

Guns, Butter, and Growth: The Consequences of Military Spending Reconsidered

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Abstract

How does increasing military spending affect social spending and economic growth? We argue leaders vary in their preferences over how to pay for military spending and failing to account for interdependence among methods of government finance, government spending, and economic performance limits scholars' ability to identify the consequences of military spending. We use vector autoregressive models to estimate the relationships among military spending, social spending, economic growth, tax revenue, debt, and the money supply in the United States between 1947 and 2008. We find that increasing military spending has a non-linear effect on economic growth that varies over time and the existence of a guns-vs.-butter trade-off is conditional on leaders' preferences regarding the social welfare state, taxes, debt, and inflation.

The political fortunes of leaders, governments, and regimes rise and fall based on their ability to provide not only national security but also social benefits and a strong economy (Gasiorowski 1995, Bueno de Mesquita et al. 2003, Goemans 2008). Investigations of the relationships between military spending, social spending, and economic performance, therefore, bring together some of the more salient aspects of international relations, foreign policy, and comparative politics. Unfortunately, there is no consensus on how military expenditures influence patterns of social spending or the economy.

We argue that the lack of agreement on the relationships between military spending, social spending, and economic growth is at least partially driven by scholars' failure to account for three important things. First, how governments finance military spending can influence the consequences of military spending (Oatley 2015). Governments pay for military expenditures by reducing other expenditures and/or increasing the budget via higher tax revenue, and/or incurring higher levels of debt, and/or increasing the money supply (Rasler and Thompson 1985, Rockoff 2012, Carter and Palmer 2016). Past research has not given enough attention to the system that relates these factors to each other. Second, leaders and governments differ in the relative importance they place on providing social benefits and a growing economy and their preferences over how military spending should be financed (Bueno de Mesquita et al. 2003, Oatley 2015, Carter and Palmer 2015, Cappella Zielinski 2016). For example, actors vary considerably in their ability and willingness to pay for higher military spending by borrowing money (Schultz and Weingast 2003, DiGiuseppe 2015) and with higher taxes (Flores-Macias and Kreps 2013). Given the interdependence between government spending, the economy, and methods of government finance, leaders' preferences over how to pay for national defense should influence the effects of military expenditures on social spending and the economy. Third, effects of military spending on social expenditures and economic growth can manifest differently over time due to indirect relationships among these variables. The interdependence among government spending, the economy, and methods of government finance implies that changes in military spending will have

indirect effects on social expenditures and the economy through tax revenue, debt, and/or the money supply that would take time to appear (e.g., Mintz and Huang 1991). Importantly, the time necessary for changes in one factor to work through the system is an empirical issue and imposing an inappropriate lag structure on the empirical models can lead to incorrect substantive inferences.

With these challenges in mind, we estimate the relationships between government spending, economic growth, and finance methods on quarterly data from the United States for the period from 1947 to 2008 using vector autoregressive (VAR) models. VAR models are able simultaneously to account for each of the three issues common among analyses of the relationships between military spending and social expenditures and the economy. First, VAR estimators model each variable as a function of its past values and the past values of every other variable included in the system of equations and place no *a priori* assumptions about the endogenous or exogenous nature of the relationships between variables (Enders 2004, Box-Steffensmeier et al. 2015). Our estimation technique therefore allows the data to tell us how the variables are related and captures direct and indirect relationships among government spending, economic growth, and methods of government finance. Second, VAR models allow us to estimate how leaders' preferences over finance methods influence the effects of military spending on social spending and economic growth. The directional and substantive effects of variables in a VAR are identified using impulse response functions (IRFs) and forecast error variance decompositions (FEVDs). Calculating IRFs and FEVDs require one to specify the order in which contemporaneous changes in the variables can influence one another. If the results of IRFs and FEVDs are sensitive to the orderings one specifies, the relationships between and among variables are conditional on how changes in variables move through the system of equations. We exploit this feature of VAR models to assess our claim that leaders' preferences can influence the effect of military spending on social spending and economic growth. More specifically, we link variation in the relative importance leaders place on protecting the social welfare state, avoiding

tax increases, keeping the debt down, and not engaging in expansionary monetary policy to the contemporaneous ordering of the variables in a set of IRFs and FEVDs. For expositional purposes, we use the administrations of Presidents Truman, Kennedy, Johnson, and Reagan as heuristics when discussing how four sets of orderings over methods of government finance influence the effect of military spending on social spending and economic growth. Third, because variables are modeled as a function of their previous values and the values of all other variables in the system of equations, VAR models estimate how relationships between and among variables play out over time.

Our analyses yield three results important for understanding the relationships between and among guns, butter, and economic growth. First, military expenditures, social spending, the economy, tax revenue, debt, and the money supply are all related to one another, at least indirectly. Thus, analyses of the guns-butter trade-off or the relationship between military spending and economic growth that do not consider how governments finance their expenditures are misspecified. Second, we find that changes in military spending have a non-linear effect on GDP growth that varies over time. This suggests, among other things, that the relationship between military spending and economic growth is nuanced and analysts' findings will be sensitive to whether and how they consider short-term and long-term dynamics (Smith 2000). Third, our analyses suggest whether a "guns-vs-butter" trade-off exists is conditional on decision-makers' relative preferences for increasing social spending compared to reducing taxes, the debt, or the money supply. Specifically, we find that military and social spending are complementary in scenarios where decision-makers place a higher priority on supporting the social welfare state (e.g., President Johnson and his Great Society programs), but that the guns-butter trade-off exists when decision-makers place a higher priority on reducing taxes and/or keeping the debt low (e.g., President Truman's financing of the Korean War). This is consistent with previous research that finds the guns-butter trade-off is conditional on decision-makers' preferences over social welfare programs (Palmer 1990, Whitten and Williams 2011).

The remainder of the manuscript proceeds as follows. The first section provides a brief overview of existing research on how military spending influences social spending and economic growth. We then identify how methods of government finance link patterns of military spending, social spending, and the economy. The third section describes our research design while the fourth reports our results. We conclude with a discussion of the implications of our findings.

Guns, Butter, and Growth

Scholarship on the political and economic consequences of military spending is extensive (see Garfinkel and Skaperdas 2012 for a recent review). Our substantive interest is with how increases in military spending affect patterns of social spending (the guns-butter trade-off)¹ and economic growth (the defense-growth nexus). We first provide a brief summary of the most prominent arguments and findings in the literature on the relationship between military expenditures and social spending before doing the same for research on the link between military spending and economic growth.

Research on the relationship between military spending and social spending tends to be framed around the guns-butter trade-off (Russett 1969, Mintz 1989, Heo and Bohte 2012). The traditional guns-vs-butter framework is straightforward: because resources are scarce, there is an inverse relationship between military spending and non-military spending. The guns-butter trade-off then implies that a growing military budget should be met with a proportional decrease in social spending. Despite its intuitive logic and early empirical support for the argument (Russett 1969), most research fails to find evidence of a generic and direct trade-off between military and social spending (Domke, Eichenberg and Kelleher 1983, Heo and Bohte 2012). More nuanced analyses, though, suggest the existence of conditional or indirect trade-offs between military and social spending. For example, small allies of the United States (Palmer 1990), right-wing

¹ We note that while “guns” pertains to military spending, there are two varieties of “butter” in the literature. That is, butter sometimes means social spending while other times butter refers to economic growth. We use butter to refer to social spending.

governments (Whitten and Williams 2011), and non-democracies during interstate wars (Carter and Palmer 2015) appear to reduce social spending in order to finance higher levels of military spending. Perhaps most notably for our concerns, Mintz and Huang (1991) identify an indirect link between military and social spending through economic growth. Specifically, Mintz and Huang find that higher military spending reduces long-term spending on education by crowding out investment, which reduces economic growth, which in turn reduces the resources available for education spending. Thus, while there is little evidence of a direct guns-vs-butter trade-off, accounting for intervening factors and indirect pathways reveals that patterns of military spending and social spending are systematically related in some cases.

The relationship between military spending and economic growth is the subject of considerable research in political science and defense economics. We structure our discussion around two prominent approaches in the literature that reach opposite conclusions about the nature of the defense-growth nexus.

The first, associated with “military Keynesianism,” argues that military spending spurs economic growth primarily by increasing aggregate demand and employment (Mintz and Hicks 1984). Accordingly, military spending represents a counter-cyclical fiscal policy tool that can improve the economy through both direct and indirect channels (e.g., Mintz and Hicks 1984). Military spending most directly stimulates the economy by allowing a government to hire people and increase the size of its military, increase existing orders from defense contractors, and/or sign new contracts with companies in the defense industry (Mintz and Hicks 1984, DeRouen and Heo 2000, Heo and Bohte 2012). Indirectly, increases in military spending stimulate the economy by leading defense sub-contractors to increase their workforce and payroll and raising salaries of members of the military, which provides them with more money to spend (DeRouen and Heo 2000). Thus, military Keynesianism argues military spending has a positive multiplier effect and increasing military expenditures leads to economic growth (Dunne, Smith and Willenbockel 2005, Pieroni, d’Agostino and Lorusso 2008).

An alternative set of arguments claims that increasing military spending harms a country's economy. The most prominent of these arguments, at least in political science, focuses on the relationship between military spending, private investment, and economic performance and follows from three stylized facts (Mintz and Huang 1990, 1991, Heo 2010). First, a state's economy can be divided into consumption and non-consumption segments (Smith 1980, Mintz and Huang 1990). Second, military spending and private investment compete with one another for the non-consumption portion of a state's economy (Smith 1980, Rasler and Thompson 1988). Third, investment has a positive effect on economic growth (De Long and Summers 1991). It therefore follows that military spending should reduce economic growth to the extent that military expenditures crowd out investment in the non-consumption segment of a state's economy (Mintz and Huang 1991, Heo 2010).

As the previous paragraphs suggest, there is no consensus regarding the effect of military expenditures on economic growth. Proponents of the military Keynesian and opportunity costs perspectives both present theoretical models and evidence in support of their preferred approaches. Consistent with the competing perspectives, meta-analyses by Chan (1985), Ram (1995), Smith (2000), and Dunne and Uye (2009) find no evidence for a general positive or negative relationship between military expenditures and economic performance in the literature (d'Agostino, Dunne and Pieroni 2010).

We take no position on the relative merits of the competing claims about the relationship between military spending and economic growth. That said, we see two missing ingredients in existing studies. First, how leaders choose to finance national defense should influence how changes in military spending work their way through the economy. Second, because military spending can influence the economy directly and indirectly through methods of government finance, the changes in military expenditures likely have different effects on economic performance over time. Oatley (2015) demonstrates these points, arguing the performance of the contemporary U.S. economy is best understood as a series of booms and busts driven by military

build-ups. He first demonstrates that large, deficit-financed growth in military spending has resulted in the longest and largest expansions of the U.S. economy in the post-World War II era. Contrary to concerns about military spending crowding out investment (e.g., Mintz and Huang 1991), foreign capital floods into the American economy when military build-ups are financed with deficit spending, which leads to increased output and strong economic growth over the short- and medium-term (Oatley 2015, pgs. 89-104). However, the credit booms that follow these large macroeconomic imbalances lead to asset bubbles that cause economic crises when they pop (Oatley 2015, pgs. 132-146). Importantly, these dynamics do not hold when military build-ups are financed with increased tax revenue because paying for national defense without increasing the deficit reduces the demand for foreign capital in the U.S. economy. Further, Oatley's finding that deficit-financed growth in the military budget is associated with economic booms in the short- and medium-term and economic busts in the long-term is problematic for arguments that claim military spending has a straightforward negative or positive effect on economic growth.

Oatley's research suggests whether growth in the military budget is financed with debt or taxes can influence the relationship between military spending and economic growth. However, scholars have pointed out that leaders have methods of financing military spending beyond taxes and deficit spending at their disposal. The next section demonstrates that government spending, the economy, and the various methods of government finance are all related to one another. This suggests that accurately identifying the effects of military spending on social spending or economic growth requires that analysts simultaneously consider relationships between and among government spending on the military and social benefits, the economy, tax revenue, debt, and the money supply.

Government Finance, Military Spending, and the Economy

Previous scholarship largely fails to appreciate how the ways in which governments finance the military can influence how growth in military spending influences social spending

and/or economic growth and that leaders vary in their preferences over methods of government finance. A useful starting point for understanding the implications of this is the traditional guns-butter trade-off. As described above, the basic guns-butter framework assumes government spending is divided between military spending (m) and non-military/social spending (b) and subject to budget constraint (k); or

$$m + b = k \quad (1)$$

The relationship between m , b , and k in the guns-butter trade-off highlights the two basic strategies by which governments finance military spending: reducing non-military spending and/or increasing their budget (Rasler and Thompson 1985, Carter and Palmer 2016). While a general, direct trade-off does not appear to exist (Heo and Bohte 2012), there is evidence of conditional and indirect links between military and social spending (Palmer 1990, Mintz and Huang 1991, Whitten and Williams 2011). Social welfare programs tend to be popular with the public and, therefore, governments often try to avoid reducing social spending when increasing military spending (DiGiuseppe 2015).² From Equation 1, a growing military budget can be accommodated without reducing social spending if a government increases the total resources devoted to government expenditures.

Scholars commonly focus on three strategies that allow governments to pay for military spending by increasing their budgets (Rasler and Thompson 1985, Rockoff 2012). The first, and arguably most traditional method, is to increase tax revenue. There is a long line of scholarship that links the demand for military spending to tax revenue (Organski and Kugler 1980, Tilly 1992, Bank, Stark and Thorndike 2008). Consistent with this, recent work by Heo and Bohte

² Note that governments can pay for higher military spending by reducing non-military spending without engaging in the guns-vs-butter trade-off. For example, a government could re-allocate to the military resources previously budgeted to infrastructure, servicing debt, the bureaucracy, or any other program not associated with the social welfare state without increasing their overall budget. However, following most research that uses the guns-butter framework, we largely treat all non-military spending as “social” spending.

(2012) finds higher military spending is associated with increases in tax rates. The *Confronting the Costs of War* project reports that 75% of the primary interstate war belligerents between 1823 and 2003 instituted a tax to finance their war efforts (Cappella Zielinski 2016).³ Flores-Macías and Kreps (2013) find that the United States historically has passed taxes to pay for its wars, at least when the president is associated with the “pro-tax” party.

A second method governments use to finance increases in military expenditures is to borrow money (Tilly 1992, Schultz and Weingast 1998, Heo and Bohte 2012). Governments often prefer to finance military spending through deficit spending because borrowing money is less politically costly than raising taxes or reducing social spending (Slantchev 2012, Shea 2014, Oatley 2015). Additionally, borrowing often allows governments to raise more money and do so in a shorter time period than raising taxes or cutting non-military expenditures (Schultz and Weingast 1998, Slantchev 2011, Rockoff 2012). However, leaders’ ability to borrow money on the international market at low interest rates varies considerably (Schultz and Weingast 1998, Beaulieu, Cox, and Sebastian 2012, Tomz 2012), meaning the relative attractiveness of this finance strategy varies considerably for different leaders.

Finally, governments can finance increases in military spending by “printing money” (Rockoff 2012, Cappella Zielinski 2016). Governments have an incentive to avoid using the printing press to pay for higher military spending because loose monetary policy can lead to inflation. This is undesirable because inflation is politically unpopular and can harm a state's economic performance, which threatens the survival of governments, regimes, and leaders (Gasiorowski 1995, Goemans 2008). However, financing military spending by printing money is an option for governments that control their currency and, in some cases, is preferable to increasing taxes, reducing non-military spending, and/or borrowing money. In particular, increasing the money supply allows governments to raise a lot of money quickly, entails lower

³ Data available at <http://sites.bu.edu/cappella/confronting-the-cost-of-war-data/>.

administrative costs than raising taxes or borrowing money, and is often less politically costly, at least in the short term, than either increasing taxes or reducing social spending (Rockoff 2012). Consistent with these claims, there is evidence that governments rely on the printing press to finance a growing defense budget. The *Confronting the Costs of War* project indicates that 30 of 61 interstate war participants between 1823 and 2003 financed at least 25% of their war efforts by printing money (Cappella Zielinski 2016). With the exception of the Korean War, the United States has relied on expansionary monetary policy to partially finance its mobilization efforts in every interstate war since the Spanish-American War (Rockoff 2012). More generally, Majeski (1992) finds that growth in demand for military spending is associated with increases in the money supply.⁴

It is important to be clear about how some contemporary governments use the printing press to pay for military spending. While scholars often use the euphemism of “printing money,” governments cannot force independent central banks to print currency that will then be used to finance military spending. Rather, governments can issue bonds that central banks purchase, providing capital that the government can use to finance a military build-up but must be repaid (Rockoff 2012, especially 17-22). Beyond the government’s need to repay the central bank, the associated increase in the money supply can lead to inflationary pressures and serve as an “indirect tax” on the population (Cappella Zielinski 2016, 13). Thus, states with independent central banks pay for military spending by “printing money” through a process of taking on financial obligations that must be repaid.

Existing research on how states finance military spending allows us to refine Equation 1. We can now define a government's budget constraint as a function of its level of debt (d), money supply (s), and tax revenue (t); or, $k = t + d + s$. Substituting into Equation 1 yields:

$$m + b = t + d + s \quad (2)$$

Equation 2 highlights two important points. First, increasing military spending can be accomplished by lowering social spending, increasing tax revenue, increasing the debt, and/or increasing the money supply. Second, reductions in social spending and increased levels of tax revenue, debt, and money are substitutes for an increase in military spending of any given size; which implies they are unlikely to be independent of one another. This point is consistent with Heo and Bohte's (2012) analyses of how military spending influences the tax rate, social welfare spending, and the deficit and Carter and Palmer's work (2016) on how regime type influences patterns of interstate war finance. Equation 2 therefore indicates that identifying what happens when governments increase military spending requires analysts to consider explicitly how governments finance military expenditures and the relationships among finance methods.

Neither traditional guns-vs-butter analyses nor Equation 2 includes the role of the economy. However, government spending, methods of government finance, and a state's economy are all at least indirectly related to one another. There are numerous ways to demonstrate this. We focus on what we feel to be the most straightforward. A state's GDP (e) in a given year is defined as the sum of consumer spending (c), government spending (g), investment (i), and net exports and imports (nx); or, $e = c + g + i + nx$. From Equation 2, we can write government spending as $g(m, b, t, d, s)$ and, consequently, GDP as:

$$e = c + g(m, b, t, d, s) + i + nx \quad (3)$$

Equation 3 identifies a state's GDP as a function of military spending, social spending, tax revenue, debt, and the money supply. However, each of these variables is a function of GDP due to how a state's economy influences government finance. For example, while the specifics of tax regimes vary across governments, all include taxes on types of consumer spending, investment, and imports. A government's total tax revenue therefore is a function of GDP (Persson and Tabellini 2002). A state's economy also influences its level of debt. In particular, states with stronger economies are able to borrow money at a cheaper rate on the international market (Afonso, Gomes and Rother 2011) and, therefore, have higher levels of debt (Global

Financial Data 2012). Finally, a state's money supply often is influenced by the performance of its economy. This occurs when central banks pursue expansionary monetary policies in an attempt to stimulate an economy (Clarida, Gali and Gertler 1998). Accordingly, we can define a government's tax revenue, level of debt, and money supply as functions of its economy; or, $t(e)$, $d(e)$, and $s(e)$. Substituting these terms into Equation 2 implies that both military spending and social spending are indirect functions of a state's economy:

$$m + b = t(e) + d(e) + s(e) \quad (4)$$

The preceding discussion demonstrates that government spending, tax revenue, debt, the money supply and a state's economy are all related to each other. It is important to stress that the relationships among these variables are not mechanic and likely vary depending on context. There are two related reasons for this. First, political leaders choose how much their government spends on defense and how they pay for military spending. Second, political leaders vary in their preferences over how to finance military spending. There is extensive evidence that the preferences and constraints facing political leaders and governments influence how they allocate the economic resources available to them (Palmer 1990, Bueno de Mesquita et al. 2003, Whitten and Williams 2011, Carter and Palmer 2016). The implications of this simple and uncontroversial observation for the consequences of increased military spending are substantial. If leaders vary in their preferences over the relative importance of maintaining or expanding the social welfare state, keeping taxes low, reducing the debt, or tightening or expanding the money supply, it is unlikely increasing military spending will always have the same effects on social spending and methods of government finance. Instead, leaders' preferences should induce variation in the effects of increased military expenditures.

Two related observations further complicate the idea that the effect of military spending on social spending and the economy should always manifest in the same way. First, as Oatley (2015) demonstrates, the effect of increasing military spending on economic growth can be conditional on how national defense is financed and vary over time. Second, the economy

influences the size of a government's budget and, therefore, its ability to spend money on the military and social programs (d'Agostino, Dunne, and Pieroni 2010). Therefore, how leaders and governments finance national defense can have different effects on the resources available to pay for spending on the military and social benefits at different points in time.

The preceding sections demonstrate four important points for understanding the consequences of military spending. First, government spending, the economy, and methods of government finance are related to one another. Second, political leaders' preferences will influence the extent to which military expenditures are financed by reducing social spending, increasing tax revenue, increasing debt, and/or increasing the money supply finance expenditures. Third, the effects of increasing military spending on the economy and social spending can be conditional on how the military is financed. Fourth, relationships between government spending, the economy, and finance methods can vary over time. The next section describes our strategy for estimating the effects of military spending on social spending and economic growth in light of these points.

Research Design

We estimate the relationships among military expenditures, social spending, the economy, and methods of government finance using vector autoregressive (VAR) models. A VAR model is a system of equations that typically includes relatively few variables and, importantly, places very few restrictions on the possible relationships among the variables in the system. Each equation in the VAR regresses a given variable on its past values and the past values of all of the other variables in the system. A key feature of a VAR is that each variable is treated symmetrically: the model makes no assumptions regarding the exogeneity or endogeneity of variables included in the system of equations (Freeman, Williams and Lin 1989, Enders 2004). Put differently, theory dictates which variables are included in the system of equations and the nature of the relationships among the variables is estimated. VAR models are well suited to our

purpose because they allow us to explicitly assess whether and how patterns of military spending, social spending, the economy, and methods of government finance are related. Other scholars have used VAR models to estimate the consequences of military spending for social spending and/or economic growth (e.g., Kinsella 1990, Oatley 2015). However, our analyses are the first to simultaneously consider the relationships among military expenditures, social spending, tax revenue, debt and the money supply.

Our primary analyses use a six-equation VAR to estimate the economic and financial consequences of increasing military spending in the United States on a quarterly data set for the period from the first quarter of 1947 to the first quarter of 2008. Each of our measures is reported in constant 2009 dollars and drawn from the Federal Reserve Bank of St. Louis' "FRED" website (Federal Reserve Bank of St. Louis 2017).⁵ *Military Spending* is measured as quarterly outlays on national defense consumption or investment (BEA series A824RC1).⁶ *Social Spending* is operationalized as total quarterly transfers of government social benefits (series W015RU1Q027NBEA). *GDP* is taken from the FRED series GDP. *Tax Revenue* is operationalized as the federal government's total current tax receipts (series W006RC1Q027SBEA). We measure *Debt* using the federal government's total debt liabilities (series FGDSLAQ027S).⁷ Finally, the *Money Supply* is measured with the adjusted monetary base (series AMBSL).⁸

⁵ The series were in current dollars but were converted to constant 2009 dollars using the deflator series (GDPDEF) from FRED. All measures except our indicators for debt and social spending were seasonally adjusted. Our measure of debt did not contain a seasonal component. Our indicator of social spending was seasonally adjusted by applying a MA(4) smoothing filter to the series.

⁶ The military spending series contains a variety of costs, included personal benefits, investments, and consumption. Unfortunately, quarterly data, which is required for our analysis, are not available for these components of the military spending series.

⁷ We use this series to measure debt because it is available for a longer period of time than other indicators.

⁸ We converted the monthly AMBSL series to a quarterly measure by calculating the average of AMBSL for a given quarter.

We specified *Military Spending*, *Social Spending*, *GDP*, *Tax Revenue*, *Debt*, and *Money Supply* as growth rates.⁹ Tests for the appropriate lag length for the VAR came back with conflicting results. The Bayesian information criterion (SBIC) and the Hannan and Quinn information criterion (HQIC) indicated only one lag was necessary. The final prediction error (FPE), Akaike's information criterion (AIC) suggested four lags and the likelihood ratio test indicated as many as sixteen lags should be used. We settled on four lags because this specification reduced the autocorrelation in the errors without an extreme number of lags that would consume a large number of degrees of freedom and introduce even greater inefficiency into the model.

It is difficult to draw substantive inferences directly from VAR models due to the number of estimated parameters and the interdependent nature of the model specification; i.e., every variable is a function of its own lagged values and the lagged values of every other variable included in the model (Enders 2004, Box-Steffensmeier et al. 2015). We therefore report the parameter estimates associated with our VAR models and Granger causality tests in the appendix and focus our discussion here on three post-estimation quantities that identify how increases in military spending affect social spending, the economy, and methods of government finance. Importantly, these quantities allow us to assess how variation in the strategies leaders might choose to finance national defense influences the effects of increasing military spending on social spending and economic growth over time.

The first two quantities of interest are marginal and cumulative orthogonalized impulse response functions (IRFs). Impulse response functions trace out the directional effect of a one-

⁹ We report diagnostic analyses in the appendix but briefly describe some important results here. The univariate analysis for each time series shows a persistent trend when the series are measured in levels. Analysis of the ACF, PACF, and Dickey Fuller tests also indicate that the series are non-stationary in levels. The univariate growth rates series are stationary, do not show evidence of structural breaks, and reduce autocorrelation in the errors of the VAR. Some argue that removing trends or other dynamic features from series used in a VAR may also remove important dynamics for the VAR to model (Enders 2004). However, we chose to model the series as growth rates as a conservative assessment of the relationships among government spending, government finance, and economic growth.

period, one-standard deviation shock of one variable on the other variables in the system of equations. Below, we report the marginal and cumulative IRFs associated with an increase in *Military Spending* on *Social Spending* and *GDP* over twenty quarters. These impulse response functions allow us to identify how the effects of increasing military spending play out over time. Further, presenting both the marginal and cumulative IRFs allows us to identify how increasing military spending affects social spending or economic growth in any of the given quarters (marginal IRFs) and the overall effect of military expenditures on social benefits spending and economic performance (cumulative IRFs). The third quantity we present is the forecast error variance decomposition (FEVDs) associated with increases in *Military Spending*. FEVDs estimate the proportion of the variance of a variable that can be attributed to changes in another variable. The FEVDs allow us to identify the influence of increasing military spending on social spending and economic growth in a given quarter relative to the influence of other variables in the VAR on social spending and economic growth.

Estimating IRFs and FEVDs require the analyst to impose a contemporaneous ordering on the variables to provide a structure to the system of equations. Because shocks to one variable can be correlated with shocks to other variables, it would be impossible to disentangle the influence of respective changes in different variables without specifying a contemporaneous ordering among the variables (Enders 2004, Box-Steffensmeier et. al. 2014). As Box-Steffensmeier et. al. (2014, 117) write, “This means that we are forced to assume an ordering of variables when using this innovation accounting technique (impulse response functions). This amounts to an assumption about how shocks cascade contemporaneously through the entire system.” For example, the first variable in a given order can contemporaneously influence all of the other variables in the system; the second variable can only contemporaneously influence variables that come after it in the ordering, the third variable can only contemporaneously influence the variables that come after it in the ordering, and so on. Regardless of where a

variable is placed in an ordering, though, all variables in a system can influence one another through the lags included in the VAR.

The results of IRFs and FEVDs are sensitive to the ordering of variables if contemporaneous correlations exist among the error terms of the equations in a VAR (Box-Steffensmeier et. al. 2014). The question that naturally arises, then, is how should one specify the contemporaneous ordering of the variables? Box-Steffensmeier et al. (2014, 117) argue that theoretical considerations should guide the contemporaneous ordering among variables. We follow this advice and exploit the sensitivity of IRFs and FEVDs to the contemporaneous orderings among variables in a VAR to assess how variation in leaders' preferences over how military spending should be financed influences the effect of military spending on social spending and economic growth. The stronger a leader feels about having a comprehensive social welfare state, or lowering taxes, or creating a smaller national debt, or reducing the money supply, the more binding that constraint is on a leader's decision-making process. Consider the extreme example of a leader who cares only about not increasing the debt. In this scenario, the leader's decisions regarding how to finance military spending at time t through social spending, tax revenues, and the money supply will be driven by a desire not to increase the debt but considerations about social spending, tax revenues, and the money supply/inflation will not influence his/her decision to not finance a growing military budget by increasing the debt at time t . More generally, variables leaders care more about should directly influence their decisions about variables they care less about. This implies that variables a leader cares more about should appear earlier in the contemporaneous orderings of the IRFs and FEVDs.

We use this logic to link variation in leaders' preferences over methods for financing the military to our statistical analyses via the contemporaneous orderings of variables for the IRFs and FEVDs. Our use of a six-equation VAR means there are $6!$ (720) possible orderings one could consider. To provide a more parsimonious and manageable set of analyses, we focus on four stylized sets of preferences that we consider reasonable and perhaps observed. We might

refer to these preferences by neutral appellations - α , β , etc. We believe, however, the reader will be assisted if we broadly interpret, for heuristic purposes, the orderings as reflecting the preferences of Presidents Harry Truman, John Kennedy, Lyndon Johnson, and Ronald Reagan. We assume that *GDP* and *Military Spending* are the first two variables in each ordering. This reflects the ideas that all governments and administrations are constrained by the size of the economy and, to the extent possible, will spend the military resources they deem necessary to provide for the national defense. Beyond this assumption, the orderings reflect variation in the relative importance Presidents Truman, Kennedy, Johnson, and Reagan placed on the social welfare state, having low taxes, debt, and avoiding the inflation that an expansionary monetary policy can induce. We next summarize the reasons underlying the relative preference orderings for each president.

President Truman's primary concern when financing U.S. involvement in the Korean War was keeping the debt down (Bank, Stark and Thorndike 2008, Rockoff 2012). Truman also was acutely worried about inflation (Rockoff 2012, Cappella Zielinski 2016). Given his desire not to increase the debt or engage in expansionary monetary policy, Truman stopped pursuing the expansion of the social welfare state associated with his "Fair Deal" proposals and raised taxes to finance the Korean War (Hamby 1972, Bank, Stark and Thorndike 2008). This implies the following contemporaneous ordering: $GDP \rightarrow \text{Military Spending} \rightarrow \text{Debt} \rightarrow \text{Money Supply} \rightarrow \text{Tax Revenue} \rightarrow \text{Social Spending}$.

President Kennedy was far less willing than President Truman to reduce the scope of the social welfare state or to raise taxes to pay for military spending. Indeed, while increasing military spending in an attempt to keep up with the Soviets and finance the U.S. government's initial involvement in Vietnam, Kennedy's "New Frontier" programs increased social spending and he pressed for a tax cut to stimulate the economy in 1963. Instead of raising taxes or reducing social spending to finance military spending, Kennedy increased the debt and dramatically

increased the money supply (Rockoff 2012). President Kennedy's policy preferences can be represented with the following contemporaneous ordering: GDP → Military Spending → Social Spending → Taxes → Debt → Money Supply.

Financing the United States' involvement in Vietnam famously weighed on President Lyndon Johnson. Above all, Johnson sought to protect his "Great Society" programs and consequently paid for the war in Vietnam with expansionary monetary policy, borrowing money, and raising taxes (Bator 2008). Johnson became increasingly concerned about inflation as the war endured and economic growth slowed in his second term (Rockoff 2012). This led Johnson to tighten monetary policy and rely increasingly on debt and tax revenue to finance the Vietnam War in his final years in office (Bank, Stark, and Thorndike 2008, Cappella Zielinski 2016). President Johnson's revealed preferences imply the following contemporaneous ordering: GDP → Military Spending → Social Spending → Money Supply → Debt → Taxes.

President Reagan was loathe to finance the military build-up during his administration with higher taxes. Reagan, along with Federal Reserve Chairman Paul Volcker, also favored tightening the money supply in an attempt to fight inflation (Feldstein 1993). Reagan was willing, though, to reduce the size and the scope of the social welfare state (e.g., Pierson 1995) and had little problem with increasing the national debt, which rose from \$964 billion to \$2.7 trillion during his time in office (FRED 2017). Accordingly, we can represent President Reagan's preferences with the following contemporaneous ordering: GDP → Military Spending → Taxes → Money Supply → Debt → Social Spending.

The above orderings place a structure on the system of equations and allow us to identify the effects of increasing military expenditures on the other variables in our VAR. Before moving on, it is important to highlight three things about these orderings. First, we stress that we use presidents' names as a heuristic device to assess whether variation in preferences over military finance influence the consequences of military spending for social spending and the economy.

We do not insist, and it is not substantively important, that the respective administrations held to these preferences. Second, the results associated with a given scenario are not based on estimates drawn only from the years of each respective presidency. That is, we estimate and conduct IRFs and FEVDs for each scenario on the full data set. Third, the results associated with a given scenario do not necessarily reflect the observed relationships among variables during the motivating administration.

Results

We first present results that identify the effect of increasing military spending on patterns of social spending before turning to the relationship between military expenditures and economic growth.

The Effects of Military Spending on Social Spending

Figure 1 presents the quarterly effects of a one-period, one-standard deviation increase in *Military Spending on Social Spending* (with 95% confidence intervals) over twenty quarters for each of our four orderings.

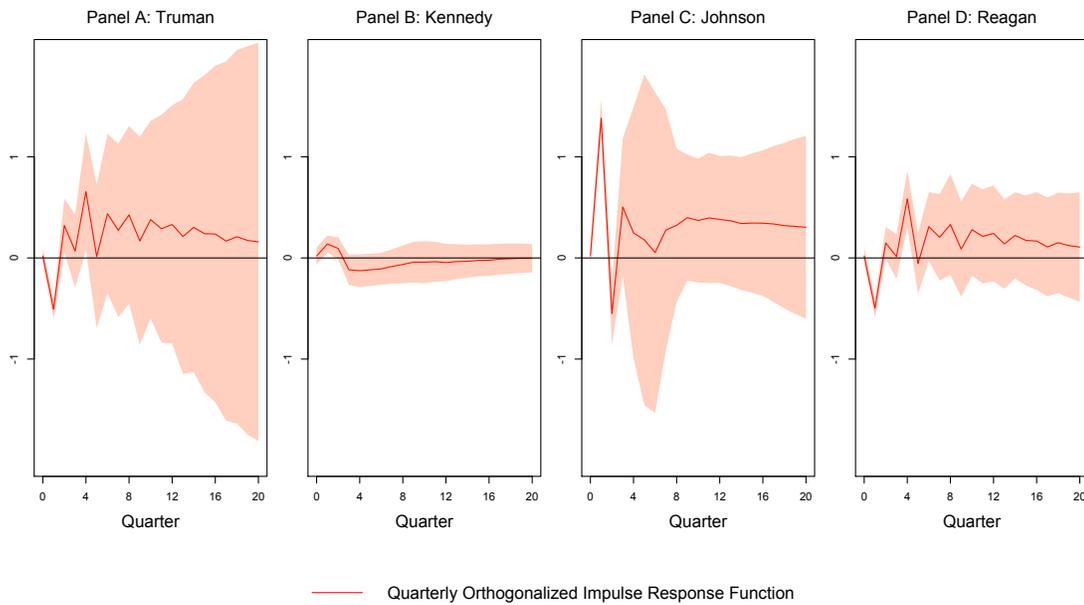


Figure 1: The Marginal Effect of Increasing *Military Spending on Social Spending*.

The first thing that stands out in Figure 1 is that the relationship between increases in military spending and social spending is conditional on the contemporaneous ordering of the variables in our VAR. Most importantly, the first quarter following an increase in military spending sees a significant decrease in social spending in the Truman and Reagan scenarios and a significant increase in social spending in the Kennedy and Johnson scenarios. This lack of a general, short-term trade-off between military spending and social spending is consistent with most empirical research on the topic (Domke, Eichenberg and Kelleher 1983, Heo and Bohte 2012). Further, the relationship between military spending and social expenditures in the short-run is not random. That is, when military spending increases, we observe a guns-butter trade-off in the two scenarios that mimic Presidential administrations willing to reduce social spending (Truman and Reagan) and a complementary relationship between military and social spending when the variable orderings reflect presidents who sought to protect or expand the social welfare state (Kennedy and Johnson). Our results, therefore, are consistent with research that finds evidence of a guns-butter trade-off when decision-makers have a preference for reducing spending on the social welfare state when increasing military expenditures (Palmer 1990, Whitten and Williams 2011).

The results in Figure 1 also demonstrate that the marginal effect of military spending on social spending can vary over time. For example, increasing spending on national defense has a negative and significant marginal effect on social spending in Quarter 1 and positive and statistically significant marginal effects in Quarters 2 and 4 in the scenario that mimics President Truman's policy preferences. Less dramatically, increasing military expenditures has a positive and significant marginal effect on social spending in Quarter 1 and then negative and insignificant marginal effects in Quarters 2-20 in the Kennedy scenario. The differences in the direction and magnitude of the marginal effects over time complicate our ability to identify the overall effect of military expenditures on social spending. Figure 2, therefore, plots the cumulative effect of a one period, one standard deviation shock to *Military Spending* on *Social Spending* (with 95%

confidence intervals) over twenty quarters.

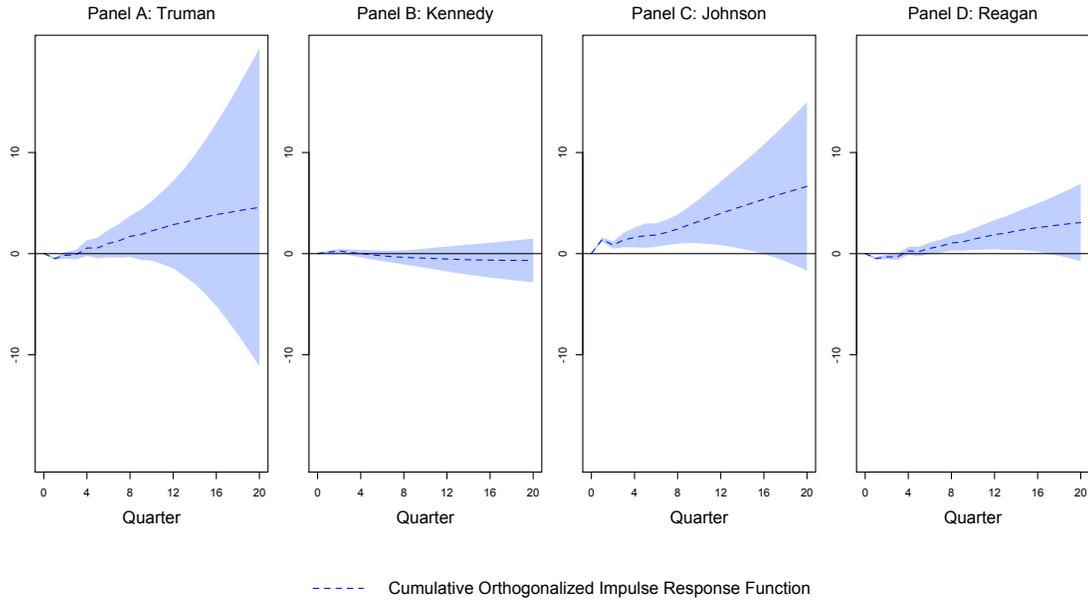


Figure 2: The Cumulative Effect of Increasing *Military Spending* on *Social Spending*.

Figure 2 illustrates the importance of considering both the marginal and cumulative effects of military spending on social spending. This is most clearly seen in the scenario that models President Reagan’s policy preferences. The cumulative effect of increasing military spending is a statistically significant reduction in social spending in Quarters 1-3. However, the direction of this relationship reverses in Quarter 4 and is positive and statistically significant between Quarters 7 and 16. The cumulative effects of increasing military spending on social spending are informative but less dramatic in the other scenarios. The overall effect of military spending on social expenditures is negative and significant in the Truman scenario in Quarter 1 and statistically insignificant in the remaining quarters. The scenario that models President Kennedy’s preferences suggests a positive and significant relationship between military expenditures and social spending in Quarters 1 and 2 and an insignificant relationship in subsequent quarters. Finally, the cumulative effects of increasing military spending on social spending are positive and statistically significant for Quarters 1-15 in the scenario that models

President Johnson's policy preferences.

Figure 3 reports the forecast error variance decomposition (with 95% confidence intervals) for each of the four scenarios for a one-quarter, one-standard deviation shock to growth rates in military spending. As noted above, FEVDs identify the importance of changes in military spending for changes in social spending relative to the other variables in the VAR. Under the Truman scenario, changes in military spending explain approximately 35% of the growth in military spending during the second quarter following the increase and approximately 20% of social spending in subsequent quarters. The shock to military spending explains between 5% and 10% of the variance in social spending during the first four quarters and between 10% and 15% of changes in social spending in subsequent quarters in the Kennedy scenario. The change in military spending has a large influence on social spending in the Johnson scenario, explaining between 49% and 59% of the variance in social spending starting in the second quarter after the shock in military spending. Changes in military spending also have a significant influence on social spending in the Reagan scenario, explaining roughly 30% of the growth in social spending in Quarters 2-4 and 45% and 50% of social spending in Quarters 5-20.

The results presented thus far suggest that the direction and relative magnitude of the effect military spending has on social spending is conditional on leaders' preferences on how to finance national defense and can change over time. We now present our findings for the relationship between changes in military spending and economic growth.

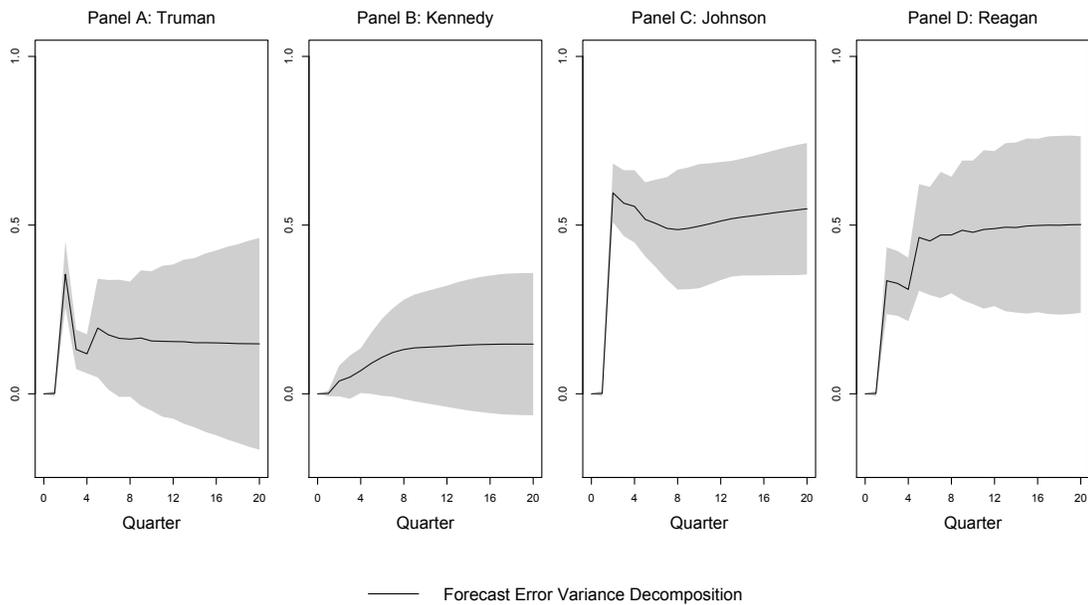


Figure 3: The Variance in *Social Spending* Explained by an Increase in *Military Spending*.

The Effects of Military Spending on Economic Growth

Figure 4 presents the quarterly effects of a one-period, one-standard deviation increase in *Military Spending* on *GDP* over twenty quarters in each of our four scenarios. Two things stand out about Figure 4. First, the impulse response functions identify the same qualitative relationship between military spending and economic growth in each ordering. Second, changes in military spending have a non-linear effect on economic growth that varies over time. The initial marginal effect of increasing military spending on economic performance is negative and statistically significant in each scenario. However, the marginal effect of military spending on the economy quickly changes signs and becomes positive and statistically significant for multiple quarters in each of the four scenarios (Truman and Kennedy: Quarters 4-7; Johnson: Quarters 5-7; Reagan: Quarters 4-8). Notably, the results in Figure 4 are substantively similar to Oatley’s findings on the short- to medium-term relationship between security shocks, the military build-ups they induce, and economic growth (2015, pgs. 95-97).

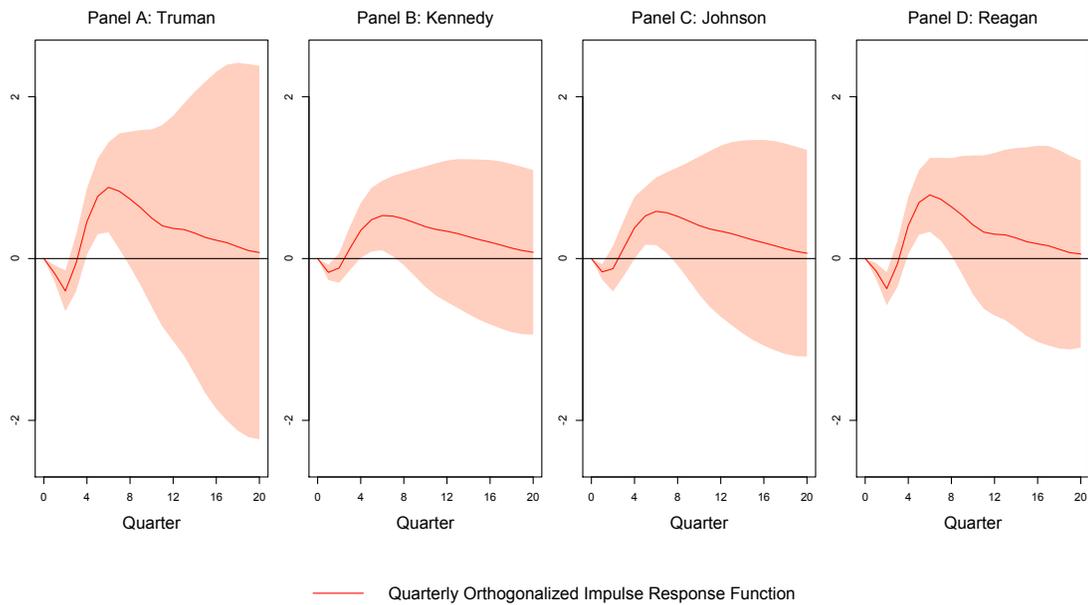


Figure 4: The Marginal Effect of Increasing *Military Spending* on *GDP*.

Figure 5 presents the cumulative effects of a one-quarter, one-standard deviation increase in *Military Spending* on *GDP* over twenty quarters. As with the marginal effects, the overall effect of military spending on economic growth varies over time in each of the four scenarios. For example, the cumulative effect of military spending on economic growth is negative and significant in Quarter 1 and positive and significant in Quarters 7-9 in the Johnson scenario.

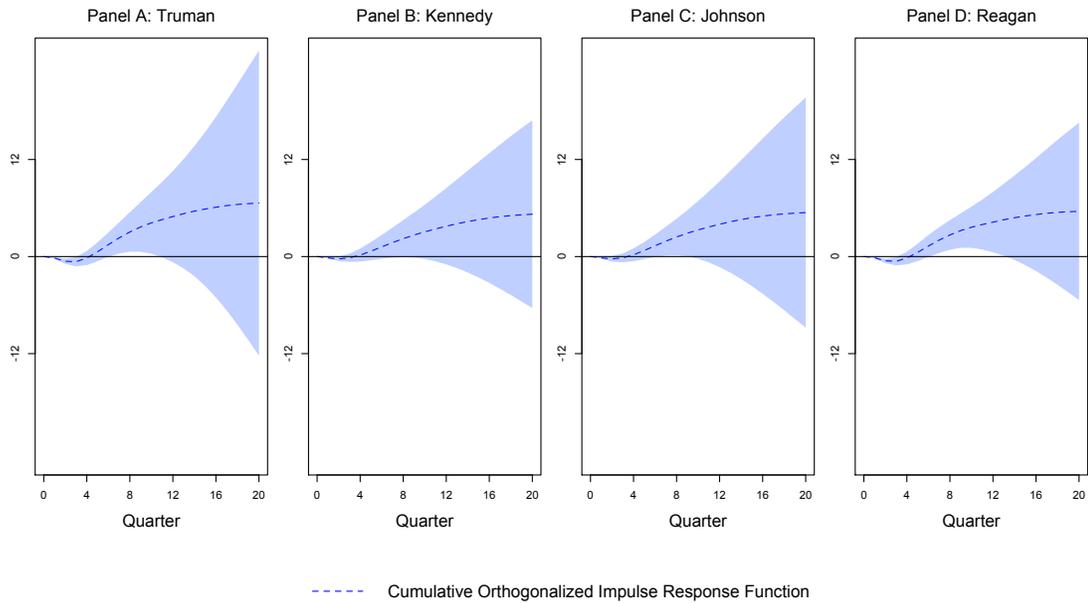


Figure 5: The Cumulative Effects of Increasing *Military Spending* on *GDP*.

The non-linear, time-varying effect of military spending on economic growth identified in Figures 4 and 5 offers a potential explanation for the lack of consensus in the literature on the relationship between military spending and economic performance. Changes in military spending have a positive effect, a negative effect, or no effect on marginal and cumulative economic growth at different points in time. Further, while the qualitative nature of the relationship between military spending and economic growth is similar in each scenario, whether the marginal or cumulative effects are significantly different from zero at a given point in time is conditional on analysts' assumptions about how changes in military spending reverberate through the system of equations. This implies analyses of the relationship between military spending and economic performance likely will yield different substantive inferences depending on how analysts specify their empirical models, the assumptions they make about how changes in military spending reverberate through the system of equations, whether they are focused on marginal or cumulative effects, and the period of time after a change in military spending they are considering.

Figure 6 reports the forecast error variance decomposition for a one-quarter, one-standard

deviation shock to military on GDP growth over twenty quarters. Overall, the relative influence of a shock to military spending on the growth rate of GDP in each of our four scenarios is similar. A positive shock to military spending explains less than 10% of the variance in economic performance for roughly the first five periods. After two years, though, increasing military spending explains between 20% and 32% of the variance in economic performance in the Truman, Kennedy, and Johnson scenarios and between 34% and 43% of the variance in economic growth in the Reagan scenario.

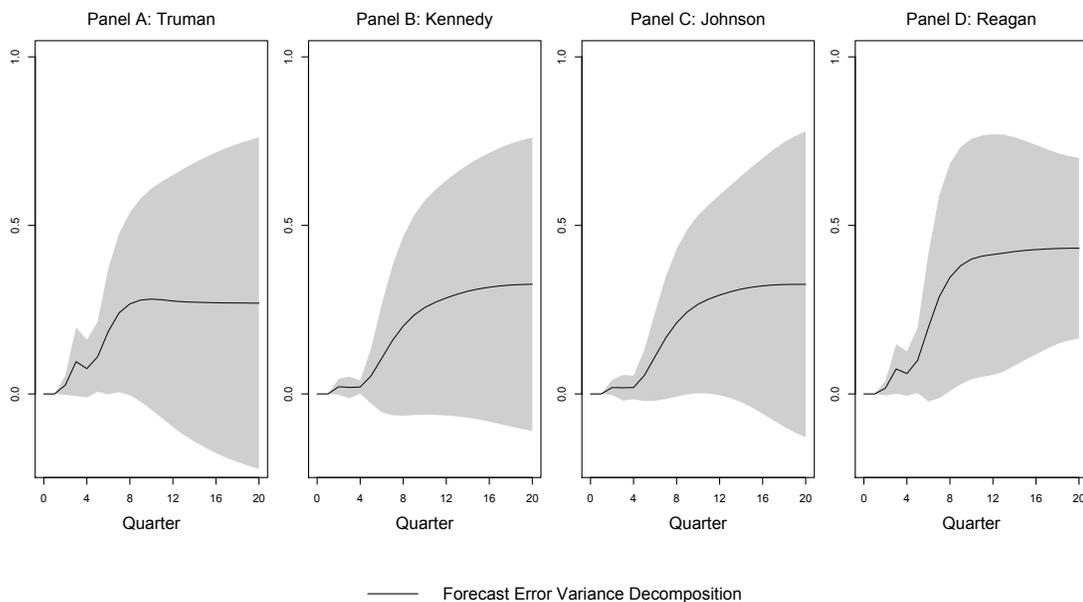


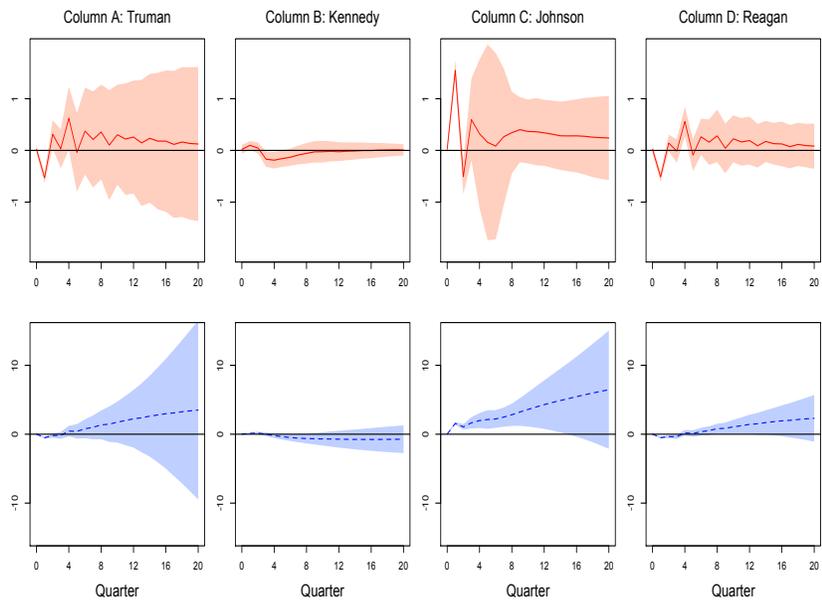
Figure 6: Variance in *GDP* Explained by an Increase in *Military Spending*.

Robustness Checks

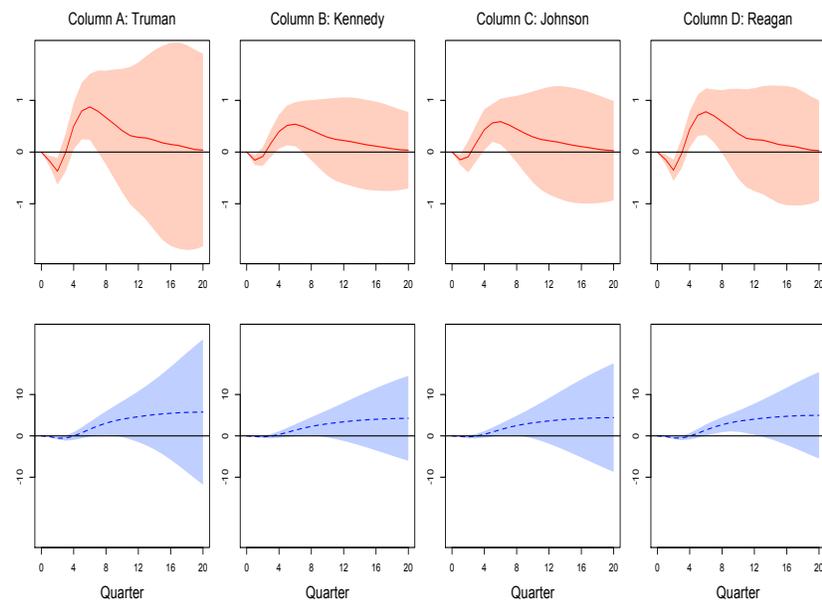
VAR models traditionally are specified by including only variables of theoretical interest and their lagged values in the system of equations. The primary reason for this is that each variable added to a VAR substantially increases the number of parameters that must be estimated (Box-Steffensmeier et al. 2015). Adding one more endogenous variable to our six-equation

VAR, for example, would require the estimation of an additional 53 parameters.¹⁰ Thus, parsimony is a virtue when specifying VAR models. Nevertheless, we realize that external threats and interstate war are associated with significant increases in military spending (Fordham and Walker 2005, Oatley 2015) and our primary analyses do not account for these relationships. We estimated two additional VAR models that account for the relative security of the United States. The first coded interstate war involvement based on the MID4 project (Palmer et al. 2015) while the second, following Oatley (2015), used the “security shock” variable developed by Ramey (2011). Figures 7 and 8 report the marginal and cumulative effects of a positive, one-standard deviation, one-period shock to *Military Spending* on *Social Spending* (top panel of each figure) and *GDP* (bottom panel of each figure) based on these respective models. Importantly, holding the various scenarios constant, increasing military spending has the same substantive effects on social spending and economic growth in these two models as it does in our primary model.

¹⁰ A seven-equation VAR with four lags of each variable requires the estimation of 29 parameters for each equation while a six-equation VAR with four lags of each variable requires the estimation of 25 parameters for each equation, which translates to 29×7 or 203 total parameters versus 25×6 or 150 total parameters.



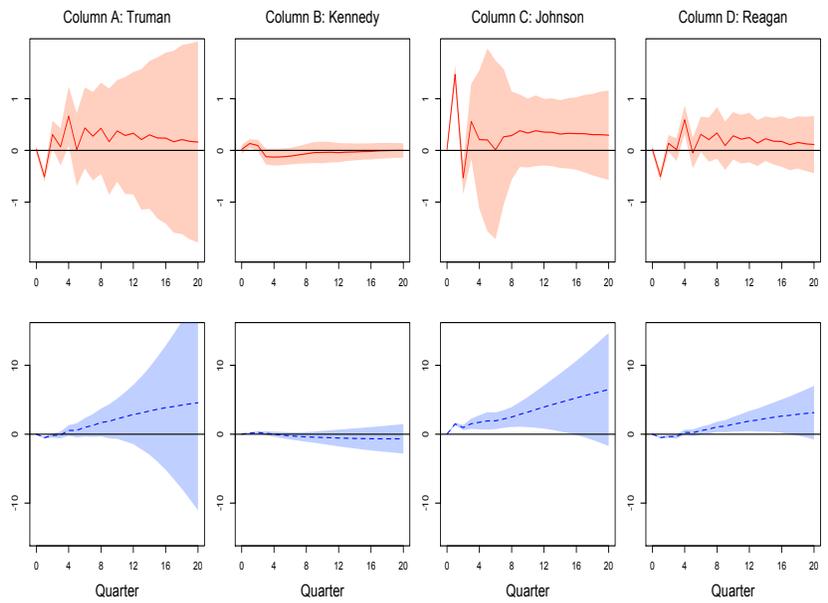
(a) Social Spending



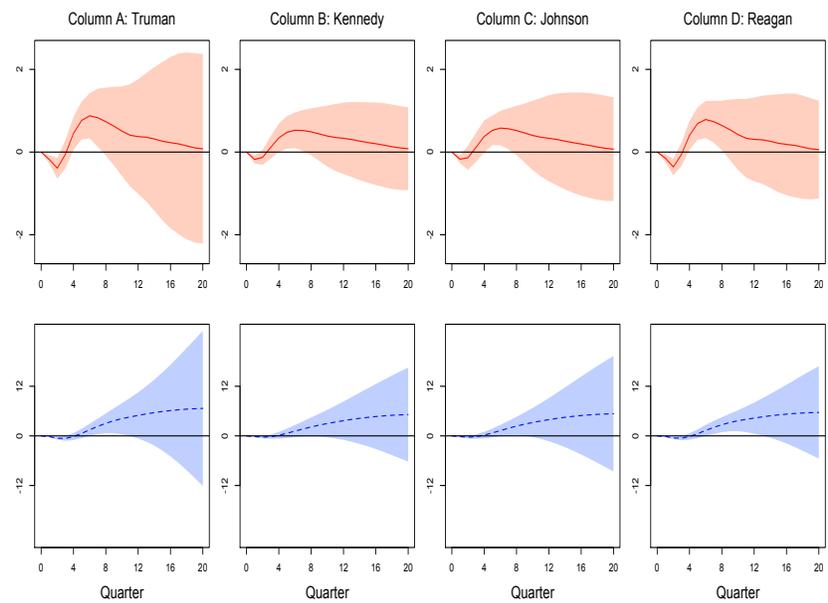
(b) GDP

— Quarterly Orthogonalized Impulse Response Function
 - - - Cumulative Orthogonalized Impulse Response Function

Figure 7: The Effects of Increasing *Military Spending* on *Social Spending* and *GDP* when Accounting for *Interstate War*.



(a) Social Spending



(b) GDP

— Quarterly Orthogonalized Impulse Response Function
 - - - Cumulative Orthogonalized Impulse Response Function

Figure 8: The Effects of Increasing *Military Spending* on *Social Spending* and *GDP* when Accounting for *Security Shocks*.

The Effect of Military Spending on Methods of Government Finance

While our primary interest is in how military spending affects social spending and economic growth, our analyses also identify how changes in military spending influence patterns of tax revenue, debt, and the money supply. These results are presented in the appendix for space purposes. We briefly note here that the effects of increasing military spending on patterns of tax revenue, debt, and the money supply, in terms of direction and relative importance, are conditional on the contemporaneous orderings of the variables in our VARs. For example, increasing military spending explains between 55% and 73% of the variance in money supply after the third quarter in the scenario modeling President Kennedy's policy preferences, but only 10% of the variance in the money supply in the Reagan scenario. Further, that changes in military spending explain substantial variance in each series suggests it is appropriate to incorporate variables that capture different methods of government finance in our VARs. More important from a theoretical perspective though, our results are consistent with the claim that variation in leaders' preferences over how governments should finance military spending is likely to induce variation in the consequences of increasing military spending.

Discussion and Conclusion

Extensive research has failed to reach a consensus on the influence of military spending on social spending and economic growth. Our arguments and findings provide insight as to why. Theoretically, we stress that political leaders vary in their preferences over how to pay for national defense and the interdependent relationships between government spending, the economy, and methods of government finance. When considered jointly, these points suggest there is little reason to expect the effects of increasing military spending to always manifest in the same manner and that identifying the consequences of increasing military spending requires one to consider leaders' preferences over methods of government finance and patterns of social spending, economic growth, taxes, debt, and the money supply over time.

Our empirical analyses yield three notable results. First, at least indirectly, military spending, social spending, the economy, tax revenue, debt, and the money supply are all related to one another. For our purpose, the most important implication of these relationships is that statistical models estimating the effect of military spending on social spending or the economy without considering the different methods with which governments can finance their expenditures are misspecified. More generally, these results suggest scholars interested in either the causes or consequences of government spending need to think carefully about how expenditures are financed.

Second, we find evidence that whether increasing military spending leads to a guns-butter trade-off is conditional on leaders' preferences and behavior. We find a complementary relationship between military and social spending when leaders have a strong preference for protecting or expanding the social welfare state (e.g., the Johnson scenario) and a trade-off when leaders are relatively more concerned with keeping taxes or debt low (e.g., Truman). These findings are consistent with previous research that finds the guns-butter trade-off is conditional on decision-makers' preferences over social welfare programs (Whitten and Williams 2011, Carter and Palmer 2015).

Third, we find that military spending has a non-linear effect on economic growth that varies over time. Increasing military spending leads to significantly lower GDP growth in the quarter or two immediately following the increase and then significantly higher economic growth starting after four or five quarters. Framed differently, our results indicate that changes in military spending have a positive effect, a negative effect, and no effect on economic growth at different points in time. This implies that whether and how analysts distinguish between the short-run and long-run effects of military spending on economic performance will influence what they find.

Our arguments and results suggest multiple avenues for future research. Perhaps most obviously, our general framework could be applied to countries other than the United States. All leaders have preferences over how to pay for national defense and we strongly suspect that

government spending, the economy, and methods of government finance are all related to each other in countries besides the United States. However, the United States' role of hegemon and position at the center of the global economy in the post-World War II era means that, compared to other countries, its military budget is far larger and its ability to finance military spending with foreign capital without crowding out private investment is far greater (Oatley 2015). This suggests that the specific relationships between military expenditures, social spending, the economy, tax revenue, debt, and the money supply described here might not travel outside of the United States. Unfortunately, space considerations mean that analyzing the interdependence in government expenditures, methods of government finance, and economic performance in other countries must be left to future research.

Our analyses also have implications for our understanding of how countries pay for interstate war. A greater ability and/or willingness to finance war may affect a state's ability to pursue war, extend its duration once hostilities have commenced, and obtain better outcomes on the battlefield or through negotiated settlements (Slantchev 2012, Shea 2014). Understanding how leaders decide to pay for war can tell us much about how they evaluate political and financial constraints. This is because leaders vary in their preferences over how to pay for national defense and, therefore, will vary in their willingness to sacrifice the resources dedicated to the provision of social benefits, lower taxes, lower levels of debt, or non-inflationary monetary policy to finance war. This implies, for example, that leaders whose coalitions consist primarily of the beneficiaries of social programs may be less willing to increase military spending and to engage in interstate conflicts, especially those that necessitate large mobilization efforts that tap into resources dedicated to social benefits. Thus, our argument and analyses have implications for how leaders will finance interstate wars, the extent to which they are willing to mobilize resources to fight, and, consequently, the initiation, prosecution, and outcome of interstate conflicts.

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