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Rusty guns and buttery soldiers: unemployment and the domestic origins of defense spending

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Abstract

Scholars and practitioners continue to debate transatlantic burden sharing, which has implications for broader questions of collective action and international organizations. Little research, however, has analyzed domestic and institutional drivers of burden-sharing behavior; even less has disaggregated defense spending to measure burden sharing more precisely. This paper enhances understanding of the relationship between national political economies and burden shifting, operationalizing burden shifting as the extent to which a country limits or decreases defense expenditures, while at the same time favoring personnel over equipment modernization and readiness in the composition of defense budgets. Why do countries choose to allocate defense resources to personnel, rather than equipment modernization? I find that governments slightly decrease top-line defense spending in response to unemployment while shifting much more substantial amounts within defense budgets from equipment expenditures into personnel. This research highlights the intimate connection between Europe's economic fortunes, transatlantic security, and burden sharing in North Atlantic Treaty Organization and the European Union – of particular interest as a pandemic buffets the transatlantic economy. It also points policy analysts toward factors more amenable to political decisions than the structural variables generally associated with burden sharing, bridging significant gaps between defense economics, security studies, and comparative political economy.

Keywords: political economy of security; international organizations; collective action; defense economics; NATO/EU

Introduction

Resource allocation is a strategic decision, and burden sharing in international organizations is central to the study of international collective action. North Atlantic Treaty Organization (NATO) and the European Union (EU) both seek to influence members not just to increase overall defense spending, but also to spend more on equipment modernization. What drives such increases? Most research on transatlantic burden sharing focuses on the international sources of differences in top-line defense spending. Yet in a 'fog of peace', in which allies cannot agree about a single threat, compelling them toward 'a particular strategic path (Goldman, 1994, 40–42)', domestic politics takes on more importance than international factors. This article advances and tests a theory about domestic sources of burden *shifting*: 'limiting contributions to the collective effort ... without wrecking the alliance (Thies, 2015, 5)'.

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†This research is the author's alone, and does not necessarily reflect any US government position.

What is the relationship between unemployment and defense spending? I find that governments reduce spending on agreed priorities as unemployment increases. Not only do they slightly decrease overall defense spending as a share of GDP, they decrease, over time, the share of equipment in both defense budgets and GDP, shifting resources into personnel. Doing so is the opposite of the balanced '3 C's' approach to burden sharing that allies have agreed.[1] Although the long-term employment effects of the COVID-19 pandemic are unclear, it is a severe shock. This development, combined with the finding that unemployment dampens burden-sharing efforts, suggests that unemployment may be a particular challenge for allies as they seek to meet their public commitments to one another.[2]

I focus on the composition of defense budgets to analyze burden sharing as defined by NATO and EU members themselves, bridging a gap between research and policy. States can burden shift by decreasing overall defense expenditures, but they do so more subtly by shifting defense resources away from equipment and into personnel, which need not – and often does not – occur through hiring additional personnel. Focusing on the composition of defense budgets as NATO and EU members track them, and in areas that they have identified as strategic, helps bridge a gap between research and policy. While this paper is not the first to disaggregate defense spending (Becker and Malesky, 2017; Bove and Cavatorta, 2012), no study to date has explicitly analyzed the effects of an exogenous variable on states' ability to meet their declared aims of spending 2% of GDP on defense and 20% of defense budgets on equipment (European Council, 2016; NATO, 2014).

I draw on defense economics research on burden sharing, international security literature on alliances, and political economy research on the domestic and regional implications of defense spending to develop and test a theory that unemployment dampens burden sharing, as defined by NATO and the EU.[3] I contribute to these literatures, as well as to the political economy of security subfield, which draws them together. In particular, I analyze the factors that shape 'guns vs. butter' trade-offs, which are more complicated than the current literature acknowledges, and vary among countries. My findings may also interest students of labor markets, political economies of multilateral and national institutions, and European politics. Specifically, the use of disaggregated defense spending data for a more detailed understanding of macroeconomic trade-offs perceived by leaders can help inform policy: employment policies on both sides of the Atlantic are likely to shape defense spending choices. Scholars can help inform policy-makers by disaggregating defense spending into the categories that interest policy-makers, and identifying factors that may affect the likelihood of policy initiatives coming to fruition. While unemployment is a thorny problem, it is more amenable to national policy than is, for example, threat proximity or behavior. National action, or even multilateral coordination, is more likely to affect unemployment than it is to move a national capital farther from Moscow, or to affect the capabilities or intent of transnational terrorist groups.

I test my predictions using World Bank (2019) unemployment data for 34 members of NATO and the EU from 1991 to 2019, and a purpose-built data set containing disaggregated defense spending tracked by NATO (NATO, 2018) and the EU (European Council, 2016), covering the same countries and years. These variables allow me to test the relationship between

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[1]NATO Secretary-General Stoltenberg refers to the '3 C's' of burden sharing: Cash (defense share of GDP), Capabilities (equipment share), and Contributions (operating and maintenance share). NATO allies pledged at their 2014 Wales Summit to move toward spending 2% of GDP on defense and 20% of defense budgets on equipment modernization, an aim that EU members have also agreed.

[2]While no shock of the order of the COVID-19 pandemic has occurred in previous years covered by this study, we might take the labor market shocks in Latvia and Lithuania during the transatlantic financial crisis as somewhat indicative. Even these two states, concerned about threats from neighboring Russia, shifted defense budgets rather dramatically toward personnel when faced with rapid increases in unemployment. When unemployment increased by 9.8% points in Latvia in 2009, equipment shares of the defense budget dropped by 9.5% points, while personnel rose by 13 points. The next year in Lithuania, when unemployment rose by 4 points, equipment spending declined by 6.2 points, while personnel spending rose by 4.7.

[3]Acknowledging continued debate about the definition of burden sharing, I use NATO and the EU's current definitions of burden sharing, which are consistent with Cimbala and Forster's (2005, 1) definition of the concept as 'the distribution of costs and risks among members of a group in the process of accomplishing a goal'.

unemployment and burden shifting, controlling for a set of theoretically important covariates in a variety of empirical forms and specifications. Data availability for those covariates means that the main models in the paper include fewer countries (30) and years (2004–18).

Unemployment leads states in Europe and North America to shift defense burdens to their allies – the opposite of what they have pledged. To avoid jeopardizing the security benefits of alliances, governments respond to unemployment with small top-line defense cuts, and larger shifts *within* defense budgets from capabilities and contributions, into personnel. Economic distress thus affects defense spending as governments seek to burden shift by using military spending as 'welfare policy in disguise (Whitten and Williams, 2011, 117)', making the most prominent shifts in the composition of defense budgets, rather than overall national budgets.

My analysis is robust to multiple specifications and identification strategies, the use of several subsamples capturing varying institutional memberships, and different data sources. This robustness suggests that the relationship between unemployment and defense burden shifting is not the result of common statistical pitfalls.

In short, my findings suggest that transatlantic burden sharing is closely linked with national labor markets. Unemployment is a leading indicator of declines in defense investments in capabilities and operational readiness. Rather than a simple guns vs. butter trade-off, members of the transatlantic community are challenged to ensure economies generate enough butter (employment opportunities) to enable their defense planners to focus on capabilities and readiness.

Unemployment, domestic political economies, and defense spending

In spite of rich burden-sharing research on international, domestic, and institutional drivers of defense spending, there is no consensus on relationships between defense spending and economic performance, even among meta-analyses (Alptekin and Levine, 2012; Dunne and Smith, 2020).

Do governments *behave* as if defense spending reduces unemployment? My findings suggest that they do. While states with significant domestic defense industries can generate employment through the procurement of new equipment, those without can channel stimulus into their domestic economies much more directly through personnel – not just by hiring more, which is rare in practice, but by preserving personnel from cuts, or by maintaining or increasing compensation. Even with the use of offsets,[4] equipment procurement cannot offer this kind of stimulus to the majority of European economies, which have no significant domestic defense industry.

Burden-shifting research notes how difficult it is to actually identify qualitatively: members of the transatlantic community 'cannot openly shirk … jeopardizing the alliance that all value highly (Thies, 2015, 8)'. Scholars and practitioners have only recently focused on disaggregated expenditures to resolve this difficulty; analyses remain incomplete (Becker, 2017).[5]

This incomplete picture leaves open questions regarding burden sharing in international organizations. The 2014 Wales Pledge on Defense Investment,[6] NATO's most significant public effort to address the burden-sharing issue, emphasizes equally topline defense spending (2% of GDP) and equipment modernization (20% of defense spending). The European Council (2016) formally embraced those aims soon after.[7] Empirical analysis (Becker, 2017) validates NATO Secretary-General Jens Stoltenberg's (2018) alliterative linkage between today's 'cash',

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[4]Agreements intended to 'offset' costs and gain economic benefits for purchasing states when they buy defense equipment from foreign suppliers.

[5]Scholars have also pointed to the domestic sources of foreign policy (Arena *et al.*, 2009; Fordham, 1998; Potrafke, 2011) and defense spending (Bove *et al.*, 2017), and contrasted those with external strategic drivers (Arvanitidis *et al.*, 2017; Christie, 2019; Kim and Sandler, 2019).

[6]Supplementary File B.

[7]Spending guidelines predate the Wales Pledge, though never agreed by Heads of State and Government. In NATO's 2006 Comprehensive Political Guidance, Allies 'committed to endeavour, to meet the 2% target of GDP devoted to defence spending (Appathurai, 2006)'.

tomorrow's 'capabilities', and operational 'contributions'. Identifying and modeling domestic drivers of disaggregated defense spending can help us learn if such pledges work.

Testing relationships between national-level independent variables and dependent variables that capture actual burden-sharing behavior – rather than just top-line defense spending – thus helps bridge gaps between international political economy, international relations, defense economics, and foreign policy. The insight that unemployment drives states to burden shift highlights the connection between transatlantic economies and foreign, security, and defense policy. It also affirms theoretical work identifying disaggregated defense spending as a countercyclical policy tool.[8]

Theory: international and domestic collective action

While research on causes and effects of overall defense spending is well developed, no published study has directly tested relationships between domestic unemployment and burden sharing as NATO and the EU have defined it. I build on three strands of literature to develop my theory on the relationship between unemployment and budget composition: first, defense economics research on alliance burden sharing; second, international security research on alliances; third, international political economy research on domestic origins of defense spending.

Alliance burden sharing as a collective action

Collective action theorizing weighs heavily in the economics literature on burden sharing. Olson and Zeckhauser (1966) first developed an exploitation hypothesis, whereby smaller allies free ride on larger allies' expenditures. Operationalizing spillover effects as the total spending of all other allies, Sandler and Forbes (1980) found that prior to 1967 allied defense spending was a public good – its consumption was both non-excludable and non-rivalrous. After 1967, though, it became a joint product, meaning that the degree of publicness varied (Cornes and Sandler, 1984). Threats from states and non-state actors are now part of defense spending models.

The defense economics literature thus suggests that alliance burden shifting is endemic. Larger allies may use international organizations to induce transparency or to coerce smaller allies into spending more than they otherwise would.

I argue that opportunities for coercion, but particularly transparency (through institutionalized sharing of defense spending and capabilities) in international organizations like NATO and the EU means that unemployment-related burden shifting is subtle. As unemployment increases, states shift small amounts out of defense budgets, obscuring larger shifts within budgets – out of agreed priorities and into personnel. NATO and the EU emphasize overall defense spending and the share of that spending allocated to equipment and operations as primary burden-sharing metrics, consistent with the definition of burden sharing as the 'distribution of costs among group members in support of common goals (Cimbala and Forster, 2005, 1)'.

International security: threats, institutions, and culture

The international security literature also emphasizes the role of state (Walt, 1987) and non-state (Haesebrouck, 2018) threats in alliance politics. Institutionalist work emphasizes adaptability in international organizations (Wallander, 2000). Constructivist scholars (Oma, 2012) point to the role of strategic culture in alliances and coalitions.

While I acknowledge that threats, institutions, and strategic culture all shape burden-sharing choices, I contend that states shift burdens to the extent that institutional architecture allows. While NATO as an alliance encourages burden shifting, NATO as an organization, with its
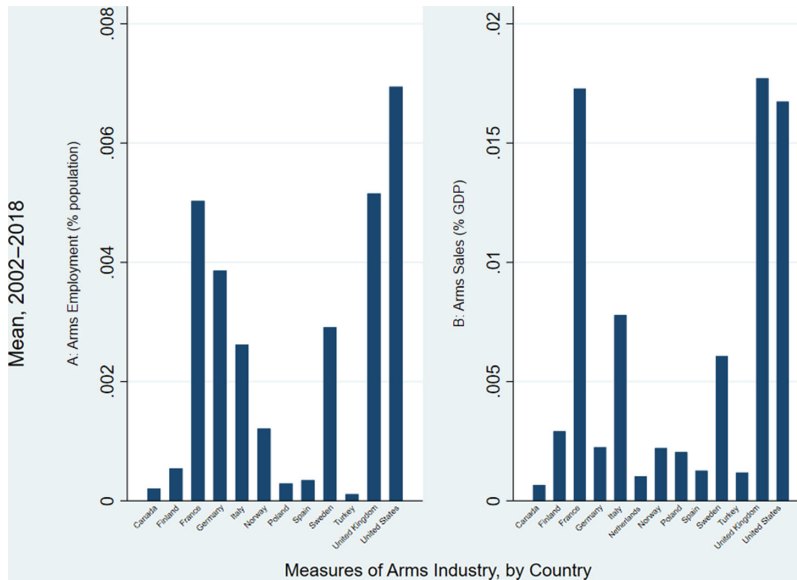
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[8]Supplementary File A.

Figure 1. Unequal distribution of arms sales and employment (SIPRI, 2019).

transparent accounting of allied expenditures and capabilities development, alongside opportunities for public accountability, mitigates such tendencies.

Domestic political economies and defense spending

For these reasons, a third strand of literature, highlighting the domestic origins of defense spending, leads me to my key independent variable: unemployment.

Nincic and Cusack (1979) proposed that, because defense spending can be justified on national security grounds where other types of stabilizers cannot, US governments are tempted to use defense spending for nondefense ends. I argue that in the context of transatlantic security, this sort of justification is even more important, and that it affects primarily personnel spending. Because few European states possess any defense industry at all, as Figure 1 illustrates, personnel is the only way most states can use defense spending as a stabilizer. Although personnel expenditures are difficult to adjust quickly, states do manage to do so – more quickly, in fact, than equipment expenditures, which are often tied to long-term projects.

I propose three reasons why states respond to unemployment by shifting resources out of defense, while disguising further burden shifting within their defense budgets. First, states are increasingly constrained in their use of stabilizers in domestic labor markets: the Stability and Growth Pact (SGP) constrains EU members, and the Budget Control Act constrains the US. As options narrow, shifting resources within budgets becomes more attractive. Shifting from equipment into personnel allows states to minimize appearances of burden shifting, while ensuring their national 'guns vs. butter' trade-offs enable them to derive private benefits from defense spending.

Second, policy-makers everywhere may reasonably believe that personnel expenditures can have direct effects on employment – this is not the case for equipment expenditures, the effects of which are indirect. European states with significant defense industries[9] spent 50% more on

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[9]France, Germany, Italy, Sweden, and the UK (Supplementary File A). Even these states do not compare to the US in terms of the potential for purchasing effects in national economies.
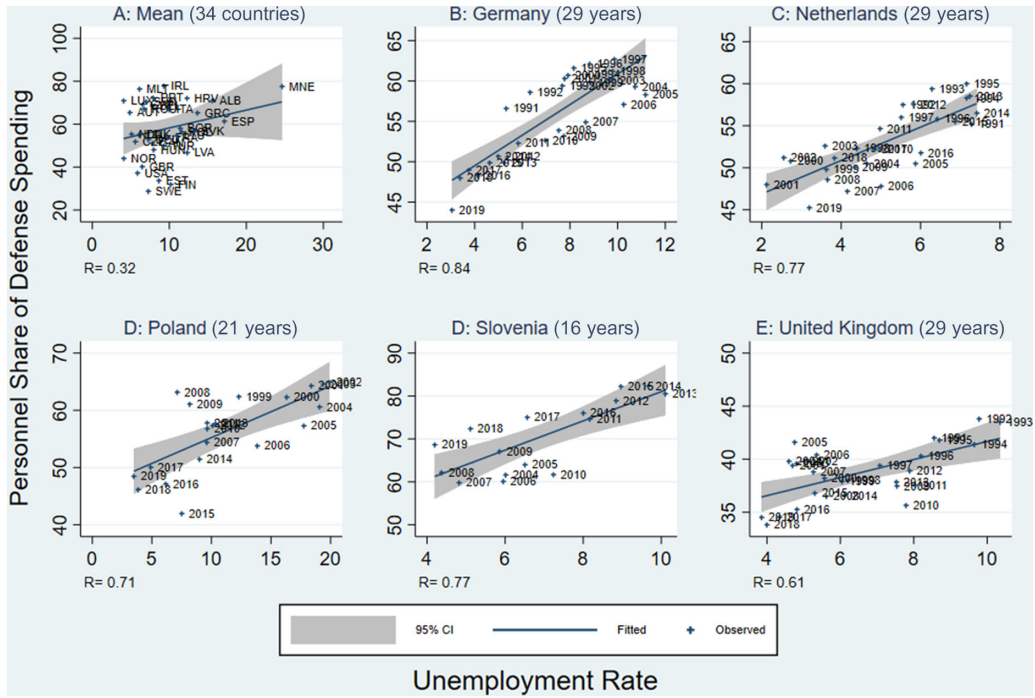
Figure 2. Unemployment and personnel spending (full sample mean, Germany, the Netherlands, Poland, Slovenia, UK).

equipment between 2006 and 2013 than did states without, and states with above-average domestic R&D expenditures spent 25% more on equipment than those that were below average.

Third, governments can derive other particularistic benefits from personnel spending that they cannot from equipment and other spending. Such benefits enable states to justify burden shifting on security grounds. For example, states may increase salaries or delay reductions in personnel to support domestic counterterrorism or border control. States can also use personnel in gendarmeries focused solely on internal defense, which they can defend on security grounds with both constituents and allies. All of these behaviors amount to burden shifting.

Figure 2 illustrates the bivariate correlation between unemployment and the proportion of defense budgets allocated to personnel in the full sample and in five countries with varying structural situations: in each, the correlation is substantial and consistent over time.[10] Figure 3 illustrates the same correlation for different years, starting with the full sample. Together, Figures 2 and 3 demonstrate consistent correlations between unemployment and personnel spending including outside of the 30 countries and the 14 years (2004–18) for which data on the full set of covariates are available.

The use of personnel spending as an economic stabilizer is not tantamount to adding personnel, nor does it depend on any assumptions regarding Hicks neutrality – the notion that technological developments increase the marginal productivity of labor and capital in the same proportion. The dependent variables are not measures of defense 'outputs', notoriously difficult to measure (Becker, 2017), but of decisions to allocate resources. I am not estimating a production function, but state policy decisions. Many states have increased the share of personnel in their defense budgets while the size of their forces has declined. States may limit cuts to personnel and stabilize compensation, hoping to stimulate demand more directly than other defense

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[10]Supplementary File C (Figures C1 and C2) contains analogous scatter plots for each state in the study.

Personnel Share of Defense Spending

A: Full Sample (701 observations)
R= 0.32

B: 2001 (18 countries)
R= 0.25

C: 2011 (33 countries)
R= 0.28

D: 2019 (27 countries)
R= 0.52
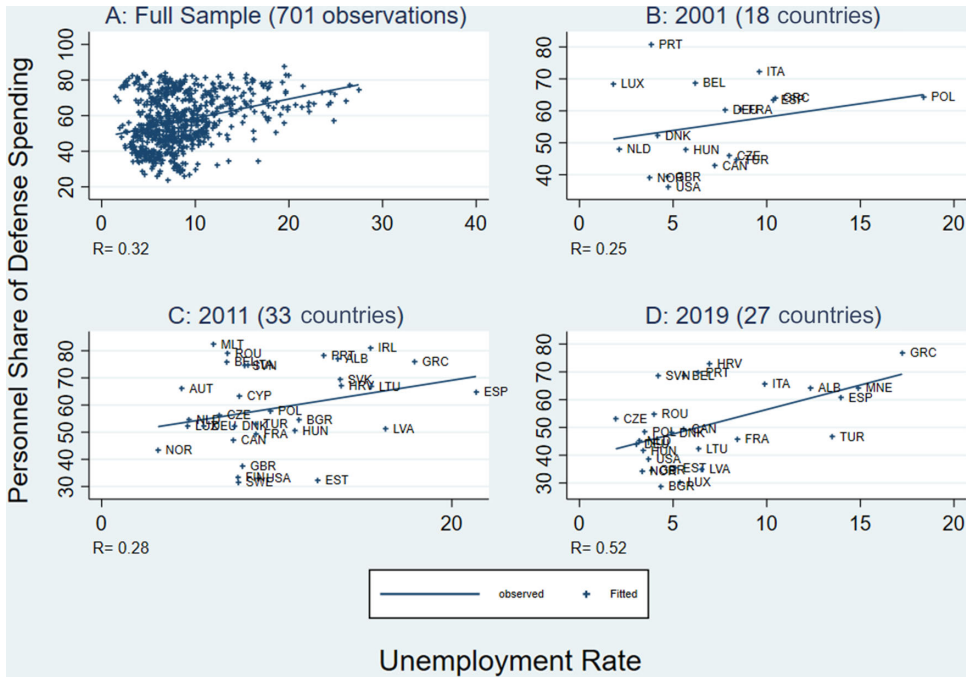
observed   + Fitted

Unemployment Rate

Figure 3. Unemployment and personnel spending (full sample, 2001, 2011, 2019).

spending. Doing so is inconsistent with increasingly capital-intensive military requirements and multilateral agreements. This phenomenon is not due to widespread policies aimed at increasing the level of technical skill in the military workforce in conjunction with improvements in military technology (Cancian and Klein, 2015; Wallace *et al.*, 2015). For example, two of the most technologically advanced countries in the study – the US and the UK – devoted 37% of defense spending to personnel in 2015. That same year, two of NATO's least high-tech militaries – Albania and Bulgaria – devoted 65% and 68%, respectively.

To test my theory that unemployment leads states to shift defense burdens, I hypothesize that states shift resources out of 'guns' and into 'butter' to the extent they can, but will particularly shift defense resources into personnel spending, which generates more 'butter' in terms of salaries and multipliers, in the absence of defense industrial spillovers:

HYPOTHESIS 1 : The higher the unemployment rate a state experiences in year $t-1$, the more of its defense budget it allocates to personnel in year t, at the expense of equipment spending in particular.

Data and measurement

I operationalize burden shifting as moving defense resources out of modernization and readiness and into personnel – shifting defense burdens without overtly free riding. This approach is consistent with academic definitions of burden sharing as 'the distribution of costs and risks among members of a group in the process of accomplishing a goal (Cimbala and Forster, 2005, 1)'.

As importantly, it is consistent with NATO's understanding of burden sharing as 'about spending, about contributions, about capabilities, so we speak about the three Cs, cash, contributions and capabilities (Stoltenberg, 2018)'.

Defense economists separate a 'payroll (personnel) effect' from a 'purchasing (equipment) effect (Sasaki, 1963, 302)'. Only recently has there been sufficient disaggregated time-series data available for panel analysis. Expanding the analysis to include the six EU members that are not part of NATO allows for a more robust analysis than recent work on NATO.[11]

Disaggregating thus enables a clearer understanding of actual burden-sharing behavior by helping scholars differentiate collective from particularistic spending. Conflating the two poses a major theoretical problem by commingling personnel spending with the equipment spending allies have pledged to one another to increase.[12]

While scholars have argued that burden-sharing measures should include refugee assistance and foreign aid, using NATO and the EU's own burden-sharing metrics ensures consistency across countries and over time, enabling systematic analysis across as many as 35 members of the transatlantic community. It also helps address the role of confounders like spillover effects and strategic choices, national wealth and population, threat, national political economies, and strategic culture.

Disaggregated defense spending represents 'a consistent basis of comparison of the defense effort of Alliance members based on a common definition of defense expenditure (NATO, 2018)'.[13] This data is the point of reference for actual transatlantic burden-sharing discussions, the source for the most widely used defense spending data set (SIPRI, 2018), and for the most cited defense economics research (Dunne *et al.*, 2005). The European Defence Agency (2018) replicated NATO's data collection methodology and presentation from 2006 to 2017. Supplementary File E discusses robustness checks using different measures for variables, as well as varying samples to ensure the results are not artifacts of varying alliance commitments, organizational memberships, data particularities, or other factors specific to groups of countries.

Because NATO and EU members face similar structural constraints, we might expect them to allocate resources similarly within defense budgets, even if their overall allocations to defense are subject to free riding, burden shifting, or even balancing. In reality, the composition of defense budgets varies widely. For example, less than 2% of Bulgarian and Slovenian defense spending in 2015 went to equipment, while Poland and Luxembourg each allocated over 30%. Cross-country variation in the share allocated to each of the other three categories is significant, ranging from 6.2% to 39.5% for O&M, 36.4% to 80.7% for personnel, and from under 0.1% to 10.1% for infrastructure. Figure 4 visualizes the composition of defense budgets for all states studied, with horizontal lines at 2% for the overall GDP target, and 0.4%, the share of overall GDP a state would dedicate to equipment were it meeting both the 2% guideline and allocating the prescribed 20% of defense spending to equipment. Note that more countries achieved the latter than the former in 2017.

More important is the variation within countries over time. Figure 5 illustrates this variation using two pairs of small countries with similar economic, cultural, and geostrategic situations. The wide variation in disaggregated defense spending both between and within countries over time suggests that domestic political economies affect burden-sharing behavior more than structural factors. Note that France has consistently invested more than 0.5% of GDP in equipment, and decreasing personnel expenditures brought it below the 2% guideline.

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[11]Supplementary File D.

[12]Becker (2017) discusses quantitative and qualitative measures of burden sharing in detail, and the ability of disaggregated quantitative data to capture the critical components of qualitative data.

[13]NATO (2018) further elaborates to address common questions regarding its data: 'In view of differences between both these sources and national GDP forecasts, and also the definition of NATO defence expenditure and national definitions, the figures shown in this report may diverge considerably from those which are quoted by media, published by national authorities or given in national budgets. Equipment expenditure includes expenditure on major equipment as well as on research and development devoted to major equipment. Personnel expenditure includes pensions paid to retirees'.
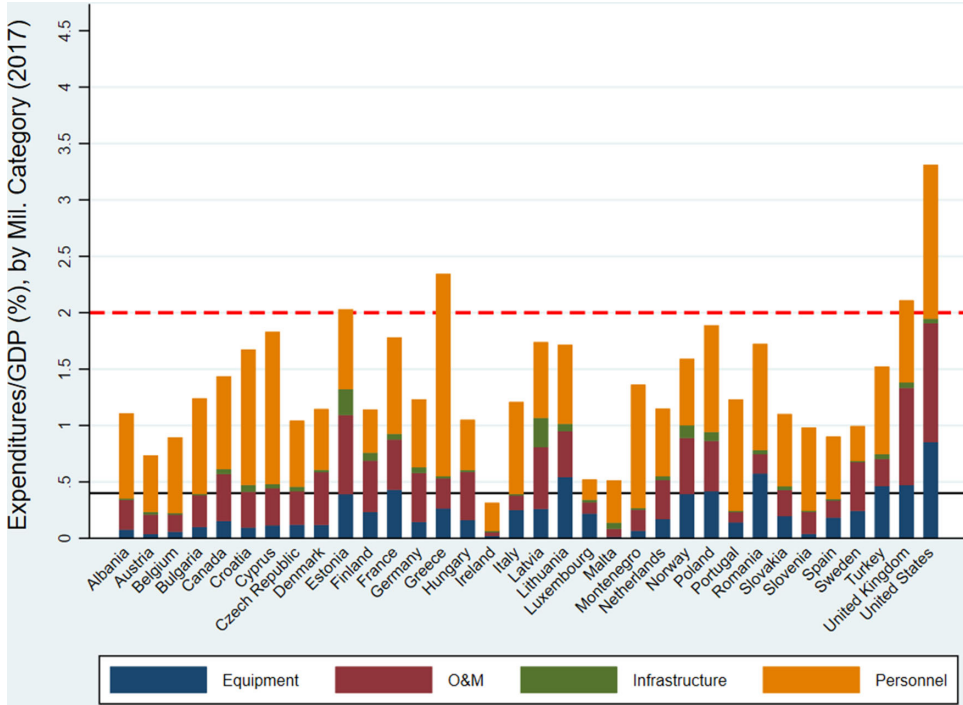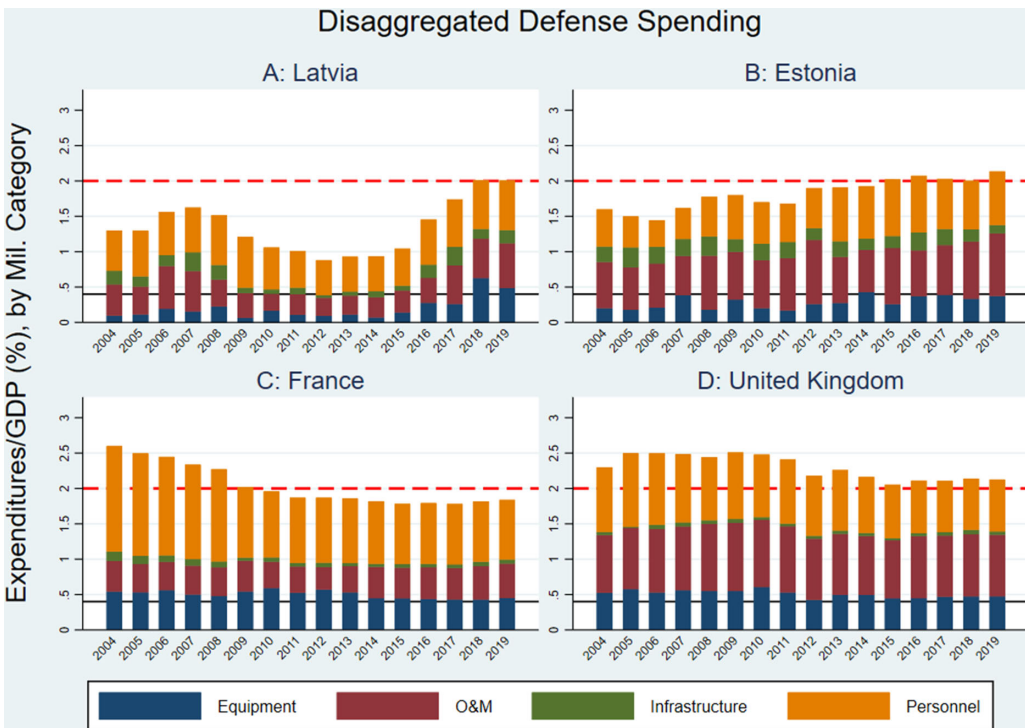
Figure 4. Disaggregated defense spending.

Figure 5. Disaggregated defense spending (Latvia, Estonia, France, UK).

Because most current scholarship does not disaggregate spending, it cannot explain this variation. Testing my theory that states burden shift in response to unemployment helps address this shortcoming.

Disaggregating quantitative data also helps engage directly with defense economists, who initially viewed burden sharing through a pure public good[14] lens, but eventually moved to a joint product[15] approach, and with constructivists who advocate more interpretive approaches of foreign policy, focusing on culture and identity.

Results: unemployment and burden shifting

I begin with a theoretical model of transatlantic burden sharing[16]:

$$M_{it} = f(U_{it-1}, GDP_{it-1}, T_{it-1}, TE_{it-1}, I_{t-1}, V_{it-1}, PS_{it-1}, A_{it-1}, YR_{it-1}), \tag{1}$$

where M_{it} is the share of military spending in GDP in country i during year t, expressed as a percentage (NATO, 2018). In order to test my theory, I replace M_{it} with the shares of personnel and equipment in overall defense spending. I expect unemployment to correlate with increased personnel, and decreased equipment expenditures.

U_{it-1}, the key independent variable, is the unemployment rate in country i during the previous year, $t-1$ (World Bank, 2019). I expect states experiencing increased unemployment to burden shift by reducing overall defense spending, while shifting defense resources out of equipment modernization and into personnel. I consider the World Bank's World Database of Indicators (WDI) unemployment data to be the best available source, as it incorporates the International Labor Organization's ILOSTAT data, and is the most comprehensive that is available in terms of country and year coverage. The OECD gathers separate unemployment data for its members, covering fewer country years. The correlation coefficient for the 627 observations for which there is both OECD and WB/ILO data available is 0.9937, leaving me very confident in the utility of the data in my analysis.

GDP_{it-1} is country i's rank within the sample in GDP in year $t-1$. I use rank for this variable because GDP itself is the denominator in some variations of the dependent variable, and doing so is a convention in the defense economics literature (Kim and Sandler, 2019). Canonical public choice theorizing (Olson and Zeckhauser, 1966) indicates that GDP rank correlates positively with defense spending as a share of GDP. GDP rank also addresses the size, which can be a proxy for labor supply.

T_{it-1} is the state-centric military threat level in country i in year $t-1$.[17] It is the product of Russian military expenditures and the inverse distance from country i's capital to Moscow.

TE_{it-1} is country i's score on the World Governance Indicators Political Stability and Absence of Violence/Terrorism measure (Kaufmann *et al.*, 2011). I include this variable because political stability and vulnerability to various forms of internal and transnational political violence may also shape resource allocation.

I_{t-1} is the party of the government in power (Scartascini *et al.*, 2018).[18] Party ideology may affect how states respond to unemployment, as well as how states allocate resources and pursue foreign policy.

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[14]A good whose consumption is non-excludable (the cost of keeping nonpayers from using it is prohibitive) and non-rivalrous (nonpayers can consume it without increasing its cost or diminishing other users' utility).

[15]A situation featuring 'rivalry in consumption, multiple outputs, benefit exclusion, *and* private benefits (Sandler and Forbes, 1980)'.

[16]Supplementary File D.

[17]Russian capability (measured by defense spending)* intent (coded as 1.5 from 1953 to 1989, 1 from 1990 to 2008, 1.25 from the invasion of Georgia in 2008 through 2014, and 1.5 following the annexation of Crimea in 2014).

[18]Coded as 1 for right and 0 for left. Supplementary Table E11 replicates the empirical analysis using the welfare and international policy dimensions identified by Whitten and Williams (2011), reducing the sample size due to data availability but

V_{it-1} is the Database of Political Institutions' 'checks' score for country i in year $t-1$ (Scartascini *et al.*, 2018), a comprehensive measure of all actors with the ability to thwart policy change including independent executives, multiple legislative bodies, and number of parties in the ruling coalition. This variable addresses the effect of domestic political institutions, and executive autonomy on the transmission of macroeconomic variables to budgeting.

PS_{it-1} is the percentage of military personnel in the overall labor force of country i in year $t-1$, expressed as a percentage (World Bank, 2019). This variable captures the weight of military employment in national economies, as well as relative factor endowments and transitions from a conscript force to an all-volunteer force, which may also affect how states allocate defense resources and how macroeconomic variables' effects transmit to defense choices.

A_{it-1} is the extent to which country i's national security strategy was Atlanticist in year $t-1$. Becker and Malesky (2017, 165) found that Atlanticism, or a preference 'for a transatlantic approach to European security, in which the US' role is central', in strategic culture[19] is a driver of operating expenditures, and noted that personnel expenditures appear to crowd out other types of expenditures.

YR_{it-1} is the number of years country i has been a member of NATO. This variable helps capture alliance institutionalization, and time-specific factors not otherwise addressed, such as spill-over effects from other allies' spending, and changes in overall alliance strategy that affect the publicness of allies' spending.

To maximize variation on these variables, I constructed a panel data set of total defense spending as a percentage of GDP, as well as personnel, equipment, O&M, and infrastructure shares of defense budgets across all 35 states that are members of NATO or the EU.[20] Measuring this way is useful because it is comparable across countries and over time, and converts easily into real expenditures or shares of GDP for robustness checks.[21]

Because unemployment's effects on disaggregated defense spending are likely dynamic and accrue over time, I initially test my theory with an Error Correction Model (ECM), estimating short- and long-term effects in a single model (De Boef and Keele, 2008). Such models are widely used by defense economists estimating demand for and effects of aggregate defense spending (Cavatorta and Smith, 2017). ECMs regress a first-differenced dependent variable on its lagged level, and those of covariates. Their use rests on the theoretical assumption that the relationship between unemployment and personnel expenditures resembles a moving equilibrium, with personnel spending responding to 1-year changes in unemployment, but with the full effects only becoming apparent over time. This assumption is appropriate for unemployment, which is strongly

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does not substantively affect the results. The use of veto points further addresses the multidimensionality of domestic political choices.

[19]Measured with Unsupervised Automated Content Analysis of allies' national security strategies capturing national approaches (Berenskoetter, 2005).

[20]Supplementary Table E3 summarizes data availability by country year, for each model. The fully specified models comprise 2004–18 for 30 of the 35 states.

[21]Supplementary File E contains these robustness checks, many of which address the time-series properties of the data. I use PCSE to address heteroscedasticity and contemporaneous correlation in errors (Beck and Katz, 1995). I test for cointegration using the Westerlund (2007) test. The p-value for the test of panel cointregration is 0.864, indicating the null cannot be rejected. I test for stationarity within the panels using Stata's *xtunitroot* procedure, calculating an inverse chi-squared score of 107.66, with a p-value of 0.0001, which rejects the presence of unit roots and enables assumption of data stationarity within panels. I test for autocorrelation in personnel expenditures using the panel actest. The p-value of 0 indicates that serial dependency in defense spending is a problem. This is unsurprising: defense spending is subject to bureaucratic inertia, and personnel spending may be particularly sticky. Replicating the PCSE analysis with a Newey–West estimator to address serial dependency yields substantively similar results to the PCSE estimate (coefficient of −0. 051, significant at the 1% level in the bivariate model for overall defense spending, and of −0.021, significant at the 10% level, for the fully specified model). An Arellano–Bond estimation confirms that past year defense spending strongly predicts current year spending, but that unemployment still exerts a strong influence. These results remain in the Supplementary Files because lagged defense spending risks 'dominating (Achen, 2000, 4)' the other, substantive variables.
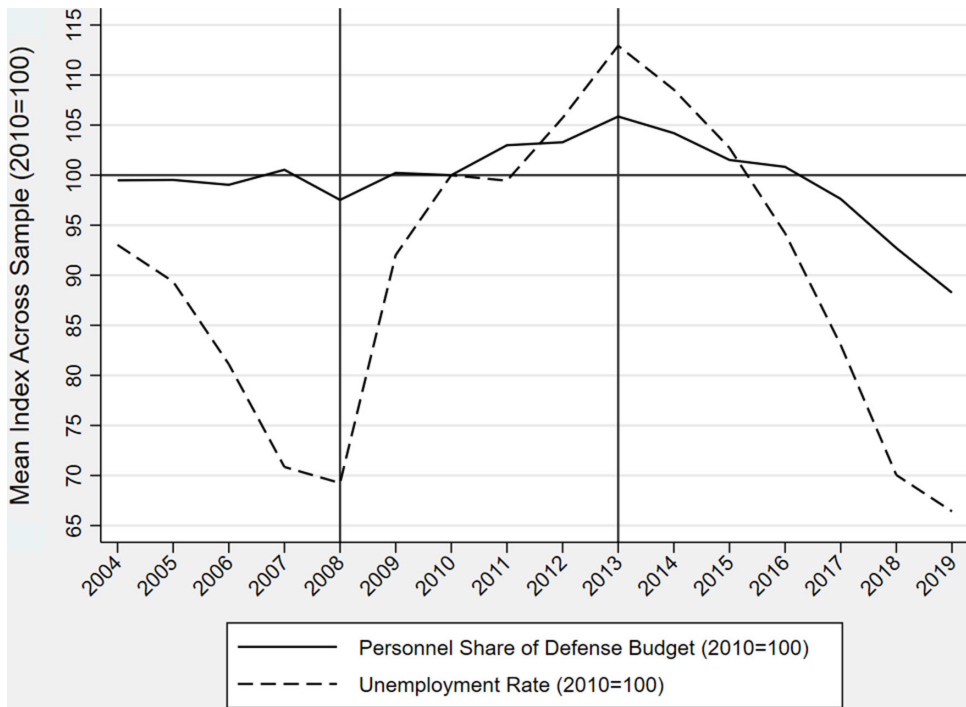
Figure 6. Mean unemployment and personnel expenditures over time.

predicted by previous levels, but is not static. Figure 6 visualizes this: both unemployment and personnel spending evolve gradually over time, with major shifts in unemployment (e.g. in 2008 and 2013) preceding shifts in personnel spending, which is more stable.

An ECM is appropriate for stationary, non-cointegrated time-series data, and does not yield spurious inferences with highly autoregressive data (De Boef and Keele, 2008). Personnel spending and unemployment are stationary[22] and not cointegrated.[23]

I, therefore, estimate the following ECM:

$$\Delta y_{i,t} = \alpha + \beta_0 y_{i,t-1} + \beta_1 x_{i,t-1} + \beta_2 \Delta x_{i,t} + u_{i,t}, \qquad (2)$$

where βk is yearly changes and β_0 and β_1 are lagged values. α_i is a set of country fixed effects (FE) in each model. I estimate long-term effects by dividing the coefficient on the lagged independent variable by the inverse of the coefficient on the lagged dependent variable:

$$\frac{\beta_1 x}{-\beta_0 Y} \qquad (3)$$

The results are presented in Table 1.

I begin with a bivariate analysis between personnel spending and unemployment, visualized in Figures 2 and 3, but using only those country years available for all covariates. I then test the strength of that relationship by adding covariates to address the theoretical confounders discussed above. Model 2 includes GDP rank in accordance with public choice theorizing. Model 3 adds a synthetic variable combining Russian defense spending in year *t and* country *i's* capital's distance

[22]An inverse chi-squared score of 597, $P=0.000$ using Stata's xtunitroot procedure rejects the presence of unit roots, allowing for the assumption of stationary data within panels.

[23]The p-value in Stata's xtwest procedure (Westerlund, 2007) is 0.677, meaning that the data is not cointegrated.

Table 1. Correlates of disaggregated defense spending (ECM)

| Independent variables | (1) Bivariate | Dependent variable: ΔPersonnel (% MILEX) | | | | ΔEquipment (%MILEX) (6) Full Spec | ΔO&M % MILEX (7) Full Spec | ΔMILEX (%GDP) (8) Full Spec |
		(2) Public choice	(3) Threat	(4) Domestic PE	(5) Transatlantic PE			
L.Dependent variable	−0.361***	−0.360***	−0.363***	−0.378***	−0.395***	−0.521***	−0.599***	−0.284***
	(0.088)	(0.086)	(0.093)	(0.099)	(0.091)	(0.086)	(0.087)	(0.045)
ΔUnemployment	0.621***	0.468***	0.508***	0.474***	0.474***	−0.098	−0.260	−0.004
	(0.184)	(0.167)	(0.172)	(0.179)	(0.178)	(0.155)	(0.164)	(0.008)
L.Unemployment	0.293***	0.305***	0.229*	0.236**	0.259**	−0.267***	−0.006	−0.007**
	(0.085)	(0.116)	(0.119)	(0.107)	(0.121)	(0.099)	(0.071)	(0.003)
ΔGDP (rank)		−0.387*	−0.467*	−0.471*	−0.447*	0.460	−0.074	0.002
		(0.231)	(0.245)	(0.243)	(0.240)	(0.331)	(0.206)	(0.010)
L.GDP (rank)		0.089	−0.137	−0.134	−0.124	0.037	0.099	−0.001
		(0.199)	(0.200)	(0.201)	(0.201)	(0.183)	(0.150)	(0.005)
ΔState Threat (Russia MILEX × Inverse Capital Distance)			0.093	0.081	0.087	−0.076	−0.015	−0.004**
			(0.065)	(0.066)	(0.065)	(0.058)	(0.037)	(0.002)
L.State Threat (Russia MILEX × Inverse Capital Distance)			−0.018	−0.025	−0.007	−0.021	0.037	0.001
			(0.015)	(0.017)	(0.026)	(0.019)	(0.025)	(000)
ΔPolitical Violence/Absence of Terrorism			1.702	2.055	2.077	0.145	−2.283	−0.062
			(2.428)	(2.449)	(2.509)	(2.176)	(1.626)	(0.050)
L.Political Violence/Absence of Terrorism			0.960	1.616	1.834	−1.521	−0.854	−0.030
			(1.465)	(1.474)	(1.399)	(1.356)	(1.579)	(0.048)
ΔRight-Leaning Executive				−0.397	−0.270	0.719	−0.604	0.002
				(0.815)	(0.816)	(0.804)	(0.634)	(0.022)
L.Right-Leaning Executive				0.126	−0.028	0.429	−0.315	0.008
				(0.547)	(0.574)	(0.637)	(0.590)	(0.029)
ΔChecks/Veto Points				−0.020	0.061	−0.010	0.095	−0.009
				(0.323)	(0.305)	(0.299)	(0.267)	(0.010)
L.Checks/Veto Points				−0.492	−0.444	0.424	0.300	−0.010
				(0.457)	(0.435)	(0.388)	(0.370)	(0.012)
ΔArmed forces personnel (% of total labor force)				−3.339*	−3.881**	1.101	2.354	0.092
				(1.839)	(1.883)	(1.675)	(1.906)	(0.065)
L.Armed forces personnel (% of total labor force)				−2.532	−3.367	6.150**	−2.805	0.128*
				(2.186)	(2.340)	(2.879)	(1.729)	(0.071)

(*Continued*)

Table 1. (*Continued*)

Independent variables	(1) Bivariate	Dependent variable: ΔPersonnel (% MILEX)				ΔEquipment (%MILEX) (6) Full Spec	ΔO&M % MILEX (7) Full Spec	ΔMILEX (%GDP) (8) Full Spec
		(2) Public choice	(3) Threat	(4) Domestic PE	(5) Transatlantic PE			
ΔAtlanticism score (content analysis)					−0.033	0.030	0.019	0.002
					(0.037)	(0.020)	(0.031)	(0.001)
L.Atlanticism score (content analysis)					−0.067*	0.044	0.035*	−0.000
					(0.036)	(0.031)	(0.019)	(0.001)
ΔYears in NATO					18.941**	−26.846***	8.285	1.289***
					(9.252)	(10.216)	(9.258)	(0.348)
L.Years in NATO					−0.160	0.345**	−0.226*	−0.008
					(0.157)	(0.143)	(0.123)	(0.005)
Constant	11.967***	−1.751	32.941	37.194	28.510	7.627	12.456	0.490
	(3.066)	(32.192)	(31.744)	(31.984)	(26.898)	(25.363)	(18.805)	(0.654)
Long-Run multiplier (unemployment)	0.81	0.85	0.63	0.62	0.66	−0.51	0.01	−0.02
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	359	359	359	359	359	359	359	359
Number of countries	30	30	30	30	30	30	30	30
Years	2005–17	2005–17	2005–17	2005–17	2005–17	2005–17	2005–17	2005–17
Overall R^2	0.241	0.249	0.266	0.280	0.289	0.320	0.375	0.328
RMSE	4.522	4.510	4.488	4.488	4.480	4.120	3.165	0.127

Robust standard errors in parentheses.
*$P < 0.1$, **$P < 0.05$, ***$P < 0.01$.

from Moscow to address state-centric threat, and the World Bank's Political Violence/Absence of Terrorism indicator to capture non-state threats. Model 4 adds domestic political economy variables: political ideology of the executive and institutional constraints. Model 5 adds transatlantic political economy variables: country i's Atlanticism score in year t, and the number of years it has been in NATO. This latter variable also addresses time-trending and year-specific shocks, as well as institutional membership and neutrality, with non-NATO members of the EU taking on the value of zero. Models 6–8 replicate model 5, using equipment, O&M, and overall defense spending as dependent variables, respectively.

The key finding is that the relationship between both long-term and short-term unemployment and personnel spending is significant and positive. Both long-term and short-term relationships are robust to the addition of confounders – the coefficient remains stable and significant across all models. The substantive implications are also sizeable. The coefficient of 0.474 (significant at the 1% level) on the first difference in the fully specified model indicates that a 1 standard deviation annual change in unemployment (4.38% points) would yield a 2.08% point change in annual personnel spending. Considering that the mean annual personnel share of defense budgets is 57%, and the maximum annual change is 26.25%, this change is substantively meaningful. The long-run multiplier of 0.66 in model 5 is even more substantively meaningful.[24] Figure 7 plots the cumulative effects of a one standard deviation change in unemployment. The solid line shows that the effect of such a change in year 1 would accumulate in personnel spending, and by 16 years after a spike in unemployment in a particular country, that country would spend over 4 percentage points more of its defense budget on personnel. Similarly, the second panel in Figure 7 visualizes how unemployment affects equipment spending over time. Equipment weighs systematically less in defense budgets than personnel (15.8% as opposed to 56.7% on average), so while the numbers on the y-axis are smaller, the effects are nearly as striking, in line with the long-run multiplier of −0.51 on equipment spending in model 6. Columns 7 and 8 in Table 1 suggest that unemployment primarily affects defense budget composition, and generally comport with past theorizing on operational and overall defense spending.

In sum, Table 1 and Figure 7 demonstrate a strong correlation between unemployment and defense budget composition – states facing more unemployment spend more on personnel and less on equipment. While these results are merely correlational, they are robust to multiple specifications and not spurious. The ECM mitigates concerns about underlying trends in both unemployment and defense budget composition, as does the noncorrelation in overall defense expenditures. Reverse causality is also fairly unlikely – increasing personnel expenditures are unlikely to cause unemployment directly, but the use of the weight of the armed forces in the overall labor force in models 4–8 also addresses this possibility. The relatively high R-squared in each model suggests unobserved heterogeneity and is not likely to be a major issue.

Nonetheless, Table 2 reports results from two additional modeling approaches, designed to further test the robustness of the results depicted in Table 1, and to help ascertain causality: a Prais–Winsten model using panel-corrected standard errors (PCSE) and country FE, and a two-stage least squares (2SLS) model using shocks in housing markets as an (imperfect) instrument for unemployment. I specify the PCSE models, reported in columns 1–8, as follows:

$$Y_{i,t} = \beta_0 + \beta_1 UEM_{i,t} + \delta X_{i,t} + \alpha_i + \varepsilon_{i,t} \qquad (4)$$

where Y is the dependent variable (overall and disaggregated defense spending), UEM is the key independent variable (unemployment), X is the matrix of control variables specified above,

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[24]The long-run multiplier for unemployment was manually calculated in accordance with Equation (3) and (Smith, 2019). I eschew reporting standard errors for the LRM because of the challenges involved in accurate reporting using the Bewley method or the delta method of doing so with relatively small samples (Nieman and Peterson, 2019). The fact that the underlying coefficients on the lagged variables are significant at the 1% or 5% levels argues strongly for the significance of the LRM they were used to calculate.
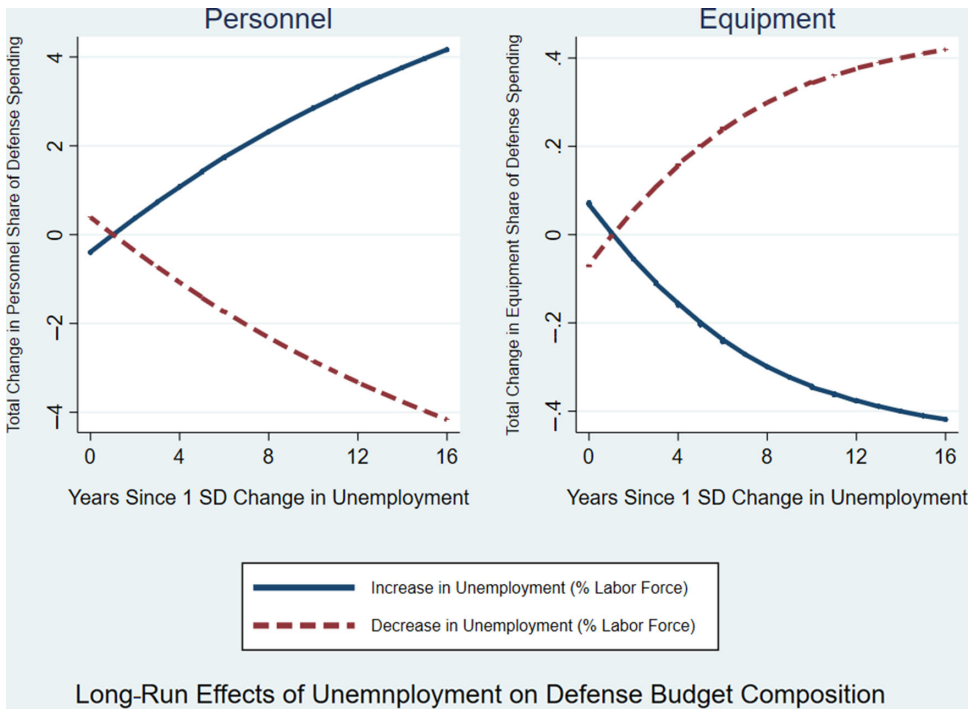
Figure 7. Long-run effects of a 1 standard deviation change in unemployment.

α is the intercept for each country, and ε is the error term. I then specify a 2SLS model with FE (to address autocorrelation) and standard errors clustered by country (to address panel cointegration).

2SLS requires a source of exogenous variation in unemployment, which is uncommon (Layard *et al.*, 2005), meaning that any instrument is likely to be imperfect. Even such an imperfect instrument can yield informative results in spite of relaxing the exclusion restriction (Nevo and Rosen, 2010), making it useful in the context of the analysis above.

I therefore use partial or incomplete random assignment: shocks in national housing markets are a source of exogenous variation in unemployment, which in turn drives overall budgeting, which then drives defense budget composition. Housing shocks themselves have no direct effect on defense budget composition. The relationship between housing shocks and unemployment is well documented (Reinhart and Rogoff, 2008). I find no evidence that housing shocks directly affect disaggregated defense spending – if a relationship exists, it is because unemployment transmits housing price shocks into overall and defense budget composition.

Because housing shocks are nonetheless likely an imperfect instrumental variable in this case, I include another possible pathway (GDP) in my 2SLS model. I also test if the instrument is 'plausibly exogenous', and 'can yield informative results even under appreciable deviations from an exact exclusion restriction (Conley *et al.*, 2012, 261)'. When γ is set to 0.06 using the Union of Confidence Intervals method in Stata's 'plausexog' module (Clarke, 2019), the confidence interval for the 2SLS estimate for personnel spending is [.131, 1.829], suggesting that the exclusion restriction need only be relaxed slightly in this case. The robustness of the relationship to various modeling choices accounting for serial correlation and other statistical pitfalls leaves me confident that unemployment precedes burden shifting, temporally and likely causally.

Housing price shocks are likely to affect unemployment in particular ways. For example, the prevalence of households with negative home equity may reduce labor mobility and increase

Table 2. Correlates of transatlantic burden shifting

Prais–Winsten regressions with panel-corrected standard errors, country FE

	Dependent variable: Personnel (% of defense budget)						Two-stage least squares			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Baseline	Public choice	Threat	Domestic PE	Transatlantic PE	Factor substi-tution	First Stage for UEM	MILEX (% GDP)	Personnel share	Equipment share
Unemployment (% labor force)	0.444***	0.665***	0.682***	0.671***	0.679***	0.065*	−0.159***	−0.026**	−0.844***	−0.787***
	(0.104)	(0.110)	(0.106)	(0.109)	(0.108)	(0.037)	(0.043)	(0.012)	(0.324)	(0.252)
ΔOECD housing index, 2-year lag GDP (rank)		0.611***	0.648***	0.610***	0.615***	−0.017		0.007	0.697**	−0.632**
		(0.141)	(0.156)	(0.154)	(0.158)	(0.048)		(0.014)	(0.399)	(0.263)
State Threat (Russia MILEX × Inverse Capital Distance)			0.012	0.004	0.026	0.023**				
			(0.020)	(0.023)	(0.026)	(0.009)				
Political Violence/Absence of Terrorism			1.292	1.504	1.593	0.028				
			(1.273)	(1.308)	(1.330)	(0.350)				
Right-Leaning Executive				0.567	0.606	0.208				
				(0.466)	(0.464)	(0.133)				
Checks/Veto Points				−0.550	−0.508	−0.005				
				(0.424)	(0.411)	(0.076)				
Armed forces personnel (% of total labor force)				−1.083	−1.322	−1.042**				
				(1.092)	(1.131)	(0.512)				
Atlanticism score					−0.064***	−0.008				
					(0.020)	(0.006)				
Years in NATO					−0.181	−0.101**				
					(0.112)	(0.044)				
Equipment (% defense budget)						−0.999***				
						(0.017)				
O&M (% defense budget)						−1.029***				
						(0.023)				
Constant	35.214***	−56.663***	−62.823***	−54.061**	−42.929	108.566***	8.936***			
	(2.223)	(21.222)	(23.592)	(23.639)	(26.297)	(8.835)	(0.001)			
Observations	401	401	401	401	401	401	288	288	288	288
R-squared	0.966	0.973	0.969	0.969	0.968	0.996	0.289	0.138	0.136	0.128
Number of countries	30	30	30	30	30	30	28	28	28	28
RMSE	4.262	4.174	4.189	4.191	4.194	1.133	2.292	0.201	4.885	4.345
AIC								−133.4	1705	1638
F-test								0.000890		

Standard errors in parentheses.
*$P < 0.1$, **$P < 0.05$, ***$P < 0.01$.

structural unemployment (Crowe *et al.*, 2013), and large and sudden capital reversals such as those experienced during a housing shock often lead to rising unemployment (Lane, 2012). In the US, the 2001–09 housing bubble and bust caused employment swings of over 60% in the construction industry, 35% in some manufacturing sectors, and 40% in some trade sectors, excluding massive effects in financial and real estate industries (BLS, 2011). Governments seek to address such issues with stabilization mechanisms. For example, the American Recovery and Reinvestment Act explicitly aimed at reducing unemployment associated with housing and financial shocks. SGP restrictions make it all but impossible for EU members to act unilaterally, adding an interorganizational challenge with NATO (Hofmann, 2009).

Housing price shocks might move top-line military expenditures in the same direction as employment, via changes in government revenue, for example. However, there is no reason to expect that housing price shocks would affect the *share* of national wealth allocated to defense or the allocation of resources *within* defense budgets – there is no evidence that defense ministries track housing prices or consider them when making decisions regarding the allocation of resources within budgets. Nor is there a plausible reason that they would do so. There is also no reason to believe that allocating defense resources toward personnel would affect housing markets, as personnel expenditures represent, on average, less than 1% of GDP.[25] Housing price shocks are thus a useful instrument for unemployment, allowing me to estimate the effect of unemployment on burden shifting. Because housing prices and unemployment are difficult to disentangle from the broader economic situation, and because GDP influences defense spending, GDP remains in all models. The rest of the theoretical controls are not plausibly correlated with both my instrument (housing shocks) and my dependent variable (burden shifting).[26] The first difference of the OECD index of real house prices is, therefore, my instrument for unemployment.[27]

I use a 1-year lag for all of the independent variables, as policy-makers' responses to unemployment are likely to manifest only after rates are published, and because inherent delays in the legislative and policy-making processes prevent policy-makers from responding simultaneously.

The key dependent variables, *Military Burden* and its disaggregated components, are discussed above and in more detail in Supplementary File D. The key independent variable remains *Unemployment* as a percentage of the labor force.

I argue that

$$Y_{it} = \beta_0 + \beta_1 UEM_{it-1} + \delta GDP_{it} + \varepsilon_{it} \tag{5}$$

describes the relationship between unemployment and defense expenditures, where Y_{it} is the overall military burden (successively replaced with each disaggregated category), UEM is the unemployment rate in a particular country, and GDP remains as a control that could be related to both unemployment *and* defense spending. β is the coefficient of interest throughout the analysis. In the first stage of the 2SLS analysis, I estimate

$$UEM_{it} = \lambda_{UEM} + \beta_{UEM} H_{it-1} + \delta GDP_{it} + \upsilon_{UEMit}, \tag{6}$$

where UEM is the unemployment rate and H is the year-on-year change of the OECD index of housing prices. I use H as an instrument for UEM in Equation (6). Because H_{it} is not correlated with ϵ_{it}, I argue that this is a valid identification strategy. H is not in Equation (5) because while it

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[25]The use of 1-year lags on all independent variables in all regressions also addresses the possibility of reverse causality between personnel expenditures and housing markets. Supplementary File E includes further robustness checks over a longer period, using 5-year moving averages for all variables, with varying samples and at the level of individual states.

[26]Supplementary File E discusses in detail the inclusion/exclusion choices for the 2SLS.

[27]While such an index is likely imprecise, using the first difference allows me to focus on changes over time in data that is 'reliable', allowing for questions of 'validity (Shively, 2017, 50)'. Such validity concerns are lessened because the index is measured 'in collaboration with other International Organisations (BIS, Eurostat, IMF, UNECE and World Bank)', and is the only one available of its kind (OECD, 2019).

correlates with the causal variable of interest (unemployment), it does not correlate with unobservable causes of unemployment excluded from the equation.

I present the results in Table 2. The main equation is Equation (5). Treating UEM_{it}, as endogenous, I model it as

$$UEM_{it-1} = \varsigma + \beta H_{it-2} + GDP'_{it}\delta + \upsilon_{it} \tag{7}$$

where H_{it} is the housing instrument. The exclusion restriction is that H_{it}, while correlated with unemployment, is not correlated with unobservable determinants of disaggregated defense spending. So I estimate Equations (5) and (6) jointly with 2SLS, using H_{it-2} as an instrument for UEM_{it-1}. I use a more parsimonious set of controls here than in the PCSE model, only controlling for GDP, which plausibly correlates with both housing shocks and personnel expenditures. I expect wealthier countries to engage in less burden shifting. GDP also addresses questions of reverse causation with the general state of economies or questions like the post-Cold War 'Peace Dividend'. The remaining theoretical explanations are addressed by the first stage of the 2SLS because they are not plausibly correlated to shocks in residential housing markets, and therefore do not appear in this model. I use country FE in all models, clustering standard errors by country in the 2SLS models.

Columns 1 through 5 of Table 2 report the results of a progression through five PCSE models, mirroring the columns in Table 1. The coefficients are large and statistically significant in the predicted direction in each of the models – they are also stable across the models, and similar to those in the ECM. Column 6 considers the substitutability of the four components of defense spending (Bove and Cavatorta, 2012) and points in the same direction – unemployment's relationship with personnel spending remains positive, and negative with equipment and O&M.

As in the ECM, in spite of numerous controls, omitted determinants of personnel and equipment spending that correlate with unemployment may remain. Reverse causality may also be an issue – military spending may affect unemployment. Columns 7–10 of Table 2 present the results of the 2SLS model described above to address these issues.

Column 7 presents the first stage estimate of the relationship between housing prices and unemployment: as predicted, negative housing shocks are associated with increased unemployment. A 1% decline in housing prices is associated with a 0.159% point increase in unemployment, significant at the 1% level. The F-test of the excluded instrument reported in column 7 (0.00089) also supports the theoretical notion that housing shocks have no direct effect on defense spending. Knowing that housing prices are a strong (if imperfect) instrument for unemployment allows us to examine subsequent 2SLS estimates with additional confidence of their relevance and validity.

The 2SLS estimates in columns 8–10 demonstrate the strong, likely causal relationship between unemployment in year $y-1$ and burden shifting in year y. The relationship remains large, positive, significant, and robust to controls for GDP rank and country FE. The coefficient of -0.026 in column 10, significant at the 5% level, suggests that unemployment also leads countries to devote a slightly smaller share of GDP to defense.

Column 9 indicates that for each 1% point increase in unemployment, personnel's share of defense spending increases by 0.844% points, significant at the 1% level. In the case of the US that would represent nearly $300 million in 2015. Column 10 indicates nearly the precise opposite relationship between unemployment and equipment's share of defense budgets (-0.787 points), significant at the 1% level. Together, the results in columns 8–10 confirm the hypotheses that unemployment leads countries to spend slightly less on defense, while at the same time shifting significant portions of their defense budgets out of equipment and into personnel. Unemployment causes countries to shift burdens of collective defense to their allies.

I report the Akaike's Information Criterion (AIC) and the Bayesian Information Criterion (BIC) rather than the R-squared, which tells us little in a 2SLS. The difference between the AIC in the models of interest and the baseline model is large and negative, meaning the 2SLS

model improves fit. Taken in conjunction with the high R-squared for the PCSE models, this leaves me confident that my results are consistent across models. The 2SLS addresses the risk of reverse causality and of omitted variable bias without risking collinearity. The p-value of the F-statistic of 0.00089 in column 8 attests to the strength of the instrument.

I further assess the validity of my instrumental variable approach using the standard Schaffer (2010) routine. I do so with the fully specified 2SLS model for the effect of unemployment on personnel expenditures, as this is the central 2SLS analysis. I first examine the F-test for weak identification of the excluded instrument, testing the null hypothesis that including the instruments in the model does lead to a better statistical fit (Angrist and Pischke, 2008). The output of the F-test for my housing instrument is 41.83, indicating that it is a good instrument. The Kleibergen–Paap rk Wald F statistic of 41.826 is also well above the Stock and Yogo threshold of 16.38, allowing me to conclude cautiously that my instrument is not weak. Different clusters of states behaving differently with regard to the key variables of interest, as presented above, can help explain any additional potential weakness. I can also reject the null hypothesis that the model is underidentified: the p-value in an underidentification test using the Kleibergen–Paap rk LM statistic is 0.013.

Robustness and extended validity

The similarity between the PCSE and 2SLS estimates suggests this relationship is very robust. Nonetheless, I present the results of multiple additional robustness checks in Supplementary File E. These checks include year FE, varying lags, and varying periods to account for the possibility that burden-shifting behavior is subject to temporal effects. I vary samples of states and use country FE to ensure the results are not due to country-specific shocks. I use both disaggregated spending in real dollars and share of GDP, as well as absolute personnel numbers as independent variables to address concerns that the behavior is driven by other factors not related to budget composition. The robustness of this analysis to such a variety of modeling choices suggests that the relationship between unemployment and burden shifting in the allocation of resources to and within defense budgets is causal, and it addresses concerns about the timing of the effects of unemployment on defense spending.

Because of the compositional nature of disaggregated defense spending data, Supplementary Table E12 reports a replication of the main analysis using Seemingly Unrelated Regressions (SUR). Supplementary Table E15 reports an Arellano–Bond estimation to further address serial correlation.

Could these findings be generalizable beyond the transatlantic community? Disaggregated defense spending is only available for NATO and EU members. There appears to be no statistically significant relationship between unemployment and overall defense spending as a share of GDP across the 153 states ($n = 3855$) for which data for those two variables is available. Labor markets differ significantly across regions, but we might expect non-Western states – especially those without significant defense industries – to use personnel spending as a labor market stabilizer just as much or more than do western states. Gathering disaggregated data for non-NATO and EU members would be helpful to analysts, but it is not certain that other institutions are ready to perform the tasks that NATO and the EU perform in order to do so.

Discussion

Understanding the domestic origins of burden shifting advances theoretical debates on burden sharing to inform policy in a way that previous work focusing on structural variables cannot. It also engages with debates on the relationship between defense and social policies, and helps understand the extent to which great powers are able to exert authority in regional security

complexes, which are themselves central to international order. Additionally, the precision gained by disaggregating defense expenditures helps reconcile methodological disputes over 'form of contribution (Oma, 2012, 566)'.

Operationalizing burden shifting as decreasing defense spending while shifting expenses within budgets away from equipment and into personnel also bridges a gap between security and defense economics research. A panel analysis of disaggregated data from as many as 35 states enables granularity that scholars have called for. In the security literature, theory-driven empirical attempts to conduct such an analysis have focused on case studies, results of which may not generalize (Bennett *et al.*, 1994).

I have advanced and found support for a theory about the domestic origins of burden shifting. Countries experiencing unemployment spend less on defense, and at the same time shift resources away from the acquisition of capability-enhancing equipment, reorienting them toward personnel spending, which they consider a stabilizer. This behavior has substantive negative effects on transatlantic burden sharing – it is the opposite of what NATO allies agreed to do in Wales in 2014 - a set of goals that the European Council subsequently embraced, and that have been less public aspirations for many years.

Shocks in housing markets are mostly exogenous to defense budgeting processes, they result in unemployment, and governments respond to rising unemployment by shifting more of the burden of collective defense to their allies. They do so because they perceive personnel spending to have a direct effect on employment, whereas equipment investment can only have an indirect effect, if any. Governments appear to prefer this more direct route to addressing employment, even though it may damage military capability and readiness through reduced investment. They do not acknowledge doing so because they fear allies identifying them as 'burden-shifters, intent on limiting their contribution to the collective effort (Thies, 2015, 7)'. While few states acknowledge this behavior, it is apparent in the data. Numerous robustness checks, beyond the PCSE and 2SLS models in Table 2, leave me confident that my findings are not artifacts of common statistical pitfalls.

The relationship between unemployment and burden shifting has important implications for transatlantic security, particularly in the context of the adverse economic and labor market shock represented by the COVID-19 crisis. It affirms the strategic significance of a healthy European economy. The more members of the transatlantic community struggle with unemployment, the less likely they are to share the strategic burden of their collectively envisioned adaptation and deterrence in the face of evolving challenges. These implications may be similar for other parts of the world, but scholars would need to develop reliably accurate disaggregated defense spending data beyond members of NATO and the EU to extend the analysis beyond the transatlantic community.

Future research may benefit from examining the effects of other domestic or EU-level variables on burden sharing. Exploring the effects of EU fiscal policy on defense planning and strategy is particularly promising, as it could build on these findings to provide insights on interorganizational relations and institutional design. Such research has implications well beyond defense: the extent to which states are willing to suborn international agreements to cope with domestic challenges is important for broader questions of international collective action, burden sharing, and the international order itself. While my findings are clear about the effects of states' perceptions of the effect of personnel spending on unemployment, I have not explored that effect itself, which is another potential avenue for future research. The disaggregation of defense spending data may also help in resolving other difficult issues in the burden-sharing debate, and can help inform detailed case studies. Doing so would reconcile opportunities presented by a move toward interpretive analysis in the burden-sharing literature with the analytical promise of quantitative analysis.

References

Achen, C.H. (2000), 'Why lagged dependent variables can suppress the explanatory power of other independent variables', *Ann Arbor* **1001**: 48106-1248.

Alptekin, A. and P Levine (2012), 'Military expenditure and economic growth: a meta-analysis', *European Journal of Political Economy* **28**(4): 636–650.

Angrist, J.D. and J-S. Pischke (2008), *Mostly Harmless Econometrics: An Empiricist's Companion*, Princeton: Princeton University Press.

Appathurai, J. (2006), 'NATO Speech: Briefing by NATO Spokesman - MOD - 8 June 2006', Retrieved 1 February 2019 from https://www.nato.int/docu/speech/2006/s060608m.htm

Arena, P., G. Palmer and G. Palmer (2009), 'Politics or the Economy? Domestic correlates of dispute involvement in developed democracies', *International Studies Quarterly* **53**(4): 955–975.

Arvanitidis, P., C. Kollias, and P. Messis (2017), 'Converging Allies?', *Peace Economics, Peace Science and Public Policy* **23**(2). Retrieved 26 February 2020 from https://www.degruyter.com/view/j/peps.2017.23.issue-2/peps-2016-0044/peps-2016-0044.xml

Beck, N. and J.N. Katz (1995), 'What to Do (and Not to Do) with time-series cross-section data', *American Political Science Review* **89**(3): 634–647.

Becker, J. (2017), 'The correlates of transatlantic burden sharing: revising the agenda for theoretical and policy analysis', *Defense & Security Analysis* **33**(2): 131–157.

Becker, J. and E. Malesky (2017), 'The continent or the 'Grand Large'? Strategic culture and operational burden-sharing in NATO', *International Studies Quarterly* **61**(1): 163–180.

Bennett, A., J. Lepgold and D. Unger (1994), 'Burden-sharing in the Persian gulf war', *International Organization* **48**(1): 39–75.

Berenskoetter, F.S. (2005), 'Mapping the mind gap: a comparison of US and European security strategies', *Security Dialogue* **36**(1): 71–92.

BLS (2011), 'The impact of the U.S. housing bubble and bust on employment, 2001–2009 : the economics daily : U.S. Bureau of labor statistics', Retrieved 28 November 2018 from https://www.bls.gov/opub/ted/2011/ted_20110103.htm

Bove, V. and E. Cavatorta (2012), 'From conscription to volunteers: budget shares in NATO defence spending', *Defence and Peace Economics* **23**(3): 273–288.

Bove, V., G. Efthyvoulou and A. Navas (2017), 'Political cycles in public expenditure: butter vs guns', *Journal of Comparative Economics* **45**(3): 582–604.

Cancian, M.F. and M.W. Klein (2015), *Military Officer Quality in the All-Volunteer Force*. National Bureau of Economic Research. Working Paper. Retrieved 28 November 2018 from http://www.nber.org/papers/w21372

Cavatorta, E. and R. Smith (2017), 'Factor models in panels with cross-sectional dependence: an application to the extended SIPRI military expenditure data', *Defence and Peace Economics* **28**(4): 437–456.

Christie, E.H. (2019), 'The demand for military expenditure in Europe: the role of fiscal space in the context of a resurgent Russia', *Defence and Peace Economics* **30**(1): 72–84.

Cimbala, S.J. and P. Forster (2005), *The US, NATO and Military Burden-Sharing*, New York: Routledge.

Clarke, D. (2019), *PLAUSEXOG: Stata Module to Implement Conley et al's Plausibly Exogenous Bounds*. Retrieved 15 April 2020 from https://econpapers.repec.org/software/bocbocode/s457832.htm

Conley, T.G., C.B. Hansen and P.E. Rossi (2012), 'Plausibly exogenous', *The Review of Economics and Statistics* **94**(1): 260–272.

Cornes, R. and T. Sandler (1984), 'Easy riders, joint production, and public goods', *The Economic Journal* **94**(375): 580.

Crowe, C., G. Dell'Ariccia, D. Igan and P. Rabanal (2013), 'How to deal with real estate booms: lessons from country experiences', *Journal of Financial Stability* **9**(3): 300–319.

De Boef, S. and L. Keele (2008), 'Taking time seriously', *American Journal of Political Science* **52**(1): 184–200.

Dunne, P. and R. Smith (2020), 'Military expenditure, investment and growth', *Defence and Peace Economics* **31**(6): 601–614.

Dunne, P., R. Smith and D. Willenbockel (2005), 'Models of military expenditure and growth: a critical review', *Defence and Peace Economics* **16**(6): 449–461.

EDA (2018), 'Defence Data Portal', Retrieved 25 February 2019 from https://www.eda.europa.eu/info-hub/defence-data-portal

European Council (2016), 'European Council Meeting (15 December 2016) – Conclusions', Retrieved 27 November 2018 from https://www.consilium.europa.eu/media/21929/15-euco-conclusions-final.pdf

Fordham, B.O. (1998), 'Economic interests, party, and ideology in early cold war era U.S. foreign policy', *International Organization* **52**(2): 359–396.

Goldman, E. (1994), 'Thinking about strategy absent the enemy', *Security Studies* **4**(1): 40–85.

Haesebrouck, T. (2018), 'Democratic participation in the air strikes against Islamic state: a qualitative comparative analysis', *Foreign Policy Analysis* **14**(2): 254–275.

Hofmann, S.C. (2009), 'Overlapping institutions in the realm of international security: the case of NATO and ESDP', *Perspectives on Politics* **7**(1): 45–52.

Kaufmann, D., A. Kraay and M. Mastruzzi (2011), 'The worldwide governance indicators: methodology and analytical issues', *Hague Journal on the Rule of Law* **3**(2): 220–246.

Kim, W., T. Sandler (2019), 'NATO at 70: pledges, free riding, and benefit-burden concordance', *Defence and Peace Economics* 1–14.

Lane, P.R. (2012), 'The European sovereign debt crisis', *Journal of Economic Perspectives* **26**(3): 49–68.

Layard, P.R.G., R. Layard, S.J. Nickell, S. Nickell and R. Jackman (2005), *Unemployment: Macroeconomic Performance and the Labour Market*, Oxford University Press.

NATO (2014), 'Wales Summit Declaration Issued by the Heads of State and Government Participating in the Meeting of the North Atlantic Council in Wales', *NATO*. Retrieved 28 November 2018 from http://www.nato.int/cps/en/natohq/official_texts_112964.htm

NATO (2018), 'Information on defence expenditures', *NATO*. Retrieved 28 November 2018 from http://www.nato.int/cps/en/natohq/topics_49198.htm

Nevo, A. and A.M. Rosen (2010), 'Identification with imperfect instruments', *The Review of Economics and Statistics* **94**(3): 659–671.

Nieman, M.D. and D.A.M. Peterson (2019), 'Long run confidence: estimating confidence intervals when using long run multipliers', *Iowa State University Digital Repository* **16**.

Nincic, M. and T.R. Cusack (1979), 'The political economy of US military spending', *Journal of Peace Research* **16**(2): 101–115.

OECD (2019), 'Residential Property Price Indices (RPPIs) and Related Housing Indicators - Frequently Asked Questions – OECD', Retrieved 24 February 2020 from http://www.oecd.org/sdd/prices-ppp/residential-property-price-indices-rppis-and-related-housing-indicators-faqs.htm

Olson, M. and R. Zeckhauser (1966), 'An economic theory of alliances', *The Review of Economics and Statistics* **48**(3): 266–279.

Oma, I.M. (2012), 'Explaining states' burden-sharing behaviour within NATO', *Cooperation and Conflict* **47**(4): 562–573.

Potrafke, N. (2011), 'Does government ideology influence budget composition? Empirical evidence from OECD countries', *Economics of Governance* **12**(2): 101–134.

Reinhart, C.M. and K.S. Rogoff (2008), 'Is the 2007 US sub-prime financial crisis so Different? An international historical comparison', *American Economic Review* **98**(2): 339–344.

Sandler, T. and J.F. Forbes (1980), 'Burden sharing, strategy, and the design of nato', *Economic Inquiry* **18**(3): 425–444.

Sasaki, K. (1963), 'Military expenditures and the employment multiplier in Hawaii', *The Review of Economics and Statistics* **45**(3): 298–304.

Scartascini, C., C. Cruz and P. Keefer (2018), *The Database of Political Institutions 2017 (DPI2017)*. Inter-American Development Bank. Retrieved 16 April 2020 from http://publications.iadb.org/11319/8806

Schaffer, M.E. (2010), xtivreg2: stata module to perform extended IV/2SLS, GMM and AC/HAC, LIML and k-class regression for panel data models. http://ideas.repec.org/c/boc/bocode/s456501.html

Shively, W.P. (2017), *The Craft of Political Research*. Routledge. Retrieved 26 February 2020 from https://www.taylorfrancis.com/books/9781315269559

SIPRI (2018), 'SIPRI military expenditure database', Retrieved 28 November 2018 from https://www.sipri.org/databases/milex

SIPRI (2019), 'SIPRI arms industry database', Retrieved 28 November 2018 from https://www.sipri.org/databases/armsindustry

Smith, R. (2019), 'Email correspondence with Ron Smith, ECM',

Stoltenberg, J. (2018), 'Press conference by NATO secretary general Jens Stoltenberg following the meeting of the North Atlantic council at the level of heads of state and government (NATO Summit Brussels)', *NATO*. Retrieved 28 November 2018 from http://www.nato.int/cps/en/natohq/opinions_156733.htm

Thies, W.J. (2015), *Friendly Rivals: Bargaining and Burden-Shifting in NATO: Bargaining and Burden-Shifting in NATO*, Routledge.

Wallace, R.A., M. Colarusso, A.O. Hall, D.S. Lyle, M. Walker (2015), *PAID TO PERFORM: Aligning Total Military Compensation With Talent Management*. Strategic Studies Institute, US Army War College. Retrieved 28 November 2018 from https://www.jstor.org/stable/resrep11928

Wallander, C.A. (2000), 'Institutional assets and adaptability: NATO after the cold war', *International Organization* **54**(4): 705–735.

Walt, S.M. (1987), *The Origins of Alliances*, Ithaca: Cornell University Press.

Westerlund, J. (2007), 'Testing for error correction in panel data', *Oxford Bulletin of Economics and Statistics* **69**(6): 709–748.

Whitten, G.D. and L.K. Williams (2011), 'Buttery guns and welfare hawks: the politics of defense spending in advanced industrial democracies', *American Journal of Political Science* **55**(1): 117–134.

World Bank (2019), 'World Development Indicators (WDI) Data Catalog', Retrieved 28 November 2018 from https://datacatalog.worldbank.org/dataset/world-development-indicators