Buttery Guns and Welfare Hawks: The Politics of Defense Spending in Advanced Industrial Democracies

Supporting Information

Overview

In this document we discuss in greater detail a number of decisions that we made in our analyses dealing with the dependent variable, model specification, and the choice of which nations to include and exclude from our sample.

Choice of Dependent Variable

As we state in the manuscript, we chose to model military spending across nations and time as a percentage of GDP. In the paper we provide a set of citations to other studies of comparative government spending that have used a similar strategy in their attempt to model government spending across nations and over time. While we believe that there are strong theoretical reasons to use this measure, there are also strong technical reasons to use this particular dependent variable. In particular, the most obvious alternative measures of military spending exhibit time series properties that have been shown to be prone to spurious inferences. This is best illustrated in figures.

Figure 1 shows the plot of military spending in millions of dollars across time for the nations included in this study. The general upward trend in values of this variable makes us suspicious that there may be a panel unit root, or, in other words, that our series are not stationary and therefore might be prone to spurious inferences (Granger and Newbold 1974). As we discuss in the paper, we conducted tests for panel unit roots using a procedure developed by Im, Pesaran, and Shin (2003).[1] When we conduct this test for military spending in millions of dollars we receive a test statistic of $Z_{\tilde{t}-bar} = 11.89$ with a corresponding p-value of 1.00. We also fail to reject the null of panel unit roots in the Levin and Lin (1992) tests.[2] Collectively, this is strong evidence confirming our intuition of non-stationarity.

A standard practice when one encounters strong evidence of non-stationarity in a series is to difference the variable in question. Figure 2 shows a plot of differenced military spending across time for our sample of cases. While this variable is stationary in mean ($Z_{\tilde{t}-bar} = -14.67$), Figure 2 demonstrates that it is clearly not stationary in variance. Although all standard econometric treatments of stationarity (e.g., Asteriou and Hall 2006, p. 231) discuss this assumption, there are no canned tests for variance-stationarity avail-

[1] We used the test developed by Im, Pesaran, and Shin because this is one of the few tests that allows us to relax the assumption of a uniform rho statistic across our panels. Like most tests for panel unit roots, the test developed by Im, Pesaran, and Shin requires that there be no gaps in the time series.

[2] The test for panel unit roots developed by Levin and Lin requires a rectangular data matrix for the dependent variable. Since our coverage for countries and years is not quite rectangular, we ran three separate tests for panel non-stationarity: one for all countries in our sample from 1957 to 1995, one for all countries in our sample except Portugal 1957 to 1995 (because of the gap in the series caused by the caretaker government in 1979), and one for all countries in our sample from 1960 to 1995 (because of different starting points). The adjusted t-values for the IPS tests on the three samples are 7.45, 6.84, and 6.09, all with corresponding p-values of 1.0.

able in Stata.

In comparison, our choice of dependent variable, *military expenditures as a % of GDP* meets the requirements of mean and variance stationarity. As noted in the manuscript, both the Im, Pesaran, and Shin (2003) and Levin and Lin (1992) tests reject the possibility of non-stationarity. More specifically, the Im, Pesaran, and Shin test produces a test statistic of $Z_{\tilde{t}-bar} = -2.70$, which means that we can reject the null of unit roots at the 99% confidence level (p-value=0.003). The Levin and Lin (1992) provide further support.[3] Additionally, Figure 3 plots the series across time. Not only does the series appear to be mean stationary, but it also outperforms the other two alternatives by meeting the variance stationarity assumption of time series.

Expanded Sample

We theorize that changes in defense spending reflect the domestic political consequences related to defense spending. As such, governments will respond to international conflicts differently, according to their ideological position on international involvement and domestic welfare priorities. A key assumption of this theory is that governments be able to produce meaningful changes in the level of defense spending to meet these domestic priorities. Furthermore, governments must be able to use their involvement in international conflict to justify these changes. Our sample of advanced democracies includes a wide variation of levels of defense spending and international conflict involvement.

Yet, we exclude four advanced democracies from the empirical analysis because they do not satisfy the assumptions described above. First, we exclude Japan and Germany because of the constitutional limits on the offensive use of force. We suggest that it is uninformative to view the interactive relationships between partisanship, international conflict and defense spending in these states. Second, we exclude Iceland because the vast majority of meaningful changes in defense spending are beyond the control of Iceland and instead under the purview of the United States. Finally, we exclude the United States from the sample because of the unique spending dynamics that were a function of profound security threats during the Cold War. While we have strong theoretical rationale for excluding these states, it is important to note whether the empirical results are robust to this expanded sample. If not, then our conclusions about the welfare effects of defense spending might be limited to the advanced democracies in the sample.

To determine the robustness of these models, we estimate the same four models (shown in Tables 3 and 4 in the manuscript) on an expanded sample that includes all four excluded states. The new sample includes 922 observations (rather than the old sample of 776 observations) and adds 45 observations for the US, 37 for Japan, 44 for Iceland and 20 for Germany. Table 3 shows the differences between the two samples. The results of these four models are presented in Table 4. The two additive and two interactive models pro-

[3]The resulting t-star statistics were -4.33, -4.39, and -4.38, all with p-values less than .001.

vide coefficients that are similarly signed and of the same magnitude as those presented in the manuscript. Two exceptions are the *alliance*$_{t-1}$ variable which is now statistically significant (at the 90% confidence level) in the Additive and Interactive Two-Dimensional models, and *real growth in GDP*$_{t-1}$, which is significant and positive in every model except the Interactive Two-Dimensional model. While *real growth in GDP*$_{t-1}$ is in the expected direction, the *alliance*$_{t-1}$ variable is positive once we include the US in the sample.

More importantly, the key theoretical variables—the partisanship variables, international conflict, and their interactions—are all at the same levels of statistical significance as in the manuscript. Thus, based on the preliminary analysis of the coefficients, we can be confident that the empirical results that we discover in the manuscript are not artifacts of sample selection. Indeed, the results are robust even after introducing much more variation in defense spending behaviors.

As in the manuscript, these coefficients only allow a limited number of inferences to be made about short- and long-term relationships. We therefore provide Figures 4-6, which show the marginal effects of the partisanship variables and international conflict involvement. While there are slight differences in the statistical significance of some of the relationships, we are given more confidence that our relationships are robust to the expanded sample. One difference is in Figure 4, where the marginal effect of a shift toward the right is now statistically significant (at the 90% confidence level) at all values of conflict involvement. The rest of the inferences are similar to those in the manuscript. What is important to note from the right panel is that the relationship between conflict involvement and defense spending is not conditioned by the government's right-left position. Figure 5 shows that austere governments only increase military spending in response to conflict involvement. Unlike austere governments, generous governments—who pursue higher levels of defense spending for their distributional benefits—do not need higher levels of defense spending during conflict. Figure 6 shows that the marginal effect of a move toward a hawkish government is positive (though the marginal effect borders conventional levels of statistical significance) when there are no conflicts. Conflict has a positive effect on defense spending for all levels of hawkishness, though the strength of the effect decreases for more hawkish governments.

The dynamic simulations show that the long-term relationships observed in the manuscript are also present in the expanded sample. Figures 7-9 demonstrate that domestic concerns (in the form of generous governments) dominate international positions (in the form of hawkishness) to influence defense spending. These relationships are conditional on the amount of international conflict involvement. Altogether, these figures indicate that while we have strong theoretical justifications for excluding these four countries, this decision has no discernible impact on the external validity of our results. Thus, we are confident that the incentives to use defense spending as welfare spending in disguise exist within all advanced democracies, and that these incentives combine with international conflict to explain changes in defense spending.

Government Strength

One possibility that we need to control for is that government strength—in the form of minority government—may change the ability of the government to influence military spending in the budgetary process. If the government must rely on the support of non-governing parties to gain majority support for the budget, then they may be constrained in their ability to implement their policy priorities. If this is the case, then one might expect that the effects of government partisanship and international conflict may depend on whether the governing parties control a majority of seats in parliament. One way of determining whether majority support conditions the relationship between government partisanship, international conflict, and defense spending is by including a three-way interaction into the model. Table 5 adds two three-way interactions (*Minority*×*Conflict*×*Welfare* and *Minority*×*Conflict*×*International*) into the Two-Dimensional Interactive Model.

Table 5 provides the results of the interactive models of defense spending under minority governments. The coefficients themselves are difficult to interpret, given that they provide rather limited hypothesis tests (Brambor, Clark and Golder 2006). A more appropriate test to determine whether minority government—as a lower-order coefficient or as part of an interaction—influences defense spending is an F-test (Kam and Franzese 2007: 59-60). This test indicates that we cannot reject the null hypothesis that all of the variables including the minority variable are collectively equal to zero (χ^2=4.01, p-value=0.68). More specifically, an F-test that the *Minority*×*Conflict*×*Welfare* and *Minority*×*Conflict*×*International* are collectively zero tests whether government strength (in this case, minority government) conditions the key theoretical relationships emphasized in the manuscript. The F-test indicates that we fail to reject the null hypothesis that these coefficients are zero (χ^2=0.56, p-value=0.76). Thus, we are confident that the strength of the government—whether additively or interactively—does not change the relationship between partisanship, international conflict, and defense spending.

Reverse Causality

In footnote #17 in the manuscript we describe our tests that address the possibility that military spending drives conflict involvement. In Table 6 we predict our international conflict involvement variable with the strategic environment variables included in the manuscript. If *military expenditures as a % of* GDP_{t-1} is statistically significant, then there is the possibility that the relationship we uncover in the manuscript is the result of military spending affecting conflict. Table 6 shows that the coefficient for *military expenditures as a % of* GDP_{t-1} is negative and not close to being statistically significant at conventional levels. This gives us confidence that the causal arrow points in the direction from conflict involvement influencing military spending and not the reverse.

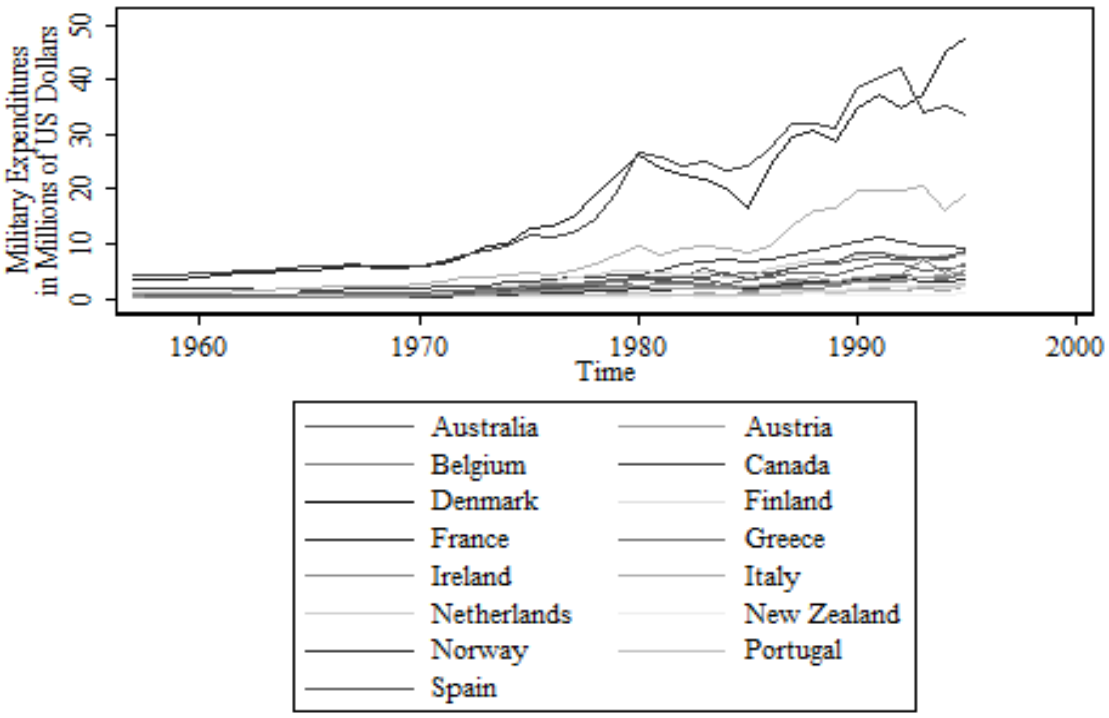

Figure 1: Military Spending in Millions of Dollars

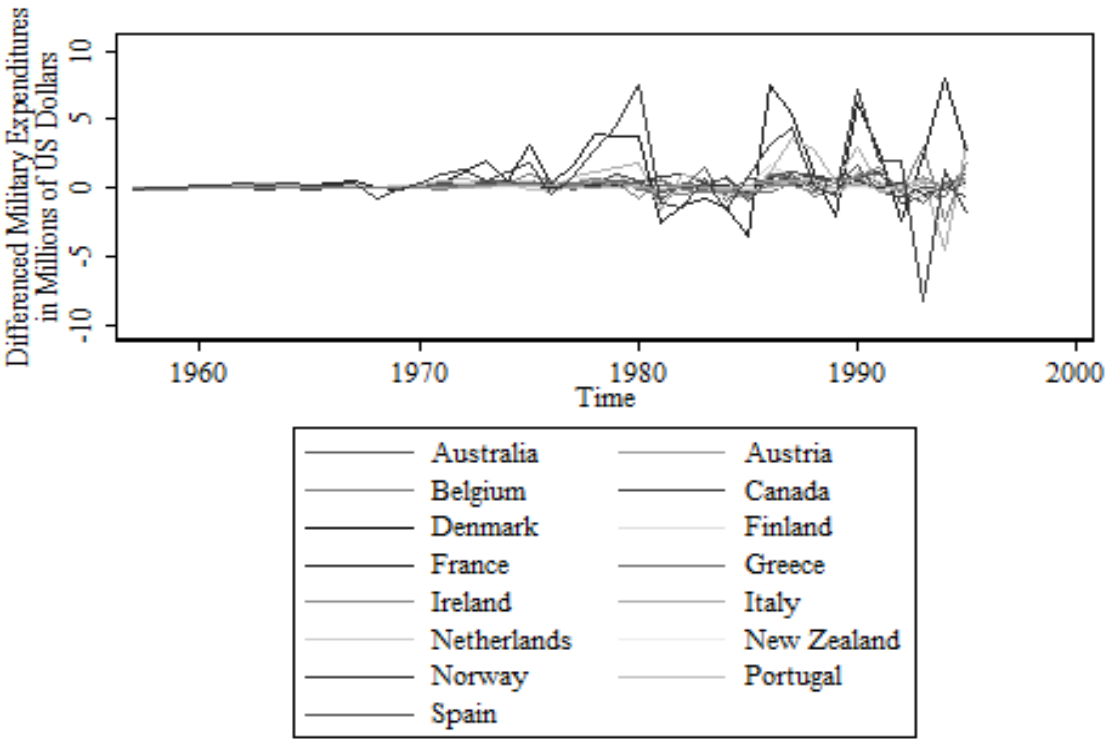

Figure 2: Differenced Military Spending in Millions of Dollars

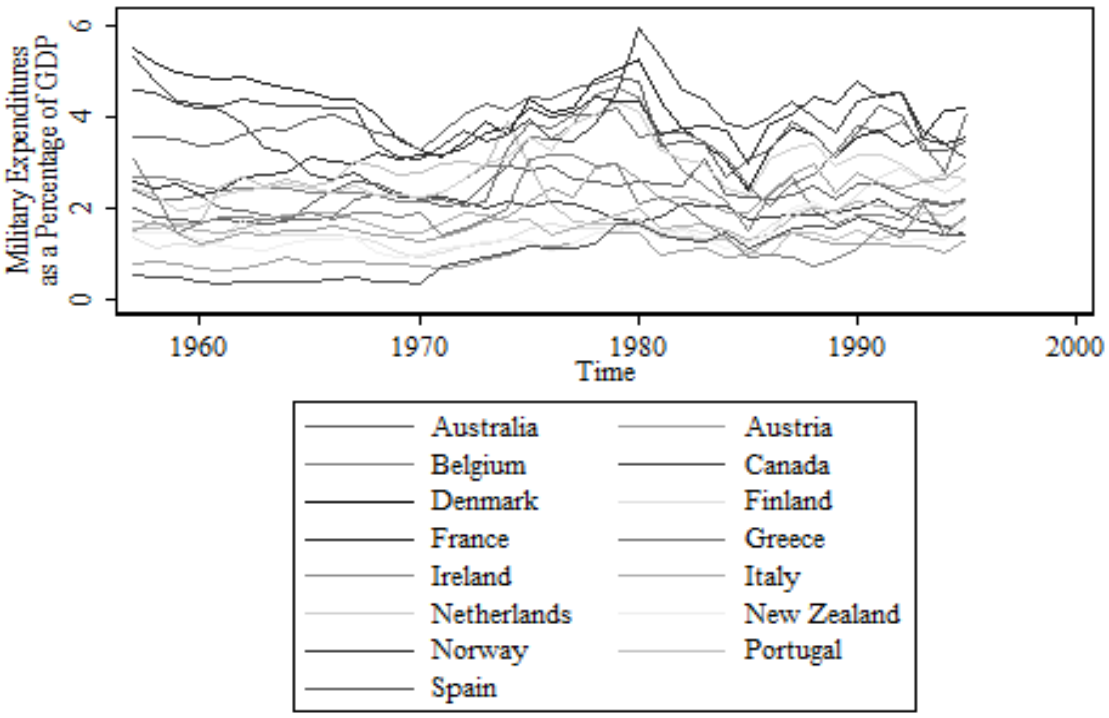

Figure 3: Military Spending as a Percentage of GDP

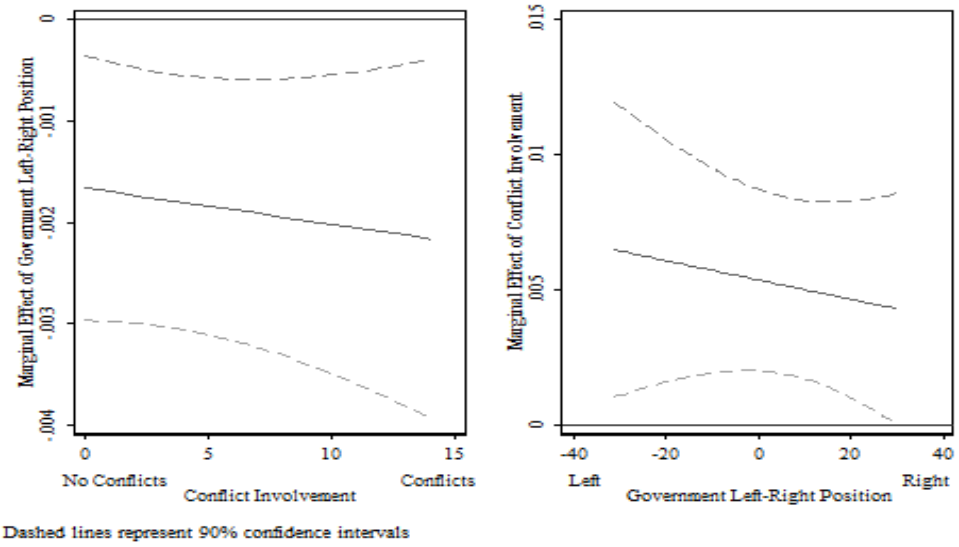

Figure 4: Estimated Contingent Effects of Government Right-Left Position and Conflict Involvement on Defense Spending: Expanded Sample

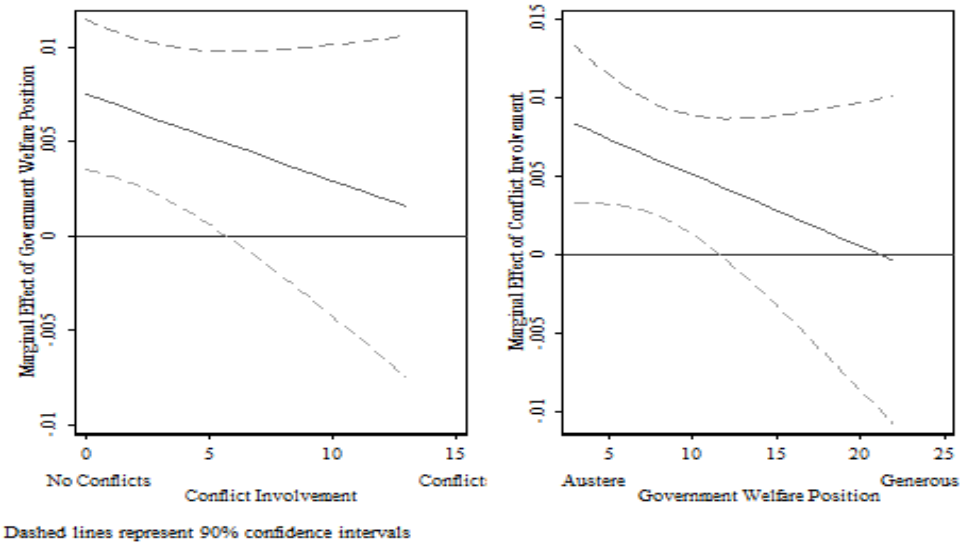

Figure 5: Estimated Contingent Effects of Government Welfare Position and Conflict Involvement on Defense Spending: Expanded Sample

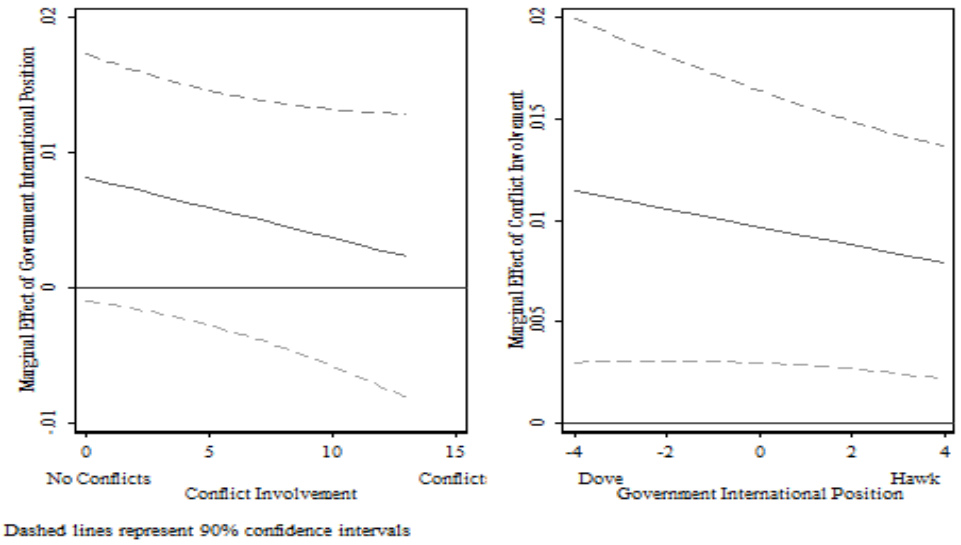

Figure 6: Estimated Contingent Effects of Government International Position and Conflict Involvement on Defense Spending: Expanded Sample

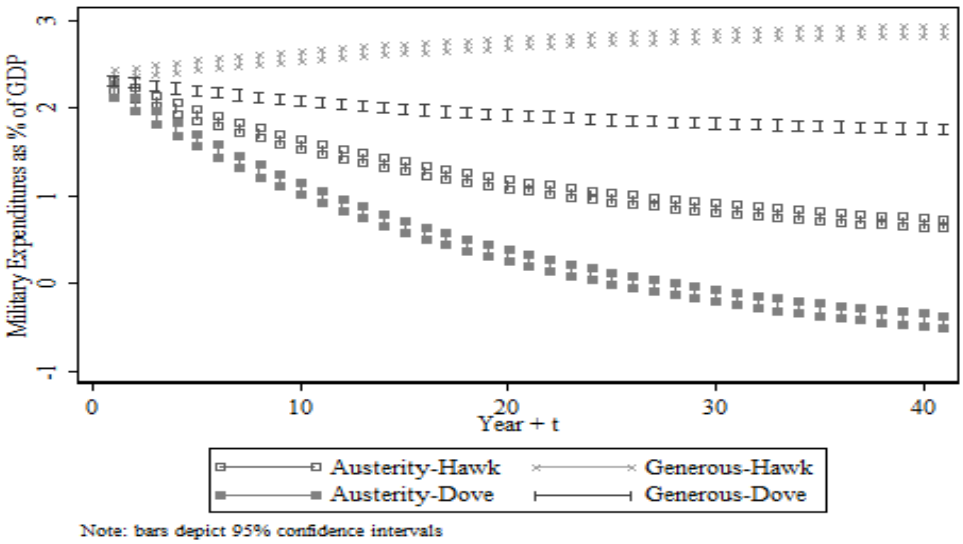

Figure 7: Predicted Defense Spending by Four Government Types over 40 Years of Peace: Expanded Sample

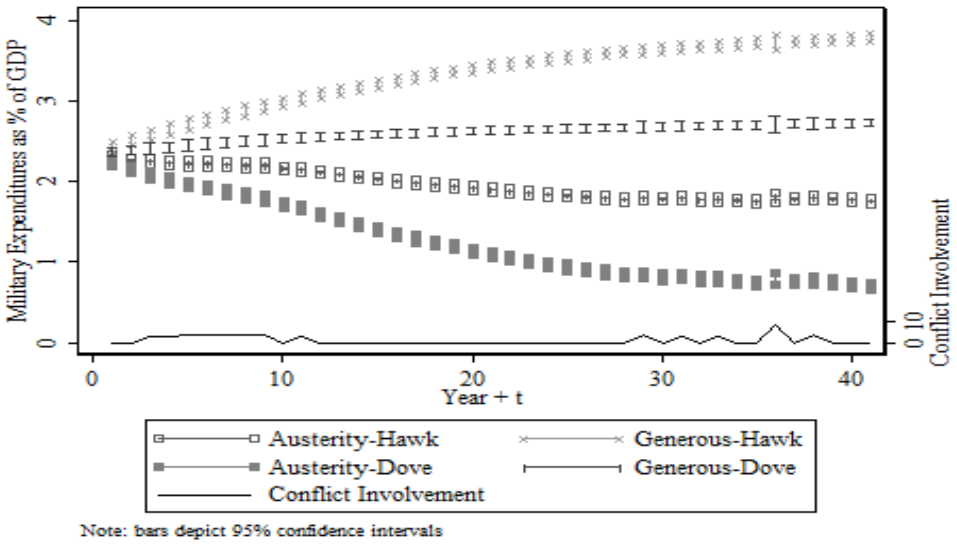

Figure 8: Predicted Defense Spending by Four Government Types over 40 Years of Swedish Conflict Involvement: Expanded Sample

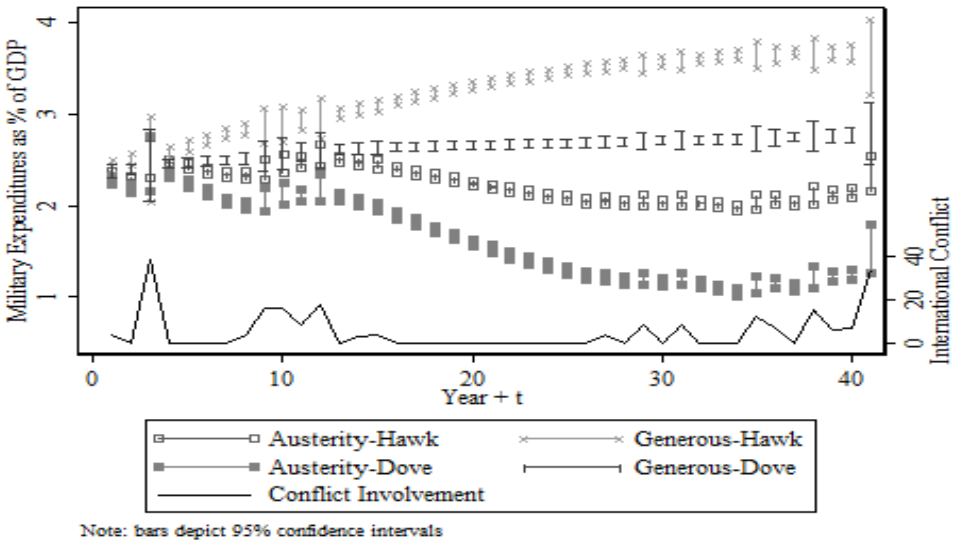

Figure 9: Predicted Defense Spending by Four Government Types over 40 Years of French Conflict Involvement: Expanded Sample

Table 1: Additive and Interactive Models of Defense Spending: Military Expenditures

Independent Variable	Additive One-Dim.	Additive Two-Dim.	Interactive One-Dim.	Interactive Two-Dim.
Lagged Military Exp.	0.921***	0.922***	0.921***	0.922***
	(0.041)	(0.041)	(0.041)	(0.041)
Gov't Left-Right Position	2,133.643		1,997.880	
	(3,370.061)		(3,411.492)	
Gov't Welfare Position		1,340.719		3,851.000
		(9,785.903)		(9,524.652)
Gov't International Position		25,830.318		22,694.006
		(23,242.118)		(22,038.620)
Gov't Left-Right×Conflict			58.865	
			(828.469)	
Gov't Welfare×Conflict				-2,069.052
				(3,908.372)
Gov't International×Conflict				2,627.234
				(12,643.426)
Conflict Involvement	27,019.424	27,269.210	27,225.701	49,212.011
	(19,075.811)	(19,134.870)	(18,686.669)	(45,127.050)
Minority Gov't	131,091.225	137,586.424	130,848.703	136,590.532
	(151,588.313)	(153,332.067)	(151,658.095)	(152,441.145)
Number of Gov't Parties	17,393.838	15,681.861	17,121.211	15,288.400
	(55,404.758)	(53,795.860)	(55,190.593)	(53,991.077)
Election Year	70,990.450	72,692.705	70,419.552	69,031.336
	(113,641.214)	(115,935.765)	(114,232.612)	(116,247.629)
Real GDP	0.002**	0.002**	0.002**	0.002**
	(0.001)	(0.001)	(0.001)	(0.001)
Real Growth in GDP$_{t-1}$	1510378.041	1528481.290	1463923.668	1251975.516
	(1934404.599)	(1921636.961)	(1991880.233)	(2024983.676)
CINC$_{t-1}$	22965352.417	23729135.550	23195428.136	22102817.064
	(36334577.693)	(36811152.690)	(36532096.221)	(37827499.510)
Alliance$_{t-1}$	-133,443.855	-154,312.156*	-133,456.074	-141,725.140
	(92,466.054)	(90,533.338)	(91,616.342)	(89,664.590)
US/USSR CINC Ratio$_{t-1}$	-174,738.385	-173,925.653	-174,165.726	-179,370.068
	(258,881.114)	(251,413.450)	(258,590.614)	(252,174.612)
Change in US Mil. Exp.$_{t-1}$	58,272.148	58,525.032	56,855.284	41,518.997
	(107,159.307)	(104,901.484)	(107,359.580)	(97,871.937)
Constant	57,212.054	35,784.362	57,835.034	14,764.536
	(375,463.344)	(398,180.995)	(374,726.715)	(395,409.348)
Observations	762	762	762	762
R^2	0.975	0.975	0.975	0.975

Table 2: Additive and Interactive Models of Defense Spending: Differenced Military Expenditures

Independent Variable	**Additive One-Dim.**	**Additive Two-Dim.**	**Interactive One-Dim.**	**Interactive Two-Dim.**
Gov't Left-Right Position	857.813		735.655	
	(3,122.930)		(3,212.785)	
Gov't Welfare Position		-590.264		2,579.669
		(9,288.821)		(9,100.025)
Gov't International Position		25,611.845		21,859.336
		(23,050.949)		(21,987.265)
Gov't Left-Right×Conflict			53.362	
			(855.818)	
Gov't Welfare×Conflict				-2,336.133
				(4,079.188)
Gov't International×Conflict				3,296.752
				(12,919.056)
Conflict Involvement	26,845.598	27,312.485	27,042.259	52,011.420
	(19,662.686)	(19,710.897)	(19,249.936)	(47,231.160)
Minority Gov't	95,423.446	106,447.186	95,181.932	101,916.967
	(137,871.714)	(141,950.890)	(137,745.454)	(142,327.345)
Number of Gov't Parties	48,500.419	45,385.798	48,152.871	43,786.318
	(52,548.942)	(50,815.901)	(52,334.804)	(50,890.955)
Election Year	91,528.616	93,052.739	91,129.676	89,792.058
	(122,012.220)	(123,865.120)	(122,550.442)	(124,630.611)
Real GDP	0.000	0.000	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)
Real Growth in GDP$_{t-1}$	2375958.227	2414293.631	2333355.967	2091436.460
	(1985096.219)	(1967481.563)	(2052581.555)	(2078851.979)
CINC$_{t-1}$	1510701.366	2790027.986	1702267.166	1281210.319
	(34062617.298)	(34491240.427)	(34294920.706)	(35686485.974)
Alliance$_{t-1}$	-9,889.463	-49,981.127	-10,769.517	-37,447.476
	(99,318.823)	(98,510.163)	(97,594.603)	(98,805.606)
US/USSR CINC Ratio$_{t-1}$	-154,677.501	-158,591.015	-153,425.250	-161,636.374
	(244,698.184)	(240,565.584)	(244,407.420)	(242,593.558)
Change in US Mil. Exp.$_{t-1}$	58,321.941	54,893.278	57,018.260	36,012.721
	(106,317.878)	(105,183.497)	(106,587.745)	(98,174.017)
Constant	-16,258.830	4,803.206	-16,174.401	-25,180.007
	(349,793.976)	(374,434.016)	(348,912.356)	(373,868.281)
Observations	762	762	762	762
R^2	0.033	0.035	0.033	0.039

Standard errors in parentheses

Table 3: Cases Analyzed

	Original Sample		Expanded Sample	
Country	**Observations**	**Years Covered**	**Observations**	**Years Covered**
Australia	46	1952-1997	46	1952-1997
Austria	39	1957-1995	39	1957-1995
Belgium	42	1954-1995	42	1954-1995
Canada	46	1952-1997	46	1952-1997
Denmark	45	1952-1996	45	1952-1996
Finland	44	1952-1995	44	1952-1995
France	46	1952-1997	46	1952-1997
Germany	—	—	20	1972-1991
Greece	23	1974-1996	23	1974-1996
Iceland	—	—	44	1952-1995
Ireland	46	1952-1997	46	1952-1997
Italy	45	1952-1996	45	1952-1996
Japan	—	—	37	1960-1996
Netherlands	45	1952-1996	45	1952-1996
New Zealand	45	1952-1996	45	1952-1996
Norway	46	1952-1997	46	1952-1997
Portugal	19	1976-1978, 1980-1995	19	1976-1978, 1980-1995
Spain	20	1977-1996	20	1977-1996
Sweden	45	1953-1997	45	1953-1997
Switzerland	44	1952-1995	44	1952-1995
Turkey	44	1952-1995	44	1952-1995
United Kingdom	46	1952-1997	46	1952-1997
United States	—	—	45	1952-1996
Total	**776**		**922**	

Table 4: Additive and Interactive Models of Defense Spending: Expanded Sample

Independent Variable	Additive One-Dim.	Additive Two-Dim.	Interactive One-Dim.	Interactive Two-Dim.
Military Exp. (% of GDP)$_{t-1}$	0.928***	0.930***	0.928***	0.929***
	(0.017)	(0.017)	(0.017)	(0.017)
Gov't Left-Right Position	-0.002**		-0.002**	
	(0.001)		(0.001)	
Gov't Welfare Position		0.007***		0.007***
		(0.002)		(0.002)
Gov't International Position		0.007		0.008*
		(0.005)		(0.006)
Gov't Left-Right×Conflict			-0.000	
			(0.000)	
Gov't Welfare×Conflict				-0.0004
				(0.000)
Gov't International×Conflict				-0.0004
				(0.000)
Conflict Involvement	0.005***	0.006***	0.005***	0.010**
	(0.002)	(0.002)	(0.002)	(0.004)
Minority Gov't	0.009	0.001	0.011	0.004
	(0.028)	(0.027)	(0.028)	(0.027)
Number of Gov't Parties	0.010	0.012	0.010	0.012
	(0.011)	(0.010)	(0.011)	(0.010)
Election Year	0.018	0.017	0.018	0.017
	(0.021)	(0.021)	(0.021)	(0.021)
Real Growth in GDP$_{t-1}$	0.736*	0.786*	0.755*	0.724
	(0.483)	(0.485)	(0.484)	(0.485)
CINC$_{t-1}$	0.767	0.783	0.772	0.668
	(0.708)	(0.705)	(0.705)	(0.695)
Alliance$_{t-1}$	0.022	0.046*	0.022	0.048*
	(0.030)	(0.030)	(0.030)	(0.030)
US/USSR CINC Ratio$_{t-1}$	-0.035	-0.035	-0.035	-0.036
	(0.067)	(0.067)	(0.067)	(0.067)
Change in US Mil. Exp.$_{t-1}$	0.083***	0.081***	0.083***	0.079***
	(0.027)	(0.027)	(0.027)	(0.027)
Constant	0.133	0.035	0.133	0.031
	(0.089)	(0.094)	(0.089)	(0.093)
Observations	922	922	922	922
R^2	0.955	0.955	0.955	0.955

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 5: Two-Dimensional Interactive Model of Defense Spending: Controlling for Conditional Effects of Minority Government

Independent Variable	β	**S.E.**
Military Exp. (% of GDP)$_{t-1}$	0.932***	(0.020)
Gov't Welfare Position	0.004	(0.003)
Gov't International Position	0.0099	(0.006)
Gov't Welfare×Conflict	-0005	(0.0006)
Gov't International×Conflict	0.0006	(0.002)
Conflict Involvement	0.009	(0.006)
Minority Gov't	-0.042	(0.072)
Minority×Conflict	0.006	(0.015)
Minority×Welfare	0.005	(0.005)
Minority×International	-0.004	(0.012)
Minority×Conflict×Welfare	0.00008	(0.001)
Minority×Conflict×International	0.002	(0.003)
Number of Gov't Parties	0.011	(0.011)
Election Year	0.007	(0.026)
Real Growth in GDP$_{t-1}$	0.403	(0.560)
CINC$_{t-1}$	2.146	(2.280)
Alliance$_{t-1}$	0.032	(0.035)
US/USSR CINC Ratio$_{t-1}$	-0.026	(0.060)
Change in US Mil. Exp.$_{t-1}$	0.080*	(0.037)
Constant	0.069	(0.093)
Observations		776
R^2		0.923

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 6: Regression Results of the Effects of Military Spending on Conflict Involvement

Independent Variable	β	**S.E.**
Military Exp. (% of GDP)$_{t-1}$	-0.127	(0.194)
Alliance$_{t-1}$	0.399	(0.489)
CINC$_{t-1}$	196.484***	(27.492)
US/USSR CINC Ratio$_{t-1}$	-0.093	(0.419)
Change in US Mil. Exp.$_{t-1}$	0.802***	(0.197)
International Conflict Involvement$_{t-1}$	0.260***	(0.034)
Constant	0.220	(0.721)
Observations		776
R^2		0.250

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1