

**Does a Change of Government  
Influence Compliance with  
International Agreements?  
Empirical Evidence for the  
NATO Two Percent Target**

*Johannes Blum, Niklas Potrafke*

Impressum:

ifo Working Papers

Publisher and distributor: ifo Institute – Leibniz Institute for Economic Research at the University of Munich

Poschingerstr. 5, 81679 Munich, Germany

Telephone +49(0)89 9224 0, Telefax +49(0)89 985369, email [ifo@ifo.de](mailto:ifo@ifo.de)

[www.cesifo-group.de](http://www.cesifo-group.de)

An electronic version of the paper may be downloaded from the ifo website:

[www.cesifo-group.de](http://www.cesifo-group.de)

# Does a Change of Government Influence Compliance with International Agreements? Empirical Evidence for the NATO Two Percent Target\*

## Abstract

We examine whether changes of government influence compliance with international agreements. We investigate compliance with the NATO two percent target to which all NATO countries committed themselves during the NATO summit in Wales in 2014. The dataset includes the military expenditure by NATO countries over the period 2010–2018. The results suggest that countries that do not (yet) comply with the two percent target have smaller growth rates in military expenditure relative to GDP when they experienced a large change of government, e.g. a change from a rightwing to a leftwing government, than countries that did not experience such a large change of government since the NATO summit in 2014. Countries that experienced a large change of government are, thus, less likely to comply with the two percent target. Future research should examine the credibility problem of national governments in other international agreements too.

JEL code: D72, D74, H41, H56, P16

Keywords: International agreements, compliance, credibility, time inconsistency, change of government, military expenditure, two percent target, NATO, burden sharing

Johannes Blum  
ifo Institute – Leibniz Institute for  
Economic Research  
at the University of Munich,  
University of Munich  
Poschingerstr. 5  
81679 Munich, Germany  
Phone: + 49 89 9224 1250  
blum@ifo.de

Niklas Potrafke  
ifo Institute – Leibniz Institute for  
Economic Research  
at the University of Munich,  
University of Munich  
Poschingerstr. 5  
81679 Munich, Germany  
Phone: + 49 89 9224 1319  
potrafke@ifo.de

*This paper has been accepted for publication in Defence and Peace Economics.*

\* We thank Raul Caruso, Martin Gassebner, Kai A. Konrad, the participants of the Silvaplana Political Economy Workshop 2018, and two anonymous referees for their helpful comments and Lisa Giani Contini for proof-reading.

## 1. Introduction

Countries sign international agreements to commit themselves to policy targets. Prominent examples are climate change agreements. When do countries, however, comply with international agreements? We examine a new aspect of when countries are not likely to comply with international agreements: when national government changes. It is conceivable that new governments are less willing to comply with international agreements signed by a previous government, especially when the new and the proceeding government have different platforms. We use the NATO two percent target to investigate empirically how changes of government influence compliance with an international agreement.

The two percent target has been discussed within NATO since the early 2000s to avoid problems of free-riding when defense burdens are shared. The United States have often criticized NATO allies for free-riding, meaning that it has long been an intriguing issue. The NATO countries agreed on the two percent target at the NATO summit in September 2014. Allies with military expenditure relative to GDP below 2% committed themselves to no longer decrease military expenditure and to reach the two percent target within the next ten years, i.e. by 2024. Decreasing military expenditure relative to GDP therefore means non-compliance with the two percent target. Because the target year is 2024, full compliance with this target cannot be confirmed yet. Countries that aim to meet the two percent target by 2024, however, will not meet the target overnight, but need to increase military expenditure for many years. We focus on efforts to increase military expenditure relative to GDP by those countries that have not met the two percent target yet. Whether countries reduce their efforts to increase military expenditure relative to GDP after government has changed has important implications for compliance with the two percent target in 2024, because many NATO countries are likely to experience at least one change of government within this ten-year period.

New governments are less willing to comply with international agreements signed by a previous government. The reason is a time inconsistency problem from a nation's perspective

related with international agreements. Compliance with international agreements depends on manifold issues such as agreement design, incentives, and cost-effectiveness. Empirical studies have investigated compliance with climate change agreements, anti-pollution standards, international monetary law and human rights treaties.

We use panel data for 27 NATO countries for the period 2010-2018 to examine how a change of government influences the growth rate in military expenditure for those countries that are below the two percent target. We observe rising growth rates in military expenditure for countries below the two percent target after the NATO summit in 2014. Countries that experienced a large change of government, e.g. a change from a rightwing to a leftwing government, after the summit, however, had lower growth rates in military expenditure relative to GDP than countries without such a change. Countries that experienced such a change of government after the NATO summit in 2014 are less likely to comply with the two percent target because they reduce their efforts to reach the target. Future research should investigate how changes of government influence compliance with other international agreements such as climate change and human rights treaties; and how to deal with the credibility problem of national governments when they commit themselves to international agreements.

## **2. Background**

### **2.1 Time inconsistency problems and compliance with international agreements**

Governments are less likely to comply with international agreements that a previous government has signed. A rational, forward-looking government will adjust policy decisions made in an earlier period because of restrictions the government now faces related to the expectations of optimizing agents (Kydland and Prescott 1977). Policies are likely to be time inconsistent and sticking to the initial policy would not yield an optimal outcome for a nation (see also Barro and Gordon 1983). A government that decides whether to comply with a non-binding agreement such as the NATO two percent target considers decisions of optimizing

agents both in the international (e.g., compliance of other governments) and in the domestic domain (e.g., voting behavior of the electorate). A government that does not agree with the international agreement is therefore inclined not to comply with the two percent target to which the country committed itself years ago. The risk of non-compliance is, thus, higher when government has changed after an agreement has been signed. In case of a change of government, the time inconsistency problem refers to the nation rather than to the policymaker who has been replaced. In any event, policymakers sign international agreements in the name of their nation, rather than in the name of themselves; a new government is equally tied to international agreements as the previous government was.

Scholars have examined compliance in the fields of climate policy, anti-pollution standards, monetary law and human rights treaties. International climate policy faces the same problems of free-riding associated with a public good as the NATO does with defense burden sharing. International climate change agreements attempt to deal with free-riding, but compliance is not certain: the complexity of domestic political processes and the challenge of design and enforcement of agreements in the international domain give rise to commitment problems, which induce governments to time inconsistent policies and non-compliance with earlier commitments (Hovi et al. 2009). Countries are also more likely to comply with climate change agreements the less cost-effective the measures necessary to comply with the agreements are (Barrett and Stavins 2003). Incentives play another important role for participation in and compliance with agreements to avoid free-riding behavior (Barrett and Stavins 2003). It is therefore important to investigate incentives in the context of the two percent target and to infer whether, and to what extent, NATO countries will be expected to comply with an agreement.

The design and acceptance of international treaties influence compliance. Treaties to prevent intentional oil pollution by tankers reveal that compliance with the requirement of rather costly additional equipment for tankers to reduce oil pollution is even higher than

compliance with a less cost-effective limit on oil discharge at sea. These differences in compliance are not substantiated in differences in cost-effectiveness. They are rather substantiated in both the design of such standards, which need to be transparent and verifiable, and in differences in the acceptance of these standards at the time they were introduced (Mitchell 1994).

Peer pressure and reputational concerns are other reasons for countries to comply with international treaties. An empirical study on Article VIII of the IMF's Articles of Agreement, which forbids restrictions on current international transactions, shows that peer pressure among countries located within the same region lead countries to comply with international monetary law. The probability of compliance with Article VIII is even higher in the first years after monetary restrictions have been abandoned, since countries try to regain their international reputation (Simmons 2000). Both peer and reputational effects, as well as cost-effectiveness, influence compliance with international laws against human trafficking. Countries favor prevention measures against human trafficking over protection and prosecution measures because prevention satisfies those countries that are most affected by human trafficking inflows on the one hand, and induces less cost and effort on the other (Cho and Vadlamannati 2012). Ratification of international treaties on human rights, however, has not been shown to increase the respect of human rights in a country. An effect of ratification, however, is found for countries the more democratic they are and the stronger their civil society is (Keith 1999, Hathaway 2002, Neumayer 2015).

## **2.2 NATO's Two Percent Target**

NATO countries have committed themselves to the two percent target at the NATO summit in September 2014 to counteract free-riding. NATO countries contribute to collective security, a public good within NATO, since it is nonrival and no NATO country can be excluded (Olson and Zeckhauser 1966). Countries are therefore inclined to free-ride at the expense of those allies

which contribute a disproportionately larger share to the collective good.<sup>2</sup> NATO countries discuss defense burden sharing since the early years of NATO, and the United States have often criticized NATO allies for free-riding. NATO members discussed a target of 2% military expenditure relative to GDP as a prerequisite for candidate countries to join NATO at its summit in Prague in November 2002. Because many NATO countries had decreased military expenditure themselves, a target of 2% military expenditure relative to GDP has also been discussed for NATO countries. However, this target was non-binding for candidate countries and for NATO members. The figure of 2% was probably inspired by the level of military expenditure relative to GDP of candidate countries and new members at that time. The 2% figure may also reflect the experience that NATO allies fulfilled NATO obligations at the end of the Cold War when most of them spent at least a share of 2% of their GDP on defense. NATO countries agreed on a target of 2% military expenditure relative to GDP in 2006.<sup>3</sup> At the NATO summit in Riga in November 2006, however, it was not included in the final declaration by the heads of state and government. The NATO summit in Wales in September 2014 was heavily influenced by Russia's actions against Ukraine: Russia's increasingly aggressive behavior and its geopolitical actions in the last decade—including the annexation of Crimea in March 2014—have been a new challenge for NATO, making it important to counteract free-riding within the alliance. All 28 NATO countries at that time attended the NATO summit in September 2014 and the heads of state and government for the first time committed themselves to the two percent target: allies with military expenditure relative to GDP above 2% committed themselves to maintain military expenditure above this level. Allies with military expenditure relative to GDP

---

<sup>2</sup> By contrast, elements of military expenditure are at least private to some extent and defense burdens among countries have therefore been described as Hicksian complements rather than substitutes (Murdoch and Sandler 1984). Empirical studies arrive at manifold conclusions regarding free-riding within NATO (Murdoch and Sandler 1984, Oneal 1990, Sandler 1993, Hartley and Sandler 1999, Plümper and Neumayer 2015, George and Sandler 2018).

<sup>3</sup> See [https://www.nato.int/cps/en/natohq/topics\\_67655.htm](https://www.nato.int/cps/en/natohq/topics_67655.htm) (accessed July 2, 2018).



below 2% committed themselves to no longer decrease defense spending and to reach the two percent target within the next ten years, i.e. by 2024.<sup>4</sup>

The official commitment to the two percent target in 2014 is legally not binding and sanctions in case of non-compliance with this agreement have not been defined. The same holds for the 2% target levels discussed at the NATO summits 2002 and 2006. The two percent target is therefore said to be more of a political commitment by the NATO countries.<sup>5</sup>

The two percent target is a quantitative indicator and military expenditure relative to GDP is tracked on a yearly basis. Compliance with this target is thus verifiable and transparent for all NATO countries. The two percent target is, however, often criticized within NATO: it expresses defense spending in terms of GDP, which implies that compliance with this target also depends on business cycles, leaving members shooting at a moving target in their efforts to comply.<sup>6</sup> NATO allies maintain that the capabilities needed to fulfill NATO obligations cannot simply be expressed by a spending target. Just meeting the two percent target might thus not give rise to an efficient outcome. The target does not reflect that larger countries have higher military expenditure—even as a share of GDP—than smaller ones because they also pursue interests outside of the NATO area. A considerable share of US military expenditure, for example, is attributed to the Pacific region.

### **2.3 Compliance with the NATO Two Percent Target and Changes of Government**

Though compliance with the two percent target is verifiable and transparent, compliance with it remains uncertain. Firstly, acceptance of the two percent target is mixed among NATO allies.

---

<sup>4</sup> “Allies currently meeting the NATO guideline to spend a minimum of 2% of their Gross Domestic Product (GDP) on defence will aim to continue to do so. [...] Allies whose current proportion of GDP spent on defence is below this level will: (i) halt any decline in defence expenditure, (ii) aim to increase defence expenditures in real terms as GDP grows, (iii) aim to move toward the 2% guideline within a decade with a view to meeting their NATO Capability Targets and filling NATO’s capability shortfalls.” Wales Summit Declaration [https://www.nato.int/cps/ic/natohq/official\\_texts\\_112964.htm](https://www.nato.int/cps/ic/natohq/official_texts_112964.htm) (accessed July 2, 2018).

<sup>5</sup> See “Kurzinformation: Zur Entstehungsgeschichte und rechtlichen Bindungswirkung der Zwei-Prozent-Zielvorgabe der NATO für den Anteil der nationalen Verteidigungsausgaben am jeweiligen Bruttoinlandsprodukt”, Wissenschaftliche Dienste, Deutscher Bundestag, March 21, 2017.

<sup>6</sup> See Lunn, S., and N. Williams. 2017. “NATO Defence Spending: The Irrationality of 2%.” European Leadership Network.

Secondly, the two percent target is a solely cost-effective policy measure and compliance with it is likely to be at the expense of spending on civilian public goods. The marginal “political” cost of spending on the military instead of on civilian public goods is thus increasing. Countries below the two percent target will be less inclined to further increase military expenditure as they get closer to 2% military expenditure relative to GDP. Thirdly, incentives to comply are limited because no credible sanctioning or penalties exist if countries fail to reach the two percent target.

Fourthly, changes of government are likely to influence compliance. A new government is likely to have a political platform that deviates from the platform of the previous government that was in power during the 2014 NATO summit. Even in cases where the new government favors higher military expenditure than the previous government, the new government may have concerns with an agreement signed by the previous government because the new and the previous governments are domestic competitors. A new government is inclined to keep its costly pre-election promises at the expense of military spending, following the “guns vs. butter” trade-off (see also Bove et al. 2017). Peer pressure and reputational cost are, moreover, strong incentives to comply with international agreements, which are reduced for new governments. Peer pressure and reputational cost in case of non-compliance are high since NATO allies represent a fairly homogeneous group of countries, which collaborate in numerous fields other than defense policy. Maintaining reputation in the international domain is important for future collaboration with allied countries in other policy fields. However, reputational costs for not complying with the two percent target will be lower for a new government than for a government that signed the agreement in 2014. The credibility problem for new governments is reduced since it is not their own word they break.

Theory on the determinants of compliance does not clearly indicate whether NATO countries will comply with the two percent target; or whether incentives to free-ride prevail. We expect, however, that changes of government will have a negative effect on compliance.

For countries below the two percent target, we expect lower growth rates of military expenditure relative to GDP when these countries experienced a change of government after the NATO summit in 2014. In turn, we expect higher growth rates when the same government is still in power. We expect the effect of a change of government on compliance to be stronger the larger the change of government is.

The direction of a change in government ideology, i.e. whether the change occurs from leftwing to rightwing or from rightwing to leftwing, is also likely to influence compliance with the two percent target. Rightwing governments are expected to increase military expenditure because they endorse security and support the hierarchies and discipline that are associated with armed forces. Leftwing governments are expected to increase military expenditure because they favour a large government and increasing military expenditure may well increase public employment.<sup>7</sup> Empirical evidence on ideology-induced military expenditure for OECD countries is, however, mixed (Potrafke 2011, Whitten and Williams 2011, Kauder and Potrafke 2016, Bove et al. 2017, Nordvang 2018; on ideology-induced policies in OECD countries see also Potrafke 2017 and 2018). We examine whether compliance with the two percent target is higher when a rightwing government replaces a leftwing government than when a leftwing government replaces a rightwing government.

### **3. Empirical analysis**

#### **3.1 Data and descriptive statistics**

Our dataset includes 27 NATO countries from 2010 to 2018. Two NATO countries are not included: Iceland because lack of data (Iceland has no own defense forces) and Montenegro, which joined NATO not before June 2017. Albania and Croatia joined NATO in 2009. By using data for the period 2010-2018, our sample includes countries that have been NATO members for the entire observation period. We use NATO data for military expenditure, which is the

---

<sup>7</sup> Scholars discuss the extent to which leftwing governments are pro-labor (see Vadlamannati and Tamazian 2017).

official data source on defense spending within NATO; figures for 2017 and 2018 are estimates. We use SIPRI data on military expenditure for a robustness test to confirm our inferences.

By the time of the NATO summit in September 2014, military expenditure relative to GDP was at a historic low: the United States, Greece and the United Kingdom were the only NATO countries with military expenditure relative to GDP above 2% at that time. Figure 1 shows that the United States, Greece and the United Kingdom had military expenditure relative to GDP above 2%. The United States, however, has continuously decreased its military expenditure since 2011 after considerable increases in the years before. Figure 2 shows that Poland and Estonia increased military expenditure relative to GDP prior to the 2014 NATO summit and both reached the two percent target in 2015. Estonia maintained military expenditure relative to GDP above 2%, while Poland decreased military expenditure relative to GDP again in 2016 and 2017 and is estimated to be closely below the two percent target in 2018. Figure 3 shows countries with strong efforts towards the two percent target. Lithuania and Latvia drastically increased military expenditure relative to GDP since 2013 and 2014. The increasing defense efforts made by the Baltic countries, however, are influenced by the annexation of Crimea by Russia rather than by the two percent target. Latvia is estimated to have reached exactly 2% military expenditure relative to GDP in 2018, while Lithuania and Romania are closely below. Only the United States, Greece, the United Kingdom, Estonia and Latvia thus managed to comply with the two percent target in 2018; Poland, Romania and Lithuania were closely below.

Figure 4 shows growth rates of military expenditure relative to GDP for the individual years. Both mean and median growth rates have increased since 2014 and turned positive in 2015 and 2016. Increasing growth rates since 2014 reflect NATO countries' efforts to comply with the two percent target. Growth rates in military expenditure relative to GDP after the NATO summit in 2014 reveal a clear pattern: in 2015, 13 NATO countries increased military expenditure relative to GDP compared to the previous year and 13 countries decreased military

expenditure relative to GDP compared to the previous year. Germany neither increased nor decreased military expenditure relative to GDP. In 2016, the ratio of countries increasing military expenditure to countries decreasing military expenditure was 14 to ten, while three countries neither increased nor decreased military expenditure relative to GDP. This ratio was 17 to ten for 2017 and 21 to four (with two countries neither increasing nor decreasing military expenditure relative to GDP) for 2018. The four countries that reduced military expenditure in 2018 compared to 2017 are Canada, Greece, the United Kingdom, and the United States, which—except of Canada—all complied with the two percent target the year before.

We use growth rates in military expenditure relative to GDP for the years after the NATO summit, i.e. 2015-2018, to show differences between countries that had military expenditure relative to GDP of above or below 2% in the previous year. For countries below 2% military expenditure relative to GDP, we distinguish between countries that experienced a change of government after the NATO summit in 2014 and those that did not. We consider two types of changes of government, which also include changes of the political platform: firstly, a *small* change of government describes a new personnel composition of the cabinet including a small change in government ideology, i.e. a change in the ideology score of one.<sup>8</sup> We measure government ideology by the index of Potrafke (2009), which is based on Budge et al. (1993) and update it for non-OECD NATO member countries. The index assumes values from 1 (rightwing) to 5 (leftwing). Changes in the government ideology index from year  $t$  to year  $t+1$ , thus, describe a change in government ideology. A small change of government occurs when government changes and the government ideology index changes by one point, such as from a center to a leftwing government. Out of the 27 NATO countries considered, ten countries have experienced such a small change of government since the NATO summit in September 2014. Nine of these ten countries had military expenditure relative to GDP of below 2% in at least

---

<sup>8</sup> We ignore changes of government without changes in government ideology, i.e. when members of the cabinet are replaced but the government party or coalition stays in power.

one of the years from 2014 to 2016;<sup>9</sup> Greece was continuously above 2%. Secondly, *large* changes of government describe substantial changes in government ideology, i.e. changes in the ideology score of at least two. The large changes are almost exclusively changes from a leftwing to a rightwing government or vice versa. Seven countries experienced such a large change in government ideology since the NATO summit in September 2014: Canada, Portugal and Spain changed from a rightwing to a leftwing government and Croatia, Denmark, and the United States changed from a leftwing to a rightwing government. In Italy, Giuseppe Conte replaced the center-government of Paolo Gentiloni in June 2018. Though the Conte Cabinet and the government parties can hardly be described by rightwing-leftwing-schemes, this change of government was substantial and we indicate it as a large change too. Six of these seven countries which experienced a large change of government had military expenditure relative to GDP continuously below 2%; the United States were continuously above 2%.

A large change of government and a small change of government are mutually exclusive. We indicate both types of changes of government for years in which the change of government occurred in the first half of the calendar year and otherwise one year later. This time lag of at least half a year implies that changes in the defense budget by a new government become effective at earliest half a year after this new government assumed office.

Figure 5 shows that after the NATO summit in 2014, countries above 2% military expenditure relative to GDP in the previous year had growth rates of around 0%; and both the mean and median growth rate for these countries were even negative (mean: -0.8%; median: -0.8%). Low growth rates in military expenditure relative to GDP for countries above the two percent target mirror the course of military expenditure relative to GDP for the countries shown in Figure 1 from 2014 onwards. By contrast, many countries with military expenditure relative to GDP below 2% in the previous year had positive growth rates in military expenditure relative

---

<sup>9</sup> Governments might decide to increase military expenditure relative to GDP after the NATO summit in 2014, i.e. for the years 2015-2018, considering the level of military expenditure relative to GDP they observed for the respective previous year.

to GDP in the years from 2015 to 2018. Countries below 2% military expenditure relative to GDP that did not (yet) experience neither a small nor a large change of government after the NATO summit in 2014 had considerably larger growth rates (mean: 6.1%; median: 4.1%) than countries that already met the two percent target. In contrast, countries below 2% military expenditure relative to GDP that experienced a *small* change of government had growth rates (mean: 3.8%; median: 1.2%) that were smaller than those of countries without a small change of government.<sup>10</sup> The pattern is even clearer for countries with below 2% military expenditure relative to GDP, which experienced a *large* change of government after the NATO summit in 2014: these countries had smaller growth rates (mean: 0.9%; median: 0%). Latvia and Norway, for example, experienced no change of government in the years after the NATO summit in 2014 and increased military expenditure relative to GDP until 2018. By contrast, Croatia experienced a change from a leftwing to a rightwing government, i.e. a large change of government, in January 2016 and decreased military expenditure relative to GDP in 2016 by more than 10%. Portugal decreased military expenditure relative to GDP after the change from a rightwing to a leftwing government in November 2015. The growth rates in military expenditure relative to GDP for Canada and Portugal, which both changed from a rightwing to a leftwing government, and Croatia and Denmark, which both changed from a leftwing to a rightwing government, however, do not indicate that the direction of the government ideology change influences compliance with the two percent target differently.

The descriptive statistics indicate that a change of government is related to compliance with the two percent target depending on how strong the change of government is. Changes of government that include changes in government ideology, or even a change from a rightwing to a leftwing government or vice versa, corroborate that new national governments are less likely to comply with international agreements signed by previous national governments. We

---

<sup>10</sup> Mean in growth rates are not weighted according to the GDP of each country, i.e. this mean does not equal the growth rate of all countries' military expenditure relative to all countries' GDP.

elaborate on conditional correlations between changes of government and compliance with the two percent target by estimating panel data models in the next sections.

### 3.2 Empirical strategy

The baseline panel data model has the following form:

$$\begin{aligned}
 & \textit{Military expenditure relative to GDP (Growth rates)}_{it} = \\
 & \alpha_j \textit{Two percent target}_{it} + \beta_j \textit{Change of government since '14}_{ijt} + \\
 & \gamma_j \textit{Two percent target}_{it} * \textit{Change of government since '14}_{ijt} + \\
 & \sum_n \zeta_{jn} x_{int} + \eta_i + \tau_t + u_{ijt}
 \end{aligned}$$

$$\text{with } i = 1, \dots, 27; t = 1, \dots, 9; j = 1, 2; n = 1, \dots, 8 \quad (1)$$

The dependent variable *Military expenditure relative to GDP (Growth rates)<sub>it</sub>* describes growth rates in military expenditure relative to GDP for country *i* in year *t*. The dummy variable *Two percent target<sub>it</sub>* assumes the value 1 for the years after the NATO summit in 2014, i.e. for the years 2015-2018, if military expenditure relative to GDP was below the two percent target the year before, and value 0 otherwise. The variable *Two percent target<sub>it</sub>* reflects that a country which intends to comply with the two percent target is expected to increase military expenditure disproportionately compared to expected GDP growth when this country did not (yet) meet the two percent target in the previous year. The variable *Change of government since '14<sub>ijt</sub>* indicates small and large changes of government (*j* = 2) after the NATO summit in September 2014 in country *i* in year *t* (*t* ≥ 2015), as described in section 3.1. The dummy variables assume the value 1 when a change of government occurred after the NATO summit in September 2014 (as described in section 3.1, the change of government needs to have occurred within the first half of the calendar year; otherwise the dummy variables indicate the change of government one



year later). The variables for changes of government thus assume the value 1 in years in which the government that agreed to the two percent target in September 2014 has no longer been in office. We include the interaction term between the *Two percent target<sub>it</sub>* and the *Change of government since '14<sub>ijt</sub>* variable to examine whether countries below 2% military expenditure relative to GDP that experienced a change of government after the NATO summit in 2014 increased growth in military expenditure to a smaller extent than countries that did not (yet) experience a change of government.

We include eight control variables (n = 8). Firstly, we add variables measuring government ideology and parliamentary elections. *Rightwing<sub>it</sub>* is a dummy variable based on the government ideology index of Potrafke (2009) and assumes the value 1 for rightwing governments, i.e. a government ideology index with values 1 or 2, and value 0 otherwise. We control for government ideology because rightwing governments are likely to have higher military expenditure than leftwing governments have (Whitten and Williams 2011, Bove et al. 2017). The election dummy variable *Election (t+1)<sub>it</sub>* is 1 in years which precede parliamentary elections. We control for elections because governments in times of elections are likely to shift public spending from military expenditure to social welfare to compete for votes (Bove et al. 2017). Secondly, we include variables describing conflicts, as well as internal and external threats. The dummy variable *War (t-1)<sub>it</sub>* indicates whether a country has been involved in an interstate war (i.e. a war with another country) or an internal war (i.e. a war between a government and internal conflict groups) in year t-1 with at least 25 battle-related deaths. We consider wars in period t-1 because military expenditure is likely to increase with a time lag once a country gets involved in a conflict; in turn, military expenditure is likely to also decrease with a time lag once a conflict has ended, because it takes time to demobilize and military resources need to be replenished. The data for armed conflicts is taken from the 'UCDP/PRIO Armed Conflict Dataset' (Version 17.2) and defined according to Gleditsch et al. (2002). The variable *Internal threat<sub>it</sub>* proxies domestic conflict probability and a country's internal stability.

The variable is defined as the average of an eleven-point index for internal violence over the past ten years. This index is taken from the ‘Major Episodes of Political Violence (MEPV) and Conflict Regions, 1946-2016’ dataset by the Center for Systemic Peace. The definition of both variables  $War (t-1)_{it}$  and  $Internal\ threat_{it}$  has been shown to explain variance in military expenditure relative to GDP (Blum 2018, 2019). Countries like Latvia, Lithuania, and Norway most probably increased military expenditure because of Russia’s aggressions—peaking in the annexation of the Crimea peninsula in March 2014—rather than because of the two percent target. We therefore add a dummy variable  $Crimea_{it}$  which assumes the value 1 for countries with a common border with Russia for the years 2014-2018, and value 0 otherwise.<sup>11</sup> This variable (jointly with fixed year effects) ensures that effects of the change in the security environment and effects of the two percent target are disentangled. Thirdly, we add three socioeconomic variables: the growth rate of GDP in constant (2010) US dollars, the growth rate of population and the growth rate in government debt relative to GDP. The growth rates of GDP and population are included to investigate substitution effects when GDP and population increase (Dunne et al. 2008, Albalade et al. 2012, Langlotz and Potrafke 2016, Blum 2018, Pamp et al. 2018). The growth rate in the debt-to-GDP ratio accounts for a country’s fiscal capacity; fiscal capacity and other macroeconomic factors have been shown to influence military expenditure in European countries and NATO countries (Christie 2017, Odehnal and Neubauer 2018). Data for GDP and population are taken from the World Bank; data for government debt to GDP are taken from the IMF. We include fixed country,  $\eta_i$ , and also fixed time effects,  $\tau_t$ , and estimate the fixed-effects model with ordinary least squares and standard errors robust to heteroskedasticity (Huber/White/sandwich standard errors – see Huber 1967 and White 1980).

---

<sup>11</sup> Poland and Lithuania are also labeled as having a common border with Russia because they are adjacent to the Russian exclave Kaliningrad.

Table 1 and 2 show summary statistics and correlations of the variables. Data for the three socioeconomic variables are available for the period from 2010 to 2017 only. We therefore estimate balanced panels for the periods 2010-2018 and 2010-2017 and include the three socioeconomic variables in the panel for the period 2010-2017 only.

## 4. Empirical results

### 4.1 Baseline results

Table 3 shows the baseline results. Columns (4) and (5) relate to the period 2010-2017 and thus exclude the large changes of government in Italy and Spain and the small change of government in Hungary (the Fidesz party regained the two-third-majority in parliament) in 2018 but consider the three socioeconomic variables which are not yet available for 2018. We examine whether inferences regarding changes of government in countries that do not (yet) meet the two percent target change when individual control variables are included or excluded. The coefficient of the *Two percent target<sub>it</sub>* variable (countries which had military expenditure relative to GDP after the NATO summit of below 2% in the previous year) is statistically significant at the 1% level. The numerical meaning of the coefficient is that after the NATO summit in 2014, countries which had military expenditure relative to GDP of below 2% in the previous year and did not experience a change of government increased the growth rate in military expenditure relative to GDP by 9.8 percentage points. This estimate corroborates that countries below the two percent target increased military expenditure relative to GDP, while countries that already comply with the two percent target did not further increase military expenditure relative to GDP. The estimate is quite large: the mean growth rate of military expenditure relative to GDP until the 2014 NATO summit was -3.8% (median: -3.7%; see Figure 4) and the coefficient estimate, thus, indicates that countries below the two percent target and without a change of government on average managed to turn growth rates for military expenditure relative to GDP into positive values. The coefficient estimates of the interaction

term between countries below the two percent target and with a small change of government are negative in columns (1) to (5), but lack statistical significance.

The variable measuring a large change of government after the NATO summit in 2014 has a positive sign and is statistically significant at the 1% level in columns (1) to (4) and at the 10% level when year fixed effects are added in column (5). The positive estimate for the large change of government is attributed to the United States because it is the only country that experienced a large change of government without being below the two percent target. This estimate thus reflects that the United States' average growth rate of military expenditure relative to GDP was on average lower in the years before Donald Trump assumed office than after the Trump administration was in office.<sup>12</sup> The coefficient estimate of the interaction term between countries below the two percent target and with a large change of government is negative and statistically significant at the 1% level in columns (1) to (4) and at the 5% significance level in column (5) when year fixed effects are added.

The marginal effect of a large change of government for countries below the two percent target (shown below the coefficient estimates in Table 3) is negative and statistically significant at the 1% level in column (1), at the 5% level in columns (2) and (3), at the 10% level in column (4) and again at the 5% level when year fixed effects are added in column (5). The size of the marginal effect indicates that countries below the two percent target in the previous year that experienced a large change of government decreased growth rates by up to 4.8 percentage points. The effect of 4.8 percentage points is quite large. It is almost half the size of the 9.8 percentage points increase for NATO countries which had military expenditure relative to GDP of below 2% in the previous year and did not experience a change in government ideology. And

---

<sup>12</sup> No standard error of the estimate for the large change of government is reported in column (2) because the coefficient perfectly predicts the growth rate in military expenditure relative to GDP for the United States after the large change of government in 2017. Prediction is no longer perfect and standard errors are computed when the dummy variable for rightwing governments is added in column (2).

it is larger than the 3.8% average growth rate of military expenditure relative to GDP (median: 2.3%; see Figure 4) for all NATO countries in the years after the NATO summit.

The coefficient for rightwing governments,  $Rightwing_{it}$ , and the coefficient for an upcoming election,  $Election(t+1)_{it}$ , do not turn out to be statistically significant in columns (3) to (5). The coefficients for  $War(t-1)_{it}$ , i.e. an armed conflict in the previous year, and  $Internal\ threat_{it}$  are statistically significant at the 1% level in columns (3) to (5), except for the coefficient for  $Internal\ threat_{it}$  which is significant at the 5% significance level in column (5). A war in the previous year is associated with an increase in the growth rate of military expenditure relative to GDP by up to 10.1 percentage points. The positive relationship of both previous war and internal threat and the growth rate of military expenditure relative to GDP is in line with earlier findings (Collier and Hoeffler 2007, Dunne et al. 2008, Blum 2018, 2019). The coefficient of the dummy variable  $Crimea_{it}$  is positive and statistically significant at the 10% level in column (4). The coefficients for the growth rates of GDP, population and government debt relative to GDP added in column (4) do not turn out to be statistically significant. These results do not support findings of previous studies using military expenditure as the dependent variable. Studies which control for GDP and population use larger samples and include developing countries or both developing and developed countries (Dunne et al. 2008, Albalade et al. 2012, Blum 2018, Pamp et al. 2018). We focus, however, on the rather homogeneous group of NATO countries. Samples of studies which control for government debt include European countries or NATO members, i.e. rather homogeneous groups of countries. However, these empirical models are estimated in levels or first differences rather than in growth rates (Christie 2017, Odehnal and Neubauer 2018). Column (5) also includes fixed year effects but the results hardly differ from those in column (4). The year fixed effects in column (5) do not turn out to be statistically significant except for the years 2012 and 2013, for which the fixed effect is positive and significant at the 5% and the 10% level (not reported). An F-Test on the joint significance of the fixed year effects shows that the year fixed effects are jointly significant at the 10% level.

Estimation results for changes of government which distinguish between changes from leftwing to rightwing and changes from rightwing to leftwing do not indicate that the direction of the government ideology change influences compliance with the two percent target (results not shown).

#### **4.2 Robustness Tests**

We examine the robustness of our results for large changes of government. Firstly, data on military expenditure published by NATO differ from data collected by SIPRI for some countries. The SIPRI data suggest that the United Kingdom did not comply with the two percent target in any of the years of the observation period, while France did comply with the two percent target in all years of the observation period. Turkey did comply with the two percent target in 2016 and 2017 and Poland did not comply with the two percent target in 2016 according to SIPRI data. Differences in figures for military expenditure between SIPRI, NATO and other data sources give rise to disagreements on compliance and non-compliance with the two percent target among NATO countries because countries will claim figures on own military expenditure that are favorable for them. When we use SIPRI instead of NATO data on military expenditure, inferences regarding changes of government for countries below the two percent target do not change (Table 4).<sup>13</sup> The coefficient for rightwing governments is negative and statistically significant at the 5% and 10% level in columns (3) to (5). This result is not in line with the findings of Bove et al. (2017), but it reflects the changes in growth rates of military expenditure relative to GDP for two countries: Canada had higher average growth rates for military expenditure relative to GDP after the leftwing government of Justin Trudeau replaced the rightwing government of Stephen Harper in 2015. Poland also had on average lower growth rates for military expenditure relative to GDP after the rightwing government replaced the

---

<sup>13</sup> Out of the 216 observations in the panel, 13 observations are SIPRI estimates and one observation is described to be “highly uncertain”.

center government in 2015. The coefficient of the dummy variable  $Crimea_{it}$  is positive and statistically significant at the 5% level in columns (3) to (5). Countries with a common border to Russia perceived a higher level of threat originating from Russia after Russia's annexation of Crimea in March 2014 and, therefore, increased military expenditure relative to GDP. On average, these countries increased growth rates in military expenditure relative to GDP by up to 12.7 percentage points in response to the annexation of Crimea.

Secondly, we apply a spatial lag model to account for spatial dependences in military expenditure among NATO allies. Following the Security Web concept of Rosh (1988), growth rates in military expenditure relative to GDP are likely to be influenced by neighboring countries with which a country shares a common border (Blum 2018). We therefore estimate a spatial autoregressive model (SAR) following Anselin (1988), which controls for growth rates in military expenditure relative to GDP of countries with a common land or sea border using maximum likelihood estimation.<sup>14</sup> Table 5 shows that the results hardly differ from the baseline estimation results. The coefficient estimate of the spatial lag of military expenditure relative to GDP is statistically significant at the 5% level in columns (1), (2) and (4) and indicates that countries increase the growth rate in military expenditure relative to GDP by almost 0.2 percentage points when a neighboring country increases its growth rate of military expenditure relative to GDP by 1.0 percentage points. The coefficient estimate of the spatial lag is statistically significant only at the 10% level in column (3) and does not turn out to be statistically significant in column (5).

One may well want to control for time-invariant variables that are likely to be correlated with the growth in military expenditure relative to GDP: the geographical distance to Russia and the initial level of military expenditure relative to GDP. It is conceivable that the growth in military expenditure is larger, the closer a country is located to Russia. The growth in military

---

<sup>14</sup> The binary contiguity matrix is row-standardized.

expenditure is also likely to be smaller, the larger military expenditure relative to GDP in 2010 was. We include the inverse distance between capitals of NATO countries and Moscow and military expenditure relative to GDP in 2010 and exclude fixed country effects. Geographical closeness to Russia has the expected positive sign but lacks statistical significance. Military expenditure relative to GDP in 2010 has the expected negative sign and is statistically significant in individual specifications. Including the geographical closeness to Russia and military expenditure relative to GDP in 2010 does not change the inferences regarding effects of large changes of government on the growth in military expenditure (results not shown).

## **5. Conclusion**

We have examined whether changes of government influence compliance with international agreements by means of the NATO two percent target. Whether countries reduce their efforts to increase military expenditure relative to GDP after a change of government has important implications for compliance with the two percent target in 2024, because many NATO countries are likely to experience changes of government within this ten-year period. We have used panel data for 27 NATO countries for the period 2010-2018 and found that countries that experienced a large change of government, e.g. a change of government from leftwing to rightwing or vice versa, are less likely to comply with the two percent target than countries that did not experience such a change of government after the NATO summit in 2014. Changes of government, however, do not turn out to be statistically significant when changes in government ideology are rather small, e.g. changes to or away from a center government.

The sample size with 27 NATO countries we observed from 2010-2018 is small and only few countries experienced a large change of government after the NATO summit in 2014 for which we found the negative effect on growth rates in military expenditure relative to GDP. Investigating whether changes of government influence compliance with international agreements, however, is a worthwhile endeavor, even when samples are small.



We propose that international treaties and agreements need to be designed in a way that encourage compliance even when a government that has signed the treaty or agreement is no longer in power. In an intergovernmental organization such as the NATO alliance, member states might not commit themselves to binding agreements with impending sanctions in case of non-compliance. Agreement design should therefore consider positive incentives for governments to comply, irrespective of whether the incumbent or his or her predecessor committed to the agreement.

Future research should examine what determines compliance with international treaties and agreements in policy fields other than defense policy. Findings on the determinants of compliance should help to deal with the credibility problem of national governments when committing to international agreements and how to design future international treaties and agreements.

## References

- Albalade, D., G. Bel, and F. Elias. 2012. "Institutional Determinants of Military Spending." *Journal of Comparative Economics* 40: 279-290.
- Anselin, L. 1988. *Spatial Econometrics: Methods and Models*. Kluwer Academic Publishers, Dordrecht.
- Barrett, S., and R. Stavins. 2003. "Increasing Participation and Compliance in International Climate Change Agreements." *International Environmental Agreements: Politics, Law and Economics* 3: 349-376.
- Barro, R. J., and D. B. Gordon. 1983. "A Positive Theory of Monetary Policy in a Natural Rate Model." *Journal of Political Economy* 91 (4): 589-610.
- Blum, J. 2018. "Defense Burden and the Effect of Democracy: Evidence from a Spatial Panel Analysis." *Defence and Peace Economics* 29 (6): 614-641.
- Blum, J. 2019. "The Impact of Democracy's Third Wave on National Defense Spending: Evidence from a Spatial Panel Analysis 1972-2013." Unpublished Manuscript.
- Bove, V., G. Efthyvoulou, and A. Navas. 2017. "Political Cycles in Public Expenditure: Butter vs Guns." *Journal of Comparative Economics* 45 (3): 582-604.
- Budge, I., H. Keman, and J. Woldendorp. 1993. "Political Data 1945-1990. Party Government in 20 Democracies." *European Journal of Political Research* 24 (1): 1-119.
- Cho, S.-Y., and K. C. Vadlamannati. 2012. "Compliance with the Anti-Trafficking Protocol." *European Journal of Political Economy* 28: 249-265.
- Christie, E. H. 2017. "The Demand for Military Expenditure in Europe: The Role of Fiscal Space in the Context of a Resurgent Russia." *Defence and Peace Economics*, forthcoming.
- Collier, P., and A. Hoeffler. 2007. "Unintended Consequences: Do Aid Promote Arms Races?" *Oxford Bulletin of Economics and Statistics* 69 (1): 1-27.
- Dunne, J. P., S. Perlo-Freeman, and R. P. Smith. 2008. "The Demand for Military Spending in Developing Countries: Hostility versus Capability." *Defence and Peace Economics* 19 (4): 293-302.
- George, J., and T. Sandler. 2018. "Demand for Military Spending in NATO, 1968-2015: A Spatial Panel Approach." *European Journal of Political Economy* 53: 222-236.
- Gleditsch, N. P., P. Wallensteen, M. Eriksson, M. Sollenberg, and H. Strand. 2002. "Armed Conflict 1946-2001: A New Dataset." *Journal of Peace Research* 39 (5): 615-637.
- Hartley, K., and T. Sandler. 1999. "NATO Burden-Sharing: Past and Future." *Journal of Peace Research* 36 (6): 665-680.
- Hathaway, O. 2002. "Do Human Rights Treaties Make a Difference?" *Yale Law Journal* 111: 1935-2042.
- Hovi, J., D. F. Sprinz, and A. Underdal. 2009. "Implementing Long-term Climate Policy: Time Inconsistency, Domestic Politics, International Anarchy." *Global Environmental Politics* 9 (3): 20-39.
- Huber, P.J. 1967. "The Behavior of Maximum Likelihood Estimates Under Nonstandard Conditions." *Proceedings of the Fifth Berkeley Symposium on Mathematical Statistics and Probability*: 221-233.

- Kauder, B., and N. Potrafke. 2016. "The Growth in Military Expenditure in Germany 1951-2011: Did Parties Matter?" *Defence and Peace Economics* 27 (4): 503-519.
- Keith, L. C. 1999. "The United Nations International Covenant on Civil and Political Rights: Does it Make a Difference in Human Rights Behavior?" *Journal of Peace Research* 36: 95-118.
- Kydland, F. E., and E. C. Prescott. 1977. "Rules Rather than Discretion: The Inconsistency of Optimal Plans." *Journal of Political Economy* 85 (3): 473-492.
- Langlotz, S., and N. Potrafke. 2016. "Does Development Aid increase Military Expenditure?" CESifo Working Paper No. 6088.
- Mitchell, R. B. 1994. "Regime Design Matters: Intentional Oil Pollution and Treaty Compliance." *International Organization* 48 (3): 425-458.
- Murdoch, J. C., and T. Sandler. 1984. "Complementarity, Free Riding, and the Military Expenditures of NATO Allies." *Journal of Public Economics* 25: 83-101.
- Neumayer, E. 2005. "Do International Human Right Treaties Improve Respect for Human Rights?" *Journal of Conflict Resolution* 49 (6): 925-953.
- Nordvang, E. U. 2018. "Does Politics Matter? Norwegian Defence Spending and its Political Determinants." Master Thesis, University of Oslo.
- Odehnal, J., and J. Neubauer. 2018. "Economic, Security, and Political Determinants of Military Spending in NATO Countries" *Defence and Peace Economics*, forthcoming.
- Olson, M., and R. Zeckhauser. 1966. "An Economic Theory of Alliances." *Review of Economics and Statistics* 48 (3): 266-279.
- Oneal, J. R. 1990. "Testing the Theory of Collective Action." *Journal of Conflict Resolution* 34 (3): 426-448.
- Pamp, O., F. Dendorfer, and P. W. Thurner. 2018. "Arm your friends and save on defense? The impact of arms exports on military expenditures." *Public Choice* 177: 165-187.
- Potrafke, N. 2009. "Did Globalization Restrict Partisan Politics? An Empirical Evaluation of Social Expenditures in a Panel of OECD Countries." *Public Choice* 140 (1/2): 105-124.
- Potrafke, N. 2011. "Does Government Ideology Influence Budget Composition? Empirical Evidence from OECD Countries." *Economics of Governance* 12 (2): 101-134.
- Potrafke, N. 2017. "Partisan Politics: The Empirical Evidence from OECD Panel Studies." *Journal of Comparative Economics* 45(4): 712-750.
- Potrafke, N. 2018. "Government ideology and economic policy-making in the United States – A survey." *Public Choice* 174 (1-2): 145-207.
- Plümper, T., and E. Neumayer. 2015. "Free-riding in alliances: Testing an Old Theory with a New Method." *Conflict Management and Peace Science* 32 (3): 247-268.
- Rosh, R. M. 1988. "Third World Militarization – Security Webs and the States they ensnare." *Journal of Conflict Resolution* 32 (4): 671-698.
- Sandler, T. 1993. "The Economic Theory of Alliances. A Survey." *Journal of Conflict Resolution* 37 (3): 446-483.
- Sandler, T., and J. C. Murdoch. 2000. "On Sharing NATO Defence Burdens in the 1990s and Beyond." *Fiscal Studies* 21 (3): 297-327.
- Simmons, B. A. 2000. "International Law and State Behavior: Commitment and Compliance in International Monetary Affairs." *American Political Science Review* 94 (4): 819-835.

- Vadlamannati, K. C. and A. Tamazian. 2017. "Are Left-Wing Governments Really Pro-Labor? An Empirical Investigation for Latin America." *Kyklos* 70 (1): 129-160.
- White, H. 1980. "A Heteroskedasticity-consistent Covariance Matrix Estimator and a Direct Test for Heteroscedasticity." *Econometrica* 48: 817-838.
- 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: 117–134.

**Figures**

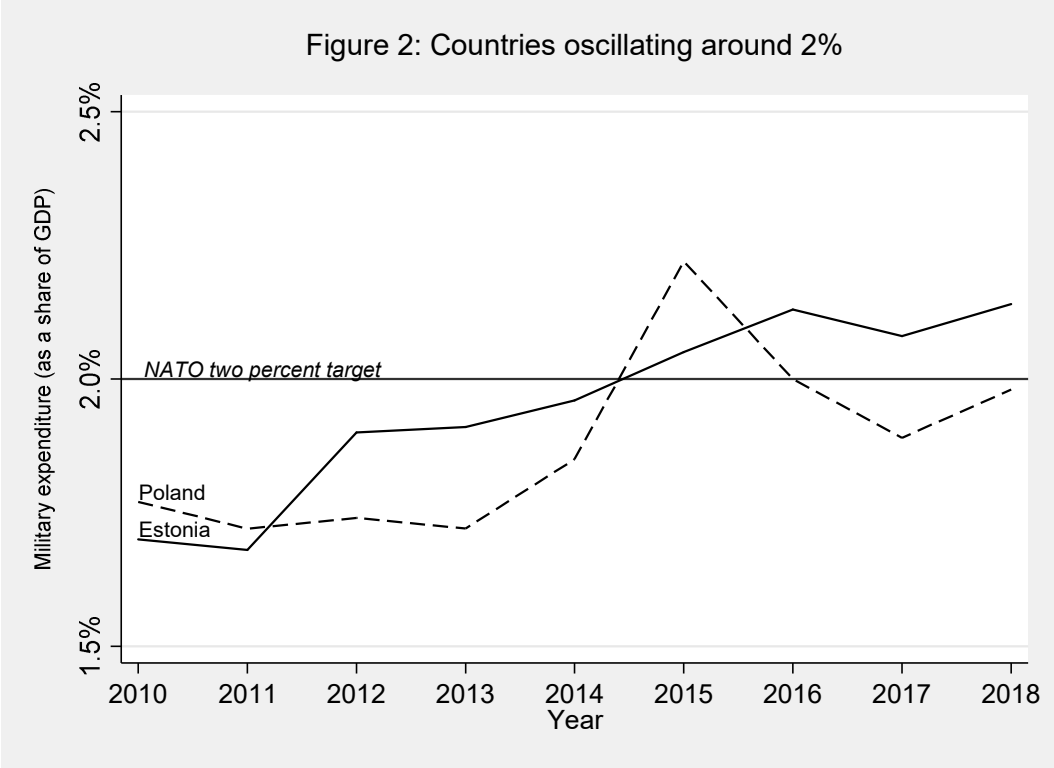
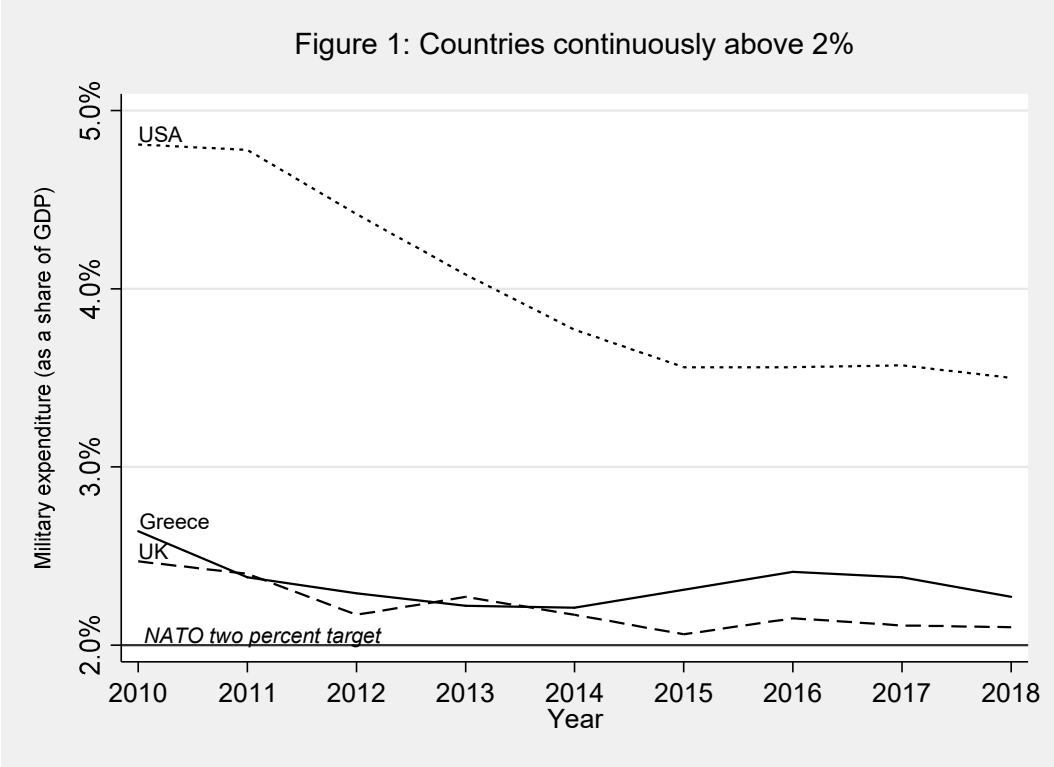


Figure 3: Countries with strong efforts towards 2%

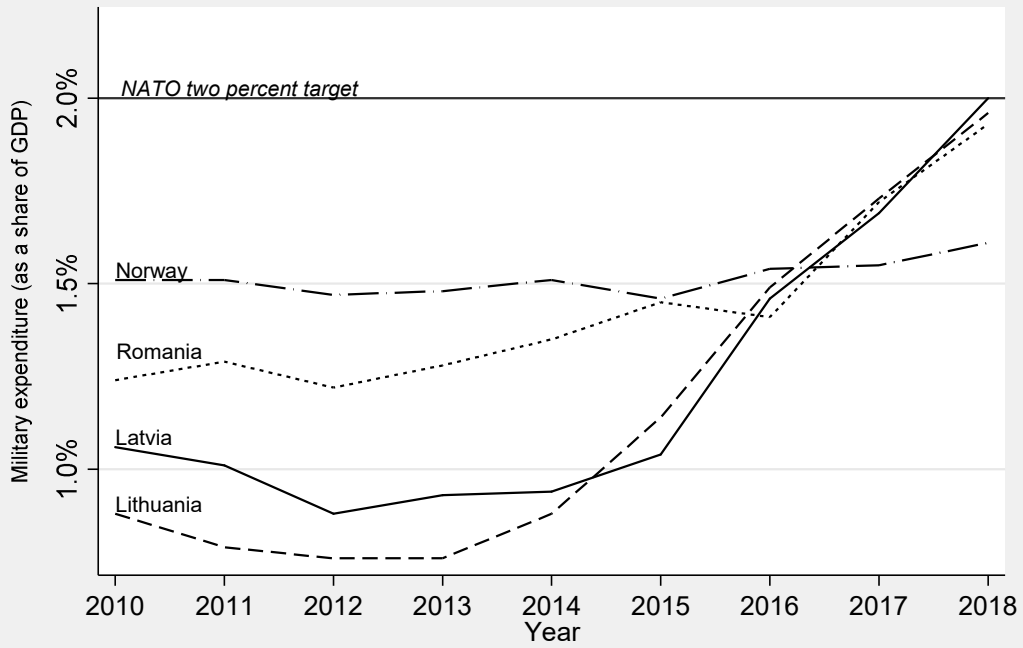


Figure 4: Growth rates 2010-2018

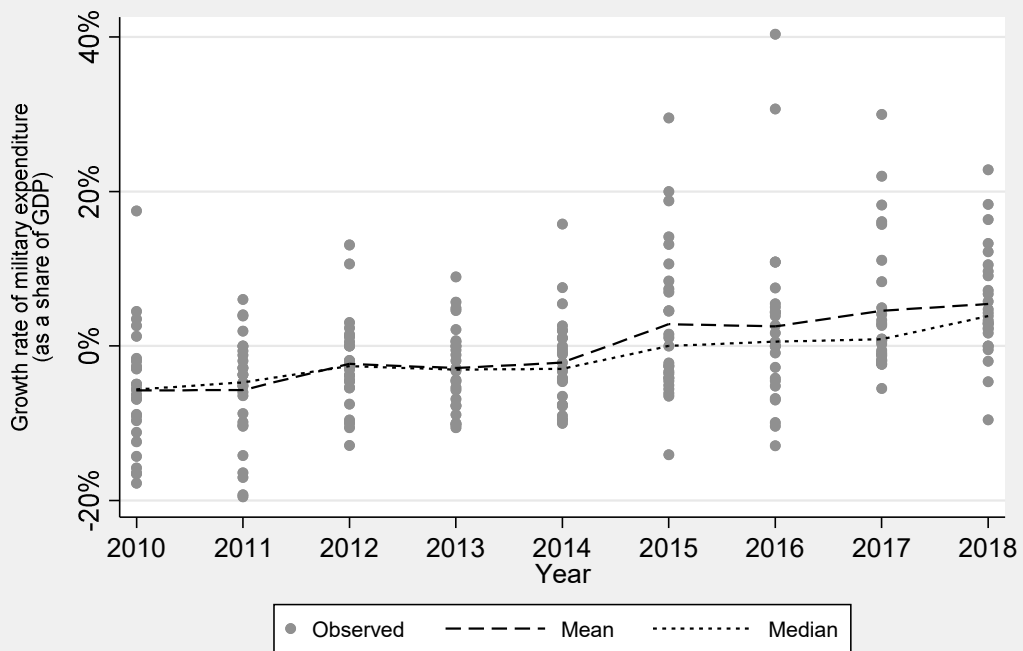
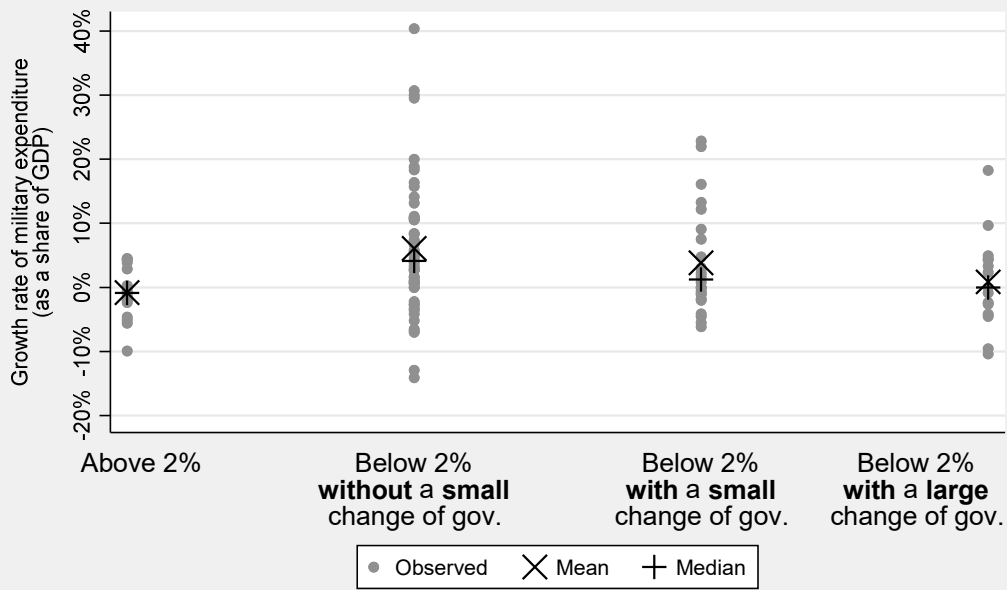


Figure 5: Growth rates 2015-2018 for countries above and below the two percent target and with and without a change of government



## Tables

**Table 1: Summary statistics**

	Observations	Mean	Std. Dev.	Min	p25	p75	Max
NATO Milexp to GDP <sup>a</sup>	243	-0.004	0.087	-0.195	-0.054	0.033	0.404
SIPRI Milexp to GDP <sup>a</sup>	216	-0.008	0.087	-0.229	-0.054	0.025	0.409
Two percent target	243	0.379	0.486	0	0	1	1
Small change since '14	243	0.119	0.325	0	0	0	1
Large change since '14	243	0.070	0.256	0	0	0	1
Rightwing	243	0.428	0.496	0	0	1	1
Election (t+1)	243	0.272	0.446	0	0	1	1
War (t-1)	243	0.070	0.256	0	0	0	1
Internal threat	243	0.066	0.341	0	0	0	2
Crimea	243	0.103	0.304	0	0	0	1
GDP <sup>a</sup>	216	0.019	0.024	-0.091	0.010	0.031	0.111
Population <sup>a</sup>	216	0.002	0.009	-0.031	-0.003	0.007	0.030
Debt-to-GDP <sup>a</sup>	216	0.029	0.098	-0.318	-0.025	0.059	0.604

<sup>a</sup> denotes variables which are expressed in year-on-year growth rates.



**Table 2: Correlations**

	NATO Milexp to GDP <sup>a</sup>	SIPRI Milexp to GDP <sup>a</sup>	Two percent target	Small change since '14	Large change since '14	Right- wing	Election (t+1)	War (t-1)	Internal threat	Crimea	GDP <sup>a</sup>	Popul- ation <sup>a</sup>	Debt-to- GDP <sup>a</sup>
NATO Milexp to GDP <sup>a</sup>	1.000												
SIPRI Milexp to GDP <sup>a</sup>	0.910	1.000											
Two percent target	0.450	0.439	1.000										
Small change since '14	0.139	0.144	0.341	1.000									
Large change since '14	0.033	0.018	0.285	-0.101	1.000								
Rightwing	-0.065	-0.077	-0.024	-0.011	0.056	1.000							
Election (t+1)	0.005	0.005	-0.038	-0.082	-0.059	0.014	1.000						
War (t-1)	-0.087	-0.073	-0.114	-0.101	0.051	0.089	0.014	1.000					
Internal threat	-0.018	-0.000	0.048	-0.071	-0.053	0.224	0.023	0.611	1.000				
Crimea	0.370	0.396	0.183	0.084	-0.093	0.063	0.006	-0.093	-0.066	1.000			
GDP <sup>a</sup>	0.157	0.183	0.263	0.113	0.030	0.076	-0.012	0.280	0.377	0.116	1.000		
Population <sup>a</sup>	-0.038	-0.056	0.014	-0.117	0.030	-0.050	-0.018	0.303	0.315	-0.147	0.136	1.000	
Debt-to-GDP <sup>a</sup>	-0.110	-0.105	-0.315	-0.141	-0.146	-0.074	0.051	-0.115	-0.152	-0.087	-0.372	-0.134	1.000

<sup>a</sup> denotes variables which are expressed in year-on-year growth rates.

**Table 3: Baseline estimation results**

NATO Milexp to GDP <sup>a</sup>	(1)	(2)	(3)	(4)	(5)
	2010-18	2010-18	2010-18	2010-17	2010-17
Two percent target	0.098*** (0.021)	0.096*** (0.021)	0.082*** (0.016)	0.075*** (0.020)	0.075** (0.030)
Small change since '14	0.021 (0.052)	0.024 (0.049)	0.014 (0.058)	0.012 (0.072)	0.005 (0.075)
Two percent target*Small change since '14	-0.040 (0.049)	-0.039 (0.048)	-0.024 (0.054)	-0.033 (0.068)	-0.036 (0.069)
Large change since '14	0.046*** (0.000)	0.055*** (0.013)	0.064*** (0.015)	0.077*** (0.014)	0.057* (0.032)
Two percent target*Large change since '14	-0.094*** (0.018)	-0.103*** (0.024)	-0.101*** (0.024)	-0.114*** (0.026)	-0.102** (0.043)
Rightwing		-0.008 (0.012)	-0.017 (0.014)	-0.017 (0.015)	-0.014 (0.015)
Election (t+1)		0.003 (0.009)	0.003 (0.009)	0.009 (0.009)	0.010 (0.009)
War (t-1)			0.101*** (0.007)	0.084*** (0.010)	0.067*** (0.015)
Internal threat			0.109*** (0.017)	0.100*** (0.027)	0.084** (0.039)
Crimea			0.072 (0.047)	0.081* (0.047)	0.083 (0.053)
GDP <sup>a</sup>				0.159 (0.380)	0.359 (0.406)
Population <sup>a</sup>				0.348 (2.341)	0.034 (2.248)
Debt-to-GDP <sup>a</sup>				0.018 (0.116)	0.031 (0.112)
Marginal Effect of Large change since '14 (if Two percent target=1)	-0.048*** (0.018)	-0.048** (0.019)	-0.037** (0.017)	-0.037* (0.021)	-0.045** (0.022)
Country Fixed Effects	yes	yes	yes	yes	yes
Year Fixed Effects	no	no	no	no	yes
Observations	243	243	243	216	216
Countries	27	27	27	27	27
R <sup>2</sup> Overall	0.222	0.224	0.101	0.093	0.141
R <sup>2</sup> Within	0.246	0.247	0.285	0.260	0.287
R <sup>2</sup> Between	0.071	0.077	0.002	0.002	0.017

Notes: Standard errors in parentheses. \*, \*\*, and \*\*\* indicate significance at the 10, 5, and 1% significance level, respectively. All regressions apply standard errors clustered at the country level.

<sup>a</sup> denotes variables which are expressed in year-on-year growth rates.

**Table 4: Robustness test with SIPRI data**

SIPRI Milexp to GDP <sup>a</sup>	(1)	(2)	(3)	(4)	(5)
	2010-17	2010-17	2010-17	2010-17	2010-17
Two percent target	0.087*** (0.022)	0.085*** (0.023)	0.065*** (0.016)	0.063*** (0.018)	0.062** (0.028)
Small change since '14	0.016 (0.045)	0.019 (0.044)	0.005 (0.055)	-0.006 (0.050)	-0.021 (0.054)
Two percent target*Small change since '14	-0.007 (0.058)	-0.004 (0.057)	0.021 (0.061)	0.033 (0.061)	0.038 (0.059)
Large change since '14	0.027*** (0.000)	0.041*** (0.013)	0.055*** (0.014)	0.057*** (0.013)	0.045 (0.027)
Two percent target*Large change since '14	-0.078*** (0.021)	-0.090*** (0.024)	-0.086*** (0.023)	-0.089*** (0.023)	-0.087** (0.038)
Rightwing		-0.013 (0.012)	-0.026** (0.013)	-0.026* (0.013)	-0.027** (0.013)
Election (t+1)		0.003 (0.011)	0.003 (0.011)	0.003 (0.011)	0.005 (0.010)
War (t-1)			0.111*** (0.014)	0.112*** (0.015)	0.089*** (0.019)
Internal threat			0.152*** (0.007)	0.168*** (0.023)	0.168*** (0.031)
Crimea			0.112** (0.046)	0.115** (0.042)	0.126** (0.048)
GDP <sup>a</sup>				0.454 (0.465)	0.784 (0.470)
Population <sup>a</sup>				0.428 (2.329)	0.113 (2.247)
Debt-to-GDP <sup>a</sup>				0.066 (0.117)	0.075 (0.111)
Marginal Effect of Large change since '14 (if Two percent target=1)	-0.051** (0.021)	-0.049** (0.023)	-0.031* (0.018)	-0.032 (0.019)	-0.042* (0.023)
Country Fixed Effects	yes	yes	yes	yes	yes
Year Fixed Effects	no	no	no	no	yes
Observations	216	216	216	216	216
Countries	27	27	27	27	27
R <sup>2</sup> Overall	0.193	0.199	0.095	0.0839	0.112
R <sup>2</sup> Within	0.213	0.216	0.303	0.311	0.346
R <sup>2</sup> Between	0.053	0.072	0.007	0.009	0.026

Notes: Standard errors in parentheses. \*, \*\*, and \*\*\* indicate significance at the 10, 5, and 1% significance level, respectively. All regressions apply standard errors clustered at the country level.

<sup>a</sup> denotes variables which are expressed in year-on-year growth rates.

**Table 5: Robustness test with a spatial autoregressive model (SAR)**

NATO Milexp to GDP <sup>a</sup>	(1)	(2)	(3)	(4)	(5)
	2010-18	2010-18	2010-18	2010-17	2010-17
Two percent target	0.088*** (0.017)	0.087*** (0.017)	0.078*** (0.015)	0.071*** (0.019)	0.081*** (0.031)
Small change since '14	0.009 (0.053)	0.012 (0.050)	0.008 (0.057)	0.008 (0.070)	0.011 (0.072)
Two percent target*Small change since '14	-0.031 (0.049)	-0.030 (0.047)	-0.020 (0.052)	-0.030 (0.067)	-0.043 (0.067)
Large change since '14	0.036*** (0.004)	0.044*** (0.014)	0.056*** (0.013)	0.057*** (0.014)	0.048 (0.031)
Two percent target*Large change since '14	-0.084*** (0.015)	-0.092*** (0.021)	-0.095*** (0.022)	-0.094*** (0.025)	-0.093** (0.041)
Rightwing		-0.008 (0.012)	-0.016 (0.013)	-0.016 (0.014)	-0.014 (0.014)
Election (t+1)		0.003 (0.008)	0.003 (0.008)	0.009 (0.008)	0.010 (0.008)
War (t-1)			0.098*** (0.007)	0.082*** (0.009)	0.065*** (0.014)
Internal threat			0.095*** (0.019)	0.088*** (0.028)	0.075* (0.039)
Crimea			0.061 (0.045)	0.071 (0.046)	0.076 (0.051)
GDP <sup>a</sup>				0.175 (0.366)	0.353 (0.387)
Population <sup>a</sup>				0.213 (2.228)	-0.062 (2.107)
Debt-to-GDP <sup>a</sup>				0.029 (0.112)	0.037 (0.107)
Spatial $\rho$	0.159** (0.064)	0.159** (0.064)	0.102* (0.053)	0.098** (0.043)	0.078 (0.051)
Error Variance $\sigma^2$	0.005*** (0.001)	0.005*** (0.001)	0.005*** (0.001)	0.005*** (0.001)	0.005*** (0.001)
Country Fixed Effects	yes	yes	yes	yes	yes
Year Fixed Effects	no	no	no	no	yes
Observations	243	243	243	216	216
Countries	27	27	27	27	27
R <sup>2</sup> Overall	0.223	0.225	0.116	0.109	0.158
R <sup>2</sup> Within	0.243	0.245	0.287	0.263	0.290
R <sup>2</sup> Between	0.086	0.0911	0.003	0.004	0.025

Notes: Standard errors in parentheses. \*, \*\*, and \*\*\* indicate significance at the 10, 5, and 1% significance level, respectively. All regressions apply standard errors clustered at the country level.

<sup>a</sup> denotes variables which are expressed in year-on-year growth rates.

## ifo Working Papers

- No. 289 Aksoy, C. G. and P. Poutvaara, Refugees' Self-selection into Europe. Who Migrates Where?, January 2019.
- No. 288 Potrafke, N., Dragnet-controls and government ideology, January 2019.
- No. 287 Drometer, M., Institutional quality and foreign aid, December 2018.
- No. 286 Nikolka, T., Family Return migration, December 2018.
- No. 285 Dahlberg, M. and M. Valeyathepillay, On the Anatomy of a Refugee Dispersal Policy: Neighborhood Integration and Dynamic Sorting, December 2018.
- No. 284 Mier, M. and C. Weissbart, Power Markets in Transition: Decarbonization, Energy Efficiency, and Short-Term Demand Response, December 2018.
- No. 283 Kauppinen, I. and P. Poutvaara, Preference for Redistribution and International Migration, December 2018.
- No. 282 Schwefer, M., Birth Order Effects and Educational Achievement in the Developing World, December 2018.
- No. 281 Simon, L. K., Shocking Choice: Trade Shocks, Local Labor Markets and Vocational Occupations Choices, December 2018.
- No. 280 Klug, T., T. Schuler and E. Mayer, The Corporate Saving Glut and the Current Account in Germany, December 2018.
- No. 279 Schwefer, M. and P. Poutvaara, Husbands' and wives' diverging perceptions on who decides, December 2018.
- No. 278 Curuk, M. and S. Sen, Climate Policy and Resource Extraction with Variable Markups and Imperfect Substitutes, November 2018.

- No. 277 Potrafke, N., Electoral cycles in perceived corruption: International empirical evidence, November 2018.
- No. 276 Potrafke, N. and F. Roesel, A banana republic? The effects of inconsistencies in the counting of votes on voting behavior, November 2018.
- No. 275 Bussolo, M., C. Krolage, M. Makovec, A. Peichl, M. Stöckli, I. Torre and C. Wittneben, Vertical and Horizontal Redistribution: The Cases of Western and Eastern Europe, November 2018.
- No. 274 Schmitt, A., Optimal Carbon Pricing and Income Taxation Without Commitment, November 2018.
- No. 273 Heinrich, M. and M. Reif, Forecasting using mixed-frequency VARs with time-varying parameters, October 2018.
- No. 272 Potrafke, N., The globalisation-welfare state nexus: Evidence from Asia, October 2018.
- No. 271 Sandkamp, A. and S. Yang, Where Has the Rum Gone? Firms' Choice of Transport Mode under the Threat of Maritime Piracy, October 2018.
- No. 270 Weissbart, C., Decarbonization of Power Markets under Stability and Fairness: Do They Influence Efficiency?, October 2018.
- No. 269 Hausfeld, J. and S. Resnjanskij, Risky Decisions and the Opportunity of Time, October 2018.
- No. 268 Bornmann, L., K. Wohlrabe and S. Gralka, The Graduation Shift of German Universities of Applied Sciences, October 2018.
- No. 267 Potrafke, N., Does public sector outsourcing decrease public employment? Empirical evidence from OECD countries, October 2018.
- No. 266 Hayo, B. and F. Neumeier, Central Bank Independence in New Zealand: Public Knowledge About and Attitude Towards the Policy Target Agreement, October 2018.
- No. 265 Reif, M., Macroeconomic Uncertainty and Forecasting Macroeconomic Aggregates, October 2018.