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10
Appendix 1: Tables

Table 10.1: Summary statistics

Variable	**Mean**	**Std. Dev.**	**N**
Coups or wars	0.157	0.364	4431
Wars	0.127	0.333	4427
Coups	0.061	0.239	4416
Peaceful (party) transition	0.075	0.263	3499
Military govt.	0.221	0.415	4579
Nationalist govt.	0.153	0.360	4558
Center govt.	0.063	0.243	4539
Left-wing govt.	0.319	0.466	4539
Right-wing govt.	0.223	0.416	4539
Polity IV Score	0.578	7.596	4211
Transition (POLITY IV)	0.019	0.135	4427
Interruption (POLITY IV)	0.012	0.109	4427
Interregnum (POLITY IV)	0.018	0.134	4427
Competitive participation (POLITY IV)	2.813	1.535	4143
Unregulated participation (POLITY IV)	0.014	0.117	4201
Competitive executive recruitment (POLITY IV)	2.038	0.924	3595
Unregulated executive succession (POLITY IV)	0.144	0.351	4201
Avg. Polity 1950-75	-2.194	6.764	4562
Non-peaceful transitions	0.116	0.320	657
Transitions due to war	0.051	0.221	526
Army anti-govt.	0.027	0.163	4429
Army anti-govt. during coup/war	0.175	0.380	693
Army anti-military govt. during coup/war	0.252	0.435	254
Army anti-civil govt. during coup/war	0.133	0.340	421
log(GDP Per capita)	8.108	1.200	4662
Govt. share of GDP per capita	19.747	10.594	4662
Local municipal elections	1.250	0.840	2563
Local state elections	0.769	0.814	3465

Table 10.2: Capturing variation in q^P

	(1)	(2)	(3)	(4)	(5)	(6)
Polity IV Score	0.008***	0.011***				
	(0.001)	(0.001)				
Compet. participation			0.034***	0.039***		
			(0.003)	(0.007)		
Unregulated participation			0.350***	0.365***		
			(0.032)	(0.107)		
Competitive exec. recruitment					0.054***	0.059***
					(0.005)	(0.008)
Log(GDP per capita)		-0.008		-0.013		-0.020
		(0.015)		(0.015)		(0.016)
Country fixed effects	N	Y	N	Y	N	Y
Year dummies	N	Y	N	Y	N	Y
F-Stat. on political openness variables	41.65***	14.88***	100.29***	17.94***	136.55***	55.84***
Observations	3421	3352	3333	3264	3333	3264
Countries	135	134	134	133	134	133
R-sq.	0.06	0.13	0.06	0.12	0.06	0.13

Standard errors clustered by country reported in parenthesis. Dependent variable: dummy indicating transition of party. Sample: country-years in peace.
*** 1% significance level, ** 5% significance level, * 10% significance level

Table 10.3: Capturing variation in q^W

	(1)	(2)	(3)	(4)
Army anti-govt.	0.205***	0.171	0.200**	0.258**
	(0.076)	(0.108)	(0.092)	(0.128)
Army anti-govt and military govt.			-0.019	-0.309**
			(0.156)	(0.153)
Military govt.			0.023	0.006
			(0.021)	(0.044)
Log(GDP per capita)		-0.062		-0.089
		(0.102)		(0.099)
Country fixed effects	N	Y	N	Y
Year dummies	N	Y	N	Y
F-test on military variables	7.17***	2.48	3.68**	1.51
Observations	504	504	498	498
Countries	63	63	63	63
R-sq.	0.06	0.37	0.06	0.39

Standard errors clustered by country. Dependent variable: transitions of govt. because of wars. Sample: country-years at war.
*** 1% significance level, ** 5% significance level, * 10% significance level

Table 10.4: Summary statistics on $\hat{q}^P$ and $\hat{q}^W$, two stage procedure

	Mean	Std. Dev.	Minimum	Maximum	Correlation
$\hat{q}^P$	0.064	0.061	-0.029	0.132	-0.153
$\hat{q}^W$	0.043	0.033	0.038	0.243	

Estimates from table 10.2, column (5) and table 10.3, column (1). Sample: both $\hat{q}^P$ and $\hat{q}^W$ are non-missing.

Table 10.5: Coups and wars depending on dummy for anti-government armies and competition in executive recruitment

Avg. country-years with coups and wars				
	Competitive executive recruitment			
Army anti-govt.	Unregulated	Selection	Dual/Transitional	Election
N	0.235	0.106	0.100	0.075
Y	1	1	1	1
Avg. country-years with wars				
	Competitive executive recruitment			
Army anti-govt.	Unregulated	Selection	Dual/Transitional	Election
N	0.202	0.100	0.086	0.073
Y	0.194	0.333	0.583	0.556
Avg. country-years with coups				
	Competitive executive recruitment			
Army anti-govt.	Unregulated	Selection	Dual/Transitional	Election
N	0.088	0.038	0.035	0.015
Y	0.984	0.778	0.667	0.889

Table 10.6: Main equation of wars; two-step estimation

	Probability model					
	Linear	Linear	Linear	Linear	Linear	Linear
Variables	(1)	(2)	(3)	(4)	(5)	(6)
$(\hat{q}^W - \hat{q}^P)\times$Avg. X	0.670	0.766***	1.283**	1.118**	1.124	2.849**
	(0.330)	(0.254)	(0.523)	(0.431)	(0.741)	(1.275)
$(\hat{q}^W - \hat{q}^P)$Lag Conflict†		-1.216*		-1.232*	-1.126*	
		(0.669)		(0.640)	(0.592)	
$(\hat{q}^W - \hat{q}^P)$ln(GDP per cap.)†			0.708*	0.379	2.887**	2.122
			(0.397)	(0.340)	(1.281)	(1.407)
$(1 - \hat{q}^P)\times$Average $-d$	-0.200	-0.666**	-1.276**	-1.123**	-1.102	-2.459
	(0.480)	(0.270)	(0.608)	(0.441)	(0.741)	(1.603)
$(1 - \hat{q}^P)$Lag Conflict†		1.115		1.150	1.040	
		(0.801)		(0.788)	(0.752)	
$(1 - \hat{q}^P)$ln(GDP per cap.)†			-0.730	-0.441	-2.977**	-4.194**
			(0.445)	(0.339)	(1.368)	(1.889)
Average $-c_2$	0.310	0.765***	1.333**	1.199***	1.180	2.291*
	(0.452)	(0.258)	(0.582)	(0.423)	(0.712)	(1.198)
Lag Conflict†		-0.286		-0.322	-0.225	
		(0.768)		(0.756)	(0.717)	
ln(GDP per cap.)†			0.652	0.410	2.875**	3.987**
			(0.423)	(0.326)	(1.313)	(1.810)
Avg. GDP by country and year trends††	N	N	N	N	Y	Y
Country fixed effects	N	N	N	N	N	Y
Observations	3873	3741	3798	3670	3670	3798
R-sq.	0.02	0.62	0.04	0.63	0.63	0.53
Countries	135	135	134	134	134	134

Standard errors clustered by country in parenthesis. $\hat{q}^W$ from table 10.3, column (1); $\hat{q}^P$ from table 10.2, column (5). † De-meaned variables. †† De-meaned 3rd order polynomials of de-meaned variables (by themselves, multiplied by $q^W - q^P$ and by $1 - q^P$). *** significant at 1%, ** significant at 5%, * significant at 10%.

Table 10.7: Main equation of wars; Roy model estimation

Equation	Variables	Model (1)	(2)	(3)	(4)	(5)
X	Constant	3.396	4.401**	4.432*	6.114**	8.273**
		(3.495)	(1.875)	(2.384)	(2.501)	(4.016)
	Lag conflict†		-5.804**		-5.741**	-4.351
			(2.896)		(2.836)	(2.908)
	ln(GDP per cap.)†			2.338*	2.005	9.259
				(1.387)	(1.228)	(5.987)
	Country avg. ln GDP††	N	N	N	N	Y
	Year trend††	N	N	N	N	Y
Wald test, heterogeneous X		-	4.02**	2.84*	5.05*	7.16
d	Constant	0.885	2.602	4.251	6.056**	10.332*
		(4.158)	(2.326)	(2.920)	(2.941)	(5.376)
	Lag conflict†		-3.518		-3.850	-3.090
			(3.740)		(3.747)	(3.866)
	ln(GDP per cap.)†			2.100	2.114	9.943
				(1.661)	(1.429)	(7.404)
	Country avg. ln GDP††	N	N	N	N	Y
	Year trend††	N	N	N	N	Y
Wald test, heterogeneous d		-	0.88	1.60	2.77	8.03
c	Constant	1.189	-1.044	-2.569	-4.344	-8.205
		(2.779)	(2.296)	(2.830)	(2.912)	(5.158)
	Lag conflict†		0.736		1.113	0.395
			(3.670)		(3.680)	(3.781)
	ln(GDP per cap.)†			-1.583	-1.897	-10.079
				(1.506)	(1.395)	(7.319)
	Country avg. ln GDP††	N	N	N	N	Y
	Year trend††	N	N	N	N	Y
Wald test, heterogeneous c_2		-	0.04	1.10	1.85	6.66
Wald test, heterogeneous c_2, X and d		-	423.75***	8.46**	423.42***	632.73***

q^W	Army anti-govt.	0.154	0.219***	0.207**	0.219***	0.221***
		(0.108)	(0.082)	(0.085)	(0.082)	(0.082)
	Constant	0.283	-0.002	0.086	-0.002	-0.001
		(0.195)	(0.007)	(0.075)	(0.008)	(0.008)
	ρ_1	0.160	-0.022*	0.046	-0.024*	-0.022
		(0.111)	(0.013)	(0.044)	(0.013)	(0.014)
q^P	Compet. exec. recruit.	0.059***	0.057***	0.060***	0.057***	0.057***
		(0.009)	(0.005)	(0.006)	(0.005)	(0.005)
	Constant	-0.053	-0.035***	-0.056***	-0.036***	-0.036***
		(0.037)	(0.007)	(0.017)	(0.007)	(0.007)
	ρ_2	0.078	0.042	0.090*	0.047*	0.050*
		(0.105)	(0.027)	(0.050)	(0.027)	(0.027)
Observations		3516	3516	3516	3516	3516
Log-likelihood		-1096.85	-408.65	-1039.45	-397.60	-379.15
Countries		133	133	133	133	133

Standard errors clustered by country reported in parenthesis.
† De-meaned variables. †† De-meaned 3rd order polynomials of demeaned variables.
*** significant at 1%, ** significant at 5%, * significant at 10%.

Table 10.8: Roy model of wars; considering different sources of variation for q^P and q^W

		Model				
Equation	Variables	(1)	(2)	(3)	(4)	(5)
X	Constant	8.273**	7.581**	7.679*	7.982**	8.729**
		(4.016)	(3.775)	(3.916)	(4.000)	(4.096)
	Lag conflict†	-4.351	-4.642	-4.558	-4.695	-4.673
		(2.908)	(2.957)	(2.991)	(2.910)	(3.413)
	ln(GDP per cap.)†	9.259	9.238	9.217	10.344*	10.038
		(5.987)	(6.042)	(5.945)	(6.156)	(7.512)
	Country avg. ln GDP††	Y	Y	Y	Y	Y
	Year trend††	Y	Y	Y	Y	Y
Wald test, heterogeneous X		7.42	7.30	7.28	7.19	7.17
d	Constant	10.332*	8.530*	8.282	11.284*	10.725
		(5.376)	(4.729)	(5.047)	(6.127)	(5.415)
	Lag conflict†	-3.090	-4.790	-3.101	0.853	-3.498
		(3.866)	(4.058)	(4.218)	(6.482)	(4.531)
	ln(GDP per cap.)†	9.943	8.880	10.393	17.948	11.107
		(7.404)	(7.288)	(7.466)	(11.216)	(9.244)
	Country avg. ln GDP††	Y	Y	Y	Y	Y
	Year trend††	Y	Y	Y	Y	Y
Wald test, heterogeneous d		8.19	9.05	8.22	13.45*	7.89
c	Constant	-8.205	-6.515	-6.244	-9.042	-8.624*
		(5.158)	(4.578)	(4.872)	(5.837)	(5.230)
	Lag conflict†	0.395	2.017	0.400	-3.287	0.798
		(3.781)	(3.954)	(4.115)	(6.192)	(4.438)
	ln(GDP per cap.)†	-10.079	-9.028	-10.450	-17.657	-11.246
		(7.319)	(7.211)	(7.394)	(10.780)	(9.179)
	Country avg. ln GDP††	Y	Y	Y	Y	Y
	Year trend††	Y	Y	Y	Y	Y
Wald test, heterogeneous c_2		6.78	8.35	8.33	14.43*	5.87
Wald test, heterogeneous c_2, X and d		664.43***	631.76***	662.17***	572.31***	624.03***

q^W	Army anti-govt.	0.221***	0.221***	0.221***	0.224***	0.233**
		(0.082)	(0.082)	(0.082)	(0.082)	(0.091)
	Army anti-govt vs. milit. govt.					-0.081
						(0.109)
	Milit. govt.					0.006
						(0.014)
	Constant	-0.001	-0.002	-0.001	0.000	-0.004
		(0.008)	(0.008)	(0.008)	(0.008)	(0.010)
	ρ_1	-0.022	-0.023	-0.023	-0.017	-0.024*
		(0.014)	(0.014)	(0.014)	(0.013)	(0.014)
q^P	Compet. exec. recruitment	0.057***				0.056***
		(0.005)				(0.005)
	Polity IV		0.008***			
			(0.001)			
	Compet. Participation			0.036***		
				(0.003)		
	Unregulated participation			0.369***		
				(0.035)		
	Avg. Polity 1950-75				0.005***	
					(0.001)	
	Constant	-0.036***	0.060***	-0.041***	0.071***	-0.004
		(0.007)	(0.005)	(0.006)	(0.007)	(0.009)
	ρ_2	0.050*	0.038	0.041	0.029	0.050*
		(0.027)	(0.026)	(0.027)	(0.031)	(0.027)
Observations		3516	3516	3516	3411	3513
Log-likelihood		-379.15	-375.30	-382.59	-408.17	-366.19
Countries		133	133	133	129	133

Standard errors clustered by country reported in parenthesis.
† De-meaned variables. †† De-meaned 3rd order polynomials of demeaned variables.
*** significant at 1%, ** significant at 5%, * significant at 10%.

Table 10.9: Simulated concessions and policy, using model (4) from table 10.7

Avg. Govt. share of GDP per capita							
Simulated	Leftist govts.			Non-leftist govts.			Diff. in
concession	War	Peace	Diff.	War	Peace	Diff.	diff.
1st Quartile	29.689	20.799	8.890	21.367	21.826	-0.459	9.349
2nd Quartile	25.843	19.386	6.457	17.140	19.620	-2.480	8.937
3rd Quartile	13.750	19.547	-5.797	22.998	18.542	4.456	-10.253
4th Quartile	-	17.386	-	14.933	14.871	0.062	-

Avg. Municipal autonomy							
Simulated	Nationalist govts.			Non-nationalist govts.			Diff. in
concession	War	Peace	Diff.	War	Peace	Diff.	diff.
1st Quartile	0.719	0.916	-0.197	0.984	1.233	-0.249	0.052
2nd Quartile	0.625	1.171	-0.549	1.190	1.288	-0.098	-0.451
3rd Quartile	1.000	1.484	-0.484	1.400	1.530	-0.130	-0.354
4th Quartile	-	1.652	-	1.600	1.294	-0.306	-

Avg. Local states autonomy							
Simulated	Nationalist govts.			Non-nationalist govts.			Diff. in
concession	War	Peace	Diff.	War	Peace	Diff.	diff.
1st Quartile	0.906	0.675	0.231	0.619	0.764	-0.145	0.376
2nd Quartile	0.600	0.308	0.292	0.952	0.585	0.367	-0.075
3rd Quartile	0.800	0.940	0.140	0.889	0.862	0.027	0.113
4th Quartile	-	1.871	-	1.600	1.050	0.550	-

Table 10.10: Simulated concessions and policy, using model (5) from table 10.7

100×Avg. govt. expenditures/GDP							
Simulated	Leftist govts.			Non-leftist govts.			Diff. in
concession	War	Peace	Diff.	War	Peace	Diff.	diff.
1st Quartile	24.476	22.582	1.894	17.809	20.670	-2.798	4.692
2nd Quartile	28.990	19.383	9.607	19.219	19.233	-0.014	9.621
3rd Quartile	32.394	18.269	14.125	21.409	18.444	2.965	11.160
4th Quartile	-	16.952	-	11.737	15.058	-3.321	-

Municipal autonomy							
Simulated	Nationalist govts.			Non-nationalist govts.			Diff. in
concession	War	Peace	Diff.	War	Peace	Diff.	diff.
1st Quartile	0.950	0.872	0.078	1.053	1.329	-0.276	0.354
2nd Quartile	0.500	1.089	-0.589	1.326	1.416	-0.090	-0.499
3rd Quartile	0.667	1.518	-0.851	0.500	1.330	-0.830	-0.021
4th Quartile	-	1.500	-	1.500	1.357	0.143	-

Local states autonomy							
Simulated	Nationalist govts.			Non-nationalist govts.			Diff. in
concession	War	Peace	Diff.	War	Peace	Diff.	diff.
1st Quartile	0.800	0.448	0.352	0.703	0.636	0.067	0.285
2nd Quartile	0.938	0.722	0.216	0.971	0.671	0.300	-0.084
3rd Quartile	0.733	0.973	-0.240	0.688	0.755	-0.067	-0.173
4th Quartile	-	1.700	-	1.500	1.172	0.328	-

Table 10.11: Simulated concessions

	Implied by table 10.7, column: (4)	(5)
Number of country years	3626	3438
Country-years bound by commitment	481	298
Country-years bound by commit., $q^P = 0.12$	440	298
Country-years bound by commit., $q^P = 0$	506	298
Country-years bound by commit., $q^W = 0.22$	892	1325
Country-years bound by commit., $q^W = 0$	478	295
Country-years bound by commit., after d increases by 25%	308	179
Country-years bound by commit., after d decreases by 25%	869	1866
Country-years not bound by commitment in the data		
Avg. increase in concessions, $q^P = 0.12$	-3.18%	-6.22%
Avg. increase in concessions, $q^P = 0$	2.96%	4.65%
Avg. increase in concessions, $q^W = 0.22$	29.67%	41.01%
Avg. increase in concessions, $q^W = 0$	0.01%	-0.84%
Avg. increase in concessions, after d decreases by 25%	1.55%	-4.64%
Country-years bound by commitment in the data		
Avg. increase in concessions, $q^P = 0.12$	2.41%	0.08%
Avg. increase in concessions, $q^P = 0$	0.17%	0.00%
Avg. increase in concessions, $q^W = 0.22$	0.52%	0.06%
Avg. increase in concessions, $q^W = 0$	0.14%	0.31%
Avg. increase in concessions after $d \to \infty$	340.23%	138.11%
Avg. increase in concessions after d increases by 25%	19.96%	21.08%

Table 10.12: Simulated probabilities of war

	Implied by table 10.7, column: (4)	(5)
Overall avg. prob. war	8.01%	8.08%
Country-years not bound by commitment in the data		
Avg. Probability of war	2.40%	2.25%
Avg. Prob. war, $q^P = 0.12$	2.19%	2.36%
Avg. Prob. war, $q^P = 0$	2.43%	2.17%
Avg. Prob. war, $q^W = 0.22$	29.25%	40.47%
Avg. Prob. war, $q^W = 0$	2.06%	1.93%
Avg. Prob. war, after d decreases by 25%	31.04%	50.54%
Country-years bound by commitment in the data		
Probability of war	80.17%	80.46%
Avg. prob. war, $q^P = 0.12$	82.44%	82.70%
Avg. prob. war, $q^P = 0$	77.11%	77.80%
Avg. prob. war, $q^W = 0.22$	82.17%	89.50%
Avg. prob. war, $q^W = 0$	80.18%	79.67%
Avg. prob. war after $d = X$	98.94%	85.28%
Avg. prob. war after d increases by 25%	64.28%	52.15%
Avg. prob. war after d decreases by 25%	89.56%	93.88%

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Appendix 2: A simple dynamic model

11.1 Assumptions

In this appendix, I provide a simple dynamic model consistent with the basic assumptions of the main model provided in the text. Suppose now there is a two player game where, denoted by player 1 and 2. In each period, one of them is the incumbent and the other is in the opposition (I say that $I_t = 0$ if player 1 is in the opposition and $I_t = 1$ if player 1 is in the government). The player in the government receives an exogenous $\tau_{it} = \gamma + \beta\tau_{it-1} + \omega_{it}$, where $\omega_{it} \sim i.i.d.\ G(\omega_{it})$, with mean zero. Moreover, the player in the government have an utility transfer to be made to the player in the opposition $g_t > 0$.

After the occurrence of such a transfer, the player in the opposition decides to go to war. Suppose that in each period, a player faces a cost of war $c_{It} = \mu_I + \alpha c_{It-1} + \epsilon_{It}$ if he is the incumbent and $c_{Ot} = \mu_O + \alpha c_{Ot-1} + \epsilon_{Ot}$ if he is the opposition, where $\epsilon_{it} \sim i.i.d.\ F(\epsilon_{it}), i \in \{I, O\}$ with mean zero. If the opposition decides to go to war, it becomes the government with probability q^W, otherwise, it becomes the government with probability $q^P < q^W$ (to go without too much notation, I assume these probabilities are time invariant, this assumption does not drive the conclusions to be reached here). Players discount the future with discount rate δ.

The timing of the game is as follows:

1. In each period t, both players make *promises in* t of $P_{it} = \{g_{si}(h^s)\}_{s>t}$ to be implemented in case they become incumbents, where the vector $h^t = ([\tau_0, I_0, c_{10}, c_{20}, g_0, P_0, W_0], [\tau_1, I_1, c_{11}, c_{21}, g_1, P_1, W_1], ..., \tau_t, I_t, c_{1t}, c_{2t})$ is the history of the game up to period t.

2. After observing such a promise, the player in the opposition decides to go to war ($W_t = 1$) or not ($W_t = 0$)

3. Nature decides who becomes the incumbent in the next period $t + 1$, decides on ω_{t+1} and ϵ_{t+1}

4. In $t+1$, the incumbent decides whether to implement the promise made in the last period, or to pay a cost d and implement something else

5. Steps (1)-(4) repeat infinetely

11.2 Solution

At first, I look at the equilibrium of the game described above that repeats a "static"Nash equilibrium of the stage game. That solution already has some dynamic content to it due to the fact that, in each stage, given $d > 0$, a player can make binding promises P_{it}.

Definition 4 *The promise in t* $P_{it}(h^t, g_t) = \{g_{si}(h^s)\}_{s>t}$ *is* ***implementable by player*** **i** *if, in periods* $s > t$*, during stages (1) and (4), player i does not want to make something different from what was specified by promise* P_{it}*.*

The set of all promises in t that are implementable by player i is denoted by $IP_i(h^t, g_t)$*.*

Note that, for a promise $P_{it} = (g_{t+1,i}(h^{t+1}), P'_{it+1}(h^{t+1}, g_{t+1}))$ to be implementable by player i in t, it must be true that the promise in $t+1$ given by $P'_{it+1}(h^{t+1}, g_{t+1})$ is implementable by i. In this way, the fact that player i makes promises in stage (1) of every period does not change the fact that promises are consistent with the solution with commitment.

Let $V^i_{jt}(h^{t-1})$ be the expectation (taken in $\tau_{t+1}, c_{1t+1}, c_{2t+1}$) of the payoff in t of player j when i is the incumbent. Let the set $\mathcal{V}^i_{jt}$ be the set of all $V^i_{jt}(h^{t-1})$ consistent with promises in $t-1$ that are implementable by i. Thus, given an implementable promise, one can write the payoff of player i in period t when he is in the opposition as:

$$\begin{aligned} g_t + W_t[-c_{it} + \delta(q^W V^i_{it+1}(h^{t+1}) + (1-q^W)V^j_{it+1}(h^{t+1}))] + \\ (1-W_t)\delta[q^P V^i_{it+1}(h'^{t+1}) + (1-q^P)V^j_{it+1}(h'^{t+1})] \end{aligned} \tag{1}$$

Player i's payoff in period t when we is in the government is:

$$\begin{aligned} \tau_t - g_t + W_t[-c_{it} + \beta(q^W V^j_{it+1}(h^{t+1}) + (1-q^W)V^i_{it+1}(h^{t+1}))] + \\ (1-W_t)\beta[q^P V^j_{it+1}(h'^{t+1}) + (1-q^P)V^i_{it+1}(h'^{t+1})] \end{aligned} \tag{2}$$

where the functions $V^i_{jt}(h^t)$ are in $\mathcal{V}^i_{jt}$, and the only difference between h^{t+1} and h'^{t+1} is W_t. Also, note that g_t and τ_t do not change the maximum of equations (1) and (2) in W_t. In other words, since we are looking at an equilibrium with no use of the repeated game to implement better equilibria, W_t will not depend on g_t, g_{t-1} and then on. With that in hands, one can show the following lemmas:

Lemma 5 $\sup \mathcal{V}^i_{jt} = \bar{V}^i_{jt} < \infty$ *for all* i, j.

Proof: $V^i_{it}(h^{t-1})$ is limited above by the following: (i) whenever i is in government, make $g_t = 0$ and j does not go into war; (ii) whenever i is in the opposition, j makes a transfer of d and i does the best out of (ii.1) going to war to have a higher probability of becoming an incumbent in the next period, or (ii.2) not going to war not to face the cost of wars. The payoff of (i)-(ii) is finite. ■

Lemma 6 *The promise* P_{it} *is implementable by player* $i \leftrightarrow V^i_{it+1}(h^t) \in [\bar{V}^i_{it} - d, \bar{V}^i_{it}]$, $V^i_{it+2}(h^{t+1}) \in [\bar{V}^i_{it+1} - d, \bar{V}^i_{it+1}]$, *and then on.*

Proof: Immediate from utility maximization by player i in stages (4) of each period. ■

Note that this lemma allow us to exchange implementable promises of P_{it} with implementable promises of V^i_t, V^i_{t+1} and then on.

Now, let X_t be the maximum social surplus in period t. More explicitly:

$$X_t(h^{t-1}) = \max_{P_{it};\{W_s\}_{s\geq t}} E\left[\left(\sum_{s=t}^{\infty} \delta^{s-t}[\tau_t - (c_{1t} + c_{2t})W_s]\right)|h^{t-1}\right]$$
$$s.t.\ W_s \text{ is IC } \forall s \geq t$$
$$P_{it} \in IP_i(h^t, g_t)$$

Proposition 7 *On the optimal promise,* $V^i_{jt}(h^{t-1}) + V^i_{it}(h^{t-1}) = X_t(h^{t-1})\ \forall h^t$

Proof: When $d = 0$, by lemma 2, every player is going to make promises with $V^i_{it} = \bar{V}^i_{it}$ (and, by the maximization in stage (4) in every period, make $g_t = 0$, since the player in the opposition takes g_t as given when deciding to go to war, and we are supposing a "static"repetition of the stage game Nash equilibrium). That determines the vector $\{W_s\}_s$ by the IC constraints and, thus, it determines a unique value of X_t and V^i_{jt}. By definition of $X_t(h^{t-1})$, we have that $X_t(h^{t-1}) = V^i_{jt} + V^i_{it}$.

To solve for the case when $d > 0$, I use something similar to the proof of Theorem 1 in Levin (2003). I start by showing the following lemma: suppose there is a promise in $t-1$ that is implementable by i and yields $V^i_{it} + V^i_{jt} = S$. Then, there is another promise in $t-1$ yielding U^i_{it} and U^i_{jt} to players i and j

that is (i) implementable by i and (ii) yields $U'^i_{it} + U'^i_{jt} = S$. After showing this lemma, I show that promising $V^i_{it} + V^i_{jt} < X_t$ is not optimal to player i.

Lemma 8 *Suppose $d > 0$, and that there is a promise in $t-1$ that is implementable by player i and yields V^i_{it}, V^i_{jt} to each player, with $V^i_{it} + V^i_{jt} = S$. Then, there is another promise in t that is implementable by i, yielding payoffs U^i_{it} and U^i_{jt}, with $U^i_{it} + U^i_{jt} = S$.*

Proof: To see that, take the original implementable promise in t, and change $g_{t+1}(h^{t+1})$ by $g_{t+1}(h^{t+1}) + \epsilon$ if $W_t = 0$, and by $g_{t+1}(h^{t+1}) + \epsilon\frac{(1-q^P)}{(1-q^W)}$ if $W_t = 1$ (more explicitly, take $\epsilon < 0$ if $g_{t+1}(h^{t+1}) > 0$, and $0 < \epsilon$ if $g_{t+1}(h^{t+1}) = 0$). Since the original promise is implementable, the new promise is also implementable with $d > 0$ and small enough ϵ. Note that the opposition will to go to war in $t+1$ (and in $s \geq t+1$, more generally) iff:

$$-c_{jt+1} + \delta(q^W V^j_{jt+2}(h^{t+2}) + (1-q^W)V^i_{jt+2}(h^{t+2})) \geq \\ \delta(q^P V^j_{jt+2}(h'^{t+2}) + (1-q^P)V^i_{jt+2}(h'^{t+2})) \qquad (3)$$

Now, as the promises of $\{g_s\}_{s>t+1}$ were not changed by the new implementable promise under consideration, equation (3) indicates that the decisions of war in $t+1$, $t+2$ and then on have not changed after the change in implementable promise. Consequently, the continuation values from $t+1$ onwards have not changed. Now, going for the decision of war in t, it is given by:

$$const + \delta(1-q^W)\epsilon\frac{(1-q^P)}{(1-q^W)} \geq const' + \delta(1-q^P)\epsilon \qquad (4)$$

Where *const* and *const*$'$ are terms that are constant across the two promises under consideration (note that, since war decisions in $t+1$ onwards have not changed, and the two promises I set up do not change g_{t+2} onwards, the continuation values in $t+2$ have not changed across promises). Now, note that the terms proportional to ϵ in both sides of (4) can be cut off, which makes the decision of war in t under the new promise the same as the decision of war under the original promise.

Now, since both promises implement the same vector of $\{W_s\}_{s\geq t}$, they both have the same social surplus $S = E[-\sum(c_{1t} + c_{2t})W_t]$.■

Lemma 9 *Suppose there is an implementable promise V^i_{it} and V^i_{jt} such that $V^i_{it} + V^i_{jt} < X_t$. Then, this implementable promise is not optimal for player i.*

Proof: By definition of X_t, there is an implementable promise U^i_{it}, U^i_{jt} such that $U^i_{it}+U^i_{jt} = X_t$. From lemma 3 and 2, it can be seen that every payoff vector U^i_{it}, U^i_{jt} with $U^i_{it} \in [\bar{V}^i_{it} - d, \bar{V}^i_{it}]$, $U^i_{jt} < \bar{V}^i_{jt}$ and $U^i_{it} + U^i_{jt} = X_t$ is implementable.

Now, take the promise V^i_{it} and V^i_{jt}. First, suppose that $X - V^i_{jt} \leq \bar{V}^i_{it}$ and consider the deviation $X - V^i_{jt}$ and V^i_{jt}. Since V^i_{jt} has not changed, the incentives for war have not changed. Also, since $V^i_{it} + V^i_{jt} < X_t$, the payoff to player i has increased with the new promise. Finally, since $\bar{V}^i_{it} \geq X - V^i_{jt} > V^i_{it} \geq \bar{V}^i_{it} - d$ and $V^i_{jt} < \bar{V}^i_{jt}$ (the last inequality comes from the feasibility of the original promise), the new promise is implementable, and thus, deviating to $X - V^i_{jt}, V^i_{jt}$ is optimal for i.

Now, suppose that $X - V^i_{jt} > \bar{V}^i_{it}$. In this case, the above deviation is not feasible. However, player i may deviate to promising to himself $\bar{V}^i_{it}$ and promising to the opposition $X - \bar{V}^i_{it}$. Trivially, the new promise is implementable, since $\bar{V}^i_{it} \in [\bar{V}^i_{it} - d, \bar{V}^i_{it}]$. Moreover, promising to player j the continuation value $X - \bar{V}^i_{it}$ implements the same solution of wars as the promise that makes X, which minimizes expected costs of war. Finally, promising $X - \bar{V}^i_{it}$ to the opposition must be feasible (in terms of making $X - \bar{V}^i_{it} < \bar{V}^i_{jt}$), otherwise, X would not be attainable. Consequently, if $X - V^i_{jt} > \bar{V}^i_{it}$, then it must be optimal to deviate to promising $\bar{V}^i_{it}$ to oneself and promising $X - \bar{V}^i_{it}$ to the other player. ■

These two lemmas (3 and 4) prove the proposition, that on the optimal promise, $V^i_{it} + V^i_{jt} = X_t$. ■

This proposition makes the core link between the dynamic problem presented in this appendix and the problem presented in the text. More explicitly, we can now simplify the notation of the problem, and say that if V^i_t is the value that player i promises to 1, which, by the proposition I just proved, implies that player 2 will get $X - V^i_t$. Denote by $\bar{V}_t$ the maximum continuation value that can be promised to player 1 starting from period t (which does not depend on the previous occurrence of wars), and denote by $X_t - \underline{V}_t$ the maximum player 2 can promise to himself as a continuation value from period t on.

Even more, this proposition shows that the player in government would not want to implement an inefficient punishment in response to the player in opposition going into war. That is going to be true as long as the player in government has the capacity to make a perfect transfer to the player in government. Here, this transfer is given by g_t.

With this notation, the condition for player i to go into wars when he is in the opposition becomes:

$$-c_{it-1} - \delta q^W V_t^i(h^t) - \delta(1 - q^W)V_t^j(h^t) \geq -\delta q^P V_t^i(h^t) - \delta(1 - q^P)V_t^j(h^t) \quad (5)$$

Finally, the last proposition proves the existence of a Markov solution to the dynamic model above.

Proposition 10 *There is a solution of the promise making stage that makes* g_t *be a function of* $\tau_{t-1}, I_{t-1}, c_{1t-1}, c_{2t-1}, W_{t-1}$.

Proof: With no loss in generality, suppose the incumbent is player 1. The problem of the incumbent making the promise is:

$$\max_{g_t, \{V^1(h^s)\}} W_t(-c_{it} + \delta q^W V_{t+1}^2(h^{t+1}) + \delta(1 - q^W)V_{t+1}^1(h^{t+1}))+ \\ (1 - W_t)(\delta q^P V_{t+1}^2(h'^{t+1}) + \delta(1 - q^P)V_{t+1}^1(h'^{t+1})) \quad (6)$$

$$s.t. - c_{it} - \beta q^W V_{t+1}^2(h^{t+1}) - \beta(1 - q^W)V_{t+1}^1(h^{t+1}) \geq \\ - \beta q^P V_{t+1}^2(h^{t+1}) - \beta(1 - q^P)V_{t+1}^1(h^{t+1}) \quad (7)$$

$$V_{t+1}^1 \in [\bar{V}_{t+1} - d, \bar{V}_{t+1}] \quad (8)$$

The equivalent problem can be written to the player in the opposition. Now, note that exept for W_t, c_{1t}, c_{2t}, I_t and τ_t (this last variable is important to determine τ_{t+1}, and consequently, the value $\bar{V}_{t+1}$ player 1 can get as an incumbent), the history of the game h^{t+1} does not enter the maximization problem. Consequently, the values V_{t+1}^i are only a function of W_t, c_{1t}, c_{2t}, I_t and τ_t (and, analogously, the continuation value promised in $t-1$ to be received in t, given by V_t^i, is a function of $W_{t-1}, c_{1t-1}, c_{2t-1}, I_{t-1}, \tau_{t-1}$). Finally, note that g_t can change so that the value promised in $t-1$ can be attained. Consequently, g_t is going to adjust to make a function of $W_{t-1}, c_{1,t-1}, c_{2t-1}, I_{t-1}, \tau_{t-1}$ be equal to the the weighted sum of (i) the expectation of V_{t+1}^i conditional on $W_{t-1}, c_{1,t-1}, c_{2t-1}, I_{t-1}, \tau_{t-1}$ plus (ii) $\gamma + \beta\tau_{it-1}$ minus (iii) g_t. Consequently, g_t will be a function of $W_{t-1}, c_{1,t-1}, c_{2t-1}, I_{t-1}, \tau_{t-1}$. ■

The intuition from the proposition above is the following: suppose a player in government is providing incentives to the opposition using $g_t, g_{t+1}, ...$. The player in government can provide the same incentives for W_{t-1} by (i) resetting $g_{t+1}, g_{t+2}, ...$ to provide optimal incentives for the choices of $W_t, W_{t+1}, ...$ and (ii) adjusting g_t to provide the same incentives to the opposition that was provided by the original promise.

With this proposition in hands, we can say that, in fact, the solution of the model stated during the main part of the article is the solution to this dynamic model. Finally, note that the value of problem (6)-(8) is $\bar{V}_t - E_{t-1}[\tau_t]$, and the value of the problem of player 2 is $X - \underline{V}_t - E_{t-1}[\tau_t]$. These fixed point problems can be used to solve for $\bar{V}_t$ and $\underline{V}_t$.

11.3 How could relationships be modeled in this framework?

Note that, despite the fact that the model explicitly considers that transfers g_t are tailored to provide incentives for the opposition not to go to war, as if there was a relationship between the two players, I do not allow for a relationship between the two players to create incentives for the player in government to implement its promises.

Despite that, relationships can be added to this framework in the following manner: suppose that, besides relationships, there is some other mechanism that make players pay for deviations of their promises (say, a legislative or a judiciary who will not be willing to accept a transfer different from the one promised, or a foreign power willing to cut aid off in the case of a broken promise), and this mechanism imposes a cost $\tilde{d}$ on the player who breaks his promises.

Now, suppose players play the following strategy: play as if there was a cost on broken promises of $d \geq \tilde{d}$. If, in any period, a player deviates from his promise, go back to playing the "static"Nash equilibrium with $\tilde{d}$. In each period, the player i in the government is going to get the payoff $\tau_t - g_t + \bar{V}^i_{t+1}(d)$, supposing the Markov solution is valid, and making it explicit that the value $\bar{V}^i_{t+1}$ depends on d.

With this reputational scheme, the choice by the player i in government is between implementing g_t and $\bar{V}^i_{t+1}(d)$, or implementing $g_t = 0$ and having to pay $\tilde{d}$ and continue with $\bar{V}^i_{t+1}(\tilde{d})$. The player in the government chooses to implement his promise if $g_t < \bar{V}^i_{t+1}(d) - \bar{V}_{t+1}(\tilde{d}) + \tilde{d}$. In other words, for this to be an equilibrium, it must be true that $d = \bar{V}^i_{t+1}(d) - \bar{V}^i_{t+1}(\tilde{d}) + \tilde{d}$. Now, note that the choice set of both the incumbent and the opposition expands with d, and thus, their payoff must increase weakly in d. That shows a trade-off in increasing the formal/artificial $\tilde{d}$: it increases directly the costs of breaking a promise, but it decreases the capacity to punish the party who has not cooperated. I do not analyze this here, since it is out of the scope of this paper.