“Does Defense Spending Really Promote Aggregate Output in the U.S.?”*

Major Jeffrey S. Smith
Department of Economics and Finance
Air Force Institute of Technology
2950 Hobson Way
Wright-Patterson AFB OH 45433
jeffrey.smith@afit.edu
corresponding author

M.H. Tuttle
Department of Economics and International Business
Sam Houston State University
Box 2118
Huntsville, TX 77341-2118
mht001@shsu.edu
936-294-1386

Abstract

Many studies have examined the relationship between defense spending and growth in real aggregate output, with mixed results. Most recently, Atesoglu (2002) uses time series analysis and finds a positive relationship between defense spending and output. Capturing the error correction term as the long run adjustment parameter and including the long run adjustment in the relationship, we do not find evidence that defense spending promotes growth in real output. We re-estimated the relationship and dummied all U.S. involvements in a military conflict, with similar results concerning military spending's effect on output. Interestingly, we do find tradeoffs between defense and non-defense government spending during war time, but not during periods of peace.

The question of military spending and its effect on growth has received much attention over the last 20+ years. To answer the question, there are two distinctly different approaches used in the literature, the production function framework credited to Feder (1982), and an aggregate, time series modeling approach. We think the question, which has not been definitively answered (in our humble opinion), is worthy of a second look. While the question has received varying levels of attention, more recently, Atesoglu's (2002) work, using cointegration analysis, serves as the foundation for our interest. Atesoglu suggests significant linkages between military spending and aggregate real output. As an example, he indicates that a 4% increase in military spending leads to a 2% increase in aggregate real output.

Why ask the question again so soon? It should be fairly obvious, given the geopolitical realities that have developed since Atesoglu's 2002 paper, that the question of linkages has become eminently more important. Unquestionably, the impetus for increased military spending is in place. Ever since the events of September 11, 2001, the United States has adopted a more aggressive attitude towards national security, actually declaring war against terrorism (Bush 2001). While this paper intends to steer clear of the political arguments surrounding the global war on terrorism (commonly referred to as GWOT in the military), it should be of interest if the data show that increased military spending drives growth in real aggregate output. If so, the increased spending that results from the war on terror may have the added effect of stimulating the national economy. We also examine the nature of asymmetrical adjustments in the relationship, as well as how actual military conflicts affect this relationship.

The remainder of this paper is organized as follows. The second section outlines the previous literature and the model, the third section includes the methodology and empirical results, while section four concludes.

Model

Borrowing from Atesoglu (2002), the traditional Keynesian cross is defined as:

$$QL_t = CL_t + IL_t + XL_t + ML_t + GL_t \qquad 1$$

where CL_t is real consumption spending, IL_t is real investment, XL_t is real net exports, ML_t is real defense spending, and GL_t is real non-defense government spending.

Consumption is defined as some level of autonomous consumption, plus the marginal propensity to consume times disposable income:

$$CL_t = a + b(QL_t - TL_t) \qquad 2$$

where TL is defined as real taxes, as equals:

$$TL_t = n + gQL_t \qquad 3$$

Investment is a negative function of real interest rates:

$$IL_t = e - fR_t \qquad 4$$

Real net exports is a negative function of real output and real interest rates:

$$XL_t = z - mQL_t - nR_t \qquad 5$$

The reduced form solution, including a stochastic error term, is:

$$QL_t = \alpha + \beta ML_t + \delta GL_t - \lambda R_t + u_t \qquad 6$$

where $\alpha = (a - nb + e + z)/(1 - b(1 - g) + m)$, $\beta = 1/(1 - b(1 - g) + m)$, $\delta = 1/(1 - b(1 - g) + m)$, and $\lambda = (f + n)/(1 - b(1 - g) + m)$. As noted by Atesoglu (2002), this model differs from the normal Keynesian cross in its treatment of R_t (investment normally modeled as a function of nominal interest rates), while net exports are normally assumed to depend only on real income, versus real income and real interest rates as in this model.

Previous Literature

Sandler and Hartley (1995) and Ram (1993) both identify the proposed benefits of defense spending, such as; a stimulative effect if the economy is currently underemployed, spillovers from defense-related R&D (e.g. global positioning system), enhancement of growth if the spending is used to improve social infrastructure (applicable to lesser developed countries (LDCs)), care and feeding of the troops (again for LDCs), and maintaining national security, which allows businesses to grow without worry. Reasons both note that defense spending may inhibit growth are: 1. diverting resources (crowding out), 2. adverse balance of payments (LDCs), 3. diverting R&D from the private sector, especially if the military technological spillovers have no direct applicability in the consumer market, 4. inefficient bureaucracies and excess burdens created by taxes. So what have empirical studies found?

Atesoglu and Mueller (1990), using Feder's production function approach, find an elasticity of real output with respect to real defense spending of .062, indicating a significantly positive but inelastic response. Assuming 3.1% real growth in GNP, Atesoglu and Mueller (1990) predicted a decline in real output from 1.1% to 2.8% as a result of a decrease in defense spending ranging from 4% to 10%. Chowdhury (1991) and Kusi (1994) used Granger-causality tests to determine the direction of causality, if any, between defense spending and economic growth. Chowdhury analyzed fifty-five LDCs and Kusi analyzed seventy-seven developing countries. Chowdhury found defense expenditures Granger-causes economic growth in fifteen countries, but with a sign that's opposite of Atesoglu and Mueller (1990) and Atesoglu (2002). In fact, Chowdhury reports the "defense spending coefficient in the growth equation is significantly negative…". Kusi (1994) found a statistically significant causal relationship for seven of the seventy-seven countries, with four of the seven exhibiting positive contributions to economic growth (all four are in Asia). Huang and Mintz (1991), using ordinary ridge regressions, find no significant productivity effect from military expenditures to economic growth, supporting their 1990 finding of "no direct defense-growth tradeoffs in the United States 1952 – 1988." Heo (1998) only finds significant military externality effects in twenty-two of eighty countries, of which eighteen are positive. However, when Heo combines productivity and technological effects in the military sector, ten countries show positive and significant effects, while twelve different countries show a significantly negative impact on growth." So, Heo (1998) finds support for a peace dividend (higher real output resulting from lower defense expenditures) in roughly two-thirds of the eighty countries analyzed. Brumm (1997) finds the real per capita GDP growth is positively correlated with military spending's share of GDP. Brumm's study, however, used a limited dataset (1974 -1989) and estimated a Barro-regression across eighty eight countries, so its direct applicability to this argument is limited. Payne *et al.* (1993) use the forecast error variance decomposition from an unrestricted VAR (1960 to 1990) to support Granger-causality tests that show no significant impact of defense spending on the "economic performance variables." Curiously, Payne *et al.* (1993) do not find evidence to support cointegration, in contrast to Atesoglu (2002). In summary, there remains a divergence in results, as indicated by Sandler and Hartley (1995); they list five studies where military spending has a positive effect, ten studies where military spending has a negative effect, and nine studies with little or no impact.

Thus the question remains, why are we reinvestigating the issue? First of all, Atesoglu (2002) applied a Keynesian model to the U.S. defense spending – real output relationship, and he found the aforementioned positive and significant contribution to real output from defense spending. Sandler and Hartley (1995) indicate that most demand-side (Keynesian) representations of aggregate demand are associated with negative impacts on real growth, due to the before-mentioned crowding out effect. This apparent inconsistency with previous research, as well as some peculiarities in his model, led us to reconsider his conclusions. In his empirical work, Atesoglu (2002) uses a variable specification of 16 quarterly lags. By all measures, this seems extraordinarily long, especially given the fact that observations are measured quarterly. There are no reported test results to indicate how or why 16 periods was selected, and in fact, we find evidence of at most 4 lags (using the Akaike Information Criteria test). We were also intrigued by the positive and significant effect military spending has on output. We look suspiciously on the practice of interpreting individual coefficients in the cointegrating equation. . Interpreting the coefficient on military spending alone, when the variables act together to adjust, may be a misinterpretation of the process. Nor were we ready to accept the conclusion that military spending causes growth in real GDP. We are more inclined to "believe" our principles of economics lectures, where we draw the production possibilities frontier with guns on one axis and butter on the other. While surely oversimplified, increased military spending is expected to come at the expense of "other government spending", thus its affect on output should be ambiguous, at best. As such, let us now look at the data and our results.

Data

The data used comes from two sources. Gross Domestic Product (GDP), aggregate defense spending (DS), and aggregate non-defense spending (NDS) are available from the Bureau of Economic Analysis (BEA).[1] The Aaa rate source is the Board of Governors of the Federal Reserve System and made available at the Federal Reserve Bank of St. Louis Federal Reserve Economic Data® (FRED®) database.[2] The GDP deflator from the BEA is used to convert all series into real values, and the data range is 1947:Q2 to 2004:Q4. Finally, real GDP, defense spending, and non-defense spending variables are transformed into natural log levels.

Atesoglu (2002) finds that these series contain a unit root. Testing, using the Augmented Dickey-Fuller (ADF) test (Dickey and Fuller, 1981) and the KPSS test (Kwiatkowski, et. al, 1992), confirms this result. Unit root tests are provided in the Appendix. Tests also reveal that each variable is stationary in their first-differences. Therefore, each is integrated of order one. Given the non-stationarity of the variables, the next section conducts formal cointegration tests.

Cointegration

The four variables used in this investigation were found to share a long run relationship in previous research. This paper tests for cointegration using Johansen's (1991) procedure. The cointegration test uses three lags in the test VAR.[3] Also, a constant is included in both the cointegrating vector and test VAR. The Johansen test rejects the null of zero cointegrating vectors, but fails to reject the null of one cointegrating vector. This confirms Atesoglu's 2002 results but is in conflict with the Engle-Yoo cointegration test performed by Payne *et al.* (1993). The results of the test are presented in Table 1, and the cointegrating vector is normalized on real GDP.

Do Changes in Defense Spending Affect Real Output?

A Vector Error-Correction Model (VECM) is used to estimate the effect of defense spending on real output, as well as the effect of changes in real output on defense spending and non-defense spending. Specifically, do shocks to defense spending affect real output in the short run and/or the long run? Further, do real output shocks have any affect on defense and non-defense spending?

Table 2 reports the results of our benchmark VECM using the cointegration relationship provided in Table 1. In Table 2, ECT represent the error-correction term derived from Table 1. The parameter associated with the ECT is the estimated long run adjustment from a shock to any variable in the cointegration relationship (the adjustment parameter). The other rows in Table 2 give the sum of the three lagged parameters in each equation.

In Table 2, the adjustment parameters suggest that defense and non-defense spending exhibit error-correction behavior, while results fail to reject the null of zero response of real output and the Aaa rate in the long run to changes in any variable.[4] Therefore, it appears that changes in the error-correction term aid in predicting defense and non-defense spending in the long run, but it fails to add predictive power when forecasting real output or the Aaa rate. Further, real GDP and the Aaa rate help predict real GDP in the short run, given the rejection of the joint statistical insignificance of the GDP and Aaa parameters in the GDP equation (column one of Table 2).

From the results in Table 2, it appears that defense spending and non-defense spending contain little, if any, information concerning the growth of real output in the long run. Conversely, changes in real output, which alter the long run equilibrium (i.e. the error-correction term), may aid in forecasting defense and non-defense spending in the long run. To examine this issue further, we estimate the ability of current period values of GDP, defense spending, non-defense spending, Aaa rate, and the error-correction term in forecasting each variable over different time horizons. Specifically, several versions of equation X are estimated. In equation 7, **y** is one of the variables of interest (GDP, DS, NDS, or Aaa). The sum of each variable, over a particular future time horizon, is regressed on the current value of each variable and the error-correction term.[5] If the variable responds in the long run, then the error-correction term should successfully forecast that variable and α_5 should be statistically significant.

$$\sum_{i=1}^{j} \Delta \mathbf{y}_{t+i} = \alpha_1 \Delta GDP_t + \alpha_2 \Delta DS_t + \alpha_3 \Delta NDS_t + \alpha_4 \Delta Aaa_t + \alpha_5 ECT_t + \sigma_t \qquad 7$$

j = 2, 4, and 8

Results of the long run forecast performance regressions are presented in Table 3. The long run forecast regressions support the results in Table 2. In panel A, aggregate output and the Aaa rate statistically and economically forecast real output. Yet, the error-correction term contains little information concerning the changes in real output, both in the short run and the long run. Therefore, changes in defense and non-defense spending appear to have no statistical or economic impact on real GDP in the long run.

The reverse is true in Panel B. When examining the short and long run forecasting performance of the various variables, the error-correction term, real output, and defense spending are statistically and economically important predictors of defense spending. Changes in real output, in this sample, are important in determining the future changes in real defense spending. The findings here suggest that the causality unidirectional, in the long run, running from real output to real defense spending.

The Effect of War on Defense Spending

The adjustment of defense spending may potentially differ during periods of U.S. involvement in military conflicts. A dummy variable equaling one during U.S. involvement in a military conflict is added to the VECM specification presented in Table 2.[6] Table 4 presents the results. Once asymmetric adjustment is allowed, the response of defense and non-defense spending differs substantially between the war and non-war periods.

Interestingly, defense spending responds to shocks during periods of military conflict and may respond to shocks during periods of peace. Specifically, during periods of war, a shock to GDP will increase military spending in the next period. Given the cointegration relationship in Table 1 and the adjustment of defense spending during war, shocks to non-defense spending during periods of war decreases the error-correction term and defense spending in the following period. Further, during periods of peace, the adjustment parameter on defense spending is marginally insignificant, with a p-value of 0.108. Therefore, from the economically significant parameter value of 0.039, shocks to GDP and non-defense spending may still forecast changes in defense spending in the long run during periods of peace.

Like defense spending, the error-correction term helps predict changes in non-defense spending in the long run. During periods of peace, positive shocks to GDP has a positive effect in the following period, while positive shocks to defense spending has a negative impact. Therefore, the VECM presented in Table 4 suggests that there are potentially significant substitution between defense and non-defense spending during peace-time and war-time.

The question remains whether the error-correction term can forecast changes in any of the variables in the long run. A version of equation 7, given in equation 8, is estimated, where an interaction between the error-correction term and the war dummy is added. The results are reported in Table 5.

$$\sum_{i=1}^{j} \Delta \mathbf{y}_{t+i} = \alpha_1 \Delta GDP_t + \alpha_2 \Delta DS_t + \alpha_3 \Delta NDS_t + \alpha_4 \Delta Aaa_t + \alpha_5 ECT_t + \alpha_6 ECT_t * WAR_t + \sigma_t \qquad 8$$

j = 2, 4, and 8

In Table 5, the results are robust to those in Table 3. The error-correction term has long run forecasting ability for defense spending in war and in peace. The error-correction term in periods of war and peace is an economically and statistically significant predictor of defense spending over two, four, and eight quarter horizons. Over a two quarter horizon, the war adjustment forecasts GDP, but it fails to forecast over longer time horizons.

Conclusion

This paper finds the real output plays an important role in forecasting real defense spending in the U.S., but finds little evidence supporting a positive or negative effect in real output from defense spending changes. Therefore, the long run causality found here runs from real output changes to real defense spending changes. Our framework attempts to model the long-term relationship between the traditional Keynesian function. In contrast to Atesoglu (2002), we do not find support for his conclusion that military spending promotes real aggregate output. We do not find any evidence that real output adjusts in the long-run to any of the variables in the system. We do find evidence that defense and non-defense spending adjust in the long-run. When further examining the nature of military vs non-military spending in times of war, military spending adjusts during times of war, while non-military spending adjusts during times of peace. This makes sense intuitively; one would expect military spending to adjust during periods of war (spending increases rapidly), while non-defense spending has the ability to adjust during times of peace (when defense spending is essentially at a steady-state.) Finally, being at war helps forecast real GDP over two quarters, but loses its ability to forecast beyond that timeframe.

References

Atesoglu, H.S., and Mueller, M.J. 1990. "Defense Spending and Economic Growth." *Defence Economics.* 2: 19-27.

Atesoglu, H.S. 2002. "Defense Spending Promotes Aggregate Output in the United States – Evidence from Cointegration Analysis." *Defence and Peace Economics.* 13(1): 55–60.

Brumm, H.J. "Military Spending, Government Disarray, and Economic Growth: A Cross-Country Empirical Analysis." *Journal of Macroeconomics.* 19(4): 827-838.

Chowdhury, A.R. 1991. "A Causal Analysis of Defense Spending and Economic Growth." *Journal of Conflict Resolution*, 35(1): 80-97.

Dickey, D., and Fuller, W.A. 1981. "Likelihood Ratio Statistics for Autoregressive Time Series with a Unit Root." *Econometrica*. 49: 1057-72.

Feder, G. 1982. "On Exports and Economic Growth." *Journal of Development Economics.* 12: 59-73.

Heo, U. 1998. "Modeling the Defense-Growth Relationship Around the Globe." *Journal of Conflict Resolution.* 42(5): 637–657.

Huang. C. and Mintz, A. 1990. "Ridge Regression Analsysis of the Defense-Growth Trade-off in the United States." *Defence Economics.* 2: 29-37.

Huang, C. and Mintz, A. 1991. "Defence Expenditures and Economic Growth: The Externality Effect." *Defence Economics.* 3: 35-40.

Johansen, Soren. 1995. *Likelihood-based Inference in Cointegrated Vector Autoregressive Models*, Oxford: Oxford University Press.

Kusi, N.K. 1994. "Economic Growth and Defense Spending in Developing Countries." *Journal of Conflict Resolution.* 38(1): 152-159.

Kwiatkowski, D., Phillips, P.C.B., Schmidt, P., and Shin, Y. 1992. "Testing the Null Hypothesis of Stationarity Against the Alternative Hypothesis of a Unit Root." *Journal of Econometrics.* 54: 159-178.

Paynes, J.E., Ross, K.L., and Olszewski, E.A. 1993. "Defense Versus Nondefense Spending: A Macroeconomic Comparison." In *Defense Spending and Economic Growth.* Westview, Boulder.

Ram, R. 1993. "Conceptual Linkages Between Defense Spending and Economic Growth and Development: A Selective Review." In *Defense Spending and Economic Growth.* Westview, Boulder.

Sandler, T., and Hartley, K. 1995. *The Economics of Defense.* Cambridge University, Cambridge.

Speech delivered by President George W. Bush, September 11, 2001.

Table 1 Cointegration Test Results 1947:Q2 – 2004:Q4					
Number of Cointegrating Vectors		Trace Statistic		95% Level of Confidence Critical Value	
Zero		49.13		47.86	
≤ One		19.81		29.79	
≤ Two		5.53		15.49	
≤ Three		0.63		3.84	
Cointegration Vector	Real GDP	Defense Spending	Non-Defense Spending	Real Aaa Rate	Constant
	1.000	-0.743** (0.134)	-0.831** (0.081)	0.039** (0.015)	-0.501

Standard errors in parentheses.
** denotes significance at a ninety-five percent level of confidence.

Table 2 VECM Results				
	ΔGDP Equation	ΔDS Equation	ΔNDS Equation	ΔAaa Equation
ECT_{t-1}	-0.001 (0.004)	0.056** (0.012)	0.060** (0.029)	-0.131 (0.245)
$\Sigma\Delta GDP_{t-i}$	0.311** (0.121)	0.527 (0.401)	-0.054 (0.756)	-4.089 (6.986)
$\Sigma\Delta DS_{t-i}$	0.002 (0.043)	0.571** (0.092)	0.173 (0.293)	2.283 (2.193)
$\Sigma\Delta NDS_{t-i}$	-0.004 (0.026)	-0.129 (0.100)	-0.128 (0.214)	0.591 (1.621)
$\Sigma\Delta Aaa_{t-i}$	-0.007* (0.003)	-0.021** (0.009)	0.002 (0.030)	-0.006 (0.970)

Standard errors in parentheses.
** and * denotes significance at a ninety-five percent and ninety percent level of confidence respectively.
In the VECM, 3 lags (i = 3) were used.

Table 3
Long Run Forecast Regressions

Forecast Horizon (j)	ECT_t	ΔGDP_t	ΔDS_t	ΔNDS_t	ΔAaa_t
Panel A $\sum_{i=1}^{j} \Delta GDP_{t+i}$					
2	0.000 (0.007)	1.161** (0.104)	0.002 (0.039)	0.002 (0.019)	-0.008** (0.002)
4	0.005 (0.016)	1.927** (0.228)	-0.017 (0.075)	0.036 (0.038)	-0.013** (0.004)
8	0.026 (0.031)	3.214** (0.463)	0.089 (0.125)	0.118* (0.068)	-0.017** (0.007)
Panel B $\sum_{i=1}^{j} \Delta DS_{t+i}$					
2	0.068** (0.027)	0.791** (0.347)	0.879** (0.213)	-0.099 (0.067)	-0.008 (0.007)
4	0.168** (0.062)	2.276** (0.930)	1.162** (0.211)	-0.250** (0.128)	-0.030** (0.014)
8	0.408** (0.108)	3.231** (1.204)	1.125** (0.342)	-0.267 (0.191)	-0.043** (0.019)
Panel C $\sum_{i=1}^{j} \Delta NDS_{t+i}$					
2	-0.021 (0.052)	0.657 (0.895)	0.268 (0.174)	-0.143 (0.131)	0.006 (0.010)
4	-0.044 (0.074)	0.864 (0.839)	0.678** (0.273)	0.015 (0.178)	0.003 (0.013)
8	-0.095 (0.071)	3.269** (0.910)	1.030** (0.402)	-0.240 (0.159)	0.010 (0.015)
Panel D $\sum_{i=1}^{j} \Delta Aaa_{t+i}$					
2	0.072 (0.302)	-4.920 (5.396)	4.516** (1.990)	1.412 (0.877)	-0.113 (0.146)
4	0.121 (0.484)	-3.856 (6.631)	5.253** (2.618)	0.522 (0.947)	-0.109 (0.177)
8	0.174 (0.553)	3.039 (9.296)	5.076** (2.786)	-0.898 (0.976)	-0.217 (0.189)

Newey-West corrected standard errors in parentheses.
** and * denotes significance at a ninety-five percent and ninety percent level of confidence respectively.

Table 4 VECM Results				
	ΔGDP Equation	ΔDS Equation	ΔNDS Equation	ΔAaa Equation
Non-War Adjustment	0.000 (0.008)	0.039 (0.024)	0.161** (0.050)	0.173 (0.444)
War Adjustment	-0.003 (0.012)	0.083** (0.028)	-0.106 (0.072)	-0.632 (0.774)
$\Sigma\Delta GDP_{t-i}$	0.315** (0.119)	0.472 (0.417)	0.283 (0.751)	-3.075 (6.752)
$\Sigma\Delta DS_{t-i}$	0.003 (0.043)	0.556** (0.092)	0.269 (0.302)	2.572 (2.244)
$\Sigma\Delta NDS_{t-i}$	-0.004 (0.026)	-0.123 (0.095)	-0.164 (0.210)	0.485 (1.686)
$\Sigma\Delta Aaa_{t-i}$	-0.007** (0.003)	-0.018** (0.009)	-0.017 (0.029)	-0.063 (0.165)

Standard errors in parentheses.
** and * denotes significance at a ninety-five percent and ninety percent level of confidence respectively.
In the VECM, 3 lags (i = 3) were used.

Table 5
Long Run Forecast Regressions

Forecast Horizon (j)	Non-War Adjustment	War Adjustment	ΔGDP_t	ΔDS_t	ΔNDS_t	ΔAaa_t
Panel A			$\sum_{i=1}^{j} \Delta GDP_{t+i}$			
2	0.005 (0.009)	-0.012* (0.007)	1.148** (0.106)	0.010 (0.040)	-0.007 (0.017)	-0.009** (0.002)
4	0.014 (0.020)	-0.018 (0.017)	1.908** (0.234)	-0.001 (0.078)	0.019 (0.036)	-0.014** (0.004)
8	0.048 (0.036)	-0.040 (0.029)	3.186** (0.476)	0.143 (0.143)	0.069 (0.059)	-0.019** (0.008)
Panel B			$\sum_{i=1}^{j} \Delta DS_{t+i}$			
Forecast Horizon (j)	Non-War Adjustment	War Adjustment	ΔGDP_t	ΔDS_t	ΔNDS_t	ΔAaa_t
2	0.044** (0.018)	0.127** (0.061)	0.852** (0.365)	0.842** (0.153)	-0.055 (0.044)	-0.006 (0.006)
4	0.137** (0.056)	0.250** (0.099)	2.343** (0.939)	1.106** (0.180)	-0.189** (0.091)	-0.027** (0.013)
8	0.400** (0.130)	0.430** (0.102)	3.241** (1.187)	1.107** (0.312)	-0.250 (0.178)	-0.042** (0.021)
Panel C			$\sum_{i=1}^{j} \Delta NDS_{t+i}$			
Forecast Horizon (j)	Non-War Adjustment	War Adjustment	ΔGDP_t	ΔDS_t	ΔNDS_t	ΔAaa_t
2	-0.013 (0.068)	-0.039 (0.031)	0.637 (0.868)	0.280 (0.170)	-0.158 (0.131)	0.005 (0.011)
4	-0.047 (0.097)	-0.037 (0.049)	0.869 (0.810)	0.673** (0.253)	0.020 (0.178)	0.003 (0.015)
8	-0.127 (0.086)	-0.002 (0.051)	3.308** (0.904)	0.954** (0.357)	-0.171 (0.171)	0.013 (0.016)
Panel D			$\sum_{i=1}^{j} \Delta Aaa_{t+i}$			
Forecast Horizon (j)	Non-War Adjustment	War Adjustment	ΔGDP_t	ΔDS_t	ΔNDS_t	ΔAaa_t
2	0.162 (0.408)	-0.147 (0.254)	5.171 (5.217)	4.655** (2.053)	1.244 (0.892)	-0.120 (0.144)
4	0.075 (0.668)	0.241 (0.530)	-3.758 (6.521)	5.171** (2.334)	0.612 (0.959)	-0.105 (0.172)
8	0.329 (0.725)	-0.280 (0.820)	2.850 (9.256)	5.447* (3.037)	-1.234 (1.003)	-0.232 (0.179)

Newey-West corrected standard errors in parentheses.
War Adjustment is the sum α_5 and α_6 in equation X+1.
** and * denotes significance at a ninety-five percent and ninety percent level of confidence respectively.

Endnotes

[*] The views expressed in this paper are those of the authors and do not necessarily reflect the official policy or position of the U.S. Air Force, the Department of Defense, or the U.S. Government.

[1] More precisely, the two government spending variables include both consumption and gross investment expenditures. All are seasonally adjusted and measured at an annual rate.

[2] Moody's Seasoned Aaa Corporate Bond Rate

[3] The Schwarz information criterion suggests using two lags and the Akaike information criteria suggests four lags.

[4] Atesoglu (2002) also fails to find error-correction behavior in the real Aaa rate.

[5] The specific time horizons used are two quarters (i = 1 to 2), four quarters (i = 1 to 4), and eight quarters (i = 1 to 8) ahead.

[6] The war dates derived from Wikipedia. The Korea war covers the period 1950:Q3 through 1953:Q2. The second period, 1965:Q2 through 1972:Q4 denotes the Vietnam War. The final two periods, 1990:Q3 to 1991:Q1 and 2001Q4 through the end of the sample, signify the First Gulf War and the War on Terror.