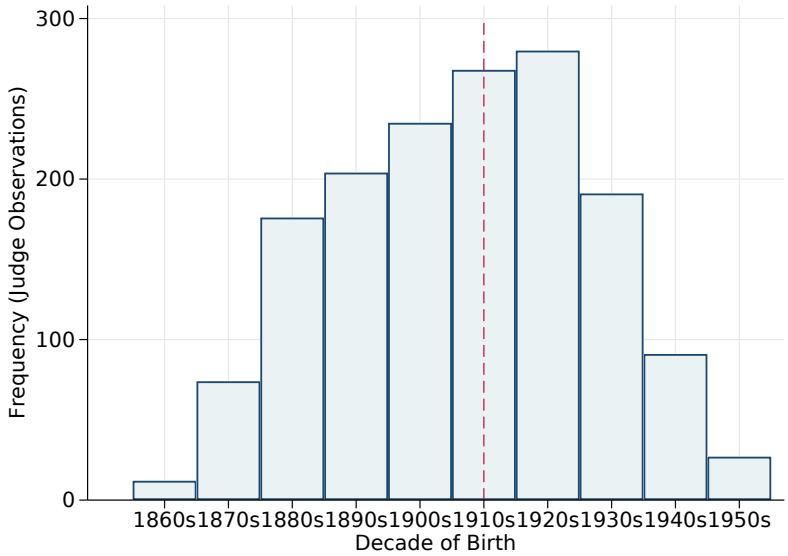
Appendix

A Background and Data

A.1 Aging and Retirement Decisions

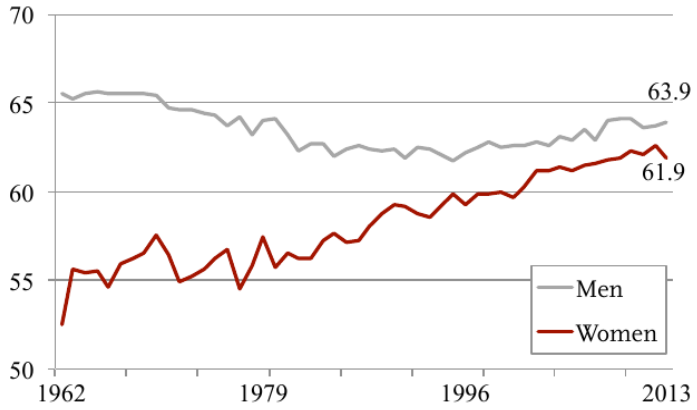
Figure A.1: Distribution of Judge Birth Decades



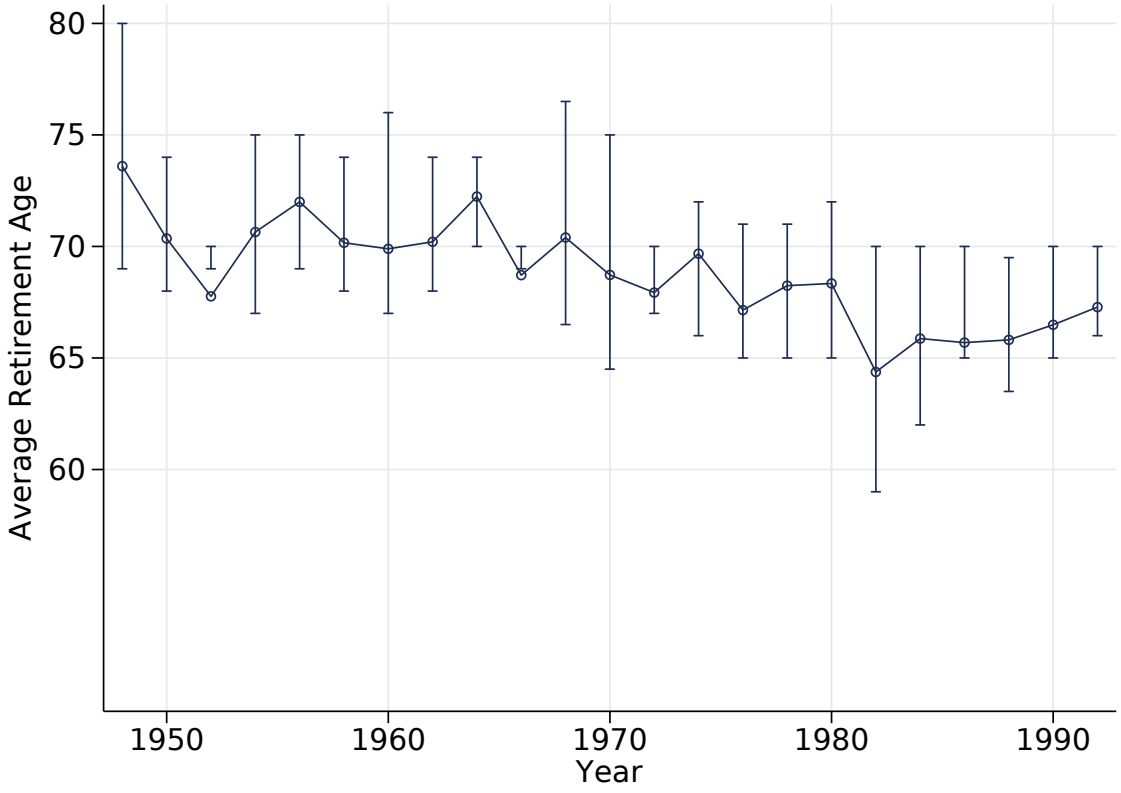
Number of judges in each birth decade cohort. Vertical dashed line at median.

Figure A.2: Average Retirement Age for U.S. Workers and Judges,

(A) Average Retirement Age for U.S. Workers, by Gender, 1962-2013

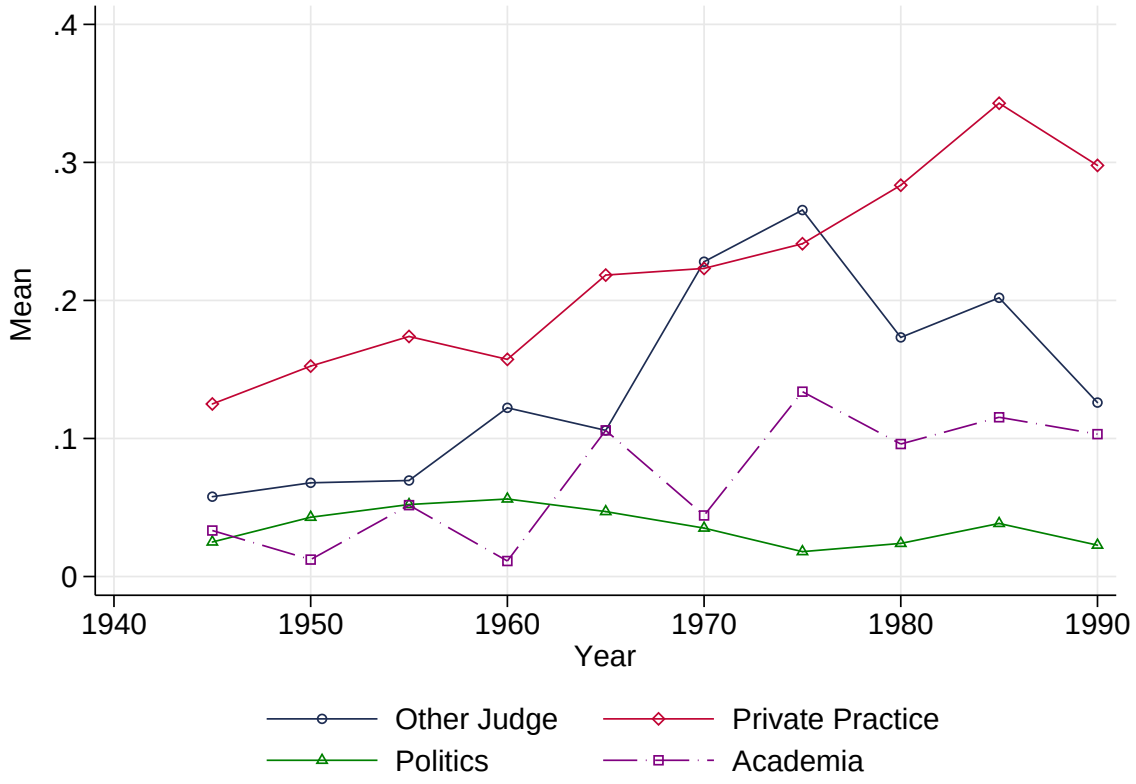


(B) Average Retirement Age for State Supreme Court Judges, 1948-1994



Panel (A): Average retirement age by gender for U.S. workers, computed from CPS by Munnell (2015). Panel (B): Average retirement age of state supreme court judges, by year. Error spikes give 25th and 75th percentiles.

Figure A.3: Post-Judgeship Careers



Proportion of judges with documented careers after their state supreme court judgeship, including other judgeship, private practice, politics, and academia. Plotted by five-year bins.

What do judges do after retirement? Figure A.3 shows the trends in these career choices. At the beginning of the sample, few judges took on more work after their judgeship. That has become more common in recent years. If they do take another career, it is usually in private practice as an attorney.

A.2 Mandatory Retirement

Table A.1: Tabulations on Treatment and Control Judges

Reform	Number of Courts with Treatment Variation	Number of Obs (Judge-Year)			Number of Judges		
		Controls	Treated	Total	Controls	Treated	Total
Retirement Age 70	9	11265	1390	12655	1240	172	1368
Retirement Age 72	3	12373	884	13257	1348	88	1421
Retirement Age 75	2	10584	259	12373	1191	34	1219

Notes. Summary tabulations on Retirement Reform Judges. The column gives the number of courts that experience a change in the retirement rule. The second set of columns gives the number of judge-year observations in the control and treatment groups (and total) when a change in retirement rule occurs in that year. The third list of columns gives the number of judges in these respective groups.

Appendix Table A.1 provides tabulations on the relevant treatment variation in the data for mandatory retirement reforms. The first column of numbers gives the number of court-years where at least one treated (selected post-reform) and one control judge (selected pre-reform) is on the court that year. The second set of columns gives the number of judge-year observations in the control and treatment groups (and total). The third list of columns gives the number of distinct judges in these respective groups.

Table A.2: Rules on Judge Senior Status, by State

State	Retirement Age	Seniority	Note
Alabama	70	Yes	Supernumerary judge
Alaska	70	No	Only to work on temporary assignments
Arizona	70	No	Only to work on temporary assignments
Arkansas	none	—	No retirement benefits if seek re-election past age 70
California	none	—	
Colorado	72	No	
Conneticut	70	Yes	State referee
Delaware	none	—	
Florida	75	No	Allows temporary assignments
Georgia	none	—	
Hawaii	70	No	
Idaho	none	—	
Illinois	none	—	Retirement Act for age 75, declared unconstitutional in 2009
Indiana	75	No	
Iowa	72	Yes	
Kansas	75	No	
Kentucky	none	—	
Louisiana	70	No	
Maine	none	—	
Maryland	70	No	
Massachusetts	70	No	
Michigan	70	No	
Minnesota	70	No	
Mississippi	none	—	
Missouri	70	Yes	Senior judge
Montana	none	—	
Nebraska	none	—	
Nevada	none	—	
New Hampshire	70	No	
New Jersey	70	No	
New Mexico	none	—	
New York	70	Yes	May serve after 70 until 76
North Carolina	72	No	Only to work on temporary assignments
North Dakota	none	—	
Ohio	70	No	
Oklahoma	none	—	
Oregon	75	No	Legislature may ask retired judges to work on temporary assignments
Pennsylvania	75	Yes	Senior judge
Rhode Island	none	—	
South Carolina	72	—	
South Dakota	70	No	
Tennessee	none	—	
Texas	75	No	Conditions may vary based on Art. 5 of Texas Constitution
Utah	75	No	
Vermont	90	No	
Virginia	73	No	
Washington	75	No	
West Virginia	none	—	
Wisconsin	70	Yes	Can serve a judge on a temporary basis
Wyoming	70	Yes	

A.3 Case Assignment

Table A.3: Summary Statistics on Area of Law and Related Industries

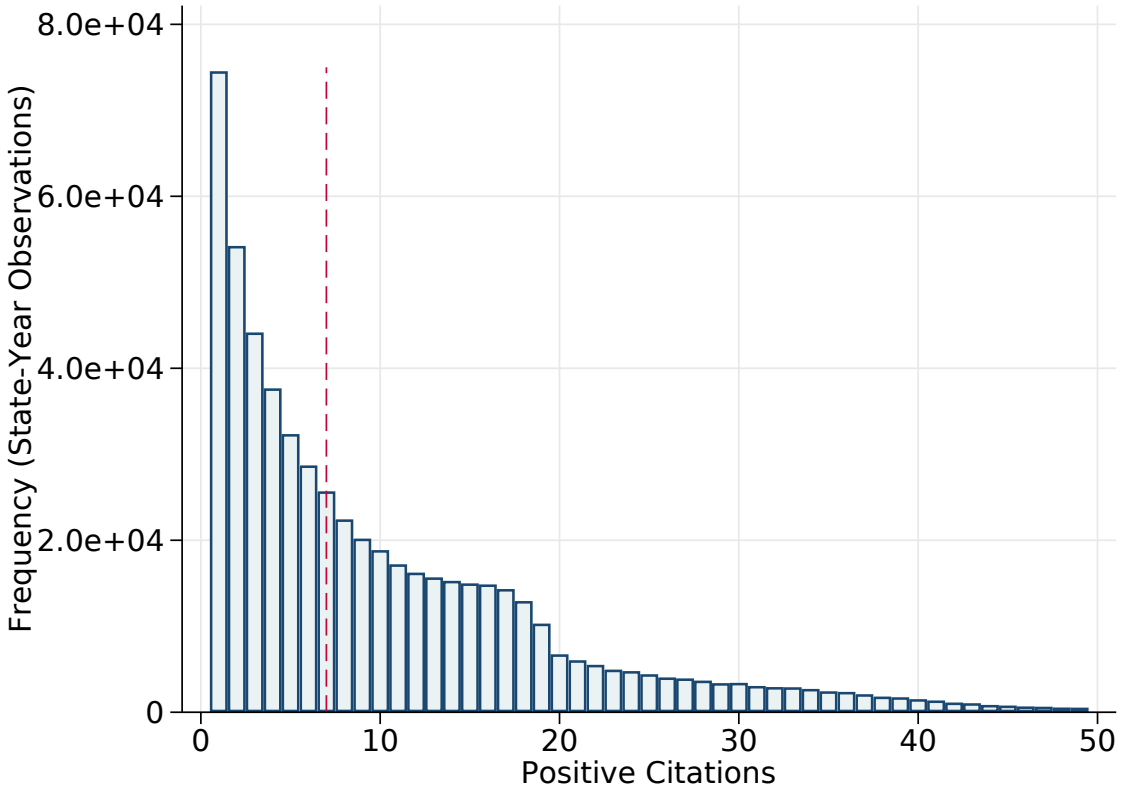
Area of Law	Freq.	Percent	Related Industrial Sector	Freq.	Percent
Criminal Law	191810	21.85	Real Estate	28527	13.64
Civil Procedure	74757	8.52	Law Enforcement	10758	5.14
Evidence	66377	7.56	Automobiles	10206	4.88
Torts	57915	6.6	Insurance	9158	4.38
Damages & Remedies	45073	5.14	Tax	8509	4.07
Contracts	40888	4.66	Construction & Engineering	6332	3.03
Real Property	36408	4.15	Workers' Compensation	5397	2.58
Constitutional Law	34038	3.88	Banking	4917	2.35
Family Law	32191	3.67	Legal & Compliance Services	4682	2.24
Workers' Compensation	22955	2.62	Automobile Insurance	4124	1.97
Insurance Law	19375	2.21	Property Management	4108	1.96
Administrative Law	18264	2.08	Transportation	3890	1.86
Wills, Trusts & Estates	18179	2.07	Child Welfare	3689	1.76
Tax & Accounting	16978	1.93	Employment Services	3679	1.76
Employment Law	14601	1.66	Health & Medical	3478	1.66
Habeas Corpus	13426	1.53	Oil & Gas	3189	1.52
Appellate Procedure	13140	1.5	Railroads	2777	1.33
Professional Responsibility	12052	1.37	Hospitals	2719	1.3
Motor Vehicles & Traffic Law	9644	1.1	Education	2586	1.24
Land Use Planning & Zoning	9122	1.04	Trucking	2097	1
Government	8942	1.02	Bridges & Roads	1751	0.84
Mortgages & Liens	7531	0.86	Agriculture & Farming	1729	0.83
Landlord & Tenant	5499	0.63	Mortgage Lending	1680	0.8
Construction Law	4997	0.57	Manufacturing	1612	0.77
Elections & Politics	4972	0.57	Real Estate Agents & Brokers	1573	0.75
Eminent Domain	4943	0.56	Unions	1485	0.71
Labor Law	4790	0.55	Financial Services	1469	0.7
Government Employees	4773	0.54	Judiciary	1448	0.69
Debtor Creditor	4260	0.49	Politics	1336	0.64
Employee Benefits	4208	0.48	Teachers	1300	0.62
Medical Malpractice	4113	0.47	Medical Procedures	1273	0.61
Personal Property	3994	0.46	Public Works	1223	0.58
Corporate Law	3958	0.45	Life Insurance & Annuities	1155	0.55
Negotiable Instruments	3843	0.44	Apartment Leasing	1127	0.54
Education Law	3803	0.43	Mining & Natural Resources	1115	0.53
Banking & Finance	3380	0.39	Drug Trafficking	1105	0.53
Alcohol & Beverage	3213	0.37	Sewer & Water	990	0.47
Civil Rights	3138	0.36	Electric	985	0.47
Health Law	2950	0.34	Water & Sewer	972	0.46
Transportation Law	2839	0.32	Physicians	966	0.46
Partnerships	2333	0.27	Firearms & Weapons	962	0.46
Natural Resources	2301	0.26	Motorcycles	919	0.44
Legal Malpractice	2285	0.26	Water	904	0.43
Products Liability	2280	0.26	Food & Beverage	888	0.42
Alternative Dispute Resolution	2144	0.24	Commercial Real Estate	883	0.42
Communications & Media	2048	0.23	Property & Casualty Insurance	854	0.41
Environmental Law	1857	0.21	Administration	837	0.4

Table A.4: Case Assignment Rules on State Supreme Courts

Discretionary	Random	Rotating
Arizona	Idaho	Alaska
California	Louisiana	Alabama
Colorado	Mississippi	Arkansas
Connecticut	New Hampshire	Florida
Delaware	New York	Georgia
Hawaii	Ohio	Iowa
Indiana	South Dakota	Illinois
Kansas	Tennessee	Maine
Kentucky	Texas	Minnesota
Massachusetts	Virginia	Missouri
Maryland	Washington	Montana
New Jersey	Wisconsin	North Carolina
Oregon		North Dakota
Pennsylvania		Nebraska
Wyoming		New Mexico
		Nevada
		Oklahoma
		Rhode Island
		South Carolina
		Utah
		Vermont
		West Virginia

List of states by rules for case assignment in state supreme courts. Rules collected by Christensen et al. (2012).

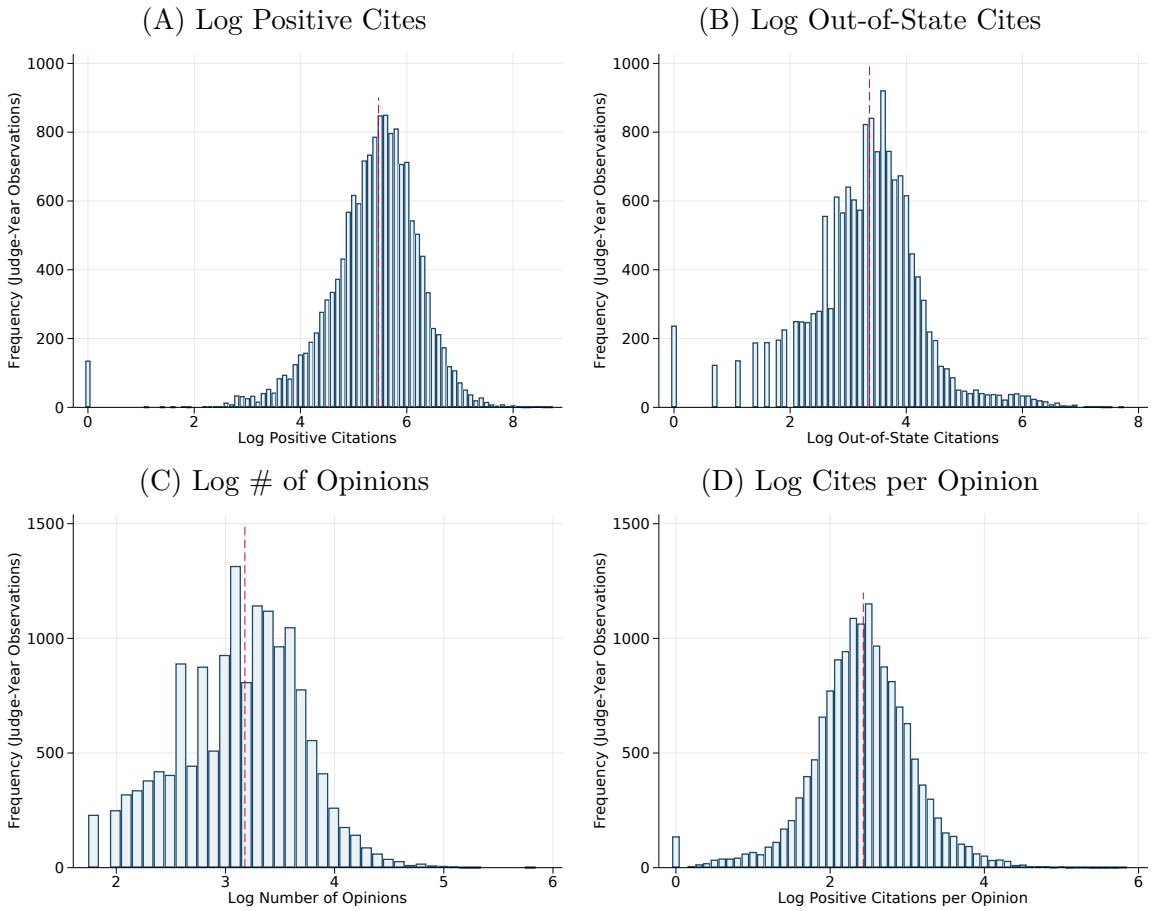
Figure A.4: Distribution of Citations by Case



Notes. Hstiogram of the number of positive cites per case in the dataset. Vertical dashed line at the median.

A.4 Judge Performance

Figure A.5: Distributions of Outcome Variables - Judge-Year



Notes. Histograms of judge-year performance measures. Vertical dashed line at median.

A.5 Clerk Quality and Judge Age

A potential confounder for the relationship between judge age and judge performance is selection of different types of clerks to judges by different ages. To check this, we require a dataset on clerk quality, which we could then match to judge age and look for systematic variation in clerk quality. Here, we do this with a dataset of federal court clerks for which we have the ranking of the law schools they attended.

Data on clerks is not available for state supreme courts. But it is available for a large sample of judges in the federal courts for the years 1995 through 2004, collected

by Bonica et al. (2017). We used the information on clerk law school attendance from this dataset.

We have data on law school rankings from Leiter (2000), who produced a variety of rankings using data from 1998. For our purposes, it is helpful that there is a ranking on "quality of student body", constructed from LSAT scores and college GPA. This ranking is available for the top 50 schools, with Yale at #1, Georgetown at #10, Fordham at #25, and Chicago-Kent at #50.

For each clerkship, we have information on the judge and the clerk. For the judge, we have information on the court and the age in years. For circuit judges, we have the specific circuit (1st, 2nd, D.C., etc). For the district courts, the data do not include the specific court. Therefore the best specification, in terms of netting out all court-year-level factors, restricts analysis to the circuit courts.

Table A.5: Judge Age and Clerk Quality (Evidence from U.S. Federal Courts

	(1)	(2)	(3)	(4)	(5)	(6)
	Clerk Law School Ranking (Higher is Worse Ranking)					
Judge Age (Years)	-0.00162	0.0593	0.0306	0.0199	0.0767*	0.0396
	(0.0304)	(0.0539)	(0.0643)	(0.0214)	(0.0388)	(0.0453)
Judge Sample	Only Circuit Courts			All Federal Courts		
Court-Year FE	X	X	X			
Court-Type X Year FE				X	X	X
School Ranks Included	1-25	1-50	1-50	1-25	1-50	1-50
Max Age 70			X			X
N	3215	3683	3483	7623	9632	9174
Adj. R-sq	0.040	0.052	0.047	0.045	0.071	0.068

Notes. Observation is a clerk-year. "Clerk Law School Ranking" is the student body quality ranking, 1-50, from Leiter (2000). Standard errors clustered by judge in parentheses. + p<.0.1, * p<0.05, ** p<0.01.

Appendix Table A.5 reports the estimates for a regression of clerk law school ranking on judge age. The regression for circuit courts (Columns 1 through 3) include court-year fixed effects. The regression for all federal courts (Columns 4 through 6) includes court-type × year fixed effects. Columns 1 and 4 include clerks from the top 25 schools. Columns 2, 3, 5, and 6 include the full ranking of 50 schools. Columns 3 and 6 exclude judges above the age of 70. Standard errors are clustered by judge.

Overall, there is no consistent relationship between judge age and clerk quality. In

the preferred specifications in the circuit courts, there is no relationship. When including all courts (where we cannot include court-year fixed effects), there is a statistically significant positive effect, suggesting that older judges get worse-ranked clerks.

B Additional Analysis of Mandatory Retirement Reforms

Table B.1: Effect of Reform on Citations: Additional Measures

	(1)	(2)	(3)	(4)	(5)	(6)
	Cites After 10 years		Has Cite		Drop 5% Outliers	
Ret. Reform	0.140*	0.169*	0.0218	0.0307	0.233**	0.263**
	(0.0648)	(0.0688)	(0.0243)	(0.0268)	(0.0774)	(0.0836)
Year / Court FE	X	X	X	X	X	X
Trends/Windows		X		X		X
N	15010	15010	15010	15010	14763	14763
R-sq	0.410	0.473	0.773	0.804	0.454	0.520

Notes. Observation is a judge working in a year. "Retirement Reform" is an indicator for the ten years after the introduction of mandatory retirement. "Cites after 10 Years" means the log of the positive cites to a judge's cases in a year, from cases more than ten years later. "Has Cite" means the proportion of cases with at least one positive citation. "Drop 5% Outliers" is the baseline outcome (log of positive cites to a judge's cases in a year) but for each court-year, the top 5% of cases by cite count are dropped. Court Treat Windows means court-specific treatment windows (ten years before and after reform). Standard errors clustered by state in parentheses. + p<.0.1, * p<0.05, ** p<0.01.

Table B.2: Effect of Reform on Citations: Different Windows

	(1)	(2)	(3)	(4)	(5)	(6)
	Effect on Log Positive Cites					
Treatment Window	6		14		All	
Retirement Reform	0.171**	0.159**	0.218**	0.204**	0.0493	0.303**
	(0.0552)	(0.0532)	(0.0776)	(0.0693)	(0.114)	(0.0929)
Year FE, Court FE	X	X	X	X	X	X
Court Trends/Windows		X		X		X
N	2357	2357	2357	2357	2357	2357
R-sq	0.811	0.883	0.812	0.885	0.810	0.880

Notes. Observation is a judge working in a year. "Retirement Reform" is an indicator for the ten years after the introduction of mandatory retirement. Court Treat Windows means court-specific treatment windows (ten years before and after reform). Standard errors clustered by state in parentheses. + p<.0.1, * p<0.05, ** p<0.01.

Table B.3: Effect of Reform on Log Cites: Senior Status Rules

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Effect on Log Citations per Judge-Year							
Retirement Reform	0.209*	0.282*	0.245**	0.246*	0.251**	0.243*	0.202*	0.270*
	(0.0879)	(0.119)	(0.0809)	(0.0904)	(0.0799)	(0.0896)	(0.0904)	(0.103)
× Grandfather Rule	0.0657	-0.127						
	(0.111)	(0.146)						
× Finish Term			-0.115	-0.0939				
			(0.0762)	(0.0983)				
× Finish Term Half					-0.355**	-0.0573		
					(0.0749)	(0.109)		
× Finish Year							0.134	-0.135
							(0.120)	(0.115)
Year FE, Court FE	X	X	X	X	X	X	X	X
Court Trends/Windows		X		X		X		X
N	9868	9868	9868	9868	9868	9868	9868	9868
R-sq	0.370	0.438	0.370	0.438	0.371	0.438	0.370	0.438

Observation is a judge working in a year. "Retirement Reform" is an indicator for the ten years after the introduction of mandatory retirement. Coefficients are interacted with respective senior status rules (respectively: the rule not applying to sitting judges, being allowed to finish the term, being allowed to finish terms that are over halfway finished, and being able to finish out the year). Court Treat Windows means court-specific treatment windows (ten years before and after reform). Standard errors clustered by state in parentheses. + p<.0.1, * p<0.05, ** p<0.01.

Table B.4: Effect of Reform on Log Cites, Only Reform States

	(1)	(2)	(3)	(4)	(5)
	Effect on Log Citations per Judge-Year				
Retirement Reform	0.295**	0.262**	0.273*	0.349*	0.552**
	(0.0818)	(0.0869)	(0.113)	(0.158)	(0.176)
Court FE, Year FE	X	X	X	X	X
Court Trends/Windows		X	X	X	X
Init Court Rules × Year FE			X	X	X
Init Case Types × Year FE				X	X
Init Age × Year FE					X
N	5562	5562	5562	5562	5562
R-sq	0.288	0.346	0.382	0.435	0.457

Observation is a judge working in a year. "Retirement Reform" is an indicator for the ten years after the introduction of mandatory retirement. Court Treat Windows means court-specific treatment windows (ten years before and after reform). "Init X" × year FE means initial values are interacted with year. "Init Court Rules" includes a state's 1947 rules for judge selection/retention system, admin office, intermediate appellate court, number of judges, and term length. "Init Case Types" includes a court's 1947 average values for case characteristics (legal area and related industries). "Init Age" includes the initial mean and standard deviation for judge age on the court. Standard errors clustered by state in parentheses. + p<.0.1, * p<0.05, ** p<0.01.

Table B.5: Effect of Reform on Citations: Alternative Clustering

	(1)	(2)	(5)	(6)
Clustering Group	State and Year		None (Robust)	
Retirement Reform	0.228**	0.253**	0.228**	0.253**
	(0.0458)	(0.0436)	(0.0291)	(0.0300)
Court FE, Year FE	X	X	X	X
Court Trends/Windows		X		X
N	15010	15010	15010	15010
R-sq	0.460	0.526	0.460	0.526

Notes. Observation is a judge working in a year. "Retirement Reform" is an indicator for the ten years after the introduction of mandatory retirement. Court Treat Windows means court-specific treatment windows (ten years before and after reform). Standard errors clustered by state in parentheses. + p<.0.1, * p<0.05, ** p<0.01.

Table B.6: Effect of Reform on Log Cites, Alternative Weighting

	(1)	(2)	(3)	(4)
	Effect on Log Positve Cites per Judge-Year			
Retirement Reform	0.211**	0.253**	0.133+	0.181*
	(0.0750)	(0.0858)	(0.0736)	(0.0802)
Weighting	# of Opinions		Judges Equal	
Court FE, Year FE	X	X	X	X
Court Trends/Windows		X		X
N	15010	15010	15010	15010
R-sq	0.496	0.569	0.421	0.499

Observation is a judge working in a year. "Retirement Reform" is an indicator for the ten years after the introduction of mandatory retirement. Court Treat Windows means court-specific treatment windows (ten years before and after reform). Standard errors clustered by state in parentheses. + p<.0.1, * p<0.05, ** p<0.01.

Table B.7: Effect of Reform on Log Cites, with Time-Varying Controls

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Effect on Log Positive Cites per Judge-Year							
Retirement Reform	0.106+	0.148*	0.251**	0.271**	0.202**	0.225**	0.143**	0.172*
	(0.0572)	(0.0703)	(0.0886)	(0.0804)	(0.0725)	(0.0804)	(0.0504)	(0.0644)
Court FE, Year FE	X	X	X	X	X	X	X	X
Court Trends/Windows		X		X		X		X
Case Controls	X	X						
Rule Controls			X	X				
Judge Experience FE					X	X		
Lagged Dep. Var.							X	X
N	15010	15010	13863	13863	15006	15006	13304	13304
R-sq	0.611	0.652	0.457	0.523	0.478	0.545	0.585	0.609

Observation is a judge working in a year. "Retirement Reform" is an indicator for the ten years after the introduction of mandatory retirement. Court Treat Windows means court-specific treatment windows (ten years before and after reform).Case controls means the first five principal components of the matrix of controls for legal topic and related industries. Rule controls means rules for selection and retention of juges and other institutional items. Judge Experience FE means fixed effects for yeras on the court. Lagged Dep. Var. means the court-year lag of the dependent variable (log positive cites in the previous year). Standard errors clustered by state in parentheses. + p<.0.1, * p<0.05, ** p<0.01.

Table B.8: Effect of Reform on Citations: Separately by Maximum Age Imposed

	(1)	(2)	(3)	(4)	(5)	(6)
	Effect on Log Positive Cites					
Maximum Age	70		72		75	
Retirement Reform	0.212+	0.291*	0.396**	0.310**	0.155+	0.165**
	(0.117)	(0.133)	(0.113)	(0.0773)	(0.0899)	(0.0384)
Court FE, Year FE	X	X	X	X	X	X
Court Trends/Windows		X		X		X
N	15010	15010	15010	15010	15010	15010
R-sq	0.459	0.524	0.459	0.518	0.458	0.517

Notes. Observation is a judge working in a year. "Retirement Reform" is an indicator for the ten years after the introduction of mandatory retirement. Court Treat Windows means court-specific treatment windows (ten years before and after reform). Standard errors clustered by state in parentheses. + p<.0.1, * p<0.05, ** p<0.01.

Table B.9: Effect of Mandatory Retirement Reform, Merit vs. Other Systems

	(1)	(2)	(3)	(4)
	Effect on Log Positive Cites			
Appointment System	Merit		Other System	
Retirement Reform	-0.124	-0.0314	0.193*	0.243*
	(0.130)	(0.112)	(0.0849)	(0.107)
Year FE, Court FE	X	X	X	X
Court Trends/Windows		X	X	X
N	2442	2442	12568	12568
R-sq	0.375	0.428	0.474	0.535

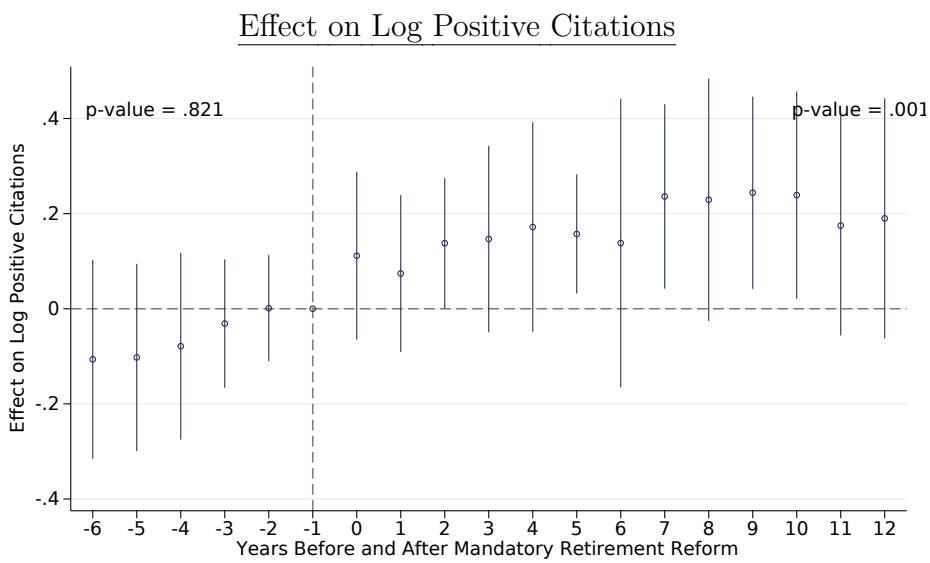
Notes. Observation is a judge working in a year. "Retirement Reform" is an indicator for the ten years after the introduction of mandatory retirement. "Experience" is the years of experience of each judge. Each of the outcome about the end of judgeship are dummy equal to 1 indicating how the judgeship ended. Court Treat Windows means court-specific treatment windows (ten years before and after reform). Standard errors clustered by state in parentheses. + p<.0.1, * p<0.05, ** p<0.01.

Table B.10: Effect of Mandatory Retirement Reform, Other Institutional Features

	(1)	(2)	(3)	(4)	(5)	(6)
			Effect on How Judgeship Ended			
	Experience		Retirement	Death	Other Job	Lost Election
Retirement Reform	-1.301*	-1.464*	-0.0123	0.00633	0.00687	-0.0134
	(0.593)	(0.695)	(0.0463)	(0.0281)	(0.0505)	(0.0163)
Year FE, Court FE	X	X	X	X	X	X
Court Trends/Windows		X	X	X	X	X
N	15010	15010	15010	15010	15010	15010
R-sq	0.162	0.189	0.155	0.114	0.125	0.074

Notes. Observation is a judge working in a year. "Retirement Reform" is an indicator for the ten years after the introduction of mandatory retirement. "Experience" is the years of experience of each judge. Each of the outcome about the end of judgeship are dummy equal to 1 indicating how the judgeship ended. Court Treat Windows means court-specific treatment windows (ten years before and after reform). Standard errors clustered by state in parentheses. + p<.0.1, * p<0.05, ** p<0.01.

Figure B.1: Event-Study Effect of Reform with Initial Covariates



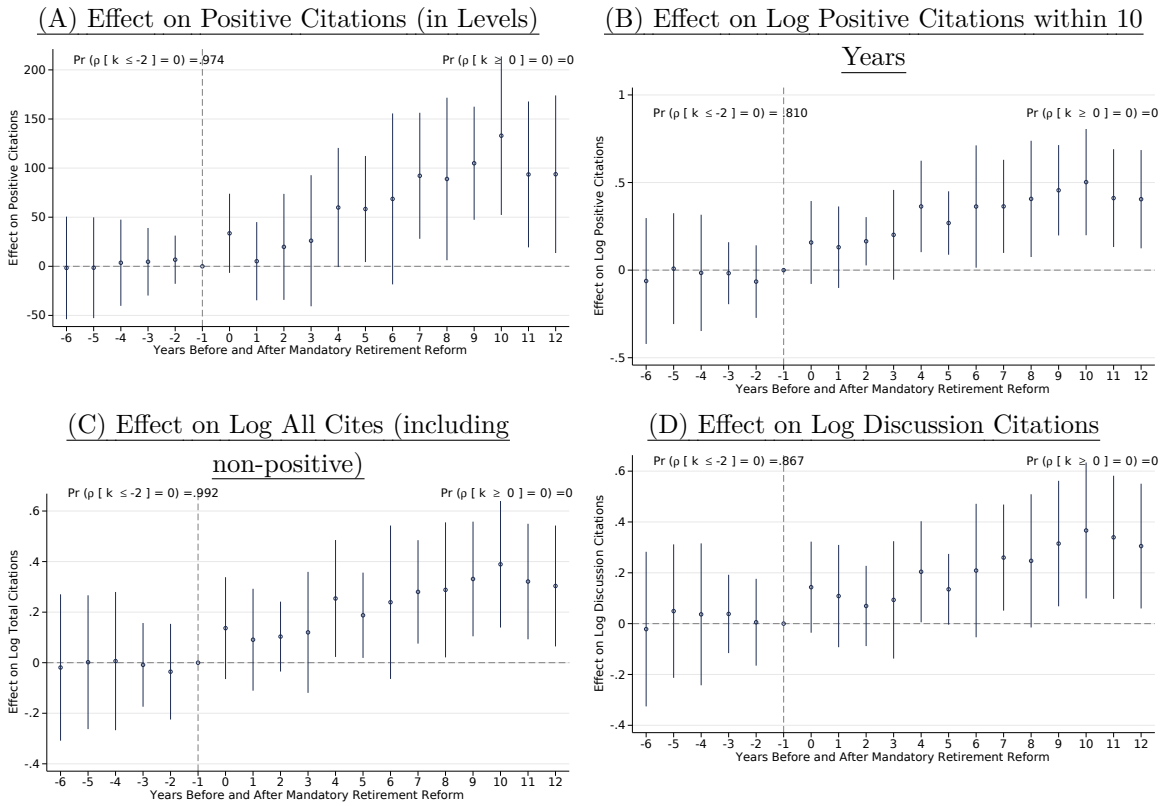
Court performance before and after reforms implementing retirement ages of 70, 72 or 75. The outcome is the log positive citations of a judge in a year. Time series is a coefficient plot from the event study regression (2), with coefficents estimated relative to the year before the reform. Regression includes court and year fixed effects and court-specific event windows, plus initial rules, cases, and age variables, interacted with year. 95% confidence intervals constructed with standard errors clustered by state.

Table B.11: Effect of Reform on Inverse Hyperbolic Sine of Citations

	(1)	(2)	(3)	(4)	(5)
	Inverse Hyperbolic Sine of Positive Cites per Judge-Year				
Retirement Reform	0.231**	0.257**	0.240**	0.324**	0.304**
	(0.0787)	(0.0868)	(0.0860)	(0.0941)	(0.0960)
Court FE, Year FE	X	X	X	X	X
Court Trends/Windows		X	X	X	X
Init Court Rules × Year FE			X	X	X
Init Case Types × Year FE				X	X
Init Age × Year FE					X
N	15010	15010	15010	15010	15010
R-sq	0.451	0.519	0.530	0.546	0.556

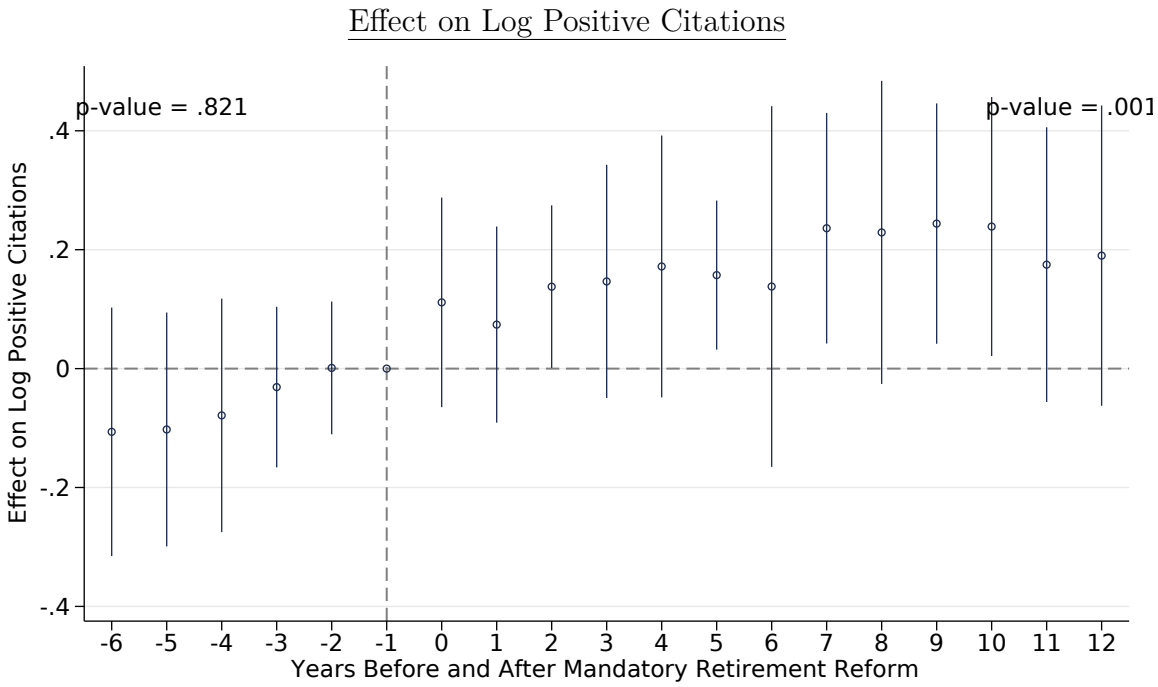
Notes. DD effect of mandatory retirement reform on inverse hyperbolic sine (asinh) positive citations to a judge's opinions in ten years after reform, relative to ten years before reform. Observation is a judge working in a year. "Ret. Reform" is a treatment indicator for the ten years after the introduction of mandatory retirement. Court Treat Windows means court-specific treatment windows (ten years before and after reform). "Init X" × year FE means initial values are interacted with year. "Init Court Rules" includes a state's 1947 rules for judge selection/retention system, admin office, intermediate appellate court, number of judges, and term length. "Init Case Types" includes a court's 1947 average values for case characteristics (legal area and related industries). "Init Age" includes the initial mean and standard deviation for judge age on the court. Standard errors clustered by state in parentheses. + p<.0.1, * p<0.05, ** p<0.01.

Figure B.2: Event-Study Effect on Performance: Alternative Cite Measures



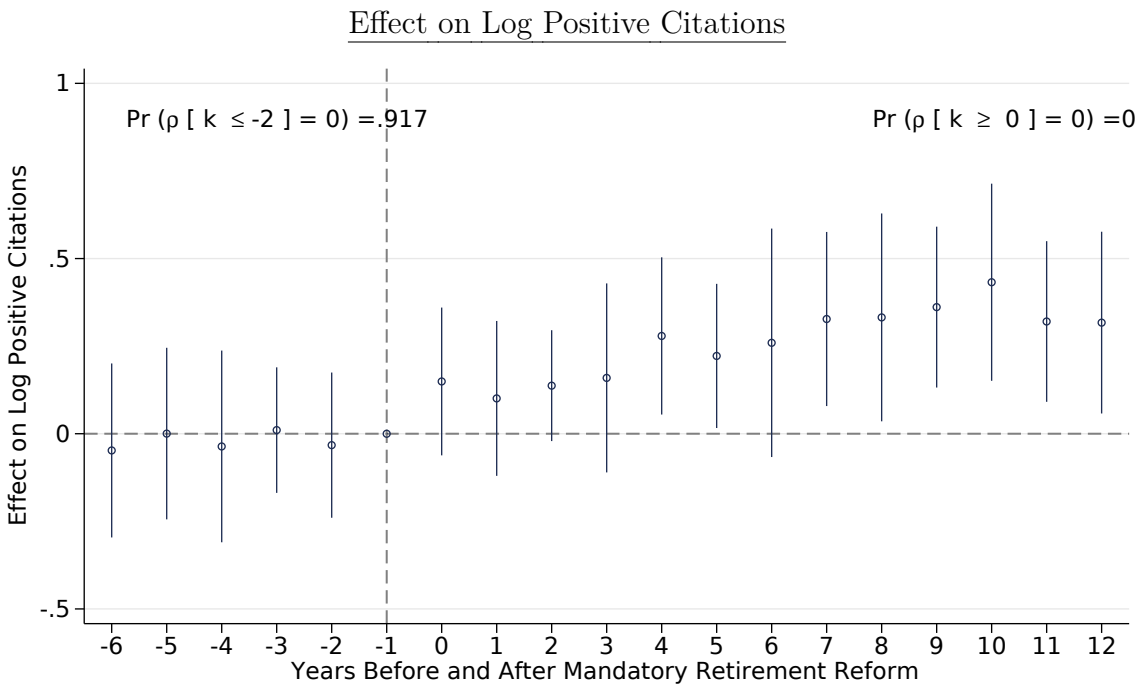
Judge performance before and after reforms implementing retirement ages of 70, 72 or 75. Panel A: outcome is number of positive citations of a judge in a year (in levels, rather than logs). Panel B: outcome is the log positive citations of a judge in a year that were made within ten years of a case. Panel C: outcome is the log total citations of a judge in a year (including non-positive negative cites). Panel D: outcome is the log discussion citations of a judge in a year. Time series is a coefficient plot from the event study regression (2), with coefficents estimated relative to the year before the reform. Regression includes court and year fixed effects and court-specific event windows. 95% confidence intervals constructed with standard errors clustered by state.

Figure B.3: Event-Study Effect of Reform: Collapsed Court-Year Data



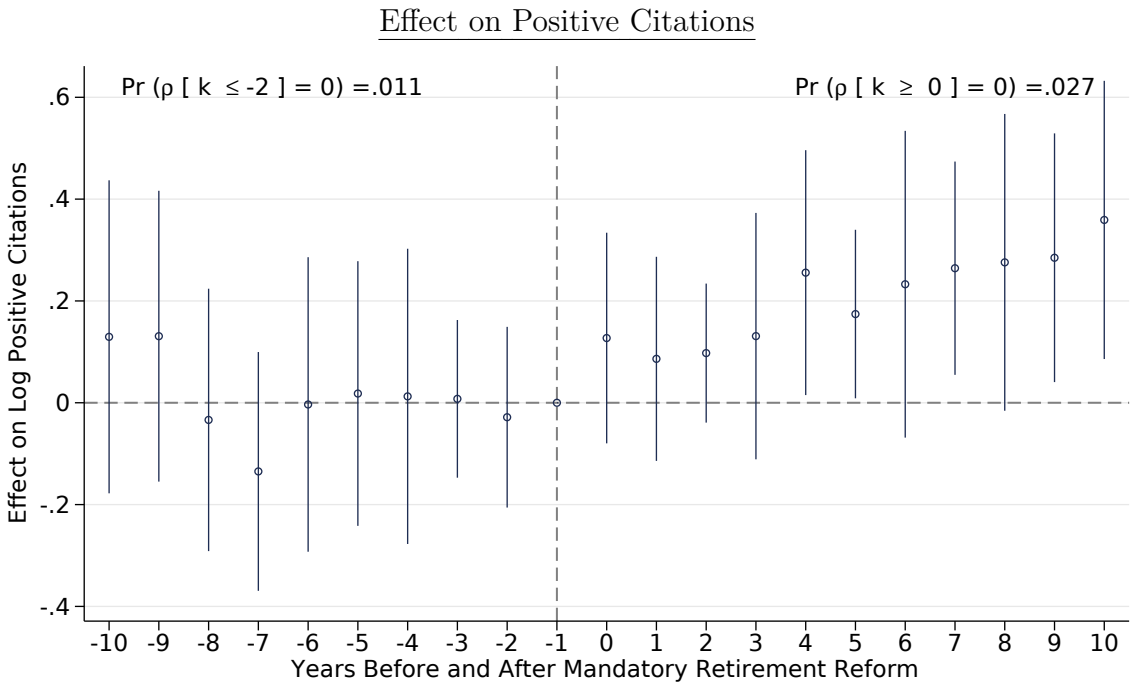
Court performance before and after reforms implementing retirement ages of 70, 72 or 75. The outcome is the log positive citations of a court in a year. Time series is a coefficient plot from the event study regression (2), with coefficents estimated relative to the year before the reform. Regression includes court and year fixed effects and court-specific event windows. 95% confidence intervals constructed with standard errors clustered by state.

Figure B.4: Event-Study Effect of Reform on Court Performance: Only Reform States



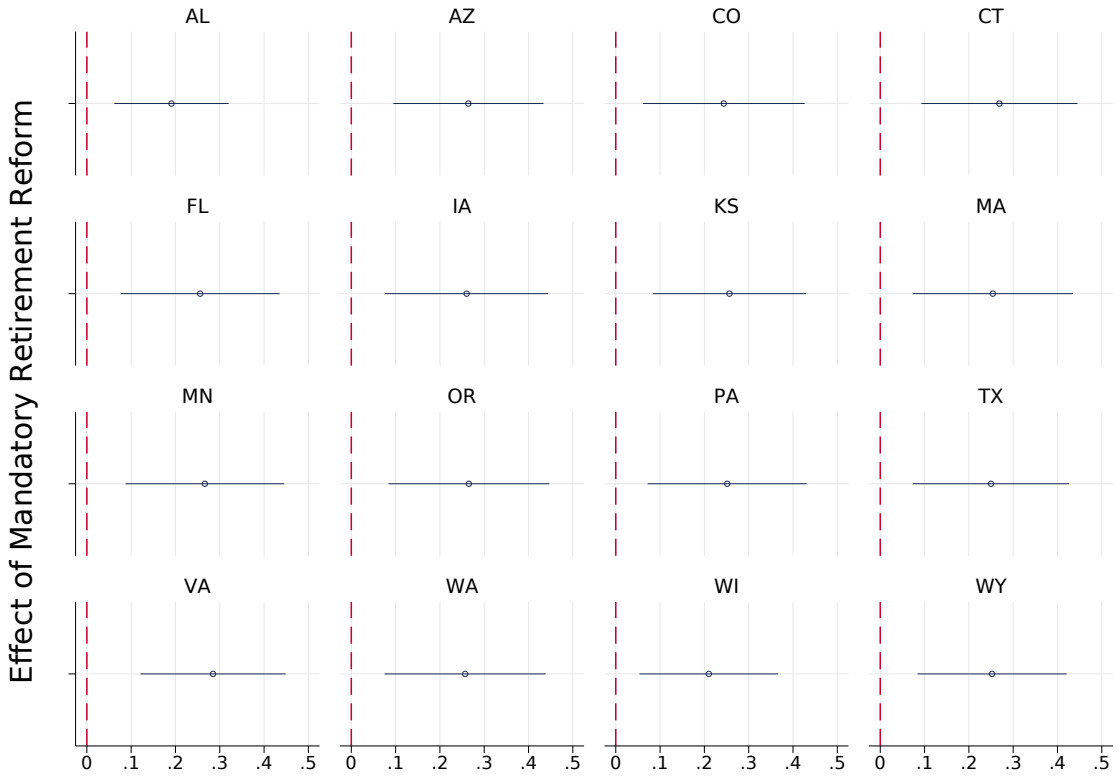
Court performance before and after reforms implementing retirement ages of 70, 72 or 75. Sample limited to reform states. The outcome is the log positive citations of a judge in a year. Time series is a coefficient plot from the event study regression (2), with coefficents estimated relative to the year before the reform. Regression includes court and year fixed effects and court-specific event windows. 95% confidence intervals constructed with standard errors clustered by state.

Figure B.5: Event-Study Effect of Reform on Court Performance: 10 Pre-Periods



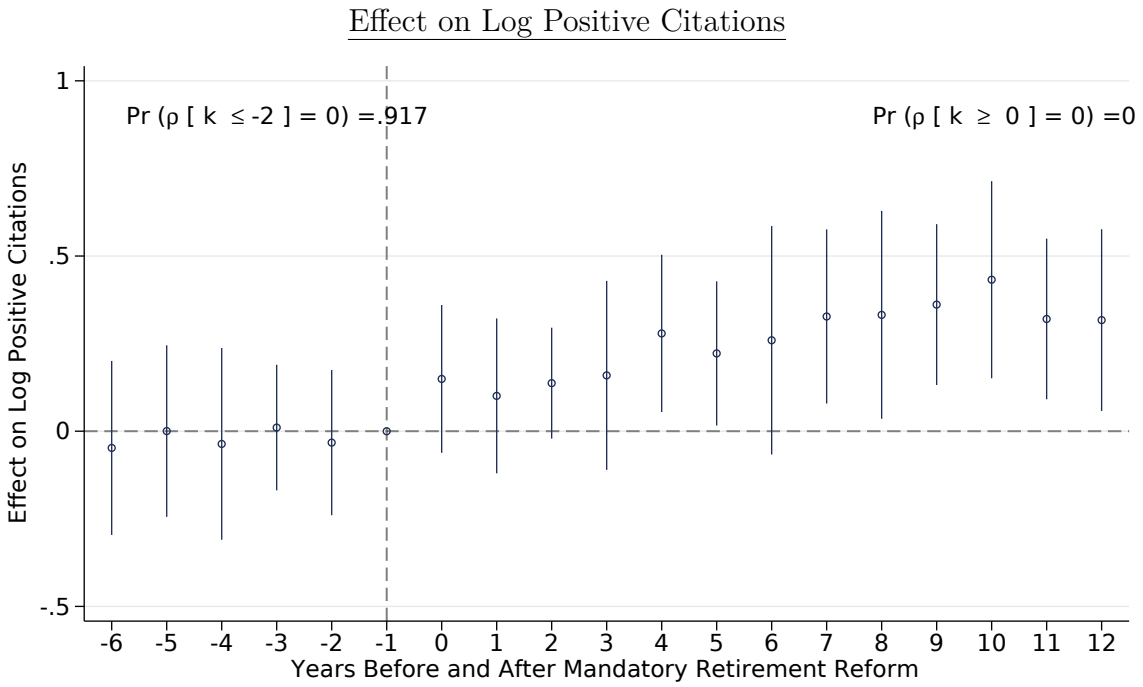
Judge performance before and after reforms implementing retirement ages of 70, 72 or 75. The outcome is the log positive citations of a judge in a year. Ten periods before and after included. Time series is a coefficient plot from the event study regression (2), with coefficents estimated relative to the year before the reform. Regression includes court and year fixed effects and court-specific event windows. 95% confidence intervals constructed with standard errors clustered by state.

Figure B.6: DD Effect of Reform, Dropping each Treated State Individually



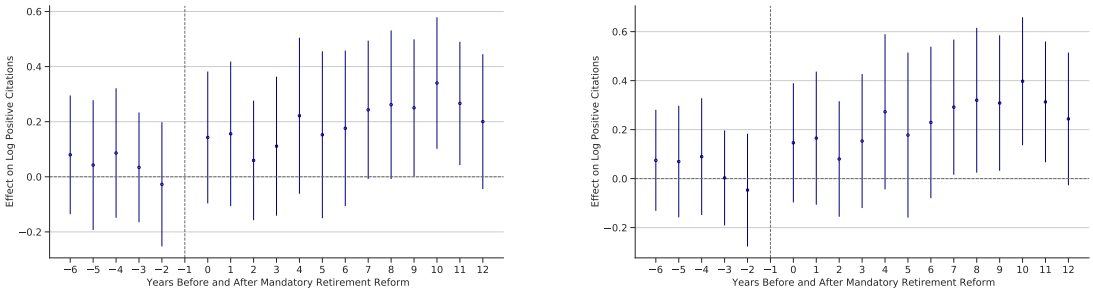
Coefficient for the effect of mandatory retirement at ages of 70, 72 or 75 on judge performance. The outcome is the log positive citations of a judge in a year. Each subfigure plots the coefficient from regression 1 excluding one treated state at a time. Includes court and year fixed effects, court-specific windows and trends.

Figure B.7: Event-Study Effect on Court Performance: Only Reform States



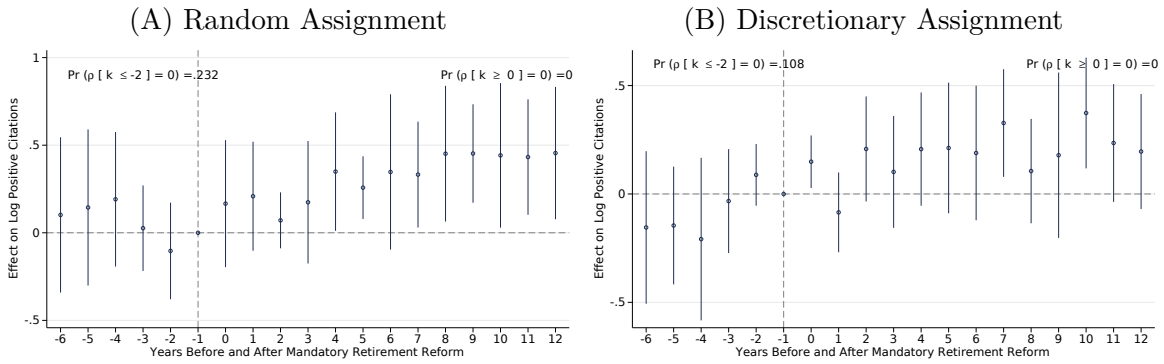
Court performance before and after reforms implementing retirement ages of 70, 72 or 75. Sample limited to reform states. The outcome is the log positive citations of a judge in a year. Time series is a coefficient plot from the event study regression (2), with coefficents estimated relative to the year before the reform. Regression includes court and year fixed effects and court-specific event windows. 95% confidence intervals constructed with standard errors clustered by state.

Figure B.8: Event-Study Effect on Performance: Adjustment for Staggered Treatment
(A) Un-Weighted Averaged Estimates (B) Weighted Average Estimates



Log positive cites to court before and after reforms implementing retirement ages of 70, 72 or 75. Time series is a coefficient plot from the event study regression (2), with coefficents estimated relative to the year before the reform. Regression includes court and year fixed effects and court-specific event windows. Coefficients and standard errors (clustered by state) adjusted for staggered treatment timing, following the method in Callaway and Sant'Anna (2019), as described in Section 3.3. Panel B uses a weighted average of the estimates based on the number of judge-year observations in the event-study window for each treated state.

Figure B.9: Event-Study Effect, by Random and Discretionary Case Assignment



Notes. Court performance before and after reforms implementing retirement ages of 70, 72 or 75. The outcome is the log positive citations to the court in a year. Panel A includes courts with random or rotating assignment of cases. Panel B includes courts with discretionary assignment of cases. Time series is a coefficient plot from the event study regression (2), with coefficents estimated relative to the year before the reform. Regression includes court and year fixed effects and court-specific event windows. 95% confidence intervals constructed with standard errors clustered by state.

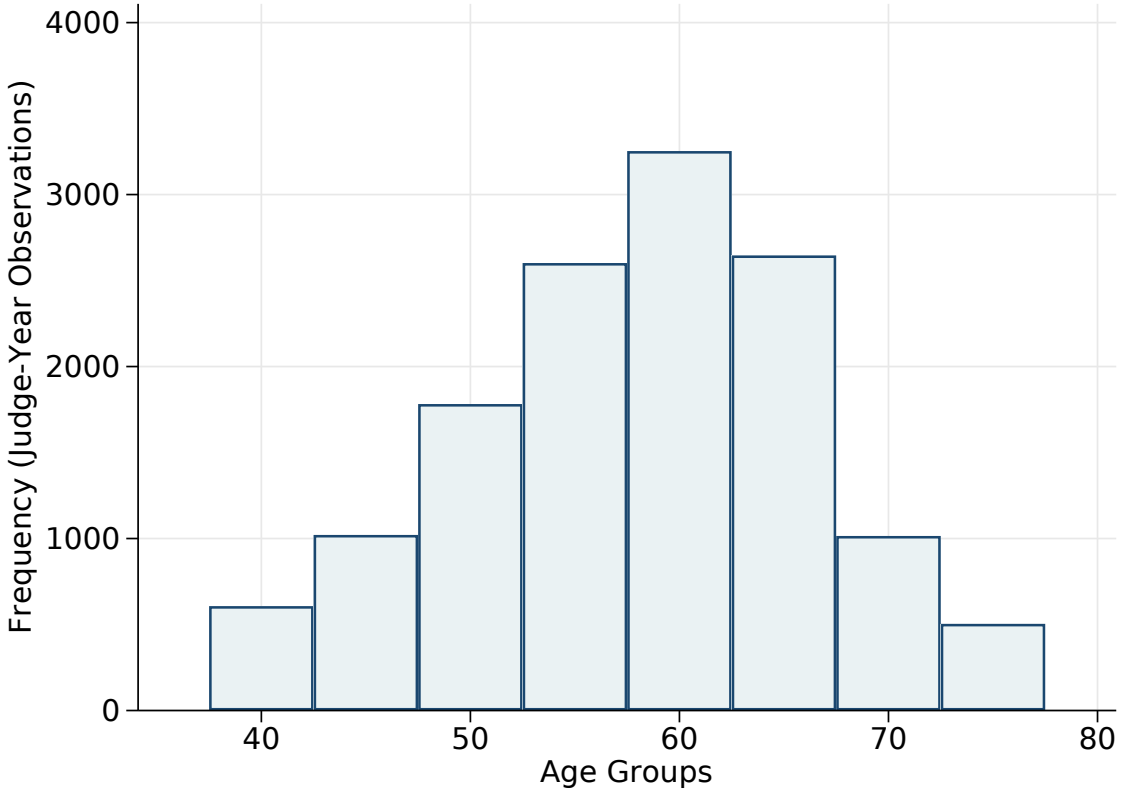
Table B.12: Effect of Mandatory Retirement Reform, Other Behavioral Dimensions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Work Output		Caselaw Research		Overruled Rate		Addendum Ops	
Retirement Reform	0.0310	0.0455	-2.557	-0.211	-0.0195**	-0.00439	0.283**	0.231**
	(0.0643)	(0.0592)	(1.718)	(1.433)	(0.00589)	(0.00593)	(0.0699)	(0.0769)
Year FE, Court FE	X	X	X	X	X	X	X	X
Court Trends/Windows		X		X		X		X
N	15010	15010	15010	15010	15010	15010	15010	15010
R-sq	0.266	0.379	0.456	0.604	0.100	0.143	0.401	0.444

Observation is a judge working in a year. "Retirement Reform" is an indicator for the ten years after the introduction of mandatory retirement. "Work Output" is log number of words written in a year. "Caselaw Research" is number of previous cases cites. "Overruled rate" is being overruled by a higher court. "Addendum Ops" is number of dissenting and concurring opinions (in logs). Court Treat Windows means court-specific treatment windows (ten years before and after reform). Standard errors clustered by state in parentheses. + p<.0.1, * p<0.05, ** p<0.01.

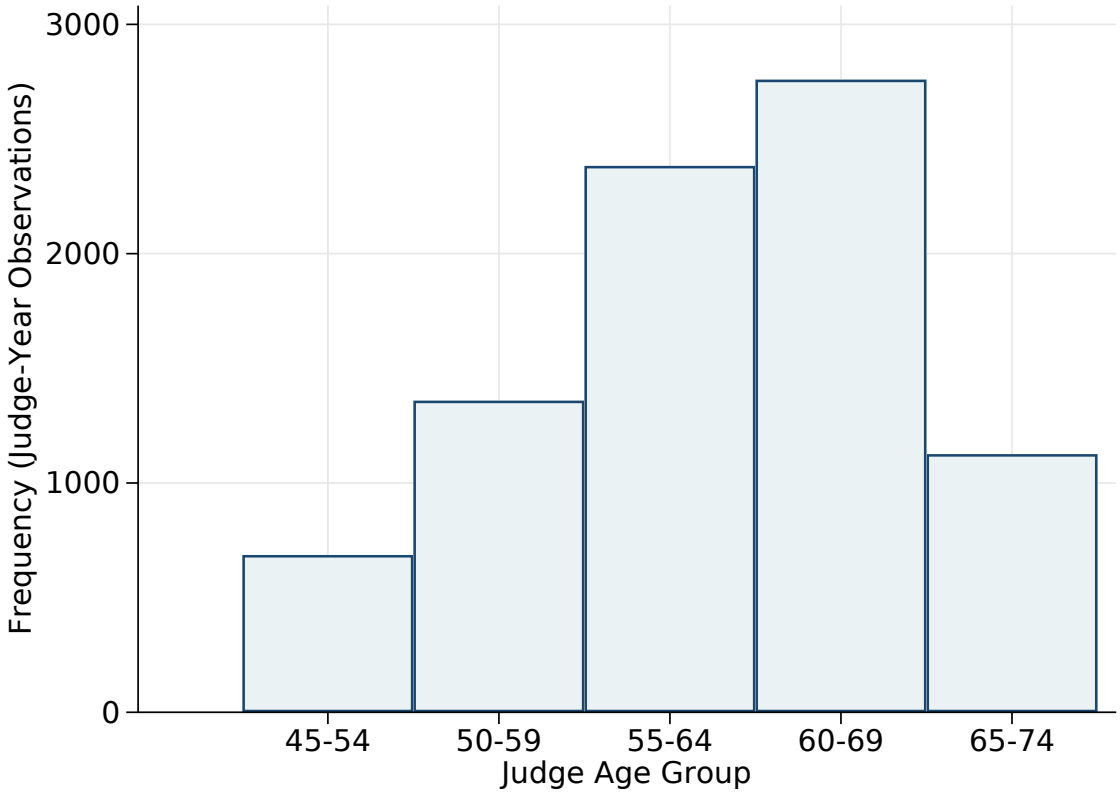
C Additional Material on Aging and Performance

Figure C.1: Distribution over Age Groups for Life Cycle Coefficient Plots



Notes. Number of judge-year observations in each five-year age group for the life cycle coefficient plots.

Figure C.2: Distribution over Age Groups for Balanced Sample Analysis



Notes. Histogram of age groups for balanced sample analysis. Number of judge-years in each overlapping ten-year balanced sample.

Table C.1: Judge Age and Inverse Hyperbolic Sine of Citations

	(1)	(2)	(3)	(4)
	Inverse Hyperbolic Sine of Positive Cites			
Judge Age (Years)	-0.00831**	-0.00821**	-0.00714**	0.0327*
	(0.00138)	(0.00111)	(0.00125)	(0.0128)
Age Squared				-0.000335**
				(0.000114)
Court-Year FE	X	X	X	X
First-Year Baseline		X	X	X
Cohort FE / Trends			X	X
N	14981	14981	14981	14981
R-sq	0.670	0.695	0.700	0.701

Observation is a judge working in a year. Outcome is inverse hyperbolic since (asinh) of positive cites to a judge in a year. Court-Year FE is interacted court-year fixed effects. First-Year Baseline means a judge's value for the outcome in their first year on the court is included as a control. Cohort FE means fixed effect for decade that the judge started on the court. Cohort Trends means judge starting-year interacted with court fixed effect. Standard errors clustered by state in parentheses. + p<.0.1, * p<0.05, ** p<0.01.

Table C.2: Judge Age and Additional Measures of Performance, Logs

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Cites in 10 Years		All Cites		Discuss Cites		Out-of-State Cites	
Judge Age	-0.00695**	0.0348**	-0.00747**	0.0321*	-0.00844**	0.0338**	-0.00882**	0.0292*
	(0.00126)	(0.0121)	(0.00122)	(0.0130)	(0.00112)	(0.0110)	(0.00136)	(0.0131)
Age Squared		-0.000351**		-0.000333**		-0.000355**		-0.000320**
		(0.000107)		(0.000115)		(0.0000970)		(0.000115)
Court-Year FE	X	X	X	X	X	X	X	X
1st-Year Base	X	X	X	X	X	X	X	X
Cohort FE/Trend	X	X	X	X	X	X	X	X
N	14981	14981	14981	14981	14981	14981	14981	14981
R-sq	0.771	0.772	0.697	0.698	0.690	0.691	0.669	0.670

Observation is a judge working in a year. Outcomes are in logs. "Cites in 10 years" is log of positive cites to a judge in a year, within ten years of a case. "All Cites" includes negative and distinguishing (not just positive) cites. "Discuss cites" means the case was positively discussed and applied. "Out-of-state cites" means citations from courts in other states. Court-Year FE is interacted court-year fixed effects. 1st-Year Base means a judge's value for the outcome in their first year on the court is included as a control. Cohort FE means fixed effect for decade that the judge started on the court. Cohort Trends means judge starting-year interacted with court fixed effect. Standard errors clustered by state in parentheses. + p<.0.1, * p<0.05, ** p<0.01.

Table C.3: Effect of Reform on Citations: Additional Measures

	(1)	(2)	(3)	(4)	(5)	(6)
	Cites After 10 years		Has Cite		Drop 5% Outliers	
Judge Age	-0.00786**	0.0284*	-0.000410**	0.00114	-0.00764**	0.0377**
	(0.00117)	(0.0126)	(0.000131)	(0.00122)	(0.00137)	(0.0127)
Age Squared		-0.000305**		-0.0000130		-0.000381**
		(0.000111)		(0.0000107)		(0.000112)
Court-Year FE	X	X	X	X	X	X
1st-Year Base	X	X	X	X	X	X
Cohort FE/Trend	X	X	X	X	X	X
N	14981	14981	14981	14981	14726	14726
R-sq	0.654	0.655	0.927	0.927	0.707	0.708

Notes. Observation is a judge working in a year. "Retirement Reform" is an indicator for the ten years after the introduction of mandatory retirement. "Cites after 10 Years" means the log of the positive cites to a judge's cases in a year, from cases more than ten years later. "Has Cite" means the proportion of cases with at least one positive citation. "Drop 5% Outliers" is the baseline outcome (log of positive cites to a judge's cases in a year) but for each court-year, the top 5% of cases by cite count are dropped. Court-Year FE is interacted court-year fixed effects. 1st-Year Base means a judge's value for the outcome in their first year on the court is included as a control. Cohort FE means fixed effect for decade that the judge started on the court. Cohort Trends means judge starting-year interacted with court fixed effect. Standard errors clustered by state in parentheses. + p<.0.1, * p<0.05, ** p<0.01.

Table C.4: Judge Age and Additional Performance Measures, Rank Percentiles

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Cites in 10 Years		All Cites		Discuss Cites		Out-of-State Cites	
Judge Age	-0.00445**	0.0190+	-0.00460**	0.0172+	-0.00498**	0.0182*	-0.00366**	0.00134
	(0.000878)	(0.00981)	(0.000815)	(0.00880)	(0.000812)	(0.00691)	(0.000685)	(0.00749)
Age Squared		-0.000198*		-0.000184*		-0.000196**		-0.0000422
		(0.0000856)		(0.0000771)		(0.0000600)		(0.0000661)
Court-Year FE	X	X	X	X	X	X	X	X
First-Year	X	X	X	X	X	X	X	X
Cohort FE / T's	X	X	X	X	X	X	X	X
N	13655	13655	8181	13655	13655	13655	13655	13655
R-sq	0.768	0.769	0.195	0.697	0.698	0.690	0.691	0.674

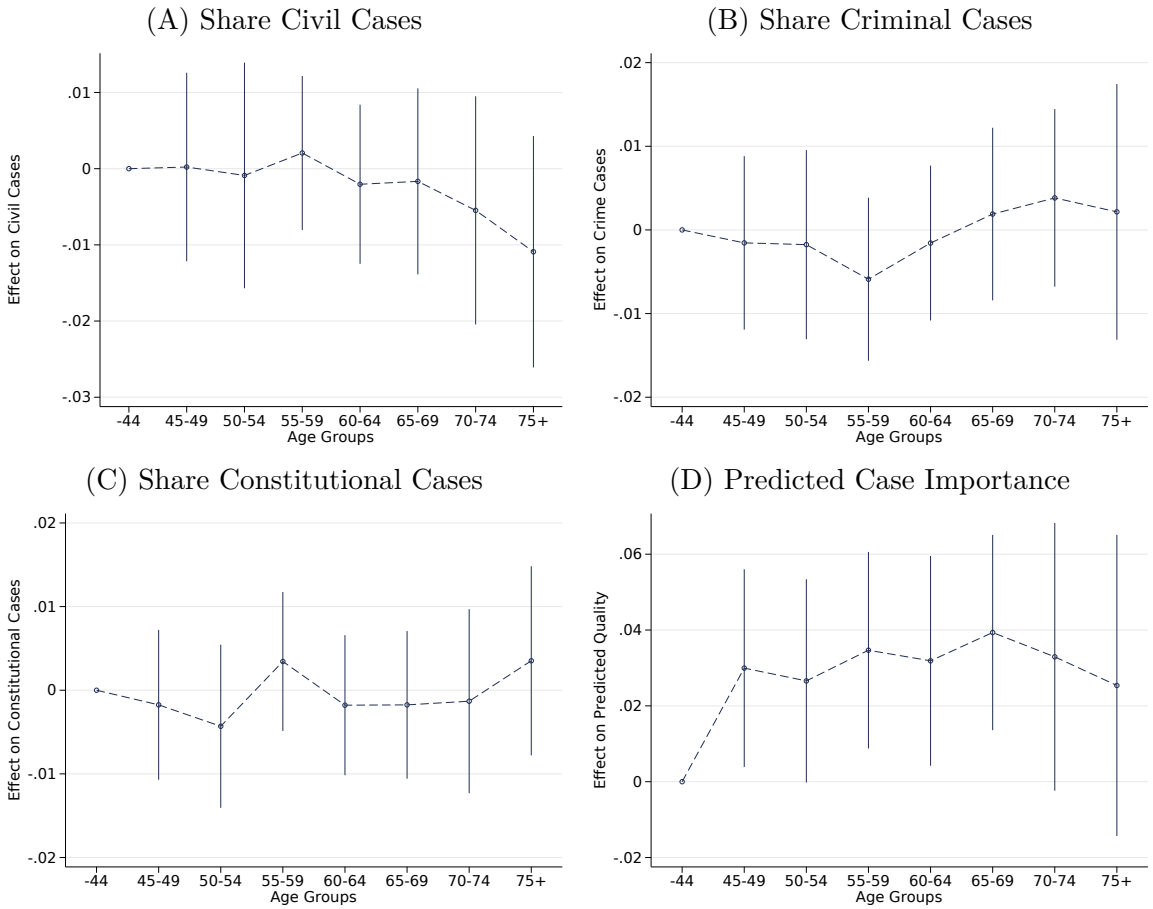
Observation is a judge working in a year. Outcomes are in rank percentiles. "Cites in 10 years" is log of positive cites to a judge in a year, within ten years of a case. "All Cites" includes negative and distinguishing (not just positive) cites. "Discuss cites" means the case was positively discussed and applied. "Out-of-state cites" means citations from courts in other states. Court-Year FE is interacted court-year fixed effects. 1st-Year Base means a judge's value for the outcome in their first year on the court is included as a control. Cohort FE means fixed effect for decade that the judge started on the court. Cohort Trends means judge starting-year interacted with court fixed effect. Standard errors clustered by state in parentheses. + p<.0.1, * p<0.05, ** p<0.01.

Table C.5: Case Type and Importance by Judge Age and Case Allocation Rule

	(1) Crim Cases	(2) Civil Cases	(3) Admin Cases	(4) Con Law Cases	(5) Pred. Cites
Age × Random	0.00427	-0.00435	-0.0164	-0.0196	-0.00127
	(0.00845)	(0.00700)	(0.0115)	(0.0129)	(0.00188)
Age × Not Rand	0.0265	-0.0198	-0.00161	-0.0131	-0.0000133
	(0.0209)	(0.0230)	(0.0176)	(0.0194)	(0.00229)
Court-Year FE	X	X	X	X	X
N	13643	13643	13607	13632	13599
adj. R-sq	0.140	0.209	-0.062	-0.042	0.397

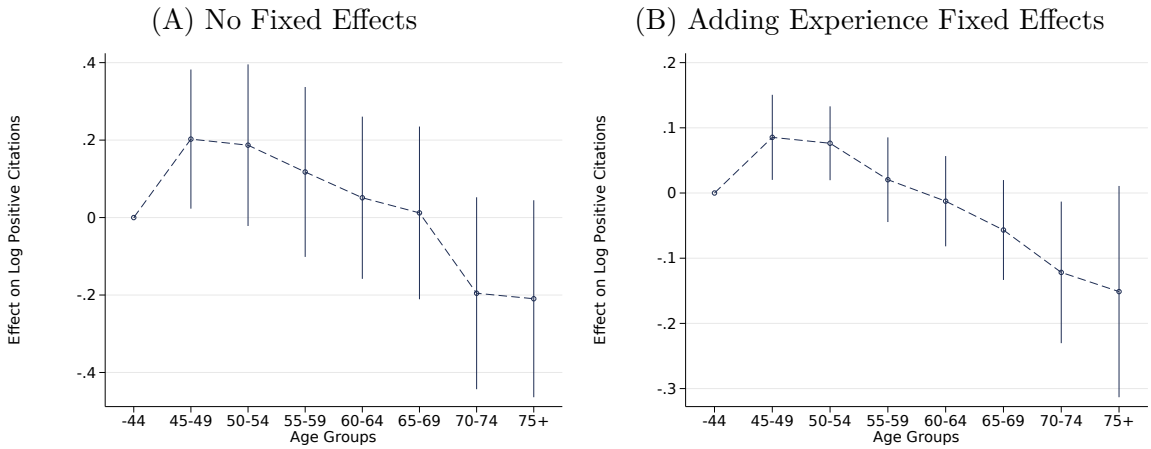
Observation is a judge working in a year. "Random" is an indicator for random-assignment states, while "Not Rand" means discretionary assignment. "Crim Cases" means proportion of cases on criminal law in a year (and respectively for civil cases, administrative cases, and constitutional law cases). "Pred. Cites" means the predicted case quality computed from an OLS regression with case characteristics (legal area and related industries). Standard errors clustered by state in parentheses. + p<.0.1, * p<0.05, ** p<0.01.

Figure C.3: Dynamic Analysis: Case Types



Dynamic coefficient plots for estimates of five-year age group differences, relative to the age < 45 group. Observation is a judge working in a year. All graphs contain court-year interacted fixed effects, first year baselines, and cohort fixed effects. 95% confidence intervals constructed using standard errors clustered by state.

Figure C.4: Judge Age and Judge Performance, Additional FE Specifications



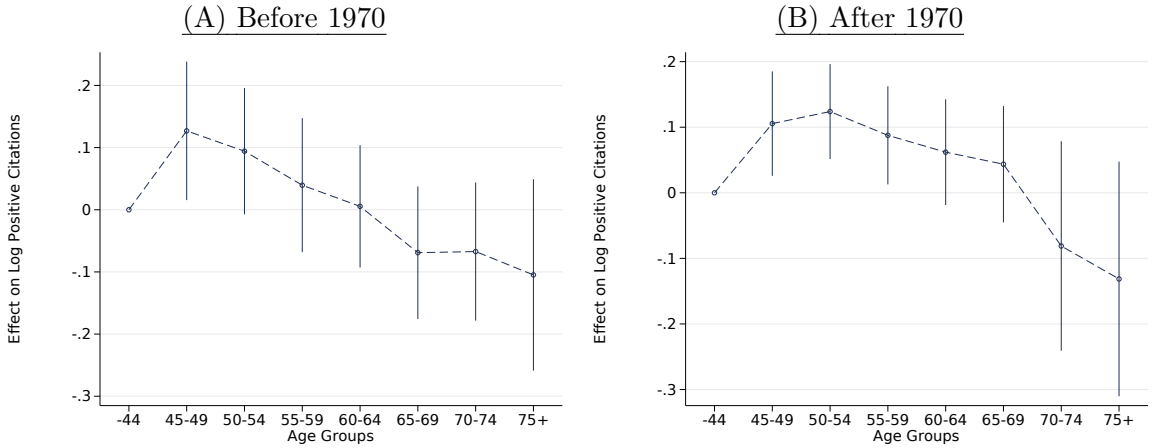
Dynamic coefficient plots for estimates of five-year age group differences, relative to the age < 45 group. Outcom is log positive cites. Observation is a judge working in a year. Panel A has no fixed effects; Panel B contains court-year interacted fixed effects, first year baselines, cohort fixed effects, and fixed effects for number of years on court. 95% confidence intervals constructed using standard errors clustered by state.

Table C.6: Judge Age and Judge Performance, by Retirement Rule

	(1)	(2)	(3)	(4)
	Voluntary Retirement		Mandatory Retirement	
	Log Cites	Rank	Log Cites	Rank
Judge Age (Years)	-0.00962**	-0.00576**	-0.00615**	-0.00390**
	(0.00320)	(0.00147)	(0.00160)	(0.00122)
Court-Year FE	X	X	X	X
First-Year Baseline	X	X	X	X
Cohort FE / Trends	X	X	X	X
N	4688	4688	8967	8967
R-sq	0.692	0.059	0.613	0.043

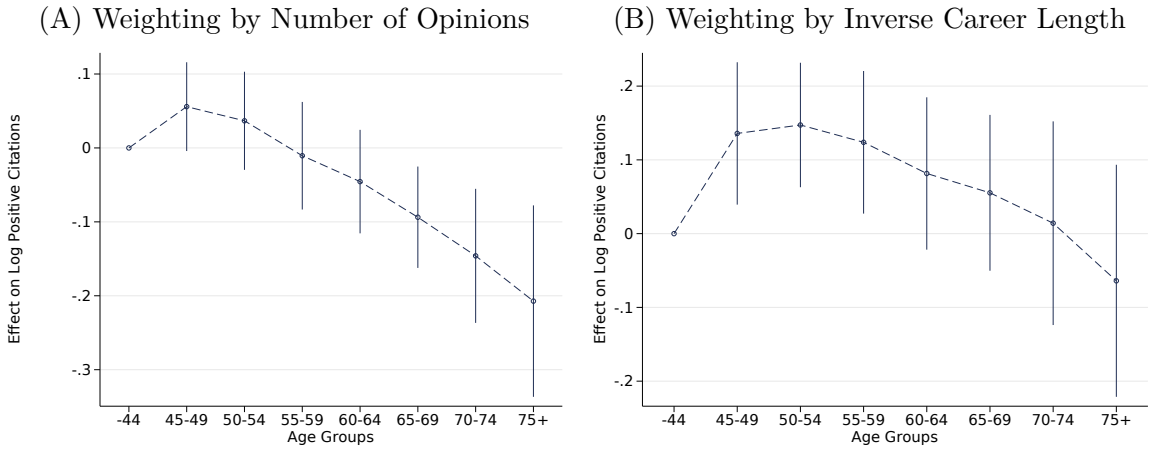
Observation is a judge working in a year. "Log Positive Cites" is log of positive cites to a judge in a year. "Rank Percentile Cites" means judges are uniformly distributed between zero and one based on number of positive citations within court-year (0 is lowest, 1 is highest). Court-Year FE is interacted court-year fixed effects. First-Year Baseline means a judge's value for the outcome in their first year on the court is included as a control. Cohort FE means fixed effect for decade that the judge started on the court. Cohort Trends means judge starting-year interacted with court fixed effect. Standard errors clustered by state in parentheses. + p<.0.1, * p<0.05, ** p<0.01.

Figure C.5: Judge Age and Judge Performance, Before/After 1970



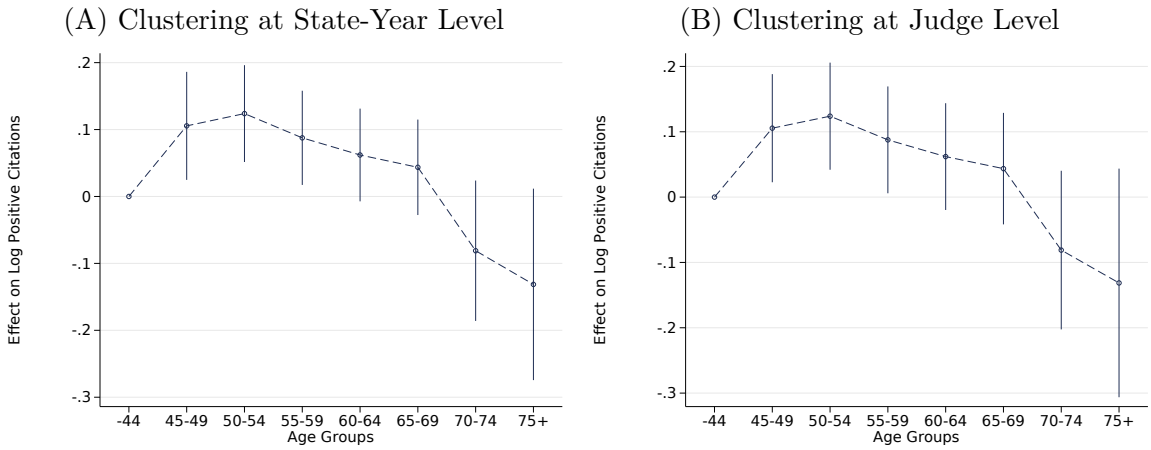
Dynamic coefficient plots for estimates of five-year age group differences, relative to the age < 45 group. Observation is a judge working in a year. All graphs contain court-year interacted fixed effects, first year baselines, and cohort fixed effects. Outcomes are log positive cites to a judge in a year. 95% confidence intervals constructed using standard errors clustered by state.

Figure C.6: Judge Age and Judge Performance, Alternative Weighting



Observation is a judge working in a year. All graphs contain court-year fixed effects. "With Controls" means a baseline for a judge's first year on the court, fixed effects for decade that the judge started on the court, and judge starting-year interacted with court fixed effect.

Figure C.7: Judge Age and Judge Performance, Alternative Clustering



Observation is a judge working in a year. All graphs contain court-year fixed effects. "With Controls" means a baseline for a judge's first year on the court, fixed effects for decade that the judge started on the court, and judge starting-year interacted with court fixed effect.

Table C.7: Additional Outcomes for Life Cycle Analysis

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Words Written	Affirm rate	Case Length	Research	Dissent	Overruled	Superseded
Judge Age	-0.00134	-0.00594	0.00154	-1.608	-0.00458*	0.00133	-0.00306**
	(0.00132)	(0.0217)	(0.00109)	(1.043)	(0.00182)	(0.000975)	(0.000883)
Court-Year FE	X	X	X	X	X	X	X
Cohort FE/Trends	X	X	X	X	X	X	X
N	13655	13655	13655	13655	13655	13655	13655
R-sq	0.563	0.747	0.719	0.607	0.504	0.328	0.464

Notes. Observation is a judge working in a year. "Words Written" is log of number of words written in opinions by a judge in a year. "Affirm Rate" is the rate that a judge affirms (rather than reverses) a lower court. "Case length" is words per opinion written. "Research" is previous cases cited in references. "Dissent" is rate of dissenting against other judges. "Overruled" is rate of being overruled by a higher court. "Superseded" is rate of being reversed by legislation. Court-Year FE is interacted court-year fixed effects. First-Year Baseline means a judge's value for the outcome in their first year on the court is included as a control. Cohort FE means fixed effect for decade that the judge started on the court. Cohort Trends means judge starting-year interacted with court fixed effect. Standard errors clustered by state in parentheses. + p<.0.1, * p<0.05, ** p<0.01.

Table C.8: Instrumenting Age with Reforms

	(1)	(2)	(3)	(4)	(5)
	Effect on Log Positive Cites per Judge-Year				
Judge Age	-0.0916**	-0.139**	-0.0766**	-0.0893**	-0.0888**
	(0.0278)	(0.0395)	(0.0232)	(0.0249)	(0.0244)
Court FE, Year FE	X	X	X	X	X
Court Trends/Windows		X	X	X	X
Init Court Rules × Year FE			X	X	X
Init Case Types × Year FE				X	X
Init Age × Year FE					X
Cragg-Donald F-stat	44.526	39.694	43.803	46.821	45.943
Kleibergen-Paap F-stat	10.372	7.416	17.520	16.991	21.625
N	15010	15010	15010	15010	15010
R-sq	0.460	0.526	0.538	0.555	0.565

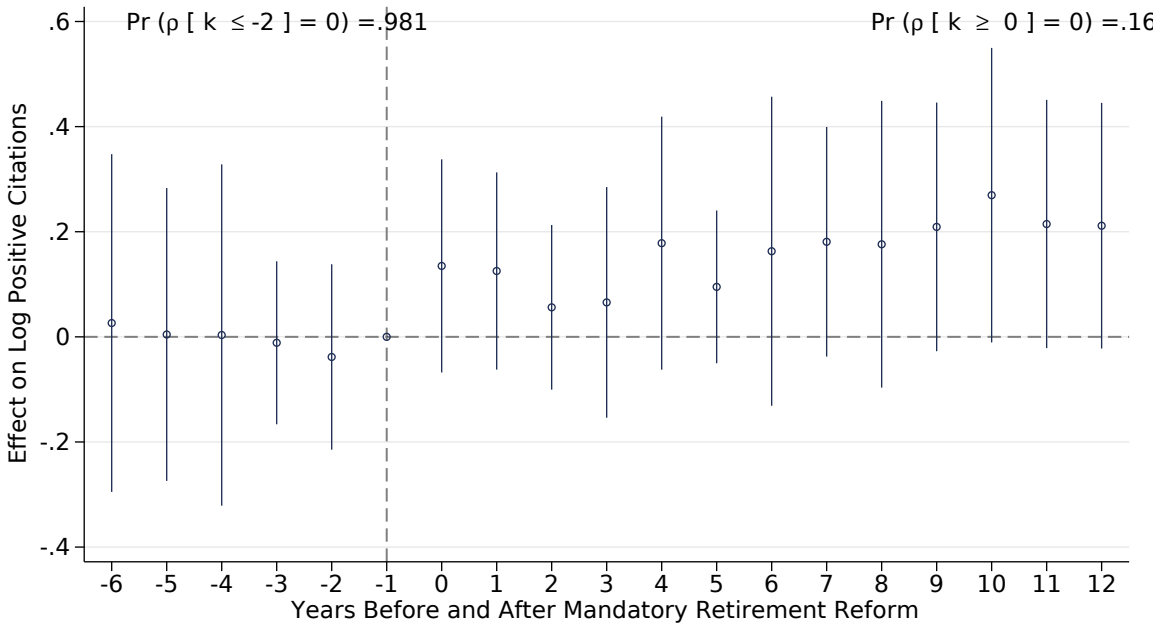
Notes. 2SLS estimates for effect of age on performance, instrumenting with the retirement reforms. Observation is a judge working in a year. "Retirement Reform" is an indicator for the ten years after the introduction of mandatory retirement. Court Treat Windows means court-specific treatment windows (ten years before and after reform). "Init X" × year FE means initial values are interacted with year. "Init Court Rules" includes a state's 1947 rules for judge selection/retention system, admin office, intermediate appellate court, number of judges, and term length. "Init Case Types" includes a court's 1947 average values for case characteristics (legal area and related industries). "Init Age" includes the initial mean and standard deviation for judge age on the court. Standard errors clustered by state in parentheses. + p<.0.1, * p<0.05, ** p<0.01.

Figure C.8: Balanced Judge Samples: Alternative Weighting and Clustering

Performance-Age estimates for separate balanced samples of judges based on age group. Observation is a judge working in a year. Outcomes are in rank percentiles, regressed on age (in years) for the specified group. 95% confidence intervals constructed using standard errors clustered by state.

D Additional Material on Team Effects of Aging

Figure D.1: Event-Study Effect of Reform on Performance, with Judge Fixed Effects



Judge performance before and after reforms implementing retirement ages of 70, 72 or 75. Outcome is log positive citations for a judge in a year. Time series is a coefficient plot from the event study regression (2), with coefficents estimated relative to the year before the reform. Regression includes court and year fixed effects and court-specific event windows, plus judge fixed effects. 95% confidence intervals constructed with standard errors clustered by state.

Table D.1: Effect of Reform, Other Quality Measures, Judge Fixed Effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Cites in Levels		Within 10 years		All Cites		Discuss Cites		Out-of-State Cites	
Ret. Reform	37.25*	18.28	0.238**	0.177	0.167*	0.131	0.109+	0.123	0.155*	0.167
	(17.63)	(17.56)	(0.0869)	(0.122)	(0.0721)	(0.0965)	(0.0543)	(0.0849)	(0.0772)	(0.105)
Year / Judge FE	X	X	X	X	X	X	X	X	X	X
Trends/Windows		X		X		X		X		X
N	14905	14905	14905	14905	14905	14905	14905	14905	14905	14905
R-sq	0.585	0.667	0.739	0.809	0.678	0.753	0.667	0.749	0.641	0.718

Notes. Observation is a judge working in a year. "Retirement Reform" is an indicator for the ten years after the introduction of mandatory retirement. "Cites in Levels" means the outcome is not logged. "Within 10 years" is the log positive cites within ten years of an opinion. "All Cites" is the log number of all citations (positive, negative, and distinguishing) to a judge in a year. "Discuss Cites" is only the positive cites where the latter judge discussed the cited opinion. "Out-of-State Cites" is the count of number of positive citations from courts in other states. "Positive Cites" is the number of positive cites (in levels). Court Treat Windows means court-specific treatment windows (ten years before and after reform). Standard errors clustered by state in parentheses. + p<.0.1, * p<0.05, ** p<0.01.

Table D.2: Mandatory Retirement Reform: Relevance of Authorship Rates

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Authorship Rate		Log Pos. Cites		Log # Opinions		Log Pos. Cites / Case	
Retirement Reform	0.0638	0.0917**	0.206*	0.213*	0.140*	0.0933*	0.0451	0.0855+
	(0.0383)	(0.0304)	(0.0838)	(0.0908)	(0.0549)	(0.0462)	(0.0464)	(0.0480)
Authorship Rate	-	-	0.406**	0.442*	0.526*	0.546**	-0.150	-0.117
			(0.151)	(0.180)	(0.197)	(0.159)	(0.115)	(0.0823)
Year FE, Court FE	X	X	X	X	X	X	X	X
Court Trends/Windows		X		X		X		X
N	2357	2357	15010	15010	15010	15010	15010	15010
R-sq	0.642	0.826	0.465	0.529	0.352	0.522	0.651	0.710

In Columns 1 and 2, an observation is court-year, while in Columns 3 through 8, an observation is a judge-year. "Retirement Reform" is an indicator for the ten years after the introduction of mandatory retirement. "Authorship Rate" is the proportion of total cases that have a signed author in the court-year. Court Treat Windows means court-specific treatment windows (ten years before and after reform). Standard errors clustered by state in parentheses. + p<.0.1, * p<0.05, ** p<0.01.

Table D.3: Comparing Judges Selected Before/After the Reform

	(1) Starting Age	(2) Log Cites / Case	(3) Rank Cites / Case
Selected Post Reform	-0.963	0.136**	0.186**
	(1.464)	(0.0240)	(0.0309)
Court × Year FE	X	X	X
N	2186	2186	2186
R-sq	0.272	0.723	0.029

Observation is a judge working in a year. Sample includes judges selected within ten years before and after the reform. "Selected Post Reform" is an indicator for judges selected within ten years after the introduction of mandatory retirement. Standard errors clustered by state in parentheses. + p<.0.1, * p<0.05, ** p<0.01.

One question not addressed directly in the main text is whether the mandatory retirement effect is driven by selection or incentives. On the selection side, the performance gain comes from the replacement of older judges with new, younger, better-performing judges. On the incentive side, mandatory retirement might increase quality for sitting judges by changing their incentives or their work environment. Incentive effects could include the need to impress the chief justice so that one can stay on as a senior justice, or else to maintain skills for obtaining non-judicial employment outside the court. Work-environment changes could be due to spillovers from the replacement of older judges with younger judges, so judges that stay on have to do less to support the older judges. Our previous estimates have not disentangled the across-judge from the within-judge effects of retirement reforms.

To get at selection, we compare judges working on the same court at the same time, but selected before/after the reforms. These regressions use court-year fixed effects so hold time-varying factors constant. The results, reported in Appendix Table D.3, show that the reforms did not significantly affect the starting age of judges. However, the judges selected after the reforms tended to be high-quality, as measured by citations per opinion.

E The Age Discrimination in Employment Act of 1967 Sec. 621

The Congress hereby finds and declares that

1. in the face of rising productivity and affluence, older workers find themselves disadvantaged in their efforts to retain employment, and especially to regain employment when displaced from jobs;

   (a) the setting of arbitrary age limits regardless of potential for job performance has become a common practice, and certain otherwise desirable practices may work to the disadvantage of older persons;

   (b) the incidence of unemployment, especially long-term unemployment with resultant deterioration of skill, morale, and employer acceptability is, relative to the younger ages, high among older workers; their numbers are great and growing; and their employment problems grave;

   (c) the existence in industries affecting commerce, of arbitrary discrimination in employment because of age, burdens commerce and the free flow of goods in commerce.

   (d) It is therefore the purpose of this chapter to promote employment of older persons based on their ability rather than age; to prohibit arbitrary age discrimination in employment; to help employers and workers find ways of meeting problems arising from the impact of age on employment.