APPENDIX

To supplement Christopher Adolph, Christian Breunig, and Chris Koski, "The Political Economy of Budget Trade-offs," forthcoming in the Journal of Public Policy.

This appendix contains several pieces of supporting material for "The Political Economy of Budget Trade-offs," including: a detailed description of the construction and contents of each of the eight state budget categories analyzed in the main text; summary statistics for all the outcome and covariate data analyzed in baseline model and supplemental models; a table of regression coefficients for the baseline model; and simulation results for the regional controls from the baseline model contained in the main text. Finally, the appendix concludes with a series of "robustness movies" exploring in detail how the simulation results from the baseline model change in each of four alternative model specifications.

A.1 Data Description

Data are constructed from the detailed annual spending data provided by the Census of Governments State Government Finances database. We define eight areas – Medicaid & Welfare, K–12 Education, Higher Education, Other Spending, Highways, Public Health & Hospitals, Police & Prisons, and Natural Resources – to capture the functions described in Table A1. Our categories are slightly modified aggregations of the original State Government Finances broad categories, chosen to better test the extant theoretical explanations of budget priorities. Specifically, we combine total social service spending, medical vendor payments, housing, and spending on insurance trust funds to form the Welfare and Medicaid category, we define Health and Hospitals as all health related spending excluding Medicaid, include in Higher Education all education spending except K-12, and include in Natural Resources all environmental and utility expenditures. Construction of K-12, Police and Prisons, and Highways spending is straightforward, while Other Spending includes all remaining budget categories, including general government, liquor, ports, airports, mass transit subsidies, and interest payments on government debt.

Constructing each of the eight policy areas is slightly complicated: because SGF data are further subdivided by accounting functions, within each of the abovementioned budgetary areas, we must aggregate spending per budget area made in different

accounts. Depending on the policy area, budget data on spending in an area may be available disaggregated into budgets for construction (category F), current operations (category E), other capital outlays (category G), assistance and subsidies (category J), transfers to local government entities (category M), transfers to school districts (category Q) and/or payments to federal welfare programs (category S). For each of the eight spending areas reported in the paper, we have combined all available relevant budget categories above.

A summary of the variation in both our budget categories and the covariates included in our compositional data models can be found in Table A2. Note that all variables are continuous (or at least ordered indexes) except for the partisan government and tax and expenditure limits control variables. For Governor Powers, "(B)" indicates Beyle's index, and "(K&S)" indicates Krupnikov and Shipan's alternative index.

Table A1. Description of state budget categories.

Budget category	Spending falling within this category
Medicaid & Welfare	Cash assistance programs (SSI, TANF); vendor payments for medical care (Medicaid); emergency relief; housing assistantce; welfare administration costs.
K–12 Education	Spending on elementary and secondary education.
Higher Education	Post-secondary education; other schools including those for the blind and vocational schools.
Other Spending	Government administration; judicial and legal expenditures; central staff services; public building costs; mass transit subsidies; airports and seaports; parks; liquor regulation; scientific and cultural facilities; stadiums; general debt service.
Highways	Construction and maintenance of roads and highways; ferries.
Public Health & Hospitals	Construction and maintenance of state hospitals, university hospitals, and mental health facilities; subsidies to private hospitals; health inspections; regulation of air and water quality; environmental cleanup.
Police & Prisons	State police; sheriffs; state highway patrol; training academies; crime labs; vehicle inspection; construction and maintenance of prisons and jails; funding for inmate rehabilitation programs; salary for prison workers and probation officers.
Natural Resources	Agriculture spending; fish and game expenditures; state administration of forests.

Table A2. Summary statistics of budget components and covariates, 1984–2009.

	Min	25th ptile	Med	Mean	SD	75th ptile	Max
Budget components							
Medicaid & Welfare	0.14	0.26	0.31	0.31	0.07	0.36	0.53
K–12 Education	0.03	0.16	0.19	0.19	0.04	0.23	0.29
Higher Education	0.06	0.11	0.13	0.13	0.03	0.16	0.22
Other Spending	0.04	0.09	0.12	0.13	0.05	0.16	0.35
Highways	0.02	0.07	0.08	0.09	0.03	0.10	0.22
Public Health & Hospitals	0.02	0.05	0.07	0.07	0.02	0.08	0.13
Police & Prisons	0.01	0.03	0.04	0.04	0.01	0.05	0.08
Natural Resources	0.01	0.02	0.03	0.04	0.02	0.04	0.14
Covariates							
Unified Democratic	0.00	0.00	0.00	0.25	0.43	1.00	1.00
Unified Republican	0.00	0.00	0.00	0.18	0.39	1.00	1.00
Governor powers (B)	0.00	7.50	8.00	7.95	1.59	9.00	10.00
Budget stringency	0.00	6.00	10.00	8.04	2.63	10.00	10.00
Unemployment rate	2.30	4.40	5.30	5.67	1.91	6.60	17.40
Real income, $k pc	13.51	22.12	25.62	26.17	5.66	29.75	46.71
Population density	0.00	0.04	0.09	0.18	0.24	0.18	1.14
Share $\leq$18 years	0.23	0.27	0.28	0.29	0.02	0.30	0.41
Share $\geq$65 years	0.08	0.12	0.13	0.13	0.02	0.14	0.19
Real pc spending growth	-0.15	0.00	0.03	0.03	0.05	0.06	0.30
Governor powers (K&S)	1.00	3.00	3.50	3.46	0.90	4.00	6.00
Tax & expenditure limits	0.00	0.00	0.00	0.45	0.50	1.00	1.00

A.2 Baseline Model Results: Coefficients and Regional Counterfactuals

Table A3 contains the estimated coefficients and goodness of fit measures for the baseline model discussed in the main text.

Figure A1 elaborates on the regional differences captured by the four region dummies for this model using the counterfactual simulation techniques used in the main text to show partisan, economic, institutional, and demographic effects on budget shares. As in the main text, filled black circles indicate changes that are significant at the 0.05 level, filled gray circles indicate significance at the 0.1 level, and open circles are non-significant results. Horizontal lines are 95% confidence intervals. All results simulated from the model presented in Table A3; all other covariates are held constant.

We find a number of strong regional differences in budgets that persist when controlling for partisan governments, economic conditions, institutions, and demography, many of which appear to fit with well-known biases in regional priorities. For example, Midwestern states – home of many of the oldest and largest public flagship universities – spend larger shares of their budgets on higher education (significant at the 0.1 level), but less on prisons and natural resources. Northeastern states, home to many private universities, spend less on higher education (significant at the 0.1 level) and especially police and prisons, but, as befits their liberal reputation, much more than the average state on Medicaid & Welfare. The Southern states spend significantly more than the average region on police and prisons, as do Western states. Western states also spend noticeably less on Medicaid and welfare and more on natural resources than states in other regions.

Nevertheless, we think the results for regions should be treated with caution. Fundamentally, we include region dummies to account for omitted variables that might be strongly correlated with the states of different regions. Thus, what the region dummies "show" the aggregate effect of the omitted characteristics of each region; these will naturally change as we add or remove observed covariates from the model. Rather than estimate what is "intrinsic" to a region, these dummy variable reveal what is left unexplained, which is in large part a function of the model itself.

Table A3. Seemingly unrelated regressions of additive-logratio–transformed state budget components, 1984–2009: Baseline results.

	Response variables are logratios: log(Component k/Other Spending)						
Covariates	K–12 Ed	Medicaid & Welfare	Public Health & Hospitals	Natural Resources	Higher Ed	Highways	Police & Prisons
Unified Democratic	0.021	0.016	0.004	0.018	0.000	0.009	0.005
	(0.011)	(0.010)	(0.011)	(0.012)	(0.009)	(0.011)	(0.009)
Unified Republican	-0.028	-0.027	-0.019	-0.004	-0.011	-0.001	-0.000
	(0.012)	(0.012)	(0.012)	(0.014)	(0.010)	(0.013)	(0.011)
Governor powers	-0.003	-0.001	0.002	0.006	-0.003	4.378	-0.002
	(0.003)	(0.002)	(0.003)	(0.003)	(0.002)	(0.003)	(0.002)
Budget stringency	0.005	0.007	0.004	0.001	0.005	0.007	0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)
Unemployment rate	-0.000	0.007	0.002	-0.004	0.002	0.000	-0.003
	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)
Real income, $k pc	0.004	0.005	0.004	0.003	0.002	0.001	0.004
	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)
Population density	-0.076	-0.097	-0.057	-0.005	-0.082	-0.122	-0.031
	(0.032)	(0.030)	(0.031)	(0.035)	(0.027)	(0.035)	(0.028)
Share $\leq$18 years	0.362	-0.230	0.166	-0.045	0.055	-0.152	-0.295
	(0.335)	(0.322)	(0.332)	(0.375)	(0.279)	(0.350)	(0.300)
Share $\geq$65 years	-0.055	-0.400	-0.064	0.295	-0.554	-0.042	-0.185
	(0.409)	(0.397)	(0.408)	(0.458)	(0.347)	(0.429)	(0.370)
Lagged logratio	0.910	0.887	0.950	0.931	0.920	0.880	0.925
	(0.007)	(0.008)	(0.007)	(0.008)	(0.006)	(0.011)	(0.007)
Trend	0.001	0.005	0.001	-0.000	0.003	0.000	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)
South	0.006	0.006	0.018	0.024	0.005	0.001	0.026
	(0.013)	(0.013)	(0.013)	(0.015)	(0.011)	(0.014)	(0.012)
Northeast	-0.007	0.023	0.009	0.016	-0.012	-0.020	-0.016
	(0.019)	(0.018)	(0.019)	(0.021)	(0.016)	(0.020)	(0.017)
West	-0.009	-0.022	0.003	0.023	-0.020	-0.011	0.022
	(0.014)	(0.013)	(0.014)	(0.015)	(0.011)	(0.014)	(0.012)
Constant	-0.191	-0.090	-0.275	-0.258	-0.071	-0.077	-0.043
	(0.156)	(0.150)	(0.156)	(0.177)	(0.130)	(0.164)	(0.140)
Im-Pesaran-Shin test	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
McElroy's R^2	0.922						
N	1222						

Table entries are additive logratio coefficients with standard errors in parentheses. Im-Pesran-Shin test shows p-values from panel unit root tests where the null hypothesis is that a unit root process is present. McElroy's R^2 measures the goodness of fit of the entire system of equations. N indicates the number of state-years analyzed. Data are fully observed for all states, years, and components excluding Alaska, Hawaii, and Nebraska.

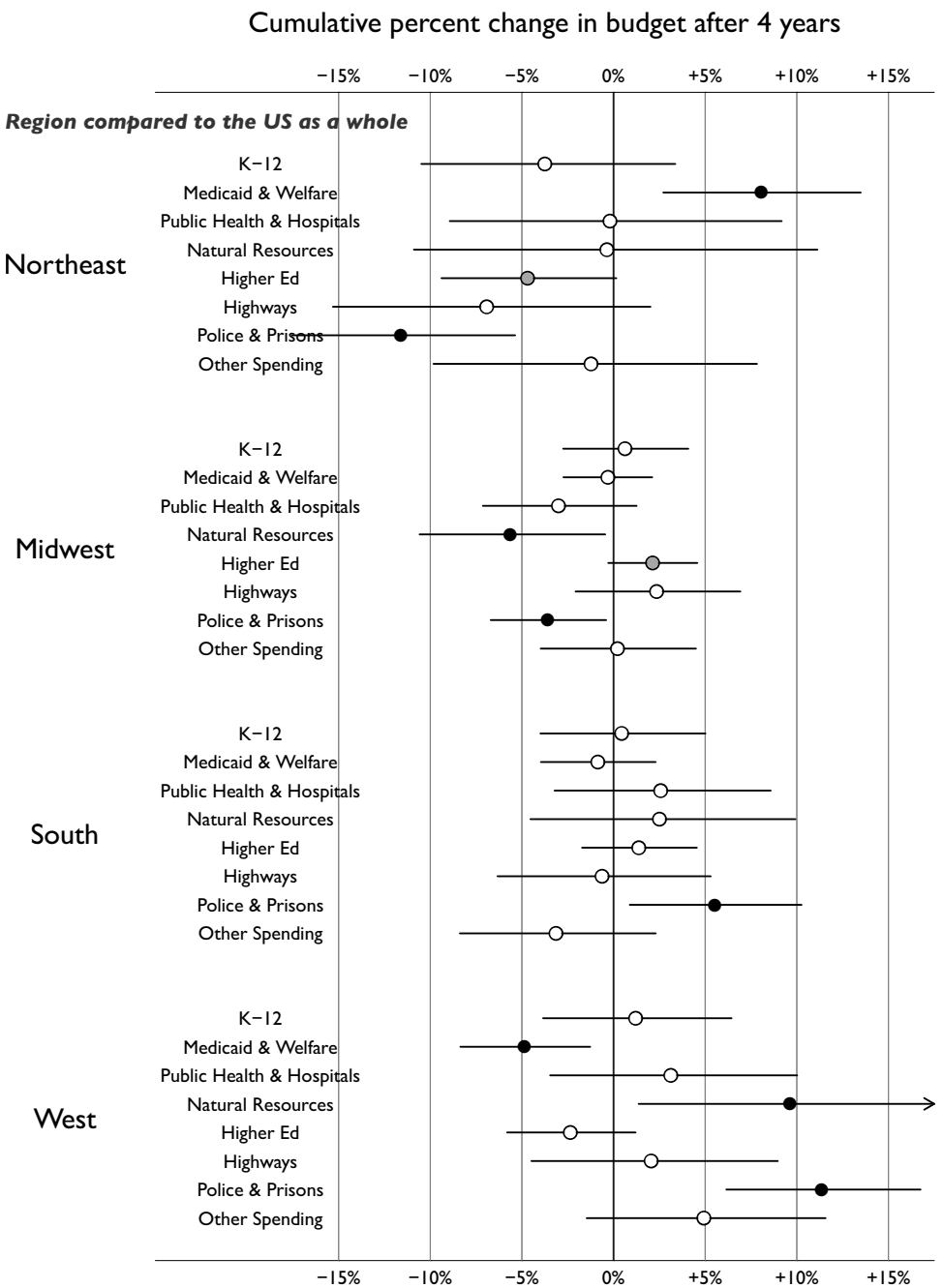

Figure A1. Estimated change in each budget component four years after hypothetical "region" change. Plotted points show the cumulative percent change in each budget share four years after a hypothetical shift from the country average to a specific region.

A.3 Alternative Models

Beyond the baseline model discussed in the main text, we consider four alternative specifications to explore the sensitivity of our results to debatable assumptions and measurements. Thus our five models are:

- M1 The baseline model
- M2 The baseline plus a control for real growth in total spending
- M3 The baseline omitting the control for budget stringency (ACIR)
- M4 The baseline plus a control for tax and expenditure limits
- M5 The baseline with Beyle's Governor Power index replaced by Krupnikov & Shipan's measure

The rationale for each robustness check is straightforward. While our compositional data models are focused on relative shifts in budgets (division of the pie), these changes may be confounded with shifts in the total budget (the size of the pie). M2 thus includes the real growth rate of total government spending as a control. While this simple model does not cover all possible interactions between the size and division of the pie, it provides a basic check on whether our results on budget trade-offs are conflated in any obvious way with changes in the total budget.

The next two models address the issue of restrictions on changes in the size of the budget. Because most (but not all) states operate under fairly strict fiscal rules against borrowing, one might wonder whether the budget stringency variable in the baseline model captures enough variation to say anything useful about the effects of rules against deficit spending. Accordingly, M3 checks whether our other results depend on the inclusion of the ACIR measure of budget stringency. On the other hand, if stringent limits on debt spending matter, so too might extra hurdles for raising taxes or total spending levels; hence M4 adds a control for the presence of either tax or expenditure limits (coded as dummy variable equal to one if any tax or expenditure limit is present, and zero otherwise).

Finally, there is debate over the appropriate way to construct indexes of governors' powers. In the main text, we use Beyle's measure, which Krupnikov and Shipan (2012) have criticized. For our purposes, the Beyle index is useful because it contains a broader range of potential options for the powers in which we are interested – budget and veto powers. Moreover, Krupnikov and Shipan use NASBO surveys which suffer from some non-response bias in ways that Beyle's data relying on the Book of the States data

do not. Nevertheless, we consider M5, a model replacing Beyle's index of governor powers with Krupnikov and Shipan's measure.

In the main text, we used a series of dotplots to explore the substantive implication of a single model.[1] To compare the results from five separate models, we create a series of "robustness movies" made up of identically constructed dotplots. For example, the next five figures (Figures A2 through A6, marked with blue titles at the top left) show the effect of partisan control on the eight budget categories for each of the five models. Our recommendation is that readers view these pages as a full-screen PDF file, then rapidly flip backwards and forwards between adjacent pages to create a moving picture of the differences across model specifications. Models with similar substantive and statistical implications produce figures that seem to jitter only slightly from page to page: because of random error, the estimated effects and confidence intervals should "dance" on the page a little bit, but not too much. Models with contrary results literally jump out, allowing readers to focus on exceptional results.

Readers are encouraged to explore the robustness of the results for themselves. As a guide, the rest of this section highlights key areas of robustness and a few cases of sensitivity.

Partisan effects on budget compositions are highly robust. Figures A2 though A6, marked in blue, reveal no noteworthy variation in the substantive or statistical significance of partisan effects, regardless of the model specification used or the budget category considered. The sole, minor exception is that in Model 3, which drops the control for budget stringency, the relationship between partisan control and Medicaid and welfare spending is significant at the 0.1 level rather than at the 0.05 level. The confidence interval and point estimate do not noticeably vary across models. As with other borderline results covered in this appendix, the stability of this result is a reminder to pay more attention to confidence intervals than significance thresholds. Sustantively, the robustness of the partisan results provides reassurance that the partisan raiding patterns highlighted in the main text are not artifacts of a fragile model specification, but instead robust features of the data.

Institutional effects: mostly robust, but the measures by Beyle and Krupnikov-Shipan differ somewhat. The effect of institutions – governor powers and budget stringency – are

1 As in the main text, filled black circles indicate changes that are significant at the 0.05 level, filled gray circles indicate significance at the 0.1 level, and open circles are non-significant results. Horizontal lines are 95% confidence intervals. All other covariates are held constant.

generally robust, with one minor and one major exception (Figure A7–A11, marked in red). The minor exception concerns the relationship between budget stringency and police and prisons spending, which is only significant at the 0.1 level in Model 5 (which uses Krupnikov and Shipan's alternative measure of governor powers); nevertheless, the difference is slight and barely visible when confidence intervals are compared across models.

The major exception concerns the measurement of governor powers. Beyle's index and Krupnikov and Shipan's index produce distinct effect on three of the eight budget categories – without altering the result of other covariates. Whereas Beyle's measure is associated with more spending on natural resources and less spending on higher education, Krupnikov and Shipan's index is only associated with less spending on police and prisons. We do not have an obvious explanation for the discrepancy, though it is worth noting that in our sample Beyle and Krupnikov-Shipan measure mostly different things: the simple correlation between these covariates is just $r = 0.31$. As noted above, we suspect Beyle's index is the more appropriate of the two for our purposes and emphasize that no other results depend on this choice.

Finally, Figure A10 shows what happens when we include a control for tax and expenditure limits (TELs) as well as a control for budget stringency. TELs themselves have no significant relationship with any budget category. Notably, the effects of budget stringency remain unchanged, no doubt in part because the simple correlation between the budget stringency and TELs covariates is low ($r = 0.16$), suggesting these two variables tap into often distinct processes in different states.

Economic effects are mostly robust, with a handful of exceptions. Figures A12 – A16 (marked in green) explore the robustness of our economic covariates. In general, the results for unemployment are quite stable across budget categories. We note just three minor sensitivity in the relationship between our economic variables and budget shares. First, in the model adding a control for tax and expenditure limits, the negative effect of unemployment on K-12 education spending is only significant at the 0.1 level, but is little changed substantively. Second, the relationship between real income per capita and Medicaid and welfare spending is not always significant: in the model controlling for TELs, it is only significant at the 0.1 level, and in the model dropping budget stringency, it loses significance altogether, but is still positively signed. Finally, dropping budget stringency strengthens the significance of the negative relationship between economic development and highway spending.

Controlling for real spending growth does not alter the results for other covariates but does reveal that total spending growth is associated with higher shares of the budget spent on Medicaid and Welfare (significant at the 0.1 level) and Public Health and Hospitals, and smaller shares for Highways (significant at the 0.1 level) and Other Spending. The direction of causality is unclear, though it seem reasonable to suspect this is an artifact of rising costs for medical care simultaneously driving up the total spending and share of spending devoted to health and medical care for states with high needs, costs, or generosity.

Demographic effects are mostly robust, though population density depends on controlling for budget rules. Figure A17 – A21 (marked in purple) explore the robustness of our demographic findings. The associations between age composition and budget category are mostly robust, in some cases rising or dropping a significance level but not varying in substantive size or approximate confidence interval width. The statistical significance of relationships between population density and budget allocation is notably sensitive to models that drop budget stringency, though we remain skeptical of such models.

Regional dummies capture different effects when other variables are included or omitted. Figures A22 – A26 (marked in brown) show how the results for our region dummies vary across model specifications. Here there is considerable more variation across models, as one should expect: the region dummies are included in the models to soak up omitted variables that happen to be strongly correlated with the states of each regions. Thus, when we either include or exclude additional covariates from the model, we necessarily alter the mix of omitted covariates proxied by the region dummies. We leave exploration of this variation to interested readers.

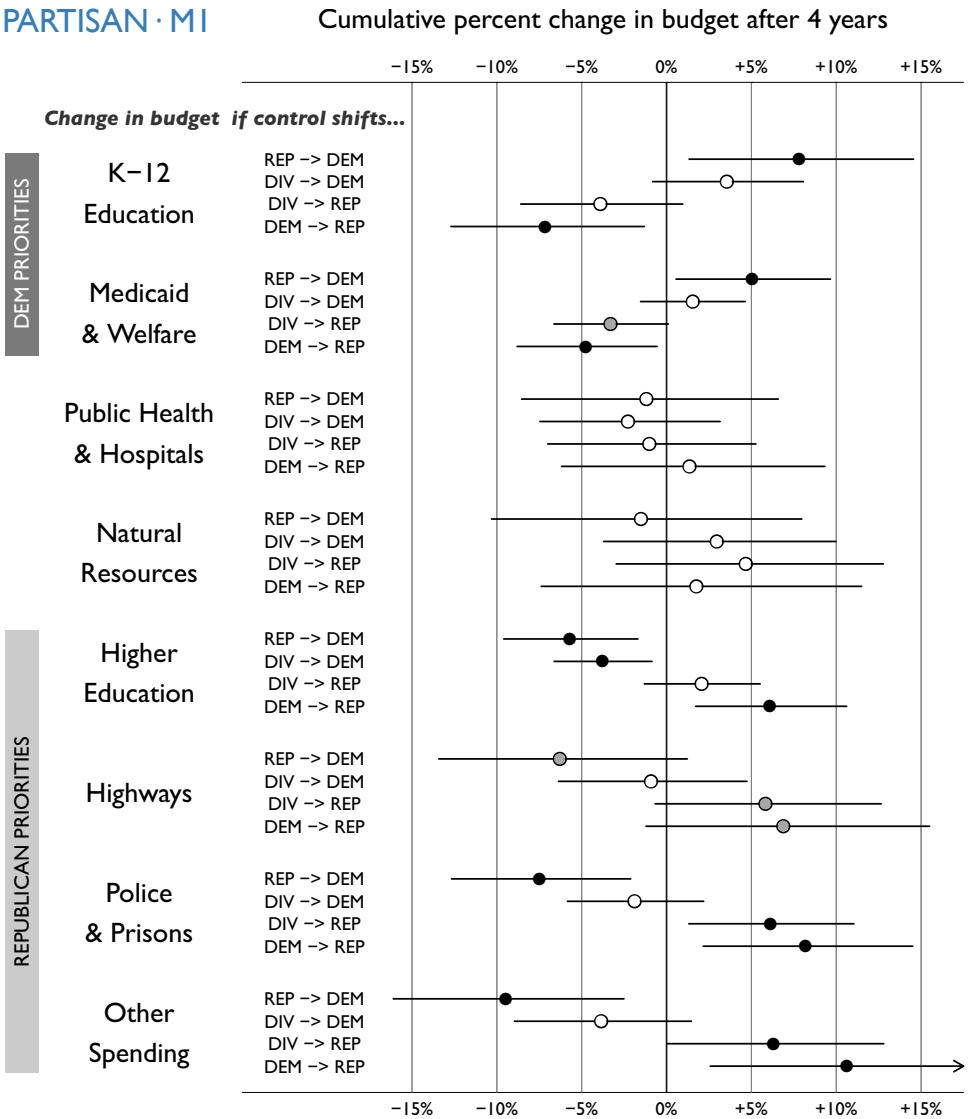

Figure A2. Estimated change in each budget component four years after a shift in partisan control: Baseline Model (repeated as reference). Plotted points show the cumulative percent changes in each budget share four years after partisan control of government shifts in the direction indicated.

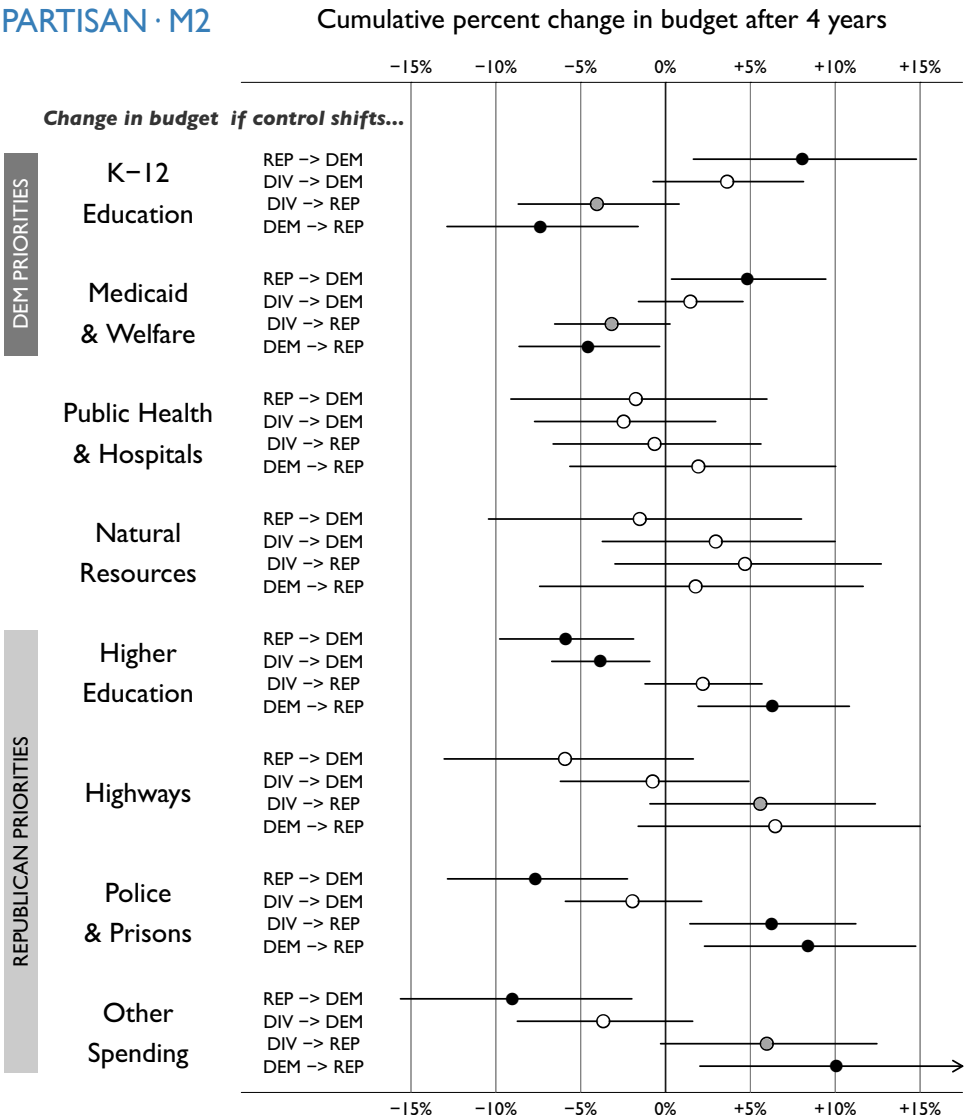

Figure A3. Estimated change in each budget component four years after a shift in partisan control: Control for Total Budget. Plotted points show the cumulative percent changes in each budget share four years after partisan control of government shifts in the direction indicated.

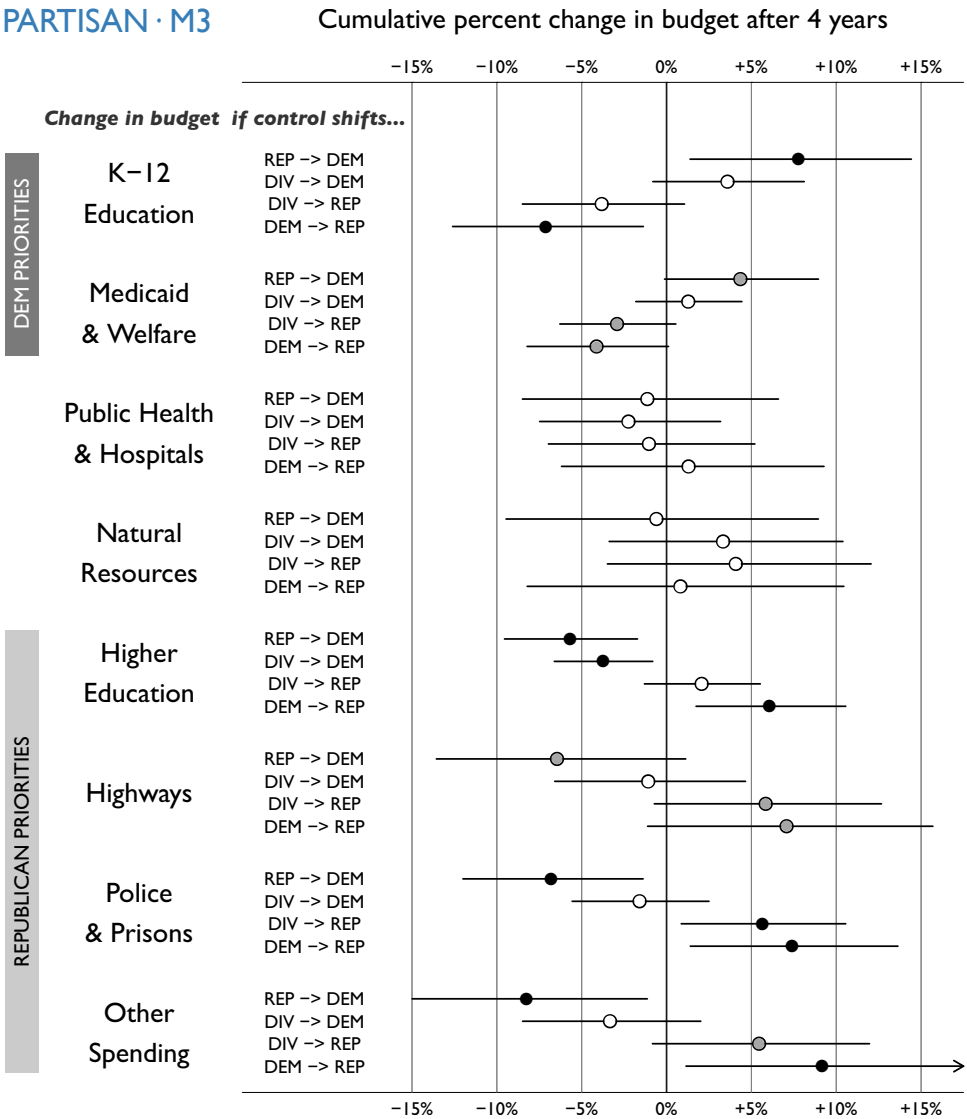

Figure A4. Estimated change in each budget component four years after a shift in partisan control: Drop Budget Stringency control. Plotted points show the cumulative percent changes in each budget share four years after partisan control of government shifts in the direction indicated.

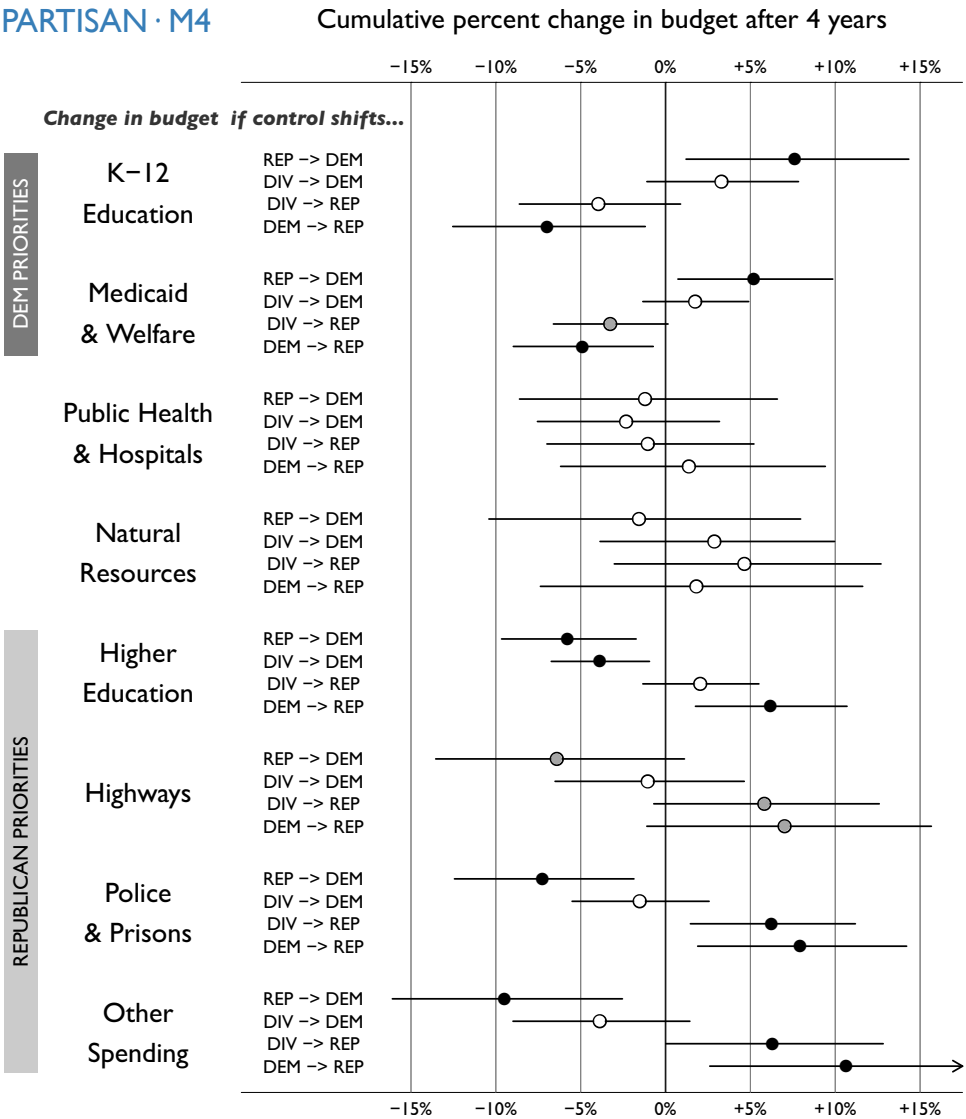

Figure A5. Estimated change in each budget component four years after a shift in partisan control: Control for tax and expenditure limits. Plotted points show the cumulative percent changes in each budget share four years after partisan control of government shifts in the direction indicated.

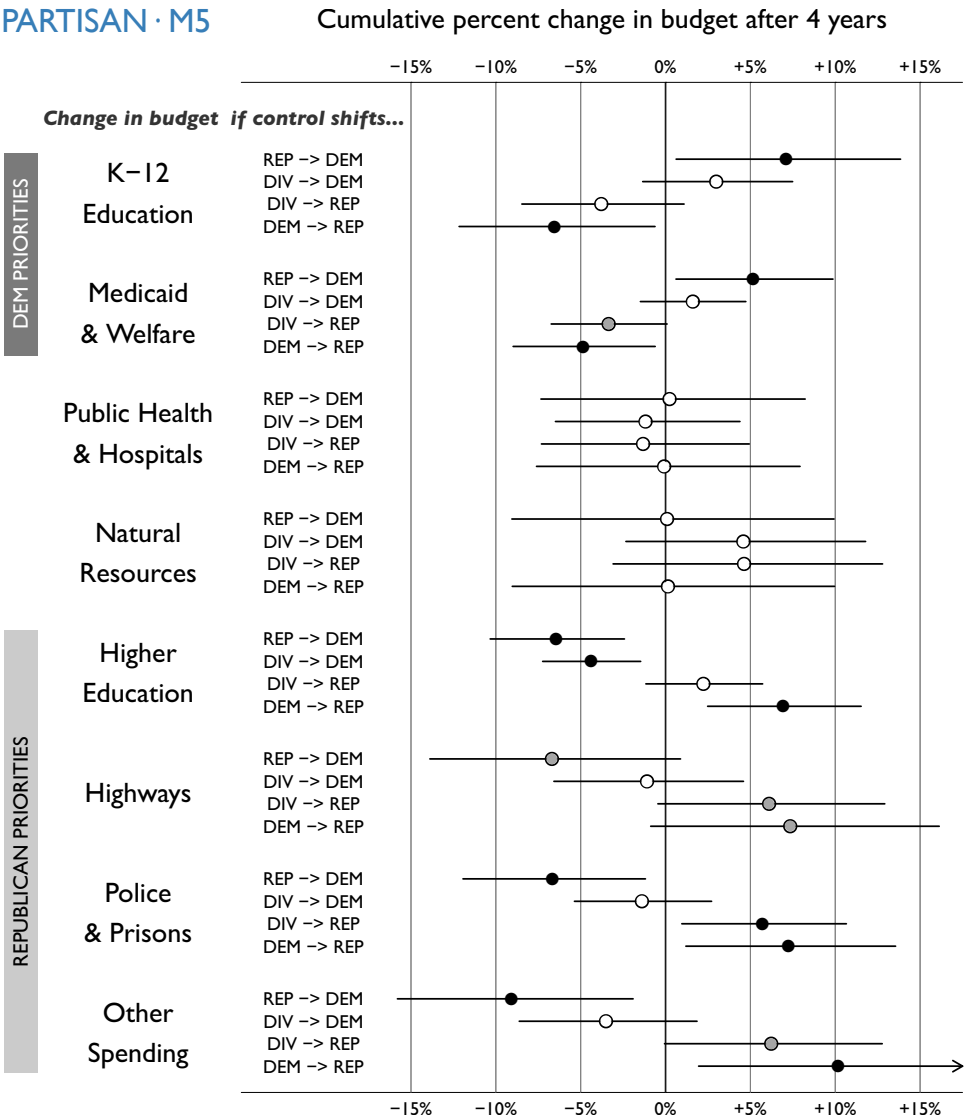

Figure A6. Estimated change in each budget component four years after a shift in partisan control: Alternative measure of Governor Power. Plotted points show the cumulative percent changes in each budget share four years after partisan control of government shifts in the direction indicated.

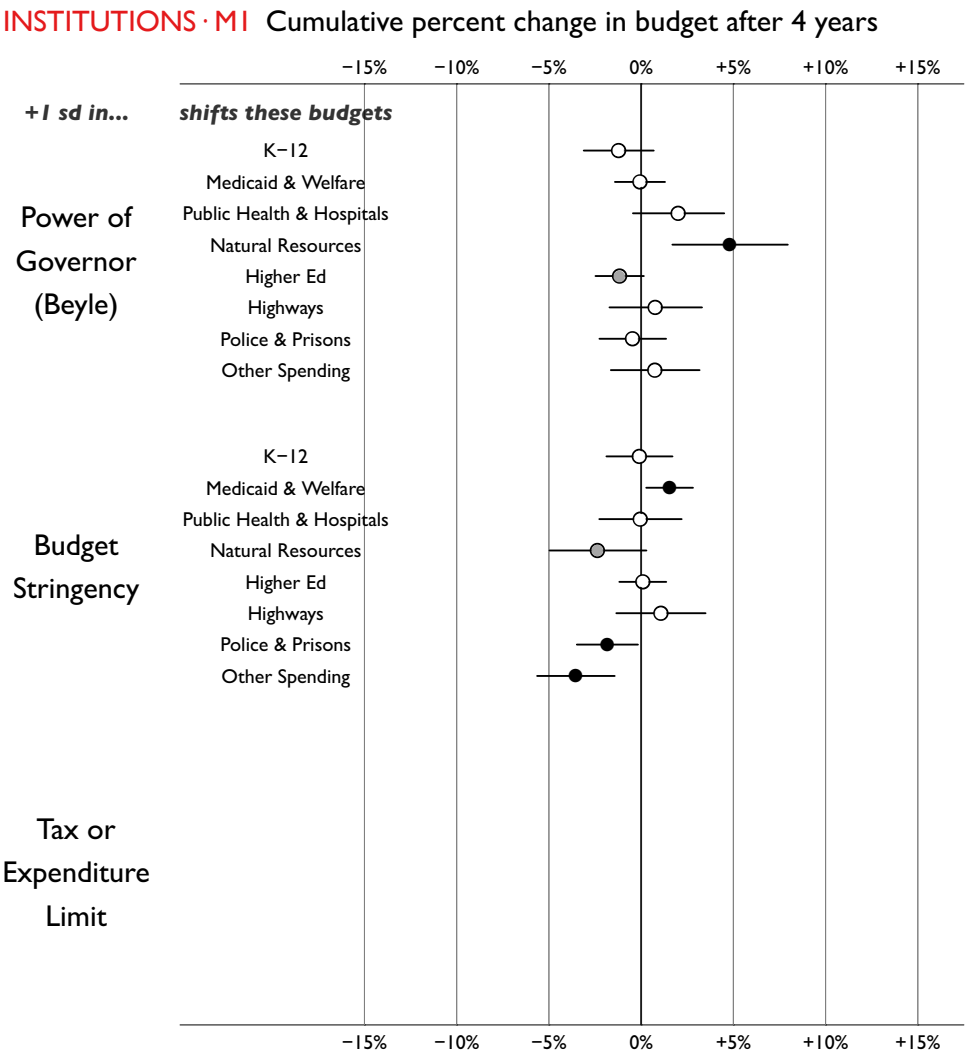

Figure A7. Estimated change in each budget component four years after institutional change: Baseline Model (repeated). Plotted points show the cumulative percent change in each budget share four years after either governor powers or budget stringency increases by one standard deviation from the mean level across states, or (in one model) if tax or expenditure limits are implemented.

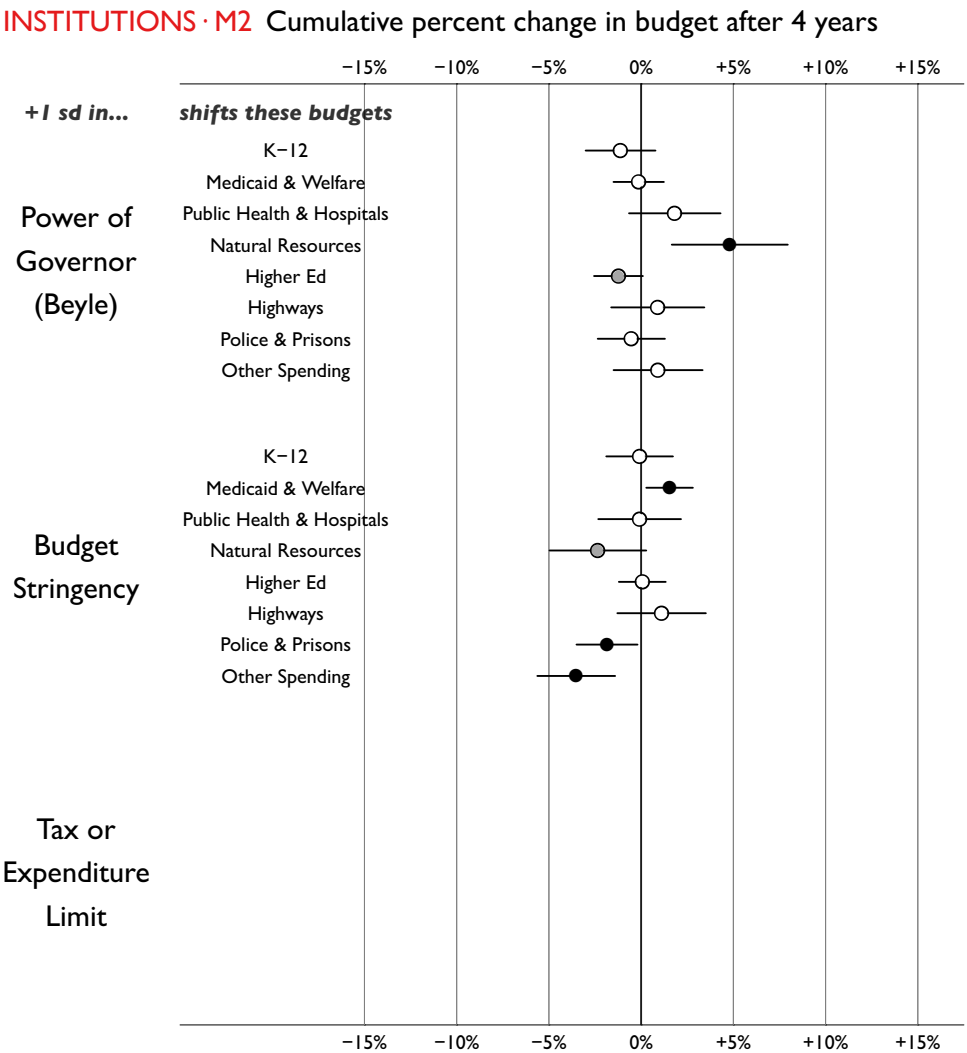

Figure A8. Estimated change in each budget component four years after institutional change: Control for Total Budget. Plotted points show the cumulative percent change in each budget share four years after either governor powers or budget stringency increases by one standard deviation from the mean level across states, or (in one model) if tax or expenditure limits are implemented.

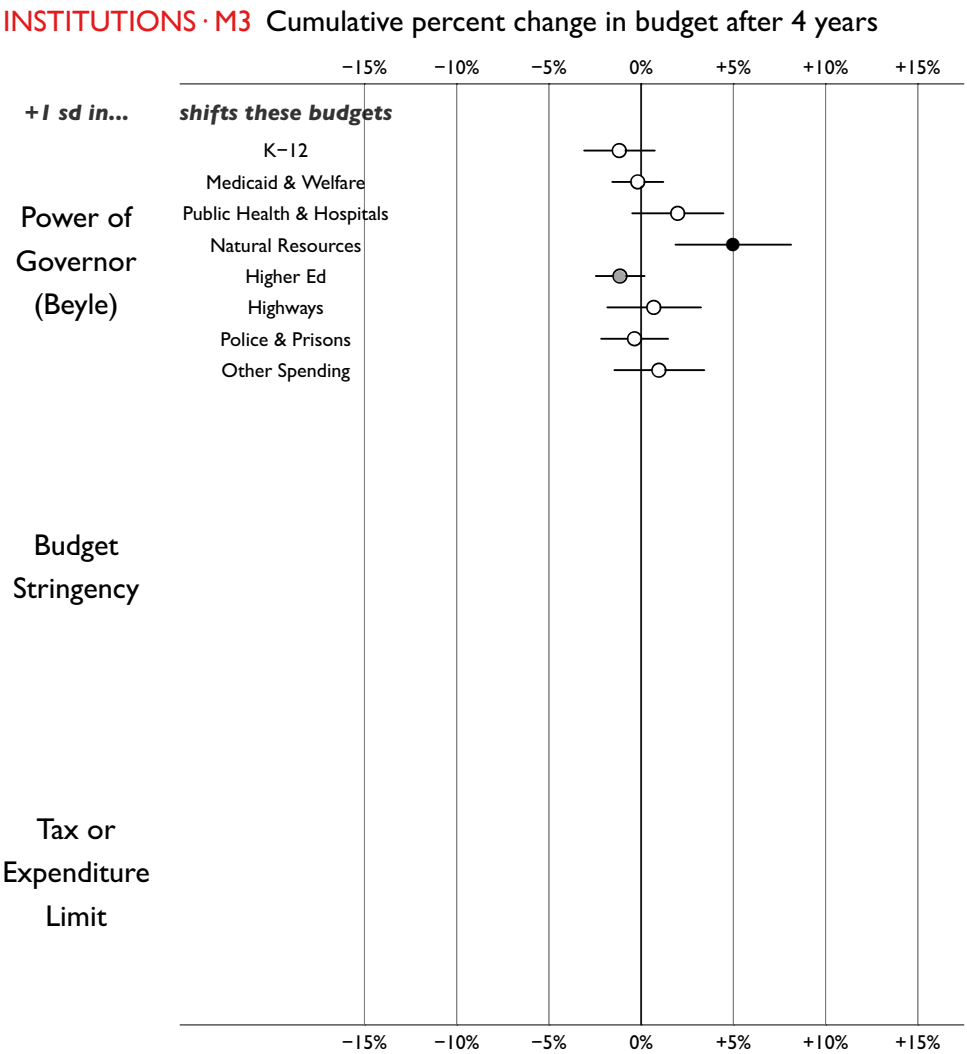

Figure A9. Estimated change in each budget component four years after institutional change: Drop Budget Stringency. Plotted points show the cumulative percent change in each budget share four years after either governor powers or budget stringency increases by one standard deviation from the mean level across states, or (in one model) if tax or expenditure limits are implemented.

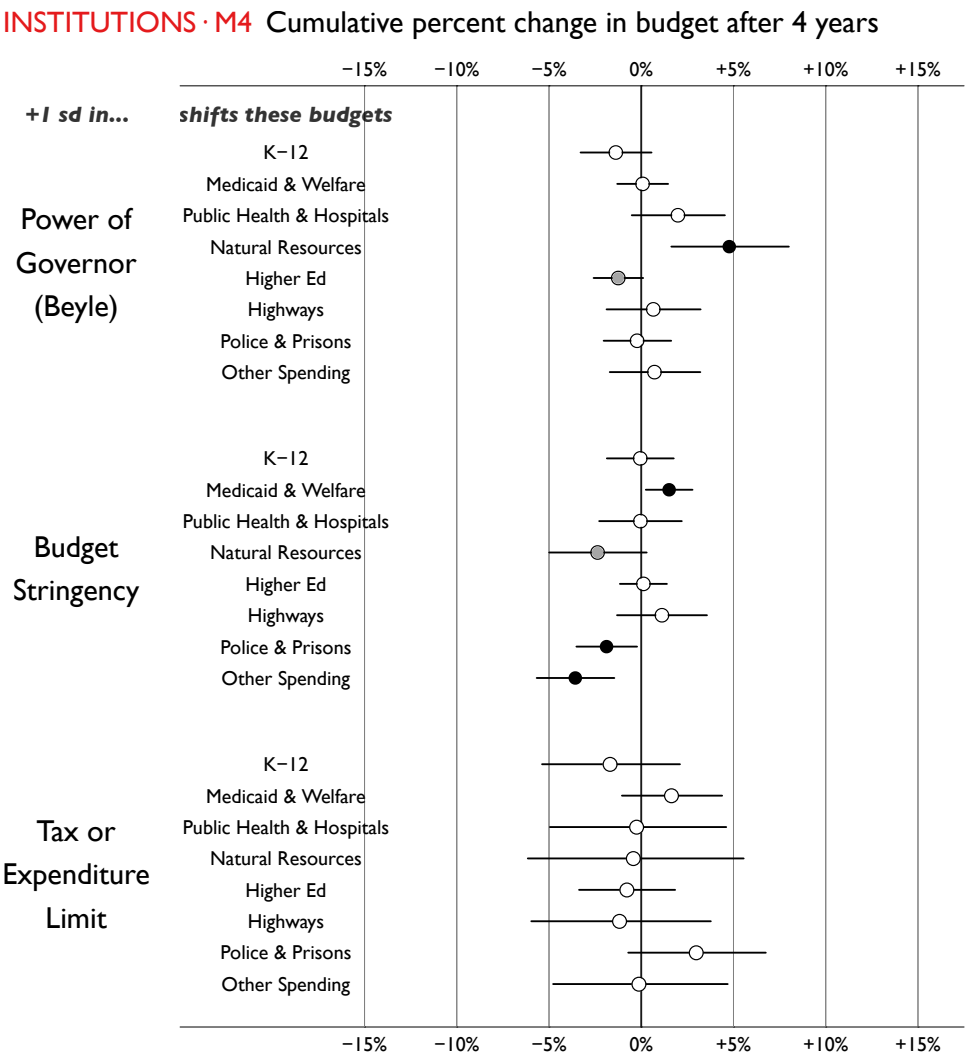

Figure A10. Estimated change in each budget component four years after institutional change: Control for tax and expenditure limits. Plotted points show the cumulative percent change in each budget share four years after either governor powers or budget stringency increases by one standard deviation from the mean level across states, or (in one model) if tax or expenditure limits are implemented.

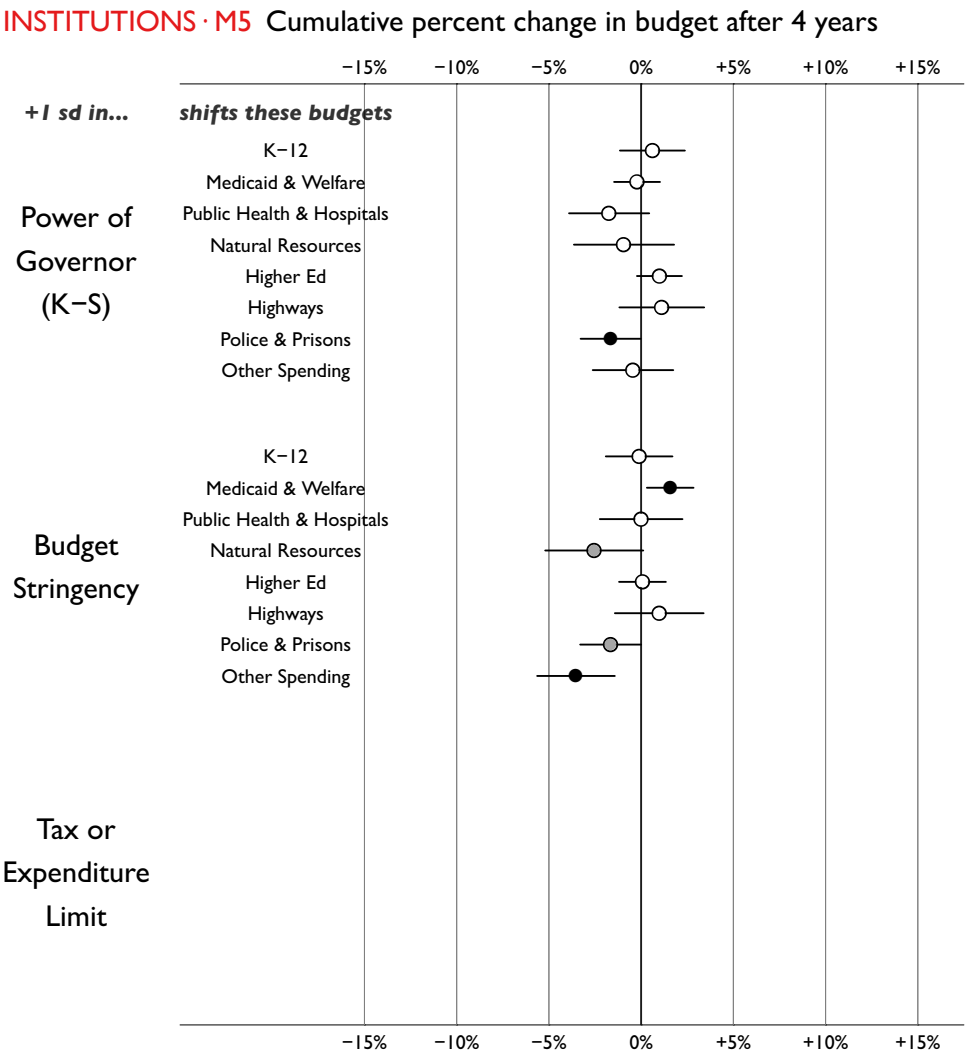

Figure A11. Estimated change in each budget component four years after institutional change: Alternative measure of Governor Power. Plotted points show the cumulative percent change in each budget share four years after either governor powers or budget stringency increases by one standard deviation from the mean level across states, or (in one model) if tax or expenditure limits are implemented.

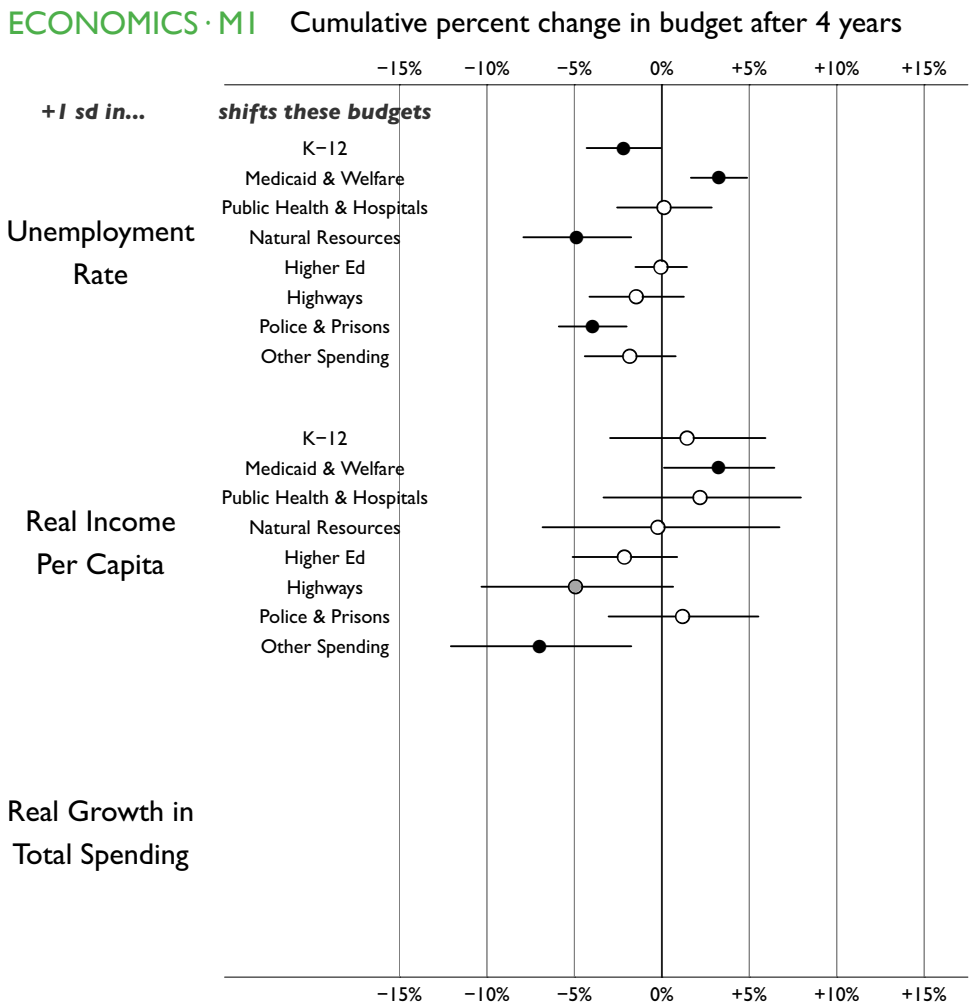

Figure A12. Estimated change in each budget component four years after a permanent economic shock: Baseline model (repeated as reference). Plotted points show the cumulative percent change in each budget share four years after either unemployment, real income per capita, or (in one model) real total spending per capita increases by one standard deviation from the mean level across states.

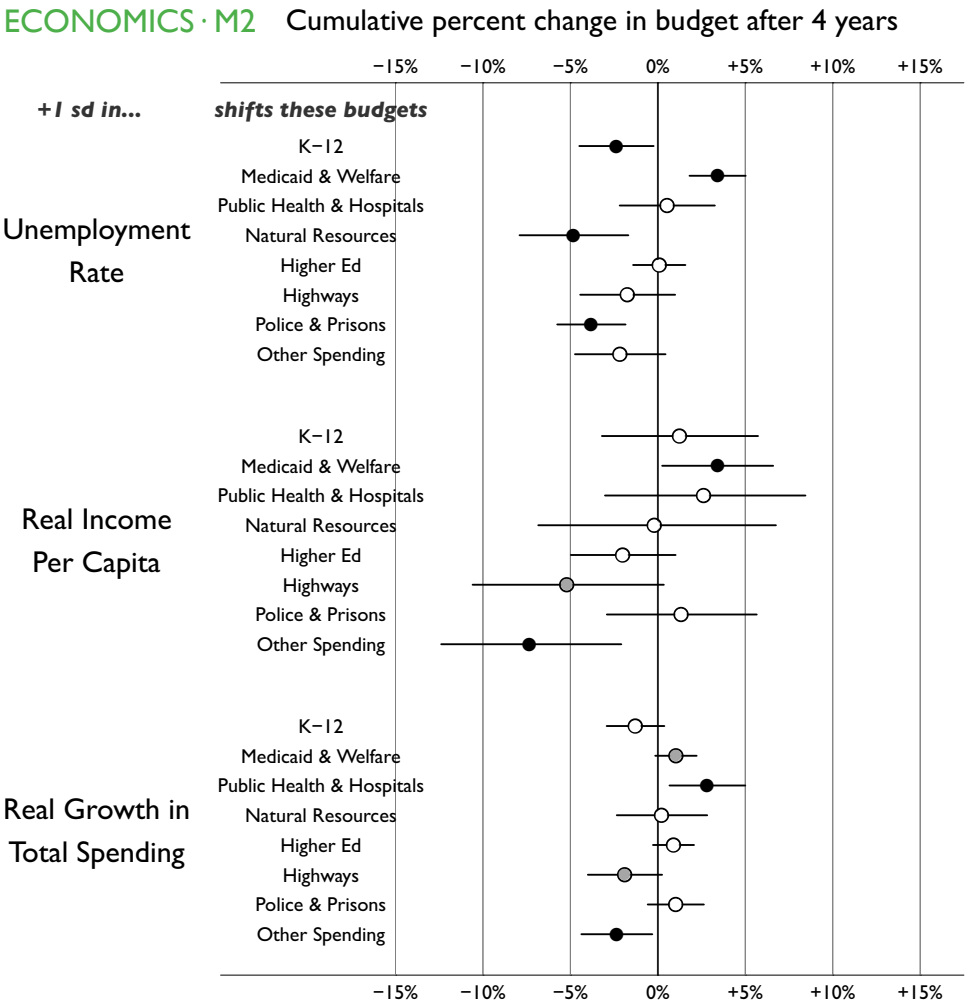

Figure A13. Estimated change in each budget component four years after a permanent economic shock: Control for Total Budget. Plotted points show the cumulative percent change in each budget share four years after either unemployment, real income per capita, or (in one model) real total spending per capita increases by one standard deviation from the mean level across states.

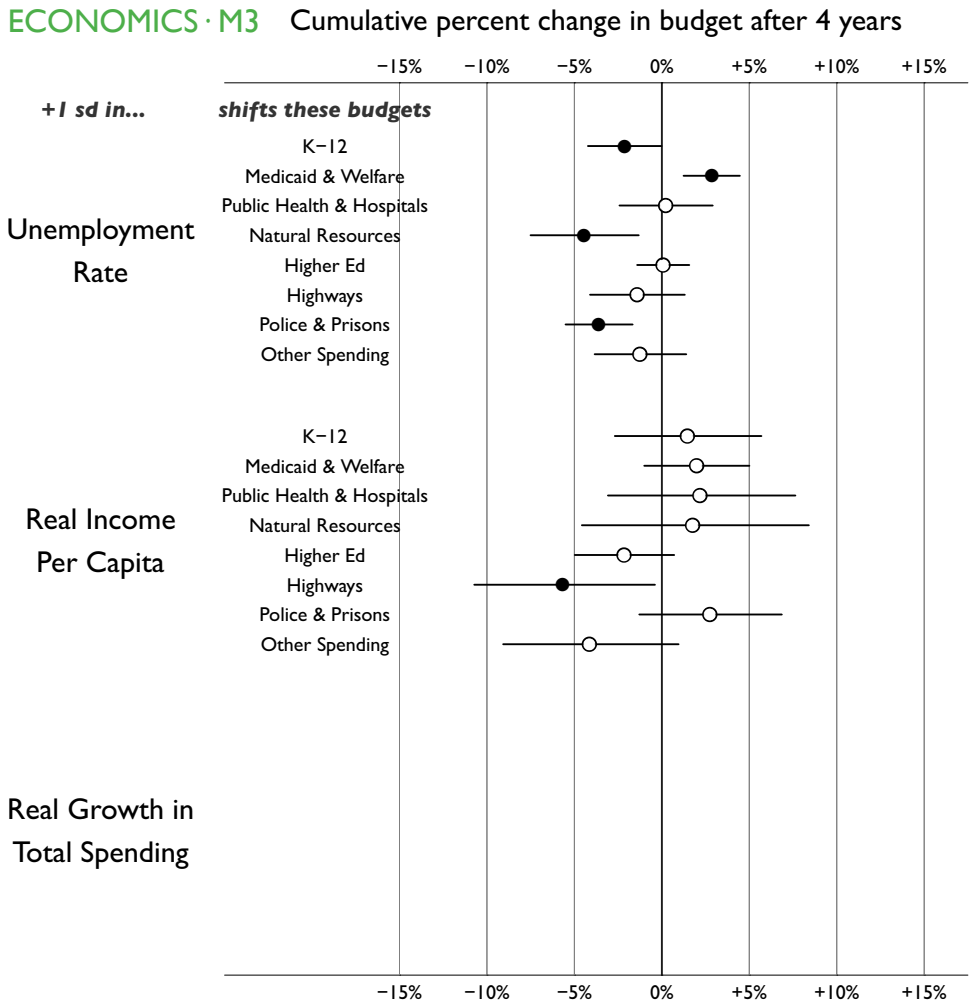

Figure A14. Estimated change in each budget component four years after a permanent economic shock: Drop Budget Stringency. Plotted points show the cumulative percent change in each budget share four years after either unemployment, real income per capita, or (in one model) real total spending per capita increases by one standard deviation from the mean level across states.

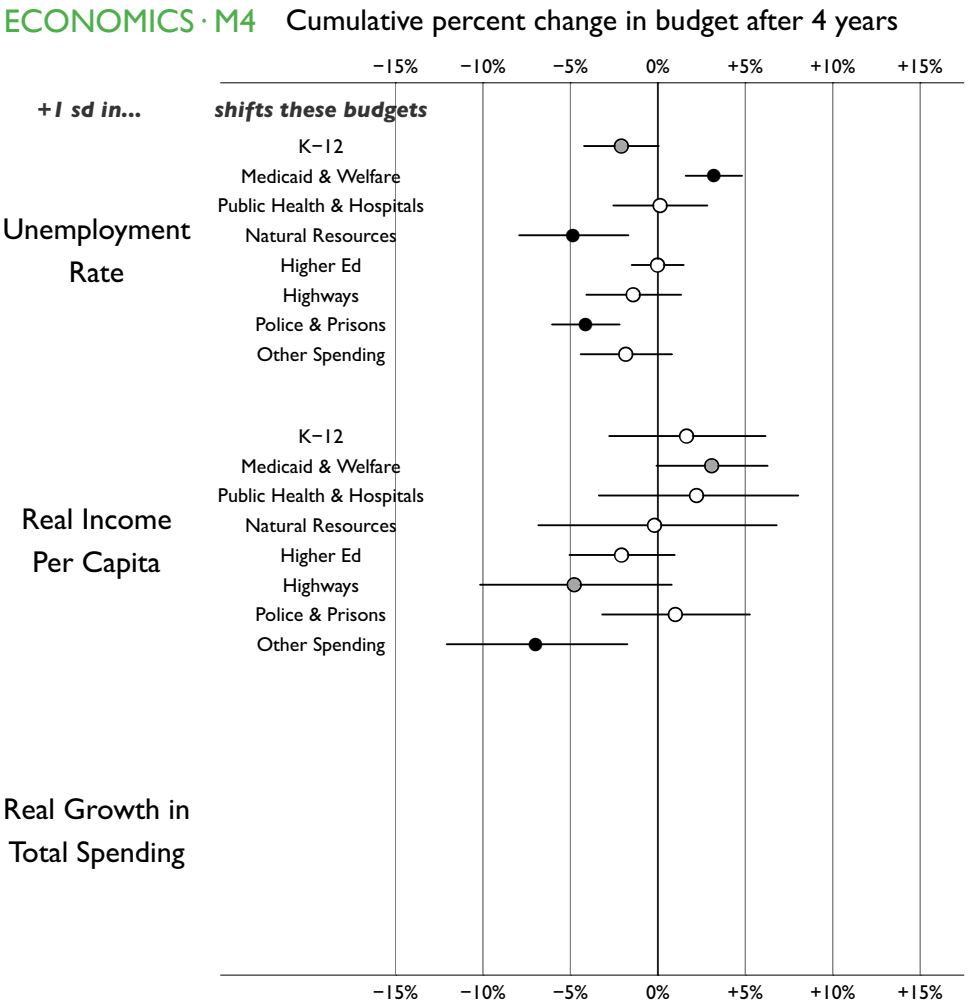

Figure A15. Estimated change in each budget component four years after a permanent economic shock: Control for tax and expenditure limits. Plotted points show the cumulative percent change in each budget share four years after either unemployment, real income per capita, or (in one model) real total spending per capita increases by one standard deviation from the mean level across states.

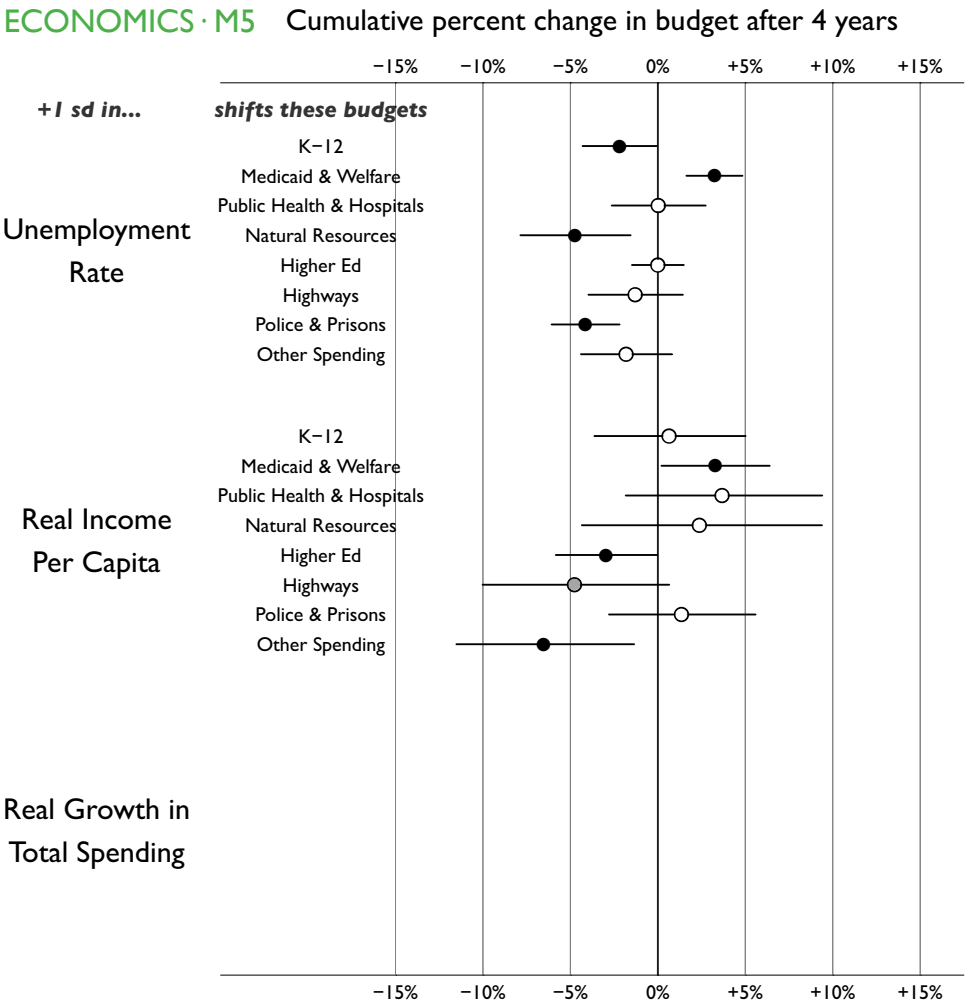

Figure A16. Estimated change in each budget component four years after a permanent economic shock: Alternative measure of Governor Power. Plotted points show the cumulative percent change in each budget share four years after either unemployment, real income per capita, or (in one model) real total spending per capita increases by one standard deviation from the mean level across states.

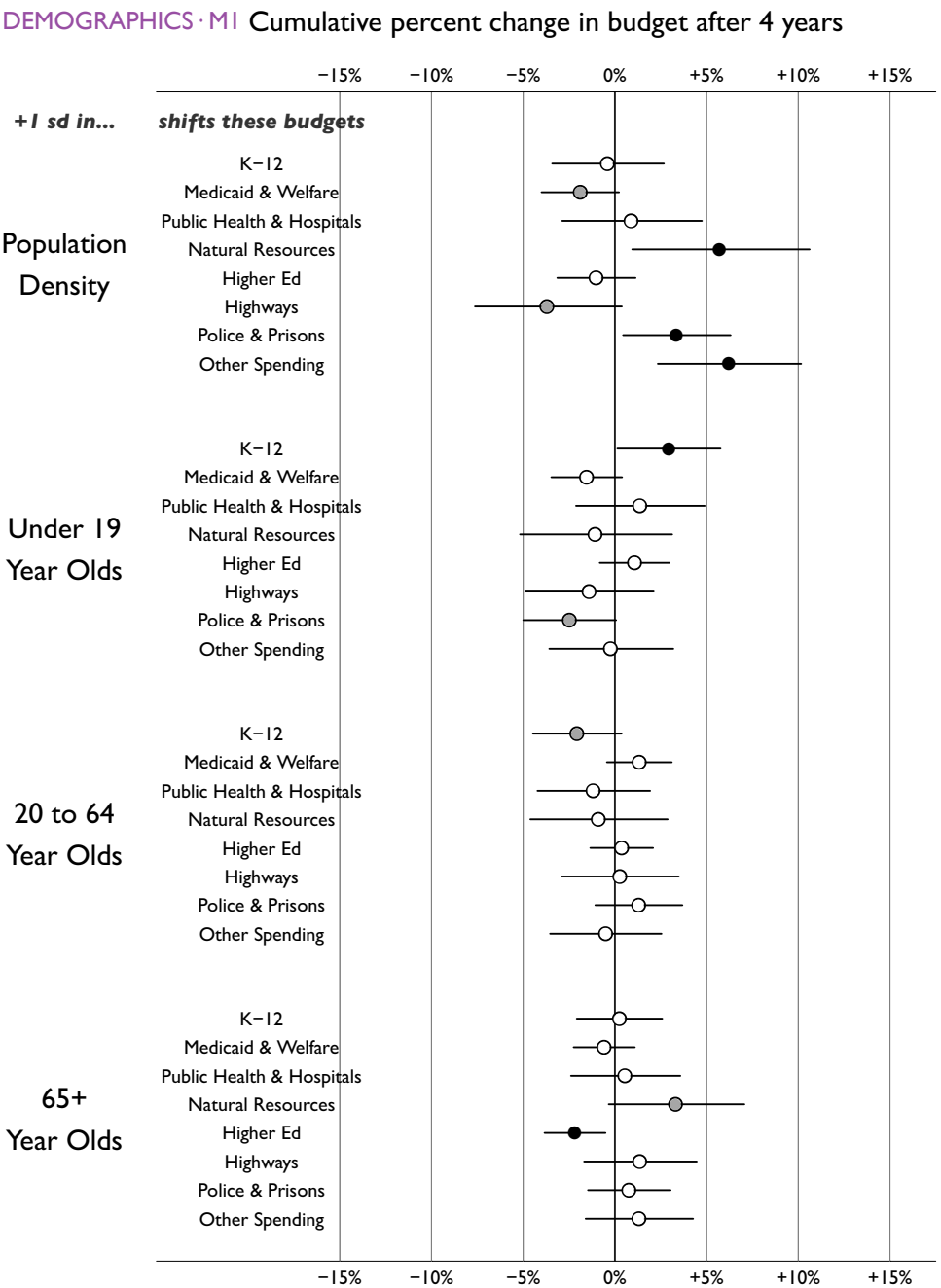

Figure A17. Estimated change in each budget component four years after demographic change: Baseline model (repeated as reference). Plotted points show the cumulative percent change in each budget share four years after either population density or one of three age groups increases by one standard deviation from the mean level across states.

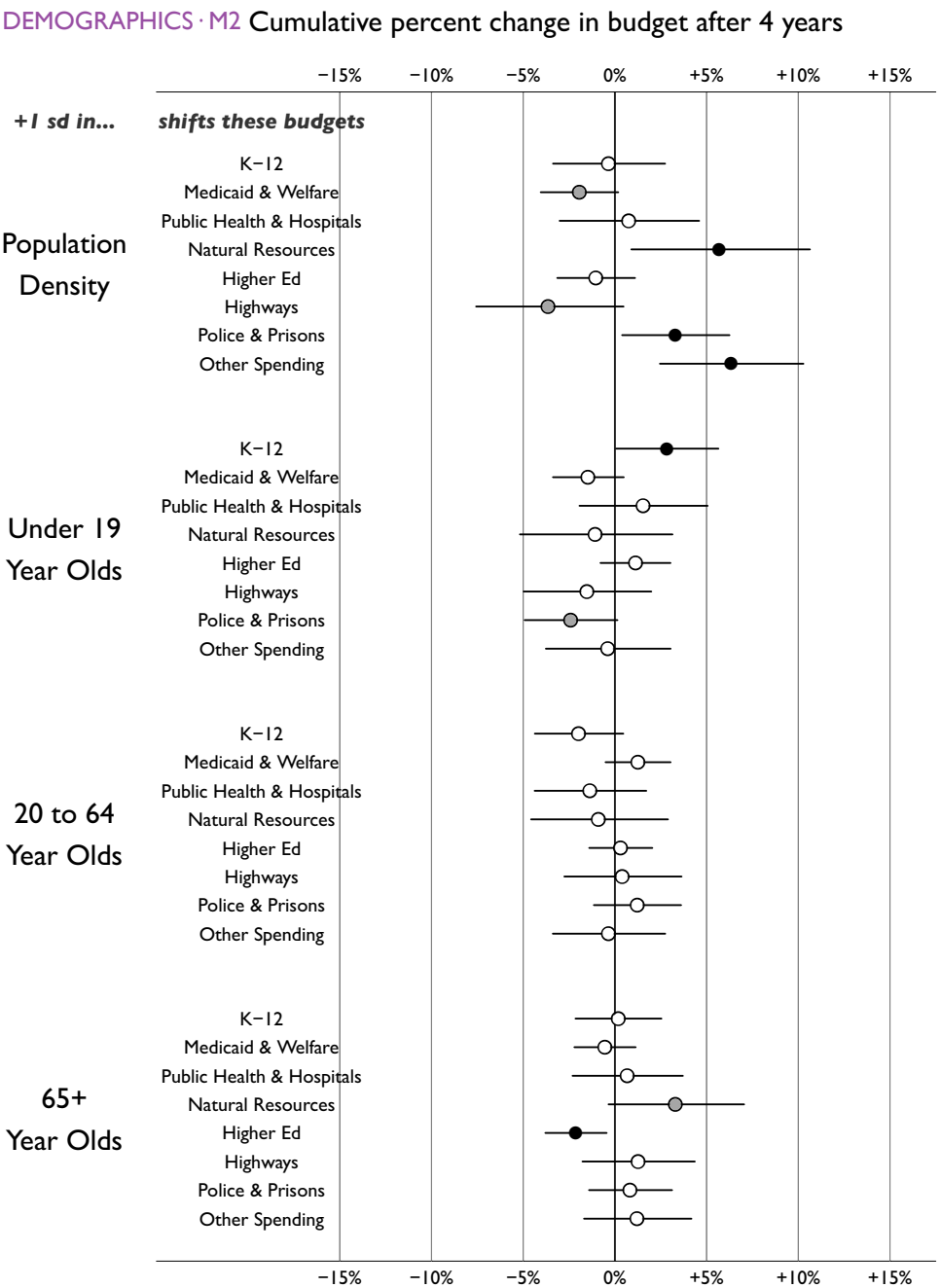

Figure A18. Estimated change in each budget component four years after a permanent economic shock: Control for Total Budget. Plotted points show the cumulative percent change in each budget share four years after either population density or one of three age groups increases by one standard deviation from the mean level across states.

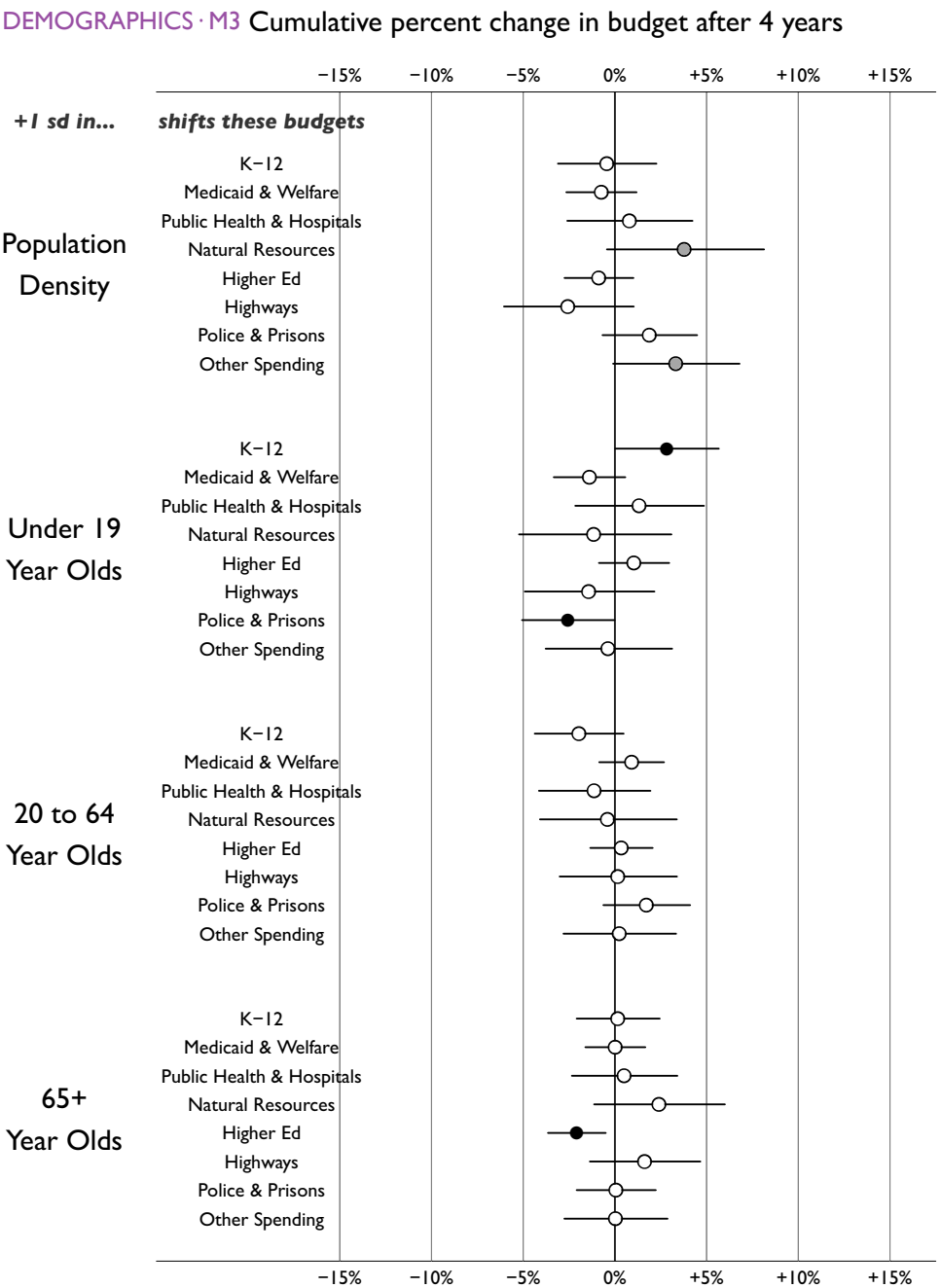

Figure A19. Estimated change in each budget component four years after a permanent economic shock: Drop Budget Stringency. Plotted points show the cumulative percent change in each budget share four years after either population density or one of three age groups increases by one standard deviation from the mean level across states.

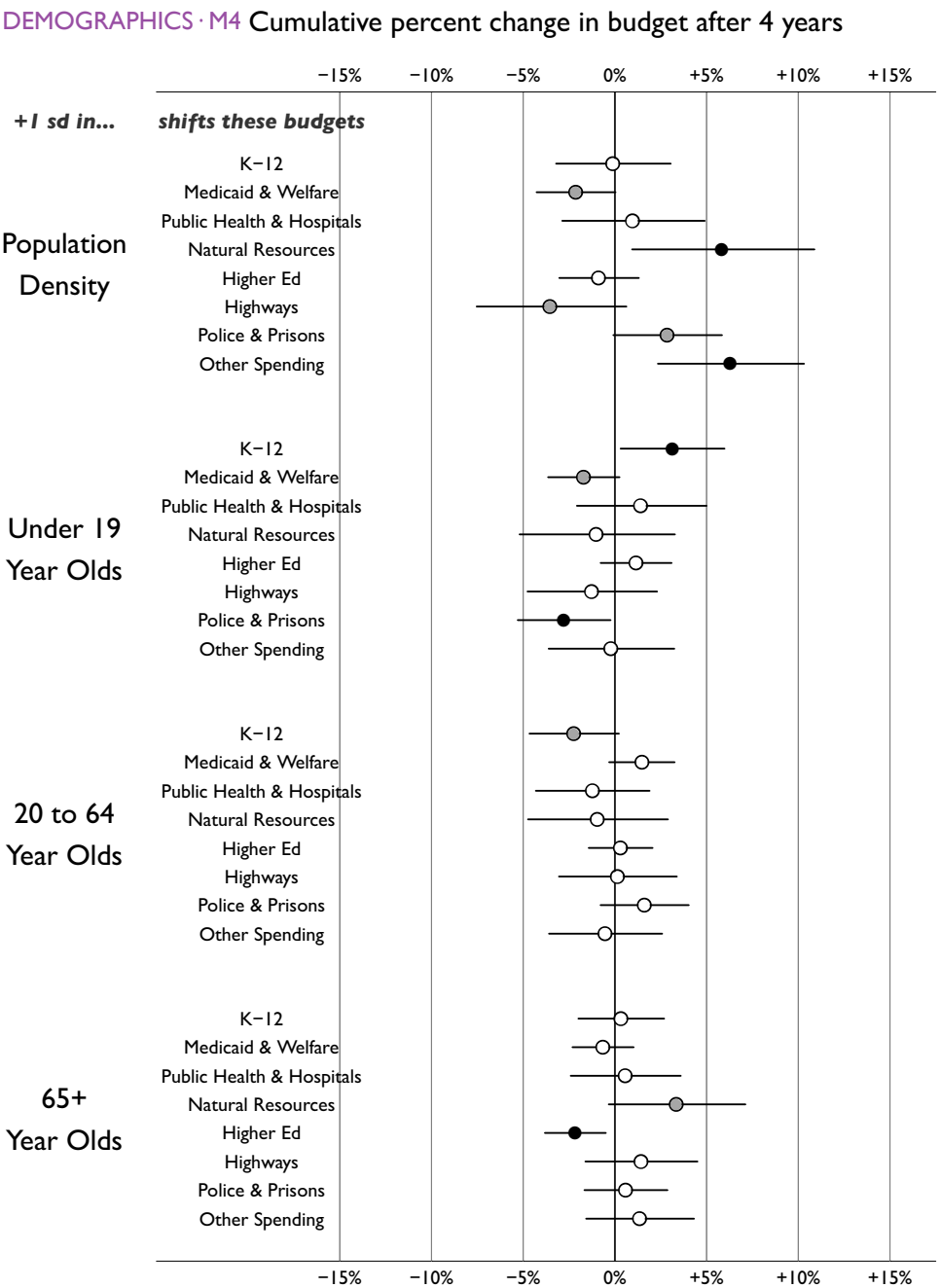

Figure A20. Estimated change in each budget component four years after a permanent economic shock: Control for tax and expenditure limits. Plotted points show the cumulative percent change in each budget share four years after either population density or one of three age groups increases by one standard deviation from the mean level across states.

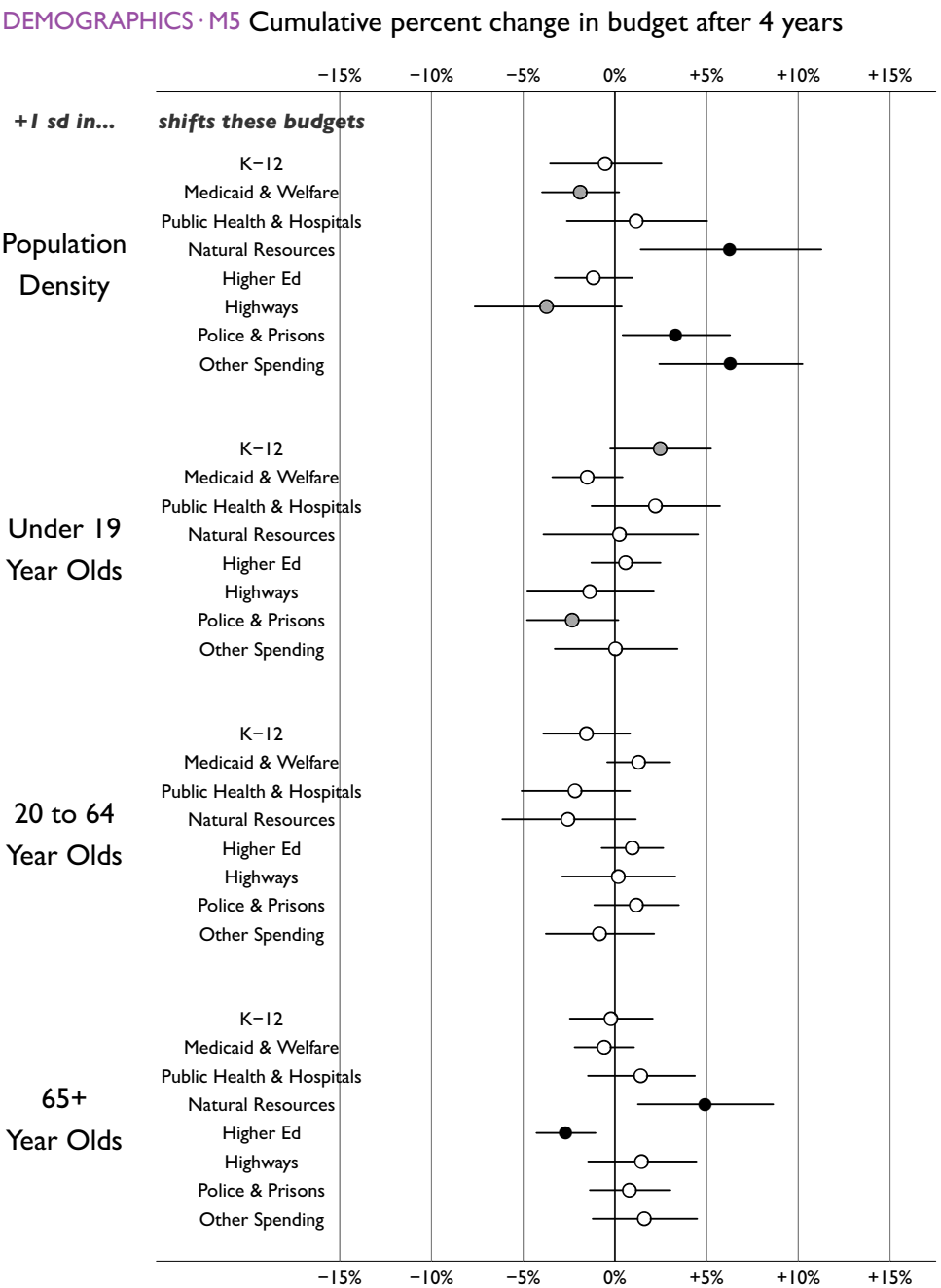

Figure A21. Estimated change in each budget component four years after a permanent economic shock: Alternative measure of Governor Power. Plotted points show the cumulative percent change in each budget share four years after either population density or one of three age groups increases by one standard deviation from the mean level across states.

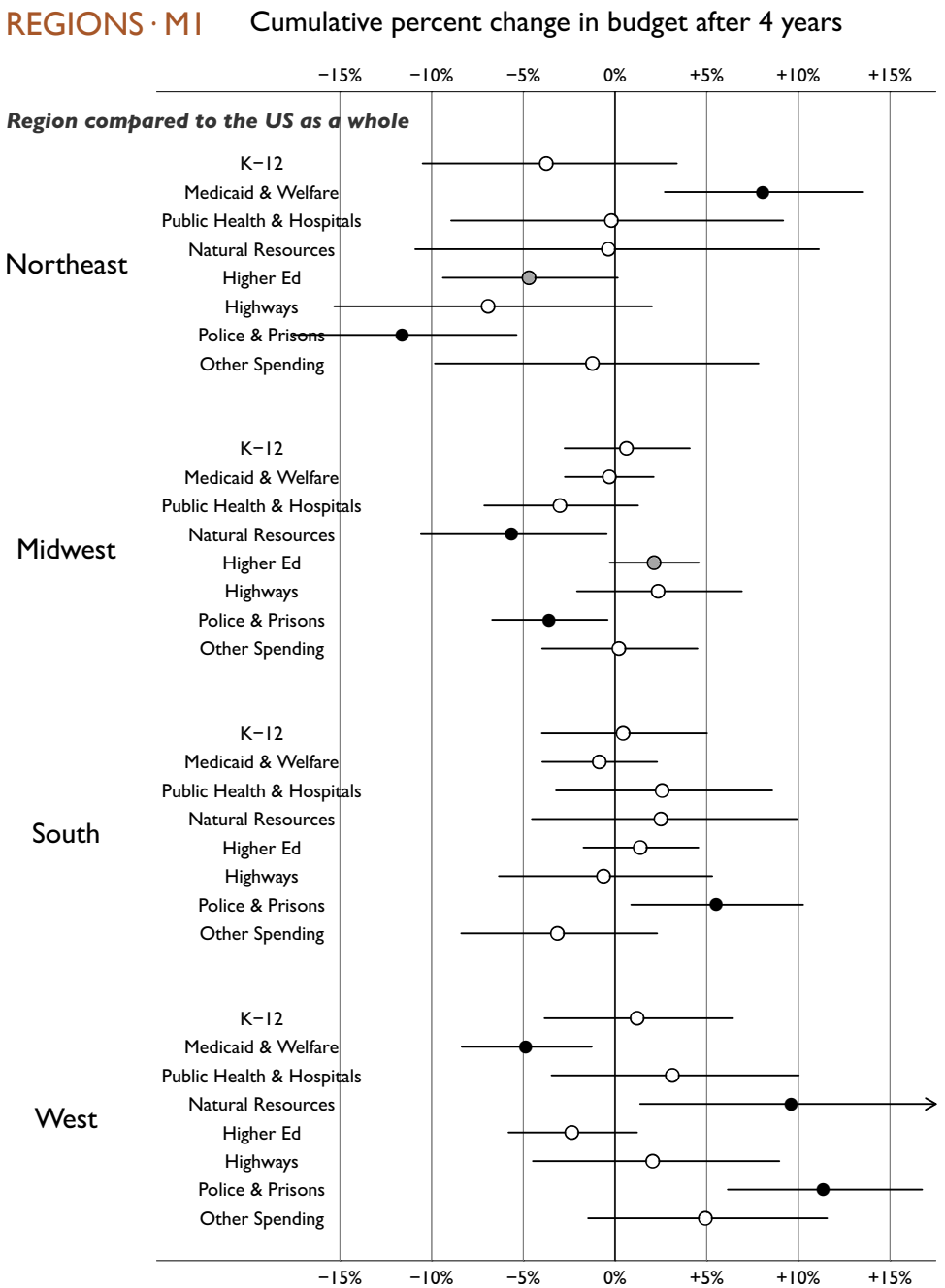

Figure A22. Estimated change in each budget component four years after hypothetical "region" change: Baseline model (repeated). Plotted points show the cumulative percent change in each budget share four years after a hypothetical shift from the country average to a specific region.

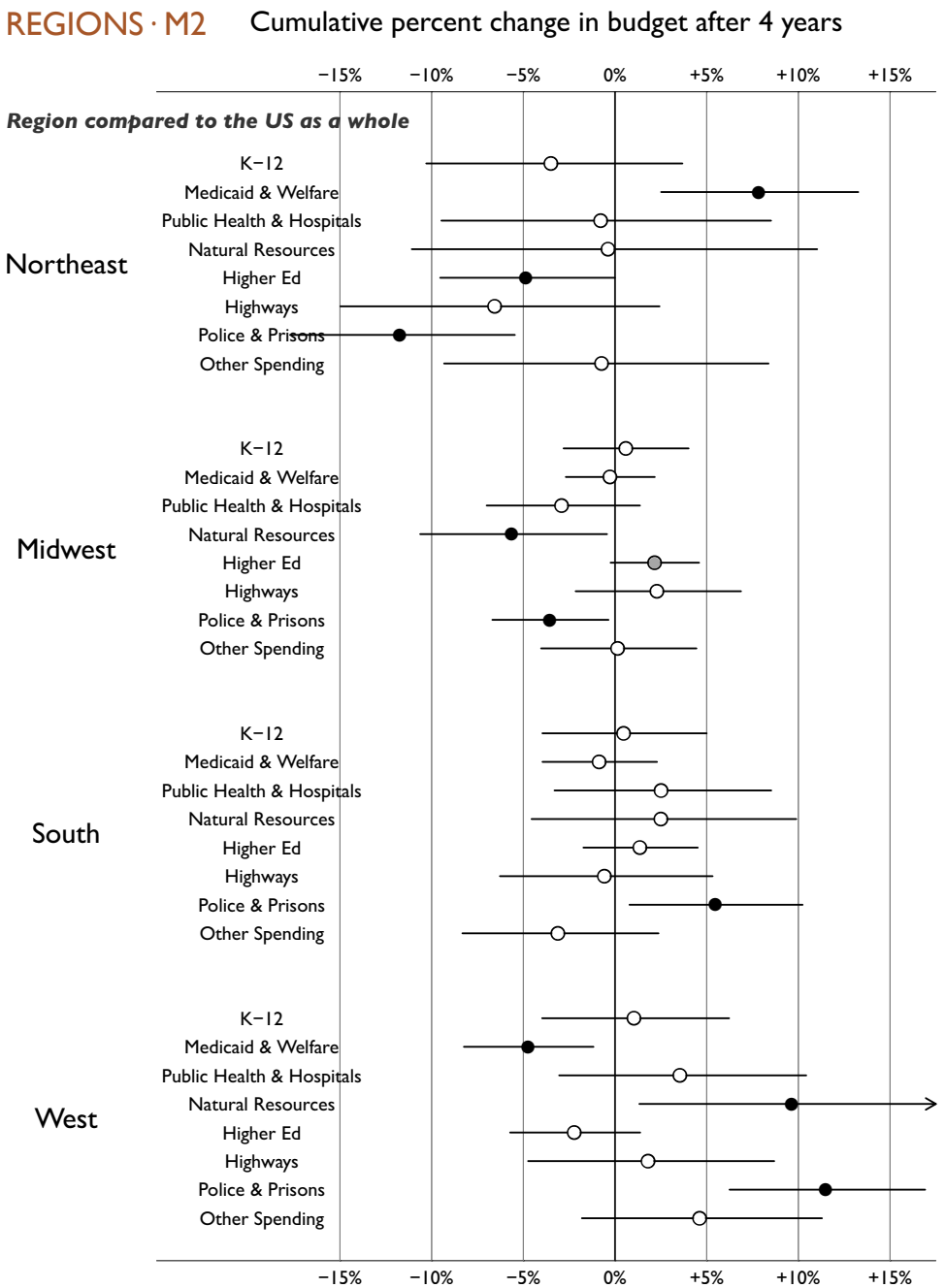

Figure A23. Estimated change in each budget component four years after hypothetical "region" change: Control for Total Budget. Plotted points show the cumulative percent change in each budget share four years after a hypothetical shift from the country average to a specific region.

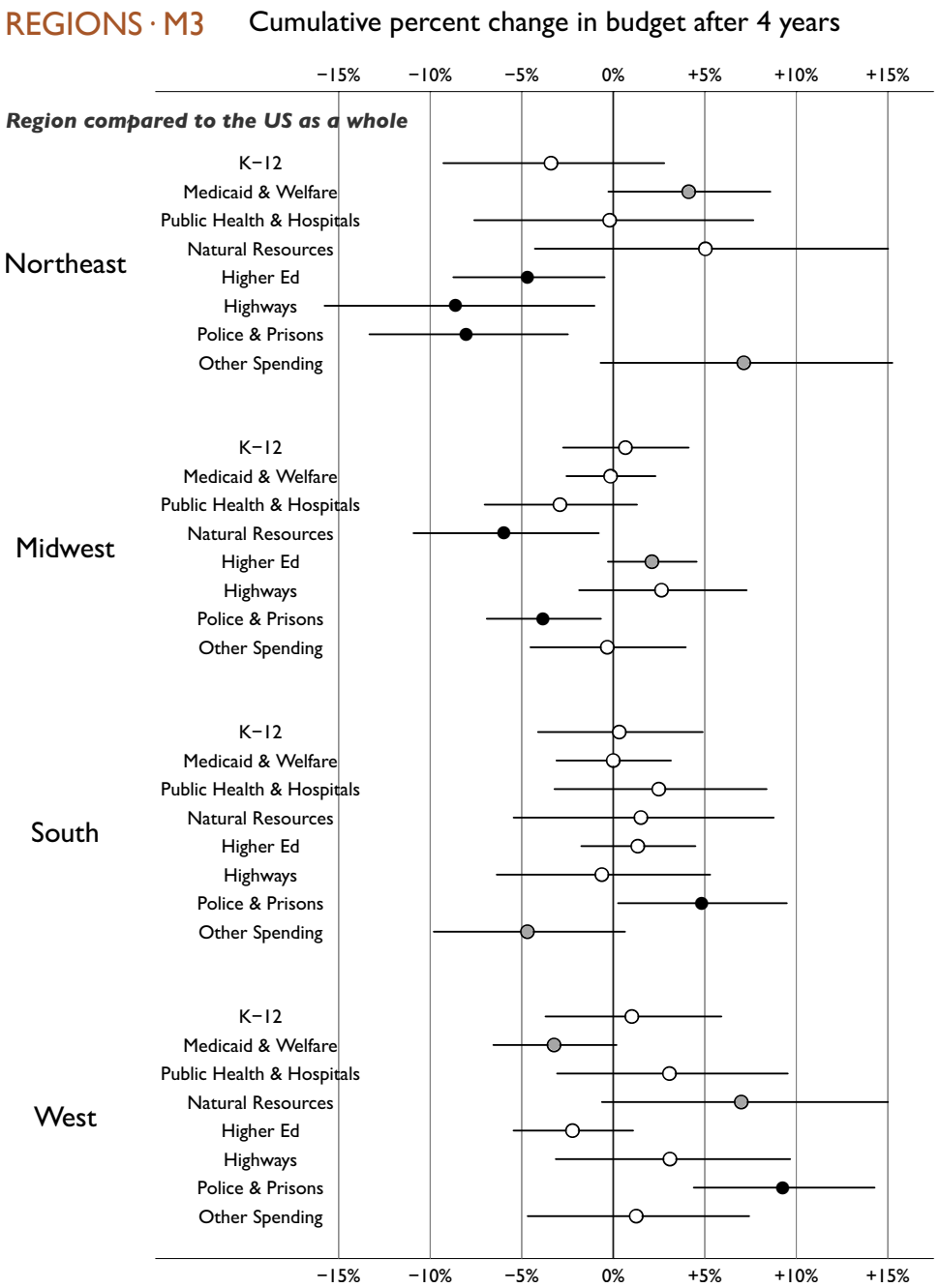

Figure A24. Estimated change in each budget component four years after hypothetical "region" change: Drop Budget Stringency. Plotted points show the cumulative percent change in each budget share four years after a hypothetical shift from the country average to a specific region.

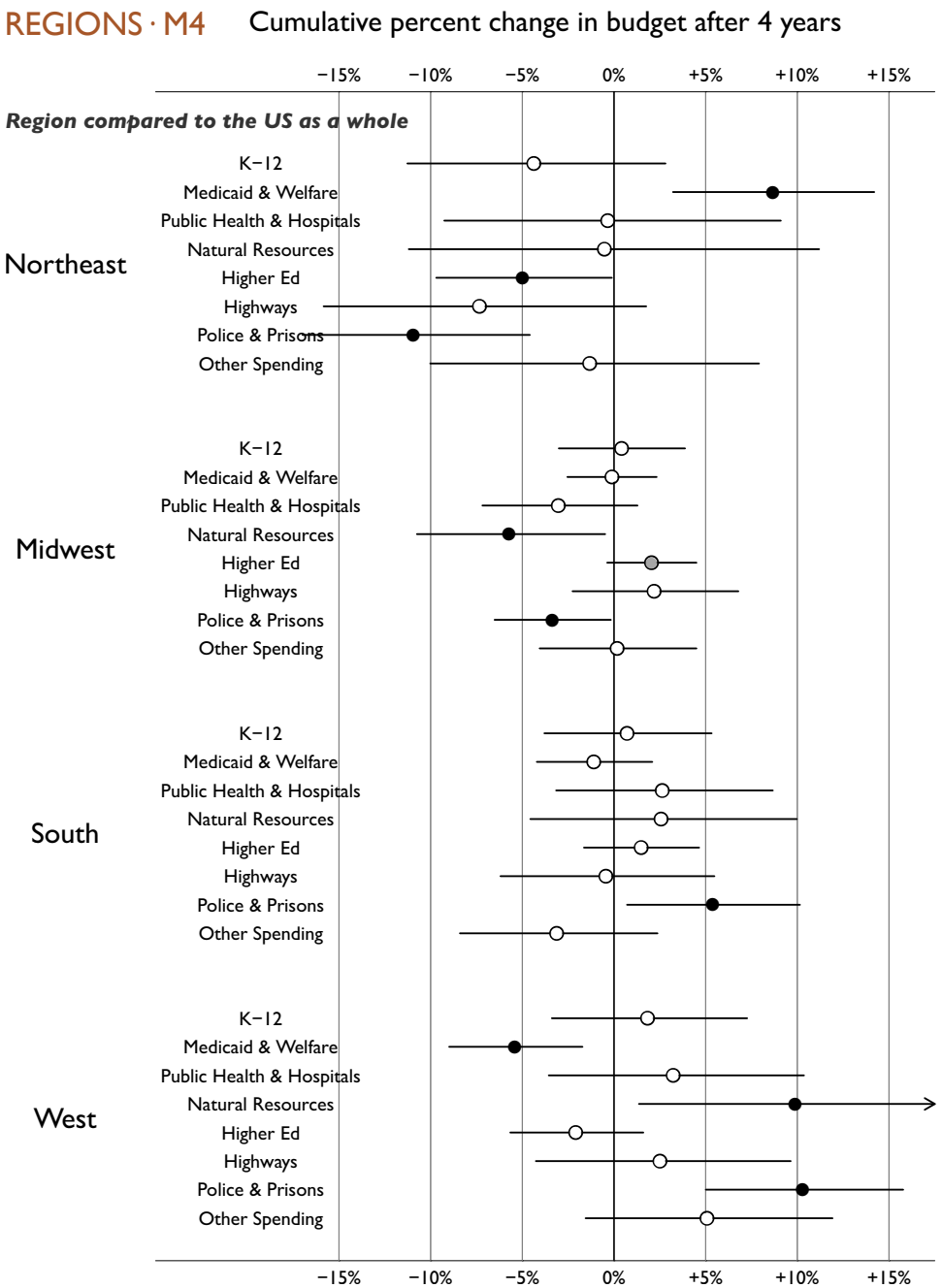

Figure A25. Estimated change in each budget component four years after hypothetical "region" change: Control for tax and expenditure limits. Plotted points show the cumulative percent change in each budget share four years after a hypothetical shift from the country average to a specific region.

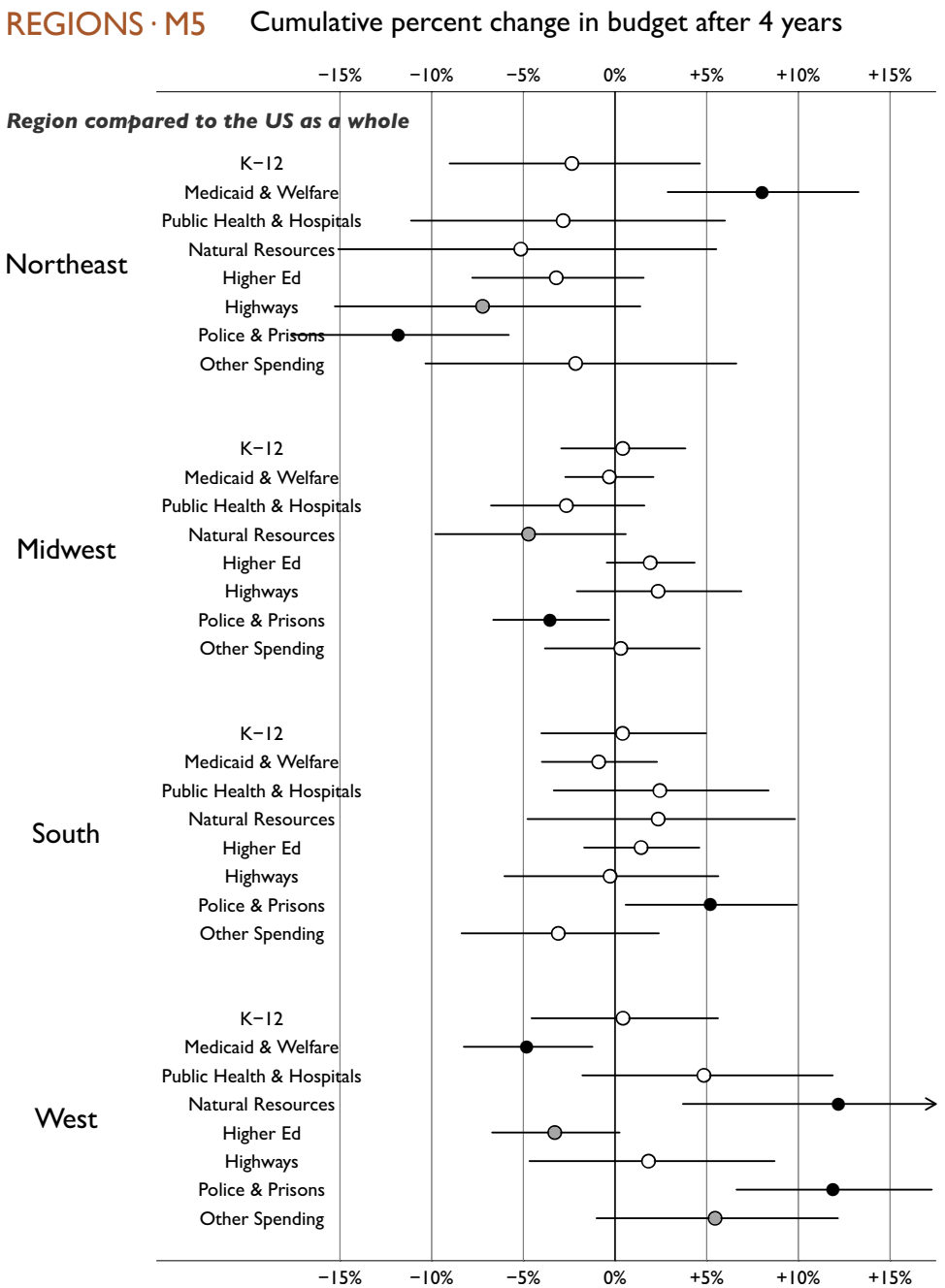

Figure A26. Estimated change in each budget component four years after hypothetical "region" change: Alternative measure of Governor Power. Plotted points show the cumulative percent change in each budget share four years after a hypothetical shift from the country average to a specific region.