

For Online Publication

**Internet Appendix for
“The Hidden Costs of Government Shutdowns”**

Included in this document are supplementary results for the paper, “The Hidden Costs of Government Shutdowns.” Part A of this document details the sample construction procedure for the final sample used in the paper. Part B describes the estimation procedure used to compute the relative cost efficiency of temporary staffing. Part C reports robustness exercise results as well as additional figures.

A. Sample construction

This section describes the sample construction methods used and the data filters applied to obtain our final sample. There are five distinct steps, lettered “A” to “E,” as well as one pre-construction step (“Z”). For each sub-step in which the sample size is changed, the number of observations is listed next to the sub-step in **bold text**.

The steps begin by using cross-walked employment status or dynamics files from the OPM. The status files contain information on employment status; the dynamics files contain information on changes to employment status, including all separation actions (e.g., quits, retirements, terminations, reductions in force, deaths, transfers). These files are row-wise identical to the raw data, with the sole exception that their encoded values have been translated using the OPM-supplied cross-walking file. Thus, the data filters applied in this construction process are the only filters applied throughout the entire data pipeline.

Z. Post-shutdown unique names retrieval

1. For each post-shutdown status file (2013.III–2017.III), keep only NSFTPs. Then, drop non-unique names. Append all of these intermediate files and drop names that are non-unique in at least one of the status files. Keep only names observed in 2013.III. Save file (“File Z1”). **[522,030]**
2. For each pre-shutdown status file (2009.III–2013.II), keep only NSFTPs. Then, drop non-unique pseudo identifiers (IDs). Append all of these intermediate files and drop pseudo IDs that are non-unique in at least one of the status files. Keep only pseudo IDs observed in 2009.III. Save file (“File Z2”). **[676,163]**

A. Dynamics file cleaning

First, append all the 2009.IV–2017.III cross-walked dynamics files into one file. Then, clean the stacked file as follows: **[2,041,413]**

1. Keep only non-seasonal full-time employees (NSFTPs). **[981,817]**
2. Keep only dynamics actions dated between October 1, 2009 and September 30, 2017. **[980,841]**
3. Keep only non-transfer separation actions. **[500,196]**
4. Drop observations with redacted names.¹ **[351,488]**
5. Stratify the stacked file into two panels corresponding to the pre- and post-periods.
 - a. 2013.IV–2017.III panel:
 - i. Keep separation actions dated between 2013.IV and 2017.III. **[196,218]**
 - ii. Merge this panel on employee names with the post-shutdown unique-names file (Z1). **[99,179]**
 - iii. Keep only the last separation action (sorted by the effective date of the action) for each employee name. **[98,287]**
 - iv. Save file (“File A1”).
 - b. 2009.III–2013.III panel:
 - i. Keep separation actions dated between 2009.IV and 2013.III. **[155,270]**

¹Names are redacted by OPM for security purposes.

- ii. Merge this panel on pseudo ID with pre-shutdown unique-pseudo IDs file (Z2). [127,886]
- iii. Keep only the last separation action (sorted by the effective date of the action) for each pseudo ID. [127,191]
- iv. Save file ("File A2").

B. Status file cleaning

Clean the cross-walked status files as follows:

- a. 2009.III [1,310,733]:
 - i. Keep only NSFTPs. [1,110,108]
 - ii. Drop observations with redacted names. [676,594]
 - iii. Drop pseudo IDs that are not unique in 2009.III and merge on pre-shutdown unique-pseudo IDs file (Z2). [676,163]
 - iv. Save file ("File B1").
- b. 2013.III (pseudo ID-matched) [1,334,966]:
 - i. Keep only NSFTPs. [1,156,437]
 - ii. Drop observations with redacted names. [722,902]
 - iii. Drop pseudo IDs that are not unique in 2013.III and merge on pre-shutdown unique-pseudo IDs file (Z2). [537,232]
 - iv. Save file ("File B2").
- c. 2013.III (name-matched) [1,334,966]:
 - i. Keep only NSFTPs. [1,156,437]
 - ii. Drop observations with redacted names. [722,902]
 - iii. Drop employee names that are not unique in 2013.III and merge on post-shutdown unique-names file (Z1). [522,036]
 - iv. Save file ("File B3").
- d. 2017.III [1,356,647]:
 - i. Keep only NSFTPs. [1,193,547]
 - ii. Drop observations with redacted names. [887,295]
 - iii. Drop employee names that are not unique in 2013.III and merge on post-shutdown unique-names file (Z1).
 - iv. Save file ("File B4").

C. Post-cohort panel construction

Construct the 2013.IV–2017.III panel as follows:

- 1. Use the 2013.III unique-names status file (B3). [522,036]
- 2. Merge this file on employee name with the post-shutdown dynamics panel (A1). Keep only observations in the master or matched files, thereby dropping dynamics observations that cannot be matched to any individual employed in 2013.III.
- 3. Merge this file on employee name with the 2017.III unique-names status file (B4). Keep only observations in the master or matched files.

4. Keep only observations on the General Schedule pay plan. [380,633]
5. Merge in “percent furloughed” variable, keeping only matched observations. [318,224]
6. Merge in occupation types, keeping all matching types. Keep only observations in occupations that are not involved in the protection of life or property. [236,309]
7. Drop observations with missing age, education, years of service, occupation, or General Schedule grade information. [235,301]
8. Drop observations with missing salary information. [235,207]
9. Drop observations with missing state or county information. [234,786]
10. Keep only observations that are matched in either Step 2 or Step 3. That is, keep only those employees who either remained at their job or had separation actions that satisfy two conditions: (a) the name is either in the post-shutdown dynamics panel (A1) or in the last status file (2017.III) of our four-year sample period (B4), and (b) the name is missing in both (A1) and (B4). [210,933]
11. Save file (“File C”).

D. Pre-cohort panel construction

Construct the 2009.IV–2013.III panel as follows:

1. Use the 2009.III unique-pseudo IDs status file (B1). [617,163]
2. Merge this file on pseudo ID with the pre-shutdown dynamics panel (A2). Keep only observations in the master or matched files, thereby dropping dynamics observations that cannot be matched to any 2009.III employee.
3. Merge on employee name with 2013.III unique-pseudo IDs status file (B2). Keep only master or matched observations.
4. Keep only observations for employees on the General Schedule pay plan. [490,711]
5. Merge in “percent furloughed” variable, keeping only matched observations. [393,220]
6. Merge in occupation types, keeping all matching types. Keep only observations in occupations that are not involved in the protection of life or property (“PLP”). [299,449]
7. Drop observations with missing age, education, tenure, occupation, or grade information. [297,994]
8. Drop observations with missing salary information. [297,765]
9. Drop observations with missing state or county information. [296,006]
10. Keep only observations that are matched in either Step 2 or Step 3. That is, keep only employees who either remained at their job or had separation actions that satisfy two conditions: (a) the pseudo ID is either in the pre-shutdown dynamics panel (A2) or in the last status file (2013.III) of our four-year sample period (B2), and (b) the pseudo ID is missing in both (A2) and (B2). [288,968]
11. Save file (“File D”).

E. Final panel construction

Construct the 2009.IV–2017.III final sample as follows:

1. Append the post-shutdown panel (C) to the pre-shutdown panel (D). [499,901]
2. Drop observations that are omitted from the estimation sample of our main specification. [499,898]

B. Procedure for estimating the relative cost efficiency of temporary staffing

We find that, in the two years after the shutdown, replacing former salaried workers who had furlough-related separations with temporary staffers was 4.75 times less payroll-efficient on average than the counterfactual in which the same employees remained employed with the federal government. That is, affected bureaus spent $(4.75 - 1) \times 100 = 375\%$ more on average than unaffected bureaus. In dollar terms, this relative decline in payroll efficiency amounts to \$969 million in increased temporary help services contract spending for affected bureaus. We describe our procedure for obtaining these calculations below.

1. Using the population data for civilian non-defense federal employees (not our final sample), we construct a panel of the total number of non-blue-collar NSFTPs and the average salaries of these NSFTPs in each bureau in the last quarter of each fiscal year. We keep only observations for the fiscal years 2014 and 2015 and compute average NSFTP counts and average salaries within each bureau in the pooled data for these two years. This leaves us with cross-sectional data at the bureau level.
2. We match this cross-sectional data to the panel of contracting data from [USAspending.gov](https://www.usaspending.gov), which contains data on the contract spending on non-blue-collar temporary staffing for each bureau and each fiscal year. We keep only observations for majority furloughed bureaus. This leaves us with 45 affected bureaus compared with 89 affected bureaus in our final sample—the two differ due to USAspending.gov data restrictions.
3. For each bureau, we compute the change in temporary staffing contract spending from fiscal years 2013 to 2011, as well as the change from 2015 to 2013. We then de-trend the 2015–2013 contract spending change using the 2013–2011 contract spending change by subtracting the latter from the former. This gets us the change in temporary staffing contract spending from 2015–2013 in excess of the trend.
4. For each bureau, we compute the average number of separations by multiplying the number of NSFTPs (calculated in Step 1) by the point estimate for one-year furlough-related separations (1.484) from Column 3 of Table II. Next, we compute the total salaries of the furlough-related leavers by multiplying the average number of separations by the average salaries (also calculated in Step 1).
5. For each bureau, we divide the de-trended contract spending change (calculated in Step 3) by the total salaries of employees with furlough-related separations (calculated in Step 4) to compute the *relative payroll efficiency* of temporary workers to salaried workers. If the two are equally payroll-efficient, this quotient should equal 1. If salaried workers are more payroll-efficient, this quotient should be greater than 1, and vice versa. The mean of this quotient in our 45-bureau subsample is 4.75.

What if we account for savings in salaried employee benefits spending? A United States Department of Agriculture employee webpage claims that the federal government

spends on average 38% of NSFTP salaries on employee benefits, which is slightly higher than the number that the Bureau of Labor Statistics reports for private sector employees (30%).^{2,3} Therefore, accounting for employee benefits spending brings the headline statistic reported in Step 5 down to $(4.75 / 1.38 - 1) \times 100 = 244\%$.

Implicit in these calculations are three main simplifying assumptions. The first assumption is that furlough-related separations occur at a constant rate over fiscal years 2014 and 2015, so that the total payroll savings accrued by not having to pay these workers is just the average of the total annual payrolls in fiscal years 2014 and 2015. Figure 4 shows evidence consistent with this assumption.

The second assumption is that the average affected bureau in our 45-bureau subsample has the same one-year average treatment effect of furlough as the average affected bureau in our final sample does. We find evidence consistent with this assumption as well. Removing the 44 out of 89 affected bureaus that are excluded from this 45-bureau subsample from our final sample leaves us with 440,172 observations (versus 499,898 in the final sample). Estimating our main regression specification again (Column 3 in Table II) on this 45-bureau subsample yields a point estimate of 1.345 on the main coefficient of interest with a standard error of 0.275 (clustered by bureau).

The third assumption is that all changes in de-trended temporary staffing contract spending from 2015 to 2013 are due to furlough-related vacancies. This assumption would be invalidated if affected bureaus systematically experienced greater-than-predicted workloads relative to unaffected bureaus and were unable to service this workload with their existing permanent workforce. This case appears implausible, however, given the broad variety of work carried out among affected bureaus.

²<https://www.fsis.usda.gov/careers/incentives/federal-employee-benefits-summary>

³<https://www.bls.gov/news.release/pdf/ecec.pdf>

C. Supplementary tables and figures

Table IA.1: Model estimation on alternatively-constructed data

This table presents robustness results for our main regression specification with respect to the sample construction. Our main sample tracks employees over time based on names and employment. Alternatively, the OPM has (in response to previous FOIA requests) provided individual “pseudo identifiers” that are available up to three quarters after the 2013 government shutdown. Columns 1 to 3 present results on our main sample using a three-quarter window for the employment outcomes, while Columns 4 to 6 repeat our main test using this three-quarter window for the employment outcomes while matching on personal identifiers. A detailed description of all variables is available in Appendix A. Standard errors in parentheses are clustered at the bureau level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

	Three-quarter employment outcomes					
	Main sample			ID-matched sample		
	Separated	Quit	Retired	Separated	Quit	Retired
	(1)	(2)	(3)	(4)	(5)	(6)
Majority furloughed \times Post-shutdown	1.192*** (0.238)	0.256** (0.098)	0.768*** (0.176)	1.116*** (0.214)	0.256*** (0.087)	0.686*** (0.171)
Person controls	Yes	Yes	Yes	Yes	Yes	Yes
Job controls	Yes	Yes	Yes	Yes	Yes	Yes
MSA \times cohort FE	Yes	Yes	Yes	Yes	Yes	Yes
Bureau FE	Yes	Yes	Yes	Yes	Yes	Yes
Occupation FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	499,898	499,898	499,898	614,421	614,421	614,421
Adjusted R-squared	0.03	0.01	0.05	0.03	0.01	0.05
Mean of dependent variable	3.63	0.90	2.36	3.66	0.99	2.31

Table IA.2: Separations for D.C.-based employees

Analogous to Table II, this table presents the results of the difference-in-differences analysis of the propensity for any type of employee separation for employees based in the Washington, D.C. area following the government shutdown. The estimations are in the form described in Equation (1). Column 2 includes person-level controls (i.e., education, tenure, and age). Column 3 also includes job controls (i.e., General Schedule grade and supervisory status) as well as occupation fixed effects. A detailed description of all variables is available in Appendix A. Standard errors in parentheses are clustered at the bureau level. Washington, D.C. encompasses seven metropolitan statistical areas: Washington-Arlington-Alexandria, D.C.-VA-MD-WV; Baltimore-Columbia-Towson, MD; Hagerstown-Martinsburg, MD-WV; Chambersburg-Waynesboro, PA; Winchester, VA-WV MSA; California-Lexington Park, MD; and Easton, MD. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

	Separated (within 4 quarters)		
	(1)	(2)	(3)
Majority furloughed \times Post-shutdown	1.241*** (0.306)	1.304*** (0.419)	1.287*** (0.360)
Person controls	No	Yes	Yes
Job controls	No	No	Yes
MSA \times cohort FE	Yes	Yes	Yes
Bureau FE	Yes	Yes	Yes
Occupation FE	No	No	Yes
Observations	138,153	138,153	138,145
Adjusted R-squared	0.00	0.02	0.03
Mean of dependent variable	4.23	4.23	4.23

Table IA.3: Model estimation on matched subsample

The table reports the estimation results for Equation (1) on a matched subsample of our final sample of employees. The subsample was matched using nearest-neighbor matching on an estimated propensity score. In order to be matched, individuals must be exactly the same in terms of the following characteristics: state of employment, occupation, supervisory status, salary tercile, tenure, and years of education. Estimated propensity scores were assigned using the same person- and job-level controls in the main specification, as well as salary. Matched individuals within a given cluster must have a difference in estimated propensity scores of less than one standard deviation of the estimated propensity score distribution (equal to 0.115).

Panel A reports the summary statistics for the matched subsample. Panel B reports the absolute normalized differences of the covariates between individuals in majority furloughed and non-majority furloughed bureaus for the pre- and post-shutdown cohorts in the main and matched samples.⁴ Panel C (next page) reports the matched-subsample estimation results. All columns include the full set of fixed effects and controls. A detailed description of all variables is available in Appendix A. Standard errors in parentheses are clustered at the bureau level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Panel A: Matched-subsample employee characteristics (means)				
Characteristic	Pre-shutdown (2009.IV)		Post-shutdown (2013.IV)	
	Majority furloughed	Non-majority furloughed	Majority furloughed	Non-majority furloughed
	(1)	(2)	(3)	(4)
Furloughed (%)	81.15	17.32	81.15	18.82
Salary (thousand \$)	82.21	82.27	86.47	91.58
General Schedule grade (1–15)	11.03	10.98	11.34	11.76
Supervisor (%)	11.25	11.58	14.34	13.64
Tenure (years)	16.73	17.00	15.64	15.43
Age (years)	50.24	48.41	50.35	48.04
College or post-grad education (%)	58.07	55.33	63.50	66.22
Post-grad education (%)	24.47	21.67	27.47	30.50
Observations	22,535	20,811	15,785	17,509

Panel B: Absolute normalized differences								
Sample	Cohort	Salary	Grade	Supervisor	Tenure	Age	College	Post-grad
Main	2009.IV	.48	.45	.12	.23	.1	.26	.23
Main	2013.IV	.41	.34	.24	.26	.09	.19	.13
Matched	2009.IV	0	.02	.01	.02	.17	.06	.07
Matched	2013.IV	.17	.15	.02	.02	.2	.06	.07

⁴The normalized difference for a variable X is given by

$$\Delta_X = \frac{\bar{X}_1 - \bar{X}_0}{\sqrt{S_1^2 + S_0^2}},$$

where, within a given sample and cohort, \bar{X}_1 and \bar{X}_0 are respectively the sample means of X for individuals in majority furloughed and non-majority furloughed bureaus; and S_1^2 and S_0^2 are respectively the sample variances for X for individuals in majority furloughed and non-majority furloughed bureaus. [Imbens and Rubin \(2015\)](#) note that linear methods for estimating average treatment effects can be sensitive to specification when absolute normalized differences of the model’s covariates exceed 0.25.

Table IA.3 (continued)

Panel C: Matched-subsample employment outcomes			
	One year employment outcomes		
	Separated	Quit	Retired
	(1)	(2)	(3)
Majority furloughed \times Post-shutdown	1.459*** (0.387)	0.320** (0.161)	0.839*** (0.294)
Person controls	Yes	Yes	Yes
Job controls	Yes	Yes	Yes
MSA \times cohort FE	Yes	Yes	Yes
Bureau FE	Yes	Yes	Yes
Occupation FE	Yes	Yes	Yes
Observations	76,570	76,570	76,570
Adjusted R-squared	0.03	0.02	0.06
Mean of dependent variable	4.40	1.17	2.76

Table IA.4: Placebo test

This table presents the results of a placebo test of our main specification for all separation types with respect to the time-indexing of the post-shutdown cohort of employees. Specifically, we consider government employees in 2010.IV as *post-period* employees. A detailed description of all variables is available in Appendix A. Standard errors in parentheses are clustered at the bureau level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

	One year employment outcomes		
	Separated	Quit	Retired
	(1)	(2)	(3)
Majority furloughed \times Post-shutdown	0.570*** (0.211)	0.173* (0.098)	0.145 (0.153)
Person controls	Yes	Yes	Yes
Job controls	Yes	Yes	Yes
MSA \times cohort FE	Yes	Yes	Yes
Bureau FE	Yes	Yes	Yes
Occupation FE	Yes	Yes	Yes
Observations	501,112	501,112	501,112
Adjusted R-squared	0.03	0.02	0.06
Mean of dependent variable	4.52	1.11	2.85

Table IA.5: Reductions in force and terminations

This table presents the results of the difference-in-differences analysis of the propensity for employees leaving civil service after the government shutdown due to (a) being laid off as the result of a reduction-in-force or (b) being terminated due to performance problems or for disciplinary purposes. The estimations are in the form described in Equation (1). Column 2 includes person-level controls (i.e., education, tenure, and age). Column 3 also includes job controls (i.e., General Schedule grade and supervisory status) as well as occupation fixed effects. A detailed description of all variables is available in Appendix A. Standard errors in parentheses are clustered at the bureau level. $***p < 0.01$, $**p < 0.05$, $*p < 0.10$.

	Reduction in force	Terminated
	(1)	(2)
Majority furloughed \times Post-shutdown	0.002 (0.010)	0.030 (0.019)
Person controls	Yes	Yes
Job controls	Yes	Yes
MSA \times cohort FE	Yes	Yes
Bureau FE	Yes	Yes
Occupation FE	Yes	Yes
Observations	499,898	499,898
Adjusted R-squared	0.01	0.00
Mean of dependent variable	0.01	0.03

Table IA.6: Quitting versus retiring for payments-facing employees and attorneys

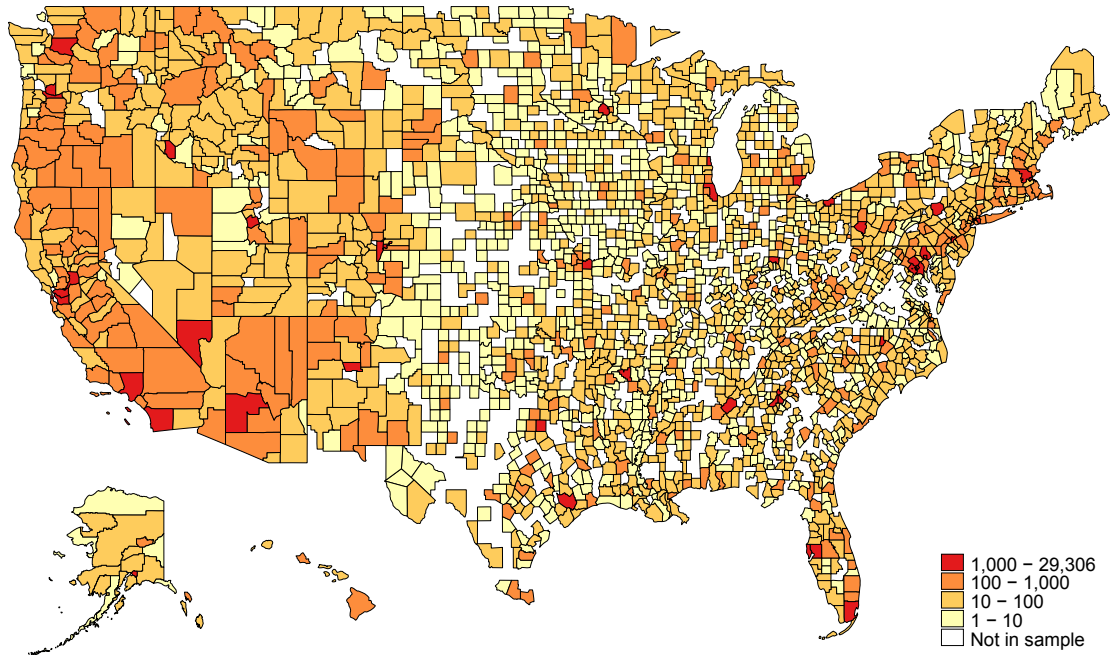
Panel A presents the results of the difference-in-differences analysis of the propensity for employee quits (Column 1) and retirements (Column 2) following the government shutdown. Any employee with an occupation in the *Accounting and Budget* or *Business and Industry* federal occupational series is considered a payments-facing employee (PFE). Similarly, Panel B presents the results of the difference-in-differences analysis of the propensity for federal employee quits and retirements among general attorneys following the government shutdown. All columns include the full set of fixed effects and controls. A detailed description of all variables is available in Appendix A. Standard errors in parentheses are clustered at the bureau level. $**p < 0.05$, $*p < 0.10$.

Panel A: Payments-facing employees (PFEs)		
	Quit (within 4 quarters)	Retired (within 4 quarters)
	(1)	(2)
Majority furloughed \times Post-shutdown \times PFE	-0.020 (0.188)	-0.054 (0.415)
Person controls	Yes	Yes
Job controls	Yes	Yes
MSA \times cohort FE	Yes	Yes
Bureau FE	Yes	Yes
Occupation FE	Yes	Yes
Observations	499,898	499,898
Adjusted R-squared	0.02	0.07
Mean of dependent variable	1.24	2.98
Panel B: Attorneys		
	Quit (within 4 quarters)	Retired (within 4 quarters)
	(1)	(2)
Majority furloughed \times Post-shutdown \times Attorney	0.788* (0.474)	-0.018 (0.264)
Person controls	Yes	Yes
Job controls	Yes	Yes
MSA \times cohort FE	Yes	Yes
Bureau FE	Yes	Yes
Occupation FE	Yes	Yes
Observations	499,898	499,898
Adjusted R-squared	0.02	0.07
Mean of dependent variable	1.24	2.98

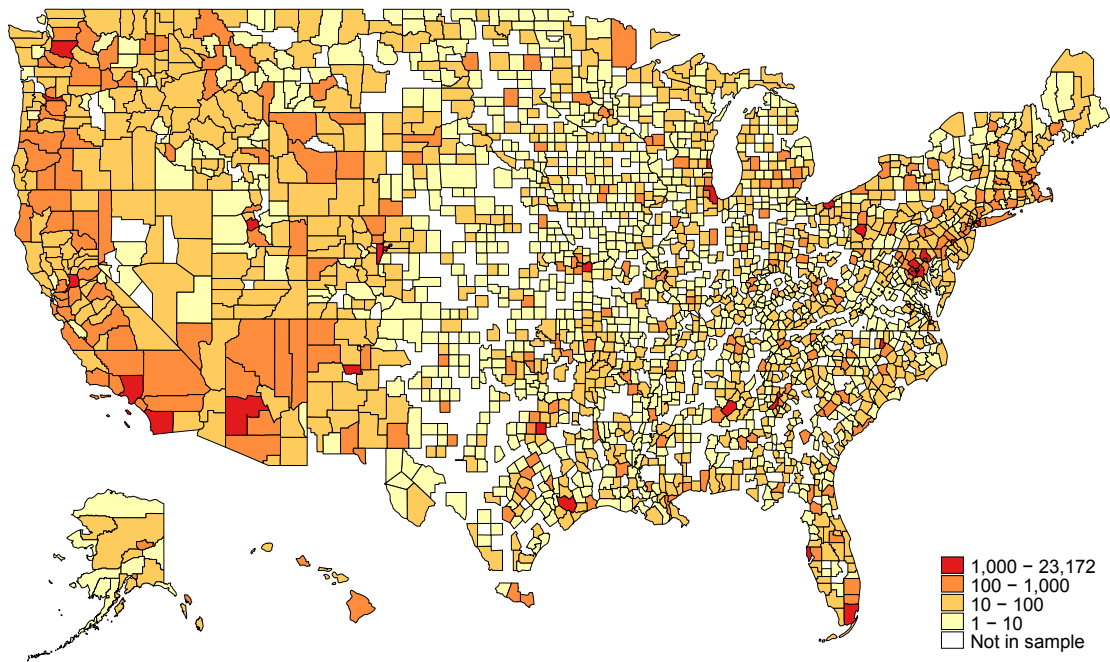
Table IA.7: Retiring, outside opportunities, and local labor markets

This table presents the results of the difference-in-differences analysis of the effect of outside opportunities on the propensity for employee retirements within one year of the shutdown. The estimations are in the form of Equation (1). Panel A divides the main sample in terms of state rankings of *number of unemployed persons per job opening* in each cohort. This variable is averaged over the four quarters following panel formation. Panel B divides the main sample in terms of locality pay area (LPA) rankings of the estimated percent difference between private sector and federal salaries for comparable occupations (i.e., the *federal wage gap*) in each cohort. This variable is measured six months after cohort formation. The data for these two variables respectively come from the Bureau of Labor Statistics' Job Openings and Labor Turnover Survey annual reports of the Federal Salary Council. All columns include the full set of fixed effects and controls. A detailed description of all variables is available in Appendix A. Standard errors in parentheses are clustered at the bureau level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Panel A: Sample splits by labor market tightness				
	Retired (within 4 quarters)			
	All 50 States & D.C.	Top 30	Top 20	Top 10
	(1)	(2)	(3)	(4)
Majority furloughed \times Post-shutdown	0.820*** (0.194)	0.813*** (0.215)	0.942*** (0.242)	0.736*** (0.258)
Person controls	Yes	Yes	Yes	Yes
Job controls	Yes	Yes	Yes	Yes
MSA \times cohort FE	Yes	Yes	Yes	Yes
Bureau FE	Yes	Yes	Yes	Yes
Occupation FE	Yes	Yes	Yes	Yes
Observations	499,898	292,749	202,811	82,677
Adjusted R-squared	0.07	0.07	0.06	0.06
Mean of sample split variable	3.62	2.82	2.64	1.89
Mean of dependent variable	2.98	2.89	2.79	2.89
Panel B: Sample splits by federal wage gap				
	Retired (within 4 quarters)			
	All 33 LPAs	Top 30	Top 20	Top 10
	(1)	(2)	(3)	(4)
Majority furloughed \times Post-shutdown	0.949*** (0.210)	0.935*** (0.211)	0.899*** (0.211)	0.671*** (0.221)
Person controls	Yes	Yes	Yes	Yes
Job controls	Yes	Yes	Yes	Yes
MSA \times cohort FE	Yes	Yes	Yes	Yes
Bureau FE	Yes	Yes	Yes	Yes
Occupation FE	Yes	Yes	Yes	Yes
Observations	297,015	289,075	268,708	206,259
Adjusted R-squared	0.06	0.06	0.06	0.06
Mean of sample split variable	68.49	69.30	71.08	75.38
Mean of dependent variable	2.81	2.81	2.81	2.66



Panel A. Pre-shutdown cohort



Panel B. Post-shutdown cohort

Figure IA.1: Geographic Distribution of Federal Employees

This map plots the distribution of federal employees across counties in the pre-shutdown cohort (288,965 employees) and the post-shutdown cohort (210,831 employees). (Due to county geography changes, 102 employees in the post-shutdown cohort are not included in the sample from which the figure is produced.)

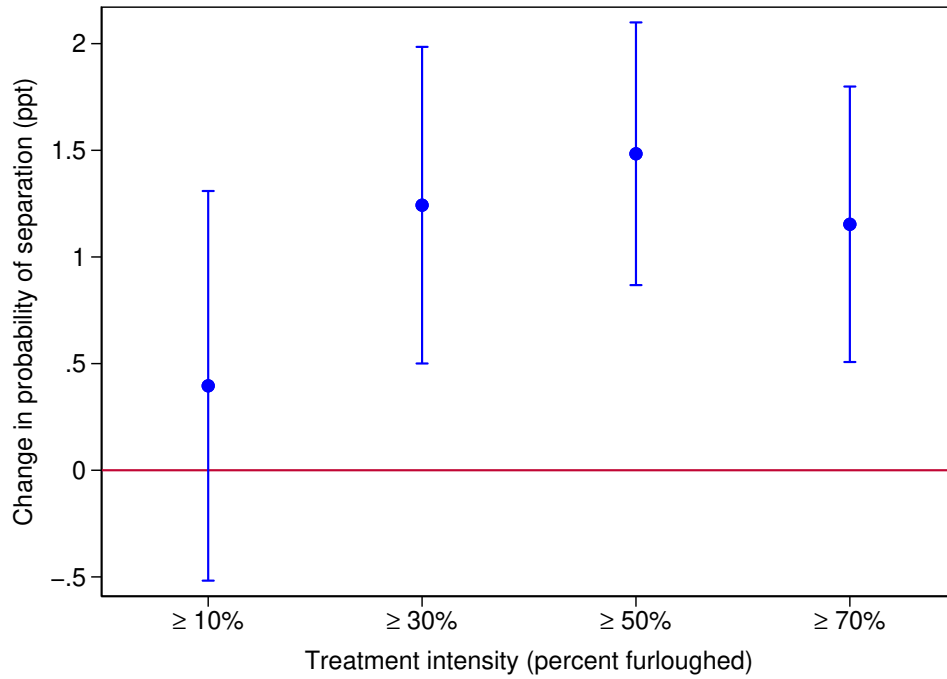
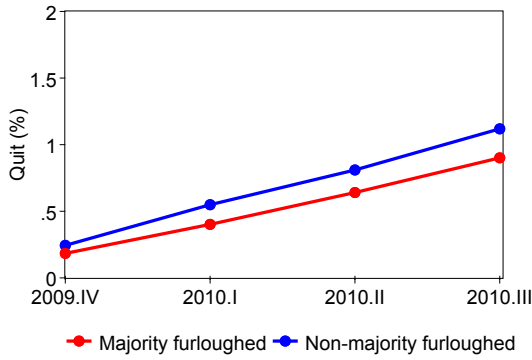
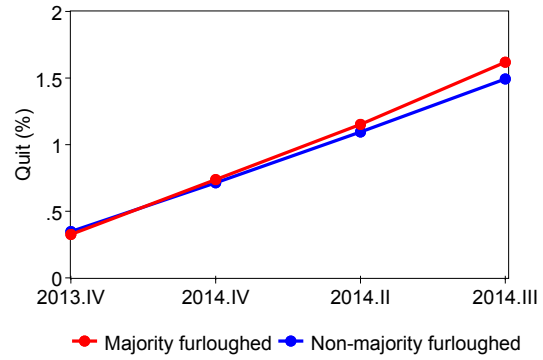


Figure IA.2: Treatment Intensity

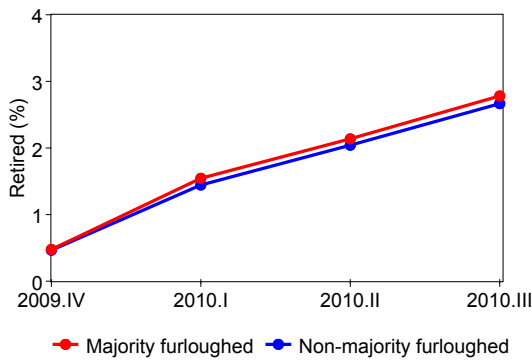
This figure plots the estimated change in the probability of an employee leaving against the treatment intensity, captured by the percent of furloughed employees at the bureau level. The coefficients are estimated using our baseline specification in Equation (1) and by replacing the majority furloughed (i.e., 50% furloughed) indicator with analogous 10%, 30%, 50%, and 70% indicators.



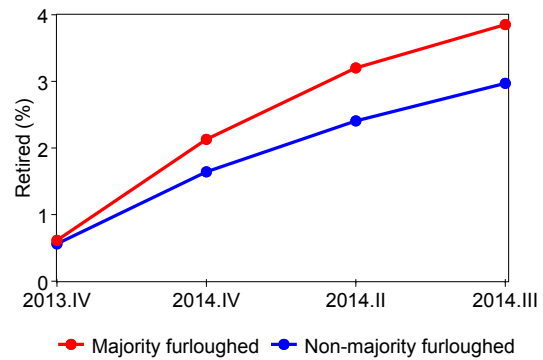
Panel A. Quit (pre-shutdown)



Panel B. Quit (post-shutdown)



Panel C. Retired (pre-shutdown)



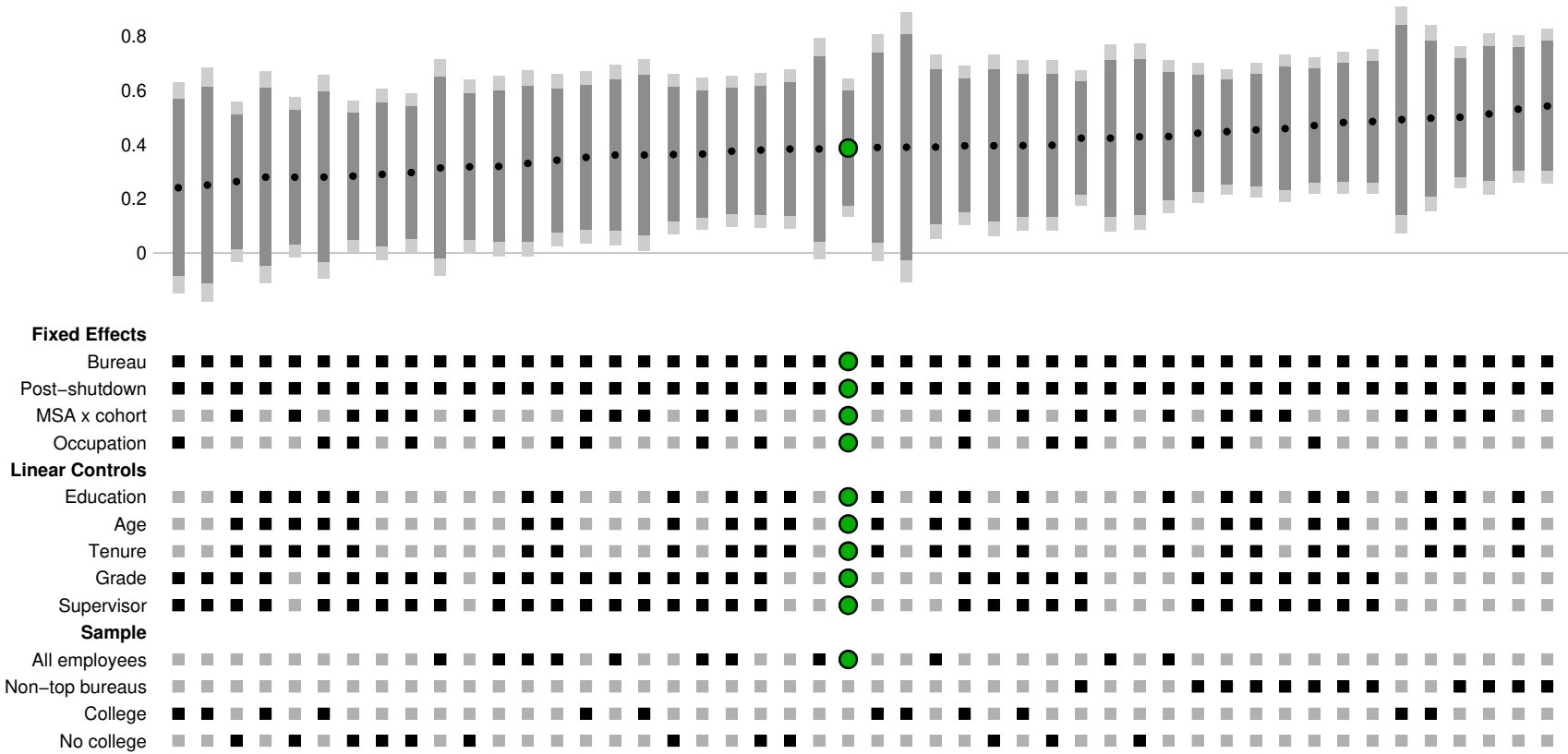
Panel D. Retired (post-shutdown)

Figure IA.3: Quitting and Retirement Trends

This figure compares the quitting (Panels A and B) and retirement rates (Panels C and D) of federal employees across the time series for the two types of government bureaus (i.e., majority furloughed vs. non-majority furloughed) and the two cohorts of employees (i.e., pre-shutdown vs. post-shutdown).

Coefficient on *Majority furloughed* x *Post-shutdown*

● Main specification • Regression coefficient □ 95% CI ■ 90% CI



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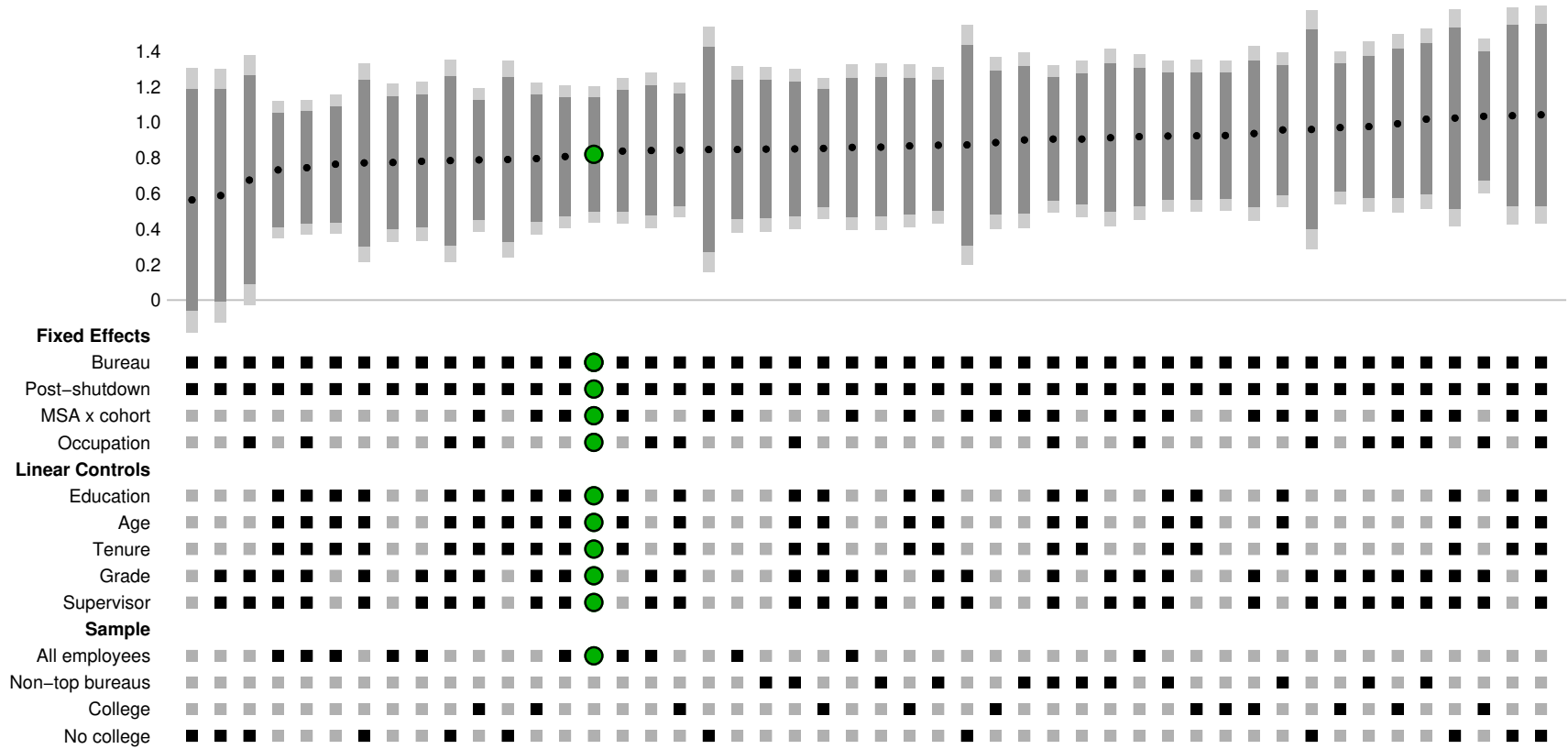
Panel A. Quit

Figure IA.4: Specification Curve Analysis of Quitting and Retirement

The figure plots the coefficients on *Majority furloughed* × *Post-shutdown* and their corresponding confidence intervals for a set of regressions in which the dependent variable is an indicator of either quitting (Panel A) or retiring (Panel B, next page) within one year after the cohort assembly date (2009.IV or 2013.IV). The regressions include different combinations of control variables and fixed effects, and they are estimated across an array of subsamples. The non-top bureaus subsample excludes the Forest Service (the largest bureau in the majority furloughed group) and the Veterans Health Administration (the largest bureau in the non-majority furloughed group). The green circles indicate the main regression specification (estimated in Columns 3 and 6 of Table III). Standard errors are clustered at the bureau level.

Coefficient on *Majority furloughed x Post-shutdown*

● Main specification ● Regression coefficient □ 95% CI ■ 90% CI



Panel B. Retired

Figure IA.4 (continued)

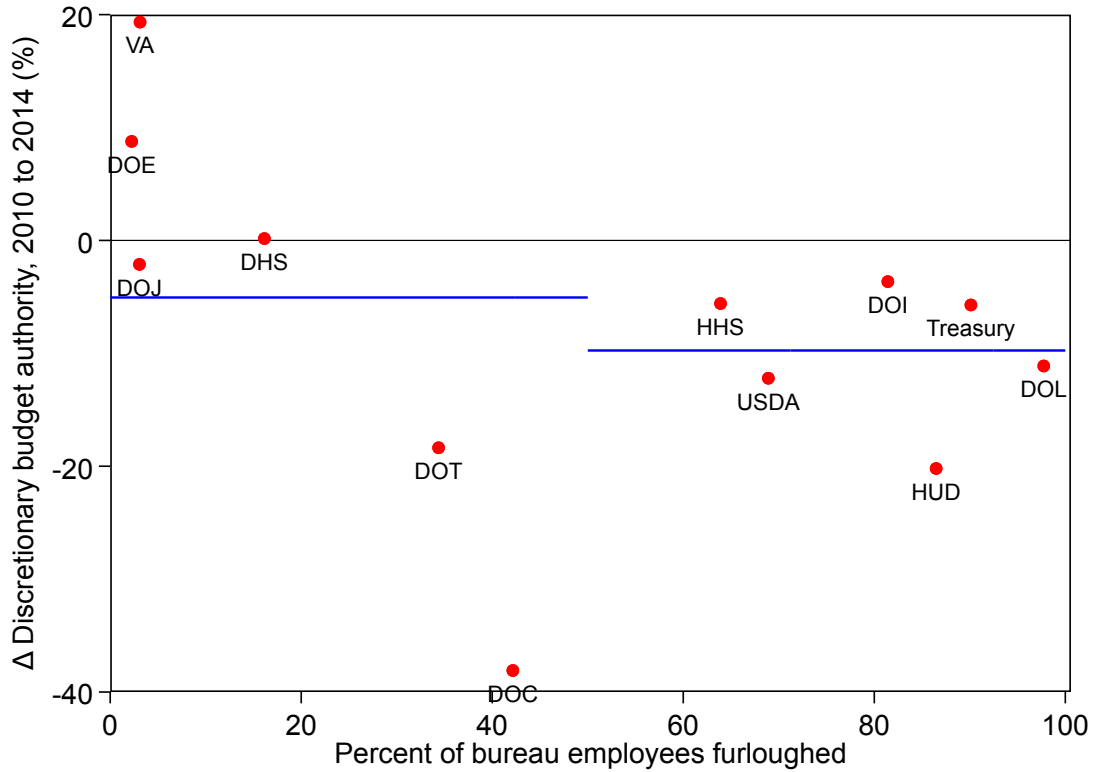


Figure IA.5: Cumulative Budget Change Prior to Shutdown

This figure shows cumulative discretionary budget changes from fiscal years 2010 to 2014 for 12 Executive Branch agencies relative to the percent of employees furloughed. Horizontal lines show budget changes for non-majority furloughed (left, < 50%) and majority furloughed (right, > 50%) agencies, respectively. Agency-level furlough counts are from [U.S. Senate \(2019\)](https://www.senate.gov/imo/media/doc/record/20190321). Discretionary budget data are from historical budget tables published by the White House (“Table 5.4: Discretionary Budget Authority by Agency,” <https://www.whitehouse.gov/omb/budget/historical-tables/>). From least furloughed to most furloughed, the 12 Executive Branch agencies with available data are: Department of Veterans Affairs (VA), Department of Energy (DOE), Department of Homeland Security (DHS), Department of Transportation (DOT), Department of Commerce (DOC), Department of Human and Health Services (HHS), Department of Agriculture (USDA), Department of the Interior (DOI), Department of Housing and Urban Development (HUD), Department of the Interior (DOI), Department of the Treasury, and Department of Labor (DOL).