed to US publishers under the 1942 Book Republication Program (BRP), and the control group covers 39 Swiss books that were not available for licensing due to Switzerland's neutrality during the war; this sample is obtained using Mahalanobis matching. The variable *post* equals one for years after 1941.

TABLE A7 – OLS, EFFECTS OF BRP AND PRICE DECLINE ON ENGLISH-LANGUAGE CITATIONS. CONTROLLING FOR LINEAR PRE-TRENDS

	(1)	(2)	(3)	(4)
English	-0.036	-0.036	-0.036	-0.036
	(0.042)	(0.042)	(0.042)	(0.042)
English x post	0.211***	-0.077	0.079	-0.074
	(0.066)	(0.091)	(0.053)	(0.091)
English x Δp x post		1.192***		0.646**
		(0.344)		(0.288)
English x Math x post			0.674**	
			(0.279)	
English x Math x Δp x post				2.383***
				(0.907)
Citation year FE	Yes	Yes	Yes	Yes
Book FE	Yes	Yes	Yes	Yes
Linear pre-trend	Yes	Yes	Yes	Yes
R-squared	0.351	0.360	0.368	0.372
N	19,680	18,986	19,680	18,986
Pre-1942 Mean	0.263	0.264	0.263	0.264

Standard errors in parentheses clustered at the book level. *** p<0.01, ** p<0.05, * p<0.1

Notes: The dependent variable measures citations to book *i* per year *t* between 1920 and 1970. The depended variable is de-trended by estimating separate linear pre-trends for English-language citations and for citations by authors publishing in other languages, and then removing these different trends in the post-period. The indicator *English* equals 1 for citations by *English-language* authors; the control group are citations to the same books from authors in other languages. The variable *post* equals one for years after 1941. The variable *Math* indicates 55 books in mathematics. The variable *Δp* measures the difference between the original price and the BRP price for book *i*, divided by the original price.

	1920-41	1942-1970	Difference
All Books (N=530)	0.106	0.338	0.232***
	(0.487)	(1.255)	(0.018)
BRP (N=283)	0.263	0.566	0.303***
	(0.775)	(1.654)	(0.042)
Swiss (N=247)	0.024	0.078	0. 054***
	(0.171)	(0.353)	(0.007)
Difference	0.239***	0.488***	0.249***
	(0.014)	(0.020)	(0. 038)
Chemistry (N=389)	0.111	0.271	0.160***
	(0.514)	(0.993)	(0.017)
BRP (N=228)	0.274	0.414	0.140***
	(0.814)	(1.251)	(0.037)
Swiss (N=161)	0.025	0.069	0.044***
	(0.177)	(0.311)	(0.007)
Difference	0.249***	0.345***	0.096***
	(0.017)	(0.019)	(0.035)
Mathematics (N=141)	0.090	0.523	0.434***
	(0.395)	(1.776)	(0.052)
BRP (N=55)	0.230	1.195	0.965***
	(0.633)	(2.661)	(0.135)
Swiss (N=86)	0.021	0.094	0.073***
	(0.152)	(0.420)	(0.015)
Difference	0.209***	1.101***	0.892***
	(0.024)	(0.054)	(0.104)

Notes: Means and standard deviations (in parentheses) for English-language citations to BRP and Swiss books i per year t between 1920 and 1970. *BRP* books include 283 books with German-owned copyrights in the National Union Catalog (NUC) that were licensed to US publishers under the 1942 Book Republication Program (BRP). Swiss books cover 247 books with Swiss-owned copyrights that were not available for copyright licensing due to Switzerland's neutrality during the war. To construct data on citations from different languages, we first collect citations from Google Scholar (available at http://scholar.google.com, accessed July 1st - September 25th, 2014), and then manually assigned all citing publications to their publication language.

TABLE A9 – COMPARISON OF MEANS:
CITATIONS TO BRP VS. SWISS BOOKS, MATCHED SAMPLE

	1920-41	1942-1970	Difference
All Books (N = 255)	0.218	0.581	0.362***
	(0.710)	(1.667)	(0.038)
BRP (N = 214)	0.283	0.661	0.378***
	(0.804)	(1.787)	(0.047)
Swiss (N = 39)	0.027	0.141	0.113***
	(0.196)	(0.531)	(0.024)
Difference	0.256***	0.520***	0.264***
	(0.036)	(0.054)	(0.091)
Chemistry (N = 193)	0.229	0.405	0.175***
	(0.751)	(1.207)	(0.033)
BRP (N = 165)	0.302	0.462	0.160***
	(0.856)	(1.291)	(0.041)
Swiss (N = 29)	0.023	0.068	0.045***
	(0.180)	(0.296)	(0.016)
Difference	0.280***	0.394***	0.115***
	(0.043)	(0.045)	(0.078)
Mathematics (N = 60)	0.186	1.147	0.961***
	(0.572)	(2.573)	(0.114)
BRP (N = 49)	0.230	1.331	1.102***
	(0.633)	(2.785)	(0.141)
Swiss (N = 11)	0.042	0.326	0.284
	(0.240)	(0.854)	(0.080)
Difference	0.188***	1.005 ***	0.818***
	(0.059)	(0.158)	(0.274)

Notes: Means and standard deviations (in parentheses) of the number of new scientific publications that cite book i per year t between 1920 and 1970. *BRP* books include 214 books with German-owned copyrights in the National Union Catalog (NUC) that were licensed to US publishers under the 1942 Book Republication Program (BRP). Swiss books cover 39 books with Swiss-owned copyrights that were not available for copyright licensing due to Switzerland's neutrality during the war. To construct data on citations from different languages, we first collect citations from Google Scholar (available at http://scholar.google.com, accessed July 1st - September 25th, 2014), and then manually assigned all citing publications to their publication language.

	(1)	(2)	(3)
BRP			0.159*
			(0.086)
BRP x post	0.097	0.170*	0.127
	(0.077)	(0.100)	(0.087)
BRP x Δp x post	1.006***	0.961***	1.066***
	(0.344)	(0.323)	(0.313)
Δp			0.282
			0.159*
Citation year FE	Yes	Yes	Yes
Book FE	Yes	Yes	No
Field FE * cit. year FE	No	Yes	No
Publication year & field FE	No	No	Yes
R-squared	0.554	0.587	0.167
N	19,844	19,244	19,383
Pre-1942 Mean	0.264	0.271	0.269
Standard errors in parentheses clustered at the book level. *** p<0.01, ** p<0.05, * p<0.1			

Notes: The the dependent variable measures citations to book *i* per year *t* between 1920 and 1970 The indicator *BRP* equals 1 for 283 books that were licensed to US publishers under the 1942 Book Republication Program (BRP). The control group covers 247 Swiss books that were not available for licensing due to Switzerland's neutrality during the war. The variable *post* equals for years after 1941. The variable *Δp* measures the difference between the original price and the BRP price for book *i*, divided by the original price.

	(1)	(2)	(3)	(4)	(5)	(6)
BRP			0.742***			0.613**
			(0.259)			(0.264)
BRP x post	0.361***	0.361***	0.439***	0.070	0.070	0.148
	(0.089)	(0.089)	(0.151)	(0.083)	(0.083)	(0.155)
BRP x Δp x post				0.992***	0.992***	1.000***
				(0.342)	(0.342)	(0.316)
Δp						0.378
						(0.287)
Citation year FE	Yes	Yes	Yes	Yes	Yes	Yes
Book FE	Yes	Yes	No	Yes	Yes	No
Publication year FE	No	No	Yes	No	No	Yes
Field FE	No	No	Yes	No	No	Yes
Linear pre-trend	No	Yes	No	No	Yes	No
R-squared	0.551	0.545	0.156	0.554	0.548	0.178
N	10,567	10,567	10,308	10,220	10,220	9,989
Pre-1942 Mean	0.263	0.263	0.268	0.264	0.264	0.269

Standard errors in parentheses are clustered at the book level. *** p<0.01, ** p<0.05, * p<0.1

Notes: OLS regressions for BRP and Swiss books that are listed among the entries of the US Library of Congress. The dependent variable measures citations to book *i* per year *t* between 1920 and 1970. The indicator *BRP* equals 1 for 283 BRP books that are listed in the Library of Congress and that were licensed to US publishers under the 1942 Book Republication Program (BRP). The control group covers 19 Swiss books in the Library of Congress that were not available for licensing due to Switzerland's neutrality during the war. The variable *post* equals for years after 1941. The variable *Δp* measures the difference between the original price and the BRP price for book *i*, divided by the original price. In columns 2 and 5 the dependent variable is de-trended by estimating separate linear pre-trends for BRP and Swiss books for pre-BRP years and controlling for trends in the post-period.

TABLE A12 – BOOKS BY ÉMIGRÉS TO THE UNITED STATES

Title	Author	Publication year	English- language Citations		Price	
			1920-41	1942-70	Original	Δp
Methoden der mathematischen Physik	R. Courant and D. Hilbert	1931	8	235	28.24	50.4
Strahlenoptik	M. Herzberger	1931	0	2	7.75	16.1
Mathematische Grundlagen der Quantenmechanik	J. v. Neumann	1932	6	28	7.85	55.4
Aufgaben und Lehrsätze aus der Analysis	G. Pólya and G. Szegő	1925	4	34	14.40	58.3

Notes: Emigrés are identified using entries in the *International Biographical Dictionary of Central European Émigrés 1933-1945* (Strauss et al. 1983), as well as based on affiliations with US universities, which we collect from the *Mathematics Genealogy Project* (available at http://genealogy.math.ndsu.nodak.edu, accessed February 1-18, 2015).

TABLE A13 – OLS, EFFECTS OF PRICE ON CITATIONS BY ENGLISH VS. OTHER LANGUAGE AUTHORS AND TO BRP VS SWISS BOOKS
DEPENDENT VARIABLE IS THE INVERSE HYPERBOLIC SINE OF CITATIONS

	(1)	(2)	(3)	(4)	(5)	(6)
English	-0.032	-0.030	-0.030			
	(0.022)	(0.023)	(0.022)			
English x post	-0.024	-0.016	-0.021			
	(0.034)	(0.035)	(0.034)			
English x Δp x post	0.403***	0.401***	0.421***			
	(0.101)	(0.103)	(0.101)			
Δp			0.166*			0.247*
			(0.081)			(0.114)
BRP						0.005
						(0.055)
BRP x post				0.057	0.057	0.059
				(0.039)	(0.046)	(0.042)
BRP x Δp x post				0.284**	0.253**	0.309**
				(0.109)	(0.112)	(0.109)
Citation year FE	Yes	Yes	Yes	Yes	Yes	Yes
Book FE	Yes	Yes	No	Yes	Yes	No
Field * cit. year FE	No	Yes	No	No	Yes	No
Pub. year & field FE	No	No	Yes	No	No	Yes
R-squared	0.381	0.431	0.147	0.543	0.607	0.223
N	18524	18524	9302	9302	9150	9302

Standard errors in parentheses are clustered at the book level. *** p<0.01, ** p<0.05, * p<0.1

Notes: The dependent variable is defined as $ln(c_{it} + (c_{it}^2 + 1)^{0.5})$, where c_{it} is citations to book i per year t between 1920 and 1970. In columns 1-3, the indicator *English* equals 1 for citations by *English-language* authors; the control group are citations to the same books from authors in other languages. In columns 4-6, the dependent variable is the log of English-language citations, the indicator *BRP* equals 1 for 283 books that were licensed to US publishers under the 1942 Book Republication Program (BRP), and the control group covers 247 Swiss books that were not available for licensing due to Switzerland's neutrality during the war. The variable *post* equals one for years after 1941. The variable Δp measures the difference between the original price and the BRP price for book i, divided by the original price.

EFFECTS OF PRICE ON CITATIONS BY ENGLISH VS. OTHER LANGUAGE AUTHORS

	OLS (1-2)		First Stage (3)	Second Stage (4-5)	
	(1)	(2)	(3)	(4)	(5)
English	-0.036	-0.034		-0.036	-0.034
	(0.042)	(0.044)		(0.042)	(0.044)
English x post	-0.090	-0.116	0.021	-0.118	-0.136
	(0.161)	(0.162)	(0.027)	(0.163)	(0.162)
English x ln(orig p) x post	0.120**	0.137***	0.088***		
	(0.051)	(0.052)	(0.010)		
English x Δp x post				1.357*	1.497**
				(0.534)	(0.539)
Citation year FE	Yes	Yes	Yes	Yes	Yes
Book FE	Yes	Yes	Yes	Yes	Yes
Field * cit. year FE	No	Yes	No	No	Yes
R-squared	0.360	0.405	0.743	0.020	0.022
N	18,986	18,843	18,986	18,986	18,524
Pre-1942 mean	0.264	0.269	--	0.264	0.269
KP F-stat	--	--	--	75.28	84.63

Standard errors in parentheses are clustered at the book level.

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

Notes: The dependent variable measures citations to book *i* per year *t* between 1920 and 1970. The indicator *English* equals 1 for citations by *English-language* authors; the control group are citations to the same book from authors in other languages. The variable *post* indicates years after 1941. The variable *ln(orig p)* denotes the natural logarithm of the original price of BRP books. The variable *Δp* measures the difference between the original price and the BRP price for book *i*, divided by the original price. In columns 4 and 5, *Δp* is instrumented by *ln(orig p)*; *KP F-stat* refers to the Kleibergen-Paap F-statistic test for weak instruments, and the first stage is shown in column 3.

	Advertised BRP books	Other BRP books	Difference
English-language citations			
pre-1942	0.374	0.178	0.197***
	(0.954)	(0.588)	(0.038)
post-1942	0.827	0.404	0.423***
	(2.049)	(1.328)	(0.037)
Other-language citations			
pre-1942	0.311	0.291	0.020
	(0.782)	(0.802)	(0.039)
post-1942	0.388	0. 394	-0.006
	(0.870)	(1.082)	(0.023)
Mathematics	1.058	0.947	0.110
	(2.324)	(2.529)	(0.109)
Chemistry	0.632	0.255	0.377***
	(1.714)	(0.715)	(0.028)
Publication year	1935	1937	-2
	(8)	(5)	(0.797)
N books	108	175	283

Note: Means and standard deviations (in parentheses, columns 1 and 2; standard errors in column 3) of select book characteristics, for books advertised in the *Library Journal* at least once and for all other books, and difference in means (column 3).

	(1)	(2)	(3)	(4)
25 miles * post	0.202***			0.173***
	(0.039)			(0.045)
50 miles * post		0.159***		
		(0.040)		
75 miles * post			0.178***	
			(0.035)	
25-50 miles * post				0.207***
				(0.073)
50-75 miles * post				-0.128**
				(0.058)
75-100 miles * post				-0.019
				(0.058)
Year FE	Yes	Yes	Yes	Yes
Location FE	Yes	Yes	Yes	Yes
R-squared	0.274	0.272	0.271	0.282
N	4,752	4,752	4,752	4,752
Pre-1942 Mean	0.031	0.031	0.031	0.031

Standard errors in parentheses clustered at the location level.
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Notes: The dependent variable counts new citations by English-language publications to BRP books in mathematics from location k in year t. The indicator *x miles* equals 1 for locations that are within x miles from a library that acquired at least one BRP book by 1956. The indicator *x-y miles* equals 1 for locations that are between x and y miles away from a library with BRP books. The variable *post* equals 1 for years after 1941.

	(1)	(2)	(3)	(4)
Émigré at 25 miles * post	0.087			0.074
	(0.068)			(0.085)
Library at 25 miles * post	0.178***			0.151***
	(0.045)			(0.053)
Émigré at 50 miles * post		0.090		
		(0.067)		
Library at 50 miles * post		0.119**		
		(0.049)		
Émigré at 75 miles * post			0.088	
			(0.063)	
Library at 75 miles * post			0.135***	
			(0.045)	
Émigré at 25-50 miles * post				-0.009
				(0.093)
Library at 25-50 miles * post				0.201**
				(0.085)
Émigré at 50-75 miles * post				0.064
				(0.076)
Library at 50-75 miles * post				-0.133*
				(0.067)
Émigré at 75-100 miles * post				-0.103
				(0.088)
Library at 75-100 miles * post				-0.003
				(0.068)
Year FE	Yes	Yes	Yes	Yes
Location FE	Yes	Yes	Yes	Yes
R-squared	0.276	0.273	0.272	0.284
N	4,752	4,752	4,752	4,752
Pre-1942 Mean	.031	.031	.031	.031

Standard errors in parentheses clustered at the location level.
*** p<0.01, ** p<0.05, * p<0.1

Notes: The dependent variable counts new citations by English-language publications to BRP books in mathematics from location *k* in year *t*. The indicator *Émigré x miles* equals 1 for locations that are within *x* miles from an institution with an émigré. The indicator *Library x-y miles* equals 1 for locations that are between *x* and *y* miles away from a library that acquired at least one BRP book by 1956. The variable *post* equals 1 for years after 1941.

	(1)	(2)	(3)	(4)	(5)	(6)
BRP			0.220***			0.141**
			(0.049)			(0.059)
BRP x post	0.393***	0.413***	0.420***	0.107	0.143*	0.116
	(0.083)	(0.133)	(0.121)	(0.076)	(0.084)	(0.078)
BRP x Δp x post				0.971***	0.969***	1.068***
				(0.338)	(0.428)	(0.305)
Δp						0.306
						(0.213)
Citation year FE	Yes	Yes	Yes	Yes	Yes	Yes
Book FE	Yes	Yes	No	Yes	Yes	No
Linear pre-trend	No	Yes	No	No	Yes	No
R-squared	0.549	0.577	0.142	0.552	0.580	0.164
N	29,879	29,212	29,241	29,504	28,865	28,894
Pre-1942 Mean	0.256	0.264	0.261	0.257	0.265	0.261

Standard errors in parentheses are clustered at the book level.
*** p<0.01, ** p<0.05, * p<0.1

Notes: OLS regressions for the full sample of BRP and Swiss books, including books that are not listed in the National Union Catalog (which captures the holdings of US libraries.) The dependent variable measures citations to book *i* per year *t* between 1920 and 1970. The indicator *BRP* equals 1 for 291 books that were licensed to US publishers under the 1942 Book Republication Program (BRP). The control group covers 486 Swiss books that were not available for licensing due to Switzerland's neutrality during the war. The variable *post* equals for years after 1941. The variable *Δp* measures the difference between the original price and the BRP price for book *i*, divided by the original price. In columns 2 and 6 the dependent variable is de-trended by estimating separate linear pre-trends for BRP and Swiss books for pre-BRP years and controlling for trends in the post-period.

TABLE A19 – OLS, EFFECTS OF BRP ON ENGLISH-LANGUAGE CITATIONS
BRP VS. SYNTHETIC CONTROLS

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
BRP	0.287***	0.287***	0.107	0.111**	0.265***	0.265***	0.313***	0.312***
	(0.052)	(0.052)	(0.082)	(0.049)	(0.043)	(0.043)	(0.050)	(0.050)
BRP x post	0.229***	0.229***	0.027	0.025	0.095**	0.095**	-0.067	-0.034
	(0.071)	(0.071)	(0.082)	(0.074)	(0.048)	(0.048)	(0.074)	(0.068)
English					-0.014***	-0.014***	0.053	0.053
					(0.000)	(0.000)	(0.048)	(0.048)
English x BRP					-0.024	-0.024	-0.116**	-0.116**
					(0.041)	(0.041)	(0.053)	(0.053)
English x post					0.049***	0.049***	-0.033	-0.033
					(0.000)	(0.000)	(0.058)	(0.058)
English x BRP x post					0.163**	0.163**		
					(0.065)	(0.065)		
Δp			0.621*	0.607***				
			(0.330)	(0.222)				
BRP * Δp * post			0.990***	0.994***			0.451***	0.319**
			(0.347)	(0.314)			(0.164)	(0.151)
English x BRP x Δp x post							1.145***	1.145***
							(0.325)	(0.325)
Citation year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Book FE	No	Yes	No	Yes	No	Yes	No	Yes
R-squared	0.037	0.424	0.080	0.438	0.040	0.285	0.071	0.300
N	13,298	13,298	12,951	12,951	26,596	26,596	25,902	25,902
Pre-1942 Mean	0.263	0.263	0.264	0.264	0.282	0.282	0.283	0.283

Standard errors in parentheses are clustered at the BRP book level. *** p<0.01, ** p<0.05, * p<0.1

Notes: OLS regressions for BRP and a sample of synthetic controls based on Swiss books. The dependent variable measures citations to book *i* per year *t* between 1920 and 1970. The variable *English* denotes English-language citations. The indicator *BRP* equals 1 for 283 BRP books that are listed in the Library of Congress and that were licensed to US publishers under the 1942 Book Republication Program (BRP). The synthetic control for each BRP book is obtained using non-English citations as the covariate and searching among Swiss books in the same field (math and chemistry). The variable *post* equals for years after 1941. The variable *Δp* measures the difference between the original price and the BRP price for book *i*, divided by the original price.

FIGURE A1 – ORIGINAL AND BRP PRICES FOR BRP BOOKS

MATHEMATICS
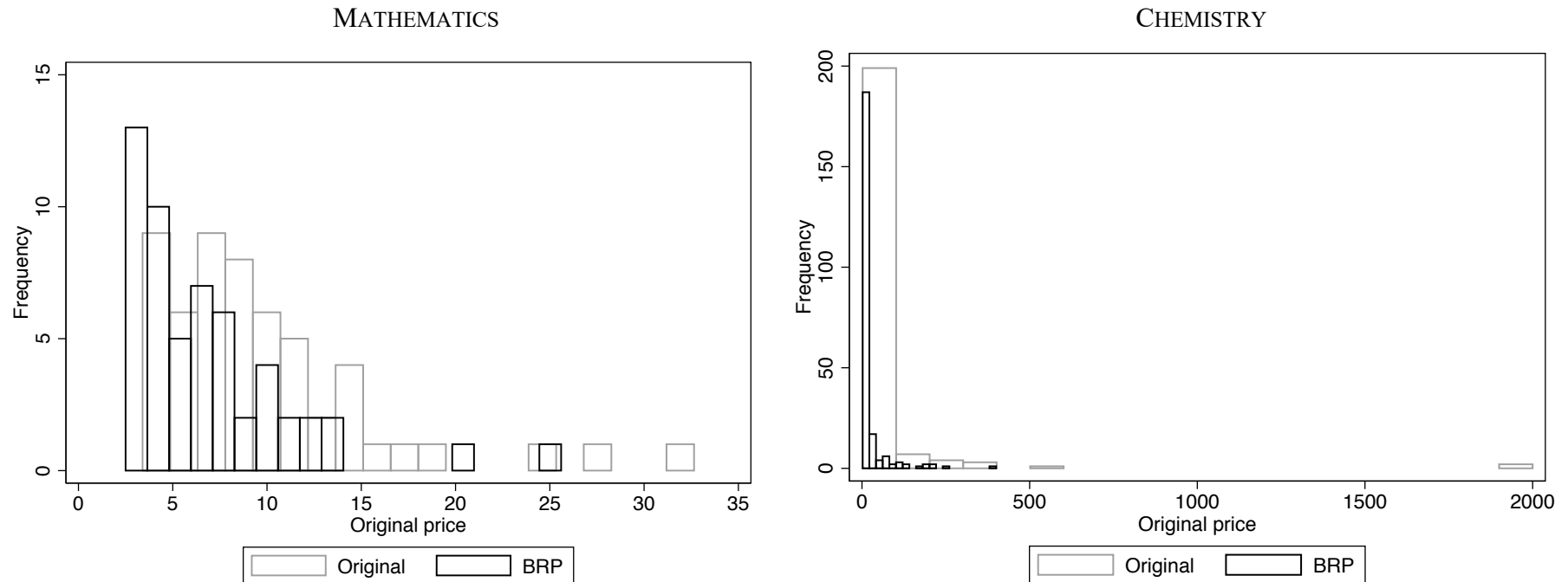
CHEMISTRY

Notes: Original (pre-BRP) and BRP prices for 55 books in mathematics (left) and 228 books in chemistry (right). Two chemistry books sold for an original price of $2,000 each: Beilstein's *Handbuch der Organischen Chemie* (with a BRP price of $400) and Saccardo's *Silloge Fungorum* (with a BRP price of $200). The most expensive math books are Courant's *Grundlagen der Mathematik* (with an original price of $32.6 and a BRP price of $25.6) and Courant and Hilbert's *Methoden der Mathematischen Physik* (with an original price of $28.2 and a BRP price of $14).

FIGURE A2 – SHARE OF GERMAN-LANGUAGE OPERAS
AT THE METROPOLITAN OPERA IN NEW YORK, 1900-1950
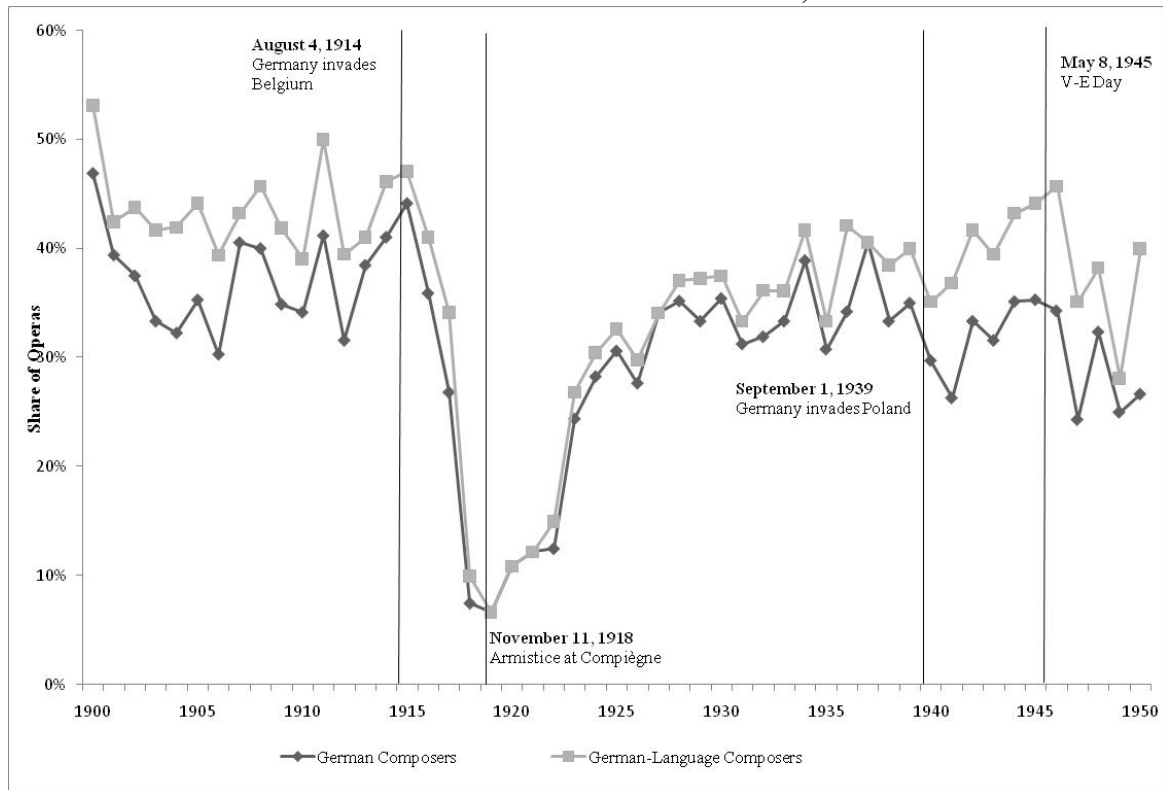
Notes: Data on the share of German-language operas collected from historical schedules of performances in the online archives of the Metropolitan Opera in New York (Moser 2012). *German composers* include Carl Maria von Weber, Engelbert Humperdinck, Friedrich Handel, Friedrich von Flotow, Giacomo Meyerbeer, Hermann Goetz, Jacques Offenbach, Ludwig van Beethoven, Max von Schillings, Peter Cornelius, Richard Strauss, and Richard Wagner. *German-language composers* further include Austrian composers Wolfgang Amadeus Mozart, Ernst Krenek, Franz von Suppé, Johann Strauss Jr. and Franz Schubert and the Bohemian Christoph von Gluck. Composers are assigned to ethnicities based on their country of birth, which means that Beethoven and Handel are counted as German, even though Beethoven was also active in Vienna and Handel in London.

FIGURE A3 – CITATIONS BY NEW PUBLICATIONS PER YEAR –
METHODEN DER MATHEMATISCHEN PHYSIK (1931) BY R. COURANT AND D. HILBERT
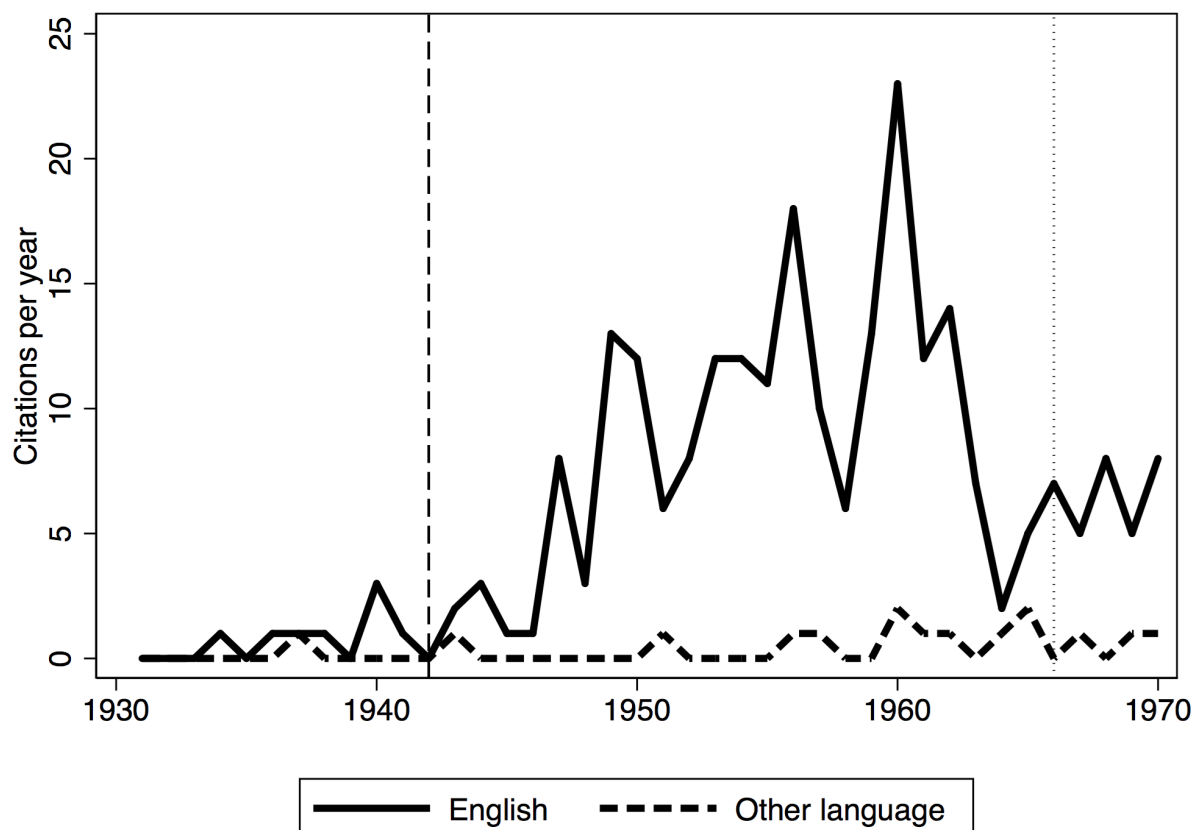
Notes: Citations *Methoden der Mathematischen Physik* (1931) by new scientific publications (book and articles) per year. Citations data from Google Scholar (http://scholar.google.com) between July 1st and September 25th, 2014. We restrict the data to new publications that cite the original German language versions of BRP books, and exclude citations to English translations (here, *Methods of Mathematical Physics*, 1966).
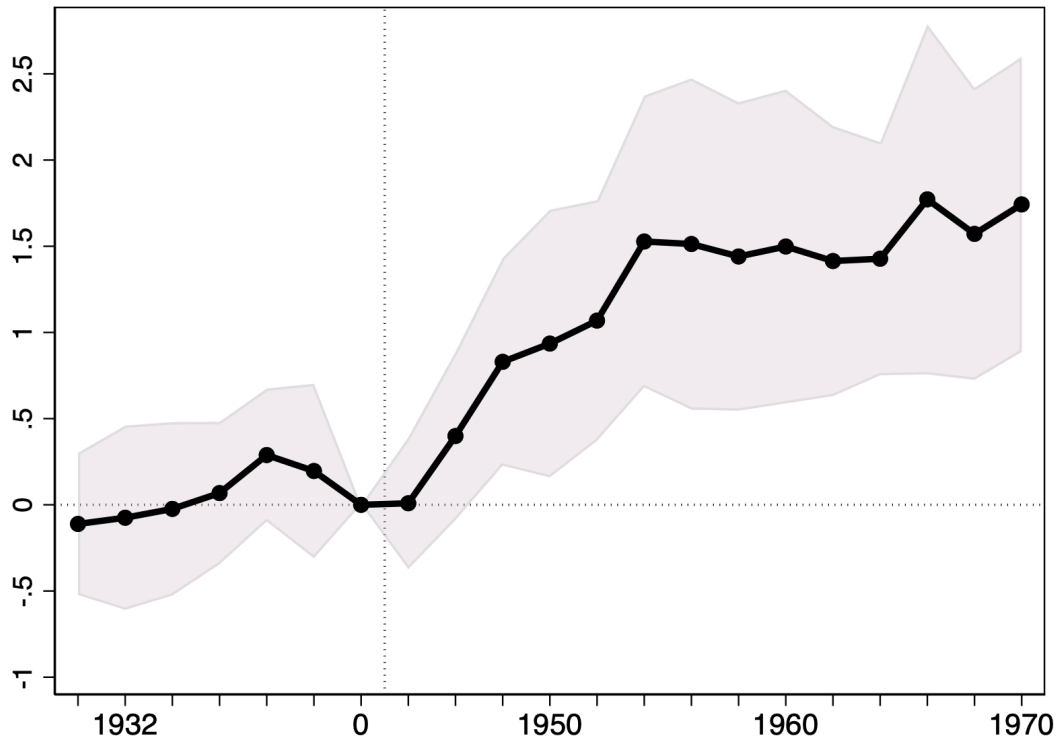
Notes: Estimates of θ_s with a 95-percent confidence interval in the OLS regression $cites_{ilt} = \alpha_1\ English_l + \alpha_2\ English_l * post_t + \beta_1\ BRP_i * English_l + \beta_2\ English_l * post_t + \beta_3\ BRP_i * English_l * post_t + \beta_4\ BRP_i * post_t * + \Delta p_i + \Sigma_s\ \theta_s\ \Delta p_i * English_l * BRP_i * \tau_s + book_i + \mu_{ft} + \tau_t + \varepsilon_{ilt}$ for two-year intervals 1920-21,…,1969-70, with years 1941-42 as the excluded period. The dependent variable $cite_{ilt}$ counts citations to book i in language l and year t. The indicator *English* equals 1 for citations from English-language authors. The indicator *BRP* equals 1 for 214 books that were licensed to US publishers under the 1942 Book Republication Program (BRP). The control group covers 39 Swiss books that were not available for licensing due to Switzerland's neutrality during the war; this sample is obtained using Mahalanobis matching. *Book_i* is a vector of book fixed effects; μ_{ft} are field-by-year fixed effects, and τ_t indicates year fixed effects. The variable Δp measures the difference between the original price and the BRP price for book i, divided by the original price. Standard errors are clustered at the book level.

FIGURE A5A – CITATIONS TO BRP BOOKS BY ÉMIGRÉS VS OTHER BRP BOOKS
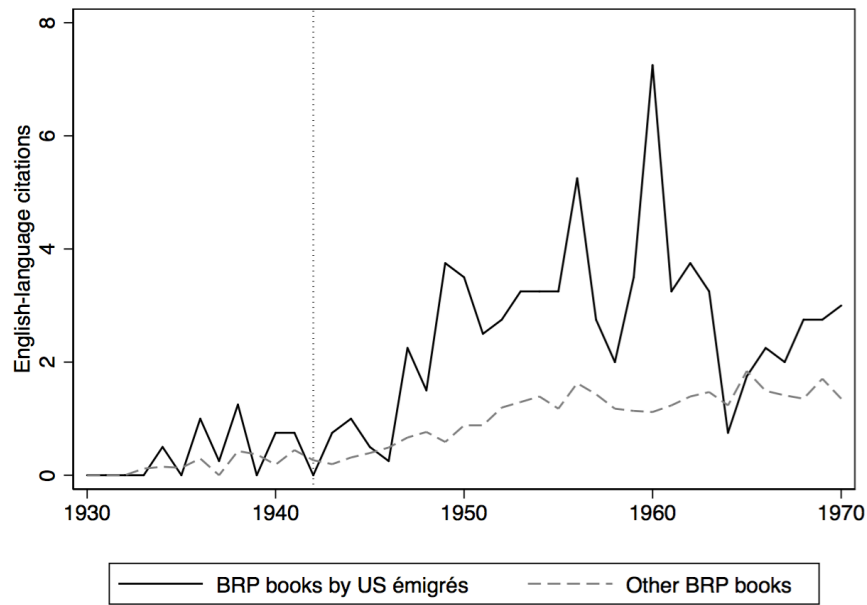
FIGURE A5B – CITATIONS TO BRP BOOKS BY ÉMIGRÉS VS OTHER BOOKS BY ÉMIGRÉS
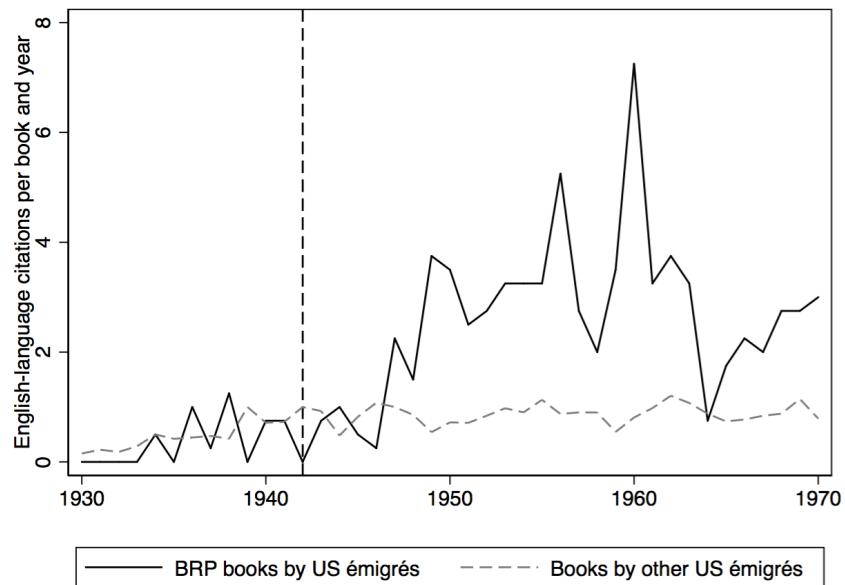
Notes: Panel A shows English-language citations per year to five BRP books by seven mathematicians who emigrated to the United States after 1932 (*BRP books by US emigres*, black line) and to all other BRP books (*Other BRP books*, grey dashed line). Panel B shows English-language citations to the same *BRP books by US emigres* (black line) and by other 115 German émigrés to the US whose work was not included in the BRP (*Books by other émigrés*). Data on émigrés from the *Dictionary of Central European Émigrés* (Straus et al. 1983), the *American Men of Science* (Cattell 1956), and the Mathematics Genealogy Project.

FIGURE A6 – CITATIONS TO BRP BOOKS BY ENGLISH-LANGUAGE AUTHORS PER BOOK AND YEAR: MATHEMATICS (TOP PANEL) AND CHEMISTRY (BOTTOM PANEL)
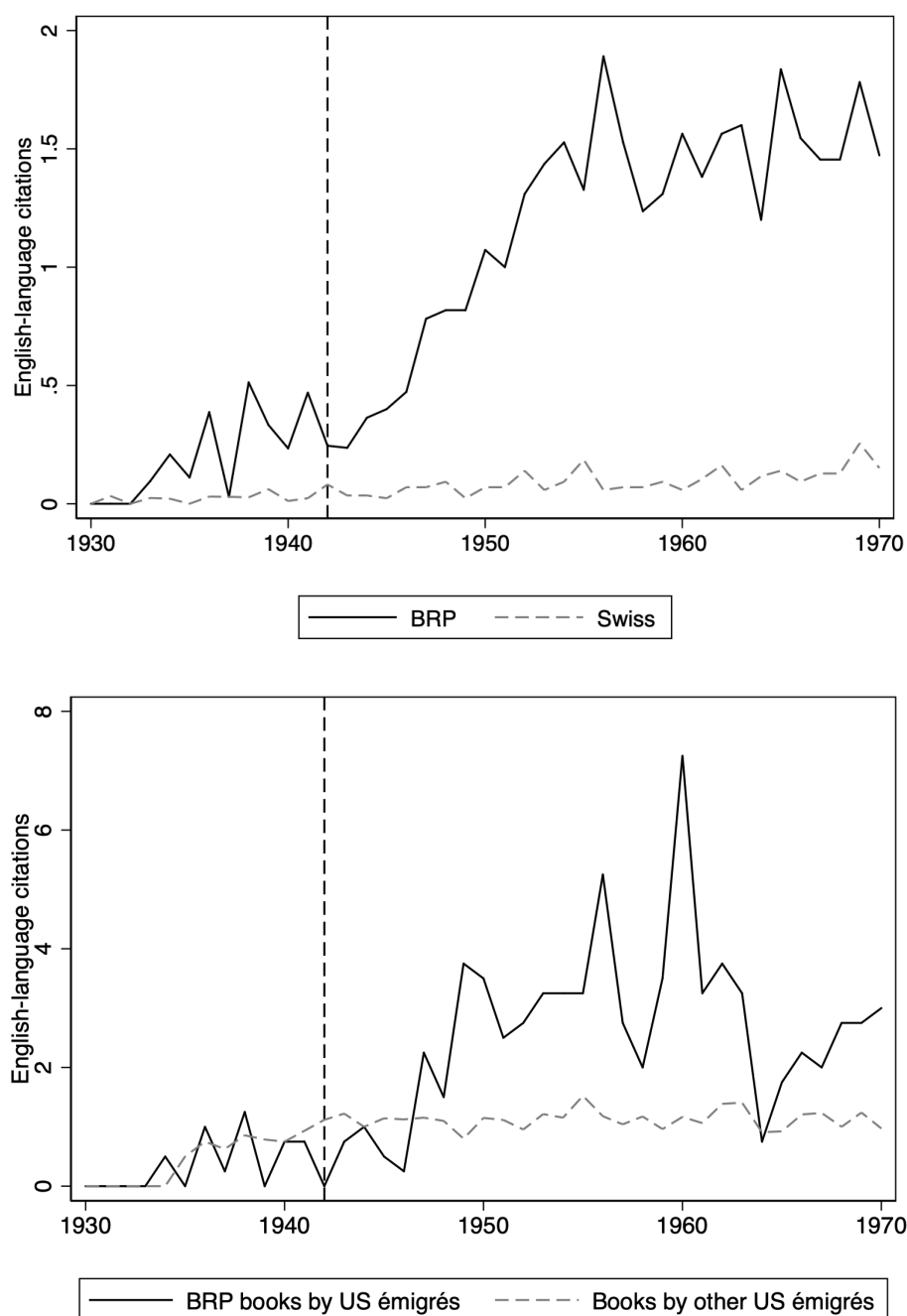
Notes: Citations per book and year for 55 mathematics books (bottom panel) and 228 BRP chemistry books (top panel) by new scientific publications in English compared with citations to BRP books by new publications in other languages (which did not benefit directly from the BRP). Citations collected from Google Scholar (http://scholar.google.com, accessed July 1st-September 25th, 2014).

FIGURE A7– PUBLICATION YEARS FOR POTENTIAL SUBSTITUTES FOR BRP BOOKS
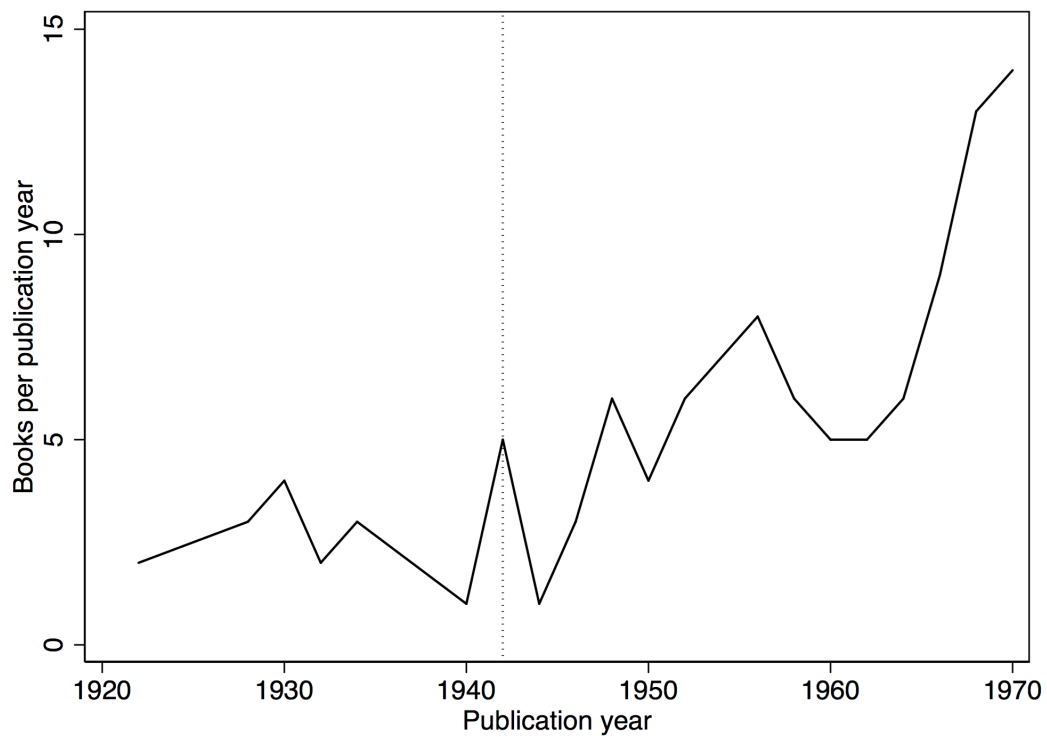
Notes: Books that customers on Amazon who bought BRP books "also bought" or "frequently bought together" with BRP books by the publication year of their first edition. For the four most highly cited BRP books in mathematics: Courant and Hilbert (1931) *Methoden der Mathematischen Physik,* Alexandroff and Hopf (1935), van der Waerden (1931), *Moderne Algebra*, Nevanlinna (1936), *Eindeutige analytische Funktionen* (R. Nevanlinna, 1936). Data collected from www.amazon.com, accessed September 21-30, 2016).
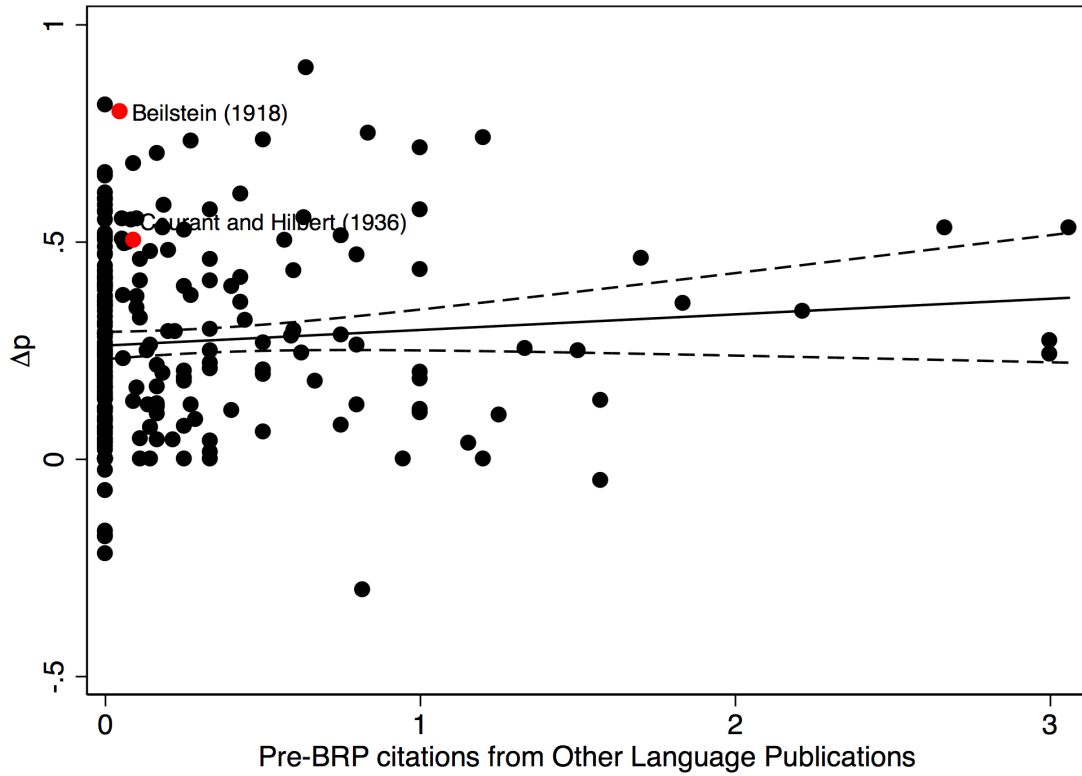
Notes: The vertical axis shows the percentage decline in price Δp (calculated as the difference between the original price and the BRP price divided by the original pre-BRP price). The horizontal axis shows the pre-BRP counts of citations per year to the same BRP book by publications in other languages. The solid line plots the linear relationship between Δp and pre-BRP citations; the dashed lines denote 5 percent confidence intervals. One additional citation by a non-English publication before the BRP is associated with an additional 3.6 percentage point decline in price (with a p-value of 0.18).

FIGURE A9 – SHARE OF LIBRARIES THAT HAD ACQUIRED A BRP BOOK BY 1956
VS ITS PRICE DECLINE IN 1942
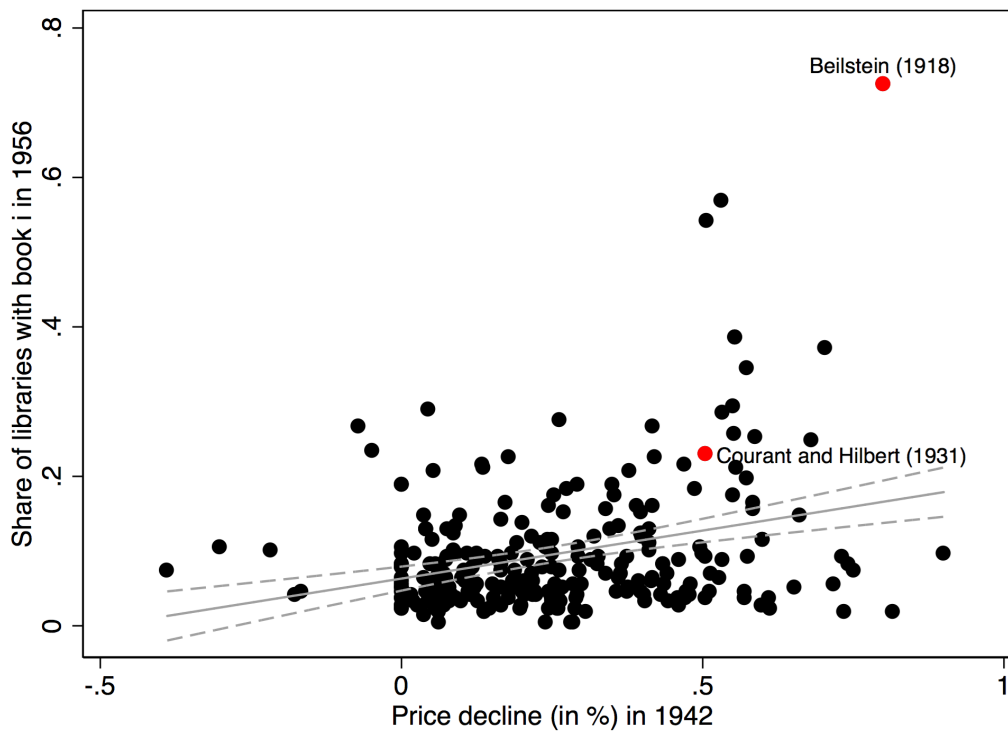
Notes: The share of libraries that had acquired a BRP book *i* by 1956 against the decline in price for the same book in 1942. Each additional 10 percent decline in price was associated with a 1.3 percent increase in the share of libraries that held a BRP book (with a p-value of 0.00). Excluding outliers (such as Beilstein), which can be found in more than 40 percent of US libraries, leaves the estimate at 0.8 (with a p-value of 0.00). We constructed data on libraries holdings of BRP books a physical copy of the National Union Catalog (Mansell 1968-1981), which is available in the Hoover Institution Library and Archives.

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Notes: Check-out sheets included in the back of the BRP book "Grundlagen Und Anwendungen Ihrer Theorie" by H.C.F von Weizsäcker. Stanford University Library, June 2016.

FIGURE A11 – NEW CITATIONS PER YEAR, BY DISTANCE OF LOCATION FROM BRP LIBRARY
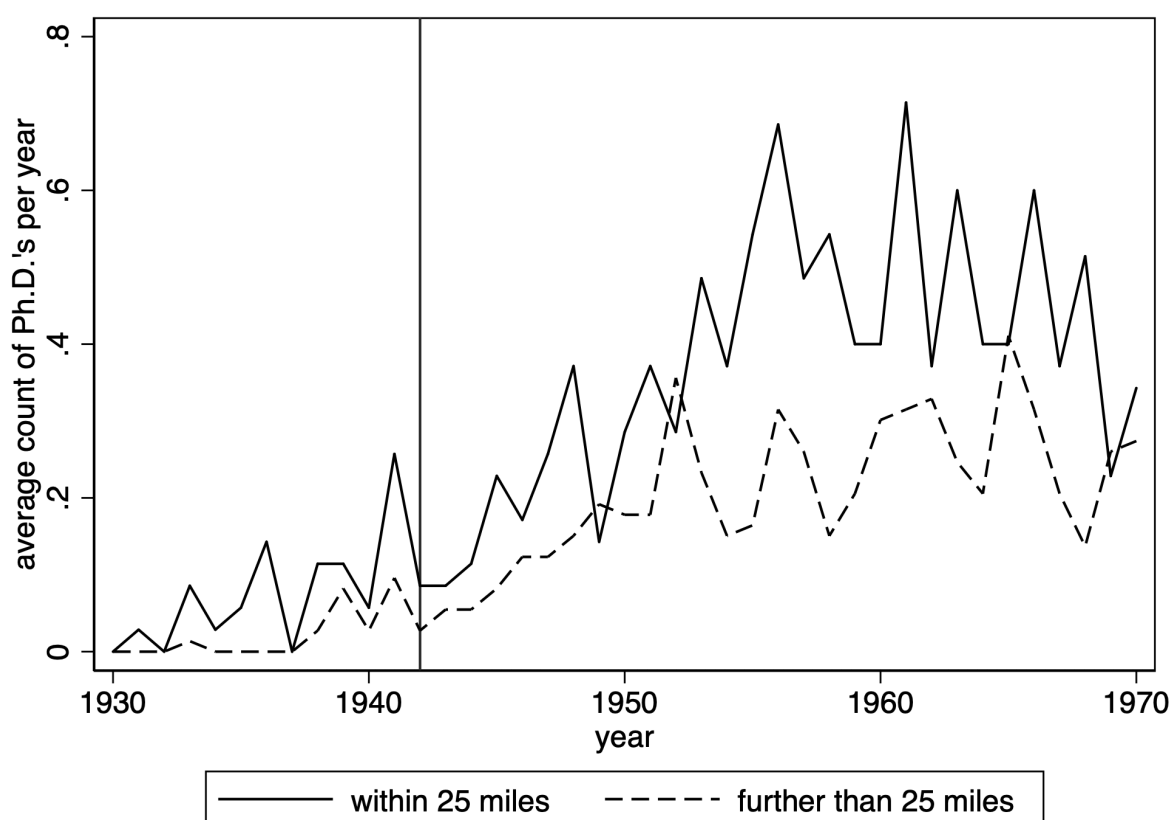

Notes: Citations by scientific publications per book and citation year for 55 BRP math books, by distance of the author from a library holding at least one BRP book. We have collected data on the geographic locations of authors from records of PhD granting institution of advisors and advisees in the Mathematics Genealogy Project (available at http://www.genealogy.ams.org, accessed January 28th-March 10, 2016). Data on libraries holdings were constructed from the records of the National Union Catalog (Mansell 1968-1981) at the Hoover Institution Library and Archives.

## FIGURE A12 – LOCATIONS OF NEW PhDS AND BRP BOOKS IN MATH

1920-1941
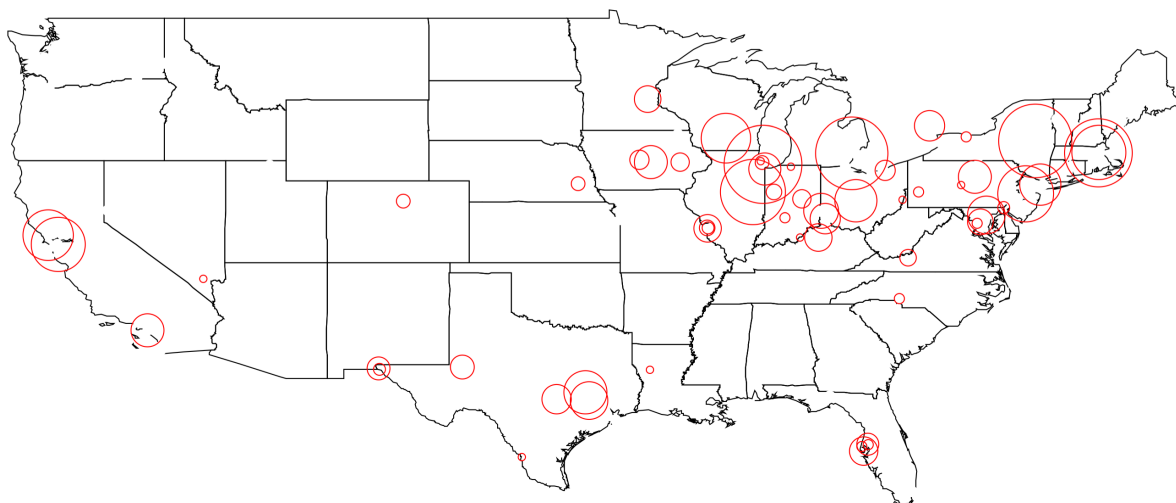
1942-1970
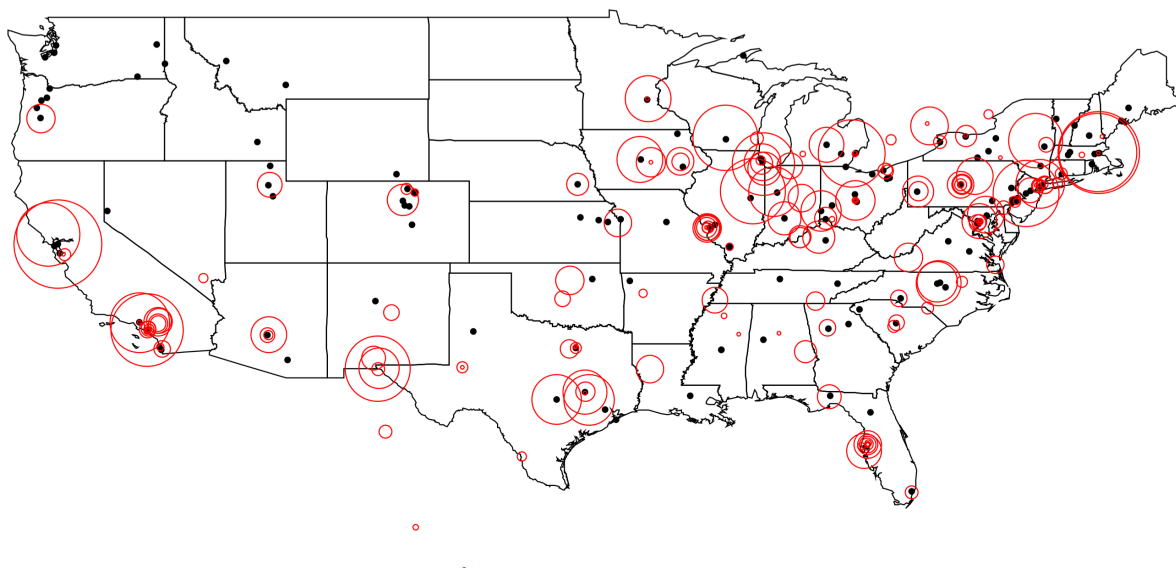
Notes: Black dots map the locations of US libraries where BRP math books had become available by 1956. Red circles show the locations of PhD-granting institutions; the size of the red circle represents the number of PhDs in a location. We have collected data on the geographic locations of authors from records of PhD granting institution of advisors and advisees in the Mathematics Genealogy Project (http://www.genealogy.ams.org, accessed January 28th-March 10, 2016).

FIGURE A13 – CITATIONS TO BRP BOOKS AND THEIR SYNTHETIC CONTROLS
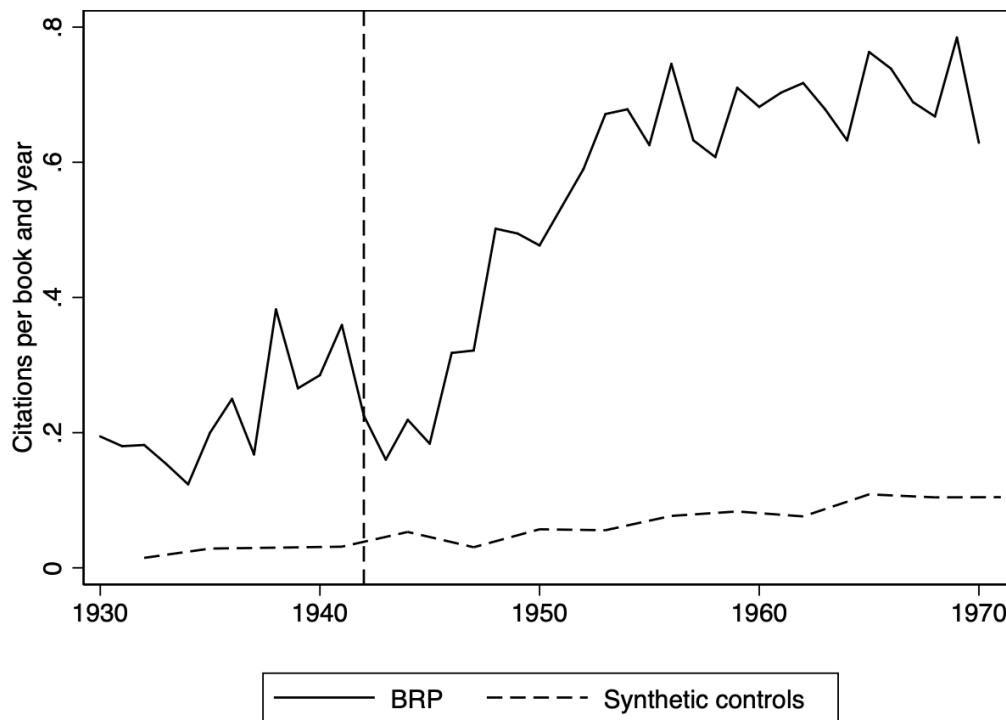
Notes: Citations per book and year for 283 BRP books and a sample of synthetic controls. based on Swiss books by new scientific publications in English compared with citations to BRP books by new publications in other languages (which did not benefit directly from the BRP). The synthetic control for each BRP book is obtained using non-English citations as the covariate and searching among Swiss books in the same field (math and chemistry). Citations collected from Google Scholar (http://scholar.google.com, accessed July 1st-September 25th, 2014).

We build a simple model to highlight the economic mechanisms by which copyrights for scientific content may help to shape the creation of new knowledge. Two identical generations of researchers produce new knowledge in periods *t-1* and *t*. The concept of cumulative science (Scotchmer 1991) is captured by allowing second-generation scientists in period *t* to build on knowledge y_{t-1} created by researchers in the first generation *t-1*. Normalizing the price of new knowledge y_t to equal 1, scientists receive a sure payoff y_t if they produce new knowledge; this payoff can take the form of a money, peer recognition, or any other rewards that scientists value.

To access existing knowledge y_{t-1}, second-generation scientists pay a price *p*. Here, *p* represents the price of a book, but *p* could also be viewed as an access fee for a compilation of knowledge or an online depository of scientific articles. To reflect the indivisibility of existing knowledge, we assume that scientists pay *p* to use any quantity of existing knowledge. In other words, scientists must buy the entire book, or pay the full fee to access any part of the collection.

In addition to existing knowledge y_{t-1}, scientists use capital k_t, which is available at the rental rate *r*. Unlike existing knowledge, capital is divisible. Scientists are price takers for *p* and *r*. Depending on input prices *p* and *r*, scientists either invest in follow-on science, and receive $y_t = f(y_{t-1}, k_t)$, or they do nothing, and receive a payoff of zero.

Second-generation scientists choose k_t^* to maximize net payoffs $y_t - p - rk_t^*$. They invest in creating new knowledge only if *p* is below a threshold price *p'* such that

$$f(y_{t-1}, k_t^*) - p' - rk_t^* \geq 0 \text{ or } p' = f(y_{t-1}, k_t^*) - rk_t^* \quad (4)$$

This implies – under a general set of production functions - that scientists produce more new knowledge when *p* is low. For a Cobb-Douglas production function $y_t = y_{t-1}^{1-\alpha} k_t^{\alpha}$, the threshold price equals

$$p' = \alpha^{\alpha/1-\alpha}(1-\alpha) \, y_{t-1} \, r^{-\alpha/1-\alpha}$$

Complementarities with Physical Capital

The benefits of capital may vary across disciplines according to their dependence on other factors of production (and in particular physical capital) in addition to pre-existing knowledge. To examine these effects, we first extend the knowledge production function to allow for heterogeneous effects across disciplines. Let $y_{m,t} = g(y_{m,t-1}, k_t)$ represent a discipline

in which knowledge creation depends primarily on human capital, such as mathematics. Let $y_{c,t} = z(y_{c,t-1}, k_t)$ be a discipline in which knowledge production requires physical capital (such as laboratory space for chemical research). The elasticity of knowledge production with respect to physical capital is $e^c(y_{c,t-1}, k_t) = z_k(y_{c,t-1}, k_t) k_t / z(y_{c,t-1}, k_t)$ for chemistry and $e^m(y_{c,t-1}, k_t) = g_k(y_{m,t-1}, k_t) k_t / g(y_{m,t-1}, k_t)$ for mathematics. This elasticity is smaller for mathematics than for chemistry, so that $e^m(y_{m,t-1}, k_t) < e^c(y_{c,t-1}, k_t)$ for every $\{y_{m,t-1}, y_{c,t-1}, k_t\}$. Then, the threshold prices for existing knowledge (above which scientists choose not to invest in follow-on research) become

$$p_c' = z(y_{c,t-1}, k_c^*) - z_k(y_{c,t-1}, k_c^*) k_c^* = z(y_{c,t-1}, k_c^*)(1 - e^c(y_{c,t-1}, k_c^*))$$
$$p_m' = g(y_{m,t-1} k_m^*) - g_k(y_{m,t-1}, k_m^*) k_m^* = g(y_{m,t-1} k_m^*)(1 - e^m(y_{m,t-1}, k_m^*))$$

If existing knowledge is equally valuable across disciplines, so that $y_{c,t-1} = y_{m,t-1}$, then $p'_m \geq p'_c$. More generally, p' is weakly decreasing in the elasticity of cumulative knowledge with respect to physical capital:

$$\frac{dp'}{de(y_{t-1}, k^*)} = -f(y_{t-1}, k^*) \leq 0 \quad \text{if} \quad f(y_{t-1}, k^*) \geq 0 \qquad (7)$$

For a Cobb-Douglas production function $y_t = y_{t-1}^{1-\alpha} k_t^\alpha$, where α is the elasticity of knowledge production with respect to physical capital,

$$\frac{dp'}{d\alpha} = \alpha^{\frac{\alpha}{1-\alpha}} y \, r^{\frac{\alpha}{\alpha-1}} \frac{1}{1-\alpha} \log(\alpha/r) \leq 0 \quad \text{if} \quad \alpha \leq r$$

which implies that the threshold price of existing knowledge at which scientists invest in new knowledge is (weakly) decreasing in the elasticity of knowledge with respect to capital.