

## Supplementary Online Content

Bonica A, Rosenthal H, Rothman DJ. The political polarization of physicians in the United States: an analysis of campaign contributions to federal elections, 1991 through 2012. *JAMA Intern Med*. Published online June 2, 2014. doi:10.1001/jamainternmed.2014.2105

### **eAppendix.** Additional Details on Methods and Additional Regression Results

This supplementary material has been provided by the authors to give readers additional information about their work.

## **eAppendix.**

### *Data sources and filtering*

#### **Contribution Records**

The contributions records were accessed at <http://data.stanford.edu/dime>. Each contribution record represents a single transaction between an individual donor and candidate or recipient committee and reports information on the name, mailing address, and occupation and employer of the donor. We exclude all contributions made to PACs affiliated with corporations, labor unions, or trade groups from the analysis. This includes contributions made to PACs associated with the AMA and other medical associations.

#### **Disclosure**

Disclosure is required by law for contributions to Super PACs, 501(c)(3)s, and 527s but is optional for political non-profit 501(c)(4)s. This does not pose a problem for our analysis since our calculations show that non-disclosing groups account for only a small fraction of total contributions—accounting for \$300 million in 2012 or approximately 6 percent of the total amount contributed on federal elections—and typically cater to a small group of the wealthiest donors.

#### **Linking Healthcare Provider Directories to Contribution Data**

Several steps were involved in merging healthcare provider directories and the DIME database. The first step was to combine data from current and past releases of healthcare provider directories. This requires merging records from the National Plan and Provider Enumeration System's (NPPES) National Provider Identifier (NPI) directory, which was launched in 2007, with records from its predecessor, the Centers for Medicare and Medicaid Services' (CMS) Unique Physician Identification Number (UPIN) directory, which was maintained starting in 1992 up until its discontinuation in 2007. The NPI and

UPIN directories each include a set of unique identifiers for physicians. The NPI directory retains UPIN ids for all individuals that were previously present in the UPIN database, which serves as a crosswalk. Both directories provide the physician's name, location and contact information, and medical specialty. In addition, the NPI directory includes information on the employer and gender for each physician.

The second step was to subset the contribution data by filtering on reported occupation and employer. We retained only records from those contributors who either (1) self-reported M.D. as their title, (2) had a self-reported occupation that matched against a list of relevant search terms that identified them as medical doctors (e.g. physician, surgeon, doctor, anesthesiologist, etc.), or (3) had a self-reported employer that matched against a list of medical schools, government agencies, and institutional health care providers compiled from the NPES and UPIN databases and an IRS database of exempt filers (accessed at <http://www.irs.gov/Charities-&-Non-Profits/Using-Exempt-Organizations-Master-File-Data>). Healthcare professionals other than licensed medical doctors were screened from the database. In order to link records across databases, we developed a customized record-linkage algorithm that compares values from the UPIN/NPI data to their corresponding values in the contribution data. For each physician in the UPIN/NPI database, the algorithm begins by querying the database of contributors on name and location in order to identify a list of potential matches. After downloading the records of potential matches from the contribution database, the algorithm then narrows the set of possible matches by comparing values for first, last and middle name, suffix, title, address, city, state, zip code, occupational title, and employer. Approximate string matching is used to compare names, addresses, occupations, and employers. The Jaro-Winkler algorithm is used to determine string similarity. Name matching was further conditioned on information frequency of first and last names obtained from Social Security Administration (<http://www.ssa.gov/OACT/babynames/limits.html>) and

the U.S. Census (<https://www.census.gov/genealogy/www/data/2010surnames/dist.all.last>), respectively. We excluded 54,048 donors in the DIME database who had self-reported occupations that appeared to identify them as physicians but who could not be matched to corresponding records in the NPI/UPIN directory with sufficient confidence. Assuming, conservatively, that all of these donors are in fact licensed physicians listed in NPI/UPIN, suggests a missed linkage rate of 17%.

All code and data needed to replicate the record-linkage will be made available by the authors on request.

### **Medical Specialty**

The NPI/UPIN taxonomy codes for medical specialty remained largely consistent across all yearly releases during the period under study. The NPI database reports more detailed information on subspecialties and includes several additional codes for specialties that gained widespread recognition within the last decade (e.g. hospitalists). We relied on documentation provided by [www.cms.gov](http://www.cms.gov) to perform the crosswalk from UPIN to NPI taxonomy codes.

The UPIN/NPI database covers all M.D.s as well as a large number of other health care professionals. We restrict our sample to the subset of individuals that report M.D. as their medical credential. In doing so, we exclude all osteopathic physicians. We further exclude from the analysis any M.D.'s that list specialties that are not approved by the American Board of Medical Specialties. Most of these M.D.'s listed one of the following as their specialty: epidemiology, periodontics, psychology, counseling, therapy, pathology, acupuncture, and chiropractic.

### **Coding Partisanship for Non-Connected Committees**

Most contributions are made to candidates and committees affiliated with a major party. However, a sizable proportion of contributions are made to ideological committees not officially affiliated with a

party. For issue-oriented PACs, Super PACs, and 527 organizations, such as the NRA Political Victory Fund and EMILY's List, we assign party codes based on the average ideology of their donors. The coding scheme is based on a set of ideological measures estimated from contribution patterns. (See note 9 in main text.) In order to be coded as a Democrat/Republican the organization must have an average donor with an ideological (CF) score below -0.5/above 0.5.

### **Sex**

For physicians who did not have sex coded in the NPI database, we used an automated coding procedure based on the sex ratios of first names or, when available, sex-specific titles (e.g. Mrs., Mr., Jr., Sr.) reported in the contribution records. We do not assign labels to individuals for whom the automated coding scheme did not reach a threshold of being 95 percent confident of their sex. In total, we were able to assign sex to 99.4 percent of the donor population. We drop the 0.6 percent unassigned from the analysis. Any measurement error associated with our procedure should downwardly bias the results. To demonstrate the accuracy of the algorithm, we have also coded those physicians that were in the NPI directory. The match between the two measures of sex is shown in the table below. Only 0.7 percent of the physicians did not match between our coding and the NPI reports.

Sex Coded by Algorithm	Reported Sex in NPI database.	
	Female	Male
Female	424926	3534
Male	3641	579697

### **Profit vs. non-profit**

Information from both databases was used to determine employment status. For doctors in the NPI database, we used information on parent organization and status as sole-proprietor to determine employment status. For those doctors that only appear in the UPIN database, we relied on self-reported

information on occupation and employer from the campaign finance database. Non-profit status for hospitals was determined by matching against a database of hospital characteristics downloaded from [http://healthdata.gov/dataset/hosp/2012-08-24/final\\_hsp\\_characteristics\\_2012\\_08\\_24.txt](http://healthdata.gov/dataset/hosp/2012-08-24/final_hsp_characteristics_2012_08_24.txt). The criterion used for to determine non-profit status is whether the IRS has granted the institution exempt-filer status. Nonprofit status for other employers was determined by matching against a list of non-profit health care providers and medical schools from the IRS exempt organizations master file (<http://www.irs.gov/Charities-&-Non-Profits/Using-Exempt-Organizations-Master-File-Data>).

### **Congressional District Assigned to the Physician**

Data Science Toolkit (see <http://www.datasciencetoolkit.org/>) and scripts written in R were used to perform the geocoding of congressional district from the addresses provided in the contribution records.

## Regression Tables

In the table below, Model 1 contains the regression reported in the text, where the observations are unweighted. Model 2 weights by the amount given; Model 3 by the logarithm of the amount. Results are similar across models. Models 4 and 5 reports results for the unweighted model independently by gender. The table also includes the election cycle fixed effects, not reported in the main text. Standard errors are in parentheses. \*\*\* $P < .001$ , \*\* $P < .01$ , \* $P < .05$ .

Variable	Model 1 (N=292281)	Model 2 Weighted (N=292281)	Model 3 Log- Weighted (N=292281)	Model 4 Males Only (N=249673)	Model 5 Females Only (N=42610)
(Intercept)	0.03 (0.00)	0.00 (0.01)	0.03 (0.00)	0.17 (0.01)	0.10 (0.01)
Allergy & Immunology	0.22 (0.01)	0.22 (0.01)	0.22 (0.01)	0.23 (0.01)	0.21 (0.02)
Anesthesiology	0.36 (0.00)	0.32 (0.00)	0.36 (0.00)	0.38 (0.01)	0.32 (0.01)
Cardiac & Thoracic Surgery	0.40 (0.01)	0.40 (0.01)	0.40 (0.01)	0.42 (0.01)	0.36 (0.05)
Cardiology	0.23 (0.01)	0.20 (0.00)	0.22 (0.01)	0.25 (0.01)	0.20 (0.02)
Colon & Rectal Surgery	0.34 (0.02)	0.04 (0.01)	0.33 (0.02)	0.38 (0.02)	0.10 (0.06)
Critical Care Medicine	0.20 (0.01)	0.39 (0.01)	0.20 (0.01)	0.22 (0.01)	0.15 (0.03)
Dermatology	0.29 (0.01)	0.25 (0.01)	0.29 (0.01)	0.32 (0.01)	0.22 (0.01)
Diagnostic Radiology (Interventional)	0.27 (0.01)	0.21 (0.01)	0.27 (0.01)	0.30 (0.01)	0.18 (0.02)
Diagnostic Radiology (Non-Interventional)	0.31 (0.00)	0.24 (0.00)	0.30 (0.00)	0.33 (0.01)	0.24 (0.01)
Endocrinology	0.14 (0.01)	0.12 (0.01)	0.14 (0.01)	0.16 (0.01)	0.12 (0.02)
Family Medicine	0.21 (0.00)	0.17 (0.00)	0.21 (0.00)	0.25 (0.01)	0.08 (0.01)
Gastroenterology	0.21 (0.01)	0.17 (0.01)	0.21 (0.01)	0.24 (0.01)	0.13 (0.02)
General Surgery	0.33 (0.01)	0.32 (0.01)	0.33 (0.01)	0.36 (0.01)	0.22 (0.02)
Gynecological Oncology	0.31 (0.02)	0.26 (0.02)	0.31 (0.02)	0.35 (0.02)	0.17 (0.05)
Gynecology	0.25 (0.01)	0.20 (0.01)	0.25 (0.01)	0.27 (0.01)	0.19 (0.02)
Hematology & Oncology	0.17 (0.01)	0.12 (0.01)	0.16 (0.01)	0.19 (0.01)	0.11 (0.01)

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	(0.01) ***	(0.01) ***	(0.01) ***	(0.01) ***	(0.01) *
Hospitalist	0.10	0.16	0.11	0.11	0.09
	(0.02) ***	(0.02) ***	(0.02) ***	(0.02) ***	(0.04) ***
Infectious Disease	0.07	0.04	0.07	0.07	0.07
	(0.01) ***	(0.01) ***	(0.01) ***	(0.01) ***	(0.02) ***
Internal Medicine	0.14	0.14	0.14	0.16	0.10
	(0.00) ***	(0.00) ***	(0.00) ***	(0.00) ***	(0.01) *
Neonatology	0.12	0.19	0.12	0.15	0.05
	(0.01) ***	(0.01) ***	(0.01) ***	(0.01) ***	(0.02) ***
Nephrology	0.15	0.12	0.15	0.17	0.14
	(0.01) ***	(0.01) ***	(0.01) ***	(0.01) ***	(0.02) ***
Neurological Surgery	0.39	0.41	0.38	0.41	0.25
	(0.01) ***	(0.01) ***	(0.01) ***	(0.01) ***	(0.04) ***
Neurology	0.14	0.07	0.13	0.15	0.13
	(0.01) ***	(0.01) ***	(0.01) ***	(0.01) ***	(0.02) ***
OBGYN	0.26	0.21	0.26	0.30	0.15
	(0.01) ***	(0.01) ***	(0.01) ***	(0.01) ***	(0.01) ***
Ophthalmology	0.33	0.32	0.33	0.35	0.29
	(0.01) ***	(0.00) ***	(0.01) ***	(0.01) ***	(0.01) ***
Orthopedic Surgery	0.39	0.35	0.39	0.41	0.26
	(0.00) ***	(0.00) ***	(0.00) ***	(0.01) ***	(0.02) ***
Orthopedic Surgery (Pediatrics)	0.35	0.37	0.36	0.38	0.24
	(0.04) ***	(0.04) ***	(0.04) ***	(0.04) ***	(0.17) ***
Orthopedic Surgery (Spine)	0.41	0.28	0.41	0.43	-0.31
	(0.01) ***	(0.01) ***	(0.01) ***	(0.01) ***	(0.24) ***
Otolaryngology	0.36	0.34	0.36	0.38	0.31
	(0.01) ***	(0.01) ***	(0.01) ***	(0.01) ***	(0.02) ***
Pediatric Cardiology	0.15	0.17	0.15	0.12	0.27
	(0.02) *	(0.02) *	(0.02) *	(0.02) *	(0.04) *
Pediatric Endocrinology	0.06	-0.04	0.05	0.04	0.06
	(0.03) *	(0.03) *	(0.03) *	(0.04) *	(0.04) *
Pediatric Gastroenterology	0.07	0.05	0.07	0.07	0.09
	(0.03) ***	(0.04) ***	(0.03) ***	(0.03) ***	(0.06) ***
Pediatric Hematology / Oncology	0.10	0.23	0.11	0.12	0.04
	(0.02) ***	(0.03) ***	(0.03) ***	(0.03) ***	(0.05) ***
Pediatric Infectious Disease	0.01	-0.03	0.01	0.01	0.03
	(0.03) ***	(0.03) ***	(0.03) ***	(0.03) ***	(0.05) ***
Pediatric Intensive Care	0.14	0.19	0.15	0.14	0.15
	(0.02) **	(0.02) **	(0.02) **	(0.02) **	(0.04) **
Pediatric Nephrology	0.12	0.02	0.12	0.15	0.06
	(0.04) **	(0.05) **	(0.04) *	(0.05) **	(0.07) **
Pediatric Neurology	0.08	0.11	0.07	0.09	0.05
	(0.03) **	(0.03) **	(0.03) **	(0.03) **	(0.05) **
Pediatric Pulmonary Disease	0.06	-0.01	0.05	0.05	0.09
	(0.03) ***	(0.03) ***	(0.03) ***	(0.04) ***	(0.07) **
Pediatric Surgery	0.35	0.28	0.34	0.39	0.16
	(0.02) ***	(0.02) ***	(0.02) ***	(0.02) ***	(0.06) ***
Pediatrics	0.09	0.18	0.09	0.08	0.09
	(0.01) ***	(0.00) ***	(0.01) ***	(0.01) ***	(0.01) ***
Physical Medicine & Rehabilitation	0.25	0.21	0.24	0.27	0.17



	(0.01) ***	(0.01) ***	(0.01) ***	(0.01) ***	(0.02) ***
Plastic Surgery	0.41	0.35	0.40	0.43	0.35
	(0.01) *	(0.01) ***	(0.01) *	(0.01) ***	(0.03) ***
Psychiatry (Child)	0.03	0.05	0.03	0.02	0.03
	(0.01) ***	(0.01) ***	(0.01) ***	(0.01) ***	(0.02) ***
Pulmonary Disease	0.16	0.23	0.16	0.19	0.09
	(0.01) ***	(0.01) ***	(0.01) ***	(0.01) ***	(0.03) ***
Rheumatology	0.16	0.23	0.16	0.17	0.12
	(0.01) ***	(0.01) ***	(0.01) ***	(0.01) ***	(0.02) ***
Trauma Surgery	0.28	0.22	0.27	0.31	0.11
	(0.02) ***	(0.02) ***	(0.02) ***	(0.02) ***	(0.06) ***
Urgent Care	0.22	0.16	0.21	0.24	0.14
	(0.01) ***	(0.01) ***	(0.01) ***	(0.01) ***	(0.01) ***
Urology	0.36	0.30	0.35	0.38	0.20
	(0.01) ***	(0.01) ***	(0.01) ***	(0.01) ***	(0.03) ***
Vascular Surgery	0.35	0.27	0.34	0.37	0.23
	(0.01) ***	(0.01) ***	(0.01) ***	(0.01) ***	(0.06) ***
Large For-Profit	0.15	0.17	0.15	0.16	0.12
	(0.00) ***	(0.00) ***	(0.00) ***	(0.00) ***	(0.01) ***
Small For-Profit	0.17	0.18	0.17	0.17	0.16
	(0.00) ***	(0.00) ***	(0.00) ***	(0.00) ***	(0.01) ***
Small Non-Profit	0.03	0.07	0.03	0.04	0.01
	(0.01) ***	(0.01) ***	(0.01) ***	(0.01) ***	(0.01) ***
Male	0.16	0.19	0.16		
	(0.00) ***	(0.00) ***	(0.00) ***		
Congressional District Partisanship	0.11	0.12	0.11	0.11	0.09
	(0.00) ***	(0.00) ***	(0.00) ***	(0.00) ***	(0.00) ***
1992	-0.06	0.02	-0.05	-0.06	-0.04
	(0.01) ***	(0.01) ***	(0.01) ***	(0.01) ***	(0.02) *
1994	0.08	0.08	0.07	0.07	0.13
	(0.00) ***	(0.01) ***	(0.00) ***	(0.00) ***	(0.02) ***
1996	0.13	0.12	0.13	0.13	0.14
	(0.00) ***	(0.00) ***	(0.00) ***	(0.00) ***	(0.01) ***
1998	0.08	0.08	0.08	0.08	0.09
	(0.00) ***	(0.01) ***	(0.00) ***	(0.00) ***	(0.01) ***
2000	0.04	0.05	0.04	0.04	0.06
	(0.00) ***	(0.00) ***	(0.00) ***	(0.00) ***	(0.01) ***
2002	0.06	0.08	0.06	0.06	0.10
	(0.00) ***	(0.00) ***	(0.00) ***	(0.00) ***	(0.01) ***
2006	-0.05	-0.02	-0.04	-0.05	-0.03
	(0.00) ***	(0.00) ***	(0.00) ***	(0.00) ***	(0.01) ***
2008	-0.08	-0.05	-0.08	-0.08	-0.09
	(0.00) ***	(0.00) ***	(0.00) ***	(0.00) ***	(0.01) ***
2010	0.00	-0.03	0.00	-0.01	0.01
	(0.00) ***	(0.00) ***	(0.00) ***	(0.00) ***	(0.01) ***
2012	-0.07	-0.02	-0.06	-0.06	-0.09
	(0.00) ***	(0.00) ***	(0.00) ***	(0.00) ***	(0.01) ***
$R^2$	0.20	0.19	0.20	0.17	0.16
Adj. $R^2$	0.20	0.19	0.19	0.17	0.16

The table below reports results for logistic regression in which the partisan giving rates have been transformed from a continuous to a dichotomous variable, taking on a value of 1 for donors who gave more than half of contribution dollars during an election cycle to Republicans and a value of 0 otherwise. Donors who split their money equally between parties are excluded from the analysis. Inspection of the table shows that our results are robust to using this transformation of the dependent variable.

<b>Logistic Regression</b>	
	<b>Model 1</b>
	(N = 292281)
(Intercept)	-1.58 (0.03) ***
Allergy & Immunology	1.09 (0.05) ***
Anesthesiology	1.79 (0.03) ***
Cardiac & Thoracic Surgery	1.99 (0.04) ***
Cardiology	1.12 (0.03) ***
Colon & Rectal Surgery	1.67 (0.09) ***
Critical Care Medicine	1.02 (0.06) ***
Dermatology	1.45 (0.03) ***
Diagnostic Radiology (Interventional)	1.32 (0.04) ***
Diagnostic Radiology (Non-Interventional)	1.50 (0.03) ***
Endocrinology	0.75 (0.05) ***
Family Medicine	1.05 (0.02) ***
Gastroenterology	1.05 (0.03) ***
General Surgery	1.62 (0.03) ***
Gynecological Oncology	1.53 (0.11) ***
Gynecology	1.26 (0.05) ***
Hematology & Oncology	0.85 (0.03) ***
Hospitalist	0.55 (0.10) ***

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Infectious Disease	0.37 (0.06)
Internal Medicine	0.75 (0.02)
Neonatology	0.66 (0.06)
Nephrology	0.80 (0.04)
Neurological Surgery	1.92 (0.04)
Neurology	0.73 (0.04)
OBGYN	1.31 (0.03)
Ophthalmology	1.60 (0.03)
Orthopedic Surgery	1.94 (0.03)
Orthopedic Surgery (Pediatrics)	1.73 (0.20)
Orthopedic Surgery (Spine)	2.03 (0.08)
Otolaryngology	1.76 (0.04)
Pediatric Cardiology	0.79 (0.10)
Pediatric Endocrinology	0.29 (0.16)
Pediatric Gastroenterology	0.36 (0.16)
Pediatric Hematology / Oncology	0.48 (0.14)
Pediatric Infectious Disease	-0.23 (0.19)
Pediatric Intensive Care	0.74 (0.11)
Pediatric Nephrology	0.69 (0.21)
Pediatric Neurology	0.46 (0.15)
Pediatric Pulmonary Disease	0.29 (0.17)
Pediatric Surgery	1.73 (0.10)
Pediatrics	0.51 (0.03)
Physical Medicine & Rehabilitation	1.22 (0.05)
Plastic Surgery	2.05 (0.04)

Psychiatry (Child)	0.13 <sup>*</sup> (0.07)
Pulmonary Disease	0.83 <sup>***</sup> (0.04)
Rheumatology	0.83 <sup>***</sup> (0.06)
Trauma Surgery	1.39 <sup>***</sup> (0.10)
Urgent Care	1.08 <sup>***</sup> (0.03)
Urology	1.73 <sup>***</sup> (0.03)
Vascular Surgery	1.71 <sup>***</sup> (0.05)
Large For-profit	0.77 <sup>***</sup> (0.02)
Small For-profit	0.84 <sup>***</sup> (0.01)
Small Non-profit	0.19 <sup>***</sup> (0.03)
Male	-0.82 <sup>***</sup> (0.01)
Congressional District Partisanship	0.52 <sup>***</sup> (0.00)
1992	-0.27 <sup>***</sup> (0.02)
1994	0.36 <sup>***</sup> (0.02)
1996	0.63 <sup>***</sup> (0.02)
1998	0.40 <sup>***</sup> (0.02)
2000	0.19 <sup>***</sup> (0.02)
2002	0.32 <sup>***</sup> (0.02)
2006	-0.22 <sup>***</sup> (0.02)
2008	-0.38 <sup>***</sup> (0.02)
2010	-0.02 <sup>***</sup> (0.02)
2012	-0.32 <sup>***</sup> (0.01)
AIC	342179.70
BIC	342867.76
Log Likelihood	-171024.85
Deviance	342049.70

\*\*\* $P < .001$ , \*\* $P < .01$ , \* $P < .05$

The table below reports the results from regressing the average partisan giving rates for each specialty on log mean earnings. The average partisan giving rates are calculated based on contributors during the 2012 election cycle in order to correspond to the data on earnings by specialty, from a 2011 survey. The correlation coefficient of  $r = 0.84$  is calculated from this bivariate regression.

<b>Model 1</b>	
	(N = 50)
(Intercept)	-5.77 <sup>***</sup> (0.58)
Log Mean Earnings	0.49 <sup>***</sup> (0.05)
$R^2$	0.71

\*\*\* $P < .001$ , \*\* $P < .01$ , \* $P < .05$