External Support and Persistent Authoritarianism in the Middle East

Daniel K. Baissa[1] and Melani Cammett[2*]

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Government Department, Harvard University[1,2]
*Corresponding author
E-mails: dbaissa@g.harvard.edu / mcammett@g.harvard.edu

ABSTRACT. Explanations for persistent authoritarianism in the Middle East invoke a plethora of domestic and international factors. Using non-parametric machine learning techniques, which remove researcher bias in model building and detect complex interactions between variables, on a large dataset of 17 Middle Eastern countries from 1962 to the eve of the 2010 Arab uprisings, we assess a broad range of existing and novel explanations. We find that foreign aid, particularly concessional lending, is crucial for authoritarian resilience, particularly above a certain threshold, and that repression, the Cold War, and external grants have secondary predictive power. Other prominent accounts, such as oil wealth, monarchical regime type, or Islamic heritage, show little effect. We propose an explanatory framework and call for complementary qualitative research to analyze possible mechanisms. These findings advance research on the politics of foreign aid and Middle Eastern authoritarianism and raise normative questions about the unintended impact of development finance.

Keywords: Authoritarianism, Foreign Aid, Repression, Middle East, Machine Learning

1 Introduction

The Middle East is home to a disproportionately large number of autocracies, with rulers who are adept at evading or quashing attempts at political liberalization. This empirical fact has generated a large research program on the roots of authoritarian persistence in the region, especially in the Arab world. Understanding the dynamics of authoritarianism in the Middle East and North Africa (MENA) is important to illuminate regime outcomes more generally and

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has direct consequences for the lived experiences of millions of people in the region, thousands of whom have taken to the streets during ongoing waves of uprisings across the region, and for foreign policy vis-a-vis the Middle East. Scholars advance diverse explanations for the exceptional durability of MENA authoritarianism – some of which point to domestic variables while others pin the blame on international factors.[1] Not all explanations are mutually exclusive, yet not all are equally convincing, whether on theoretical or empirical grounds. With so much at stake, it is imperative to assess distinct accounts of MENA authoritarian persistence.

In this article, we wade into these ongoing debates empirically, conceptually, and theoretically. We test a diverse array of explanations using an especially rigorous and appropriate set of methods – Bayesian Additive Regression Trees (BART) – which we apply to a large-scale dataset that captures existing explanations alongside factors we introduce to isolate the potential impact of distinct domestic and external drivers more precisely. This non-parametric approach enables us to adjudicate among a large number of accounts to determine which have more predictive power, bringing greater coherence to the field and an enhanced understanding of what underlies the ability of Middle Eastern dictators to cling to power so tenaciously. To our knowledge, no other study has employed such an approach, which offers a far more convincing strategy than ordinary regression analyses. In so doing, we make methodological and conceptual contributions. Methodologically, we advance machine learning (ML) approaches as applied in political sentence by employing a variable selection procedure that enables us to identify which variables best account for the outcome. Conceptually, we employ measures of authoritarian stability that we contend are more consistent with the historical record of authoritarian persistence and breakdown and are more in line with prevailing approaches to regime change beyond the MENA region.

Based on our findings, we propose a framework that builds on those privileging the role of external support (Bellin 2004; Brownlee 2012; Yom 2016) and on the politics of foreign aid (Finkel et al. 2007; Ahmed 2012; Ahmed et al. 2016; Bermeo 2016; Djankov et al. 2008), but more precisely specifies the external flows that sustain and do not sustain Middle Eastern autocrats. In particular, our results indicate that foreign economic aid in the form of concessional loans from international financial institutions, notably the World Bank, is by far the most important predictor of MENA authoritarian persistence. Foreign aid, which is fungible and subject to manipulation by recipients, may cement authoritarian rule either by subsidizing "carrots" through government spending on public benefits or "sticks" via increased repression. Without access to data on "black budgets," we cannot demonstrate the precise mechanisms through which this occurs, but it likely arises because external fiscal support frees up funds for regimes to invest more in the salaries and materiel of coercive forces. Foreign economic aid may also deter opponents from mobilizing against the regime by signaling that powerful global actors back incumbent autocrats (Jamal 2012). Because MENA countries such as the oil-rich Gulf monarchies do not receive concessional loans, we also fit a model that drops this variable. The results indicate that the Cold War period, when US-Soviet competition enabled dictators in client states to leverage foreign support, and French grants, another form of external aid, are key drivers of authoritarian persistence in the region.

[1] For reviews, see Anderson (2006), Bellin (2002), Lust (2011, 166-170), and Posusney (2005), inter alia.

Our findings are also notable for what they do not include. Military exports of high-tech weapons systems, which are rarely deployed for day-to-day repression, are not consequential. We also detect no support for other prominent explanations, such as oil wealth, monarchism, or Islamic heritage. These findings advance the research programs on the politics of foreign aid and on MENA authoritarianism by horse racing a variety of distinct accounts and by disaggregating the generic category of external support with rigorous empirical tests to show how distinct components do and do not predict regime stability.

In the next section, we review a broad range of explanations for persistent authoritarianism in the Middle East to generate hypotheses that we subsequently test. Next, we describe our data and variables, and elaborate our empirical strategy. The following section presents the results, indicating which factors are and are not predictors of durable authoritarianism in the Middle East. Building on studies of MENA authoritarianism and of the politics of foreign aid, we then present a framework to explain how concessional lending bolsters authoritarian rule. The final section highlights the theoretical implications of our findings and discusses the normative implications of our findings.

2 Explanations for persistent authoritarianism in the Middle East

The literature on authoritarian persistence in the Middle East features diverse accounts centered on a broad range of domestic and international factors.[2] Here we enumerate distinct dimensions of cultural, economic, and institutional explanations as well as external influences specified in existing approaches. Not all of these accounts are mutually exclusive. For example, specific international aid flows may be compatible with some domestic explanations for authoritarian durability, as our empirical analyses show. Indeed, economic aid likely contributes to factors emphasized in domestic accounts of ruler strategies to preempt, contain, or suppress dissent.

2.1 Domestic factors

Country-level factors linked to persistent authoritarianism in the Middle East include cultural, economic, and institutional explanations. Earlier cultural accounts contend that Islam, the predominant religion of the region's inhabitants, is not compatible with democracy (Huntington 1984; Kedourie 1994; Kramer 1993; Sharabi 1988). Much contemporary scholarship rejects simplistic doctrinal versions of this claim (Berger 2019; Cammett and Jones 2022; Ciftci 2010; Tessler 2002), and mass mobilization during the Arab uprisings belies such interpretations. More sophisticated accounts of the alleged governance deficit in the Muslim world point to legacies of Islamic institutions or state-society relations (Blaydes and Chaney 2013; Kuran 2012; Kuru 2019), although the relative importance of such distal factors for contemporary outcomes is unclear (Owen 2013; Thompson 2020).

A variety of economic factors are linked to persistent authoritarianism in the Middle East. Some associate the relative lack of industrialization and heavily statist development models with the absence of an independent middle class to agitate for political liberalization (Bellin 2002),

[2]The empirical analyses address additional possible explanations that are not central in the literature.

although middle classes can actively support authoritarian resilience (Rosenfeld 2020). Others focus on the post-independence "authoritarian bargain," in which citizens exchange political voice for public benefits (Youssef 2004). However, populist social contracts unraveled by the 1980s, rulers increasingly resort to cronyism and repression, and chronic protests show that money does not reliably buy quiescence (Cammett et al. 2015; Heydemann 2007). Finally, oil rents, which enable incumbent authoritarian rulers to use low tax rates and patronage to obviate pressures for accountability or to bolster coercive apparatuses, are a prominent explanation for MENA authoritarianism (Beblawi 1987; Bellin 1994; Ross 2001; Andersen and Ross 2014). Yet resource-based accounts cannot explain variation in political openness among oil-rich countries nor durable authoritarianism in oil-poor MENA countries (Herb 2005; Smith 2007), among other critiques (Smith and Waldner 2021).

Another class of domestic explanations centers on regime survival strategies rooted in formal and informal political institutions and practices. One such account, which garnered renewed attention in the wake of the Arab uprisings, posits a monarchical advantage in withstanding or evading popular unrest, whether because of institutionalized succession rules, enhanced "legitimacy," or distance from everyday politics (Herb 1999; Menaldo 2012). Monarchies with legislative bodies may be more likely to democratize because members of parliament have incentives to expand their leverage over the monarch and potentially greater capacity to do so (Herb 2004). Critics contend that most MENA monarchies have robust patronage machines (Yom and Gause III 2012), while others point to the durability of single-party regimes (Brownlee 2007). Another domestic explanation in this vein points to the "upgrading" of authoritarian practices alongside deepened repression (Heydemann 2007, 5).[3] Specialists agree that the MENA "coercive state" *is* especially robust in comparison with other global regions (Bellin 2004), but what sustains it is a matter of debate.[4]

2.2 External Factors

External factors, especially support by powerful foreign governments, can shore up existing authoritarian regimes by bolstering their coercive and fiscal capacities (Bellin 2004, 143). Although Levitsky and Way (2010) contend that external support fueled democratization in the post-Cold War era, Middle Eastern cases suggest that geostrategic importance conditions the nature and effects of foreign backing, as the authors concede (Levitsky and Way 2010, 19), and research on autocracy promotion holds (Tansey et al. 2017; Yakouchyk 2019).[5] As Brownlee (2002) and others argue, the geostrategic centrality of the region – shaped by its

[3] Some contend that weak civil societies secure authoritarianism in the regions. Yet the association between a robust civil society and democratic governance is contested (Berman 1997), repression undercuts the ability of independent associations to operate in the first place, and active civil society organizations operate in authoritarian contexts.

[4] Other institutionalist explanations have been proposed to explain authoritarian durability, such as electoral system design (Posusney 2002) or regime strategies vis-à-vis opposition groups (Lust-Okar 2005). We do not include measures capturing all potential institutional accounts in the BART analyses, some of which are not well captured with quantitative measures.

[5] Democracy promotion programs may also bolster authoritarianism as incumbent rulers direct aid to suit their goals (Bush 2016; Snider 2022).

large oil and gas endowments, proximity to Israel, and control over key international shipping routes – has ensured that the Middle East remains the site of extensive Western involvement, which deepened with the oil price shocks of the 1970s and again with the War on Terror after 9/11.[6] The breakdown of the bipolar global order after the Cold War further consolidated Middle Eastern state alliances with the West.

External support for dictators comes in various forms (Bush 2017, 669), not all of which may be equally important in sustaining authoritarian rule. Yom (2016) lays out three overarching categories of external backing, including coercive assistance, fiscal support, and diplomatic sponsorship, each of which may deter would-be opponents from mobilizing or bolster acceptance of the regime by the population. Both repression and cooptation can reinforce authoritarian persistence.

In principle, coercive assistance should have the most direct effect by strengthening the repressive apparatus of regimes, which can then suppress or deter opposition. Exchanges between dominant global powers and incumbent rulers bolster the coercive capacity of client states, including arms transfers, military aid, collaborative intelligence operations, boots on the ground, joint military exercises, and the establishment of military bases on the territory of the client state.

Fiscal support, which entails financial and other material aid, increases the economic capacity of the state. With enhanced material resources, rulers may be better equipped to coopt potential opponents, improve government performance, which can temper opposition by improving satisfaction with the regime, and invest in state capacities that further social control and deter the emergence of full-blown dissent. Because money is fungible, economic aid may also be used to support the salaries of the police or other agents of repression. External fiscal support comes in the form of cash grants, concessional loans, or technical aid, among other vehicles. In principle, aid is distinct from other types of external flows, such as natural resource rents and remittances, because donors can direct non-fungible aid towards specific policy goals (Bermeo 2016), but in practice MENA governments exercise discretion over inflows (Snider 2022).

Finally, diplomatic sponsorship, the subtlest form of external backing, may ensure authoritarian stability by signaling that geopolitically dominant powers will back the incumbent autocrat in the event of threats to the regime, whether through direct military intervention or indirect channels. In turn, messages from powerful external actors can embolden rulers to employ repression more liberally and deter regime opponents from mobilizing (Ambrosio and Tolstrup 2019). Diplomatic sponsorship entails actions such as official statements or legislative declarations by global powers backing incumbent rulers, while inaction can also be interpreted as a tacit form of support. Yet the effects of foreign diplomatic pronouncements are not clear-cut. First, dissident groups may be so committed to opposing the regime that the rhetoric of powerful foreign actors will not deter them, and might even embolden them. Second, the preferences of government heads articulated in diplomatic pronouncements may not easily translate into

[6] By presenting themselves as bulwarks against alleged Islamist threats, MENA autocrats have benefited from the War on Terror to undercut critics of their human rights records (Lust 2011). In an earlier era, Middle Eastern rulers played up Leftist threats to gain Western support.

action, particularly in political systems with numerous veto points – a point not lost on regime incumbents and opponents alike.[7]

3 Data and Variables

Our dataset covers 17 MENA countries from 1962 through 2007 and includes 34 variables derived from multiple sources.[8] Limitations on data availability prevented us from continuing the dataset through the Arab Uprisings period to the present. That said, 688 complete observations over 34 variables in the full set of MENA countries is sufficient for the methods we employ and provides ample regional and chronological coverage to test diverse explanations for persistent authoritarianism in the region. Future research can perform out of sample tests to predict the efficacy of our models after the Arab uprisings, but we expect that including observations from the eve of the uprisings to the present would strengthen our findings.

Because our goal is to explain the roots of persistent authoritarianism in the Middle East - not to compare the correlates of authoritarianism across multiple regions, which likely vary markedly - we focus exclusively on MENA countries.[9] We leverage intra-regional variation to focus on the predictors of persistent authoritarianism in the Middle East and our explanations do not generalize beyond the region. This scope should be of sufficient importance given that millions of MENA residents have suffered the consequences of authoritarianism for decades, the region is of high geostrategic importance, and a robust and vibrant social science literature has emerged to explain authoritarian in the Middle East.

3.1 Dependent variable: Authoritarian persistence as absence of democratization

Our main dependent variable captures persistent authoritarianism understood as a lack of democratization. We measure this outcome dichotomously, with "0" denoting a non-movement, or authoritarian stasis, and "1" denoting a positive shift in the Polity score towards greater democracy (Marshall et al. 2019). This approach has the virtue of capturing institutional shifts rather than full-blown regime change, which is more consistent with the historical record, as in Europe where monarchies evolved into democracies over hundreds of years. Authoritarian breakdown generally occurs through the gradual accumulation of institutional changes, such as the extension of suffrage to different groups or reforms to enable the secret ballot (Acemoglu and Robinson 2000; Boucoyannis 2021; Capoccia and Ziblatt 2010; Mares 2015; Stasavage 2016). Studies of political change in the Middle East should be approached similarly, and

[7] The GDELT database (www.gdeltproject.org), which collects and analyzes global broadcast, print, and web news, might provide an appropriate measures of rhetorical support, but its coverage is insufficient for our time series given the more recent exponential increase in digital information.

[8] The countries are Algeria, Bahrain, Egypt, Iran, Iraq, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Qatar, Saudi Arabia, Syria, Tunisia, United Arab Emirates, and Yemen. SI Section A provides descriptive information on all dependent and independent variables.

[9] If we aimed to benchmark the Middle East against other regions, our dataset would need to expand to include a broader array of variables associated with authoritarian stability in different regions.

therefore a measure capturing piecemeal institutional shifts as well as precipitous shocks is more appropriate than one presuming a sudden transformation.

Second, the measure we use differs from other dichotomous conceptualizations of regime type (Boix et al., Hariri 2015), which measure full-blown democratization. This is useful for some analytical purposes but would not enable us to explore relationships between potential factors influencing incremental processes of regime change and stability in the region.

3.2 Alternate dependent variable: Stability and change across political regime types

As a robustness check, we run models with a second measure of the outcome, regime shifts, captured by the Polity 4 "regime transition completed" (D4) variable. This measure indicates shifts in political institutions towards and away from democratization and takes a value "1" to denote the final year of a multi-year regime transition and "0" for no regime shift. Unlike many measures of democracy, which privilege movements from authoritarianism to democracy, this variable includes changes from institutions associated with one type of authoritarian regime to another (Wright et al. 2015), such as transitions from autocratic monarchies to republics, as has occurred in some MENA countries. The recent experience of Tunisia, which has reverted to authoritarianism under President Kais Saied, illustrates the importance of adopting a measure that allows for movements towards and away from political opening, as well as one occurring through the accumulation of incremental institutional changes. SI Section A depicts all variables as time series plots for all countries in the dataset, including the dependent variables.

Given the overwhelming prevalence and durability of authoritarianism in the region, some might be concerned that there is minimal variation in our dependent variables. As SI Section A shows, this is not the case because the outcome captures institutional shifts to and from greater political openness. We regard our use of these measures as a conceptual contribution to studies of authoritarian durability in the Middle East, which have largely adopted binary understandings of (the absence of) democracy in the region. Furthermore, as we describe and demonstrate below, BART is well suited to analyze rare phenomena.

3.3 Independent variables

BART enables the inclusion of far more predictors than traditional regression analyses. The measures we use reflect the broad range of country-level domestic and international factors identified in our review as well as others that might shape MENA authoritarian persistence.

3.3.1 Domestic Cultural, Economic, and Institutional Factors

To capture cultural explanations premised on the alleged deleterious effects of Muslim political culture or institutions on democracy, we include a measure of the Muslim percentage of the national population, as is standard practice in the existing quantitative research on regime outcomes in the Middle East (Donno and Russett 2004; Fish 2011; Hariri 2015; Menaldo 2012). Some might be concerned that there is little variation in endowments of Muslims in the cases, hindering the ability to find effects in a study focused on Middle Eastern countries

alone. Because the percentage of Muslims in national populations exhibits low variation in the Middle East, this measure is a poor candidate for explaining intra-regional regime stability. At the same time, since our outcome, too, exhibits low variation, BART might seek to classify it with a variable with low variation, such as percent Muslim, and yet this is not observed.

We use several variables to capture domestic economic factors. First, industrial production as a percentage of GDP taps into accounts that link the relative lack of industrialization and the absence of an independent middle class to agitate for political liberalization. To measure the "authoritarian bargain," which posits that government-provide economic benefits buy societal quiescence, we include lag government expenditures as a percentage of GDP (Menaldo 2012). This variable captures the degree to which the state offers consumer subsidies, public sector employment, and other forms of benefits and patronage. Finally, oil rents are proxied by log total fuel income per capita, which Menaldo (2012) finds to be the most significant variable related to oil endowments.

To assess the claim that Middle Eastern monarchies are more stable and exhibit superior governance than republics, we use a binary variable, with a value of 1 representing a monarchy and 0 for other government types. Since virtually all other regimes in the region are republics – and often single-party republics – this variable effectively measures the predictive value of republican government. We also include an indicator of whether or not a country has a parliament or council.

The analyses also account for regime use of physical repression, as measured by "physical integrity," or "... freedom from political killings and torture by the government," drawn from the V-Dem dataset and based on the Cingranelli-Richards Human Rights Database (Cingranelli and Richards 2010). Ranging from 0 to 1, more repressive regimes have *lower* physical integrity scores.

Finally, we incorporate country-level variables for ethnic fractionalization, geographic size, population size, location in the Persian Gulf Region, and whether the observation occurred during the Cold War – all factors that have been associated with either regime breakdown or authoritarianism.

3.3.2 Dimensions of External Support

Measures of external support are likely to be closely correlated because an alliance between countries – even if temporary, loose, or unfriendly – is a prerequisite for foreign backing, which often entails multiple exchanges. As a result, distinct subcomponents – coercive assistance, fiscal support, and diplomatic rhetorical support (Yom 2016) – may exhibit complex interactions, calling for an estimator with a high degree of flexibility to fairly adjudicate between them such as BART.

The first set of external support variables captures coercive assistance. One indicator uses measures of arms exports from the United States, Russia/the U.S.S.R., the United Kingdom, France, and Italy – which collectively account for the vast majority of global arms transfers. The analyses include separate measures for each country because they may have different motivations for arms sales, producing distinct effects on regime stability. The SIPRI 2020 dataset, which tracks all transfers of major conventional weapons from 1950 onward, provides

information on arms exports. We use three different measures, including yearly purchases, cumulative sum, and total purchases of arms by each country in the dataset. For the coercive assistance measures to improve authoritarian stability, arms sales from one of these major powers should have a negative effect on institutional shifts and the probability of regime type changes.

A second indicator of coercive support is light weapons, which are more commonly used to repress opponents than the high-tech weapons systems that constitute the bulk of arms exports to the region. The measure of small arms transfers is from the Norwegian Initiative on Small Arms Transfers (NISAT) database, which tracks cross-border small arms, light weapons, ammunition, explosives, missiles, and related parts and accessories (NISAT 2013).[10] We use two versions of this variable, including the cumulative sum of arms transfers to a MENA country in a given year and the cumulative percentage of small arms received by a MENA country in comparison to all other MENA countries at a given point in time.

Our second set of external support variables captures fiscal support. States with more financial backing can supply more carrots to their population, require fewer sticks, and be better equipped to buy off domestic rivals. Because money is fungible, fiscal support also enables regimes to funnel more resources to the coercive forces. A key measure of fiscal support is concessional lending (World Bank 2022), which includes multilateral loans from international financial institutions such as the World Bank, regional banks, and other intergovernmental agencies and not from a single government or organization managing loans on behalf of a single government. Concessional loans are "cheap money," or lending at below-market interest rates, grace periods, or both. From 1970-2007, the World Bank provided 99.1% of concessional loans to the Middle East, with the remainder from the Arab Fund for Economic Social Development and the Arab Monetary Fund.[11]

Based on the OECD's Overseas Development Assistance database (OECD 2022), a second measure captures loans and grants from governments, and therefore includes both "cheap" and "free" money specifically aimed at promoting economic development and welfare in the recipient country. Tracking flows from each major financial donor provides data on aid from individual countries, including the U.S., U.K., France, and Germany, as well as an aggregated measure of total aid to the countries in the dataset.[12]

4 Methods

Our empirical strategy has several distinct components. We first run tests of multicollinearity among the variables because collinear relationships will mask the predictive effects of variables in BART. For example, if oil and monarchical regime type are correlated, they might cancel out each others' predictive effects. By running separate models, we give each factor a fighting

[10]The indicator likely underreports such transfers because the data are from official government sources, which offer a partial snapshot of the light weapons trade.

[11]The IMF also issues loans to MENA countries but generally not at concessional rates, which are reserved for low-income countries.

[12]Germany, though not a major military power, is one of the largest aid donor countries so it is included for completeness.

chance to predict the outcome. Next, we run separate BART models isolating variables from other collinear variables to test their relative importance. We then use BART to select the variables with the most predictive power for explaining MENA authoritarian persistence.[13]

4.1 Why BART?

The bulk of our empirical analyses employ BART, which has unique advantages over typical regression models when competing hypotheses against each other (Chipman et al. 2010), as we elaborate here and in SI Section B. BART identifies and removes variables that have little predictive power and retains those with high predictive power, enabling us to carry out especially rigorous tests of the hypotheses.[14]

What are the advantages of BART for adjudicating debates about regime durability in the Middle East? First, like other forest-based ML models, BART is effective with sparse data and more capable of predicting rare events data than Maximum Likelihood Estimations (MLEs). Given that regime change is rare in the Middle East, BART is an ideal method for analyzing persistent authoritarianism in the region.

Second, BART allows for the use of a large number of variables when performing variable selection with far less risk of a false positive result than typical MLEs. This is especially valuable for assessing the predictors of MENA authoritarianism given the numerous explanations proposed in relevant literature. BART therefore overcomes the limitations of p-values, which indicate the probability of obtaining results at least as extreme as the observed results, assuming the null hypothesis is correct, but not the size or substantive importance of an effect (Wasserstein and Lazar 2016).

Third, BART is preferable because of its modeling process. A non-parametric estimator, BART does not require us to make assumptions regarding the functional form of the model, granting far greater flexibility than typical MLEs used in political science and giving each variable the greatest chance when competing against each other.

A tree-based model is also ideal for comparing the relative importance of various hypotheses in a context where the data-generating process is unknown (Montgomery and Olivella 2018). ML techniques, specifically BART, find the best configuration of variables to predict the outcome. We use the BART-CV function, which cross-validates between several BART models with different hyperparameters, such as the number of trees, to find the optimal fit. This also ensures objectivity in the model function. SI Section C shows decision tree examples to illustrate this procedure.

Finally, in addition to its flexibility, BART tracks how frequently predictors are chosen as a node, allowing us to use it for model-free variable selection (Chipman et al. 2010). More useful variables for predicting the outcome (and their associated hypotheses) dominate over others.

[13] Similarly, Blackwell and Olson (2021) use ML for variable selection to try to mitigate bias among interacted variables.

[14] We use BART rather than other ML techniques, such as Lasso, Random Forests, and neural network models, because of its superior efficiency for variable selection (Chipman et al. 2010)

4.2 Variable Selection

After running the BART analyses, we undertake a variable selection procedure to identify the most parsimonious model with the best fit to predict the outcome. Essentially, the procedure constructs numerous BART models, competes them against each other to identify which best predict the outcome, and then identifies which variables within the selected models best explain the outcome.

In the variable selection procedure, we examine the splitting rules across all trees and across all post-burn-in MCMC iterations to determine the inclusion proportions for each variable. The inclusion proportion for any variable refers to the number of times it is selected as a splitting rule out of all splitting rules among the posterior draws of the sum-of-trees model (Kapelner and Bleich 2013). Variables that are chosen as a splitting rule more frequently have greater predictive power and, therefore, greater importance.

5 Results

In this section, we present the results of multiple analyses aimed at isolating the explanations with the greatest predictive power for persistent authoritarianism in the Middle East.

We begin by testing for multicollinearity among our variables to probe whether their predictive power may be masked when included simultaneously. Section SI G.1 shows the correlation matrix. We ran 102 separate BART-CV models dropping correlated variables and the results were consistent across the board. Next, we conduct separate BART analyses to determine which variables predict MENA authoritarian stability using the BART-CV function. Finally, a variable selection procedure selects the most important variables for a model predicting authoritarian persistence in the region. All models use our main measure of the dependent variable, movements towards democracy, but we also conduct robustness checks using the alternative measure, which captures institutional shifts towards and away from democracy.

5.1 (Absence of) democratization

Before presenting the results, we benchmark BART against logistic and rare events logistic regressions, more typical models used in political science, to test the validity of our approach. These analyses demonstrate that using traditional MLEs on such rare occurrences is perilous for the question at hand. Movements towards democracy are extremely rare in the region and therefore both of these more common types of regressions fail to predict a single shift towards greater political opening within the sample on which they were built, where they would be expected to perform best. The logit model indicated that movements towards democracy will never occur, instead predicting that stability would occur almost 100% of the country-years in the dataset. The rare events model had nearly the same prediction, but also incorrectly classified 9% of the non-movements. By comparison, BART-CV with 50 trees and k equal to 3 accurately predicted 77% of all movements towards democracy and 73% of non-movements in the sample.

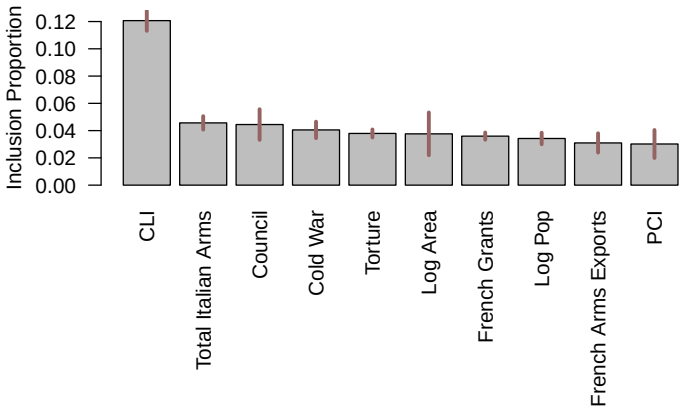
TABLE 1: BART is Much Better at Predicting Regime Shifts Towards Democracy in the Middle East than Logistic and Rare Events Logistic Regressions

	Logistic Regression	Rare Events Logistic Regression	BART
Democratic Movement	Model Error	Model Error	Model Error
Actual No	0%	9%	26.8%
Actual Yes	100%	100%	23.3%

*Note: This table shows the error rate for in-sample predictions from our dataset. "Actual Yes" means an observed increase in Polity score, or movement towards democracy, and "actual no" means otherwise. The standard logit predicts "no movement" 100% of the time, giving it a low error rate for actual non-movements, and a 100% error rate for actual moves towards democracy. The rare events logit performs worse than the standard logit, generating only false positive predictions. The BART model accurately predicts 77% of all moves towards democratization.

Next, we analyze the inclusion proportions for each variable. Figure 1 displays the inclusion proportions for the top ten variables in the model. The figure shows that concessional loans (CLI) is by far the most common variable when estimating the likelihood of a movement towards democracy. The next most common variable, the presence of a representative council (Council), has an inclusion proportion of about one-third that of concessional loans. Similarly, the remaining variables all feature much lower inclusion proportions than the loans indicator, with variations likely due to chance.

Figure 1: Results of the Variable Selection Procedure for Authoritarian Persistence in the Middle East



*Note: This figure displays the inclusion proportion for the top ten variables in the dataset. The variables with the highest inclusion proportions are ranked from left to right, showing a large gap between concessional loans and other variables. All remaining variables have approximately the same inclusion proportions and may vary more due to the random selection process than to their importance.

Based on the results of the variable selection procedure, we ran the final BART-CV model using concessional loans as the sole predictor of movement towards democracy. Table 2

TABLE 2: BART Models of Democratization in the Middle East

	BART Pre Selection	BART CLI Only
	Model Error	Model Error
Actual No	26.8%	19.0%
Actual Yes	23.3%	36.7%
Overall	26.6%	19.8%
k Hyperparameter	3	2
Number of Trees	50	50

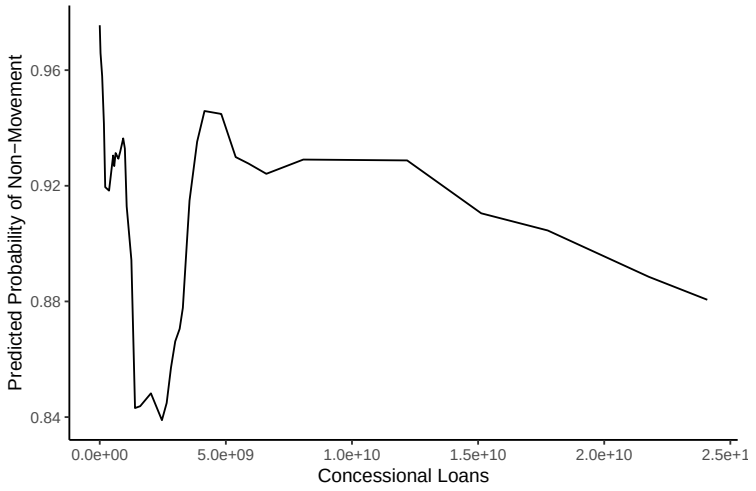
demonstrates the predictive capacity of concessional loans. Here we see that the model was slightly better at predicting non-movement and slightly worse at predicting actual movement towards democracy. Overall, the model correctly predicted the outcome approximately 80% of the time, indicating that concessional loans are a powerful predictor of authoritarian durability. (See SI Section D for BART model diagnostics.)

The variable selection procedure also yielded some striking non-findings. Despite its prominence in the literature on MENA authoritarianism, oil did not reach the inclusion criterion. Per-capita income also failed to reach the threshold, undercutting claims that middle- and high-income authoritarian regimes are more likely to democratize (Boix and Stokes 2003), at least in the Middle East. Likewise, GDP growth did not reach the inclusion criterion. These non-findings may arise because foreign support offsets revenue fluctuations, enabling governments to continue providing benefits to citizens regardless of business cycles or changes in global markets.

Similarly, other variables proxying for key explanations of MENA authoritarian durability were not selected. Despite the sub-region's geostrategic importance, a dummy variable for Gulf countries failed to meet the inclusion criterion, perhaps because non-Gulf countries, such as Egypt, may be equally or more vital to the interests of major powers. Monarchism failed to reach the threshold, indicating that monarchy neither blocks nor facilitates democracy. Given the historical record, this may not be surprising: Globally, monarchies have evolved into some of the most vibrant democracies, as in Scandinavia and the United Kingdom, and totalitarian regimes, such as the Soviet Union. When concessional loans are included in the model, the measure of physical repression was not selected. Finally, most specialists of the Middle East will not be surprised that percent Muslim did not reach the inclusion threshold, calling into question the claim that countries with larger Muslim populations or more pronounced legacies of Muslim rule are more likely to remain autocratic in the region.

Figure 2 shows partial effects of receiving concessional loans on non-movements, or persistent authoritarianism, in the Middle East. The probability of regime movements and non-movements towards democracy vary dramatically when countries receive different levels of concessional loans, initially increasing the likelihood of political liberalization before a sharp spike in favor of authoritarian persistence. Ultimately, as concessional loans reach a high level, the relationship plateaus. Caution should be used when interpreting all values above $10 billion as these values are likely driven in large part by Egypt, which has especially high debt levels.

Figure 2: The Effect of Concessional Loans on Authoritarian Persistence in the Middle East



*Note: This figure displays the predicted probabilities calculated from the post-selection BART model for concessional loans (CLI) on movements towards democracy. The probability of no movement towards democracy exceeds 96% for countries that do not take loans. As loans increase, the probability of democratization rises, but the probability then sharply decreases towards authoritarian persistence as loans rise. When loans reach extreme points, the probability of democratic shifts increases again. Thus, the relationship between concessional loans and authoritarian stability is largely U-shaped.

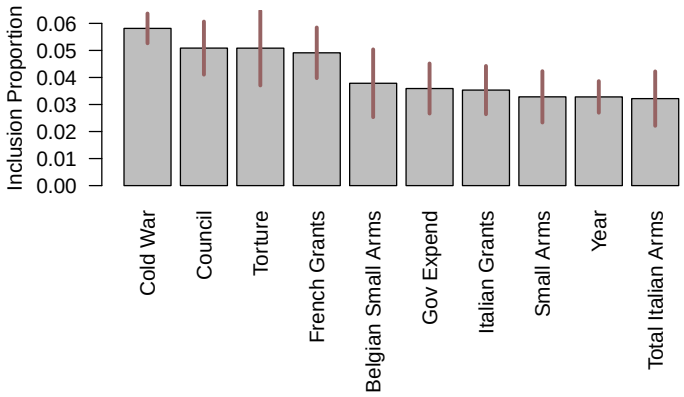
Explaining the drivers of these relationships based on these findings exposes the limitations of ML for assessing causality: Do World Bank loans drive authoritarian stability, or does the World Bank extend loans to regimes that are less likely to become more democratic? Future research should probe potential causal relationships in either direction.

As a robustness check, we run BART-CV with the alternate outcome measure, the Polity D4 variable, which codes actual regime change in the final year of a regime transition and encompasses all types of regime transitions. (SI Section F shows the results.) With this outcome variable, concessional loans remain the key predictor of authoritarianism durability in the Middle East. Again, the non-findings are equally interesting and largely corroborate the analyses of our primary outcome variable: Oil wealth, monarchism, and other common explanations in the literature are not identified as predictors. (See SI Section E for model diagnostics with the Polity D4 outcome measure.)

5.2 Predictors of Authoritarian Durability in the Middle East Beyond Concessional Loans

Our findings reflect average effects for the Middle East as a whole, however, many countries in the region, notably the high-income, oil-rich countries of the Gulf, do not receive concessional loans. What factors are most likely to drive authoritarian stability beyond concessional lending? Because the drivers of authoritarian stability net of concessional lending are of great importance

Figure 3: Results of the Variable Selection Procedure for Authoritarian Persistence Without Concessional Loans



*Note: This figure displays the inclusion proportions for the top ten variables, arranged from left to right.

for much of the MENA region, and lacking an ideal solution, we fit a BART model with the same data that drops the concessional loans variable.[15] (See SI Section D for model diagnostics dropping the CLI variable.)

Analyses run without the concessional lending variable show that the Cold War period and French grants are the main drivers of authoritarian stability in the Middle East, or the lack thereof, as depicted in Figure 3. During the cold war, authoritarian durability was at its highest,

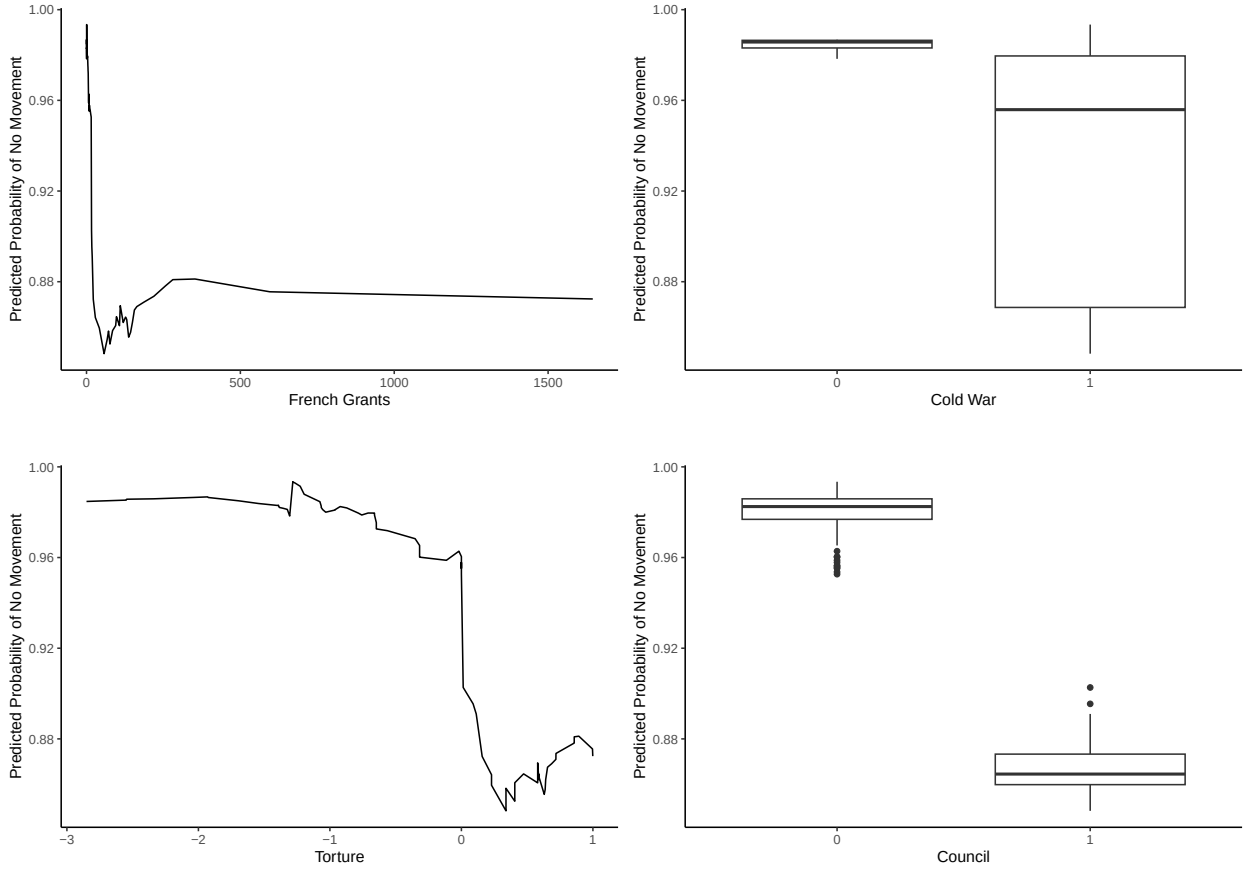
[15]Dropping countries that receive concessional loans, a potential alternate strategy, would introduce bias given that countries without concessional lending still play a role in the effect of loans, albeit only in the direction away from debtor countries.

TABLE 3: BART Models of Authoritarian Persistence in the Middle East Beyond Concessional Loans

	BART Pre Selection	BART Post Selection
	Model Error	Model Error
Actual No	24.8%	30.3%
Actual Yes	26.7%	16.7%
Overall	24.9%	29.6%
k Hyperparameter	5	2
Number of Trees	200	50

*Note: This table displays the predictive capacity of the BART model prior to variable selection as well as the BART model with only the selected variables. Note that post selection model correctly classified democratic movements 83.3% of the time, performing better than the pre-selection model.

Figure 4: Authoritarian Persistence in the Middle East Without Concessional Lending



while authoritarian regimes became more vulnerable in the post-Cold War era. Geopolitical conflict between the US and USSR induced each side to prop up its respective allies, regardless of regime type, and the end of US-Soviet competition may have created prospects for greater openness (Bermeo 2016). French grants, another form of external financial inflows, exhibit a similar relationship to authoritarian persistence as concessional loans. Lower levels of aid are associated with a drop in authoritarian stability but, as aid increases, so too does authoritarian durability.

The next best predictors of authoritarian persistence are repression and the presence of a representative council. In countries with extremely repressive states, where physical integrity scores are lowest, the probability of a movement towards democracy is lowest and stays flat until repression reaches a more "moderate" level at which point a movement towards democracy is more likely to occur. Countries that repress their citizens most heavily seem to be the most stable.

The presence of a council has the opposite effect of physical repression. Countries with a representative body are more likely to shift towards greater political opening, even though such

institutions have no real power in many MENA countries. Nonetheless, based on European cases, the democratization literature shows that councils may slowly whittle away at authoritarianism as monarchs and dictators concede some power or as councils accumulate legislative power. The presence of a council may not bring about rapid political opening but rather through a gradual process over generations (Acemoglu and Robinson 2000; Boucoyannis 2021; Stasavage 2016).

In this analysis, the overall model error rate is slightly worse than the the model including the concessional loans variable, which is to be expected. Here the full BART-CV model without concessional loans predicted 73% of the outcome correctly and the model containing solely the top five predictors identified through the variable selection procedure had an overall prediction rate of 77.2%. Again, oil is not a key driver of authoritarian stability, nor are monarchism, GDP growth, Islam, government expenditures, or US grants – a striking set of non-findings given that these factors are often invoked to explain persistent authoritarianism in the Middle East.

6 Discussion: External Support and Authoritarian Persistence in the Middle East

Our findings indicate that foreign economic aid is the single most important predictor for authoritarian persistence in the Middle East and, within this broad category, concessional lending from international financial institutions. Given that aid is often officially aimed at promoting humanitarian or development goals, it is expected to serve normatively desirable purposes (Bermeo 2011; Clemens et al. 2012; Dunning 2004; Finkel et al. 2007; Wright 2009). Our findings buttress accounts that point to the stabilizing effects of fiscal support for authoritarian rule (Ahmed et al. 2016; Bermeo 2016; Bush 2016; De Mesquita and Smith 2009; Djankov et al. 2008; Morrison 2009, 1, 3). Even if donors try to push for political opening through conditionality, recipients can manipulate aid to their own ends, as Snider (2022) shows in her analysis of the distortion of democracy promotion aid by the Egyptian and Moroccan governments.

Economic assistance can shore up authoritarian rule through the classic channels in the authoritarian toolkit – carrots and sticks. With respect to the former, external support permits governments to provide more patronage to the general population, enabling them to "extend their tenure in political office" (Ahmed 2012, 146). Conversely, if citizens believe that powerful foreign patrons of incumbent rulers are a key source of economic opportunities, they may refrain from backing the opposition (Jamal 2012). Aid can also shore up support for incumbent dictators among elites, who generally pose the most serious threats. By expanding the pie, aid may make it more palatable for rulers to share more with members of ruling coalitions.

Turning to sticks, the fungibility of economic aid can enable governments to increase repression by allowing them to funnel more resources to the coercive apparatus of the state, whether through arms purchases or increased salaries for security forces, which can decrease the incidence of coup attempts (Powell 2012; Quinlivan 1999, 1029). A well compensated policeman with a stable job is more likely to repress protesters than one who is underpaid and disgruntled, especially where alternative employment opportunities are limited. External

support also permits governments to funnel more non-salary benefits to the coercive forces, entrenching their vested interests in the status quo.

Economic aid can also bolster state repression more indirectly by deterring anti-regime mobilization. Opposition groups may interpret large aid inflows as a sign that powerful foreign patrons will intervene on the side of incumbent rulers in the face of threats, raising the cost of resistance (Cunningham 2016, 308). Because it is fungible and is a hard signal of commitment to the incumbent, aid is more likely to engender and sustain these carrot and stick-based mechanisms than military aid or rhetorical support from a foreign patron.

ML methods have limitations. First, they do not generate causal findings. Accordingly, we do not make causal claims in this article. However, ML tools can yield information to inform future causal tests. For example, if an association between variables x and y is causal, yet x is an unimportant predictor of y, this can shape understandings of why key outcomes arise and how they can be addressed. Second, although ML methods can estimate complex associations and detect relationships that researchers may not observe on their own, like all models they offer incomplete representations of the world. Some phenomena are so abstract that they are difficult to quantify or data limitations may yield measures that are only superficial representations of a deeper truth. Other variables, such as black budgets, require indicators that are by definition impossible to measure. However, in combination with qualitative research, BART presents a powerful strategy for addressing these shortcomings. The BART approach to variable selection can identify the most substantively important drivers of a sociopolitical phenomenon among known and measurable explanations, allowing qualitative researchers to hone in on mechanisms.

7 Conclusion

Our novel methodological approach based on BART provides a powerful set-up for comparing distinct accounts of the political ramifications of foreign aid and of authoritarianism in the Middle East. Our analyses reveal that foreign economic aid in the form of concessional loans is by far the most consistent predictor of MENA authoritarian persistence - a finding that holds up through rigorous ML tests with greater predictive power than standard MLEs and different model specifications capturing a large number of potential explanations. Because wealthy, oil-rich countries do not receive such loans, we also run analyses without the concessional lending variable, showing that the Cold War period, when US-Soviet competition shored up dictators in client states, and French grants, which operate similarly to concessional lending, and repression are the key predictors.

Our results bolster the broad claim that aid can hinder regime transitions (Ahmed 2012; Bermeo 2016; Djankov et al. 2008) while isolating the distinct effects of different forms of external support on authoritarian durability. More specifically, we contribute to the literature on persistent authoritarianism in the region theoretically, conceptually, and methodologically by providing a unified framework supported by rigorous empirical evidence, and by including a measure of regime change and persistence that conforms more closely to conceptualizations in the broader literature on democratization and to the actual historical record of regime

change across the world. Our findings are in line with approaches privileging external factors (Bellin 2004; Brownlee 2012; Jamal 2012; Yom 2016), however, we unpack distinct forms of foreign support and isolate the relative importance of specific forms of external support more systematically. In the absence of top-secret data on black budgets, it is impossible to test the precise mechanisms through which external support sustains authoritarianism, but the fungibility of economic inflows likely frees up funds for regimes to invest more in the salaries and materiel of the coercive forces. Future qualitative research should disentangle these effects in specific Middle Eastern countries. External economic aid may also deter anti-regime mobilization by signaling support from powerful global actors (Jamal 2012).

Of equal interest are variables that BART did *not* select. First, military aid does not have a substantial impact on MENA authoritarian durability. Second, oil is not a key predictor of MENA authoritarian persistence, bolstering critiques of the political resource curse argument (Smith and Waldner 2021). Third, monarchism does not predict regime durability in the Middle East, contrary to some accounts (Herb 1999; Bank et al. 2015; Hamid 2011; Mazaheri 2013; Menaldo 2012).[16] Fourth, Islamic culture is not associated with authoritarianism in the Middle East (Huntington 1991; Kedourie 1994), which may also raise questions for more sophisticated arguments linking deep historical legacies in Muslim societies to authoritarianism and related outcomes (Blaydes 2017; Blaydes and Chaney 2013; Hariri 2015; Kuran 2012; Kuru 2019).

Although our dataset ends in 2006, extending the time series through the current post-Arab uprisings period would likely bolster our findings. For example, Tunisia, the only country to experience a democratic transition, albeit ephemeral, is less geostrategically important and has received less aid than other MENA countries (Marzo 2020). Conversely, the case of Egypt illustrates how external support sustains authoritarianism in the region, with vast sums of aid pouring into the country, even after the 2013 coup overthrowing President Mohamed Morsi and subsequent Raba'a Massacre (Brownlee 2012; Rutherford 2018). Jordan, a stable authoritarian regime, is a paradigmatic case, benefiting from high levels of economic aid. How can our findings account for persistent authoritarianism in the oil-rich Gulf monarchies, which do not receive concessional loans, given that neither oil wealth nor monarchism are significant predictors? In this sub-region, the results of models that drop the concessional loans variable suggest that repression may be a critical factor. Firm rhetorical commitments by powerful global allies may also deter would-be opponents from rising up against the Gulf authoritarian regimes (Cunningham 2016), although our data do not allow us to test this here. While domestic factors conditioned post-uprisings trajectories, external support undoubtedly shaped the calculations and behavior of incumbent rulers and their opponents across the region.

Our core findings have important and disturbing normative implications, most starkly with respect to economic aid, which is often associated with positive developmental outcomes. If aid effectively props up Middle Eastern dictators, this raises questions about what concessional loans from multilateral actors actually achieve in the region. While the intentions of many development practitioners are noble, the net effects of economic flows from international financial institutions and other donors may unwittingly sustain threats and coercion and may

[16]Because the variable is dichotomous, and virtually all other regimes are republics, this finding indicates that the latter regime type is also not a compelling explanation (Brownlee 2007).

hinder political reform in the Middle East.

References

Acemoglu, D. and J. A. Robinson (2000). Why did the west extend the franchise? democracy, inequality, and growth in historical perspective. *The quarterly journal of economics 115*(4), 1167–1199.

Ahmed, F. Z. (2012). The perils of unearned foreign income: Aid, remittances, and government survival. *American Political Science Review 106*(1), 146–165.

Ahmed, F. Z. et al. (2016). Does foreign aid harm political rights? evidence from us aid. *Quarterly Journal of Political Science 11*(2), 183–217.

Ambrosio, T. and J. Tolstrup (2019). How do we tell authoritarian diffusion from illusion? exploring methodological issues of qualitative research on authoritarian diffusion. *Quality & Quantity 53*(6), 2741–2763.

Andersen, J. J. and M. L. Ross (2014). The big oil change: A closer look at the haber–menaldo analysis. *Comparative Political Studies 47*(7), 993–1021.

Anderson, L. (2006). Searching where the light shines: Studying democratization in the middle east. *Annu. Rev. Polit. Sci. 9*, 189–214.

Bank, A., T. Richter, and A. Sunik (2015). Long-term monarchical survival in the middle east: a configurational comparison, 1945–2012. *Democratization 22*(1), 179–200.

Beblawi, H. (1987). The rentier state in the arab world. *Arab Studies Quarterly*, 383–398.

Bellin, E. (1994). The politics of profit in tunisia: Utility of the rentier paradigm? *World Development 22*(3), 427–436.

Bellin, E. (2004). The robustness of authoritarianism in the middle east: Exceptionalism in comparative perspective. *Comparative politics*, 139–157.

Bellin, E. R. (2002). *Stalled Democracy: Capital, Labor, and the Paradox of State-Sponsored Development*. Cornell University Press.

Berger, L. (2019). Sharīa, islamism and arab support for democracy. *Democratization 26*(2), 309–326.

Berman, S. (1997). Civil society and the collapse of the weimar republic. *World Politics 49*(3), 401–429.

Bermeo, S. B. (2011). Foreign aid and regime change: A role for donor intent. *World Development 39*(11), 2021–2031.

Bermeo, S. B. (2016). Aid is not oil: Donor utility, heterogeneous aid, and the aid-democratization relationship. *International Organization 70*(1), 1–32.

Blackwell, M. and M. P. Olson (2021). Reducing model misspecification and bias in the estimation of interactions. *Political Analysis*, 1–20.

Blaydes, L. (2017). State building in the middle east. *Annual Review of Political Science 20*, 487–504.

Blaydes, L. and E. Chaney (2013). The feudal revolution and europe's rise: Political divergence of the christian west and the muslim world before 1500 ce. *American Political Science Review 107*(1), 16–34.

Boix, C. and S. C. Stokes (2003). Endogenous democratization. *World Politics*, 517–549.

Boucoyannis, D. (2021). *Kings as Judges: Power, Justice, and the Origins of Parliaments*. Cambridge University Press.

Brownlee, J. (2007). *Authoritarianism in an Age of Democratization*. Cambridge University Press Cambridge.

Brownlee, J. (2012). *Democracy Prevention: The Politics of the US-Egyptian Alliance*. Cambridge University Press.

Brownlee, J. M. (2002). Low tide after the third wave: Exploring politics under authoritarianism.

Bush, S. S. (2016). *The Taming of Democracy Assistance: Why Democracy Promotion Does Not Confront Dictator*. Cambridge University Press.

Bush, S. S. (2017). Varieties of international influence and the middle east. *PS: Political Science & Politics 50*(3), 668–671.

Cammett, M., I. Diwan, A. Richards, and J. Waterbury (2015). *A Political Economy of the Middle East*. Hachette UK.

Cammett, M. and P. Jones (2022). Politics in muslim societies. *The Oxford Handbook of Politics in Muslim Societies*, 1.

Capoccia, G. and D. Ziblatt (2010). The historical turn in democratization studies: A new research agenda for europe and beyond. *Comparative Political Studies 43*(8-9), 931–968.

Chipman, H. A., E. I. George, R. E. McCulloch, et al. (2010). Bart: Bayesian additive regression trees. *The Annals of Applied Statistics 4*(1), 266–298.

Ciftci, S. (2010). Modernization, islam, or social capital: What explains attitudes toward democracy in the muslim world? *Comparative Political Studies 43*(11), 1442–1470.

Cingranelli, D. L. and D. L. Richards (2010). The cingranelli and richads (ciri) human rights data project. *Hum. Rts. Q. 32*, 401.

Clemens, M. A., S. Radelet, R. R. Bhavnani, and S. Bazzi (2012). Counting chickens when they hatch: Timing and the effects of aid on growth. *The Economic Journal 122*(561), 590–617.

Cunningham, D. E. (2016). Preventing civil war: How the potential for international intervention can deter conflict onset. *World Politics 68*(2), 307–340.

De Mesquita, B. B. and A. Smith (2009). A political economy of aid. *International Organization 63*(2), 309–340.

Djankov, S., J. G. Montalvo, and M. Reynal-Querol (2008). The curse of aid. *Journal of economic growth 13*(3), 169–194.

Donno, D. and B. Russett (2004). Islam, authoritarianism, and female empowerment: What are the linkages? *World Politics 56*, 582–607.

Dunning, T. (2004). Conditioning the effects of aid: Cold war politics, donor credibility, and democracy in africa. *International organization 58*(2), 409–423.

Finkel, S. E., A. Pérez-Liñán, and M. A. Seligson (2007). The effects of us foreign assistance on democracy building, 1990–2003. *World Politics 59*(3), 404–439.

Fish, M. S. (2011). *Are Muslims Distinctive?: A Look at the Evidence*. Oxford University Press.

Hamid, S. (2011). Why middle east monarchies might hold on. *The Atlantic 8*, 2011.

Hariri, J. G. (2015). A contribution to the understanding of middle eastern and muslim exceptionalism. *The Journal of Politics 77*(2), 477–490.

Herb, M. (1999). *All in the Family: Absolutism, Revolution, and Democracy in Middle Eastern Monarchies*. Suny Press.

Herb, M. (2004). Princes and parliaments in the arab world. *The Middle East Journal 58*(3), 367–384.

Herb, M. (2005). No representation without taxation? rents, development, and democracy. *Comparative Politics*, 297–316.

Heydemann, S. (2007). *Upgrading authoritarianism in the Arab world*. Saban Center for Middle East Policy at the Brookings Institution.

Huntington, S. P. (1984). Will more countries become democratic? *Political Science Quarterly 99*(2), 193–218.

Huntington, S. P. (1991). *The Third Wave: Democratization in the Late Twentieth Century*, Volume 4. University of Oklahoma press.

Jamal, A. A. (2012). *Of Empires and Citizens: Pro-American Democracy or No Democracy at All?* Princeton University Press.

Kapelner, A. and J. Bleich (2013). bartmachine: Machine learning with bayesian additive regression trees. *arXiv preprint arXiv:1312.2171*.

Kedourie, E. (1994). *Democracy and Arab Political Culture*. Routledge.

Kramer, M. (1993). Where islam and democracy part ways. *Democracy in the Middle East: Defining the Challenge. Washington*, 257.

Kuran, T. (2012). *The long divergence*. Princeton University Press.

Kuru, A. T. (2019). *Islam, authoritarianism, and underdevelopment: A global and historical comparison*. Cambridge University Press.

Levitsky, S. and L. A. Way (2010). *Competitive Authoritarianism: Hybrid Regimes After the Cold War*. Cambridge University Press.

Lust, E. (2011). Missing the third wave: Islam, institutions, and democracy in the middle east. *Studies in Comparative International Development 46*(2), 163–190.

Lust-Okar, E. (2005). *Structuring conflict in the Arab world: Incumbents, opponents, and institutions*. Cambridge University Press.

Mares, I. (2015). *From open secrets to secret voting: Democratic electoral reforms and voter autonomy*. Cambridge University Press.

Marshall, M. G., T. R. Gurr, and K. Jaggers (2019). Polity iv project: political regime characteristics and transitions, 1800–2018. *Center for Systemic Peace*.

Marzo, P. (2020). International democracy promoters and transitional elites: favourable conditions for successful partnership. evidence from tunisia's democratization. *Cambridge Review of International Affairs 33*(3), 307–329.

Mazaheri, N. (2013). The saudi monarchy and economic familism in an era of business environment reforms. *Business and Politics 15*(3), 295–321.

Menaldo, V. (2012). The middle east and north africa's resilient monarchs. *The Journal of Politics 74*(3), 707–722.

Montgomery, J. M. and S. Olivella (2018). Tree-based models for political science data. *American Journal of Political Science 62*(3), 729–744.

Morrison, K. M. (2009). Oil, nontax revenue, and the redistributional foundations of regime stability. *International organization 63*(1), 107–138.

NISAT (2013). Norwegian Initiative on Small Arms Transfers. http://nisat.prio.org/. Accessed: 2022-01-08.

OECD (2022). OECD Statistics. https://stats.oecd.org/. Accessed: 2022-01-08.

Owen, R. (2013). *State, power and politics in the making of the modern Middle East*. Routledge.

Posusney, M. P. (2002). Multi-party elections in the arab world: Institutional engineering and oppositional strategies. *Studies in Comparative International Development 36*(4), 34–62.

Posusney, M. P. (2005). *The Middle East's Democracy Deficit in Comparative Perspective*. na.

Powell, J. (2012). Determinants of the attempting and outcome of coups d'état. *Journal of Conflict resolution 56*(6), 1017–1040.

Quinlivan, J. T. (1999). Coup-proofing: Its practice and consequences in the middle east. *International Security 24*(2), 131–165.

Ross, M. L. (2001). Does oil hinder democracy? *World Politics*, 325–361.

Rutherford, B. K. (2018). Egypt's new authoritarianism under sisi. *The Middle East Journal 72*(2), 185–208.

Sharabi, H. (1988). *Neopatriarchy: A Theory of Distorted Change in Arab Society*. Oxford University Press, USA.

SIPRI, A. (2020). Arms transfers database.

Smith, B. and D. Waldner (2021). *Rethinking the Resource Curse*. Cambridge University Press.

Smith, B. B. (2007). *Hard Times in the Lands of Plenty: Oil Politics in Iran and Indonesia*. Cornell University Press.

Snider, E. A. (2022). *Marketing Democracy: The Political Economy of Democracy Aid in the Middle East*, Volume 64. Cambridge University Press.

Stasavage, D. (2016). Representation and consent: why they arose in europe and not elsewhere. *Annual Review of Political Science 19*(1), 145–62.

Tansey, O., K. Koehler, and A. Schmotz (2017). Ties to the rest: Autocratic linkages and regime survival. *Comparative Political Studies 50*(9), 1221–1254.

Tessler, M. (2002). Islam and democracy in the middle east: The impact of religious orientation on attitudes toward democracy in four arab countries. *Comparative Politics*, 337–354.

Thompson, E. F. (2020). *How the West Stole Democracy from the Arabs: The Syrian Arab Congress of 1920 and the Destruction of Its Historical Liberal-Islamic Alliance*. Atlantic Monthly Press.

Wasserstein, R. L. and N. A. Lazar (2016). The asa statement on p-values: Context, process, and purpose.

World Bank (2022). External Debt Stocks, Total (DOD, Current USD). https://data.worldbank.org/indicator/DT.DOD.DECT.CD, note = Accessed: 2022-01-08.

Wright, J. (2009). How foreign aid can foster democratization in authoritarian regimes. *American journal of political science 53*(3), 552–571.

Wright, J., E. Frantz, and B. Geddes (2015). Oil and autocratic regime survival. *British Journal of Political Science 45*(2), 287–306.

Yakouchyk, K. (2019). Beyond autocracy promotion: A review. *Political Studies Review 17*(2), 147–160.

Yom, S. L. (2016). *From Resilience to Revolution: How Foreign Interventions Destablize the Middle East*. Columbia University Press.

Yom, S. L. and F. G. Gause III (2012). Resilient royals: How arab monarchies hang on. *Journal of Democracy 23*(4), 74–88.

Youssef, T. (2004). Growth and policy reform in the middle east since 1950. *Journal of Economic Perspectives 18*(3), 91–116.

External Support and Persistent Authoritarianism in the Middle East: Supplemental Information

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Appendix A

Variables

A.1.0 List of Variables and Definitions

TABLE A.1: Complete List of Variables

Variable	Dataset	Description
Democratic Movement	Polity	A dichotomous variable that takes the value "1" if a country has a positive movement in Polity IV and "0" otherwise.
Regime Change (polity)	Polity	Regime Transition Completed. Variable D4 is a flag variable that designates (by code “1") the year of a regime change or the final year of a multi-year regime transition.
Concessional Loans USD	World Bank	Public and publicly guaranteed multilateral loans include loans and credits from the World Bank, regional development banks, and other multilateral and intergovernmental agencies. Excluded are loans from funds administered by an international organization on behalf of a single donor government; these are classified as loans from governments. Concessional debt is defined as loans with an original grant element of 35 percent or more. The grant element of a loan is the grant equivalent expressed as a percentage of the amount committed. It is used as a measure of the overall cost of borrowing. The grant equivalent of a loan is its commitment (present) value, less the discounted present value of its contractual debt service; conventionally, future service payments are discounted at 5 percent. Principal repayments are actual amounts of principal (amortization) paid by the borrower in currency, goods, or services in the year specified. Data are in current U.S. dollars.
Lag Government Expenditures \% GDP	Menaldo	
Lag Civil Liberties	V-Dem	Civil liberty is understood as liberal freedom, where freedom is a property of individuals. Civil liberty is constituted by the absence of physical violence committed by government agents and the absence of constraints of private liberties and political liberties by the government.

Lag Freedom From Torture	V-Dem	Torture refers to the purposeful inflicting of extreme pain, whether mental or physical, with an aim to extract information or intimidate victims, who are in a state of incarceration. Here, we are concerned with torture practiced by state officials or other agents of the state (e.g., police, security forces, prison guards, and paramilitary groups).
Total Fuel Income	Menaldo	
US Total Grants	OECD	All grant money from host country to partner country
UK Total Grants	OECD	
France Total Grants	OECD	
Italy Total Grants	OECD	
Monarchy	Menaldo	"1" if monarchical regime type, "0" if other regime type
Cold War		"1" if prior to 1991, "0" if else
Ethnic Fractionalization	Menaldo	"The version of Ethnic Fractionalization used in the paper is from Fearon and Laitin (2003) and was created by Fearon (2002). The data was coded by the authors as missing for Qatar. Therefore, to avoid listwise deletion of observations, I imputed this missing value by coding Qatar's ethnic fractionalization as the same as Kuwait's due to the fact that the secondary literature on this topic suggests that the ethnic composition of both countries is nearly identical. The results are not sensitive to coding Qatar's ethnic fractionalization as the same as the United Arab Emirates, another country that has a similar ethnic composition."
Percapita Income	Menaldo	
Log Growth	Menaldo	"This growth rate is computed from the first difference of the natural log of the level of Per Capita Income from Haber and Menaldo (2011). Because of this first-difference transformation, it is often the case that the first year of a country panel has missing data if Per Capita Income data was not available prior to the first year in which the country enters the dataset. To avoid casewise deletion of observations due to this phenomenon, I imputed missing values for countries coded as missing for economic growth this first year. Specifically, I took the average growth rate for the 3 initial observations for the countries for which there was missing data for the first year in which they entered the sample. So, for example, if Libya did not have a value for Growth Rate in 1950, because that is the year that it entered the sample and therefore that is the first year for which Per Capita Income data is available, I took the average growth in Libya in 1951, 1952 and 1953 as a proxy for its growth rate in 1950. The results are not sensitive to taking the average for different intervals, e.g. the first 5 years."
US Arms Exports	SIPRI	Value of arms transfer by country each year
Russia Arms Exports	SIPRI	
UK Arms Exports	SIPRI	
France Arms Exports	SIPRI	
Italy Arms Exports	SIPRI	
USA total arms	SIPRI	Total value of arms transfers by country
UK total arms	SIPRI	
Russia total arms	SIPRI	
Italy total arms	SIPRI	
USA cumsum arms	SIPRI	Cumulative sum of arms transfers by country

UK cumsum arms	SIPRI	
Italy cumsum arms	SIPRI	
Russia cumsum arms	SIPRI	
France cumsum arms	SIPRI	
log population	Menaldo	"I take the data from the World Bank's World Bank Development Indicators (online edition), which begins coverage in 1960. For countries that were independent before 1960, I employ the United Nation's World Population Prospects . . . , which provides coverage since 1950."
log area	Menaldo	
Persian Gulf	Menaldo	"The dummy variable Persian Gulf is coded as a "1" for the following countries: Iran, Iraq, Saudi Arabia, Yemen, Kuwait, Bahrain, Qatar, United Arab Emirates and Oman. It is coded as a "0" for every other country in the dataset."
Percent Muslim	Menaldo	"This data is from Fearon and Laitin (2003). The data was coded by the authors as missing for Qatar. I therefore used the CIA World Factbook to fill in this missing value. Qatar is assigned a value of 78 percent based on this source."
Percent Small Arms and Cumsum	NISAT	Cumulative sum of small arms transfers to a country in a given year or cumulative percentage of small arms transfers to a country in comparison with all small arms transfers to the MENA region as a whole in a given year
GDP per capita growth annual	World Bank	
year	Menaldo	Year ranging from 1962-2007
country	Menaldo	Name of Country

A.2.0 Time Series Plots of Variables

Figure A.1: Democratic Movement

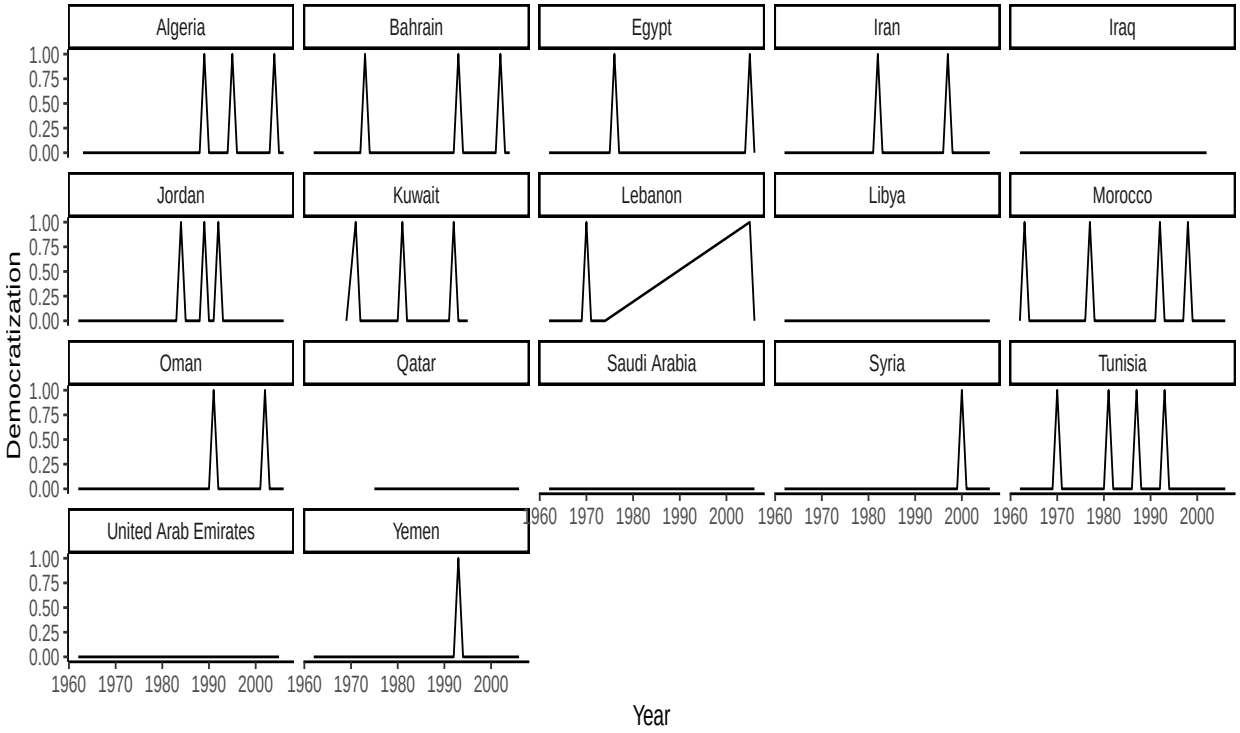


Figure A.2: Regime Changed

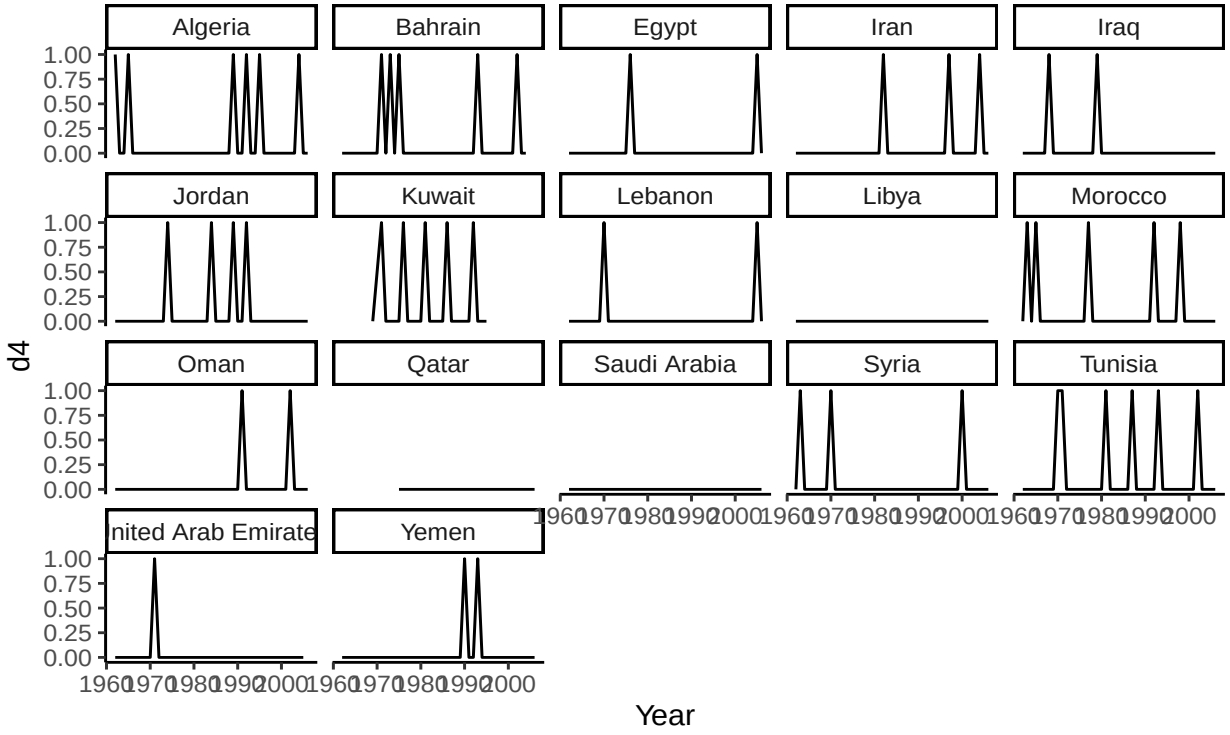


Figure A.3: Concessional Loans

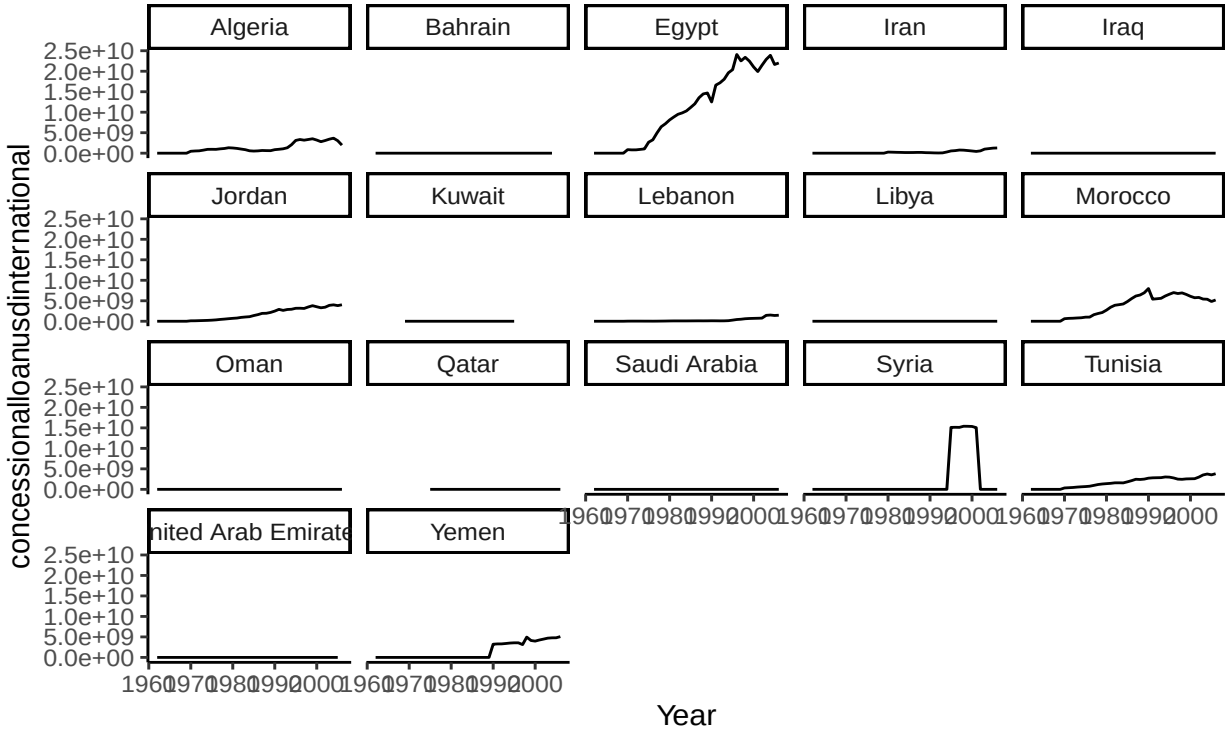


Figure A.4: Government Expenditures Percent of GDP

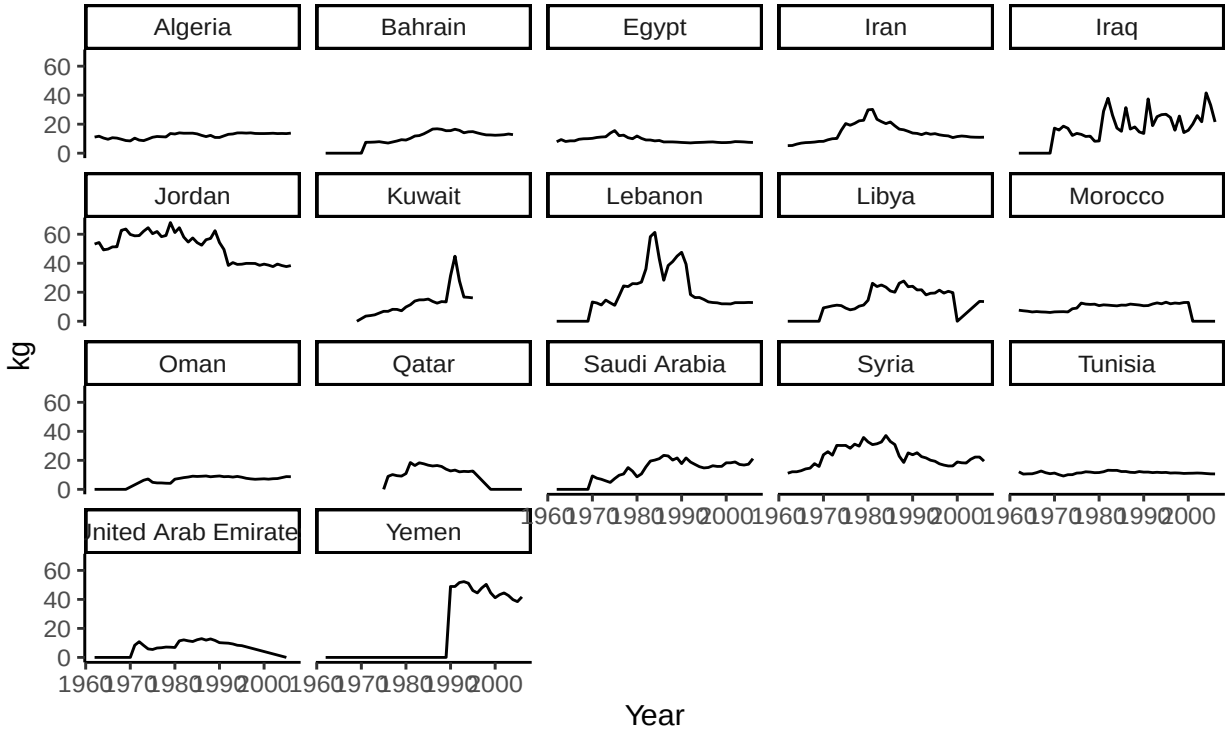


Figure A.5: Freedom From Torture

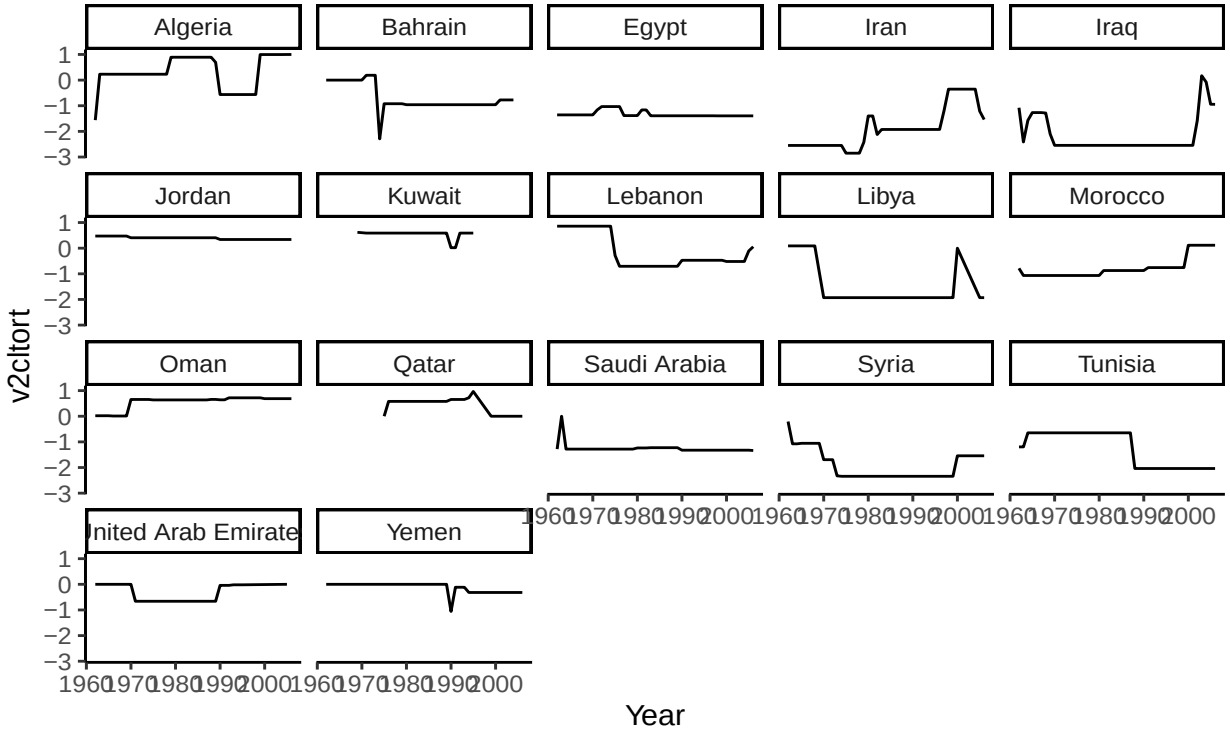


Figure A.6: Total Fuel Income

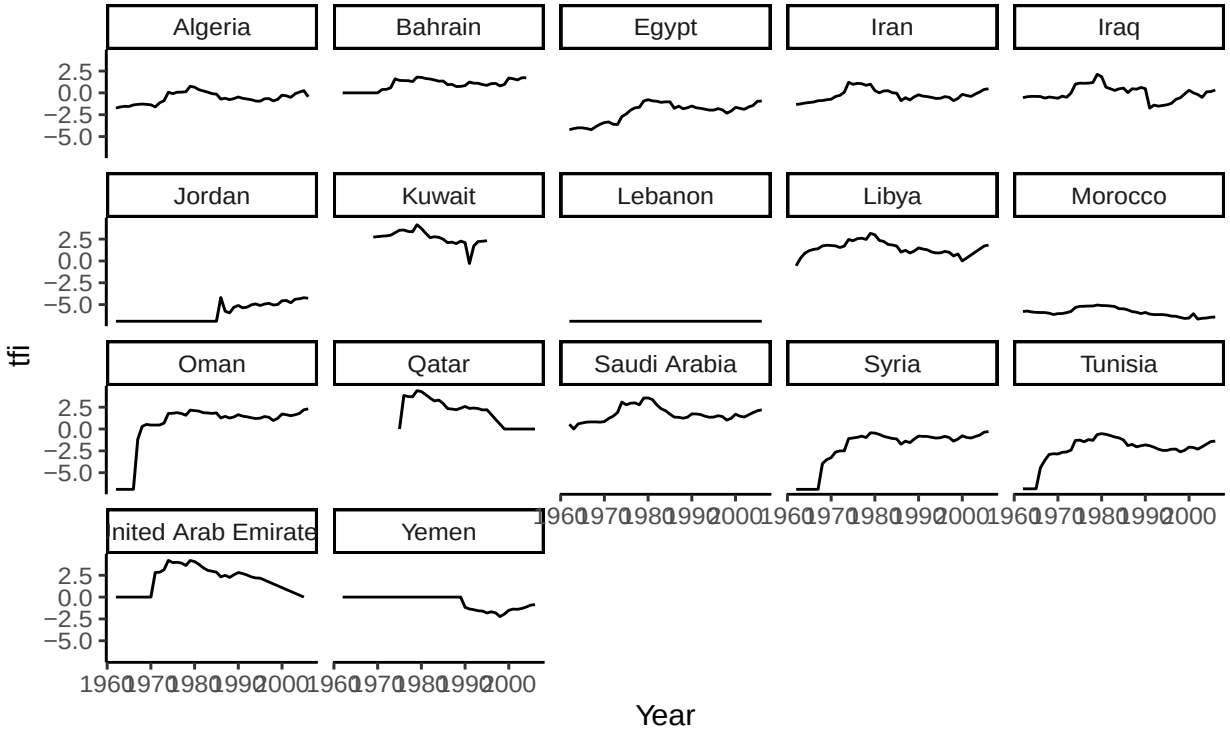


Figure A.7: US Total Grants

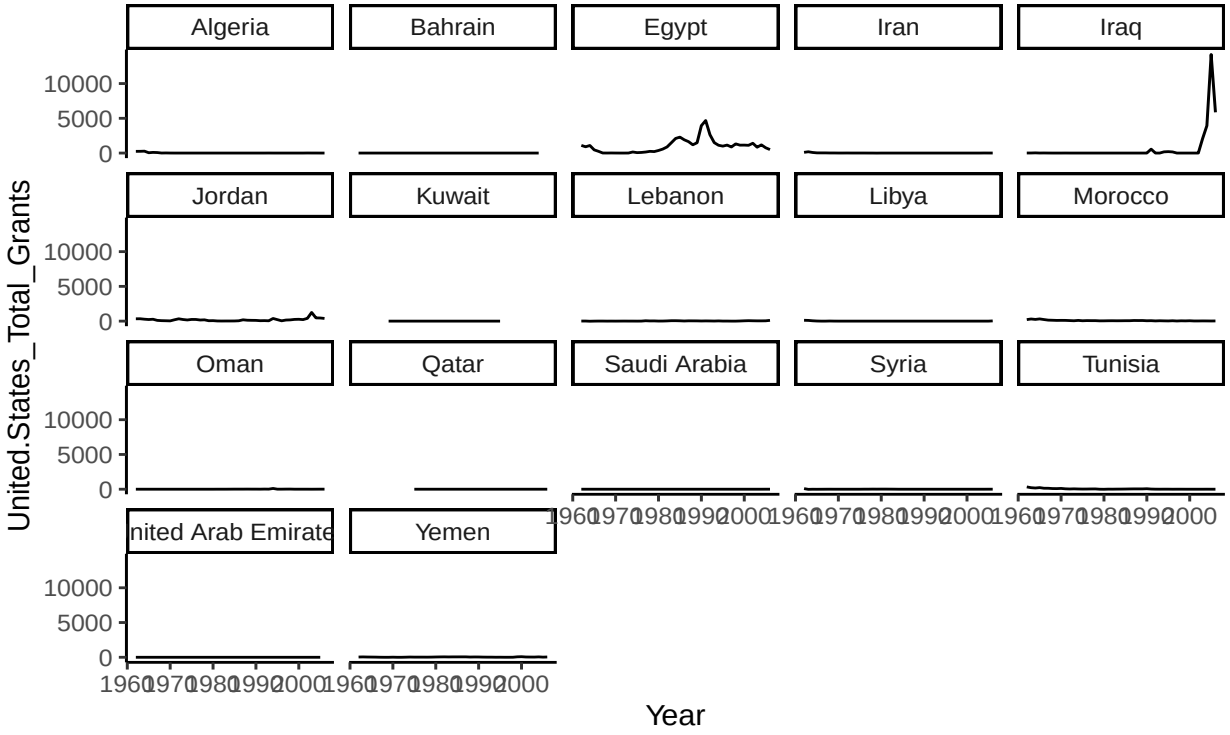


Figure A.8: UK Total Grants

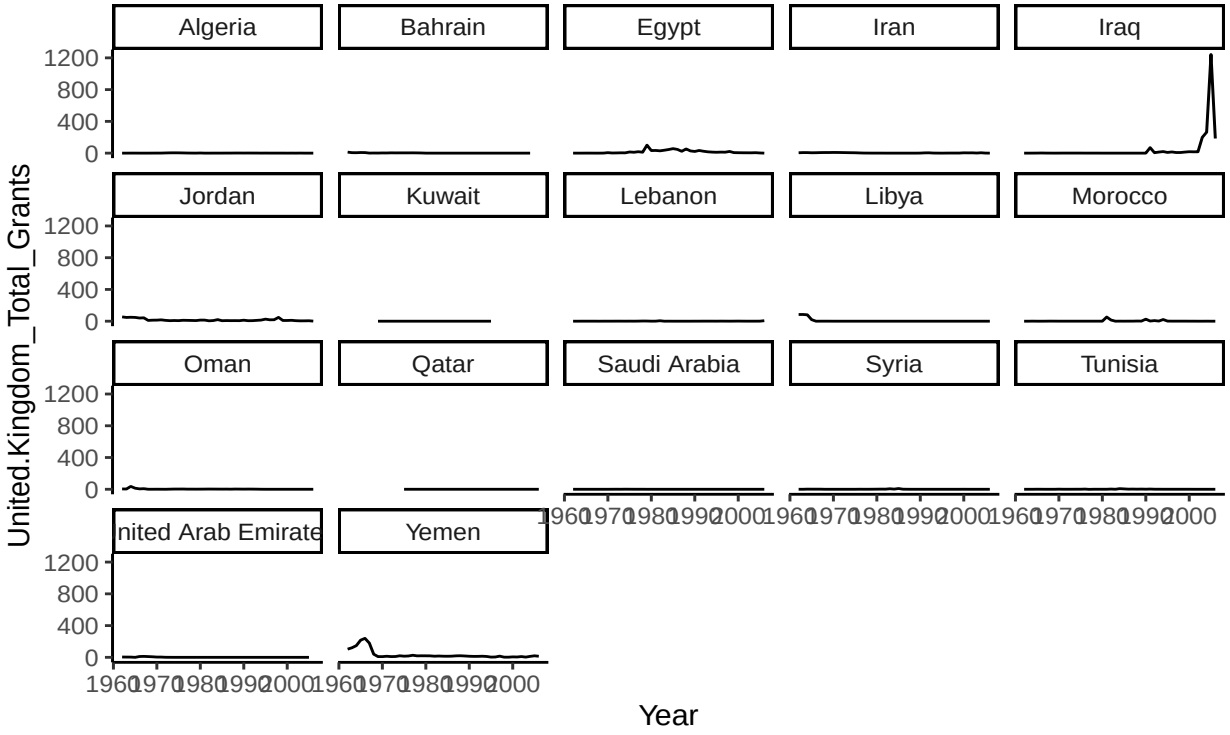


Figure A.9: France Total Grants

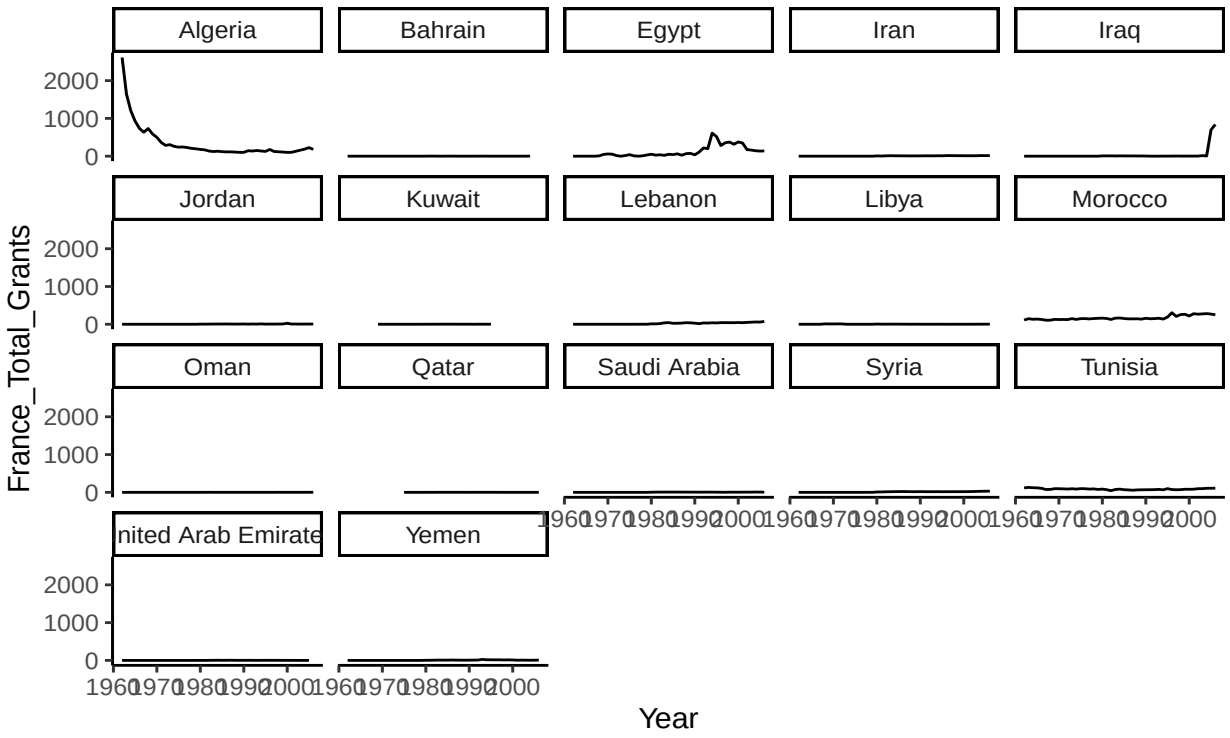


Figure A.10: Italy Total Grants

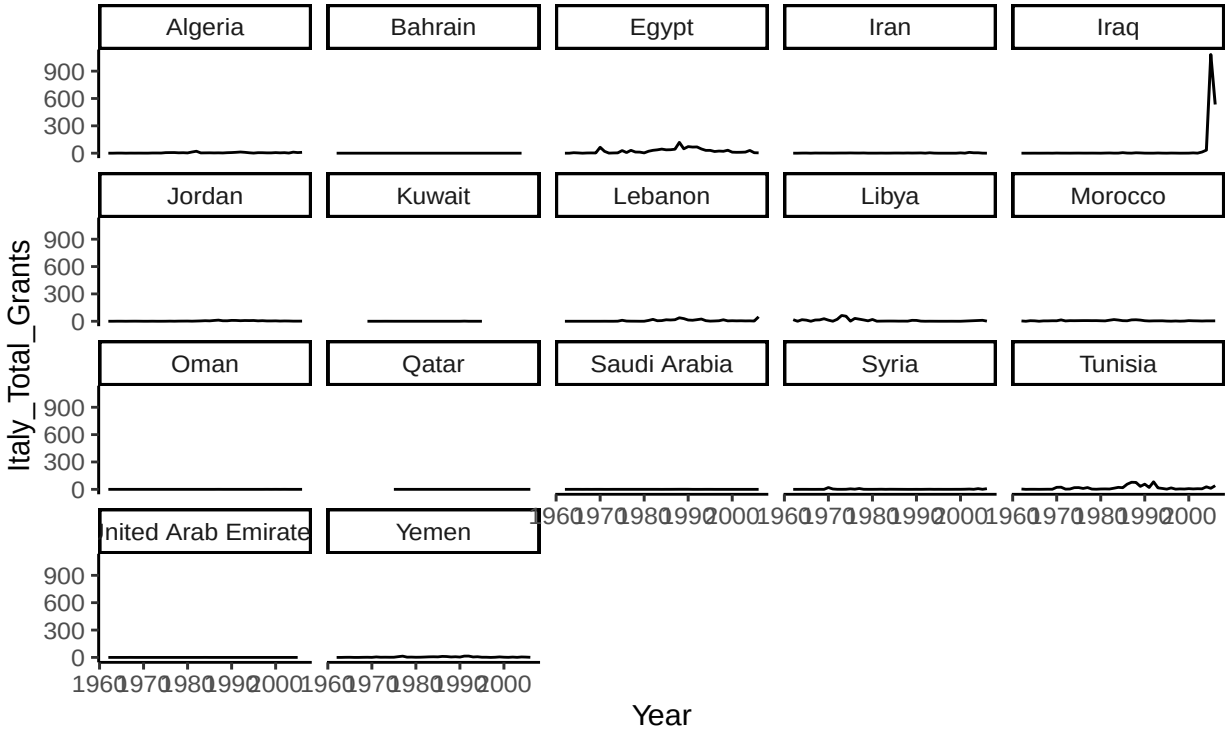


Figure A.11: Monarchism

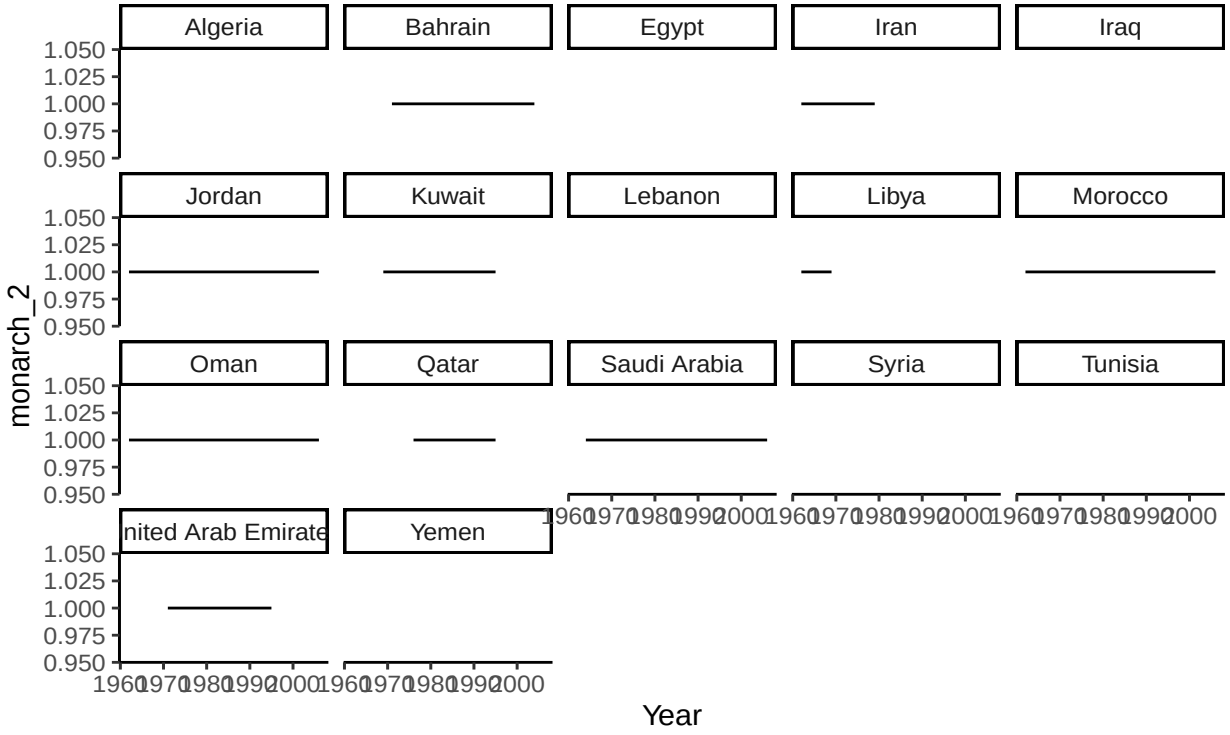


Figure A.12: Ethnic Fractionalization

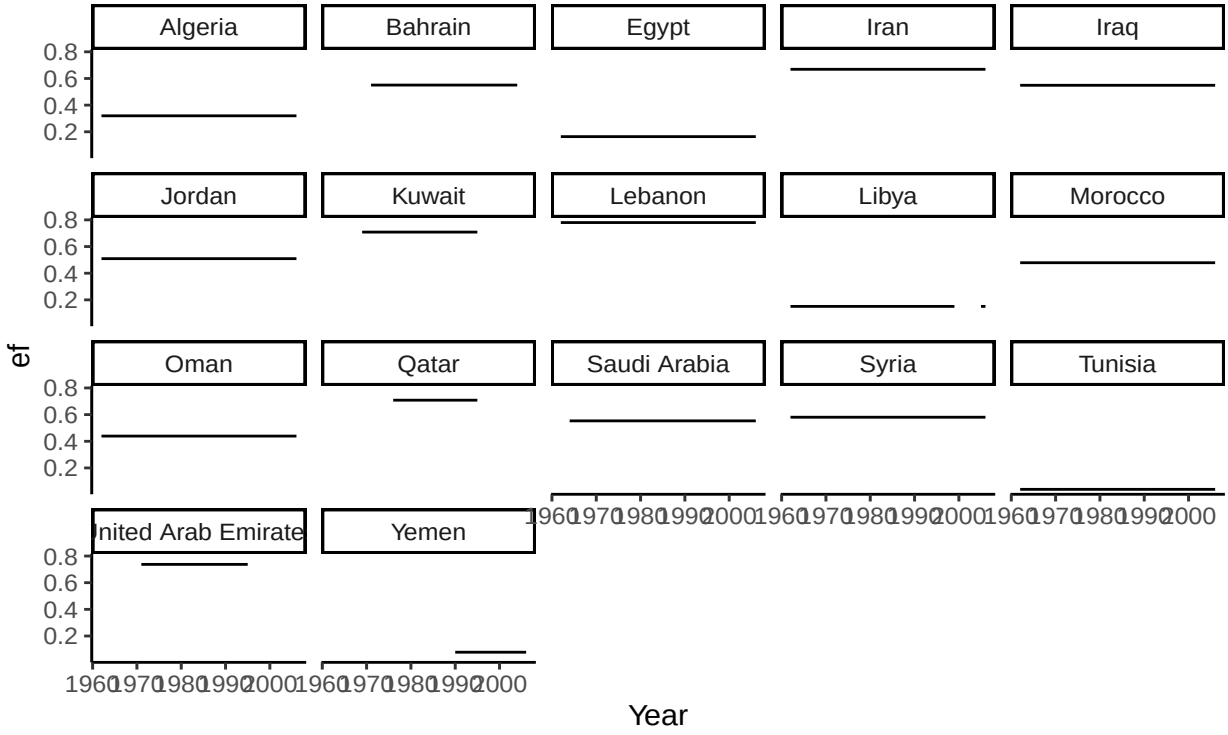


Figure A.13: Per Capita Income

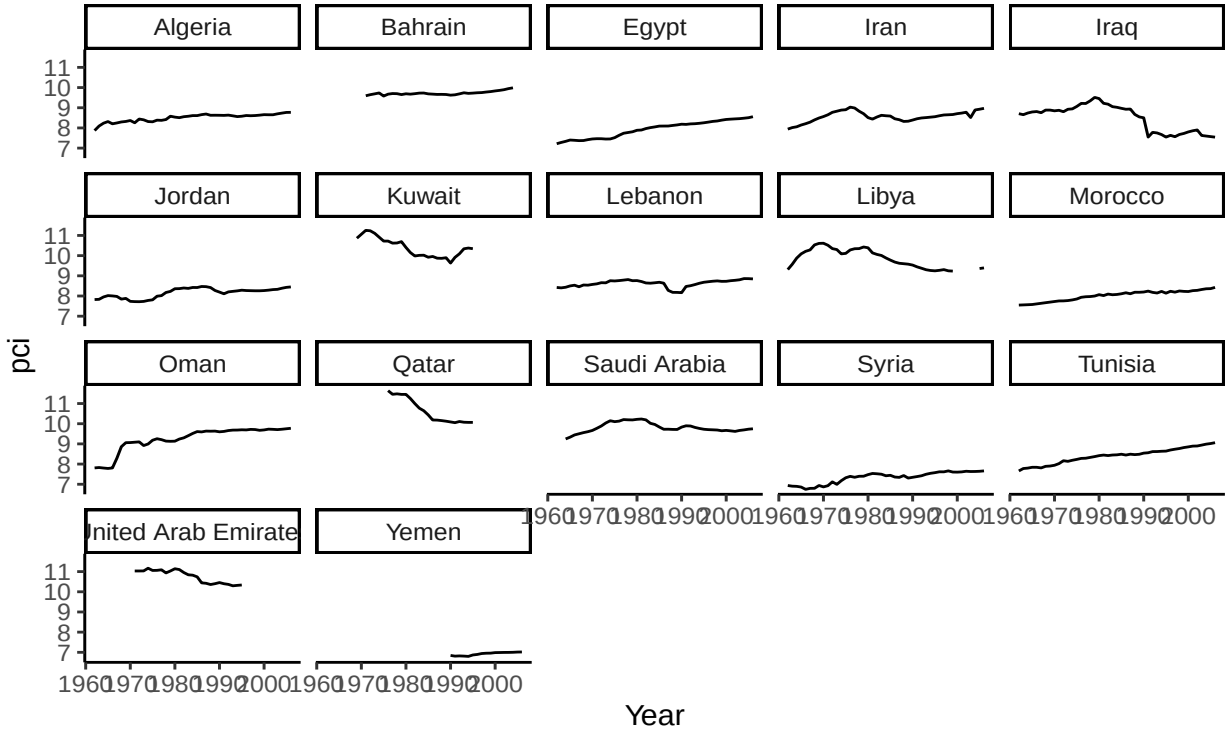


Figure A.14: Log Growth

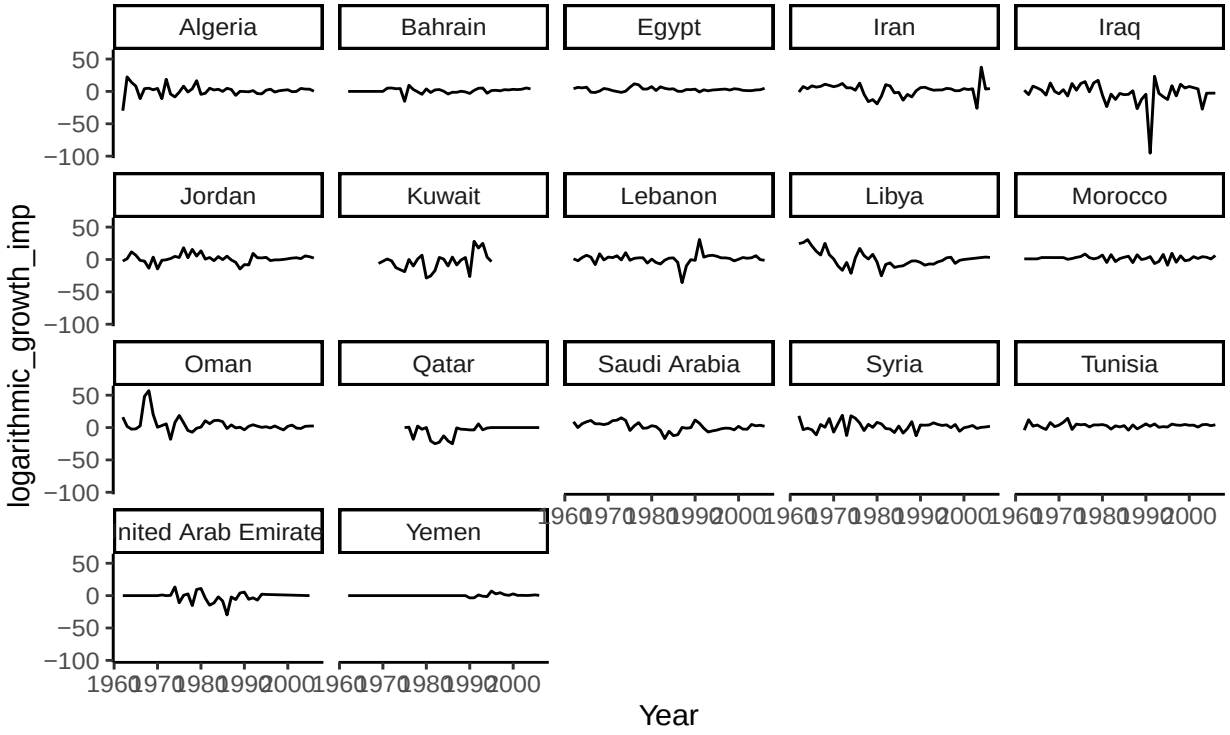


Figure A.15: US Arms Exports

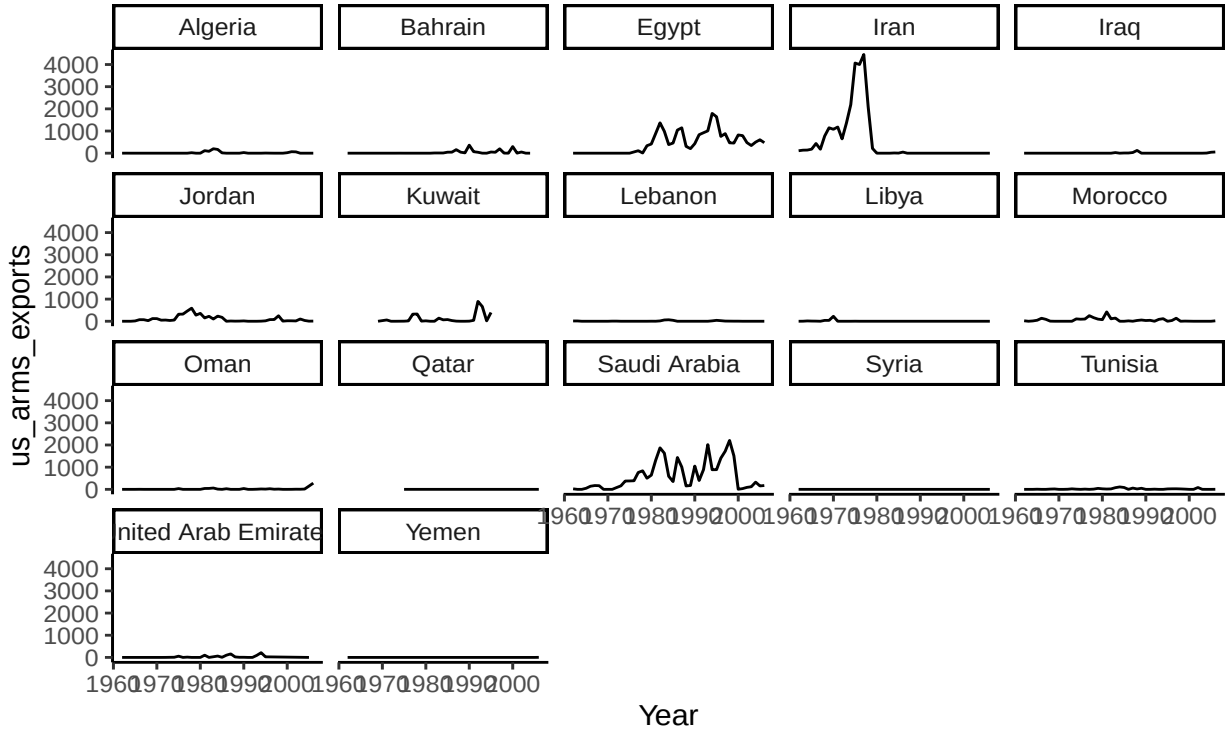


Figure A.16: Russia Arms Exports

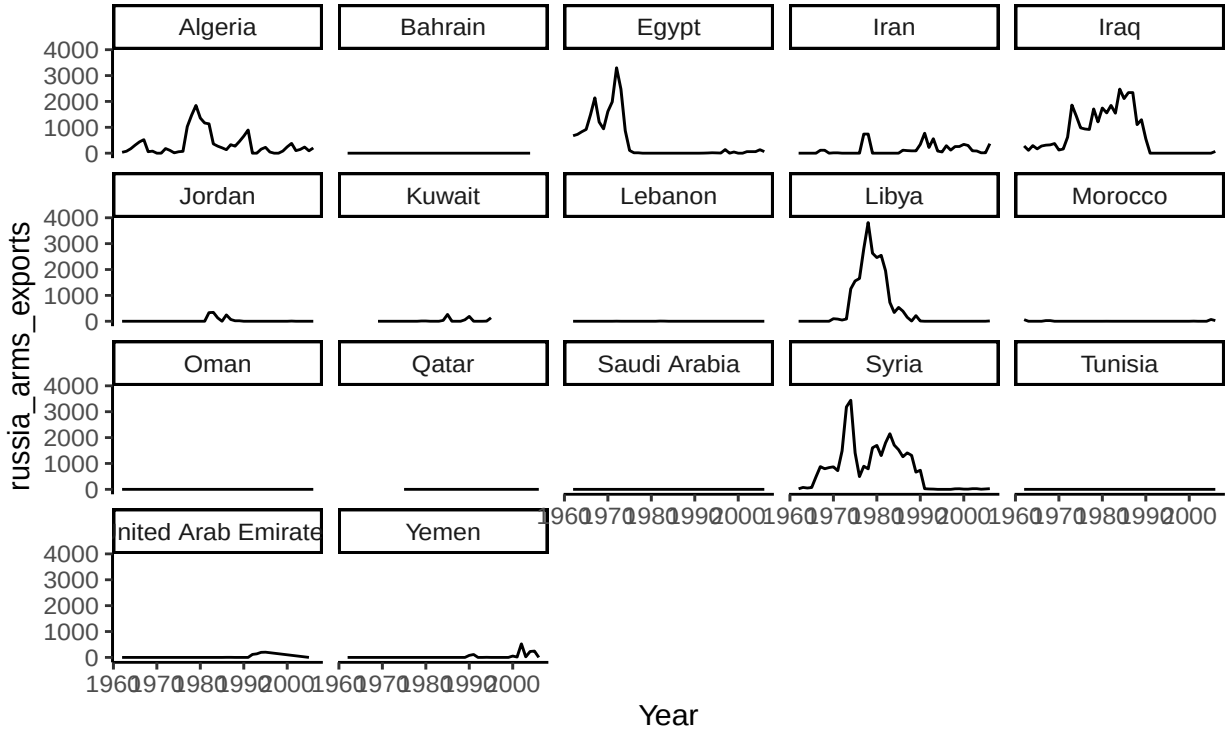


Figure A.17: UK Arms Exports

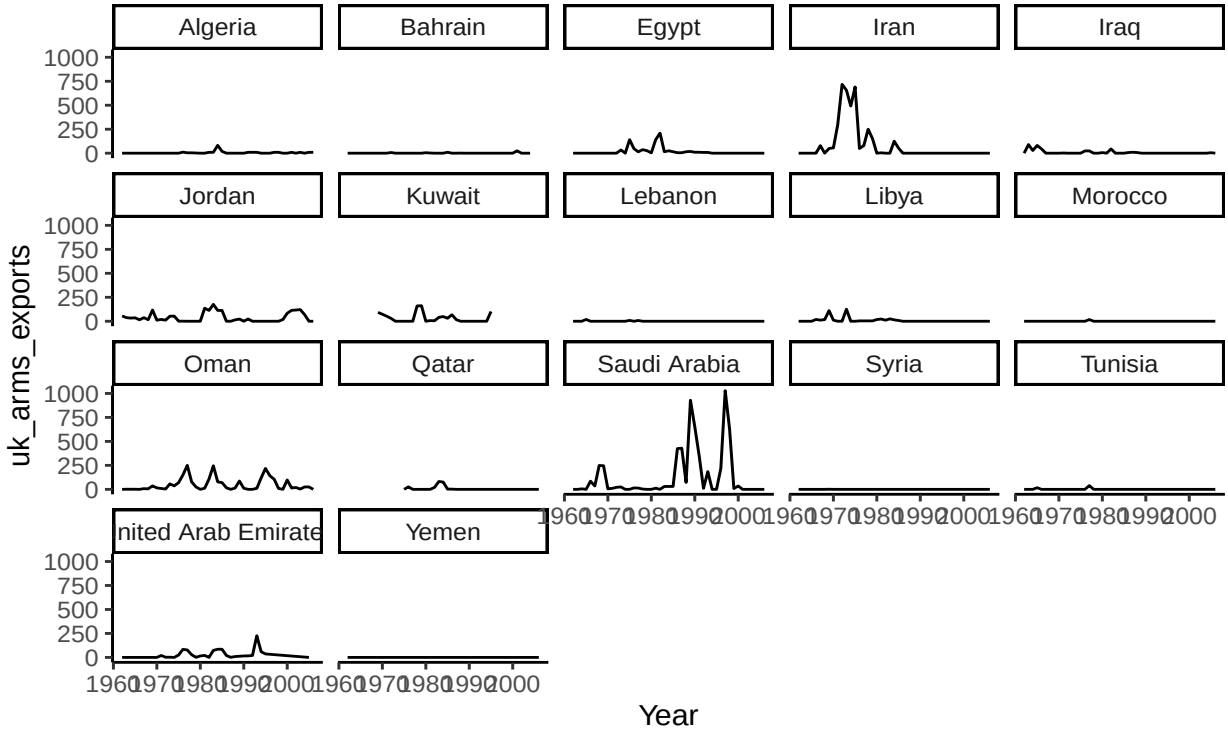


Figure A.18: France Arms Exports

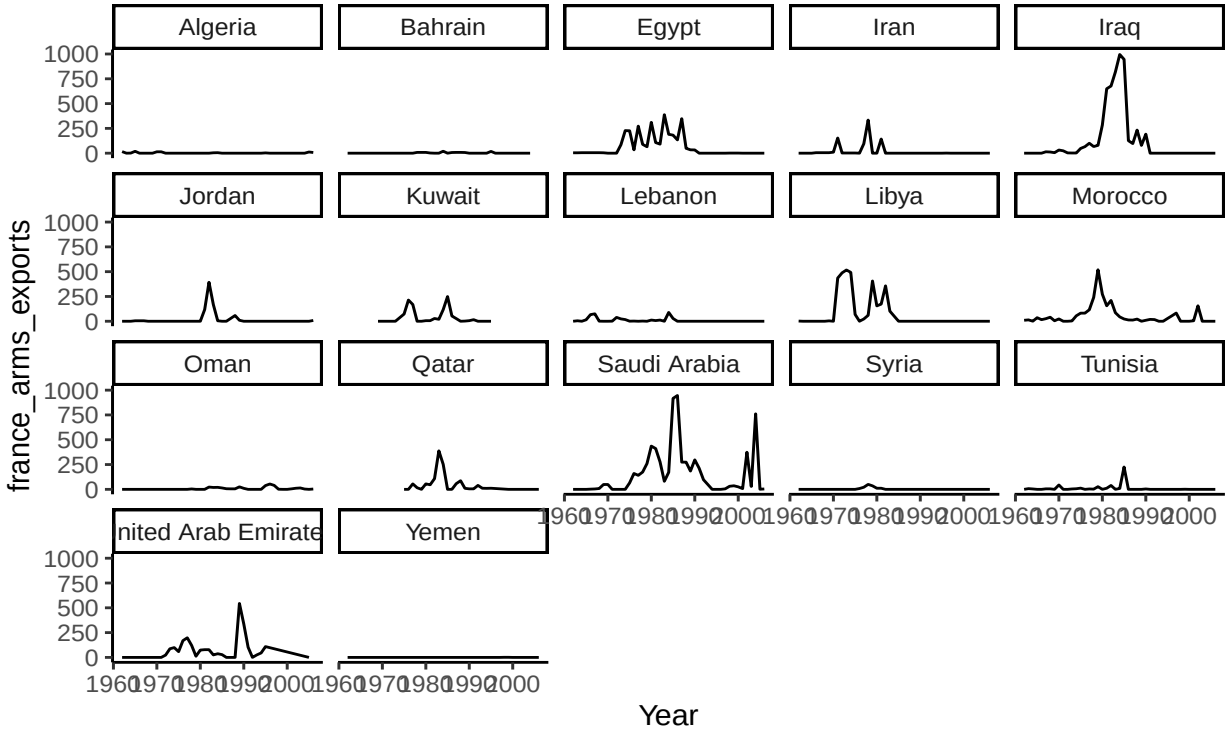


Figure A.19: Italy Arms Exports

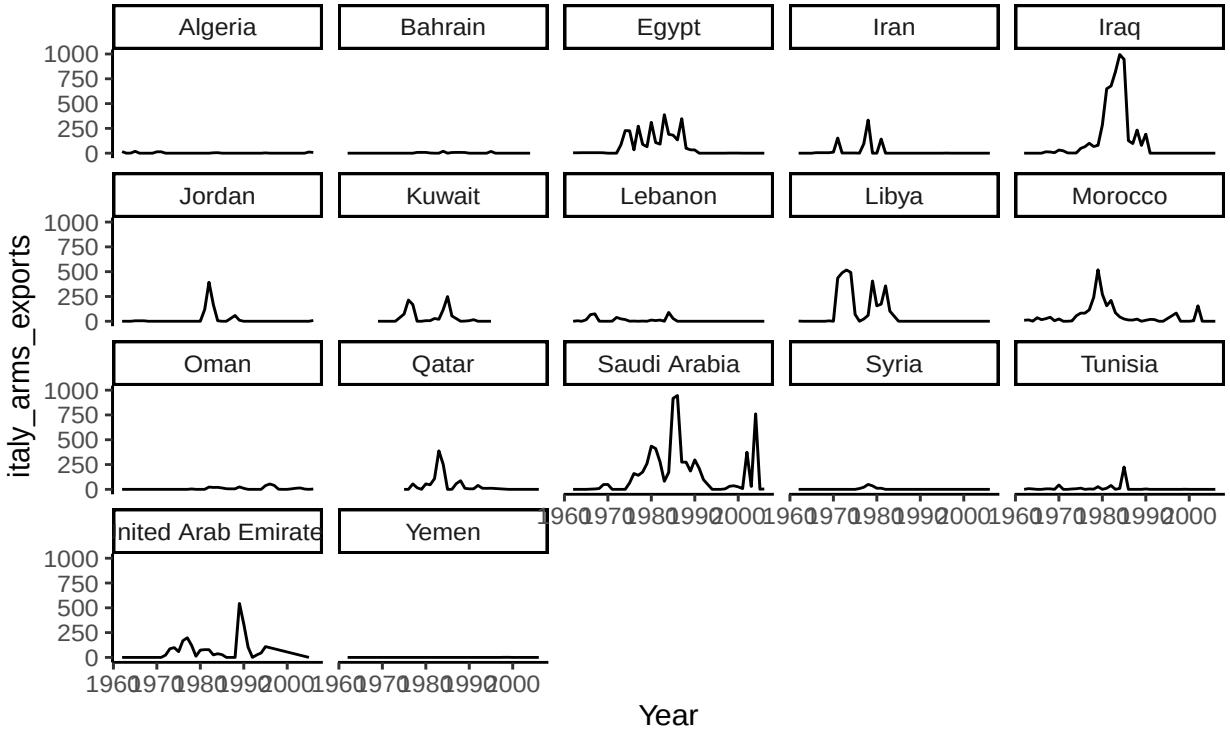


Figure A.20: Italy Arms Exports

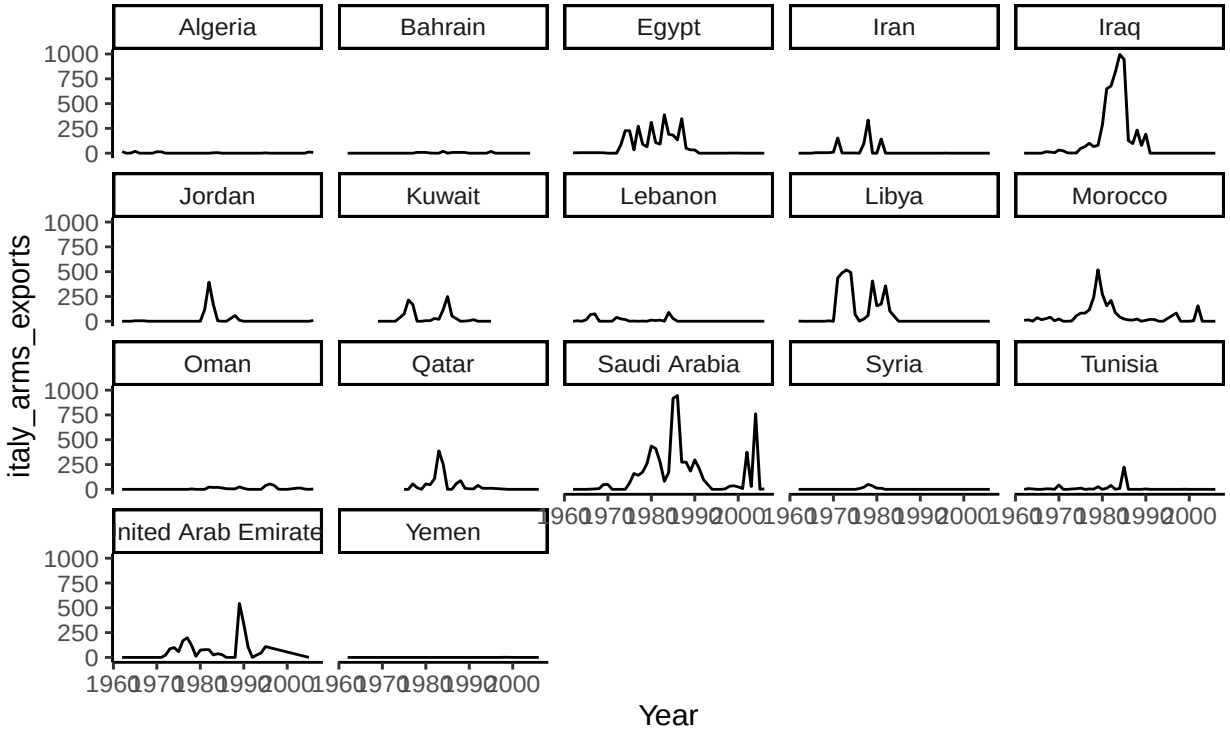


Figure A.21: Percentage of all Small Arms bought to date

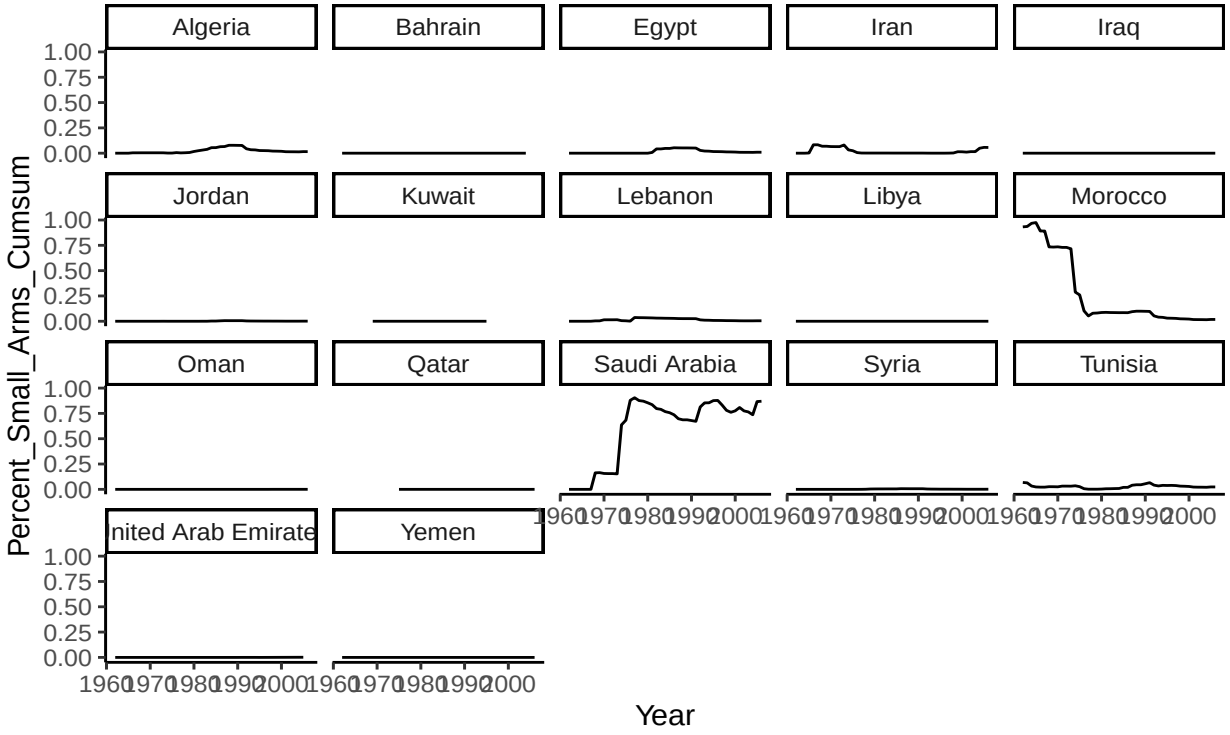
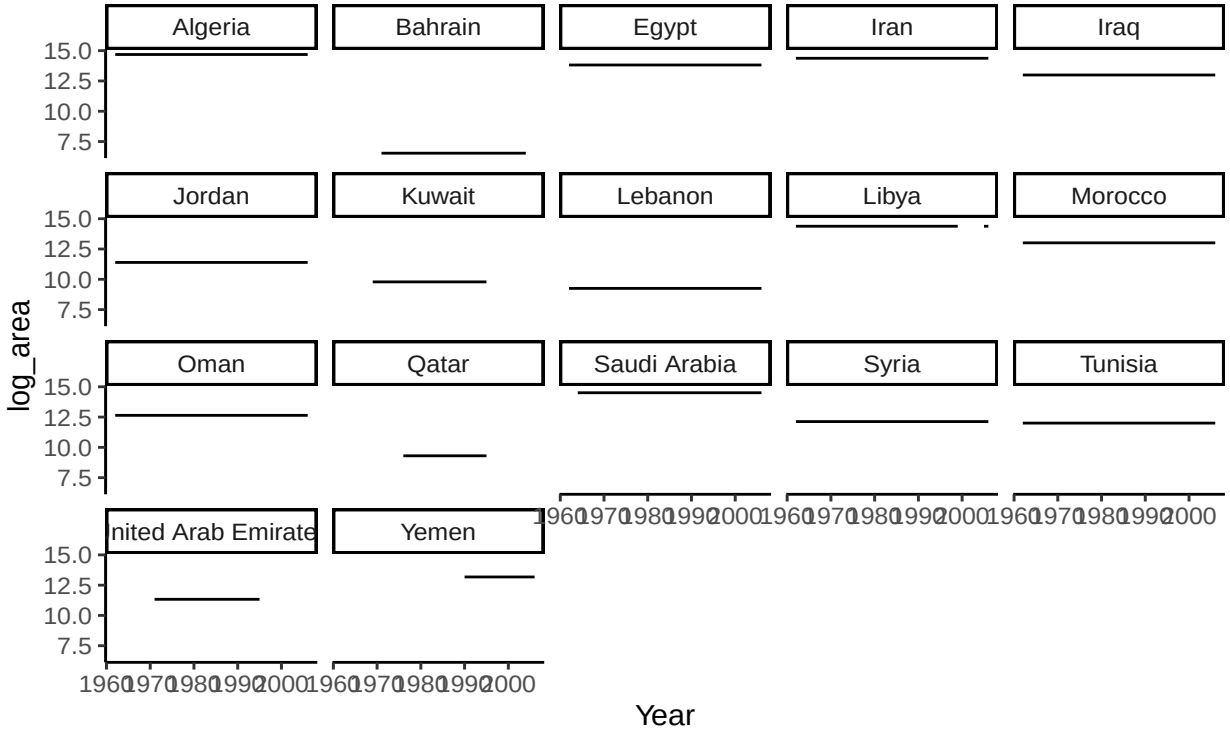


Figure A.22: Log Area



Appendix B

Why BART? An Elaboration

The empirical strategy employed by most contemporary political scientists is to generate a hypothesis; create a model of all relevant variables to be estimated; run a least squares, logit/probit, or another regression to test the model; and determine if the key independent variable is statistically significant. Although a p-value indicates the probability of obtaining results at least as extreme as the observed results, assuming that the null hypothesis is correct, it does not indicate the size or substantive importance of an effect (Wasserstein and Lazar 2016). If a variable is statistically significant but is not useful in predicting the outcome, then by definition it is not important and its associated hypothesis is weakened relative to its rivals.

BART does not require us to make assumptions regarding the "functional form" of the model, granting far greater flexibility than typical maximum likelihood estimators (MLEs). In practice, this machine learning algorithm approximates the ideal functional form, finding complex interactions and incorporating extreme curvilinear functions, while mitigating the likelihood of inadvertent p-hacking.

For example, in political science quantitative researchers commonly use a variant of

$$y = \beta_0 + \beta_{x1}x_1 + \beta_{x2}x_2 + ... + \beta_{x_n}x_n \tag{B.1}$$

with an appropriate MLE when analyzing the data (Baissa and Rainey 2020). This approach has its advantages in that it is easy to interpret and extremely efficient when the requisite assumptions are heeded. However, when the nature of the data generating process is more complicated, say in a world where there are many potential interactions and extreme curvilinear functions, traditional methods can struggle with the data. Unlike MLEs, BART is able to correctly provide estimates for data with extreme functional forms without the researcher knowing the shape of the data ex ante. For example, if a hypothetical real world variable such as authoritarian persistence were to be distributed with the functional form of

$$y = 2 + tan\left(\beta_1^{e^{\pi}} * sin(\beta_2)\right) * log\left(\frac{\beta_3}{sin(\beta_4)}\right) * \beta_5^{e^{\beta_5}} \tag{B.2}$$

then equation 1 would be inappropriate and may result in biased estimates. Unlike the traditional MLE approach, BART can handle equation 2 and would not be subject to the biases of the researcher (Montgomery and Olivella 2018) nor would the research need to generate a number of models in an attempt to fit the data well, reducing the likelihood of inadvertent p-hacking. In practice, BART's ML algorithm approximates the ideal functional form, finding complex interactions and incorporating extreme curvilinear functions, while mitigating the likelihood of inadvertent p-hacking. Social and political phenomena, such as authoritarian persistence, are often complex, requiring models that capture interactions and non-linear relationships that can occur simultaneously.

To give a concrete example, one might assume that total fuel income per capita allows a country to spend more money on government services. At the same time, as TFI gets larger, the rate of increase in GS will slow down at a given point, meaning the relationship is not linear. In other words, the equation we are describing would look something like: $\widehat{GS} = \beta_{constant} + \beta_1 TFI + \beta_2 TFI^2$. However, one might also expect that monarchies might behave differently than non-monarchies with their TFI, in other words, regime type might interact with TFI. Our new

statistical model might look something like: $\widehat{GS} = \beta_{constant} + \beta_1 TFI + \beta_2 TFI^2 + \beta_3 M + \beta_4 TFI * M + \beta_5 TFI^2 * M$, where M refers to monarchy. Alternatively, location in the Persian Gulf might also interact with fuel income and monarchism, while geographic size, per capita income, and a host of other variables may interact with these variables in different ways. In short, many possible interactions exist, and all might be important, but the results of such a regression become increasingly difficult to interpret.

Appendix C

Decision Tree Examples

To illustrate this procedure, we take the case of government expenditures as a percentage of GDP. Figure C.1 displays an example of a simple tree with two nodes: Total fuel income (TFI) and monarchy (M). The entirety of the data starts at the top of the tree. In the box for the root node, we can see that 100 percent of the data is located at that point and its mean is 17 percent. In other words, average government expenditure is 17 percent of GDP in this dataset. The data then encounters its first decision node for TFI. Decision nodes divide the data based on a yes/no Boolean response in order to best describe the data. In this case, if TFI is greater than or equal to -6.9, the data falls into the bin on the left-hand side; if not, the data goes to the second node on the right-hand side. Here we can see 88 percent of the data occurs where TFI is greater than -6.9 while 12 percent of the data is not. This also means that average government expenditure as a percent of GDP for countries where TFI is greater than or equal to -6.9 is 15 percent.

The data then divide again at the M node, where the data go to the right-hand side if a country is a monarchy and to the left-hand side if it has another regime type. Here we see that a country with a monarchy and total fuel income of less that -6.9 might have up to 58 percent of GDP consist of government spending.

In this overly simplified example, the data splits one time at a TFI node and once again at M. In a more complex tree, however, there may be multiple TFI nodes generated to best describe the data. Figure C.2 shows a more nuanced tree estimating government expenditures as a percentage of GDP. Here the tree finds that per capita income, the year, and ethnic fractionalization are also useful predictors of government expenditures. Moreover, we see that the TFI and ethnic fractionalization nodes occur more than once in the estimation of the data.

In BART, the tree creation process is then repeated a large number of times, with each tree grown from a sample of the full dataset. The number of trees used allows each tree the ability to specialize in fitting to a single part of the data, allowing the model to become extremely flexible. This is because BART's equation for a continuous DV is,

Figure C.1: Example of a Simple Tree with Two Nodes

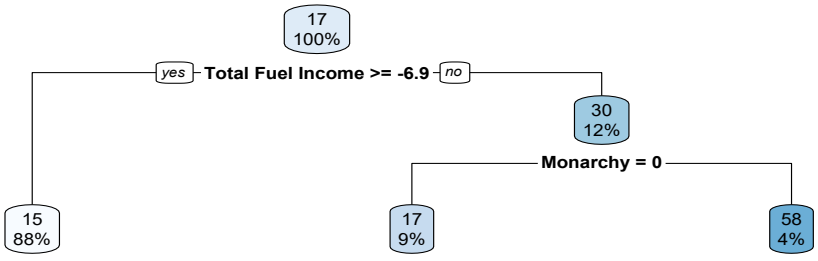
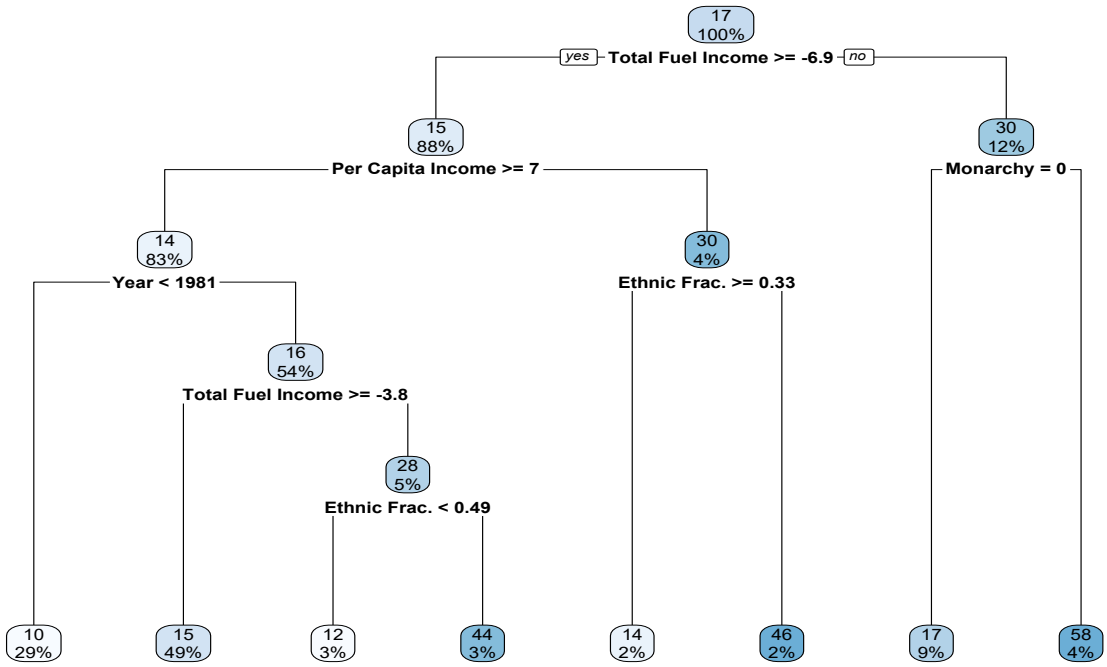


Figure C.2: Example of a More Complex Tree with Multiple Nodes



$$y_i = \sum_{m=1}^{M} T_m(X_i; \Theta_m) + \epsilon_i, where\ \epsilon_i \sim N(0, \sigma^2),$$

with independent priors (such as each variable having no effect) placed on all parameters in Θ_m over the number of trees M. BART uses a Markov Chain Monte Carlo algorithm to explore "the space of all possible 'forests'" to arrive at a sample of y_i given the predictor variables (Montgomery and Olivella 2018).

Appendix D

BART Model Diagnostics

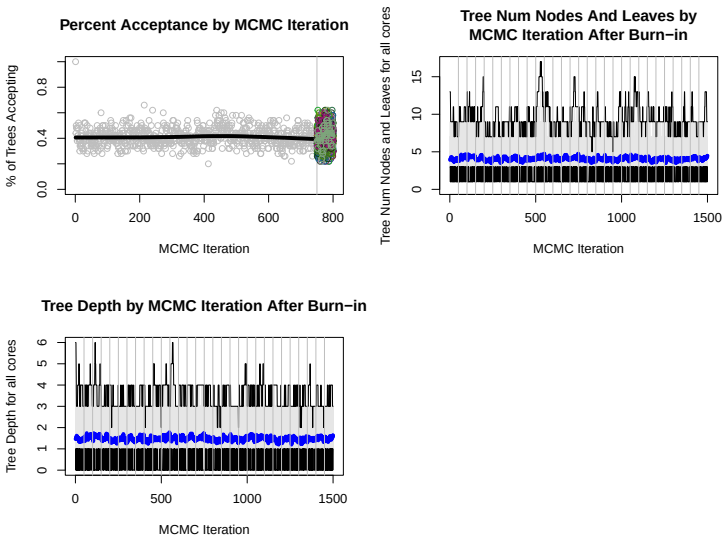


Figure D.1: BART Model Democratic Movement Diagnostics

D.1.0 BART Model Democratic Movement Diagnostics Without Loans

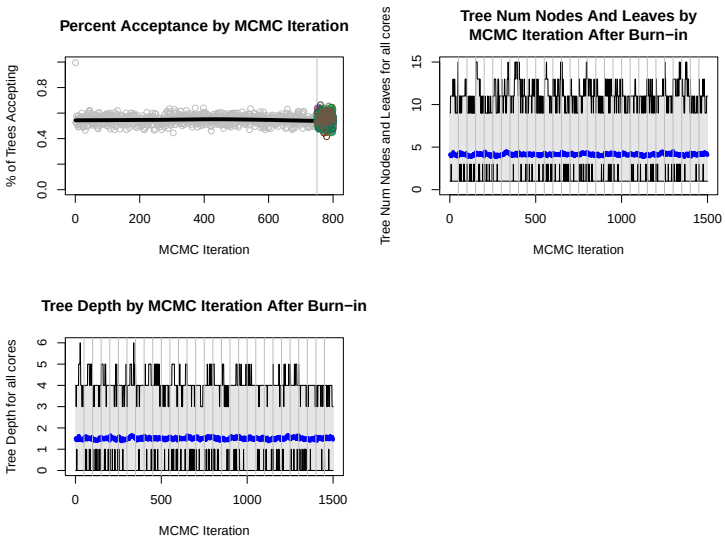


Figure D.2: BART Model Democratization Diagnostics Without Loans

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Appendix E

BART Model Diagnostics - D4

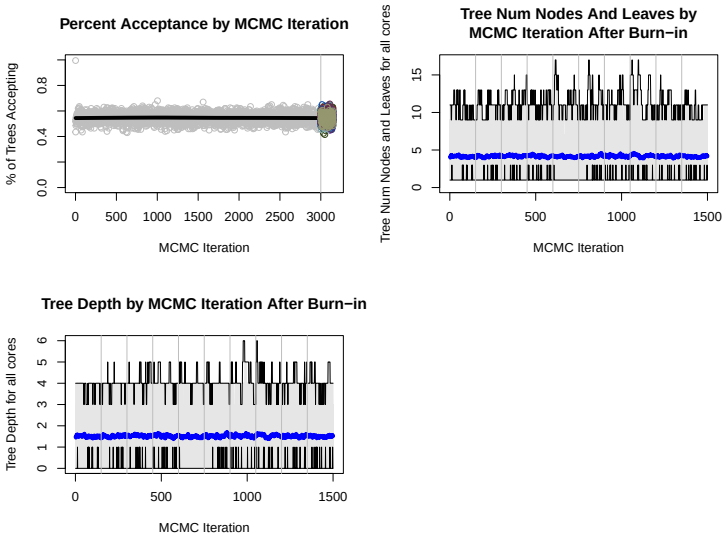


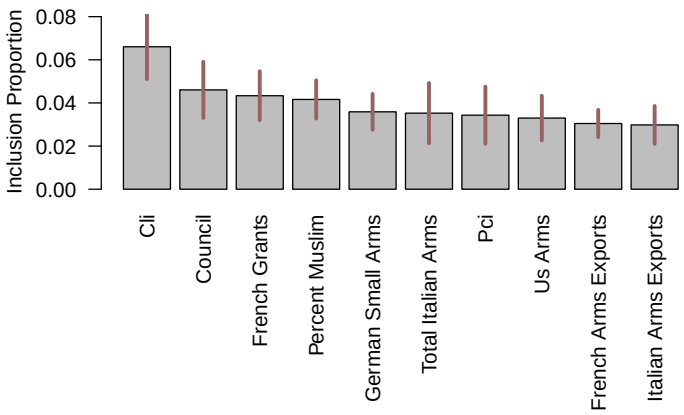
Figure E.1: BART Model Democratization Diagnostics

Appendix F

D4 Robustness Check

As a robustness check, we present the variables selected to predict the alternate dependent variable, the Polity D4 variable, which codes actual regime change in the final year of a regime transition and encompasses all types of regime transitions. To anticipate the results, concessional loans remain the key predictor of authoritarianism durability in the Middle East. Again, the non-findings are equally interesting and largely corroborate the analyses of our primary outcome variable: Oil wealth, monarchism, and other common explanations in the literature are not identified as predictors.

Figure F.1: Results of the Variable Selection Procedure for Regime Shifts (Polity D4) in the Middle East



*Note: This figure displays the inclusion proportion for the top ten variables using the alternate measure of the outcome, the Polity D4 variable. The variable with the highest inclusion proportions are ranked from left to right, again revealing a large gap between concessional loans and other variables. The remaining variables have approximately the same inclusion proportions and may vary more due to the random selection process than due to their importance.

Figure F.1 displays the inclusion proportions for the BART-CV model. These results support the findings from the democratic movement variable with, one variable selected – concessional loans. In this specification, physical repression is not a strong predictor of regime change, suggesting that regimes employing widespread torture present an illusion of strength but ultimately hard-core repression does not ensure their continuity in the Middle

TABLE F.1: BART Models of Democratization in the Middle East

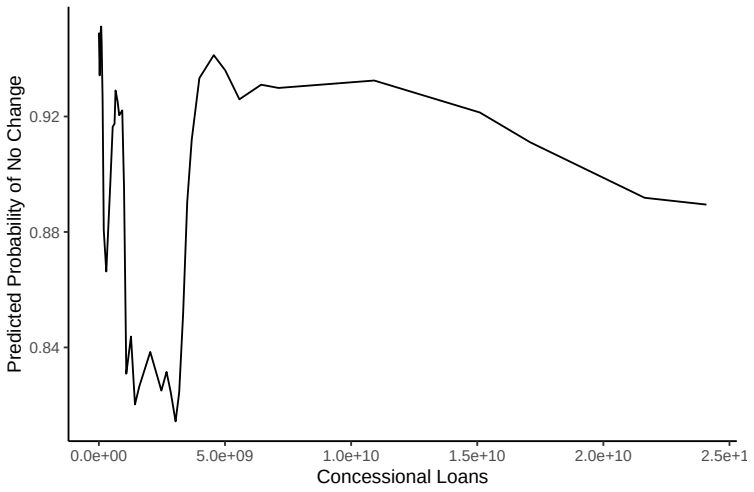
	BART Pre Selection	BART Post Selection
	Model Error	Model Error
Actual No	40.3%	27.1%
Actual Yes	10.4%	45.8%
Overall	38.3%	28.4%
k Hyperparameter	2	2
Number of Trees	200	200

*Note: This table displays the predictive capacity of the BART model prior to variable selection as well as the BART model with only the selected variables. Note that post selection model correctly classified 71.6% of all movements towards democracy and performs better than the pre-selection model.

East. Further research should disentangle the precise mechanics of how torture aids in stabilizing regimes but fails to prevent regime overthrow. Once again, variables such as oil, monarchism, and Muslim population fare poorly in predicting actual regime shifts.

Table F.1 displays the the predictive capacity of the BART-CV model and shows how well concessional loans explains authoritarian stability using the Polity D4 outcome measure.

Figure F.2: Effect of Loans on Institutional Stability



*Note: This figure displays the predicted probabilities calculated from the post selection BART model for Concessional Loans on movements towards democracy. Note that the probability of there not being an institutional change exceeds 94% for countries that do not take loans. As the amount of loans increases, the overall trend is that countries will become more likely to have a democratic movement. However, as the loans continue to increase, there is a sharp reduction in the probability of a democratic movement. This indicates that authoritarian stability follows a mostly "U" shaped curve in relation to concessional loans.

Figure F.2 displays the results of the BART-CV model using the alternate outcome measure run solely with the concessional loans variable. Here we see more or less the same distribution as with the movements towards democracy. Here as loans increase the probability of institutional instability increases until the values enter the billions (USD), at which point the probability of change turns completely around and plateaus. This evidence supports the argument that these funds may at first harm authoritarian stability, but as the value increase, authoritarians will be able to sure up and insulate themselves from factors that would otherwise destabilize them.

Appendix G

Correlations between variables

G.1.0 Correlation Matrix

This table displays the correlations between all variables in our dataset.

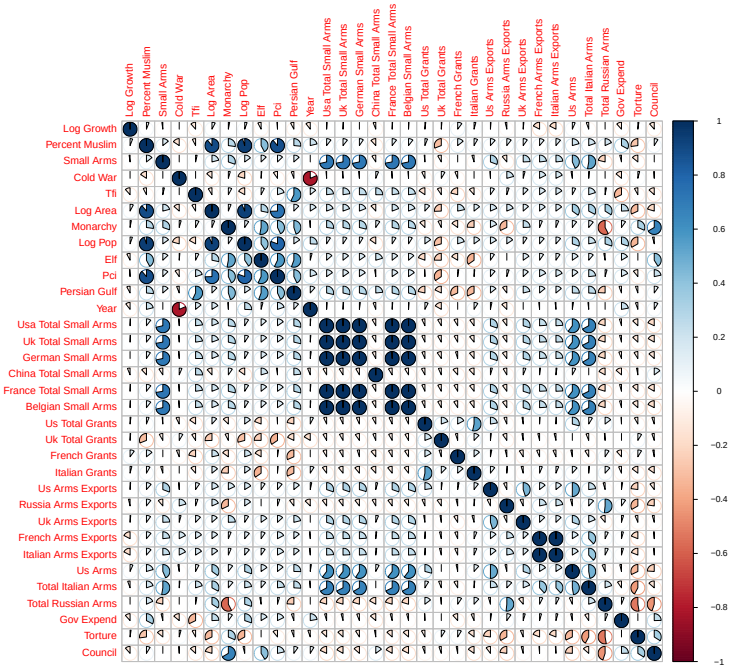


Figure G.1: Correlation Matrix

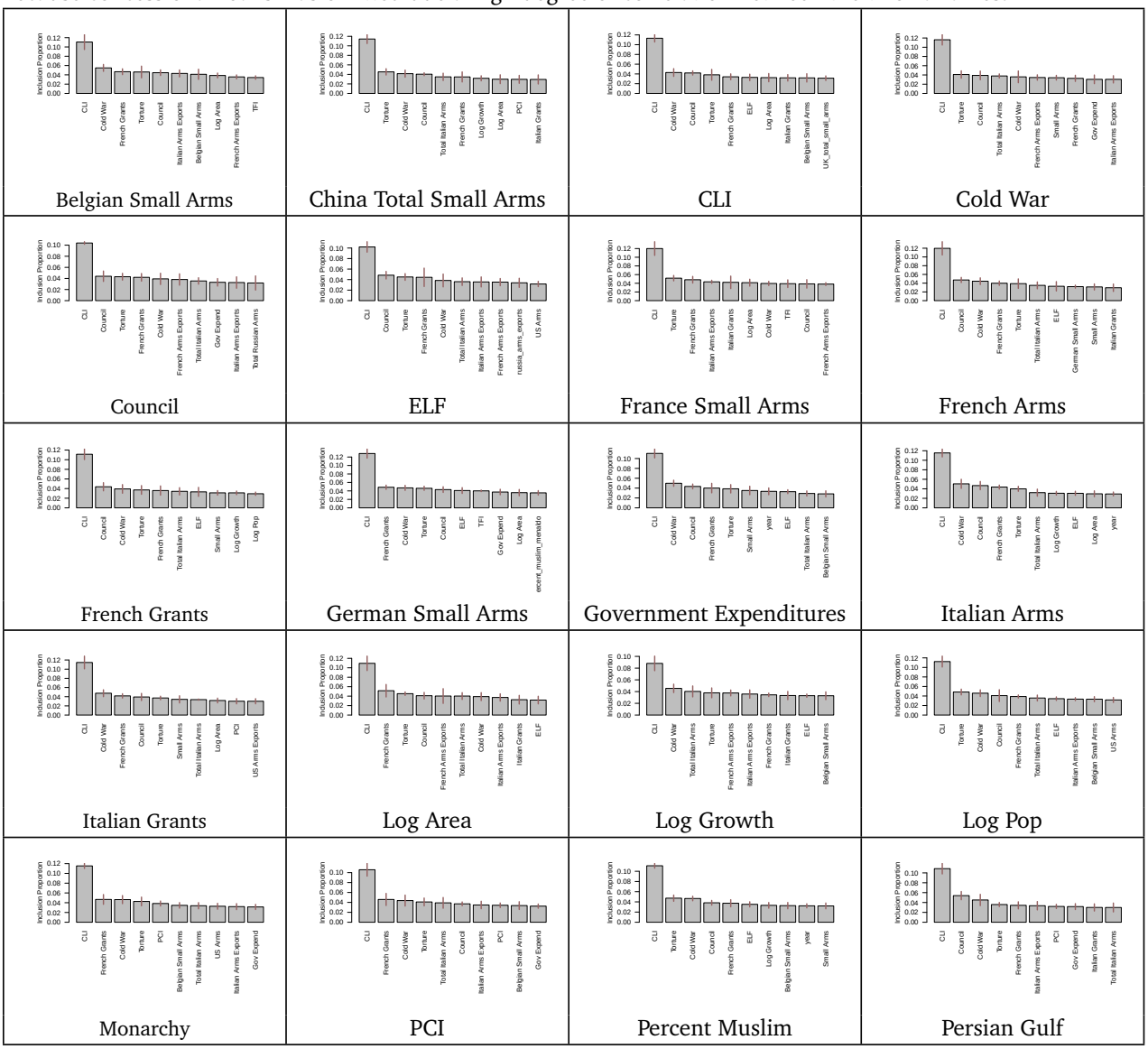
*Note: This is a correlation plot where the circles demonstrate the degree of correlation. A full circle is a 100% correlation and an empty circle is 0% correlation.

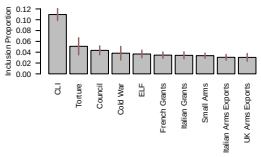
G.2.0 Variable selection with correlated variables omitted

In this section, we will show the results of our variable selection procedure using datasets derived by taking a variable and omitting all other variables in the dataset which are correlated to it. These plots are labeled with the reference variable that was used to generate the dataset that omits the variables correlated to the reference variable.

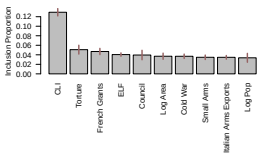
Democratic Movement

Note that the only plot which fails to show concessional loans to be the key predictor is the US Grants plot. This is because concessional loans was omitted due a high degree of correlation between the two variables.

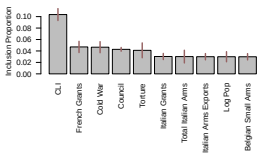




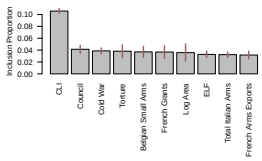
Russian Arms



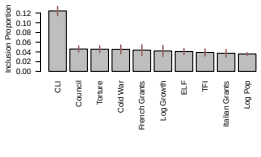
Small Arms



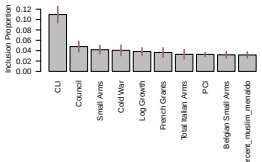
TFI



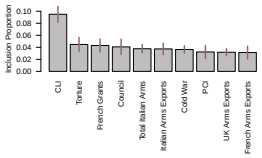
Torture



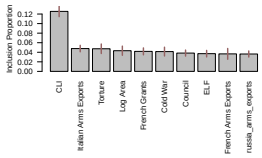
Italian Arms



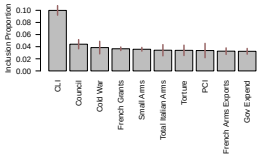
Total Russian Arms



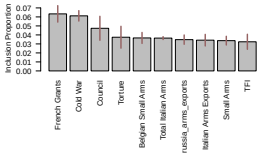
UK Arms Exports



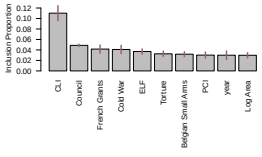
UK Total Small Arms



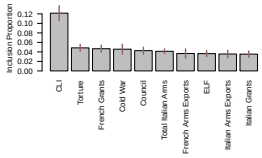
UK Total Grants



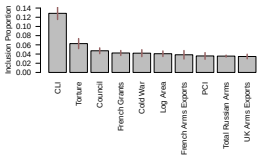
US Total Grants *

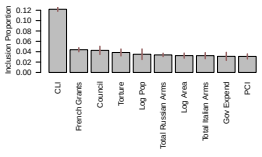


US Total Arms Exports

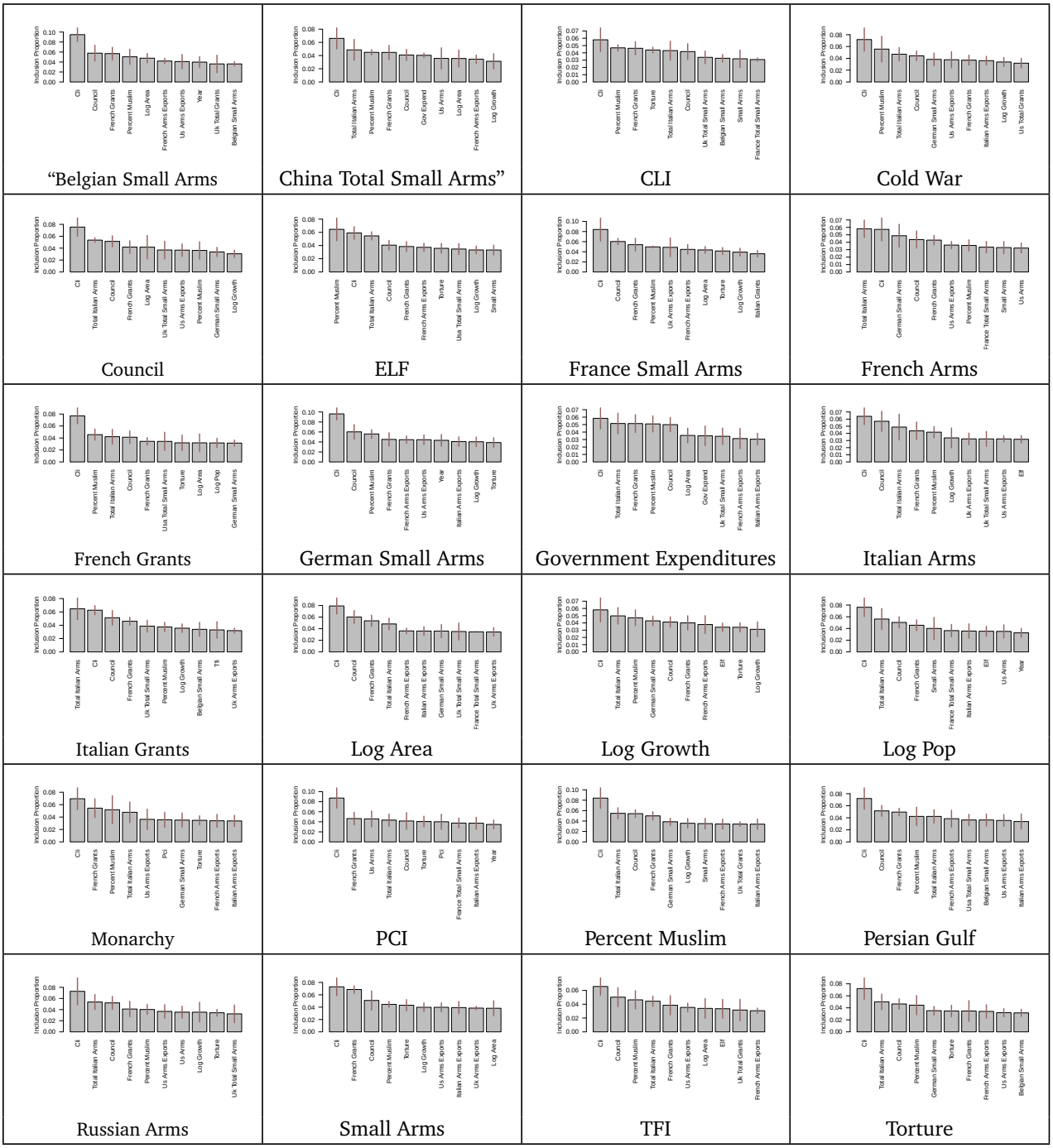


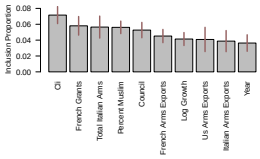
US Arms



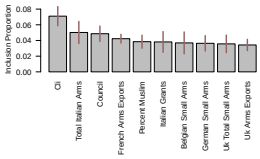


D4 Robustness Check

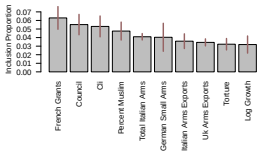




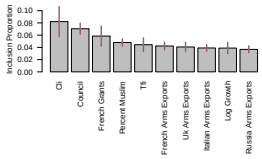
Italian Arms



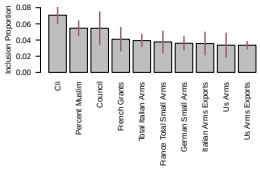
Total Russian Arms



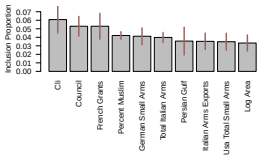
UK Arms Exports



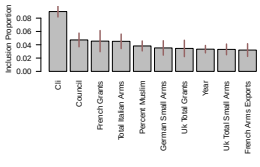
UK Total Small Arms



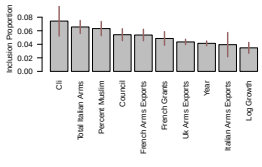
UK Total Grants



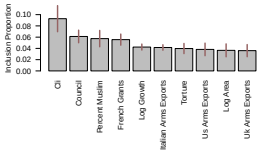
US Total Grants *

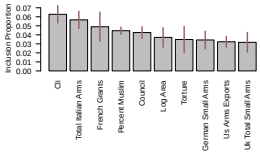


US Total Arms Exports

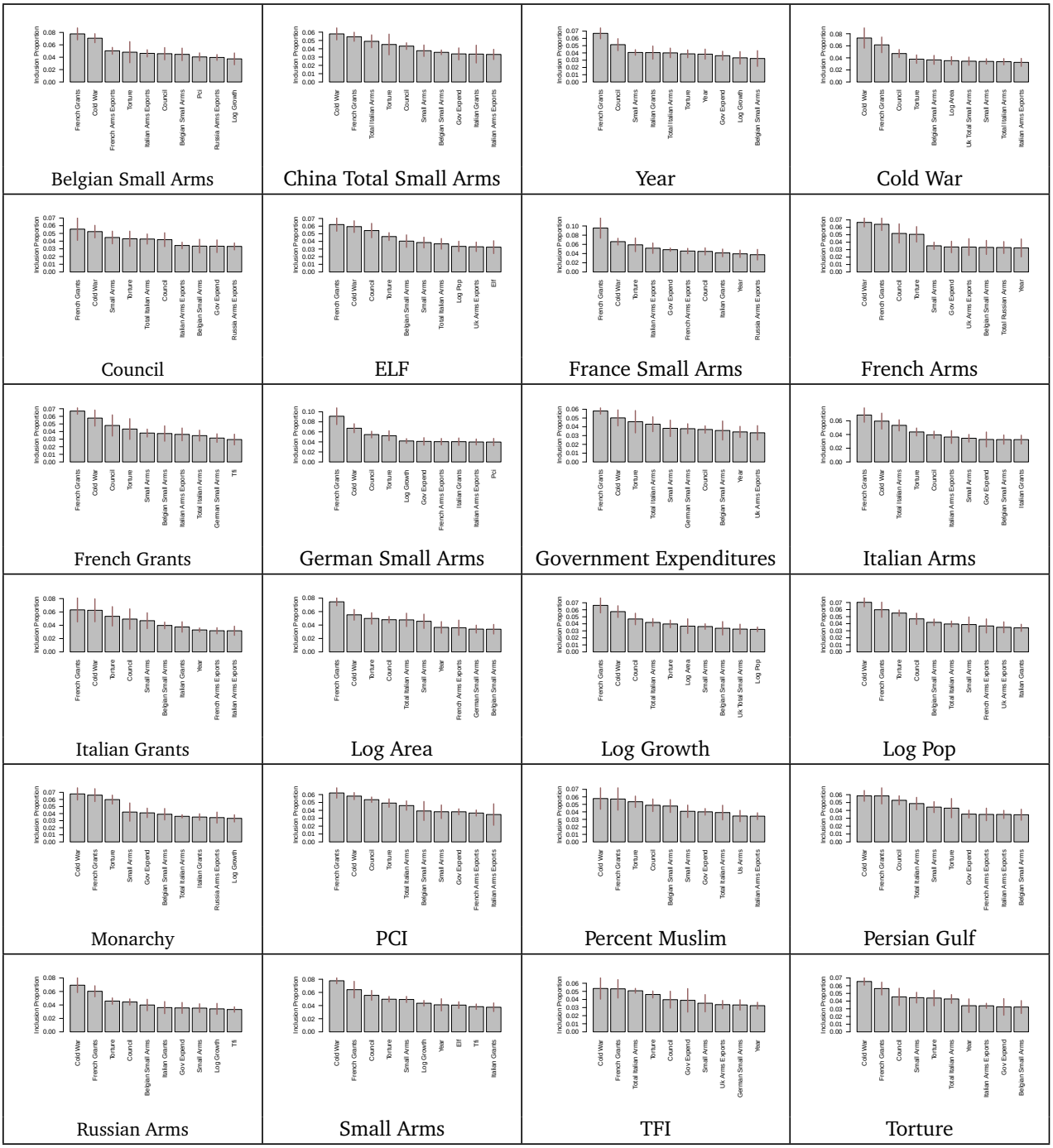


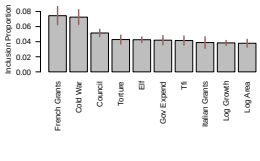
US Arms



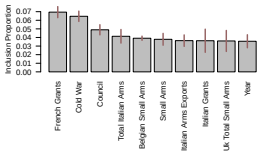


Democratic Movement Without Loans

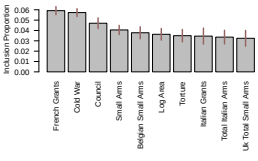




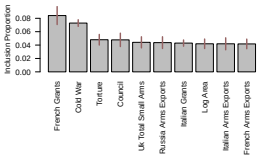
Italian Arms



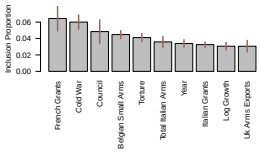
Total Russian Arms



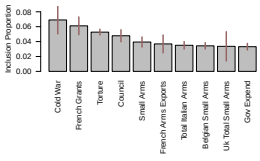
UK Arms Exports



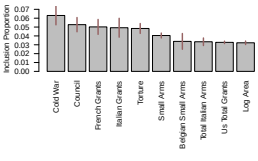
UK Total Small Arms



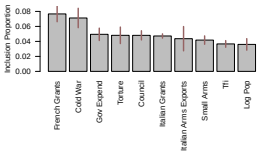
UK Total Grants



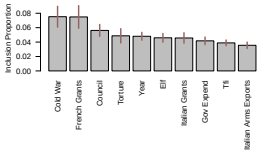
US Total Grants



US Total Arms Exports



US Arms



US Small Arms

Bibliography

Baissa, D. K. and C. Rainey (2020). When blue is not best: non-normal errors and the linear model. *Political Science Research and Methods 8*(1), 136–148.

Montgomery, J. M. and S. Olivella (2018). Tree-based models for political science data. *American Journal of Political Science 62*(3), 729–744.

Wasserstein, R. L. and N. A. Lazar (2016). The asa statement on p-values: Context, process, and purpose.