Online Appendix to 'The Political Dynamics of Bureaucratic Turnover'

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In this online appendix, we provide some additional notes on the covariates, methods, and results presented in the Research Note 'The Political Dynamics of Bureaucratic Turnover'. We first briefly justify our supplementary regression controls and discuss estimation issues. Next, we present descriptive statistics for all covariates. The appendix concludes with some step-wise regression outputs, which we omitted from the Research Note to conserve space.

Covariates and Methods

We include five binary covariates in order to adjust for heterogeneity in the background characteristics of our agency heads. *Academic sector* denotes whether a head had a Ph.D. at the time of appointment, *political sector* whether a head is affiliated with a political party,[1] *private sector* whether a head has CEO experience from the private sector, *public sector* whether a head has CEO experience from the public sector, and *sex* whether a head is a female. We include measures of academic, political, private, and public sector experience to adjust for the possibility that outside recruits may be more inclined to voluntarily leave their posts in pursuit of alternative careers than heads recruited from inside the bureaucracy[2] and because previous studies have found that agencies managed by political appointees tend to perform worse than other agencies.[3] Although we have no good theoretical reasons to adjust for sex, previous investigations of tenure times among agency heads in the Swedish

[1] We consider an agency head to have a political affiliation if he/she has: (i) served as a minister; (ii) been elected to Parliament or a local democratic assembly; (iii) been Secretary of State (the second in command at the Government Offices, following the ministers); (iv) been employed as a political adviser at the Government Offices; or (v) been employed by a political party or an organization clearly associated with a political party, such as the blue-collar union confederation *Landsorganisationen*.

[2] e.g. James et al. 2013.

[3] Lewis 2007, 2008.

bureaucracy have found substantial differences between males and females,[4] and so we include it regardless.

To account for heterogeneity in strategic environments at the time of the incumbent cabinet, we include one continuous and four binary covariates. First, we introduce a continuous covariate, *economic growth*, denoting the annual percent change in real gross domestic product. Government reorganization is almost always justified as a strategy for cost containment,[5] but, on the other hand, government reorganization is also itself a costly activity.[6] Furthermore, because the state of the economy can affect employment opportunities, it should also be relevant for the exit options of agency heads. Second, we adjust for either of the blocs being more prone to reshuffle appointees by including a binary covariate, *liberal-conservative*, denoting whether or not the cabinet is controlled by a liberal-conservative coalition.[7] For instance, it could be the case that either bloc has access to more competent or confident political leaders, making them more inclined to regularly intervene in agency activities than their competitors. Third, in order to account for the possibility that governments may front-load their most radical administrative interventions, we include a binary covariate, *new term*, denoting whether it is the first year of a new electoral term. Fourth, in order to adjust for the possibility that agency heads might exit early in anticipation of policy conflicts with future governments,[8] we include a binary covariation, *election year*, denoting whether it is an election year. Fifth and finally, we also include a binary covariate,

[4] Sandahl 2003.

[5] Pierson 2001.

[6] Carpenter and Lewis 2004.

[7] Since all social democratic governments are one-party governments while all liberal-conservative governments save one are not one-party governments, this covariate is also highly correlated with number of parties in the cabinet ($r = 0.91$).

[8] Doherty, Lewis and Limboecker 2015.

pre-1987, denoting whether a given head was observed before 1987. The 1980s was a period of intense political debate over the relationship between the parliament, cabinet and bureaucracy in Sweden. One result of this debate was Government bill 1986/87:99, which introduced a number of new escape clauses that the cabinet could invoke to transfer agency heads to other (not necessarily permanent) positions, if deemed necessary for 'organizational reasons' or 'the greater good of the agency'. In practice, this expanded the cabinet's appointment powers considerably, and so we include it to adjust for the expanded opportunities to intervene in the appointment process compared to previous regimes.[9]

We implement the covariates through a series of Cox regressions, which is a semi-parametric technique for estimating time-to-event that combines the proportional hazards duration model with the partial likelihood method for estimation.[10] The dependent variable is the hazard rate, which in our case loosely translates into the instantaneous probability that an agency head will leave their post, given that they have not yet done so. Compared to other techniques for estimating time-to-event, the principal benefit of Cox regression is that it leaves the functional form of the baseline hazard unspecified, allowing us to retrieve estimates of how the covariates affect replacement rates without a need for strong parametric assumptions about the underlying probability distribution of event occurrence. If necessary, Cox regression is also flexible enough to handle time-varying covariates, time-dependent coefficients and right censoring with relative ease, making it the natural choice for modeling complex event histories.

[9] Note, though, that Sweden had social democratic prime ministers between 1936 and 1976. Adjusting for a possible structural break in 1987 thus makes for a rather ungenerous control since, if our theory is correct, before 1987 is exactly where we should expect to find abnormally long tenure times.

[10] Box-Steffensmeier and Jones 2004; Therneau and Grambsch 2000.

To assure the robustness of our findings, we perform Cox regressions with two kinds of extensions. First, we estimate models with 'shared agency frailties', which allow for coefficients to vary across agencies. The logic behind these models is that some heads may appear more prone to leave their posts than others simply because some agencies carry unobserved attributes that make them intrinsically riskier to manage than others. For example, some agencies may operate in policy areas requiring unusually high levels of technical competence, making political leaders less inclined to intervene in their activities than other agencies.[11] Such risk factors can be modeled as a latent covariate, analogous to a random coefficient in linear hierarchical models.[12] The frailty variance is estimated from the data, but assumed to follow a Gamma distribution, and draws on variation in hazard rates both within and between agencies. As with any random-effect, agency frailties are generally required to be independent of the observed covariates. This is a restrictive assumption, but less so than the assumption of complete homogeneity that underpins frailty-less models.

Second, we stratify our heads by agency. Although Cox regression leaves the functional form of the baseline hazard unspecified, regardless of the shape the hazard function does have, it is assumed to be the same across all subjects. Stratification allows us to relax this assumption by letting each agency have its own distinct baseline hazard, while coefficients are constrained to be the same across agencies. Analogously to fixed-effects in linear models, this eliminates the influence from all unobserved, time-constant, agency-level factors by collapsing them into the unspecified hazard function of each agency.[13] For our purposes, the main drawback of these models is that, since they only consider variation within agencies, they are also prone to inflate standard errors and underestimate the effects of

[11] E.g. Bawn 1995; Epstein and O'Halloran 1999.

[12] Hougaard 2000.

[13] Allison 2009.

covariates that change slowly or only rarely over time—which holds true for some of our covariates.

Finally, although we have consulted numerous official sources when constructing the dataset, in some cases we have been unable to obtain relevant information on our measures of agency head background characteristics (see Table 1 below). To deal with this problem, we use multiple imputation by chained equations.[14] The general idea behind multiple imputation is to estimate a set of values for the missing data based on the observed data, while incorporating some random components to account for uncertainty. The missing values are first replaced by a set of simulated values through an imputation model which regresses the incomplete covariate on a set of complete covariates. The simulated datasets are analyzed separately using standard complete-data methods to obtain the quantities of interest. The estimates obtained from the simulated datasets are then combined using Rubin's rules to produce the final estimates. We use logistic regression to generate twenty multiply imputed datasets and include all covariates with complete data as well as the event indicator and Nelson-Aalen estimator of the baseline hazard in the imputation model (we estimate separate imputation models for cabinet turnover and policy incongruence). Below, we provide some additional descriptive statistics and regression outputs for the interested reader.

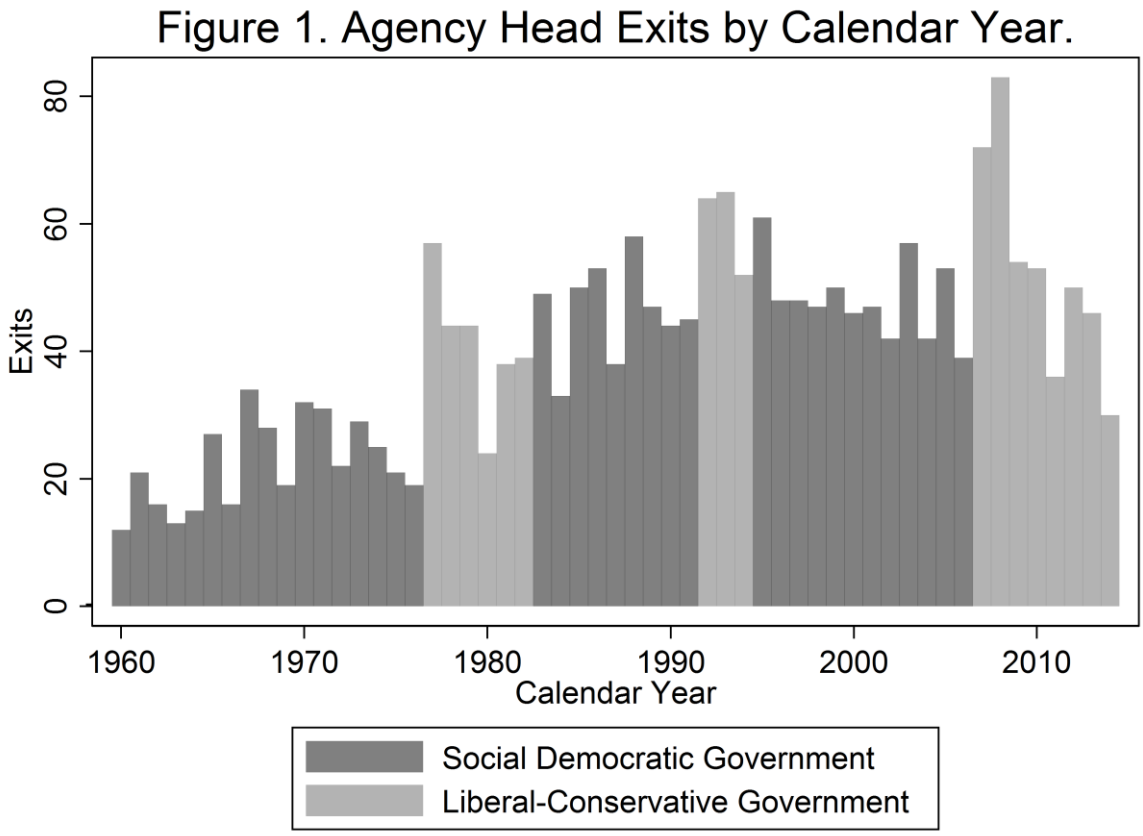
[14] White, Royston and Wood 2011; White and Royston 2009.

Descriptive Statistics

Table 1. Descriptive Statistics.

Covariates	*Obs.*	*Mean*	*Std. Dev.*	*Min.*	*Max.*	*Missing*
Cabinet Turnover	17318	0.27	0.44	0	1	-
Policy Incongruence	17318	1.37	1.76	0	8.5	-
Academic Sector	14328	0.29	0.45	0	1	17.2%
Political Sector	15103	0.41	0.49	0	1	12.8%
Private Sector	14946	0.09	0.29	0	1	13.7%
Public Sector	15004	0.65	0.48	0	1	13.4%
Sex	17318	0.16	0.37	0	1	-
Liberal-Conservative	17318	0.32	0.47	0	1	-
New Term	17318	0.30	0.46	0	1	-
Election Year	17318	0.30	0.46	0	1	-
Economic Growth	17318	2.39	2.24	-5	6.8	-
Pre-1987	17318	0.45	0.50	0	1	-

Note. Because our hazard models rely on intervals rather than snapshots, some of the observations become redundant during estimation.



Alternative Model Specifications

Table 2. Stepwise Partial Likelihood Estimates of Bureaucratic Hazards in Sweden, 1960-2014.

Covariates	*Model 1*	*Model 2*	*Model 3*	*Model 4*	*Model 5*	*Model 6*
Cabinet Turnover	1.73**	1.70**	1.54**	1.54**	1.50**	1.58**
	(0.08)	(0.08)	(0.08)	(0.08)	(0.11)	(0.09)
Academic Sector		0.92		0.93	0.90	0.91
		(0.05)		(0.05)	(0.10)	(0.06)
Political Sector		1.11*		1.15**	1.05	1.14*
		(0.05)		(0.06)	(0.08)	(0.06)
Private Sector		1.31**		1.27**	1.23	1.26**
		(0.10)		(0.10)	(0.13)	(0.11)
Public Sector		1.10		1.08	1.06	1.09
		(0.06)		(0.06)	(0.08)	(0.06)
Sex		1.38**		1.08	1.21*	1.10
		(0.08)		(0.07)	(0.10)	(0.07)
Liberal-conservative			1.14*	1.14*	1.26**	1.14*
			(0.07)	(0.07)	(0.09)	(0.07)
New Term			0.90	0.91	0.95	0.90*
			(0.05)	(0.05)	(0.07)	(0.05)
Election Year			0.98	0.97	1.02	0.97
			(0.05)	(0.05)	(0.07)	(0.05)
Economic Growth			1.02	1.02	1.03*	1.02*
			(0.01)	(0.01)	(0.02)	(0.01)
Pre-1987			0.55**	0.56**	0.52**	0.53**
			(0.03)	(0.03)	(0.04)	(0.03)
Agency fixed-effect					Yes	
Agency random-effect						Yes
Agency Heads	2355	2355	2355	2355	2355	2355
Observations	14839	14839	14839	14839	14839	14839
Exits	2147	2147	2147	2147	2147	2147

Note. Hazard ratios for listed covariates with standard errors clustered by agency in parenthesis (conditional on random-effect in Model 6). Efron method for tied events. ** p<0.01, * p<0.05 (two-tailed).

Table 3. Stepwise Partial Likelihood Estimates of Bureaucratic Hazards in Sweden, 1960-2014.

Covariates	*Model 7*	*Model 8*	*Model 9*	*Model 10*	*Model 11*	*Model 12*
Policy Incongruence	1.11**	1.11**	1.04**	1.04**	1.05**	1.05**
	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)
Academic Sector		0.92		0.93	0.90	0.91
		(0.05)		(0.05)	(0.10)	(0.06)
Political Sector		1.12*		1.16**	1.06	1.16**
		(0.05)		(0.06)	(0.08)	(0.06)
Private Sector		1.30**		1.25**	1.24*	1.24**
		(0.10)		(0.09)	(0.13)	(0.11)
Public Sector		1.10		1.07	1.07	1.09
		(0.06)		(0.05)	(0.08)	(0.06)
Sex		1.40**		1.08	1.21*	1.10
		(0.08)		(0.07)	(0.10)	(0.07)
Liberal-conservative			1.39**	1.38**	1.48**	1.40**
			(0.07)	(0.07)	(0.10)	(0.08)
New Term			0.91	0.91	0.97	0.91
			(0.05)	(0.05)	(0.07)	(0.05)
Election Year			0.97	0.97	1.01	0.96
			(0.05)	(0.05)	(0.07)	(0.05)
Economic Growth			1.03*	1.03*	1.04*	1.03*
			(0.01)	(0.01)	(0.02)	(0.01)
Pre-1987			0.56**	0.57**	0.55**	0.55**
			(0.03)	(0.03)	(0.04)	(0.03)
Agency fixed-effect					Yes	
Agency random-effect						Yes
Agency Heads	2355	2355	2355	2355	2355	2355
Observations	14839	14839	14839	14839	14839	14839
Exits	2147	2147	2147	2147	2147	2147

Note. Hazard ratios for listed covariates with standard errors clustered by agency in parenthesis (conditional on random-effect in Model 6). Efron method for tied events. ** p<0.01, * p<0.05 (two-tailed).

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