Democracy's Third Wave and National Defense Spending

Johannes Blum

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Abstract

I investigate how the third wave of democracy influenced national defense spending by using a panel of 110 countries for the period 1972-2013. I use new SIPRI data on military expenditure, which has been extended to years prior to 1988 and four democracy measures to address differences among democracy indices. The results from a dynamic panel data model suggest that democracy's third wave decreased defense spending relative to GDP by about 10% within countries that experienced democratization. This result does not show to be heterogeneous across world regions which the third wave reached in different sub-waves. I exploit the regional diffusion of democracy in the context of the third wave of democratizations as an instrumental variable (IV) for democracy in order to overcome endogeneity problems. The IV estimates indicate that democracy decreased national defense spending relative to GDP by about 20% within countries, demonstrating that OLS results underestimate the effect of democracy on national defense spending. The cumulative long-run effect of democratization resulting from the dynamics in defense spending is almost three times higher for both OLS and IV estimates.

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1. Introduction

Defense spending follows budget decisions taken by national governments and has been shown to be influenced by political institutions (e.g. Dunne and Perlo-Freeman 2003a, Collier and Hoeffler 2007, Albalate et al. 2012, Blum 2018). Against the backdrop of the worldwide decrease in popularity for democracy, and drastically reduced defense budgets in Western democracies since the end of the Cold War (which NATO's two percent target for defense spending relative to GDP is supposed to counteract), patterns of defense spending and the underlying policy decisions in democracies and autocracies are relevant for scholars and political decision-makers. On the one hand, defense spending describes—among others—one measure for the military capabilities of a nation state. Defense spending thus indicates how militarily powerful a country is. If democratization decreases national defense spending, democracies might also be less threatening, and democratization may alleviate arms races and help to solve security dilemmas. On the other hand, defense spending is one element of government spending and reveals different preferences for public spending between democracies and autocracies. National defense spending is, in turn, likely to give rise to indirect effects because it has been shown that defense spending affects other economic variables like economic growth (Dunne et al. 2005, Alptekin and Levine 2012), debt (Dunne et al. 2004) or productivity (Caruso and Francesco 2012) as well as national arms production (Blum 2019).

This paper contributes to the literature on how political institutions influence national defense spending. The third wave of democratizations as defined by Huntington (1991a) provides a unique setting to investigate how the spread of democracy influenced national defense spending.[1] Democracy's third wave doubled the number of democracies until 1990 and proceeded in regional sub-waves: it describes the democratizations in Southern Europe in the

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[1] Huntington (1991a, 1991b: 13-26) defines three waves of democratization to describe the global expansion of democracy: the introduction of male suffrage in the United States and in European countries describes the first wave lasting from the 1820s until 1926. The second wave accounts for democratizations after the Second World War until the 1960s in the former fascist European countries, countries like Japan, Korea and Turkey as well as in some Latin American countries which, however, quickly relapsed into autocratic regimes.

mid-1970s, in Latin America in the 1980s, in Eastern Europe in the early 1990s and in some African and Asian-Pacific countries. I investigate how political institutions in the context of the third wave of democratization influenced national defense spending for 110 countries over the period 1972-2013. I use new data on military expenditure by the Stockholm International Peace Research Institute (SIPRI), which has been extended to years prior to 1988, and estimate the impact of democracy's third wave by means of four democracy measures. I apply a dynamic panel data model and an instrumental variable (IV) approach in order to deal with endogeneity problems associated with the relationship between political institutions and defense spending. I find that democracy's third wave decreased national defense spending within countries that experienced democratization by about 10% according to OLS and by about 20% according to IV estimates.

Democracies are supposed to spend a smaller share of their GDP for defense than autocracies as a result of their government spending policies and their role within the international community. National defense spending represents a budget decision on the spending of public funds: a government chooses how much public funds it spends for defense and for civilian public goods—the so-called "guns versus butter" trade-off. In a democracy, an electorate votes the government and the median voter as the representative in a majority voting with single-peaked preferences is decisive for the outcome. The party or candidate that most closely reflects the preferences of the median voter takes over the government. The median voter in a democracy prefers spending on civilian public goods to defense spending; he regards defense spending as a necessity to ensure national security, while levels above the necessary level do not further increase his utility. Civilian public goods, in contrast, have a higher probability to further increase the median voter's utility. The median voter prefers "butter" to "guns". Civilian public goods spending, thus, crowds out defense spending because a government wants to ensure the support from the electorate (Dudley and Montmarquette 1981, Blum 2018). In an autocracy, in contrast, the government depends on the loyalty of the elites.

Governments in autocratic regimes must therefore allow these elites to extract rents to ensure political support. Rents for the military elite are particularly decisive in autocratic regimes: the lack of legitimation by an electorate requires financially well-endowed military personnel (including paramilitary forces upon which autocrats often rely) to ensure loyalty towards the government and avoid military coups (Kimenyi and Mbaku 1995, Bove and Brauner 2016). Moreover, strong armed forces are required if the autocratic leader has to use military force against an opposition to stay in power and preserve the regime (Geddes et al. 2018, Blum 2018). Scholars have found empirical evidence for high levels of government spending in perfect democracies and perfect autocracies to finance either public goods for the electorate, or rents for the elite (Plümper and Martin 2003, Hausken et al. 2004). Democracies thus sustain high levels of civilian public goods spending at the expense of defense spending to ensure political support by the electorate, while non-democratic regimes finance rents for the (military) elites to ensure loyalty among the (military) elite.[2]

Apart from the differences in the government spending policies of democracies and autocracies, scholars in the field of International Relations have extensively discussed whether democracies are more peaceful and, thus, the perceived threat originating from democracies—especially towards other democracies—is reduced compared to autocracies. Immanuel Kant's (1795) work "Perpetual Peace" represents an early political and philosophical reasoning that the spread of liberalism fosters peace and lowers the relevance of armed forces. According to the Democratic Peace paradigm, democracies do not go to war against each other. Empirical evidence for this theory exists (Doyle 1983a, 1983b, Maoz and Russett 1993, Russett and O'Neal 2001); the relationship between democracy and conflict is more complex, however (see the reviews of Hegre 2014 and Gates et al. 1996).

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[2] See also Wintrobe (1998) on the economics of autocratic regimes.

Scholars have estimated demand functions for national defense spending and found that strategic, political and socio-economic factors determine a country's demand for defense spending (Dunne and Perlo-Freeman 2003a, 2003b, Dunne et al. 2008, 2009, Fordham and Walker 2005, Collier and Hoeffler 2007, Goldsmith 2007, Rota 2011, Albalate et al. 2012, Brauner 2015, Töngür et al. 2015, Skogstad 2016, Yesilyurt and Elhorst 2017, George and Sandler 2018, Blum 2018).[3] Many of those studies control for democracy by means of the Polity IV index, and find a negative and statistically significant correlation between a country's Polity IV score and defense spending relative to GDP.

I estimate static and dynamic panel data models for a rich sample of 110 countries for the period 1972-2013, thus including the entire third wave of democratization. Democracy is hard to quantify, and different measures are not simply interchangeable and may well give rise to changing empirical results. I therefore apply four democracy measures to provide a comprehensive view on how political institutions influence national defense spending: the dichotomous democracy measure by Bjørnskov and Rode (2019), the Polity IV index by Marshall et al. (2018) and the dichotomous and continuous democracy measure by Gründler and Krieger (2016, 2018). The coefficient estimates for all four democracy measures indicate a significant negative impact of democracy on defense spending relative to GDP. The dichotomous democracy measures indicate that democracy's third wave decreased national defense spending relative to GDP by about 10% within countries that experienced democratization. Region-specific estimation results accounting for the sub-waves which reached different regions at different points in time, do not indicate that the impact of democracy's third wave on national defense spending relative to GDP has been heterogeneous across world regions. In a further step, I apply an IV strategy that exploits the regional diffusion of democracy in the context of the third wave of democratizations to overcome endogeneity

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[3] See Blum (2018) for a detailed discussion of the cited studies.

problems. Apart from internal instruments applied in a GMM model (Dunne and Perlo-Freeman 2003b), this is the first IV approach estimating the effect of democracy on national defense spending. The IV estimates indicate an effect of democracy on national defense spending of about 20%. The OLS estimates resulting from non-instrumented democracy measures thus underestimate the effect of democracy on national defense spending. The results for the lagged values of the dependent variable in the dynamic panel data model yield a multiplier for the cumulative long-run effect of democracy which is 2.9. This long-run multiplier indicates that established democracies have about 30% less defense spending relative to GDP according to OLS results and more than 50% less defense spending relative to GDP according to IV results than if the respective nations were under autocratic rule.

In line with previous studies, I estimate the demand for national defense spending as a share of GDP to measure the financial endowment and capabilities of the armed forces relative to the size of a country. This measure does not account for differences in total government spending and budget composition between democracies and autocracies. Data on defense spending as a share of total government spending has, however, not been extended by SIPRI to years prior to 1988. If democratization increases total government spending (see Aidt and Jensen 2013) and simultaneously reduces defense spending relative to GDP, it is likely that the impact of democracy on defense spending relative to total government spending exceeds the impact of democracy on defense spending relative to GDP.

2. Data and descriptive findings

2.1 SIRPI data for defense spending 1972-2013

Data for military expenditure relative to GDP is provided by the Stockholm International Peace Research Institute (SIPRI). The figures are defined for calendar years. SIPRI has extended data on military expenditure to years prior to 1988 for a large number of countries. The within-variation of the data is much more reliable than the between-variation due to differences among

countries in accounting rules and items included in the calculation of the figures. A large share of these new observations for years prior to 1988 are, however, SIPRI estimates. SIPRI states that these estimates are constructed to match official data to the SIPRI definition if necessary, and "to combine overlapping sources of data that do not agree with each other". To construct more consistent time series, "one series is generally raised or lowered by a fixed percentage so as to make it consistent with the other in the year at which they are joined. In a few cases, estimates of the whole series are made, usually based on expert analyses, to obtain a series more consistent with SIPRI's definition."[4] Therefore, estimated data is not fully reliable for the empirical analysis. Countries for which data on military expenditure are estimates for more than half of the observation period, i.e. for more than 21 years, are therefore excluded from the sample, which halves the share of estimates. Observations that are labeled as being "highly uncertain" are excluded from the analysis.[5] The sample includes all countries from the first year onwards for which continuous data for military expenditure relative to GDP and continuous data for the explanatory variables is available. A total of 110 countries for the period 1972-2013 are thus included in the empirical analysis, resulting in 2,978 observations. The sample includes the United States, Canada, and Western European countries, which all experienced almost no variation in democracy, but decreased defense spending after the end of the Cold War, as a control group.

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[4] See https://www.sipri.org/databases/milex/sources-and-methods and
https://www.sipri.org/databases/milex/frequently-asked-questions, both accessed November 9, 2019.
[5] Pakistan, Bangladesh, India, Ethiopia, Rwanda, Nigeria, Nepal, Jordan and Ghana are main troop contributors to UN peacekeeping missions as of 2013. UN peacekeeping missions represent important sources of income for these countries and increase defense expenditure as described by SIPRI data. Since no data on troop contributions by country is available for the period 1972-2013 to explain peacekeeping-induced variation in defense spending, these countries are excluded. Furthermore, India and Pakistan became nuclear powers at some unobserved point in time during the observation period, which might have caused these countries to considerably decrease defense spending relative to GDP.

2.2 Democracy measures

I apply four democracy measures in the empirical analysis to address differences among democracy indices. First, the dichotomous democracy measure by Bjørnskov and Rode (2019), which is an update of the Democracy-Dictatorship dataset by Cheibub et al. (2010). Second, the Polity IV index by Marshall et al. (2018), which is an update of the Polity III dataset by Jaggers and Gurr (1995). Third, the Dichotomous Support Vector Machines Democracy Index (DSVMDI) and, fourth, the Continuous Support Vector Machines Democracy Index (CSVMDI) by Gründler and Krieger (2016, 2018), which are both based on machine learning techniques. The dichotomous democracy measure by Bjørnskov and Rode (2019) classifies a country as a democracy if both chief executive and legislature are popularly elected, more than one party competes in the elections, and the power has alternated under identical electoral rules to those when the predecessor assumed office (Cheibub et al. 2010: 69-71). Bjørnskov and Rode (2019) label regime changes to democracy or dictatorship for the respective year in case the change occurred in the first half of the year, and for the subsequent year otherwise. The Polity IV index by Marshall et al. (2018) is a composite index measuring autocracy and democracy on a scale ranging from -10 to $+10$. It combines two composite indices for autocracy and democracy, both ranging between zero and ten and both consisting of sub-indices. These sub-indices account for the competitiveness and openness of executive recruiting, the constraints on the chief executive and the competitiveness and regulation of political participation. The Polity IV index and its components are coded as of the end of the year. The dichotomous and the continuous democracy measures by Gründler and Krieger (2016, 2018) both range within an interval of zero and one. The two democracy measures are calculated by means of machine learning algorithms for pattern recognition, which learn from example inputs without being explicitly programmed. The underlying input attributes to describe democracy are political participation and political competition as core elements of democracy, as well as independence of the judiciary and freedom of the press (Gründler and Krieger 2018).

Democracy is difficult to quantify because of challenges in "conceptualization, measurement, and aggregation" (Munck and Verkuilen 2002), i.e. democracy measures are different in the elements they regard as crucial to describe a democracy, the way of measuring these elements and the way of aggregating them to one quantitative measure. Democracy measures are not simply interchangeable, and the choice of democracy measure can considerably affect empirical results (Cheibub et al. 2010).[6] Selecting the right democracy measure for a quantitative analysis is therefore of essential methodological interest. Huntington (1991b: 11) prefers a dichotomous approach to describe the third wave of democracy. A dichotomous democracy measure provides a clear-cut definition and is easy to interpret in the empirical analysis. A continuous democracy measure, in turn, may be more precise in measuring democracy, and accounts for the process in which political institutions develop and democracies emerge. In terms of measurement error in democracy measures, a continuous measure implies many small errors, while a dichotomous measure implies few large errors (Alvarez et al. 1996).

Measurement error gives rise to biased estimates and if the bias is caused by a systematic, non-random measurement error, it cannot be solved by instrumental variables (Gründler and Krieger 2018, 2019). Such systematic measurement error is supposed to be ruled out if machine learning algorithms are applied for measuring democracy as stated by Gründler and Krieger (2016, 2018). The alternation rule in the measurement of democracy by Bjørnskov and Rode (2019) (i.e. that the power needs to have alternated in accordance with democratic rules before a country is described as a democracy) implies a non-random measurement error rooted in the conceptualization of democracy. The strength of political institutions is

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[6] The differences among the four democracy measures are tangible: a comparison between the dichotomous democracy measure by Bjørnskov and Rode (2019) and the dichotomous democracy measure by Gründler and Krieger (2016, 2018) shows considerable deviations especially for African and Asian-Pacific countries. Contingent on a threshold Polity IV score above which a country is indicated as a democracy, about 10% of the information from the Polity IV measure disagrees with the dichotomous democracy measure by Bjørnskov and Rode (2019). See Potrafke (2012, 2013) on how using the measure by Cheibub et al. (2010) changes established results and Gründler and Krieger (2016) on how machine learning based democracy measures resolve ambiguity about the relationship between democracy and economic growth.

underestimated for young democracies that did not yet experience a change of government, thus leading to an underestimation of the effect of democracy (Knutsen and Wig 2015). The most common source of a systematic, non-random measurement error lies in the aggregation of additive sub-components of democracy, particularly if the sub-components receive equal weights. Hence, most measurement errors lead to an underestimation of changes in political institutions and to an overestimation of the effect of democracy (Gründler and Krieger 2016, 2018, 2019). This systematic measurement error applies to the Polity IV index by Marshall et al. (2018). The reliability of the Polity IV index is, however, also contested for other reasons: the index is neither continuous nor cardinal, and owing to its composite nature, identical scores can result from numerous different combinations of the democracy and the autocracy index and their sub-indices. The bimodal distribution of the Polity IV index with peaks at very high and very low levels, moreover, casts doubt on whether this index contains more information than a dichotomous index (Vreeland 2008, Cheibub et al. 2010).[7] A threshold value for the Polity IV index above which a country is described as a democracy is, in turn, always arbitrary. Most studies estimating demand functions for national defense spending apply the Polity IV index to control for political institutions. I therefore apply the Polity IV index as a measure of democracy to ensure that the empirical results can be compared with previous research.

2.3 Descriptive findings on democracy's third wave and defense spending

The third wave of democracy started with the democratization of Portugal after the Carnation Revolution in 1974, and with Spain and Greece becoming democracies in the mid-1970s. It continued in Latin America in the 1980s with the democratization of countries like Argentina and Chile. The fall of the Iron Curtain triggered democratization in Eastern European countries such as Hungary and Poland in the early 1990s. Democratizations in African countries like

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[7] Following the findings of Vreeland (2008) that sub-indices of the Polity IV index are closely related to civil war, the Polity IV index might even confound the effect of democracy on defense spending with the effect of civil war on defense spending.

Kenya and Senegal as well as in Asian-Pacific countries like the Philippines and South Korea are also attributed to the third wave (Huntington 1991a, 1991b). Figure A1 in Appendix I shows two maps which indicate how the spread of democracy during the third wave changed the world's political landscape between 1972 and 2013. Reverse transitions during which some democracies relapsed into autocratic regimes marked the end of the first and second wave of democratization. However, by the time Huntington defined the three waves of democracy, the third wave was at its peak and it was not possible to foresee reverse transitions to mark the end of this third wave. The relapses of democracies such as Turkey and Venezuela into autocratic regimes in the mid-2010s might also mark the end of this third wave. The observation period from 1972 to 2013 thus ensures that the entire third wave of democracy is covered in the empirical analysis.

Figure 1 shows national defense spending relative to GDP, the dichotomous democracy measure by Bjørnskov and Rode (2019) and the Polity IV index for selected countries. Portugal remarkably decreased defense spending relative to GDP after the coup d'état and the subsequent transition to democracy from about 5% to less than 3%. Argentina reached defense spending relative to GDP of almost 5% during the rule of Perón and the subsequent military regime which lasted until 1983; defense spending decreased following democratization. The negative impact of democracy on defense spending is also visible for Chile following the end of the military dictatorship of Pinochet and for Uruguay after 1985; during the military regime in both countries, defense spending relative to GDP had reached values above 5% with a maximum of almost 9% for Chile in 1982. Albania, Hungary and Romania decreased national defense spending relative to GDP after becoming democracies. Indonesia already decreased defense spending in the run-up to democratic transition and retained low levels after becoming a democracy. Malawi retained low levels of defense spending relative to GDP after democratic transition, too. For the discussed countries, periods of democratic regime according to the
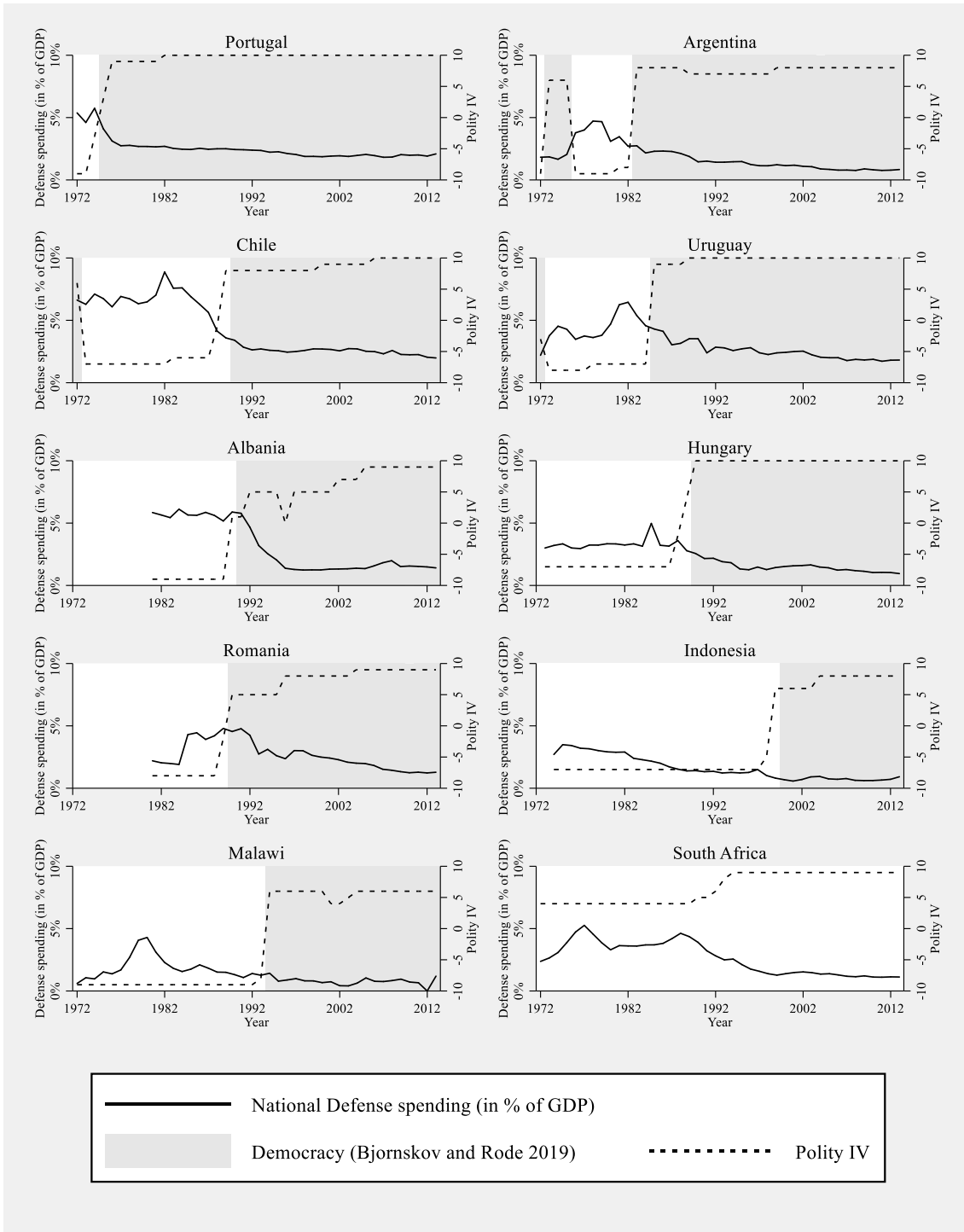
FIGURE 1: NATIONAL DEFENSE SPENDING AND DEMOCRACY IN SELECTED COUNTRIES

dichotomous democracy measure are accompanied with considerably high levels of the Polity

IV index and vice versa. South Africa is, however, not classified as a democracy according to

the dichotomous measure despite the increase to a Polity IV score of +9 which coincided with

a decrease in defense spending. Figures for North American and Western European countries

as well as for countries in the Middle East are not shown because these countries experienced almost no variation in the two democracy measures.

Table A1 in Appendix I lists the 110 countries in the sample, shows the first and last year of the continuous time series for each country and indicates whether a country experienced variation in the four democracy measures during the observation period.

3. Empirical analysis

3.1 Dynamic panel data model

I estimate a dynamic panel data model to examine how national defense spending is influenced by democracy. Persistence in defense spending and potential correlation between democracy and national defense spending prior to democratic transition require a panel model which includes dynamics of the dependent variable and thus accounts for pre-transition dynamics.[8] For instance, the denominator of the dependent variable, GDP, has been shown to experience a dip prior to democratization (Brückner and Ciccone 2011), which might give rise to pre-transition correlation between democracy and defense spending relative to GDP. The baseline model looks as follows:

$$y_{it} = \sum_{j=2}^{j=5} \beta_j \, y_{it-j} + \mu \, D_{it-1} + \boldsymbol{x_{it-1}}\boldsymbol{\delta} + \eta_i + \gamma_t + \varepsilon_{it} \tag{1}$$

The dependent variable y_{it} describes the natural logarithm of national defense spending relative to GDP for country i in year t. Using the natural logarithm of defense spending relative to GDP as the dependent variable allows to interpret the estimated coefficients as elasticities. The model follows Hamilton (2018) and Acemoglu et al. (2019) and includes four lags of the dependent

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[8] Acemoglu et al. (2019) employs a similar dynamic panel data model to estimate the effect of democracy on economic growth.

variable before regime transition. These four lags describe national defense spending relative to GDP for the period from $t - 5$ to $t - 2$ before regime transition. The lag structure of the dependent variable starts with the second instead of the first lag because the four democracy measures are all lagged by one year. An equivalent one year time lag of the dependent variable as a regressor would otherwise (depending on the timing of the transition within the year and the adjustment duration of the defense budget) be likely to correlate with the one year time lag of regime transition. The dynamic panel data model includes four lags of the dependent variable for two reasons: First, sequential exogeneity—the standard assumption for linear dynamic panel data models—needs to be fulfilled. This assumption is less demanding than strict exogeneity, which is violated once a lagged dependent variable is included in the regression. Sequential exogeneity requires that democracy and past levels of defense spending are orthogonal to current and future shocks to national defense spending as well as that the error term ε_{it} is not serially correlated. A lag structure of national defense spending that includes a sufficiently long pre-transition period accounts for dynamics in national defense spending which may influence the likelihood of regime transition. A sufficiently large lag structure of the dependent variable, moreover, rules out serial correlation in the error term. Second, consistent estimates require that conditional on fixed effects and control variables, national defense spending relative to GDP and each of the democracy measures follow stationary processes. National defense budgets are likely to be persistent and scholars have shown that past values of defense spending relative to GDP explain their current values (Dunne and Perlo-Freeman 2003b, Rota 2011). Including four lags of the dependent variable creates stationary time series with high probability (Hamilton 2018). The inclusion of lagged dependent variables gives rise to biased within-estimates with an asymptotic bias of order $1/T$ since the strict exogeneity assumption does not hold in dynamic panel data models (Nickell 1981). However, with an average of 31 year-observations per country estimated in the dynamic panel data model, this bias is supposed to be rather small.

I separately include four democracy measures D_{it-1} in the dynamic panel data model: the Bjørnskov and Rode (2019) dichotomous democracy measure *Democracy$_{it-1}$*, the Polity IV index *Polity IV$_{it-1}$* by Marshall et al. (2018), the Dichotomous Support Vector Machines Democracy Index *DSVMDI$_{it-1}$* and the Continuous Support Vector Machines Democracy Index *CSVMDI$_{it-1}$*—both by Gründler and Krieger (2016, 2018).[9] Each of the democracy measures enters the regression with a one year time lag to take account of a reaction time until budgetary adjustments become effective, as well as to mitigate possible problems of reverse causality between democracy and national defense spending. Given the coding rule of the dichotomous democracy measure by Bjørnskov and Rode (2019), this one year time lag effectively allows for a transition phase between more than half a year and less than one and a half years after the regime change until defense spending is adjusted. The time lag of the Polity IV variable effectively codes the Polity IV index as of the beginning of the year, and allows for at least one calendar year after a change in the Polity IV score until budgetary adjustments become effective.

The dynamic panel data model includes both country fixed effects η_i and year fixed effects γ_t. The empirical model thus exploits the within variation in national defense spending. The within-analysis is favorable because, as mentioned earlier, SIPRI data is more reliable over time than across countries. Year fixed effects account for global trends in defense spending which are particularly pronounced from the Cold War to the post-Cold War era. The standard errors ε_{it} are clustered at the country level and robust to serial correlation and heteroskedasticity (Huber/White/sandwich standard errors; see Huber 1967 and White 1980).

The $1 \times K$ vector $\boldsymbol{x_{it-1}}$ contains five control variables, which are all lagged by one year. The parameters of the control variables are included in the $K \times 1$ vector $\boldsymbol{\delta}$. The set of control variables includes two strategic and three socio-economic variables: *War$_{it-1}$* is a dummy

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[9] I apply the variable "Polity2" from the Polity IV dataset which prorates the Polity IV index for the duration of interregnum periods.

variable which 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. The time lag for measuring the impact of war reflects that national defense spending increases with a time lag once a country is involved in a violent conflict, and decreases with a time lag once a conflict has ended because the country then needs to demobilize and replenish military resources. Data for armed conflicts is taken from the "UCDP/PRIO Armed Conflict Dataset" by Gleditsch et al. (2002) (Version 17.2). *Internal threat$_{it-1}$* describes a country's internal stability and the probability of a domestic conflict, which is proxied by means of an eleven-point index for internal violence that is lagged by one year. Data on internal violence is taken from the "Major Episodes of Political Violence (MEPV) and Conflict Regions, 1946-2016" dataset (Version July 25, 2017). Few studies have controlled for internal threat but both variables *War$_{it-1}$* and *Internal threat$_{it-1}$* have shown to explain variance in national defense spending relative to GDP (Blum 2018, Blum and Potrafke 2019). *GDP$_{it-1}$* describes the natural logarithm of GDP in constant (2010) US dollars in year $t-1$ to investigate possible income or substitution effects (Dunne et al. 2008, Albalate et al. 2012, Blum 2018). GDP also needs to be controlled for because transitions to democracy can cause or at least be accompanied by higher economic growth (Acemoglu et al. 2019, Papaioannou and Siourounis 2008). *Population$_{it-1}$* describes the natural logarithm of a country's population in year $t-1$. The data for GDP and Population is taken from the World Development Indicators of the World Bank.[10] Scholars have controlled for trade to detect peaceful effects of economic integration or increased defense spending to protect trade routes. The results on trade are, however, mixed (Dunne and Perlo-Freeman 2003b, Dunne et al. 2008, Blum 2018). *Trade globalization$_{it-1}$* controls for the level of trade in year $t-1$ to detect possible

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[10] Data for GDP is not available for the entire observation period for Hungary, Poland and Romania. SIPRI data for military expenditure in levels and in shares of GDP have therefore been used to construct GDP figures for those countries. This procedure is intended to accurately capture variation in GDP over time for those countries. GDP data from the World Bank should, however, not be compared with GDP data compiled from SIPRI figures; this issue is, however, mitigated because the fixed effects model exploits the within-variation of countries only.

attenuation effects of trade on national defense spending. This variable measures the de facto globalization in terms of international trade and considers trade in goods, trade in services and trade partners' diversification. The data on trade globalization is taken from the KOF Globalization Index (Dreher 2006, Gygli et al. 2019). Table A2 and A3 in Appendix I show summary statistics and correlations for all variables applied in the estimation.

3.2 Estimation results

I estimate the panel model in three steps. First, I estimate equation (1) without lags of the dependent variable, i.e. a static panel data model, and without control variables. The static panel data model allows to include 110 countries with a total of 2,978 observations. Panel A of Table 1 shows estimation results for the four democracy measures with country and year fixed effects only. The correlation of the four democracy measures conditioned on country and year fixed effects yields negative estimates for all democracy measures. The Bjørnskov and Rode (2019) dichotomous democracy measure (*Democracy*) in column (1) is statistically significant at the 5% level and indicates that democracy decreases national defense spending relative to GDP by 18% within countries.[11] The three other democracy measures in columns (2) to (4) are statistically significant at the 1% level. A one-point change in a country's *Polity IV* score is associated with a decrease in national defense spending relative to GDP by 2.2%. The impact of democracy is 22% for the Dichotomous Support Vector Machines Democracy Index (*DSVMDI*) and—assuming a hypothetical change from zero to one—30% for the Continuous Support Vector Machines Democracy Index (*CSVMDI*).

Second, I add control variables to the static panel data model in panel B of Table 1. The coefficient estimates for the four democracy measures do hardly change in both size and statistical significance. A war turns out with a positive coefficient estimate which is significant

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[11] Note that the percentage impact of democracy, i.e. when the democracy dummy switches to one, is calculated as $100[\exp(-0.196) - 1] = -17.8$.

at the 1% level in columns (1) through (4). The increase in defense spending relative to GDP during wartime—an impact of 26% according to the coefficient estimate in column (1)—shows the economic significance of the impact of democracy: the negative impact of democracy on national defense spending relative to GDP according to the two dichotomous democracy measures in columns (1) and (3) is almost as large as the positive impact of a war. The impact of war on national defense spending further illustrates the "peace dividend", i.e. the decreased level of defense spending during the absence of armed conflicts. Internal threat and the coefficients of the three socio-economic variables for GDP, population and trade globalization

TABLE 1: ESTIMATION RESULTS FOR THE STATIC PANEL DATA MODEL

National defense spending (in % of GDP)[a]	(1)	(2)	(3)	(4)
Panel A: Without control variables				
Democracy $(t-1)$	-0.196**			
	(0.095)			
Polity IV $(t-1)$		-0.022***		
		(0.007)		
DSVMDI $(t-1)$			-0.250***	
			(0.069)	
CSVMDI $(t-1)$				-0.350***
				(0.098)
Country Fixed Effects	yes	yes	yes	yes
Year Fixed Effects	yes	yes	yes	yes
Observations	2,978	2,978	2,978	2,978
Countries	110	110	110	110
R^2 Overall	0.125	0.158	0.134	0.143
R^2 Within	0.197	0.210	0.207	0.206
R^2 Between	0.061	0.098	0.113	0.121
Panel B: With control variables				
Democracy $(t-1)$	-0.216**			
	(0.098)			
Polity IV $(t-1)$		-0.023***		
		(0.007)		
DSVMDI $(t-1)$			-0.240***	
			(0.071)	
CSVMDI $(t-1)$				-0.358***
				(0.098)
War $(t-1)$	0.235***	0.233***	0.211***	0.229***
	(0.062)	(0.066)	(0.060)	(0.063)
Internal threat $(t-1)$	0.021	0.013	0.018	0.016
	(0.024)	(0.022)	(0.021)	(0.022)
GDP[a] $(t-1)$	-0.136	-0.164	-0.152	-0.166
	(0.163)	(0.162)	(0.160)	(0.164)
Population[a] $(t-1)$	0.138	0.193	0.196	0.210
	(0.272)	(0.272)	(0.271)	(0.274)
Trade globalization $(t-1)$	0.003	0.002	0.003	0.002
	(0.004)	(0.004)	(0.004)	(0.004)
Country Fixed Effects	yes	yes	yes	yes
Year Fixed Effects	yes	yes	yes	yes
Observations	2,978	2,978	2,978	2,978
Countries	110	110	110	110
R^2 Overall	0.060	0.064	0.063	0.060
R^2 Within	0.217	0.227	0.223	0.224
R^2 Between	0.002	0.005	0.009	0.008

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. [a] denotes variables which are expressed in their natural logarithm.

do not turn out to be statistically significant. The lack of statistical significance for GDP and population contradicts earlier findings (Collier and Hoeffler 2007, Dunne et al. 2008, Blum 2018). The result for GDP suggests that no substitution effect exists when GDP increases, which means that defense spending increases in proportion to GDP.

Third, I include the four lags of the dependent variable and thus estimate the dynamic panel data model as described by equation (1). The lag structure reduces the number of countries from 110 to 95 (the number of countries is reduced by those countries with too short observation periods) and the total number of observations from 2,978 to 2,455. Table 2 shows that compared to Table 1, the coefficient estimates of all democracy measures are about half the size, but still statistically significant at the same levels once dynamics of the dependent variable are included in the model. The impact of democracy on national defense spending relative to GDP is reduced to 9% (*Democracy*), 1.1% (for a one-point increase in *Polity IV*), 12% (*DSVMDI*) and 16% (*CSVMDI*; for a hypothetical change from zero to one). Likewise, the coefficient estimates for a war are approximately halved in size. A Wald test does not reject the null hypothesis of equality of the two dichotomous democracy measures (columns 1 and 3). In columns (1) through (4), the second lag of the dependent variable is positive and statistically significant at the 1% level and the fourth and fifth lag of the dependent variable are statistically significant at the 5% level; however, the fourth lag has a negative sign. The results for the second lag of the dependent variable—a coefficient of 0.672 in column (1)—indicate considerable persistence in national defense spending relative to GDP and show that empirical models estimating demand functions for national defense spending should account for the dynamics in national defense spending. The results for the lag structure of the dependent variable yield a multiplier for the cumulative long-run effect of democracy of 2.9.[12] The implied long-run effect of democracy in

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[12] Note that the cumulative long-run effect of democracy is calculated as $\hat{\mu} * (1 - \sum_{j=2}^{5} \hat{\beta}_j)^{-1}$ with $\hat{\mu}$ being the parameter estimate for the democracy measure, $\hat{\beta}_j$ being the parameter estimate for the jth lag of the dependent variable and $(1 - \sum_{j=2}^{5} \hat{\beta}_j)^{-1}$ describing the long-run multiplier for parameter estimates in a dynamic panel data model (see Acemoglu et al. 2019). The long-run multiplier according to column (1) is thus calculated as $(1 - (0.672 - 0.011 - 0.029 + 0.027))^{-1} = 2.9$.

the dynamic panel data model of about 30% according to the two dichotomous democracy measures thus even exceeds the coefficient estimates for democracy in the static panel data model (Table 1).[13]

TABLE 2: ESTIMATION RESULTS FOR THE DYNAMIC PANEL DATA MODEL

National defense spending (in % of GDP)[a]	(1)	(2)	(3)	(4)
Democracy (t – 1)	-0.097**			
	(0.047)			
Polity IV (t – 1)		-0.011***		
		(0.003)		
DSVMDI (t – 1)			-0.123***	
			(0.033)	
CSVMDI (t – 1)				-0.175***
				(0.038)
War (t – 1)	0.123***	0.125***	0.115***	0.124***
	(0.034)	(0.036)	(0.034)	(0.035)
Internal threat (t – 1)	0.001	-0.003	-0.001	-0.001
	(0.006)	(0.005)	(0.005)	(0.005)
GDP[a] (t – 1)	0.066	0.050	0.054	0.046
	(0.052)	(0.053)	(0.053)	(0.054)
Population[a] (t – 1)	-0.025	0.010	0.008	0.018
	(0.134)	(0.132)	(0.134)	(0.135)
Trade globalization (t – 1)	0.000	0.000	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)
National defense spending (% of GDP)[a] (t – 2)	0.672***	0.660***	0.661***	0.660***
	(0.059)	(0.058)	(0.058)	(0.059)
National defense spending (% of GDP)[a] (t – 3)	-0.011	-0.013	-0.008	-0.009
	(0.057)	(0.057)	(0.056)	(0.057)
National defense spending (% of GDP)[a] (t – 4)	-0.029**	-0.030**	-0.030**	-0.030**
	(0.013)	(0.013)	(0.013)	(0.013)
National defense spending (% of GDP)[a] (t – 5)	0.027**	0.028**	0.028**	0.028**
	(0.011)	(0.011)	(0.011)	(0.011)
Country Fixed Effects	yes	yes	yes	yes
Year Fixed Effects	yes	yes	yes	yes
Observations	2,455	2,455	2,455	2,455
Countries	95	95	95	95
R^2 Overall	0.856	0.854	0.849	0.850
R^2 Within	0.643	0.647	0.647	0.646
R^2 Between	0.932	0.928	0.922	0.924

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. [a] denotes variables which are expressed in their natural logarithm.

3.3 Robustness tests

Several robustness tests confirm the empirical results on democracy and national defense spending. First, the lags of the dependent variable from $t - 5$ to $t - 2$ reduce the number of observations per country, and eliminate countries with too short observation periods in the dynamic panel data model. I therefore replicate Table 1 with the same 95 countries employed

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[13] A Hausman test for a fixed effects versus a random effects model confirms that the fixed effects model is the proper model of choice as opposed to a random effects model.

in the dynamic panel data model in Table 2. Table A4 in Appendix II shows that the estimation results are almost unchanged.[14]

Second, the observation period includes the period after the 2007/2008 financial crisis, which has shown to considerably influence empirical results (Eberhardt 2019). I therefore estimate the dynamic panel data model for years until 2006, i.e. exclude years after 2006, to rule out that the empirical results are sensitive to sample selection. Table A5 in Appendix II shows that the empirical results for the dynamic panel data model hardly change though the number of observations is considerably reduced from 2,455 to 1,828.

Third, countries did not exclusively experience transition from autocracy to democracy; they also experienced transition from democracy to autocracy or even several transitions from and to democracy and autocracy. I therefore exclude countries with reverse transitions, i.e. transition from democracy to autocracy. For countries with multiple transitions which later turned to a democracy, I exclude the period of the reverse transition and only include the period from the last autocratic regime onwards. This sample with fewer countries and observations allows to confirm that the effect of democracy on defense spending is indeed an effect of transition towards democracy, rather than an effect of increased defense spending after transition to autocracy. Table A6 in Appendix II shows that the estimation results for the dynamic panel data model hardly change.

Fourth, the type of autocratic regime prior to democratization might influence the estimation results because of considerable differences among different types of autocratic regimes. Two kinds of autocratic regimes need to be examined in more detail because most countries during the third wave experienced transition towards democracy initiating from these regime types: military regimes and communist regimes. Military dictatorships have shown to voluntarily hand over their power to civilian governments and—unlike civilian autocracies—

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[14] The number of observations in Table A4 in Appendix II is larger than in Table 2 because the absence of lagged dependent variables allows to include more year observations for each country.

may have even planned democratization (Wintrobe 1990, Bjørnskov 2019). Military regimes may well influence the development of political institutions on the road towards democracy and ensure that the military elite maintains its rents and privileges. The impact of democratization on national defense spending is thus likely to be reduced for military autocracies compared to civilian autocracies which experience democratization. I therefore estimate the dynamic panel data model excluding all countries that have ever been military dictatorships during the observation period. Table A7 in Appendix II shows that the dichotomous democracy measure by Bjørnskov and Rode (2019) does no longer turn out to be statistically significant. The coefficient estimates for the other three democracy measures are larger compared to the baseline results in Table 2 and confirm that military dictatorships which turn into a democracy decrease national defense spending to a lesser extent than civilian autocracies experiencing democratization. Communist regimes might have higher government spending in general compared to other autocratic regimes because of a larger government size and the government's interference with the economy. The effect of democracy on defense spending relative to GDP might therefore be driven by a decline in government spending in general. I therefore estimate the dynamic panel data model excluding all countries that have ever been communist autocracies during the observation period. Table A8 in Appendix II shows that the dichotomous democracy measure by Bjørnskov and Rode (2019) is statistically significant at the 10% level only, however, the coefficient estimates for the other three democracy measures do hardly change.[15] This result complies with the finding that government size in communist countries is not likely to differ considerably from other autocratic regimes (Kammas and Sarantides 2019).[16]

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[15] Note that military dictatorships and communist regimes are not mutually exclusive. Countries like Albania, Poland and Laos were military and communist regimes at the same time according to Bjørnskov and Rode (2019).
[16] Government ideology has been shown to influence defense spending (Whitten and Williams 2011, Bove et al. 2017, Potrafke 2020). Government ideology of the chief executive (taken from the Database of Political Institutions) as an additional control variable does, however, not turn out to be statistically significant and does not change the results on democracy. Controlling for government ideology implies a considerably limited sample since many governments cannot be categorized by means of leftwing-rightwing patterns (results not reported).

Fifth, the dynamic panel data model includes four lags of the dependent variable, thus following Acemoglu et al. (2019) and Hamilton (2018), to account for possible pre-transition correlation between democracy and defense spending. The time horizon of such pre-transition correlation might, however, be differently specified with regard to defense spending dynamics. I therefore examine whether the estimation results change once dynamics of defense spending relative to GDP are increased or reduced. The estimation results for the four democracy measures hardly change for extended dynamics in defense spending up to the tenth lag. When the lag structure is reduced to one, two, or three lags, the dichotomous democracy measure by Bjørnskov and Rode (2019) no longer turns out to be statistically significant, while the results for the remaining democracy measures remain robust. This result also holds once the lag structure of defense spending starts with the first instead of the second lag (results not reported).

3.4 Regional effect heterogeneity

Section 3.3 shows that military regimes and communist regimes experiencing transition towards democracy only slightly differ from other pre-transition regime types regarding how democratization affects national defense spending. The impact of democracy on national defense spending has, however, been shown to be heterogeneous across countries (Blum 2018). With regard to the third wave, the effect of democracy on defense spending might be heterogeneous across the sub-waves that reached different regions at different points in time. I estimate interaction terms of the four democracy measures with seven geopolitical world regions in the dynamic panel data model jointly with the respective non-interacted democracy measure for all countries. The results thus allow to infer whether the effect of democracy for one of the seven regions deviates from the democracy effect estimated across all countries in the sample, i.e. whether region-specific heterogeneity exists.

Table A9 in Appendix II shows the estimation results. The dynamic panel data models estimated in panels A through G include all 95 countries that can be included in the dynamic

analysis. In each panel, the interaction between one world region with the four democracy measures is estimated. The coefficient estimates for the non-interacted four democracy measures in panels A through G are similar to the results shown in Table 2. For countries in Latin America and Eastern Europe, however, the Bjørnskov and Rode (2019) dichotomous democracy measure does no longer turn out to be statistically significant (column 1 of panels C and D). This result indicates that the statistical significance of this democracy measure shown in Table 2 is partially attributed to democratizations in Latin American and Eastern European countries. The negative though not statistically significant interaction terms for all four democracy measures in panel D, moreover, indicate that the negative impact of democracy on national defense spending is somewhat more pronounced for Eastern European countries. The positive though only weakly statistically significant interaction terms for the democracy measures in panel E, in turn, indicate that the negative impact of democracy is somewhat less pronounced for Southern European countries.[17] For the other world regions, however, the interaction terms of the four democracy measures with each region have both positive and negative signs (panels A, B, C, and G) from columns (1) to (4). Yet the interaction terms almost never reach statistical significance. The results do not show a distinct pattern in region-specific deviations from the estimated general effect of democracy shown in Table 2. Considerable region-specific heterogeneity in the effect of democracy on national defense spending is, therefore, unlikely to exist for the third wave of democratization.

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[17] The positive and statistically significant interaction terms for countries in Western Europe and North America in columns (2) and (4) of panel F are attributed to minor changes in the Polity IV score for Belgium and the United States, and minor changes in the continuous democracy measure by Gründler and Krieger (2016, 2018). No coefficient estimates for the dichotomous democracy measures are estimated for countries in Western Europe and North America (columns 1 and 3 of panel F), because these countries did not experience any variation in these two democracy measures between 1972 and 2013.

4. Instrumental variable (IV) approach

4.1 IV strategy and exclusion restriction

The results for all four democracy measures in Tables 1 and 2 corroborate the considerations from Section 1 that the third wave of democratizations decreased national defense spending relative to GDP within countries that experienced democratization. The estimated impact of democracy on national defense spending might, however, be biased if democracy is endogenous. First, unobserved developments prior to democratic transition might drive both democratization and defense spending cuts within a country and give rise to omitted variable bias. Second, reverse causality might further give rise to endogeneity if the size of the military sector influences the chances for a regime change. The dynamic panel data model which includes country fixed effects and dynamics of the dependent variable accounts for time-invariant country characteristics and possible pre-transition correlation between democracy and defense spending. However, a remaining source of endogeneity bias that the dynamic panel data model cannot rule out relates to time-variant unobservables. Third, measurement error in democracy indices is likely because—as discussed in Section 2.2—democracy is difficult to quantify. To overcome these endogeneity concerns and yield consistent estimates for the effect of democracy, I apply an IV strategy that exploits regional sub-waves in the context of democracy's third wave as an instrumental variable for democracy. This IV strategy alleviates concerns regarding omitted variable bias and reverse causality as well as biases resulting from random measurement error. Nonetheless, biases resulting from systematic, non-random measurement error are not remedied by means of an instrumental variable.

The third wave of democracy offers a suitable setting for this IV strategy because the third wave proceeded in regional waves from Southern Europe in the mid-1970s via Latin America in the 1980s to Eastern Europe in the early 1990s, also hitting countries in Africa and Asia in cohesive patterns. Acemoglu et al. (2019) use this IV strategy to estimate the causal effect of democracy on growth and argue that "this regional pattern reflects the diffusion of the

demand for democracy […] across countries within a region, which tend to have similar histories, political cultures, practical problems, and close informational ties." I therefore treat the regional sub-waves of democracy's third wave as a "source of exogenous variation in democracy" (Acemoglu et al. 2019). I construct jackknifed democracy scores for the four democracy measures in order to describe democracy's regional diffusion. Each country i is therefore allocated to a geopolitical region R_i together with other countries $\tilde{\imath}$ which are in geographic proximity and share similar cultures and histories. For each country i, the set $L_i = \{\tilde{\imath} : \tilde{\imath} \neq i, R_{\tilde{\imath}} = R_i\}$ describes all other countries $\tilde{\imath}$ in the same region whose democracy is likely to influence democracy in country i. The jackknifed democracy instrument JDI_{it} for country i in year t is calculated as the average democracy score of the countries in set L_i, i.e. of all other countries $\tilde{\imath}$ in country i's region R_i except the democracy score of country i itself ("jackknifed" averages):

$$JDI_{it} = \frac{1}{|L_i|} \sum_{\tilde{\imath} \in L_i} D_{it} \tag{2}$$

The just-identified two-stage-least-squared (2SLS) model follows the dynamic panel data model and applies the jackknifed democracy score as an instrument for democracy:

$$D_{it-1} = \sum_{j=2}^{j=5} \lambda_j \, y_{it-j} + \theta \, JDI_{it-2} + x_{it-1}\pi + \sigma_i + \tau_t + v_{it} \tag{3}$$

$$y_{it} = \sum_{j=2}^{j=5} \beta_j \, y_{it-j} + \mu \, \widehat{D}_{it-1} + x_{it-1}\delta + \eta_i + \gamma_t + \varepsilon_{it} \tag{4}$$

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Equation (3) describes the first-stage regression which applies the jackknifed democracy score of one of the four democracy measures as an instrumental variable for the respective democracy score. The jackknifed democracy instrument is lagged by one year behind the democracy measure which is instrumented (i.e. democracy in $t - 1$ is predicted by means of jackknifed democracy in $t - 2$) because an increase in the regional diffusion of democracy is unlikely to instantly translate into an increased demand for democracy in a nearby located autocracy. Equation (4) describes the second stage that employs the instrumented democracy measure.

A valid instrumental variable needs to be relevant for describing the instrumented variable and has to fulfill the exclusion restriction. Though the relevance of the instrumental variable can be confirmed in the first-stage regression, the exclusion restriction cannot be empirically tested. The exclusion restriction is not fulfilled if the jackknifed democracy instrument influences national defense spending in country i through channels other than democracy in country i. In the following, I address two channels which are the most severe threats to the exclusion restriction: direct effects on defense spending stemming from democracy's regional diffusion and spatial dependence in defense spending.

The most obvious threat to the excludability of the instrumental variable is that the regional average level of democracy directly influences a country's defense spending relative to GDP because the perceived threat originating from democracies in the neighborhood is lower than the perceived threat originating from autocracies. According to the Democratic Peace paradigm, however, democracies are only less likely to wage war against each other—not against autocracies. The Democratic Peace paradigm does therefore not apply to autocracies prior to their democratic transition even if they are surrounded by democracies. The effect of democratic peace is a downstream effect after democratization and does—from a theoretical viewpoint—not violate the exclusion restriction. Once included in the dynamic panel data model, the jackknifed democracy scores for each democracy measure do not turn out to be statistically significant (results not reported).

Spatial dependences in defense spending would furthermore clearly violate the exclusion restriction as the regional diffusion of democracy would influence defense spending in country i not exclusively via the channel of democracy in country i itself, but also via decreased defense spending within the respective region. Scholars have shown that defense spending of neighboring countries or countries located in the same region as well as the defense spending of rivals influence a country's own level of defense spending (Dunne and Perlo-Freeman 2003a, 2003b, Dunne et al. 2008, 2009, Collier and Hoeffler 2007, Albalate et al. 2012).[18] This largely spatial relationship motivated the use of spatial lag models for estimating demand functions for defense spending. Scholars found empirical evidence for spatial dependence of national defense spending relative to GDP among countries both in cross-country analyses (Goldsmith 2007) and panel data models (Skogstad 2016, Yesilyurt and Elhorst 2017, George and Sandler 2018, Blum 2018). Though spatial dependence has been found in spatial panel data models, the model specifications in these studies differ from the model applied in my analysis: except of the analysis by Yesilyurt and Elhorst (2017), the empirical models neither include dynamics of the dependent variable to account for persistence in defense spending, nor fixed year effects to absorb common shocks. I therefore augment my dynamic panel data model by spatial dependences among countries and examine whether spatial correlation in national defense spending exists in a dynamic panel data model with both country and year fixed effects, and conditioned on strategic and socio-economic control variables. I apply a spatial autoregressive (SAR) model, which in a Bayesian model comparison has shown to be superior to other spatial lag models when demand functions for national defense spending are estimated (Yesilyurt and Elhorst 2017). The SAR model has also been applied in most previous studies in this field (Goldsmith 2007, Skogstad 2016, George and Sandler 2018). Unlike the Spatial Durbin Model (SDM), the SAR model assumes that the

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[18] These findings go back to the security web concept of Rosh (1988).

spatial lags of the explanatory variables do not turn out to be jointly significant.[19] Previous research corroborates this assumption because spatial lags of the determinants of defense spending have shown to be hardly significant (Blum 2018). Since a spatial panel model requires a strongly balanced panel, I employ two balanced panels: one for 40 countries for the entire observation period 1972-2013 and one for the period 1981-2013, which allows to include 53 countries. The 13 additional countries include further Eastern European countries since only data for Hungary is available from 1972 onwards. Due to the limited number of countries included in the spatial analysis, I apply an inverse distance matrix for the spatial weighting of observations. This matrix describes the inverse distance between the capitals of all countries included in the sample. The matrix, thus, relates all countries to one another according to their distance from each other, and carries more spatial information than a binary contiguity matrix would. The weighting matrix is row-standardized, i.e. each row sums up to one, and the model is estimated using maximum likelihood.[20] Clustered standard errors turn maximum likelihood into a pseudo maximum likelihood because the computation of clustered standard errors follows a corrected assumption about the sample distribution (Cameron and Trivedi 2009: 316-317). Likelihood-ratio tests to compare among specifications are therefore unfeasible. Table A10 in Appendix II shows the estimation results. Democracy is measured by means of the Bjørnskov and Rode (2019) dichotomous democracy measure and all columns include the full set of control variables. Columns (1) and (5) neither include country nor year fixed effects and columns (2) and (6) include country fixed effects only. The spatial autoregressive coefficient ρ is significant at the 1% level in columns (1), (2), (5) and (6) and indicates spatial dependence in defense spending relative to GDP among the countries in the sample. The spatial autoregressive coefficient does, however, no longer turn out to be statistically significant at any significance level once year fixed effects are included in columns (3) and (7); including lags of

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[19] LeSage and Pace (2009, 32-33 and 155-158) provide an overview of different spatial lag models.
[20] LeSage and Pace (2009, chapter 3) discuss maximum likelihood estimation in spatial lag models.

the dependent variable in columns (4) and (8) does not change this result. Once the spatial panel data model is fully specified and accounts for worldwide trends in defense spending from the Cold War to the post-Cold War period, spatial correlation does not further explain variance in defense spending among countries. Spatial dependences are thus unlikely to violate the exclusion restriction of the instrumental variable. The results support that the regional diffusion of democracy—measured by means of the jackknifed democracy instrument—influences national defense spending through the channel of political institutions rather than directly or through spatial dependences.

4.2 2SLS and first-stage estimation results

Table 3 shows 2SLS estimation results in panel A and first-stage results of the jackknifed democracy instrument for each of the four democracy measures in panel B. The jackknifed democracy scores for all democracy measures in panel B are statistically significant at the 1% level and the Kleibergen-Paap F-Statistics for the excluded instrument are above the 10%-critical value suggested by Stock and Yogo (2005). The first-stage results thus indicate that the jackknifed democracy scores serve as a highly relevant instrument for the respective democracy measures.[21] The 2SLS results show negative IV estimates for all four democracy measures. The Bjørnskov and Rode (2019) dichotomous democracy measure and the Gründler and Krieger (2016, 2018) dichotomous and continuous democracy measures are statistically significant at the 5% level; the Polity IV index is statistically significant at the 1% level. The IV estimates for all four democracy measures are larger and in a closer range to each other compared with the OLS estimates from the baseline dynamic panel data model. The IV estimates indicate an effect of democracy on national defense spending relative to GDP of 21% (*Democracy*), 1.4% (for a one-point increase in *Polity IV*), 17% (*DSVMDI*) and 17% (*CSVMDI*; for a hypothetical

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[21] Further lags of the jackknifed democracy instruments did not turn out to be statistically significant in the first-stage regression.

change from zero to one). A Wald test does not reject the null hypothesis of equality of the parameter estimates for the dichotomous democracy measure by Bjørnskov and Rode (2019) and the two democracy measures by Gründler and Krieger (2016, 2018). The virtually identical effect size of the dichotomous and the continuous democracy measure by Gründler and Krieger (2016, 2018) supports their credibility because both indicators are "conceptually equivalent" and supposed to yield similar estimation results (Gründler and Krieger 2018).

The larger size of the IV estimates compared to the OLS estimates shown in Table 2 indicates that OLS estimation results for the non-instrumented democracy measures underestimate the effect of democracy on national defense spending. The downward bias is likely to be attributed to the development of political institutions in the run-up of a democratization which influences national defense spending before a country is described as a democracy. Since dichotomous democracy measures are a rather rough measure of democracy, this bias is larger for the two dichotomous democracy measures (columns 1 and 3) than for the Polity IV index and the continuous democracy measure (columns 2 and 4). A second source of this downward bias is measurement error in democracy measures. The downward bias of the OLS estimates is consistent with the findings of Acemoglu et al. (2019), whose IV estimates for the effect of democracy on growth also exceed the OLS estimates.

The results for the control variables and the lags of the dependent variable hardly differ from the estimation results shown in Table 2. Again, according to the multiplier for the cumulative long-run effect of democracy, the estimated impact of democracy on national defense spending is almost three times higher in the long run. Given the IV estimates for the Bjørnskov and Rode (2019) dichotomous democracy measure and the Gründler and Krieger (2016, 2018) dichotomous and continuous democracy measures shown in Table 3, the implied long-run effect of more than 50% indicates that defense spending relative to GDP in established democracies is less than half as high as if the respective nations were under autocratic rule. The selected examples shown in Figure 1 indicate that such a long-run effect size is well plausible.

TABLE 3: TWO-STAGE-LEAST-SQUARES AND FIRST-STAGE ESTIMATION RESULTS

National defense spending (in % of GDP)[a]	(1)	(2)	(3)	(4)
Panel A: Two-stage-least-squares estimates				
Democracy (t − 1)	-0.234**			
	(0.104)			
Polity IV (t − 1)		-0.014***		
		(0.005)		
DSVMDI (t − 1)			-0.183**	
			(0.090)	
CSVMDI (t − 1)				-0.192**
				(0.095)
War (t − 1)	0.130***	0.126***	0.113***	0.125***
	(0.033)	(0.037)	(0.035)	(0.035)
Internal threat (t − 1)	-0.002	-0.005	-0.003	-0.001
	(0.007)	(0.005)	(0.006)	(0.005)
GDP[a] (t − 1)	0.034	0.038	0.037	0.042
	(0.055)	(0.054)	(0.053)	(0.057)
Population[a] (t − 1)	0.007	0.027	0.035	0.025
	(0.128)	(0.131)	(0.131)	(0.138)
Trade globalization (t − 1)	0.000	0.000	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)
National defense spending (% of GDP)[a] (t − 2)	0.659***	0.654***	0.651***	0.658***
	(0.059)	(0.057)	(0.059)	(0.059)
National defense spending (% of GDP)[a] (t − 3)	-0.008	-0.013	-0.005	-0.008
	(0.056)	(0.056)	(0.055)	(0.056)
National defense spending (% of GDP)[a] (t − 4)	-0.030**	-0.030**	-0.030**	-0.030**
	(0.013)	(0.013)	(0.013)	(0.013)
National defense spending (% of GDP)[a] (t − 5)	0.026**	0.027**	0.028**	0.028**
	(0.011)	(0.011)	(0.011)	(0.011)
Panel B: First-stage estimates *(excluded instruments only)*				
Jackknifed democracy measure (t − 2)	0.779***	1.138***	0.636***	0.801***
	(0.147)	(0.180)	(0.126)	(0.096)
Country Fixed Effects	yes	yes	yes	yes
Year Fixed Effects	yes	yes	yes	yes
Observations	2,455	2,455	2,455	2,455
Countries	95	95	95	95
R^2	0.639	0.646	0.646	0.646
Kleibergen-Paap F-Statistic	27.98	40.05	25.44	68.95
Stock-Yogo (10% rel. bias)	16.38	16.38	16.38	16.38

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. [a] denotes variables which are expressed in their natural logarithm.

5. Conclusion

I investigated how political institutions in the context of the third wave of democratization influenced national defense spending. New SIPRI data on military expenditure for years prior to 1988 allowed to examine the impact of democracy's third wave for the period 1972-2013 for 110 countries, thus including the entire third wave of democratization. Since democracy is hard to quantify and different democracy measures can yield different results, I applied four democracy measures: the dichotomous democracy measure by Bjørnskov and Rode (2019), the Polity IV index by Marshall et al. (2018) and the dichotomous and continuous democracy

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measure by Gründler and Krieger (2016, 2018). The coefficient estimates for all four democracy measures in the dynamic panel data model indicated a significant negative impact of democracy on defense spending relative to GDP, which is about 10% according to the two dichotomous democracy measures. Region-specific estimation results accounting for the sub-waves that reached different regions at different points in time did not provide evidence for effect heterogeneity across world regions. I applied an IV strategy that exploits the regional diffusion of democracy in the context of the third wave of democratizations to overcome endogeneity problems. The IV estimates indicated an effect of democracy on national defense spending of about 20%. The OLS estimates resulting from non-instrumented democracy measures thus underestimate the effect of democracy on national defense spending. For both OLS and IV estimates, the cumulative long-run effect of democratization is almost three times higher according to the dynamics in defense spending. Differences in government spending policies between democracies and autocracies and a decrease in mutually perceived threat among democratic conspecifics might lead countries to decrease defense spending after transition to democracy. The results are in line with other studies that estimate demand functions for national defense spending.

It remains open as to whether the first and second wave of democracy reduced defense spending as was the case with the third wave of democracy. The first wave took place in the era of imperialism, industrialization and the rise of the nation state in the Western world, i.e. under conditions of rivalry. The second wave occurred parallel with the onset of the Cold War, an era of system competition. Both world powers struggled for spheres of influence in a divided Europe as well as in Latin America, Africa and Asia, where they fought proxy wars (e.g. in Vietnam, Afghanistan, Angola and Ethiopia). The third wave, however, incorporates the decline and end of this bipolar system, which allowed countries to develop political institutions and liberal societies without external compulsions. The emerging democracies could reduce defense spending and avoid rent-seeking within the armed forces. Apart from its intensity and

regional diffusion, the state of the world during the third wave of democratization further makes the third wave unique compared to the first and second wave. Investigating whether and to which extent democratizations in the context of the first and the second wave of democracy decreased national defense spending would therefore be a useful starting point for future research.

The measurement of democracy remains a challenge for scholars. Political institutions are too diverse to be easily compared both among countries and over time by means of a single numeric measure. The conceptualization, i.e. the institutions defined as critical for a democratic regime, the measurement of these institutions, and the aggregation to one single measure, e.g. dichotomous or continuous, determine whether a country is described as a democracy or autocracy and often give rise to measurement error in democracy indices. Future empirical research should therefore continue to apply various democracy measures.

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Appendix I

1972

2013

■ Democracy ▢ Autocracy
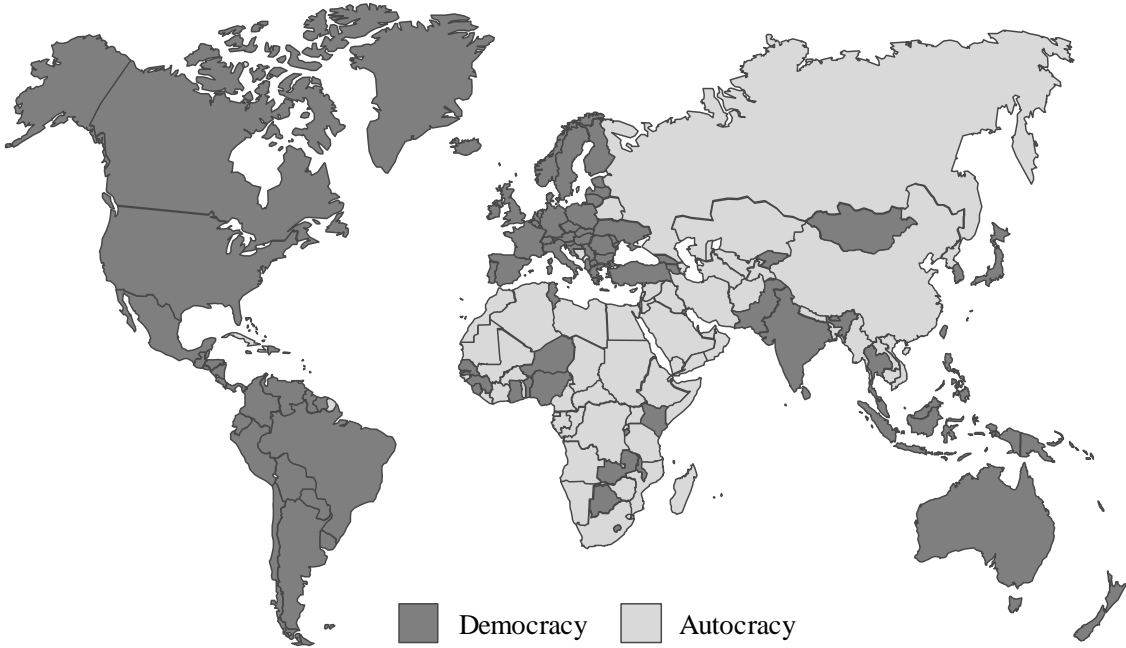
FIGURE A1: DEMOCRACIES 1972 AND 2013 ACCORDING TO THE DICHOTOMOUS DEMOCRACY
MEASURE BY BJØRNSKOV AND RODE (2019)

Notes: The 1972 map is a contemporaneous political map and does not reflect countries and borders as of 1972. The entire territory of Germany, for example, is therefore labeled as a democracy in 1972.

TABLE A1: LIST OF COUNTRIES

ID	Country	First year	Last year	Variation in democracy measures			
				Democracy	Polity IV	DSVMDI	CSVMDI
1	Albania	1981	2013	yes	yes	yes	yes
2	Algeria	1972	2013	no	yes	yes	yes
3	Angola	1985	2013	no	yes	yes	yes
4	Argentina	1972	2013	yes	yes	yes	yes
5	Armenia	1995	2013	no	yes	no	yes
6	Azerbaijan	1992	2013	no	yes	yes	yes
7	Belarus	1992	2013	no	yes	yes	yes
8	Belgium	1972	2013	no	yes	no	yes
9	Benin	2012	2013	no	no	no	yes
10	Botswana	1977	2013	no	yes	no	yes
11	Bulgaria	1989	2013	yes	yes	yes	yes
12	Burkina Faso	1972	2013	no	yes	yes	yes
13	Burundi	2012	2013	no	no	no	yes
14	Cambodia	1994	2013	no	yes	yes	yes
15	Cameroon	1972	2013	no	yes	yes	yes
16	Canada	1972	2013	no	no	no	yes
17	Central African Republic	2007	2013	no	no	yes	yes
18	Chad	2013	2013	no	no	no	no
19	Chile	1972	2013	yes	yes	yes	yes
20	Colombia	1972	2013	no	yes	no	yes
21	Croatia	1996	2013	no	yes	no	yes
22	Cuba	2009	2013	no	no	no	yes
23	Cyprus	1985	2013	no	no	no	yes
24	Czech Republic	1994	2013	no	yes	no	yes
25	Denmark	1972	2013	no	no	no	yes
26	Dominican Republic	1972	2013	no	yes	yes	yes
27	East Timor	2005	2013	no	yes	no	yes
28	Ecuador	1972	2013	yes	yes	yes	yes
29	Egypt	1972	2013	no	yes	yes	yes
30	Equatorial Guinea	2007	2009	no	no	no	yes
31	Eritrea	1994	2003	no	yes	no	yes
32	Estonia	1996	2013	no	yes	no	yes
33	Fiji	1972	2013	yes	yes	yes	yes
34	Finland	1972	2013	no	no	no	yes
35	France	1972	2013	no	yes	no	yes
36	Gabon	2010	2013	no	no	no	yes
37	Gambia	2012	2013	no	no	no	yes
38	Georgia	1996	2013	yes	yes	yes	yes
39	Germany	1972	2013	no	no	no	yes
40	Greece	1972	2013	yes	yes	yes	yes
41	Guatemala	1972	2013	yes	yes	yes	yes
42	Guinea	2012	2013	no	no	no	yes
43	Guinea-Bissau	2009	2013	yes	yes	yes	yes
44	Guyana	2000	2013	yes	no	no	yes
45	Haiti	2013	2013	no	no	no	no
46	Honduras	2000	2013	no	no	yes	yes
47	Hungary	1973	2013	yes	yes	yes	yes
48	Indonesia	1974	2013	yes	yes	yes	yes
49	Iran	1980	2013	no	yes	yes	yes
50	Ireland	1972	2013	no	no	no	yes
51	Israel	1972	2013	no	yes	no	yes
52	Italy	1972	2013	no	no	no	yes
53	Jamaica	1981	2013	no	yes	yes	yes
54	Japan	1972	2013	no	no	no	yes
55	Kenya	1972	2013	yes	yes	yes	yes
56	Kuwait	1996	2013	no	no	no	yes
57	Kyrgyzstan	1992	2013	yes	yes	yes	yes
58	Laos	1992	2013	no	no	no	yes
59	Latvia	1996	2013	no	no	no	yes
60	Lesotho	1976	2013	yes	yes	yes	yes
61	Liberia	2004	2013	yes	yes	yes	yes
62	Libya	2012	2013	no	no	yes	yes

ID	Country	First year	Last year	Variation in democracy measures			
				Democracy	Polity IV	DSVMDI	CSVMDI
63	Lithuania	1996	2013	no	no	no	yes
64	Luxembourg	1972	2013	no	no	no	yes
65	Macedonia	1996	2013	no	yes	no	yes
66	Malawi	1972	2013	yes	yes	yes	yes
67	Malaysia	1972	2013	yes	yes	yes	yes
68	Mali	1993	2013	yes	yes	yes	yes
69	Mauritania	2012	2013	no	no	no	yes
70	Mauritius	1977	2013	no	yes	no	yes
71	Moldova	1996	2013	no	yes	no	yes
72	Mongolia	1987	2013	yes	yes	yes	yes
73	Montenegro	2007	2013	no	no	no	yes
74	Morocco	1972	2013	no	yes	yes	yes
75	Mozambique	1981	2013	no	yes	yes	yes
76	Namibia	1991	2013	no	no	no	yes
77	Netherlands	1972	2013	no	no	no	yes
78	Nicaragua	1991	2013	no	yes	no	yes
79	Niger	2008	2013	yes	yes	yes	yes
80	Norway	1972	2013	no	no	no	yes
81	Oman	1972	2013	no	yes	no	no
82	Panama	1987	1999	yes	yes	yes	yes
83	Papua New Guinea	1985	2013	no	yes	no	yes
84	Poland	1981	2013	yes	yes	yes	yes
85	Portugal	1972	2013	yes	yes	yes	yes
86	Qatar	2002	2010	no	no	no	no
87	Romania	1981	2013	yes	yes	yes	yes
88	Saudi Arabia	1987	2013	no	no	no	yes
89	Senegal	1979	2013	yes	yes	yes	yes
90	Sierra Leone	2000	2013	no	yes	yes	yes
91	Singapore	1972	2013	no	no	no	yes
92	Slovak Republic	1994	2013	no	yes	no	yes
93	Slovenia	1996	2013	no	no	no	yes
94	South Africa	1972	2013	no	yes	yes	yes
95	Spain	1972	2013	yes	yes	yes	yes
96	Sudan	1990	2009	no	yes	no	yes
97	Sweden	1972	2013	no	no	no	yes
98	Switzerland	1981	2013	no	no	no	yes
99	Tajikistan	2008	2012	no	no	no	yes
100	Tunisia	1972	2013	yes	yes	yes	yes
101	Turkey	1972	2013	yes	yes	yes	yes
102	Turkmenistan	1994	1999	no	no	no	yes
103	UAE	1997	2013	no	no	no	no
104	UK	1972	2013	no	no	no	yes
105	USA	1972	2013	no	yes	no	yes
106	Uganda	1983	2013	yes	yes	yes	yes
107	Ukraine	1993	2013	no	yes	no	yes
108	Uruguay	1972	2013	yes	yes	yes	yes
109	Yemen	1992	2013	no	yes	yes	yes
110	Zambia	2004	2013	yes	yes	no	yes

TABLE A2: SUMMARY STATISTICS

	Observations	Mean	Std. Dev.	Min	p25	p75	Max
National defense spending (in % of GDP)	2978	0.029125	0.033041	1.72e-07	0.013710	0.032367	0.343764
Democracy (t – 1)	2978	0.607790	0.488325	0	0	1	1
Polity IV (t – 1)	2978	3.810947	6.919581	-10	-3	10	10
DSVMDI (t – 1)	2978	0.691404	0.461992	0	0	1	1
CSVMDI (t – 1)	2978	0.664054	0.358472	0.005817	0.346033	0.949886	0.973161
War (t – 1)	2978	0.156817	0.363689	0	0	0	1
Internal threat (t – 1)	2978	0.503358	1.429624	0	0	0	9
GDP (t – 1)	2939	4.42e+11	1.40e+12	4.57e+08	1.07e+10	2.43e+11	1.55e+13
Population (t – 1)	2978	2.37e+07	4.11e+07	342421	3960612	2.57e+07	3.14e+08
Trade globalization (t – 1)	2978	49.73571	20.54514	8.55423	32.94455	66.17088	99.55211

Note: National Defense Spending in % of GDP, GDP (t – 1) and Population (t – 1) are expressed in their absolute values.

TABLE A3: CORRELATIONS

	National defense spending (in % of GDP)[a]	Democracy (t – 1)	Polity IV (t – 1)	DSVMDI (t – 1)	CSVMDI (t – 1)	War (t – 1)	Internal threat (t – 1)	GDP[a] (t – 1)	Population[a] (t – 1)	Trade globali- zation (t – 1)
National defense spending (in % of GDP)[a]	1.000									
Democracy (t – 1)	-0.282	1.000								
Polity IV (t – 1)	-0.344	0.831	1.000							
DSVMDI (t – 1)	-0.317	0.769	0.854	1.000						
CSVMDI (t – 1)	-0.338	0.821	0.915	0.936	1.000					
War (t – 1)	0.228	-0.123	-0.172	-0.162	-0.165	1.000				
Internal threat (t – 1)	0.143	-0.166	-0.233	-0.202	-0.226	0.694	1.000			
GDP[a] (t – 1)	0.127	0.341	0.335	0.242	0.308	0.054	0.007	1.000		
Population[a] (t – 1)	0.114	0.011	-0.009	-0.020	0.011	0.269	0.243	0.689	1.000	
Trade globalization (t – 1)	-0.104	0.005	0.092	0.063	0.070	-0.268	-0.271	-0.259	-0.543	1.000

[a] denotes variables which are expressed in their natural logarithms.

Appendix II

TABLE A4: ESTIMATION RESULTS FOR THE STATIC PANEL DATA MODEL FOR 95 COUNTRIES

National defense spending (in % of GDP)[a]	(1)	(2)	(3)	(4)
Panel A: Without control variables				
Democracy (t − 1)	-0.196**			
	(0.096)			
Polity IV (t − 1)		-0.023***		
		(0.007)		
DSVMDI (t − 1)			-0.254***	
			(0.069)	
CSVMDI (t − 1)				-0.356***
				(0.099)
Country Fixed Effects	yes	yes	yes	yes
Year Fixed Effects	yes	yes	yes	yes
Observations	2,930	2,930	2,930	2,930
Countries	95	95	95	95
R^2 Overall	0.129	0.163	0.138	0.146
R^2 Within	0.198	0.211	0.208	0.207
R^2 Between	0.132	0.198	0.147	0.169
Panel B: With control variables				
Democracy (t − 1)	-0.217**			
	(0.099)			
Polity IV (t − 1)		-0.023***		
		(0.007)		
DSVMDI (t − 1)			-0.245***	
			(0.072)	
CSVMDI (t − 1)				-0.365***
				(0.099)
War (t − 1)	0.244***	0.242***	0.220***	0.239***
	(0.063)	(0.067)	(0.061)	(0.064)
Internal threat (t − 1)	0.021	0.012	0.018	0.016
	(0.024)	(0.022)	(0.021)	(0.022)
GDP[a] (t − 1)	-0.139	-0.167	-0.158	-0.173
	(0.164)	(0.162)	(0.161)	(0.165)
Population[a] (t − 1)	0.139	0.194	0.200	0.214
	(0.273)	(0.273)	(0.271)	(0.275)
Trade globalization (t − 1)	0.003	0.002	0.003	0.002
	(0.004)	(0.004)	(0.004)	(0.004)
Country Fixed Effects	yes	yes	yes	yes
Year Fixed Effects	yes	yes	yes	yes
Observations	2,930	2,930	2,930	2,930
Countries	95	95	95	95
R^2 Overall	0.062	0.066	0.063	0.060
R^2 Within	0.218	0.229	0.225	0.226
R^2 Between	0.018	0.029	0.022	0.023

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. [a] denotes variables which are expressed in their natural logarithm.

TABLE A5: ESTIMATION RESULTS FOR THE DYNAMIC PANEL DATA MODEL UNTIL THE 2007/2008 FINANCIAL CRISIS

National defense spending (in % of GDP)ᵃ	(1)	(2)	(3)	(4)
Democracy (t – 1)	-0.086*			
	(0.046)			
Polity IV (t – 1)		-0.010***		
		(0.003)		
DSVMDI (t – 1)			-0.106***	
			(0.032)	
CSVMDI (t – 1)				-0.159***
				(0.038)
War (t – 1)	0.129***	0.129***	0.118***	0.127***
	(0.032)	(0.033)	(0.034)	(0.033)
Internal threat (t – 1)	0.014	0.010	0.012	0.012
	(0.009)	(0.009)	(0.010)	(0.009)
GDPᵃ (t – 1)	0.139**	0.107	0.122*	0.107
	(0.069)	(0.068)	(0.065)	(0.067)
Populationᵃ (t – 1)	-0.147	-0.100	-0.099	-0.087
	(0.133)	(0.136)	(0.131)	(0.134)
Trade globalization (t – 1)	-0.001	-0.001	-0.001	-0.002
	(0.001)	(0.001)	(0.001)	(0.001)
National defense spending (% of GDP)ᵃ (t – 2)	0.602***	0.591***	0.593***	0.592***
	(0.053)	(0.052)	(0.053)	(0.054)
National defense spending (% of GDP)ᵃ (t – 3)	-0.001	-0.003	-0.000	-0.001
	(0.046)	(0.045)	(0.046)	(0.046)
National defense spending (% of GDP)ᵃ (t – 4)	-0.029**	-0.028**	-0.028**	-0.029**
	(0.014)	(0.013)	(0.013)	(0.013)
National defense spending (% of GDP)ᵃ (t – 5)	0.029***	0.029**	0.030***	0.029**
	(0.011)	(0.011)	(0.011)	(0.011)
Country Fixed Effects	yes	yes	yes	yes
Year Fixed Effects	yes	yes	yes	yes
Observations	1,828	1,828	1,828	1,828
Countries	89	89	89	89
R^2 Overall	0.802	0.844	0.807	0.830
R^2 Within	0.692	0.696	0.695	0.695
R^2 Between	0.828	0.876	0.833	0.859

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. ᵃ denotes variables which are expressed in their natural logarithm.

TABLE A6: ESTIMATION RESULTS FOR THE DYNAMIC PANEL DATA MODEL EXCLUDING REVERSE TRANSITIONS

National defense spending (in % of GDP)[a]	(1)	(2)	(3)	(4)
Democracy (t – 1)	-0.111**			
	(0.055)			
Polity IV (t – 1)		-0.011***		
		(0.003)		
DSVMDI (t – 1)			-0.126***	
			(0.039)	
CSVMDI (t – 1)				-0.178***
				(0.043)
War (t – 1)	0.126***	0.127***	0.114***	0.126***
	(0.038)	(0.041)	(0.039)	(0.039)
Internal threat (t – 1)	0.000	-0.004	-0.001	-0.002
	(0.006)	(0.005)	(0.005)	(0.005)
GDP[a] (t – 1)	0.076	0.059	0.062	0.052
	(0.055)	(0.055)	(0.056)	(0.057)
Population[a] (t – 1)	-0.057	-0.027	-0.035	-0.019
	(0.142)	(0.141)	(0.142)	(0.144)
Trade globalization (t – 1)	0.000	0.000	0.000	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)
National defense spending (% of GDP)[a] (t – 2)	0.679***	0.671***	0.669***	0.669***
	(0.063)	(0.062)	(0.061)	(0.062)
National defense spending (% of GDP)[a] (t – 3)	-0.028	-0.028	-0.023	-0.024
	(0.059)	(0.059)	(0.059)	(0.060)
National defense spending (% of GDP)[a] (t – 4)	-0.031**	-0.031**	-0.031**	-0.031**
	(0.012)	(0.012)	(0.012)	(0.012)
National defense spending (% of GDP)[a] (t – 5)	0.024*	0.026**	0.025*	0.025**
	(0.013)	(0.012)	(0.013)	(0.012)
Country Fixed Effects	yes	yes	yes	yes
Year Fixed Effects	yes	yes	yes	yes
Observations	2,326	2,326	2,326	2,326
Countries	91	91	91	91
R^2 Overall	0.860	0.866	0.862	0.865
R^2 Within	0.652	0.654	0.655	0.654
R^2 Between	0.935	0.940	0.939	0.942

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. [a] denotes variables which are expressed in their natural logarithm.

TABLE A7: ESTIMATION RESULTS FOR THE DYNAMIC PANEL DATA MODEL EXCLUDING MILITARY DICTATORSHIPS

National defense spending (in % of GDP)[a]	(1)	(2)	(3)	(4)
Democracy (t – 1)	-0.088			
	(0.085)			
Polity IV (t – 1)		-0.017***		
		(0.006)		
DSVMDI (t – 1)			-0.159***	
			(0.060)	
CSVMDI (t – 1)				-0.265***
				(0.071)
War (t – 1)	0.107***	0.101***	0.083**	0.099***
	(0.027)	(0.025)	(0.032)	(0.025)
Internal threat (t – 1)	-0.005	-0.011	-0.007	-0.010
	(0.011)	(0.009)	(0.011)	(0.009)
GDP[a] (t – 1)	0.076	0.027	0.041	0.014
	(0.065)	(0.067)	(0.066)	(0.069)
Population[a] (t – 1)	-0.046	0.024	0.003	0.033
	(0.163)	(0.152)	(0.162)	(0.162)
Trade globalization (t – 1)	0.001	0.001	0.001	0.001
	(0.002)	(0.002)	(0.002)	(0.001)
National defense spending (% of GDP)[a] (t – 2)	0.648***	0.631***	0.629***	0.627***
	(0.075)	(0.073)	(0.073)	(0.074)
National defense spending (% of GDP)[a] (t – 3)	0.000	-0.005	0.005	0.003
	(0.071)	(0.070)	(0.068)	(0.070)
National defense spending (% of GDP)[a] (t – 4)	-0.031**	-0.031**	-0.032**	-0.032**
	(0.013)	(0.012)	(0.013)	(0.012)
National defense spending (% of GDP)[a] (t – 5)	0.015	0.016	0.016	0.016
	(0.016)	(0.016)	(0.016)	(0.016)
Country Fixed Effects	yes	yes	yes	yes
Year Fixed Effects	yes	yes	yes	yes
Observations	1,712	1,712	1,712	1,712
Countries	70	70	70	70
R^2 Overall	0.854	0.870	0.868	0.871
R^2 Within	0.589	0.596	0.596	0.595
R^2 Between	0.928	0.948	0.948	0.956

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. [a] denotes variables which are expressed in their natural logarithm.

TABLE A8: ESTIMATION RESULTS FOR THE DYNAMIC PANEL DATA MODEL EXCLUDING COMMUNIST DICTATORSHIPS

National defense spending (in % of GDP)[a]	(1)	(2)	(3)	(4)
Democracy (t – 1)	-0.100*			
	(0.055)			
Polity IV (t – 1)		-0.011***		
		(0.003)		
DSVMDI (t – 1)			-0.113***	
			(0.040)	
CSVMDI (t – 1)				-0.153***
				(0.041)
War (t – 1)	0.132***	0.134***	0.124***	0.133***
	(0.037)	(0.040)	(0.038)	(0.038)
Internal threat (t – 1)	-0.000	-0.004	-0.002	-0.001
	(0.006)	(0.006)	(0.006)	(0.005)
GDP[a] (t – 1)	0.026	0.009	0.019	0.010
	(0.068)	(0.068)	(0.068)	(0.070)
Population[a] (t – 1)	-0.045	0.010	-0.008	0.007
	(0.154)	(0.150)	(0.155)	(0.156)
Trade globalization (t – 1)	0.000	0.000	0.000	0.000
	(0.002)	(0.002)	(0.002)	(0.002)
National defense spending (% of GDP)[a] (t – 2)	0.717***	0.706***	0.712***	0.712***
	(0.065)	(0.063)	(0.062)	(0.063)
National defense spending (% of GDP)[a] (t – 3)	-0.080	-0.078	-0.079	-0.079
	(0.076)	(0.075)	(0.075)	(0.076)
National defense spending (% of GDP)[a] (t – 4)	0.013	0.013	0.013	0.014
	(0.037)	(0.036)	(0.036)	(0.037)
National defense spending (% of GDP)[a] (t – 5)	0.003	0.001	0.002	0.003
	(0.043)	(0.041)	(0.041)	(0.041)
Country Fixed Effects	yes	yes	yes	yes
Year Fixed Effects	yes	yes	yes	yes
Observations	2,143	2,143	2,143	2,143
Countries	82	82	82	82
R^2 Overall	0.884	0.876	0.882	0.880
R^2 Within	0.623	0.626	0.626	0.625
R^2 Between	0.977	0.966	0.973	0.971

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. [a] denotes variables which are expressed in their natural logarithm.

TABLE A9: ESTIMATION RESULTS FOR THE DYNAMIC PANEL DATA MODEL ALLOWING FOR REGION-SPECIFIC EFFECT HETEROGENEITY

National defense spending (in % of GDP)[a]	(1) Democracy (t – 1)	(2) Polity IV (t – 1)	(3) DSVMDI (t – 1)	(4) CSVMDI (t – 1)
Panel A				
Democracy measure	-0.085**	-0.011***	-0.133***	-0.173***
	(0.038)	(0.002)	(0.045)	(0.045)
Democracy measure * *Africa*	-0.045	0.002	0.023	-0.005
	(0.132)	(0.007)	(0.069)	(0.095)
Panel B				
Democracy measure	-0.137**	-0.011***	-0.119***	-0.167***
	(0.057)	(0.003)	(0.032)	(0.040)
Democracy measure * *Asia & Pacific*	0.155*	0.001	-0.019	-0.050
	(0.093)	(0.005)	(0.106)	(0.103)
Panel C				
Democracy measure	-0.094	-0.010***	-0.125***	-0.190***
	(0.063)	(0.004)	(0.040)	(0.050)
Democracy measure * *Latin America*	-0.010	-0.002	0.007	0.057
	(0.073)	(0.004)	(0.056)	(0.079)
Panel D				
Democracy measure	-0.077	-0.010***	-0.116***	-0.164***
	(0.050)	(0.003)	(0.036)	(0.040)
Democracy measure * *Eastern Europe*	-0.116	-0.002	-0.058	-0.056
	(0.093)	(0.005)	(0.083)	(0.099)
Panel E				
Democracy measure	-0.098**	-0.011***	-0.124***	-0.175***
	(0.047)	(0.003)	(0.034)	(0.038)
Democracy measure * *Southern Europe*	0.055	0.017*	0.079*	0.071
	(0.048)	(0.009)	(0.042)	(0.086)
Panel F				
Democracy measure	-0.097**	-0.011***	-0.123***	-0.174***
	(0.047)	(0.003)	(0.033)	(0.038)
Democracy measure * *Western Europe & North America*	-	0.039***	-	0.661***
		(0.011)		(0.058)
Panel G				
Democracy measure	-0.097**	-0.011***	-0.126***	-0.177***
	(0.048)	(0.003)	(0.034)	(0.039)
Democracy measure * *Middle East*	-0.026	0.005	0.068	0.079
	(0.058)	(0.006)	(0.064)	(0.100)
Control Variables Included	yes	yes	yes	yes
National defense spending (% of GDP)[a] (t – 2)…(t – 5) included	yes	yes	yes	yes
Country Fixed Effects	yes	yes	yes	yes
Year Fixed Effects	yes	yes	yes	yes
Observations	2,455	2,455	2,455	2,455
Countries	95	95	95	95

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. [a] denotes variables which are expressed in their natural logarithm. The dynamic panel data models estimated in panels A through G include all 95 countries which can be included in the dynamic analysis. In each panel, the interaction term of one world region and the four democracy measures is estimated. Regional dummy variables are dropped because of multicollinearity with the country fixed effects. All regressions include the full set of control variables, include four lags of the dependent variable and account for both country and year fixed effects.

TABLE A10: ESTIMATION RESULTS FOR THE SPATIAL PANEL DATA MODEL

National defense spending	1972-2013 for 40 countries				1981-2013 for 53 countries			
(in % of GDP)[a]	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Democracy (t − 1)	-0.230**	-0.231**	-0.243***	-0.130**	-0.291***	-0.301***	-0.279***	-0.084
	(0.096)	(0.094)	(0.091)	(0.055)	(0.089)	(0.094)	(0.090)	(0.055)
War (t − 1)	0.250***	0.245***	0.248***	0.112***	0.235***	0.229**	0.223**	0.108***
	(0.084)	(0.087)	(0.089)	(0.035)	(0.089)	(0.089)	(0.089)	(0.041)
Internal threat (t − 1)	0.056***	0.057***	0.046***	0.008	0.050**	0.047**	0.047**	-0.000
	(0.016)	(0.017)	(0.017)	(0.006)	(0.021)	(0.022)	(0.022)	(0.008)
GDP[a] (t − 1)	-0.194	-0.273**	-0.314	-0.006	-0.130	-0.228**	-0.185	0.000
	(0.125)	(0.134)	(0.214)	(0.064)	(0.089)	(0.103)	(0.127)	(0.059)
Population[a] (t − 1)	0.073	0.134	0.159	-0.047	0.017	0.037	0.136	-0.001
	(0.201)	(0.252)	(0.254)	(0.148)	(0.177)	(0.284)	(0.287)	(0.169)
Trade globalization (t − 1)	-0.002	-0.001	-0.001	0.001	-0.004	-0.003	-0.002	0.000
	(0.003)	(0.004)	(0.004)	(0.002)	(0.003)	(0.003)	(0.003)	(0.002)
Nat. def. spend. (% of GDP)[a] (t − 2)				0.846***				0.728***
				(0.079)				(0.067)
Nat. def. spend. (% of GDP)[a] (t − 3)				-0.146				-0.085
				(0.137)				(0.106)
Nat. def. spend. (% of GDP)[a] (t − 4)				0.002				0.052
				(0.064)				(0.063)
Nat. def. spend. (% of GDP)[a] (t − 5)				0.050				-0.030
				(0.056)				(0.051)
Spatial ρ	0.491***	0.441***	0.157	-0.062	0.533***	0.452***	0.070	0.036
	(0.076)	(0.086)	(0.116)	(0.083)	(0.067)	(0.087)	(0.138)	(0.101)
Error variance σ²	0.099***	0.097***	0.095***	0.049	0.080***	0.078***	0.077***	0.051*
	(0.034)	(0.033)	(0.032)	(0.031)	(0.028)	(0.027)	(0.026)	(0.030)
Country Fixed Effects	no	yes	yes	yes	no	yes	yes	yes
Year Fixed Effects	no	no	yes	yes	no	no	yes	yes
Observations	1,680	1,680	1,680	1,480	1,749	1,749	1,749	1,484
Countries	40	40	40	40	53	53	53	53
R² Overall	0.037	0.023	0.020	0.866	0.058	0.022	0.069	0.875
R² Within	0.372	0.374	0.422	0.678	0.466	0.469	0.494	0.581
R² Between	0.004	0.001	0.000	0.956	0.008	0.000	0.007	0.985
Log-Likelihood	-568.3	-437.7	-405.6	126.1	-435.8	-264.2	-238.9	99.43

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. The model applies an inverse distance matrix as spatial weighting matrix. [a] denotes variables which are expressed in their natural logarithm.