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PUBLIC OPINION: A POWERFUL PREDICTOR OF U.S. DEFENSE SPENDING? A COMMENT

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A recent paper in *Defence Economics* suggests that "a single variable, the public opinion balance, ... when accompanied by a control variable measuring the proportion of responses in the 'residuum' (no opinion or keep the status quo), permits an accurate prediction of subsequent changes in the rate of change of U.S. defense outlays from the mid-1960s through the 1980s" (Higgs and Kilduff, 1993, p. 227). In contrast, this comment provides evidence that since 1986 the Higgs-Kilduff model frequently mispredicts the direction of U.S. defense spending. In addition, the average prediction error, and its variance, since 1986 consistently exceeds the average prediction error, and its variance, for the years prior to 1986.

KEY WORDS: Public opinion, U.S. defense expenditures.

INTRODUCTION

A recent paper in *Defence Economics* suggests that "a single variable, the public opinion balance, ... when accompanied by a control variable measuring the proportion of responses in the 'residuum' ..., permits an accurate prediction of subsequent changes in the rate of change of U.S. defense outlays from the mid-1960s through the 1980s" (Higgs and Kilduff, 1993, p. 227). I am in agreement with the authors that "the most remarkable aspect of the results in that [some] simple equations explain a high proportion of the variance in the dependent variable" (p. 233), namely the percentage change in the rate of growth of U.S. military outlays.

Professors Higgs and Kilduff found (see their Table 1) that a two-variable model accounts for some 89 percent of the observed variation in the U.S. military outlays growth-rate changes for the years 1965 to 1989. The two variables are, first, "opinion balance," namely, the difference between the percentage of respondents favoring "increases" in defense spending minus the percentage of respondents favoring "decreases" in such spending, and, second, "opinion residual," that is the percentage of those either not expressing an opinion at all or favoring continuation of the present level of military spending.

Because we have expended considerable resources on identifying predictors of military expenditures, the Higgs-Kilduff finding merits the profession's close attention. But in contrast to the Higgs-Kilduff conclusion, this comment provides evidence that since 1986 the Higgs-Kilduff model frequently *mispredicts* the direction of growth rates of U.S. military outlays. Additionally, since 1986 the average prediction error, and its variance, *consistently exceeds* the average prediction error, and its variance, for the years prior to 1986.

This comment proceeds as follows. To establish a baseline from which to present my evidence, the first section offers a replication of the Higgs-Kilduff model. My replication results in regression parameter estimates almost identical to those presented by Professors Higgs and Kilduff. The second section then examines the suggestion that public opinion is a powerful predictor of U.S. defense spending. This is achieved by comparing the *actual* growth rate changes in U.S. military outlays with the growth-rate changes *predicted* by the Higgs-Kilduff model and by examining the prediction residuals. The final section concludes this comment.

REPLICATION

Normally, exact or even approximate replication of empirical work in economics is not easy.[1] This is due to a variety of factors, including inadequately specified data sources, differences in data transformation, the complexity of the model employed, the use of different software and hardware, and so on. In the case at hand, however, my replication of the Higgs-Kilduff model yields almost identical regression parameter estimates. The public opinion data for 1965–1989 were kindly provided by Professor Higgs; for data on U.S. military expenditures and a deflator I relied upon the *Economic Report of the President* (1993).[2] I replicate for the years 1965–1989 and then extend the model-run by one year to learn what prediction the model yields for the out-of-sample year 1990.[3]

Equations 1, 2, and 3 in Table 1 present the statistics from my replication runs of the extended Higgs-Kilduff model for the sample years 1965–1990. (Ignore the "stepwise model," equation 4, for the moment). A comparison of the Table with the original Higgs-Kilduff table shows that the replication captures their results very well. All signs are correctly replicated and the magnitudes of the coefficients and t-values are replicated very closely, as are the R^2, adjusted R^2, SEE, D-W, and F-statistics.

My replication is therefore an acceptable basis from which to compare *actual* and *predicted* rates of change in U.S. military outlays growth and to examine regression residuals.

[1]For a general reference to replication in economics, see e.g., Dewald, Thursby, and Anderson (1986). For a specific reference to replication in the area of military expenditures and economic growth, see e.g., Brauer (1993).

[2]Specifically, U.S. military expenditures are taken from the *Economic Report of the President* (1993), Table B-1, p. 349 (years 1965–1990); the GDP-deflator is taken from the same source, Table B-3, p. 352 (years 1965–1990).

[3]All tables shown in this paper only report the results of the extended replication, 1965–1990. Upon request, data and tables for the 1965–1989 period are available from the author.

Table 1 Replication of regression estimates of the relation between the rate of change of real defense spending and the public opinion balance, 1965–1990

Equation: Model: Variable	Equation 1 One-lag	Equation 2 Two-lag	Equation 3 Four-lag	Equation 4 Stepwise
CONSTANT	–0.0723	–0.0445	0.0629	0.1614
t-value	–1.441	–0.871	0.878	5.690
p-value	0.1637	0.3935	0.3959	*0.0001*
OPBAL(–1)	0.0022	0.0008	0.0011	
t-value	6.238	2.231	3.440	
p-value	*0.0001*	*0.0439*	*0.0029*	
OPBAL-(–2)		0.018	0.0015	0.0009
t-value		4.924	2.674	2.763
p-value		*0.0001*	*0.0191*	*0.0128*
OPBAL(–3)			–0.0004	
t-value			–0.685	
p-value			0.5056	
OPBAL(–4)			0.0002	
t-value			0.611	
p-value			0.5516	
OPRES(–1)	0.0024		0.0006	
t-value	2.114		0.710	
p-value	*0.0461*		0.4900	
OPRES(–2)		0.0015	0.0009	
t-value		1.332	1.140	
p-value		0.1973	0.2747	
OPRES(–3)			0.0011	
t-value			1.314	
p-value			0.2117	
OPRES(–4)			–0.0034	–0.0031
t-value			–4.546	–4.970
p-value			*0.0005*	*0.0001*
R^2	0.6419	0.5366	0.8839	0.8443
Adjusted R^2	0.6094	0.4925	0.8124	0.8183
SEE	0.0323	0.0319	0.0060	0.0080
D-W	1.3800	1.5640	1.7010	1.4370
F	19.718	12.159	12.369	32.531
Years predicted	66–90	67–90	69–90	69–90

Note: For variables OPBAL(i) and OPRES(i), *i* is the number of years the variable is lagged. Numbers beneath the regression coefficients are Student's *t* statistics. The third number per cell refers to the p-value. P-values in *italic* typefont highlight statistically significant coefficients at the 5%-level.
Source: replication.

COMPARING ACTUAL AND PREDICTED VALUES

Consider Table 2. Column 1 lists the years 1965 to 1990. Column 2 lists the *actual* growth rate of U.S. military outlays, and column 3 refers to its *predicted* value, based on the extended Higgs-Kilduff equation 1, 1965–1990 – i.e., predicting the change in the growth rate of U.S. military outlays merely on the basis of the opinion balance and opinion residual, both lagged one year. Temporarily ignoring the *magnitude* of the prediction error (GRTH – PHAT), we note that from 1966 to 1985, the model correctly predicts the *direction* of change for 19 out of 20 years, the exception occurring for the year 1976. But for 1986 to 1989, the model falsely predicts the direction of change in four out of five years, including the one out-of-sample year, 1990. (In the replication without the out-of-sample year the model falsely predicts the direction of change in all years, 1986–1989).

Column 4 (for equation 2, the two-year lag model) shows a different result. Here (in both the replicated and in the extended model) predictions are false only for the years 1969 and 1987. For the year 1990, the difference between the predicted (0.91%) and the actual (0.35%) change in the growth rate was only half a percentage point. Finally, for the four-year lag model (equation 3), column 5 shows that false predictions occur for the years 1972, 1977, 1986, and also for 1990.

But the four-year lag model, possibly the one preferred by Professors Higgs and Kilduff (in the paper's abstract they emphasize its high R^2 value of 0.89), satisfies less than the one-year lag and two-year lag models: of the four-year lag model's eight regressors only three pass the test of statistical significance (namely, OPBAL(– 1), OPBAL(– 2), and OPRES(– 4)), as evidenced by the p-values provided in Table 1 (equation 3). An eight-variable model that includes five statistically insignificant variables may in fact not be a reliable predictor.

Running, then, the regressions once more, but including only the previously statistically significant variables, yields column 6 in Table 2. It is referred to as the "stepwise" model, because a stepwise regression I ran identifies the same variables. (The cut-off point for entering the model was a statistical significance level of 0.15). Even though unsatisfactory from a theoretical point of view (why should the opinion residual be of relevance to predicting the growth rate of military outlays four years later?), empirically the model results look quite good at first glance: as far as the model statistics are concerned (see Table 1, equation 4), the stepwise model obtains a very high R^2 (in fact, a slightly higher adjusted R^2 than the Higgs-Kilduff four-year lag model), and only the years 1972, 1977, 1986, and 1990, yield false predictions (see Table 2).

Examining this stepwise model more closely, however, reveals an interesting fact. Plotting the prediction residuals against the year of prediction (see Figure 1), shows that the more current is the year for which a prediction is made, the larger is the divergence between the actual and its predicted value. Since images can be misleading, I computed the average prediction error and standard deviation for the years prior to 1986 and for those as from 1986 (Table 3). Remarkably, in all four models, the mean prediction errors for the years since 1986 exceed, by a factor of about four, the mean prediction errors for years prior to 1986, and the standard deviation in three of the four models is larger, by a factor of up to three, for years since 1986 than for years before 1986. For example, for the stepwise model (model 4 in Table 3), for the years 1965–1985 the average prediction error was only – 0.35 percentage points in the growth rate change in military outlays. But for the years

Table 2 Model Prediction Residuals, 1965–1990

(1) YEAR	(2) GRTH	(3) One-lag PHAT	(4) Two-lag PHAT	(5) Four-lag PHAT	(6) Stepwise PHAT
1965	.	.	.	.	.
1966	16.07	8.62	.	.	.
1967	13.86	9.83	6.16	.	.
1968	2.67	5.91	7.35	.	.
1969*	- 5.16	- 8.04	4.17*	- 3.62	- 4.39
1970	- 7.95	- 4.37	- 6.19	- 7.96	- 6.39
1971	- 8.84	- 6.03	- 3.92	- 8.91	- 7.00
1972*	- 0.12	- 3.91	- 5.13	0.10*	0.87*
1973	- 6.12	- 1.80	- 3.53	- 4.13	- 3.66
1974	- 1.98	- 1.89	- 2.06	- 1.99	- 2.18
1975	- 1.01	- 0.73	- 2.06	- 1.81	- 2.44
1976*	- 1.96	1.03*	- 1.13	- 2.49	- 2.72
1977*	1.07	2.42	0.39	- 0.07*	- 0.66*
1978	0.05	6.10	1.48	1.57	1.27
1979	3.01	6.11	4.38	4.90	3.37
1980	6.71	6.50	4.43	4.89	4.35
1981	6.46	9.40	5.08	6.70	7.56
1982	8.56	8.88	7.95	8.53	9.61
1983	6.12	2.51	7.39	5.71	6.67
1984	4.10	1.28	1.61	5.40	6.64
1985	6.71	1.12	0.81	6.54	4.80
1986*	4.15	- 0.33*	0.47	- 1.17*	- 1.15*
1987*	2.27	0.06	- 0.71*	0.51	0.24
1988*	- 2.63	0.35*	- 0.31	- 0.75	- 1.14
1989*	- 2.89	1.98*	- 0.15	- 0.70	- 1.11
1990*	0.35	- 1.52*	0.91	- 0.32*	- 1.60*

NOTES: "GRTH" is the actual deflated growth rate of U.S. military outlays in percent; "PHAT" is the pedicted growth rate, also in percent. "PHAT" values marked with an asterisk (*) indicate a false prediction and the associated year for which that prediction was made.

1986–1990, that error increased to + 1.20 percentage points. To put this in perspective, 1990 national defense expenditures in the U.S. were $314.0 billion, and applying the mean prediction error of 1.20 percentage points would translate into a $3.52 billion error.

CONCLUSION

I do not wish to be misunderstood by seeming to quibble over a 'smallish' $3.5 billion. Quite to the contrary, I believe that Professors Higgs and Kilduff are posing a significant challenge to the profession. After all, from the mid-1960s to the mid-1980s their 'one-variable' model predicting changes in the growth rate of U.S. military outlays merely on the basis of public opinion works remarkably well

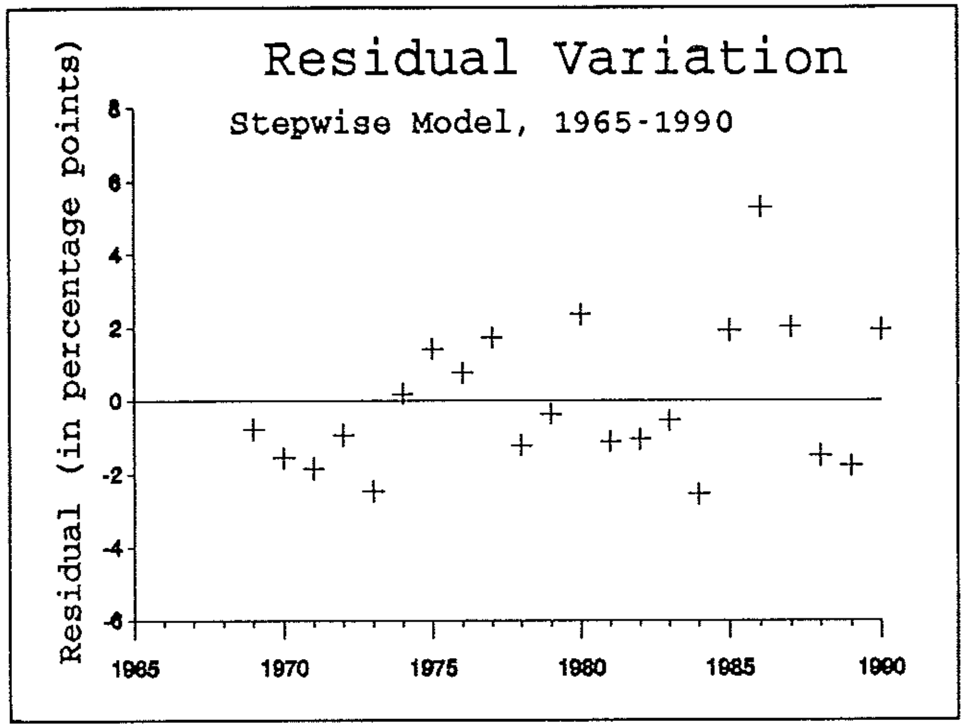

Figure 1

Table 3 Examination of Model Residuals

Model	Range*		Prediction Error*	
	Minimum	Maximum	Mean Value	St. Deviation
1. One-lag (1965–1990)				
1965–1985	- 6.05	+ 7.45	- 0.04	3.72
1986–1990	- 4.86	+ 4.48	+ 0.14	3.90
2. Two-lag (1965–1990)				
1965–1985	- 9.33	+ 7.70	- 0.05	3.97
1986–1990	- 2.74	+ 3.69	- 0.21	2.98
3. Four-lag (1965–1990)				
1965–1985	- 1.98	+ 1.82	- 0.22	1.09
1986–1990	- 2.19	+ 5.32	- 0.74	3.06
4. Stepwise (1965–1990)				
1965–1985	- 2.55	+ 2.36	- 0.35	1.52
1986–1990	- 1.77	+ 5.30	+ 1.20	2.92

*For explanation, see text.
Source: replication.

indeed. But a close examination of the residuals of the various models they present reveals an equally remarkable failure to predict correctly (i.e., direction) and/or accurately (i.e., magnitude) from the mid-1980s onward.

The obvious further challenge to the profession then includes seeking answers to the following questions: why does the model appear to fail as from the mid-1980s onward; what alternative models might capture the military outlays growth-rate changes; can military outlays of non-U.S. democracies similarly be captured by a public opinion variable; and, perhaps most important, what is it about public opinion — should further research validate its predictive power — that makes it a determinant of military outlay growth rates — i.e., what determines public opinion?

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