Regimes and Industrialization *

John Gerring
University of Texas at Austin

Haakon Gjerløw
PRIO
haagje@prio.org
(corresponding author)

Carl Henrik Knutsen
University of Oslo

* We are grateful for excellent research assistance by Solomon Negash and valuable comments and suggestions from Patrick M Kuhn and participants at the 2018 Annual APSA Meeting in Boston. The research was funded, in part, by the Research Council Norway, Young Research Talent grant, pnr 240505.

Abstract

A large literature addresses the impact of regimes on domestic policies and outcomes, e.g., education, health, inequality, redistribution, public spending, wages, infrastructure, volatility, productivity, and economic growth. We add to this literature by focusing on how regime type relates to another vital outcome, namely *industrialization*. We argue that autocratic leaders are more likely to adopt an economic model of development centered on heavy industry because of three factors that distinguish democratic and autocratic regimes: different *social bases*, different *security concerns*, and different *policy tools*. Accordingly, autocracies have stronger incentives and better capabilities to pursue a rapid and comprehensive course of industrialization. We test the hypothesis that autocracy enhances industrialization by using different measures of industrialization in a dataset spanning 200 years and most countries of the world. After a comprehensive series of tests, we conclude that industrialization stands out as one of the few areas where autocracies may enjoy a significant advantage over democracies.

Introduction

A large literature addresses how regimes influence domestic policies and policy outcomes such as education (Brown, Hunter 2004; Stasavage 2005), health and mortality (Gerring et al. 2016), inequality, redistribution and various types of public spending (Ansell, Samuels 2014; Boix 2003; Lee 2005; Mulligan et al. 2004; Lindert 2004), wages (Przeworski et al. 2000; Rodrik 1999), infrastructure (Brown, Mobarak 2009; Burgess et al. 2015; Min 2015; Saiz 2006), volatility in economic performance (Mobarak 2005; Rodrik 2008), productivity and technological change (Faust 2007; Knutsen 2015) and economic growth (Acemoglu et al. 2019; Gerring et al. 2005).

In this study, we focus on another vital outcome – *industrialization*. This refers to the development of manufacturing, especially heavy industry, and certain types of infrastructure that support industry and manufacturing, including transport and energy. Our definition is broader than that adopted by some economists, for whom industrialization may refer narrowly to increases in output or employment in manufacturing (Rodrik 2016). Importantly, we mean to encompass policy effort *and* policy outcomes. Although the former is harder to measure, and sometimes unsuccessful in its aims (Pack, Saggi 2006), it is integral to our theoretical discussion.

A large, historical literature documents the industrialization experiences of different countries and regions, and several case studies have focused on particular industrialization policies and broader import-substitution or export-promoting strategies considered conducive to industrialization. Yet, few studies concertedly address the relationship between regime type and industrialization. To our knowledge, our study is the first to examine this relationship with a global panel of countries.

Leaving open their possible role in stimulating growth (see Section II), industrial policies and outcomes are nonetheless important outcomes in their own right as they shift benefits and burdens from one sector to another. As such, they may have deleterious effects on agricultural productivity, be instrumental in hastening urbanization and dampening fertility, and enhance inequality, at least over the short-term. In these respects, and probably others, industrial policy shapes societies.

We argue, in brief, that autocratic leaders are more likely than democratic leaders to promote and implement an economic model of development centered on heavy industry. This follows, we argue, from three factors that distinguish democratic and autocratic regimes: *social bases*, *security concerns*, and *policy tools*. Together, these mechanisms suggest that autocracies have stronger incentives and better capabilities to pursue industry-centered development.

To test this hypothesis, we draw on data from a global sample of countries extending back to the early nineteenth century. Cross-national tests include country- and year-fixed effects, varying lag structures, different panel units, the inclusion of multiple lags of the dependent variable, varying measures of democracy and industrialization, and controls for potential confounders such as income, population, features of the bureaucracy and the state's role in the economy. Industrialization stands out as one of the few areas where autocracies may enjoy a significant advantage over democracies.

In the following, we briefly review extant work pertaining to institutions and industrialization, before presenting our theoretical argument for why autocracies may have stronger incentives and greater capacity to pursue industrial policies. Next, we introduce the data and main tests, centered on four measures of industrialization: railway freight, energy consumption, iron and steel production, and manufacturing value added. Before concluding, we discuss tests on alternative outcomes as well as robustness tests of our main results.

Industrialization and Politics

Economic historians and sociologists have identified multiple factors contributing to early industrialization in England (Goldstone 2009). This includes existence of crucial raw materials such as coal (Pomeranz 2000), a cultural orientation favorable to progress and science (Landes 1998), a distinctive demographic profile (Hajnal 1965), trade and conquest during the age of imperialism (Pomeranz, Topik 2014), and political fragmentation (Jones 1981). In these stories, the state is peripheral or epiphenomenal.

Other accounts grant a central role to the state as handmaiden of industrialization in other countries. Prominent examples include Prussia (Gerschenkron 1962), South Korea (Amsden 1989), the Soviet Union (Davies et al. 1994), and China (Naughton, Tsai 2015). To stimulate industrial development governments may provide tax incentives, low-interest loans, direct investment or subvention, expropriation of land for industrial development, reductions in regulatory burdens, export subsidies, export processing zones, import tariffs, and/or repression of labor organization (which, in turn, reduces production costs). Governments may also build requisite infrastructure such as ports and railways or take direct ownership of production facilities in key sectors such as steel works or electricity plants.

There is no limit, in principle, to the policy instruments governments may employ to foster industrial development. (For present purposes, all such policies are "industrial policies."). While not all such policies have been successful in achieving their aims, and oftentimes have had unintended, negative consequences on development, more broadly, several studies document how industrial policies have been successfully applied in various historical and geographic contexts (see, e.g., Nunn 2019 p.7). In the nineteenth century, the Japanese state constructed proto-factories to diffuse relevant knowledge to private firms (Tipton 2008; 53-54). During the Great Leap Forward, the Chinese government requisitioned pots and pans from citizens to produce steel out of scrap metals in "backyard furnaces" (Chan 2001). Emphasis may be placed on expanding industrial exports, as was common in East Asia (Wade 2003); protecting domestic industries against international competition, as in several Latin American countries (see, e.g., Gereffi, Wyman 1990); or forcibly transforming the economy from agriculture to manufacturing, as in Stalin's USSR (Davies et al. 1994; Shearer 1996).

Attempts at rapid industrialization usually involve investments in various types of infrastructure and coordinated policies across several sectors (Murphy et al. 1989; Rosenstein-Rodan 1943), tasks that are difficult to achieve without some sort of government intervention. Of course, virtually everything the government does has some impact on the propensity of a country to industrialize. However, some governments pursue this goal more directly and aggressively than others, and one factor that may help explain varying policy responses is the character of the political regime.

Industrialization has been a hallmark of economic growth in East Asia, and the success of that growth model is often attributed to industrial policies initiated under authoritarian auspices (Amsden 1989; Cummings 1984; Deyo 1987; Evans 1995; Gereffi, Wyman 1990; Kohli 2004; Wade 2003; Woo-Cumings 1999). Although writers do not usually identify regime type as a primary cause of those policies, it seems plausible that regime features might have played a role. Stylized contrasts between China and India support that conclusion (Bardhan 2012).

Likewise, authoritarian rule may also have pushed industrialization in other regions, including Latin America (O'Donnell 1988). However, in discussing linkages between regime type and industrial strategy, Haggard (1990) highlights the complexity and likely heterogeneity of such a relationship. While a link between authoritarianism and industrial strategy is "plausible in the East Asian NICs," Haggard (1990: 255) declares that "the association between industrial strategy and authoritarian rule in Latin America appears to be weak."

A different literature focuses explicitly on regime characteristics and includes several large-sample tests, suggesting that autocracies are likely to emphasize savings and investment, a key component in industrialization, while democracies privilege consumption (de Schweinitz 1959;

Huntington 1968; Przeworski and Limongi 1993; Przeworski et al. 2000). The assumption is that autocratic regimes can enact a variety of unpopular policies that push up aggregate savings rates without losing power, while under democratic rule myopic voters will vote against an incumbent that reduces consumption to increase private and public investments focused on long-term benefits. Indeed, autocracies have higher average savings rates, and compared to democracies their growth is fueled to a larger extent by investments in physical capital, though these results are not entirely robust (Przeworski et al. 2000; Tavares and Wacziarg 2001).

Theory

The literature reviewed above suggests that autocracies are more likely to adopt an industry-centered model of development than democracies.1 However, a theory for why this might be so has not been fully articulated. We argue that three factors that distinguish democratic and autocratic regimes – different *social bases*, *security concerns*, and *policy tools* – together suggest that autocracies have stronger incentives and better capabilities to pursue a rapid and comprehensive course of industrialization. Following this discussion, we introduce important clarifications and caveats to the theory.

Social Bases

The constituency base of autocracies is typically narrower and more privileged than the constituency base of democracies (Bueno de Mesquita et al. 2003). To the extent that incumbents try to please their constituency base to retain power, democratic leaders are more likely to be attracted to broad policies with many beneficiaries. This may include widely distributed pork that benefits large sections of their voting base or public goods benefiting everyone (Boix 2003; Brown, Hunter 2004; Gerring et al. 2005). Autocratic leaders, by contrast, must channel resources towards paying off

1 A democratic regime, for present purposes, is one where important policymaking positions are filled through regularly scheduled competitive elections before a broad electorate (Dahl 1971). An autocratic regime is one where electoral institutions are absent or monopolized by a single party, or where the franchise is extremely limited. For heuristic purposes, we refer to democracies and autocracies as crisp types in the ensuing discussion, even though these differences are often matters of degree (and will be operationalized accordingly in the empirical analysis).

those whose support, or acquiescence, is crucial for the regime's survival, including the military, leaders of industry, leading families or clans, and other elites (Bueno de Mesquita et al. 2003; Svolik 2012).

Historically, large-scale landowners and other agricultural interests were primary backers of established autocracies, and industrialists and urban business elites were primary actors behind democratization movements, for instance in many European countries (Ansell, Samuels 2014). Yet, in many contexts, including in several post-war Latin American and East Asian cases, industrial elites were key supporters of various autocratic regimes, sometimes in alliance with agricultural elites (this was also the case, historically, in Prussian/Germany; see Moore 1966). We are *not* arguing that industrial owners are more inclined to prop up autocracies than owners of plantations, or that autocrats have few incentives to placate the interests of landowners. Still, we are arguing that autocrats often have strong incentives to pursue industrial policies, as they benefit other, narrow elite groups:

Industrial policies, which are inherently particularistic, are well-suited for garnering support in key elite groups. Consider the following policy mechanisms: tax incentives, low-interest loans, direct investments or subventions, expropriations of land, alterations in regulatory burdens, export subsidies, import tariffs, and repression of labor. Each bestows benefits upon specific industries – sometimes, specific corporations and their owners – while distributing costs across numerous citizens and taxpayers. (Granted, over time, these targeted policies may bring diffuse benefits, especially if they are successful in stimulating growth. Yet, their immediate impact is highly targeted and thus well-suited for rewarding a narrow constituency, despite such longer-term "externalities".)

Industrialization also favors the privileged formal sector of the economy. As such, industrial policies are likely to reinforce existing inequalities (at least in the short-term), rewarding groups – i.e., the highly-skilled, well-educated, and urban-dwelling – that are already relatively well off. In other instances, industrial policies may be targeted towards particular families or ethnic groups the leader demands support from, as observed in numerous post-colonial African countries (Meredith 2011). It follows that industrialization suits the constituency profile of autocratic leaders more than that of democratic leaders.

Security Concerns

All leaders are concerned with security issues. Yet, we surmise that autocratic leaders are, generally speaking, more concerned with security issues (of certain kinds) than are democratic leaders. And, these differences in security concerns, we propose, contribute to increasing the incentives of autocrats to boost industrialization.

First, democracies are more likely to have resolved border disputes with neighboring states (Gibler 2007). Second, autocratic leader tenures are more sensitive to outcomes of various types of conflict, including inter-state war (Chiozza, Goemans 2004). Losing a war means an increased likelihood of being ousted for autocrats and winning a war means increased chances of staying in power, whereas these relationships are attenuated for democratic incumbents. Third, autocratic leaders are more threatened by internal dissent as they lack institutional mechanisms for peacefully resolving conflicts over political power (Przeworski 1991). For all these reasons, autocratic leaders have a direct interest in channeling resources towards developing strong security capacities.

This, in turn, should incline them toward policies that help build industrial capacity. Industrialization is critical to security, both when considering external and internal threats. Transport infrastructure – i.e., roads, railroads, bridges, harbors, and airports – serves to bind the nation together, integrating disparate groups and regions that may exhibit fissiparous tendencies. It also allows governments to deploy troops, materiel, and bureaucratic officials throughout the land. Railroads have been identified by military historians as a key factor in transporting troops and supplies. For example, Prussia constructed double-track railroad lines running to strategic points at the border, ensuring that they could assemble an army corps three to seven times faster than France during the Franco-Prussian war (Wavro 2003: 74).

Manufacturing capacity is also closely linked to military capacity. Iron and steel production, and downstream products such as vehicles and guns, is a primary example. The ability to produce these products domestically – obviating potential disruptions in supply – is regarded as a primary military objective. Sometimes, the goal of industrialization is explicitly linked to a country's self-defense. In Meiji Japan, building a strong, modern army that could fend of external security threats may have been "the principal motivation behind creating and expanding the arsenals and other publicly-financed shipyards and modern factories which acted as highly effective centers for the absorption and dissemination of Western technologies and skills" (Yamamura 1977:113).

Although Japan may be an extreme case, any country with a robust defense establishment is likely to foster some sort of "military-industrial complex" (Koistinen 1980). In China, the military plays a direct role in manufacturing (Fravel 2019). Elsewhere, the military is a key procurer of industrial products, thus directing the development of new technology and new industrial processes and products. And where the government is controlled by a military junta, or the military lurks behind the throne, policy emphasis is often placed on industrial development (Chambers, Waitoolkiat 2017; Robison 1988; Skidmore 1990; Smith 2015). Hence, there seems to be a connection between security needs and industrialization within several autocratic regimes.

Policy Tools

Having identified the varying incentives facing autocratic and democratic leaders, we turn to the policy tools. Here, too, we find important differences. Perhaps the most consequential difference is that autocratic leaders have greater leeway to apply coercion, and thus to override opposition by force (see Davenport 2007).

This is important because industrialization policies and policy outcomes are rarely Pareto optimal. Often, there are losers, at least in the short run. For those who bear the brunt of industrialization the experience may be violent and dislocating, both physically and psychologically. Industrialization is commonly associated with the displacement of people from their ancestral homes, a steep (at least relative) decline in agricultural or informal sectors, rising unemployment in those sectors, dangerous workplaces, and environmental degradation. These developments engender opposition from political parties, consumers, agricultural organizations, trade associations, labor unions, neighborhood associations, and other affected groups (Aldrich 2008; Galtung 1996; McDowell 1996; Schumpeter 1950; Smelser 1959; Thompson 1966).

Whether governments can overcome this opposition will affect the pace of industrialization. Following our argument about the social bases of regimes, autocrats should be less sensitive to grassroots opposition than democratically elected leaders. While autocrats may fear certain segments of the elite, opposition to industrialization is likely to arise at the popular level – from people whose lives, homes, neighborhoods, or livelihoods are threatened by economic change. Moreover, autocratic leaders have the tools to "win the contest" by applying brute force, i.e., by detaining opposition leaders, crushing demonstrations, and preventing the dissemination of critical reportage.

Similar coercive tools can be used to implement aggressive and transformative industrial policies. Autocratic leaders may infringe upon property rights or well-established traditional rights to allow factories or vital infrastructure (e.g., dams, railroads, airports, energy plants) to be erected in areas where people previously lived and worked (Nielsen 2010; Sargeson 2013). They may remove price subsidies, import duties, and other regulatory supports for declining sectors, and statutorily fixed prices for commodities (e.g., grain). These actions are contentious, and may violate existing statutory law, constitutional law, or legal precedent. However, rule of law, judicial independence, and private property rights protection are typically weaker in autocracies than in democracies (e.g., Helmke, Rosenbluth 2009).The cumulative effect of coercive policies should reduce costs for industry and thus hasten the process of industrialization. It is, for instance, quicker and cheaper to seize land for a new factory than to wade through lengthy processes of procurement through legal channels from thousands of small owners and fight numerous legal and political fights with community- and environmental groups that oppose the move.

Finally, it is important to note the recursive nature of policy choice and policy implementation. If industrial policies are more difficult to implement in a democracy – due to legal processes of deliberation and norms of consent – it raises their economic costs *and* political costs for politicians embracing those policies. Hence, industrial policies are, everything else equal, less likely to be adopted by democratic leaders than autocratic ones.

Clarifications and Caveats

Before concluding, we want to make four important clarifications/caveats about the theory.

First, our argument is limited in ambition. It does not imply that other proposed causes of industrialization – including natural resources and cultural features, and particular industrial policies – are irrelevant. Indeed, they may be quite potent; but presumably orthogonal to our theory. Thus, there are many "deviant cases" that do not fit the general relationship between regime type and industrialization, e.g., Sub-Saharan African autocracies that have not industrialized or democracies like England that have undergone extensive industrialization. Our goal is not to develop a comprehensive theory capable of explaining all variation in industrialization across the modern era. Rather, we aim to explain some share of the variation by pointing to one general factor –regime type – that *may* be applicable across geographical and temporal contexts.

Second, the regime–industrialization relationship could be subject to temporal scope-conditions. One might argue that states played a less prominent role in early industrialization, e.g., in 18th and early-19th century England and Belgium. If so, we would expect that the posited relationship theory would apply weakly – if at all – in this era. As it happens, only one of our outcome measures of industrialization extends back to the early-19th century, for some countries, and none of our measures extends to the 18th century. So, this potential time-constraint is hardly testable.

Third, there may be important moderators in the relationship. Among democracies one might plausibly expect variation due to differences in electoral systems, as proportional representation systems often yield policies favorable to producer interests (Chang et al. 2010). Without losing sight of such complexities, we consider it important to establish whether there is an aggregate "regime" effect, one that is applicable – with error – across the world in the modern era. We encourage future research to investigate nuances in this general relationship.

Fourth, the expectation that autocracies experience stronger industrial development does not imply that autocracies also experience stronger GDP per capita growth. Several industrial policies are likely ineffective in achieving industrialization (Pack, Saggi 2006), andsome industrial policies are expensive boondoggles (Keefer, Knack 2007). Moreover, industrialization, by itself, does not always inaugurate long-term growth. Notable examples of state-led industrialization including Mao's Great Leap Forward and import-substitution policies in Latin America with likely deleterious effects on long-term growth. Finally, many channels may connect regime type to economic development, and democracies seem to enjoy advantages in other areas such as human capital or productivity growth (see studies cited at the outset), which may offset any industrialization-related disadvantages.

Data and model specification

To operationalize industrialization, we enlist four measures that tap into different aspects of this diffuse concept: railway freight, energy consumption, iron and steel production, and manufacturing value added. This mitigates the role of possible measurement error while maximizing historical coverage, as some dimensions are measurable across longer historical time-periods than others. It also allows us to assess the robustness of findings across various aspects of industrialization that may not always move in tandem. Detailed descriptions of all variables, their sources, and definitions are available in Appendix Table A.1 and summary statistics in Table A.2.

Our first measure focuses on railways. Alongside the steam engine, the railway was perhaps the most visible embodiment of the industrial revolution. After the British Stockton & Darlington Railway's inauguration in 1825, this revolutionary means of transporting goods and people soon spread to other countries in Europe and elsewhere, helping to spur industrialization (Tang 2014). The vast increase in inland transportation-capacity allowed for reducing transaction costs associated with transporting goods and materials, and, even today, trains remain a highly efficient mode of transporting heavy goods and a central medium of industrialization (Adler, Pels and Nash 2010; Behrens and Pels 2012; Román, Espino, Martín 2007). As an indicator of industrialization, we want to know how much freight railways carried, not merely the distance that they cover. Accordingly, we focus on railway freight transported within a country, excluding livestock and passenger baggage. This is measured by the ton-kilometer and transformed by the natural logarithm.[2]

As a second measure of industrialization we use primary energy consumption, measured as thousands of coal-ton equivalents (once again log-transformed), from the Correlates of War (COW) dataset (Sarkees, Wayman 2010). Energy usage is directly connected to activities associated with industrialization. For example, the development of railroads and factories will increase primary energy consumption. Worldwide, industry accounts (and has historically accounted for) for roughly

---

2 More precisely, we transform this and other variables by taking ln(X+1), thus ensuring that our dependent variables are always positive. This transformation helps us deal with the strongly right-skewed nature of these variables, and follows the plausible assumption that an increase in, e.g., rail transport from 0 to 1000 ton-kilometers is a more substantial change than from 100 000 to 101 000 ton-kilometers. Regarding this specific dependent variable, we note that freight for servicing of railroads is typically excluded but may be included for some countries. Yet, as long as such definitional characteristics are constant for a country over time, they should be addressed by our inclusion of country-fixed effects in the regression analysis.

50% of energy consumption (BP 2018: 14). Thus, energy consumption offers a good proxy for industrialization.

A third measure captures a key industrial output, which, like energy, is simultaneously a central input for production processes in various industries. This is iron and steel production, measured as a state's (log-transformed) production of pig iron (1816-1899) and steel (1900-2012), drawn from COW (Sarkees, Wayman 2010).3 Of course, iron and steel production is ultimately dependent on an abundance of minerals (primarily iron ore, but also coal), which is unequally distributed between nations. Consequently, this measure has many zero-observations, where we cannot effectively differentiate between lack of natural resources and lack of necessary investments. However, if we are willing to assume that deposits of iron ore and coal are randomly assigned across countries, or at least not an independent cause in regime outcomes, this will increase standard errors but not bias the estimated coefficients. (We thus also conduct robustness tests omitting all zero-observations.)

Our fourth and final measure captures the share of total production that emanates from the manufacturing sector. More specifically, it measures manufacturing value added, or the net output of this sector after adding up all outputs and subtracting intermediate inputs, as percent of a country's GDP, drawn from the World Bank's World Development Indicators (WDI). This is our most comprehensive industrialization measure, though it extends back only to 1960.

To measure democracy, we draw on the Polyarchy index (Teorell et al. 2018) from the Varieties of Democracy (V-Dem) project (Coppedge et al. 2018a,b). This index includes components measuring whether the executive is (directly or indirectly) elected, freeness and fairness of elections, freedom of association, freedom of speech, and textension of suffrage. This finely

3 Including year-fixed effects in the regressions below, should, in theory, mitigate issues with the time-period specific aspect of the operationalization driving our results. Nonetheless, iron and steel production is the dependent variable where we find the least robust results for regime type.

grained measure of democracy extends back to the French Revolution for most sovereign (and some semi-sovereign) countries.

Insofar as regime type affects industrialization, it likely does so through both short- and long-term channels. Government policies such as tariffs may affect business decisions immediately, impacting level of industrialization a few years later. Other policies, such as constructing a nuclear plant, may take years to bring to fruition, with secondary effects on the economy that extend through the next half-century as the plant generates electrical power. Thus, we consider a country's level of industrialization in year *t* as the product of its regime history, extending back a century or more with some (difficult to specify) level of depreciation (more recent years are accorded greater weight). To do so, we construct a stock version of Polyarchy with a slow depreciation rate of 1% annually in our benchmark. While we prefer a slow depreciation rate that gives historical experiences relatively strong weight for theoretical reasons, the specific discount factor will inevitably be arbitrary. Yet, in opting for 1%, our benchmark follows Gerring et al.'s (2005) study on democracy and growth, and we experiment with other depreciation rates (5% and 10%) in later robustness tests. We also run models using only (lagged) level of Polyarchy to shed light on short-term effects.

Our benchmark specification treats country-years as units of analysis, analyzed in an ordinary least squares (OLS) model with country- and year-fixed effects. Right-side variables are lagged five years behind the outcome in an attempt to reduce problems of simultaneity. Standard errors are clustered by country to mitigate concerns about panel-level serial correlation.[4]

Including country-fixed effects is vital for our purposes. Holding country-specific factors constant allows us to side-step key questions about whether certain countries (such as the UK) were inherently better positioned to experience an industrial transformation than other countries (such as

4 For all log-transformed outcome variables, the estimated effect of a one unit increase in the democracy stock measure is a change in the outcome of $(e^{\beta}-1)*100\%$, where β is the regression coefficient for democracy stock.

China) due to static features such as geography, culture, or pre-1800 historical developments (Clark 2007; Landes 1998; Pomeranz 2000). Controlling for country-level, time-invariant factors also means that differential endowments of resources such as coal or iron that are deemed critical for certain types of industrialization (Pomeranz 2000), and which may also influence prospects for democratization (Ross 2012), are accounted for.

Year fixed-effects should account for major global shocks – e.g., industrial innovations or construction technologies – that may influence the costs and payoffs of investing in industrial infrastructure *and* correlate with regime type.

In addition, we control for (log-transformed) income and population levels (from Fariss et al. 2017; see Appendix Table A.1), both of which may systematically influence the propensity to industrialize as well as regime type. In robustness tests we control for additional possible confounders, such as urbanization, but we keep our benchmark specification sparse in order to mitigate post-treatment bias (e.g., manufacturing sector expansion likely affects migration to the cities, and hence urbanization).

Results

Models 1-4 in Table 1 represent the benchmark specification for our four outcomes. Model 1 employs railway freight measure as dependent variable and includes 5,476 country-year observations from 92 countries, with time series extending from 1852-1993. The two time-varying controls for income and population have the expected sign, as richer and more populous countries predict more goods being transported by railway. Concerning our main hypothesis that autocracy is positively related to industrialization, we find that the democracy stock measure, based on Polyarchy and with a 1% depreciation rate, has the expected negative sign. The coefficient is also precisely estimated with a t-value of -2.50.

In order to gauge the substantive size of the estimated effect, consider two otherwise similar countries, *A* and *B*, that start out with 0 in democratic stock, reflecting histories of harsh autocratic rule. At year *t*, country *A* experiences a democratic transition, increasing the Polyarchy score to 0.8 (approximately United Kingdom in the 1950s or present-day Taiwan), and maintains that score until year *t+10* (giving a Polyarchy stock of 8.37). These divergent histories would, according to Model 1's point estimate, lead to Country *B*, which maintained its autocratic regime, having about 49 percent more railway freight than Country *A* in year *t+15*.[5] While this point estimate is associated with a lot of uncertainty, the best guess from our benchmark specification suggests that regime type matters quite a lot for this indicator of industrialization.

Results are even stronger, both for coefficient size and absolute t-value, for the energy consumption outcome in Model 2. This result draws on 13,291 country-year observations from 175 countries, with time series running from 1816-2012, and provides further support for the notion that autocratic regimes are associated with more rapid industrialization.

Iron and steel production, in Model 3, is also negatively related to democracy stock, following our expectations, although the coefficient has a t-value of only -1.63. We discuss possible methodological issues behind the weak result below, pertaining to many 0-observations, measurement errors and autocorrelation, and report alternative tests that mitigate these issues below and in the appendix (e.g., Table A.10). Yet, even in the benchmark the point estimate is substantial: When comparing the two hypothetical countries *A* and *B* from above – where *A* undergoes a democratization from 0 to 0.8 on Polyarchy in year *t* whereas *B* remains autocratic – Model 3 predicts that country *B* will have an iron and steel production volume that exceeds that of country *A* by 24 percent in *t+15*.

5 The prediction is for *t+15,* and not *t+10*, since outcomes are lagged five years after the covariates.

Table 1: Benchmark and Selected Robustness Tests

	Ln Railway freight	Ln energy consumption	Ln iron and steel prod.	Manufacturing value added	Ln Railway freight	Ln energy consumption	Ln iron and steel prod.	Manufacturing value added	Ln Railway freight	Ln energy consumption	Ln iron and steel prod.	Manufacturing value added
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Stock Polyarchy 1 % depreciation	-0.06	-0.12	-0.03	-0.43	-0.07	-0.15	-0.01	-0.39	-0.06	-0.12	-0.02	-0.35
	(-2.50)	(-6.89)	(-1.63)	(-3.96)	(-3.16)	(-8.99)	(-0.63)	(-3.26)	(-2.03)	(-6.08)	(-0.91)	(-2.91)
Ln GDP pc	0.56	0.25	1.59	2.52					0.44	0.16	1.83	4.03
	(3.22)	(1.25)	(8.33)	(3.51)					(2.27)	(0.76)	(8.13)	(4.15)
Ln Population	0.50	1.31	1.09	2.17					0.64	1.43	1.28	5.61
	(2.77)	(6.95)	(6.31)	(3.04)					(3.6)	(5.53)	(5.95)	(4.01)
GDP pc growth									0.48	2.57	-0.59	-5.82
									(0.67)	(3.74)	(-0.59)	(-1.34)
Resource income % GDP									0.004	0.01	-0.01	-0.02
									(0.84)	(1.05)	(-1.36)	(-0.91)
Rigorous and impartial public administration									0.12	0.05	-0.19	-0.50
									(1.98)	(0.85)	(-2.63)	(-1.75)
Government ownership in the economy									-0.04	-0.01	-0.13	-0.51
									(-0.51)	(-0.19)	(-1.65)	(-1.53)
Ln time in sample									0.35	0.29	-0.33	1.24
									(0.82)	(0.97)	(-0.72)	(0.87)
Countries	92	175	181	153	93	178	185	169	91	159	159	153
Years	1852 1993	1816 2012	1816 2012	1960 2017	1850 1993	1816 2012	1816 2012	1960 2017	1852 1993	1816 2011	1816 2011	1960 2011
Observations	5,476	13,291	13,559	6,005	5,962	13,768	14,068	6,141	4,580	11,441	11,447	4,696
R^2	0.95	0.91	0.88	0.75	0.93	0.90	0.85	0.73	0.96	0.93	0.88	0.78

Note: OLS regressions. T-statistics from country clustered standard errors in parentheses. Right-side variables lagged by five years. *Omitted:* country and year fixed effects, constant.

Results are much clearer (t=-3.96 for democracy stock) when broadening our focus to manufacturing production, more generally. The point estimate in Model 4 predicts that, for the hypothetical comparison between the democratizing country *A* and the autocratic country *B, B* would have about 3 percent more of its total GDP coming from manufacturing production in *t+15*.

We turn now to discussing our alternative specifications in more detail, and start by assessing potential issues of post-treatment- or omitted variable bias.

Models 5-8 in Table 1 drop the controls for both income and population. While this could introduce omitted variable bias, both factors are possibly endogenous to regime type (Przeworski et al. 2000). Controlling for these variables could thus introduce post-treatment bias for democracy stock. Yet, results are fairly similar in this very parsimonious specification that controls only for country- and year-fixed effects.

The specification used for Models 9-12, Table 1, in contrast, privilege mitigating omitted variable bias by adding measures of other plausible confounders to the benchmark. More specifically, we include measures of economic growth (GDP p.c. growth rate from *t-1* to *t*) and natural resource dependence (oil, natural gas and mineral income as share of GDP). Next we want to ensure that the relationship between regime type and industrialization is not merely a spurious finding reflecting systematic differences in state capacity or the state's overall role in the economy. Thus, we control for indicators of bureaucratic quality (extent to which the public administration is impartial and rule-following) and government ownership. Finally, we condition on the number of years a country has been included in the sample to account for a potential trend in industrialization being related to low democracy stock scores (which, by construction, appear early in a country's history). The democracy stock coefficient is stable in size and remains statistically significant at least at the 5% level for railway freight, energy consumption, and manufacturing/GDP. Democracy stock remains negative also for iron and steel production in Model 6, but the coefficient is attenuated and insignificant at conventional levels when adding the above-described controls (t=-0.91).

Thus, the result that autocracy is systematically related to industrialization is not entirely robust across all outcome measures. Yet, the overall pattern is fairly consistent and in line with our theoretical expectations. This pattern is perhaps even more notable when contrasting the findings on our measures capturing different aspects of industrialization with findings from similar specifications on other outcome variables. We turn now to such alternative tests, reported in Table 2, where we either anticipate no relationship or a positive relationship with democracy, before we return to additional specification tests on our measures of industrialization.

First, and following the expectations that democracies prioritize human capital (thus giving more productive workers, likely to earn higher wages) and that autocracies may suppress wages (e.g., through suppressing unions and freedom of association more generally) to attract industrial activity, we find that democracies pay higher wages (see also Rodrik 1999). Polyarchy stock is positive, and highly significant with a t-value of 7.4.

Our theoretical argument focused on how autocratic and democratic regimes would prioritize differently when setting public policy, with autocratic regimes allocating more funding and attention towards activities and investments that might help boost industrialization. In this regard, we note that Model 2 suggests that the above-reported relationship between autocracy and industrialization is not simply reflecting higher levels of public spending in general. In fact, democracies have higher public spending as share of GDP, and this relationship is highly significant (t-value 6.4). Insofar as the diverging industrialization experiences of autocratic and democratic regimes are driven by systematic differences in the policies pursued, they reflect the prioritization of public spending on industrial infrastructure and projects in autocracies over other forms of spending such as social welfare- or education spending (see, e.g., Lindert 2004).6

Table 2: Alternative tests

	Laborer real wage	Public expenditure as % of GDP	Agriculture as % workforce
	(1)	(2)	(3)
Stock Polyarchy 1% depreciation	1.983	0.765	0.196
	(7.446)	(6.408)	(1.497)
Ln GDP pc	6.363	0.432	-6.480
	(1.240)	(0.293)	(-5.661)
Ln Population	-6.454	-3.908	-8.202
	(-1.528)	(-2.035)	(-4.225)
Constant	20.612	36.657	208.617
	(0.336)	(1.599)	(11.381)
Country FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Countries	117	155	154
Years	1820 - 2008	1880 - 2011	1815 - 2006
Observations	3,609	6,740	10,107
R^2	0.786	0.792	0.927

Note: OLS regressions. T-statistics from country clustered standard errors in parentheses. Right-side variables lagged by five years. *Omitted:* country and year fixed effects, constant.

Finally, we test what could be construed as an 'anti-industrialization' measure with extensive coverage (1815-2006), namely share of the workforce that works in agriculture. However, we immediately note that there is not a perfect inverse relationship between how extensive agriculture in a society is and how small the manufacturing sector is. Notably, the service sector is, often by far, the largest employer in many contemporary societies, so a small agricultural sector *can* co-exist with a small manufacturing sector. Still, *on average*, countries with larger agricultural sectors expectedly have smaller manufacturing sectors. Indeed, our Polyarchy stock measure is positively correlated with

6 We cannot rule out, however, that differences in industrial output reflect that development of industrial infrastructure is less costly in autocracies, for example through lower wages, and thus labor costs. Indeed, this would be in line with the coercion-mechanism outlined in the theory section.

employment in agriculture. However, the coefficient falls short of conventional levels of statistical significance.

We return now to our four core dependent variables tapping into different aspects of industrialization and discuss robustness to different specification choices. We start out with our specification of the democracy stock variable. The choice of a 1 percent depreciation rate was done in order to privilege long-term effects of regime type. However, the choice of exact rate is inherently arbitrary, and we also want to test specifications that strike a different balance between capturing and weighting historical/long-term effects versus short-term effects.

The relevant results are reported in Appendix Table A.3, where Models 1-4 replicate the benchmark for the four industrialization measures, but with a 5% depreciation rate. Models 5-8 prioritize recent regime features even more by using a 10% depreciation rate for calculating the Polyarchy stock measure. In all these specifications, Polyarchy stock is negatively signed. The t-values are comparatively weaker when iron and steel production is the dependent variable (-1.23 for 5% depreciation rate and -1.01 for 10% depreciation rate), whereas results are significant at least at the 10% level for all three other measures. The most robust results are those for energy consumption, with t-values of -4.35 (5% stock) and -3.64 (10% stock). Finally, Models 9-12, Table A.3 use a simple level measure of democracy (Polyarchy score measured 5 years before the outcome variables), thereby capturing only shorter-term effects. Once again, the relationships are consistently in the expected direction, and the negative Polyarchy level coefficients are significant at 10% for railway freight (t=-1.94) and at 1% for energy consumption (t=-3.31) and manufacturing as share of GDP (t=-6.82). The t-value for Polyarchy in Model 11 on Iron and steel production is -0.89, falling short of conventional levels of significance.

We also deal with the issue of ambiguous expectations on timing by trying out different lag-specifications. In the benchmark, the outcomes are measured five years after the covariates. In

Appendix Figure A1, we show that the results – both in terms of coefficient sizes and t-values – are very stable to varying the time lag, measuring the outcomes between *t+1* and *t+9*.

Regarding the choice of democracy measure and construction of democracy stock, we find that results from the benchmark are equivalent if we invert the Polyarchy measure and construct an equivalent "autocracy stock" measure. We also tested alternative operationalizations of democracy (Table A.7). When we employ the Lexical Index of Democracy from Skaaning et al. (2016) rather than Polyarchy to construct democracy stock, it falls short of statistical significance for iron and steel production and manufacturing value added. But, when we use the dichotomous electoral democracy measure from Boix et al. (2013), we once again find clear results for railway freight, energy consumption, and manufacturing value added.

Results are also quite stable to altering the sample and omitting particular countries and regions that one might expect could drive the overall relationship. For example, the benchmark specification shows that democracy stock is negative with t-values of, respectively, -2.5, -7.1, -1.5 and -3.5 for railway freight, energy consumption, iron and steel production, and manufacturing value added once we omit all countries coded by La Porta et al (1999) to have a Socialist legal origin (Table A.9). This alleviates concerns that the observed correlations simply reflect the rapid industrialization experiences of Communist countries such as the Soviet Union and China. More generally, results are not simply due to countries in one particular geographic region – such as East Asia – achieving industrialization under less democratic regimes. With one exception (removing Europe for the iron and steel regression), the estimated coefficient for democracy stock is always negative, for all outcome measures, no matter which region we exclude. Additional results, presented in Appendix Figures A.2-A.5, show that the results are also stable to omitting any single country from the regressions.

We opted to test our expectations on four quite different measures, tapping into various key aspects of industrialization. The least robust result is for the measure on Ln iron and steel consumption, although the result is always negative and substantial in size and sometimes statistically significant. One plausible reason for the lack of robustness pertains to measurement errors in this variable, which extends back to 1816.[7] Data for any single year may be over-reported or under-reported. If this error is unsystematic, we should not expect any bias in the democracy stock coefficient. But standard errors should be overestimated, increasing the probability of Type II errors (i.e., falsely rejecting a true relationship). One way to mitigate such measurement error is to average across broader time periods, as over-reporting of production in one year carries less weight and may even be cancelled out by under-reporting in another year.

Thus, we ran regression specifications with 5 or 10-year periods as time units, averaging across our variables for each period and lagging covariates one period before the outcomes. While such specifications may overlook relevant information stemming from (real) short-term changes to regime type and the outcomes, another benefit is that using longer panels further reduces autocorrelation issues, thus giving more accurate hypothesis tests. Non-modeled changes in outcomes are larger from one decade to the next than from one year to the next.

The 5- and 10-year panel results are reported in Table A.5. The point estimates are remarkably similar to in the benchmark specifications in Table 1. Interestingly, democracy stock is statistically significant at least at 5% level for all four outcomes, both when using the 5-year panels and the 10-year panels.

---

7 Another potential explanation is that Ln iron and steel production is far from normally distributed, inducing violations of OLS modelling assumptions. More specifically, many observations are clustered at 0, reflecting that many countries, over long time intervals, did not produce any iron or steel (or produced insufficient quantities to register on our variable). When omitting all the zero observations and re-running our benchmark (see Table A.10), democracy stock remains negative and the relationship turns clearer with a t-value of -4.9.

Finally, in Table 3, we replicate the set-up in Table A.5, but include lagged dependent variables as regressors in each specification. By doing so, we want to further mitigate concerns about omitted confounders correlating with any flexible, country-specific trend in both our main independent and dependent variables. As such, these models estimate the effect of a change in Polyarchy stock at *t* on the change in our industrialization measures from *t* to *t+5*. Since there may be more complex dynamics in the outcome variable, and past realizations of industrialization may affect regime type, we also tested specifications with multiple lags of the dependent variable as regressor. This control strategy should further mitigate risks of omitted variable bias as well as concerns of autocorrelation (see Acemoglu et al. 2019). In Table 3 we showcase models using the 5-year panels where we control for, alternatively, one and three lags on the dependent variable. Alternative specifications, including models with two lags on the dependent variable as regressors and different models using 10-year panels, are reported in Appendix Table A.6.

Once again, the coefficients are consistently negative across all our four measures of industrialization. Results are not robust for the railway measure when including the lagged dependent variable, however, as the standard errors are larger than the coefficient estimates. This might indicate that autocorrelation influences results for the models on railroad investment, and we should therefore be more cautious with drawing strong conclusions for this measure. In contrast, results are very clear – for different autoregressive lag models and when using different panel units -- for the three other measures, with t-values ranging between -2.1 and -5.5 for energy consumption, iron and steel production, and manufacturing as share of GDP. The same pattern appears when we estimate models with lagged dependent variables in the yearly panels (not reported).

Table 3: Lagged dependent variable models

	5-years as the panel unit							
	Ln Railway freight	Ln energy consumption	Ln iron & steel prod.	Manufacturing value added	Ln Railway freight	Ln energy consumption	Ln iron and steel prod.	Manufacturing value added
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Stock Polyarchy 1 % depr.	-0.006	-0.021	-0.015	-0.133	-0.003	-0.016	-0.012	-0.152
	(-1.329)	(-5.463)	(-2.86)	(-2.897)	(-0.531)	(-4.612)	(-2.151)	(-2.426)
Ln GDP pc	0.127	-0.024	0.278	1.11	0.037	-0.032	0.302	1.294
	(1.908)	(-0.413)	(4.353)	(2.603)	(0.574)	(-0.672)	(4.288)	(2.609)
Ln Population	0.207	1.969	2.51	8.75	0.126	2.249	3.002	16.957
	(0.327)	(4.69)	(5.408)	(1.999)	(0.191)	(4.622)	(5.430)	(2.711)
DV lagged 1 time period	0.818	0.808	0.86	0.64	0.876	1.025	1.001	0.736
	(26.505)	(44.164)	(63.19)	(15.711)	(13.16)	(28.502)	(39.830)	(14.701)
DV lagged 2 time periods					-0.098	-0.166	-0.221	-0.165
					(-1.746)	(-5.439)	(-7.942)	(-3.515)
DV lagged 3 time periods					-0.011	-0.029	0.053	0.035
					(-0.356)	(-2.535)	(1.978)	(0.876)
Constant	0.65	-3.727	-7.09	-21.022	1.463	-4.316	-8.385	-41.517
	(0.397)	(-3.308)	(-5.87)	(-1.709)	(0.950)	(-3.574)	(-5.833)	(-2.517)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1096	2638	2694	1143	916	2,288	2,333	806
R^2	0.986	0.979	0.966	0.888	0.990	0.986	0.970	0.925

Note: Ordinary least squares regression. T-statistics from country clustered standard errors in parentheses. All variables are averaged across the 5-year time periods. Right-side variables lagged by one period. Omitted: country and year fixed effects, constant

The results are virtually identical when we substitute the 1% depreciation rate version of Polyarchy stock with a 5% depreciation rate (Appendix Table A.4). Thus, even when weighting historical regime characteristics less strongly, we find that autocracy is systematically related to larger subsequent increases in energy consumption, iron and steel production and manufacturing as share of income. Finally, since there may be more complex dynamics in the outcome variable, and past realizations of industrialization may affect regime type, we also tested specifications with multiple lags of the dependent variable as regressor (Appendix Table A.6). This control strategy should further mitigate risks of omitted variable bias as well as concerns of autocorrelation (see Acemoglu et al. 2019). Our main result turns out robust also to this estimation strategy.

As a final extension, we take into consideration that other regime-dimensions, beyond the distinction between (more or less) democratic vs. autocratic regimes, might influence industrialization.

One plausible hypothesis might be that autocracies with dominant parties are more adept to push comprehensive industrialization policies than autocracies governed by a personalist dictator. Thus, we estimated models where we substituted democracy stock with dummies for the regime categories from Anckar and Fredriksson (2018), extending the time series and further developing the Geddes et al. (2014) scheme for categorizing regimes into monarchies, semi-monarchies, oligarchies, military regimes, personalist dictatorships, as well as presidential-, semi-presidential-, and parliamentary regimes. The results, which are presented in Table A.11, are very unstable, with no clear pattern emerging for differences across regime types. While this might indicate that the democracy—autocracy distinction is, indeed, among the more relevant political regime characteristics for explaining differences in industrialization, we highlight that the latter analysis is preliminary, and encourage future research to probe further into more nuanced such relationships.

Conclusion

We have proposed that countries that are governed by autocratic regimes are more likely to experience a substantial industrialization of their economies than democratically governed countries. The argument leading to this expectation rests on the differences in incentives facing autocratic and democratic leaders – leading autocratic leaders to prioritize policies that aid industrialization more heavily – as well as a difference in the capacity to enact measures that lead to industrialization. More specifically, we pointed to three likely mechanisms pertaining to the added importance of security issues and particularism in autocracies as generating incentives for industrialization, and, concerning capabilities, the more coercive nature of autocratic politics as conducive to transforming the economy towards more industrial production.

We leveraged four (quite different) measures of industrialization, with some time series running back to the early 19th century (when only Britain could be considered an industrialized economy). We also tested different measures of democracy, but mainly relied on a stock measure of (electoral) democracy that accounts for the likely drawn-out effect of regime type on industrialization. When doing so, we find fairly strong support for the hypothesis that autocracy is conducive to industrialization. While our results are not entirely robust across specifications and outcome measures, the weight of the evidence supports the relationship anticipated from our argument suggesting that autocratic regimes may serve as handmaidens of industrialization.

References

Acemoglu, Daron, Suresh Naidu, Pascual Restrepo, James A. Robinson. 2019. "Democracy does cause growth." *Journal of Political Economy* 127(1): 47-100.

Adler, Nicole, Eric Pels and Chris Nash. 2010. "High-speed rail and air transport competition: Game engineering as tool for cost-benefit analysis". *Transportation Research Part B: Methodological* 44(7): 812-33.

Anckar, Carsten and Cecilia Fredriksson. 2019. "Classifying political regimes 1800–2016: a typology and a new dataset". *European Political Science* 18, 84—96.

Aldrich, Daniel P. 2008. *Site Fights: Divisive Facilities and Civil Society in Japan and the West.* Ithaca: Cornell University Press.

Amsden, Alice. 1989. *Asia's next giant: South Korea and late industrialization*. New York: Oxford University Press.

Ansell, Ben W. and David J. Samuels. 2014. *Inequality and Democratization: An Elite-Competition Approach.* Cambridge: Cambridge University Press.

Bardhan, Pranab K. 2012. *Awakening giants, feet of clay: Assessing the economic rise of China and India*. Princeton: Princeton University Press.

Behrens, Christiaan, Eric Pels. 2012. "Intermodal competition n the London-Paris passenger market: High-speed Rail and air transport." *Journal of Urban Economics* 71(3): 278-288.

Boix, Carles, Michael K. Miller, and Sebastian Rosato. 2013. "A Complete Data Set of Political Regimes, 1800–2007". *Comparative Political Studies* 46(12): 1523-1554.

Boix, Carles. 2003. *Democracy and Redistribution*. Princeton: Princeton University Press

BP. 2018 *BP Energy Outlook*, *2018 Edition*. URL: https://www.bp.com/content/dam/bp/en/corporate/pdf/energy-economics/energy-outlook/bp-energy-outlook-2018.pdf [17-08-2018]

Brown, David, Ahmed Mushfiq Mobarak. 2009. “The Transforming Power of Democracy: Regime Type and the Distribution of Electricity.” *American Political Science Review* 103:2, 193-213.

Brown, David, Wendy Hunter. 2004. “Democracy and Human Capital Formation.” *Comparative Political Studies* 37: 842–64.

Burgess, Robin, Remi Jedwab, Edward Miguel, Ameet Morjaria, and Gerard Padró i Miquel, 2015. “The Value of Democracy: Evidence from Road Building in Kenya.” *American Economic Review* 105(6): 1817-1851.

Chambers, Paul, Napisa Waitoolkiat (eds). 2017. *Khaki Capital: The Political Economy of the Military in Southeast Asia*. Nordic Institute of Asian Studies Press.

Chan, Alfred N. 2001. *Mao's Crusade: Politics and Policy Implementation in China's Great Leap Forward.* Oxford: Oxford University Press.

Chang, Eric C. C., Mark Andreas Kayser, Drew A. Linzer, Ronald Rogowski. 2010. *Electoral Systems and the Balance of Consumer-Producer Power.* Cambridge: Cambridge University Press.

Chiozza Giacomo, H. E. Goemans. 2004. International Conflict and the Tenure of Leaders: Is War Still Ex Post Inefficient? American Journal of Political Science 48(3): 604-619.

Clark, Gregory. 2007. A Farewell to Alms: A Brief Economic History of the World. NJ: Princeton University Press.

Coppedge, Michael, John Gerring, Carl Henrik Knutsen, Staffan I. Lindberg, Svend-Erik Skaaning, Jan Teorell, David Altman, Michael Bernhard, M. Steven Fish, Agnes Cornell, Sirianne Dahlum, Haakon Gjerløw, Adam Glynn, Allen Hicken, Joshua Krusell, Anna Lührmann, Kyle L.

Marquardt, Kelly McMann, Valeriya Mechkova, Juraj Medzihorsky, Moa Olin, Pamela Paxton, Daniel Pemstein, Josefine Pernes, Johannes von Römer, Brigitte Seim, Rachel Sigman, Jeffrey Staton, Natalia Stepanova, Aksel Sundström, Eitan Tzelgov, Yi-ting Wang, Tore Wig, Steven Wilson, and Daniel Ziblatt. 2018a. "V-Dem [Country-Year/Country-Date] Dataset v8". Varieties of Democracy (V-Dem) Project.

Coppedge, Michael, John Gerring, Carl Henrik Knutsen, Staffan I. Lindberg, Svend-Erik Skaaning, Jan Teorell, David Altman, Michael Bernhard, Agnes Cornell, M. Steven Fish, Haakon Gjerløw, Adam Glynn, Allen Hicken, Joshua Krusell, Anna Lührmann, Kyle L. Marquardt, Kelly McMann, Valeriya Mechkova, Moa Olin, Pamela Paxton, Daniel Pemstein, Brigitte Seim, Rachel Sigman, Jeffrey Staton, Aksel Sundtröm, Eitan Tzelgov, Luca Uberti, Yi-ting Wang, Tore Wig, Daniel Ziblatt. 2018b. "V-Dem Codebook, v8." Varieties of Democracy (V-Dem) Project.

Cummings, Bruce. 1984. "The Origins and Development of the Northeast Asian Political Economy: Industrial Sectors, Product Cycles and Political Consequences." *International Organization* 38:1, 1-40.

Dahl, Robert. 1971. *Polyarchy.* New Haven, CT: Yale University Press.

Davenport, Christian. 2007. "State repression and political order." *Annual Review Political Science* 10: 1-23.

Davies, R.W., Mark Harrison, S.G. Wheatcroft (eds). 1994. *The Economic Transformation of the Soviet Union, 1913–1945*. Cambridge: Cambridge University Press.

De Mesquita, Bruce Bueno, Alastair Smith, James D. Morrow, Randolph M. Siverson. 2003. *The logic of political survival*. MIT press.

de Schweinitz, Karl. 1959. “Industrialization, labor controls, and democracy.” *Economic Development and Cultural Change* 7(4): 385-404.

Deyo, Frederick (ed.). 1987. *The Political Economy of the New Asian Industrialism*. Ithaca, NY: Cornell University Press.

Evans, Peter. 1995. *Embedded Autonomy: States and Industrial Transformation*. Princeton, NJ: Princeton University Press.

Fariss, Christopher J., Charles D. Crabtree, Therese Anders, Zachary M. Jones, Fridolin J. Linder, Jonathan N. Markowitz. 2017. “Latent Estimation of GDP, GDP per capita, and Population from Historic and Contemporary Sources.” Working paper.

Faust, Jörg. (2007). Democracy's Dividend: Political Order and Economic Productivity, *World Political Science Review*. 3: 1–26.

Fravel, M. Taylor. 2019. *Active Defense: China’s Military Strategy Since 1949*. Princeton: Princeton University Press, forthcoming.

Galtung, Johan. 1996. “On the Social Costs of Modernization. Social Disintegration, Atomie/ Anomie and Social Development.” *Development and Change.* 27(2): 379-413.

Geddes, Barbara, Joseph Wright and Erica Frantz. 2014. “Autocratic Breakdown and Regime Transitions: A New Data Set”. *Perspectives on Politics.*12(2). 313—331.

Gereffi, Gary, Donald L. Wyman. 1990. Manufacturing Miracles: Paths of Industrialization in Latin America and East Asia. Princeton, NJ: Princeton University Press.

Gerring, John, Carl Henrik Knutsen, Svend-Erik Skaaning, Jan Teorell, Matthew Maguire, Michael Coppedge, Staffan Lindberg. 2016. “Electoral Democracy and Human Development.” Varieties of Democracy Institute: Working Paper No. 9.

Gerring, John, Philip Bond, William T. Barndt, Carola Moreno. 2005. "Democracy and economic growth: A historical perspective." *World Politics* 57(3): 323-364.

Gerschenkron, Alexander 1962. *Economic Backwardness in Historical Perspective.* Cambridge: Belknap Press.

Gibler, Douglas M. 2007. "Bordering on Peace: Democracy, Territorial Issues, and Conflict". *International Studies Quarterly* 51(3): 509-532.

Goldstone, Jack. 2009. Why Europe? The Rise of the West in World History, 1500-1850. New York: McGraw-Hill.

Haggard, Stephan. 1990. *Pathways from the Periphery: The Politics of Growth in the Newly Industrializing Countries*. Ithaca: Cornell University Press.

Hajnal, J. 1965. "European marriage patterns in perspective." In Glass DV, Eversley DE (eds). Population in history: essays in historical demography (Chicago, Illinois, Aldine Publishing Company), 101-43.

Helmke, Gretchen and Frances Rosenbluth. 2009. "Regimes and the Rule of Law: Judicial Independence in Comparative Perspective." *Annual Review of Political Science* 12: 345-366.

Jones, Eric L. 1981. The European Miracle: Environments, Economics and Geopolitics in the History of Europe and Asia, 2d ed. Cambridge: Cambridge University Press.

Keefer, Philip, and Stephen Knack. 2007. "Boondoggles, Rent-Seeking, and Political Checks and Balances: Public Investment Under Unaccountable Governments." *Review of Economics and Statistics* 89(3): 566–72.

Knutsen, Carl Henrik 2015, Why Democracies Outgrow Autocracies in the Long Run: Civil Liberties, Information Flows and Technological Change. *Kyklos*, 68, 357– 384.

Kohli, Atul. 2004. State-Directed Development: Political Power and Industrialization in the Global Periphery. Cambridge: Cambridge University Press.

Koistinen, Paul A.C. 1980. *The Military-Industrial Complex: A Historical Perspective*. Praeger.

La Porta, Rafael, Florencio Lopez-de-Silanes, Andrei Shleifer, and Robert W. Vishny. 1999. "The Quality of Government." *Journal of Law, Economics, & Organization* 15(1): 222-279.

Landes, David. 1998. *The Wealth and Poverty of Nations*. London: Little.

Lee, Cheol-Sung. 2005. "Income inequality, democracy, and public sector size." *American Sociological Review* 70.1: 158-181.

Lindert, Peter H. 2004. *Growing Public: Social Spending and Economic Growth since the Eighteenth Century*. Cambridge: Cambridge University Press.

McDowell, C. (ed). 1996. *Understanding Impoverishment. The Consequences of Development-induced Displacement.* Oxford: Berghahn Books.

Meredith, Martin. 2011. *The Fate of Africa: A History of the Continent Since Independence.* NY: publicaffairs.

Min, Brian. 2015. *Power and the Vote: Elections and Electricity in the Developing World*. Cambridge: Cambridge University Press.

Mobarak, Ahmed Mushfiq. 2005. "Democracy, volatility, and economic development." *Review of Economics and Statistics* 87(2): 348-361.

Moore, Barrington. 1966. *Social Origins of Dictatorship and Democracy: Lord and Peasant in the Making of the Modern World.* Boston: Beacon Press.

Mulligan, Casey, B., Ricard Gil, and Xavier Sala-i-Martin. 2004. "Do Democracies Have Different Public Policies than Nondemocracies? ." *Journal of Economic Perspectives* 18(1): 51-74.

Murphy, Kevin M., Andrei Shleifer, Robert W. Vishny. 1989. "Industrialization and the Big Push." *Journal of Political Economy* 97(5):1003-1026.

Naughton, Barry, Kellee S. Tsai (eds). 2015. *State capitalism, institutional adaptation, and the Chinese miracle*. Cambridge: Cambridge University Press.

Nielsen, Kenneth Bo. 2010. "Contesting India's development? Industrialisation, land acquisition and protest in West Bengal." *Forum for Development Studies* 37:2.

Nunn, Nathan. 2019. Rethinking Economic Development. *Canadian Journal of Economics*. Forthcoming.

O'Donnell, Guillermo A. 1988. *Bureaucratic authoritarianism: Argentina, 1966-1973, in comparative perspective*. Berkeley: University of California Press.

Pack, Howard, Kamal Saggi. 2006. *The case for industrial policy: a critical survey*. The World Bank.

Pomeranz, Kenneth, and Steven Topik. 2014. The world that trade created: Society, culture and the world economy, 1400 to the present. Routledge.

Pomeranz, Kenneth. 2000. *The Great Divergence: China, Europe and the Making of the Modern World Economy*. Princeton: Princeton University Press.

Przeworski, Adam. 1991. *Democracy and the Market: Political and Economic Reforms in Eastern Europe and Latin America.* Cambridge: Cambridge University Press.

Przeworski, Adam, Michael E. Alvarez, Jose Antonio Cheibub, Fernando Limongi. 2000. *Democracy and development: political institutions and well-being in the world, 1950-1990*. Cambridge: Cambridge University Press.

Przeworski, Adam, and Fernando Limongi. 1993. "Political Regimes and Economic Growth." *The Journal of Economic Perspectives* 7(3): 51–69

Robison, Richard. 1988. "Authoritarian states, capital-owning classes, and the politics of newly industrializing countries: The case of Indonesia." *World Politics* 41(1): 52-74.

Rodrik, Dani. 1999. "Democracies pay higher wages." *The Quarterly Journal of Economics* 114(3): 707-738.

Rodrik, Dani. 2008. "The Real Exchange Rate and Economic Growth". *Brookings Papers on Economic Activity* 2008(2): 365-412.

Rodrik, Dani. 2016. "Premature deindustrialization." *Journal of Economic Growth* 21(1): 1-33.

Román, Concepción, Raquel Espino, Juan Carlos Martín. 2007. *Competition of high-speed train with air transport: The case of Madrid-Barcelona* 13(5): 277-284.

Rosenstein-Rodan, Paul N. 1943. "Problems of Industrialisation of Eastern and South-eastern Europe." *Economic Journal* 53 (June-September): 202-211.

Ross, Michael L. 2012. *The Oil Curse: How Petroleum Wealth Shapes the Development of Nations*. NJ: Princeton University Press.

Saiz, Albert. 2006. "Dictatorships and Highways." *Regional Science and Urban Economics* 36(2): 187-206.

Sargeson, Sally. 2013. "Violence as Development: Land Expropriation and China's Urbanization." *Journal of Peasant Studies* 40(6): 1063–85.

Schumpeter, Joseph A. 1950. *Capitalism, socialism and democracy*. New York: Harper & Row.

Shearer, David R. 1996. *Industry, State, and Society in Stalin's Russia, 1926-1934*. Ithaca: Cornell University Press.

Skidmore, Thomas E. 1990. *The politics of military rule in Brazil, 1964-1985*. New York: Oxford University Press.

Smelser, Neil J. 1959 [2011]. *Social change in the British industrial revolution: An application of theory to the British cotton industry*. London: Routledge.

Smith, Hazel. 2015. *North Korea: Markets and military rule*. Cambridge: Cambridge University Press.

Stasavage, David. 2005. "Democracy and Education Spending in Africa". *American Journal of Political Science* 49(2): 343-358

Stiglitz, Joseph E., J. Y. Lin, E. Patel (eds). 2014. *The Industrial Policy Revolution, vol. 2: Africa in the 21st Century*. Houndmills: Palgrave Macmillan.

Svolik, Milan. 2012. *The Politics of Authoritarian Rule.* Cambridge: Cambridge University Press.

Tang, John P. 2014. "Railroad expansion and industrialization: evidence from Meiji Japan." *The Journal of Economic History* 74(3): 863-886.

Tavares, José and Romain Wacziarg. 2001. "How democracy affects growth". *European Economic Review.* 45(8): 1341-1378.

Thompson, Edward P. 1966. *The making of the English working class*. New York: Vintage.

Tipton, Elise K. 2008. *Modern Japan: A social and political history*. London: Routledge.

Wade, Robert. 2003. Governing the Market: Economic Theory and the Role of Government in East Asian Industrialization. Princeton, NJ: Princeton University Press.

Wavro, Geoffrey. 2003. *The Franco-Prussian War: The German Conquest of France in 1870-1871*. Cambridge: Cambridge University Press.

Woo-Cumings, Meredith (ed). 1999. *The Developmental State*. Ithaca, NY: Cornell University Press.

Yamamura, Kozo. 1977. "Success Ill-gotten? The Role of Meiji Militarism in Japan's Technological Progress." *The Journal of Economic Histor*y 37(1):113-135.

Online Appendix

In this this online appendix, we first present a table (Table A.1) displaying the variable definitions and sources for all variables employed in our analysis. The next table (Table A.2) presents a series descriptive statistics for these variables.

The following series of tables and figures report various robustness tests that are briefly discussed, but not reported in detail, in the paper. These include a replication of the main results table for alternative depreciation rates on the Polyarchy stock measure, as well as regressions using the level of Polyarchy instead of stock (Table A.3). We also present coefficient plots for results from regressions where we use alternative lag structures (Figure A.1) to the one used in the benchmark specification (DV measured in t+5). Next, we report results from our jackknifing exercises omitting either entire regions or countries from the benchmark regressions (Figures A.2-A.5). As a robustness test of Table 4 in the paper, we report results when using a 5% depreciation rate for the 5- and 10-year panel specifications that also include a lagged dependent variable as regressor (Table A.4). Further, we run tests on the 5-year panel specifications where we include several additional lags on the dependent variable as regressors, in order to further mitigate omitted variable bias and autocorrelation concerns (Table A.6)

The following tables present results where we alter the core independent variable in the benchmark, either by using alternative democracy measures for calculating democracy stock (Table A.7) or by calculating autocracy stock instead of democracy stock (Table A.8). Finally, we report results when omitting particular observations that may be suspected to drive our results, namely (former) Communist countries (Table A.9) and all observations with 0-scores on iron and steel production (Table A.10).

Table A.1: Variable Description

Variable (original name)	Description
	Dependent variables used
Railway freight (railtkm)	Source: The Cross-country Historical Adoption of Technology (CHAT) dataset (Comin and Hobijn 2009) Definition: Ton-KM of freight carried on railways (excluding livestock and passenger baggage). Freight for servicing of railroads is typically excluded but may be included for some countries. Notes: In all models, we add 1 to this variable and take the natural logarithm.
Energy consumption (pec)	Source: Correlates of War (COW) dataset (Sarkees and Wayman 2010) Definition: Primary energy consumption (thousands of coal-ton equivalents). Primary Energy Consumption is a state's consumption of energy (metric ton coal equivalent) in each year for the period 1816-2012. Notes: In all models, we add 1 to this variable and take the natural logarithm.
Iron and steel production (irst)	Source: Correlates of War (COW) dataset (Sarkees and Wayman 2010) Definition: Iron and steel production (thousands of tons). Iron and Steel production reflects a state's production of pig iron (1816-1899) and steel (1900-2012) in each year for the period 1816-2012. Notes: In all models, we add 1 to this variable and take the natural logarithm.
Manufacturing value added (NV.IND.MANF.ZS)	Source: World development indicators (WDI) (The World Bank) Definition: Manufacturing, value added (% of GDP). Manufacturing refers to industries belonging to ISIC divisions 15-37. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. It is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources. The origin of value added is determined by the International Standard Industrial Classification (ISIC), revision 3.
Agriculture (agro)	Source: Miller 2015 Definition: Employment in agricultural sector, % of total employment.
Laborer real wage (LabourersRealWage)	Source: Clio Infra (www.clio-infra.eu) Definition: Building laborers' real wage by country. Measured as subsistence ratios, which indicate how many times the daily wage of a male unskilled construction laborer can buy the daily subsistence basket. Data is originally interpolated on the basis of real wages indices from the (older) literature. Notes: In all models, we use the natural logarithm of this variable.
Public expenditure (Government expenditure (% of GDP))	Source: Mauro et al. 2015 Definition: Public expenditure as % of GDP. Government expenditure estimates correspond to non-interest government expenditures.

Internet users (internetuser)	Source: The Cross-country Historical Adoption of Technology (CHAT) dataset (Comin and Hobijn 2009) Definition: Number of people with access to the worldwide network Notes: In all models, we add 1 to this variable and take the natural logarithm.
Telephone lines (telephone)	Source: The Cross-country Historical Adoption of Technology (CHAT) dataset (Comin and Hobijn 2009) Definition: Number of mainline telephone lines connecting a customer's equipment to the public switched telephone network as of year end. Notes: In all models we use the natural logarithm of this variable.
Cars (vehicle_car)	Source: The Cross-country Historical Adoption of Technology (CHAT) dataset (Comin and Hobijn 2009) Definition: Number of passenger cars (excluding tractors and similar vehicles) in use. Numbers typically derived from registration and licensing records, meaning that vehicles out of use may occasionally be included. Notes: In all models we use the natural logarithm of this variable.
	Independent variables used
Polyarchy Electoral democracy index (v2x_polyarchy)	Source: The Varieties of Democracy Dataset (V-Dem) (Coppedge et al. 2018). Variable constructed by Teorell et al. (2018) Definition: The index is formed by taking the average of, on the one hand, the weighted average of the indices measuring freedom of association thick (v2x_frassoc_thick), clean elections (v2xel_frefair), freedom of expression (v2x_freexp_altinf), elected officials (v2x_elecoff), and suffrage (v2x_suffr) and, on the other, the five-way multiplicative interaction between those indices. Notes: In all models, we add 1 to this variable and take the natural logarithm.
GDP per capita	Source: Fariss et al. (2017) Definition: GDP per capita (PPP-adjusted) Notes: In all models, we use the natural logarithm of this variable. The Fariss et al. data provide estimates of income by drawing on information from different historic and contemporary sources and using a dynamic latent trait model. In addition to an expansive coverage across time and countries (i.e., few missing values), their procedure mitigates various measurement errors that affect other extant GDP measures. We use their estimates benchmarked in the long-time series data from the Maddison project (see Jutta et al. 2018).
Population	Source: Fariss et al. (2017) Definition: Population Notes: In all models, we use the natural logarithm of this variable. The Fariss et al. data provide estimates of population by drawing on information from different historic and contemporary sources and using a dynamic latent trait model. We use their estimates benchmarked in the long-time series data from the Maddison project (see Jutta et al. 2018).

Natural resource income	Source: Miller (2015) Definition: Natural resource income as % of GDP
Rigorous and impartial public administration (v2clrspct)	Source: The Varieties of Democracy Dataset (V-Dem) (Coppedge et al. 2018). Definition: Are public officials rigorous and impartial in the performance of their duties?
State ownership of economy (v2clstown)	Source: The Varieties of Democracy Dataset (V-Dem) (Coppedge et al. 2018). Definition: Does the state own or directly control important sectors of the economy?
Time in sample	Source: Constructed by us. Definition: Variable is constructed by subtracting the country's first year with a valid value on v2x_polyarchy from the current year. Notes: In all models we use the natural logarithm of this variable.

Table A.2: Descriptive Statistics

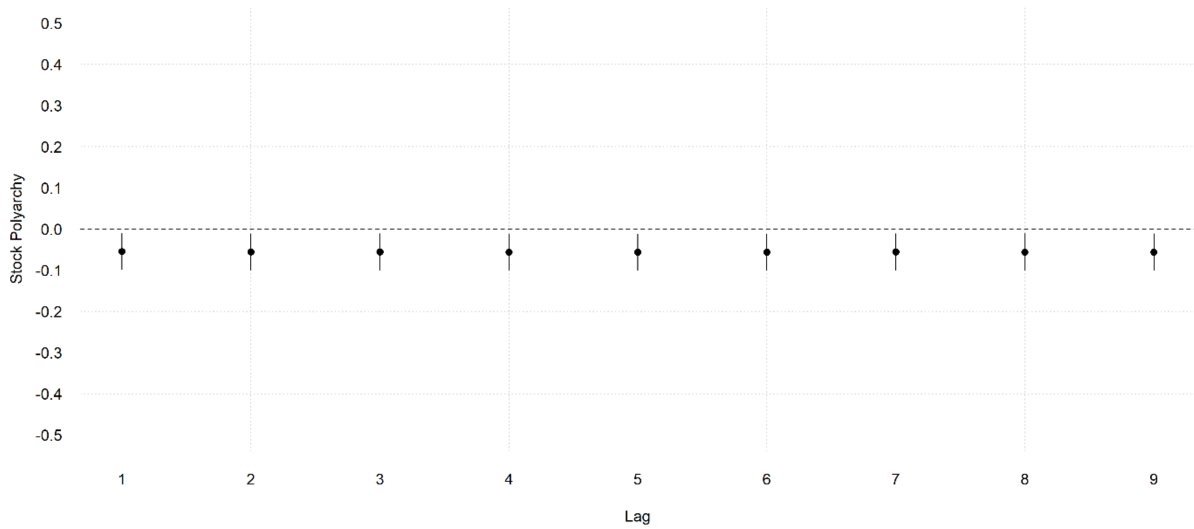
Variable name	Min	1st quantile	Median	Mean	3rd quantile	Max	N
Agriculture, % of workforce	0.00	26.20	53.60	50.77	75.00	96.90	10653
GDP per capita growth	-0.27	0.01	0.02	0.03	0.05	0.71	20773
Government ownership in the economy	-4.15	-0.96	0.25	0.05	1.15	3.31	25568
Laborer's real wage	0.03	7.44	15.44	27.99	31.59	361.27	4305
Ln cars	4.61	9.55	11.07	11.35	13.03	19.22	6672
Ln energy consumption	0.00	5.15	7.92	7.29	9.97	15.49	14080
Ln GDP per capita	4.65	6.82	7.42	7.61	8.26	11.36	20602
Ln internet users	0.00	8.11	10.66	10.04	12.89	18.88	1478
Ln iron and steel production	0.00	0.00	0.00	2.93	6.22	13.50	14494
Ln Population (in thousands)	3.33	7.42	8.44	8.47	9.52	14.04	20602
Ln railway freight	0.00	5.71	7.38	7.32	9.12	15.18	5983
Ln telephone lines	4.61	9.95	11.64	11.78	13.48	19.18	6924
Manufacturing value added, % of GDP	0.00	8.36	12.78	13.34	17.38	54.21	6161
Natural resources income, % of GDP	0.00	0.00	0.20	3.59	2.20	100.00	13342
Polyarchy Stock, 1 % depreciation	0.01	1.46	5.10	9.57	12.43	67.05	24205
Polyarchy Stock, 5 % depreciation	0.01	0.78	2.54	3.95	5.16	18.14	24205
Polyarchy Stock, 10 % depreciation	0.01	0.49	1.51	2.28	3.03	9.18	24205
Polyarchy	0.01	0.06	0.17	0.26	0.37	0.95	24205
Public expenditure, % of GDP	0.00	13.41	22.49	25.41	35.16	96.65	6987
Rigorous and impartial public administration	-3.63	-1.15	-0.15	-0.03	0.86	4.62	25255

Table A.3: Varying Depreciation Rates

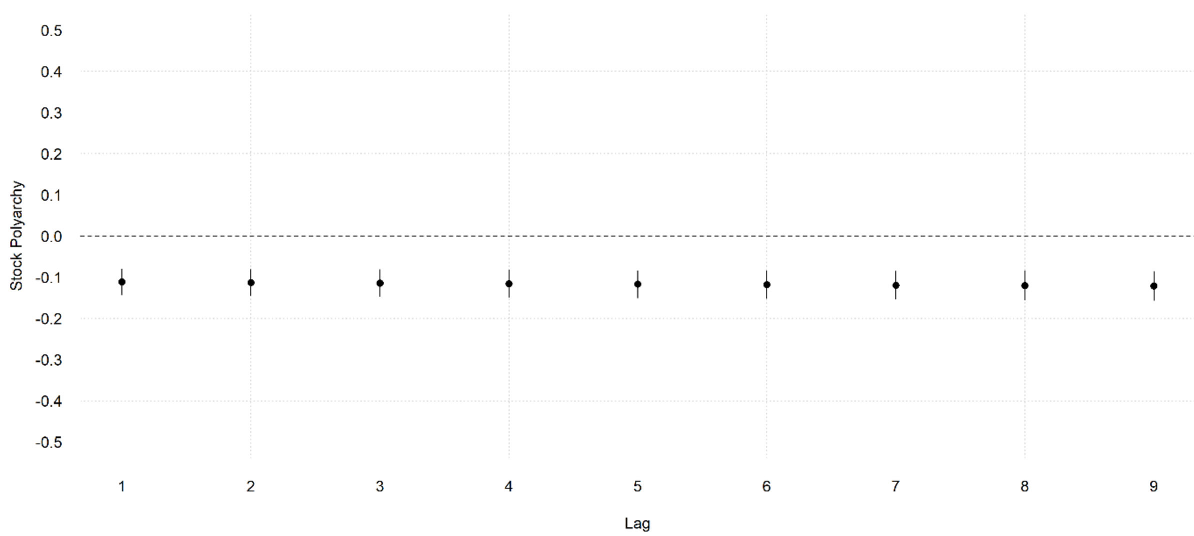
	Ln Railway freight	Ln energy consumption	Ln iron and steel prod.	Manufacturing value added	Ln Railway freight	Ln energy consumption	Ln iron and steel prod.	Manufacturing value added	Ln Railway freight	Ln energy consumption	Ln iron and steel prod.	Manufacturing value added
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Stock Polyarchy 5 % depreciation	-0.08	-0.16	-0.06	-0.40								
	(-1.86)	(-4.35)	(-1.23)	(-1.84)								
Stock Polyarchy 10 % depreciation					-0.10	-0.18	-0.07	-0.57				
					(-1.82)	(-3.64)	(-1.01)	(-1.75)				
Polyarchy									-0.57	-0.92	-0.37	-3.14
									(-1.94)	(-3.31)	(-0.89)	(-7.43)
Ln GDP pc	0.45	0.06	1.56	2.34	0.43	-0.01	1.54	2.29	0.39	-0.07	1.52	2.21
	(2.48)	(0.29)	(8.19)	(3.15)	(2.36)	(-0.04)	(8.21)	(3.04)	(2.23)	(-0.34)	(8.25)	(12.05)
Ln Population	0.58	1.51	1.13	2.95	0.61	1.57	1.15	3.04	0.62	1.62	1.17	3.15
	(3.02)	(6.55)	(6.14)	(3.50)	(3.09)	(6.73)	(6.28)	(3.54)	(3.21)	(6.94)	(6.46)	(17.32)
Constant	-4.92	-12.18	-19.30	-31.84	-4.87	-12.20	-19.31	-32.50	-4.66	-12.14	-19.35	-33.57
	(-2.09)	(-4.05)	(-8.33)	(-2.45)	(-2.08)	(-4.02)	(-8.30)	(-2.46)	(-2.05)	(-4.02)	(-8.28)	(-14.36)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Countries:	92	175	181	165	92	175	181	165	92	175	181	165
Years:	1852 1993	1816 2012	1816 2012	1960 2017	1852 1993	1816 2012	1816 2012	1960 2017	1852 1993	1816 2012	1816 2012	1960 2017
Observations	5,476	13,291	13,559	6,005	5,476	13,291	13,559	6,005	5,471	13,252	13,517	5,997
R^2	0.94	0.90	0.88	0.74	0.94	0.90	0.87	0.74	0.94	0.90	0.88	0.74

Note: Ordinary least squares regression. T-statistics from country clustered standard errors in parentheses. Right-side variables lagged by five years. *Omitted:* country and year fixed effects, constant

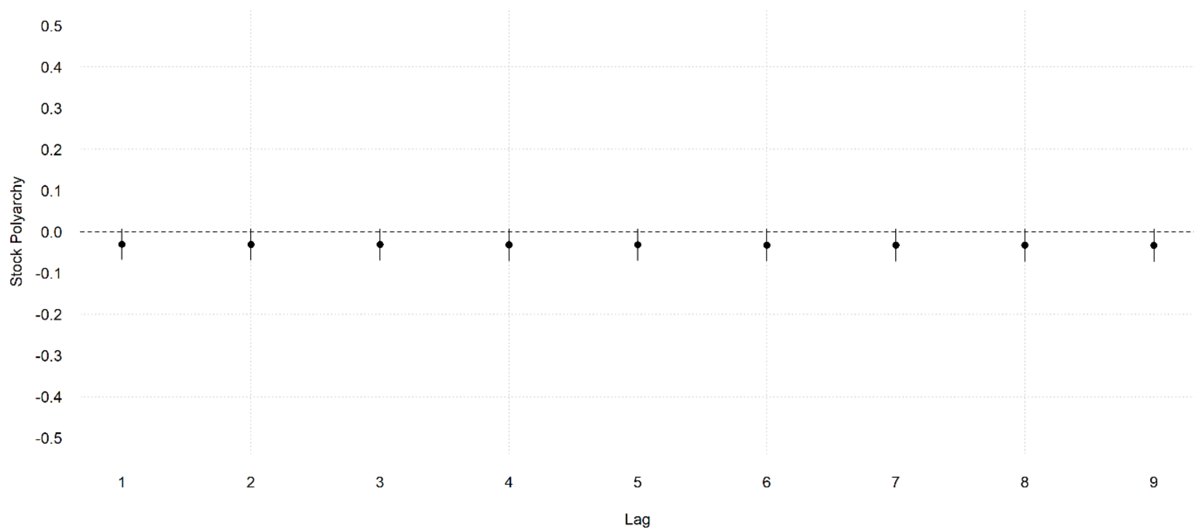
Figure A.1: Regression coefficients, with 95% percent confidence intervals, for varying lags



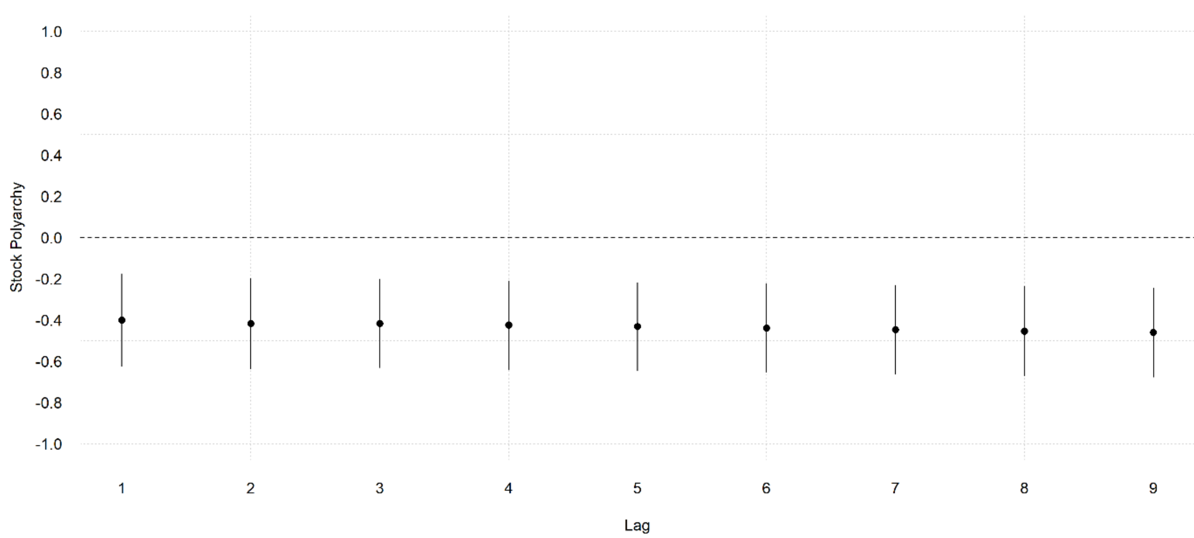
Panel (a): Railway freight (ln)



Panel (b): Energy consumption (ln)



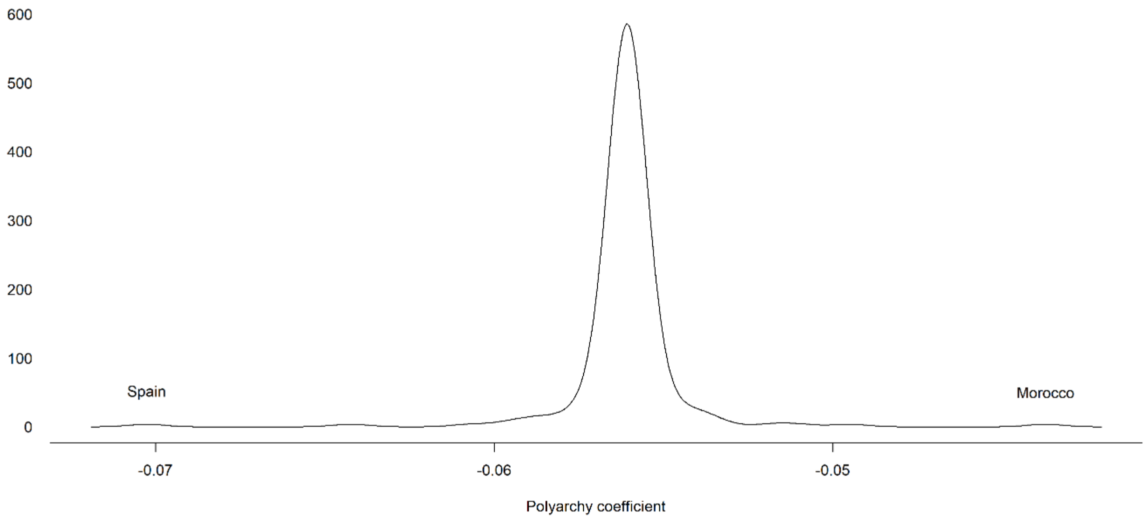
Panel (c): Iron, steel production (ln)



Panel (d): Manufacturing value added, % of GDP

Note: Coefficients and standard errors for democracy stock (1%) estimated from benchmark model (Models 1-4, Table 1) as lag varies from t-1 to t-9.

Figure A.2: Varying Samples: Distribution of democracy stock coefficient when omitting countries (top) and entire regions (bottom) for Ln railway freight



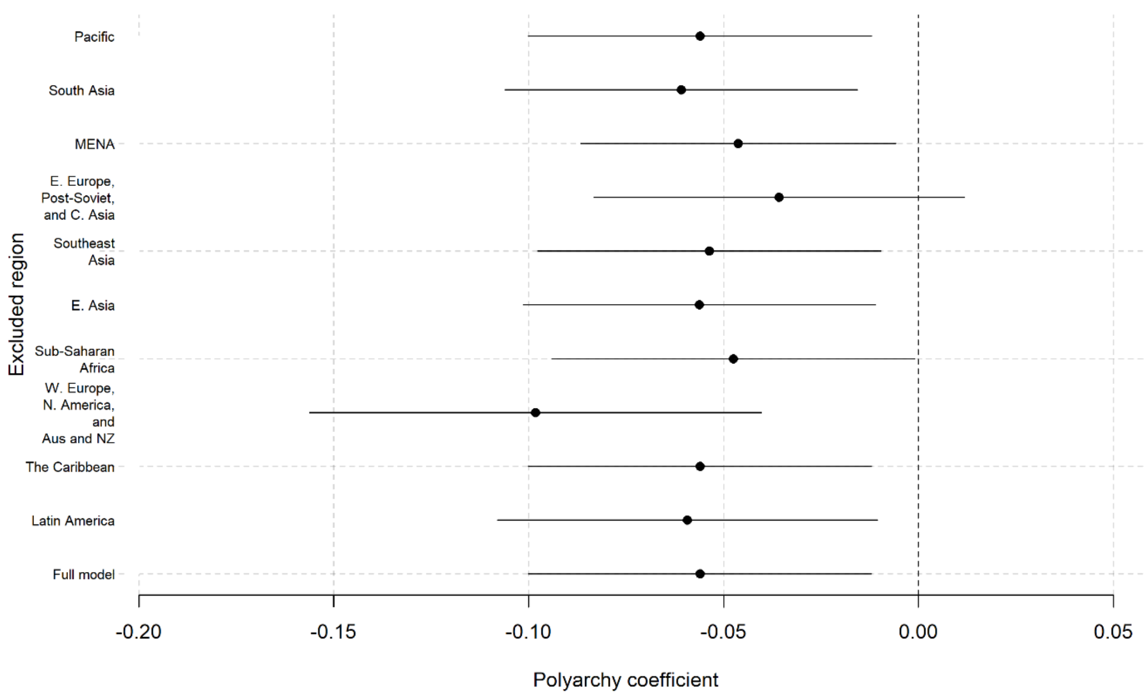
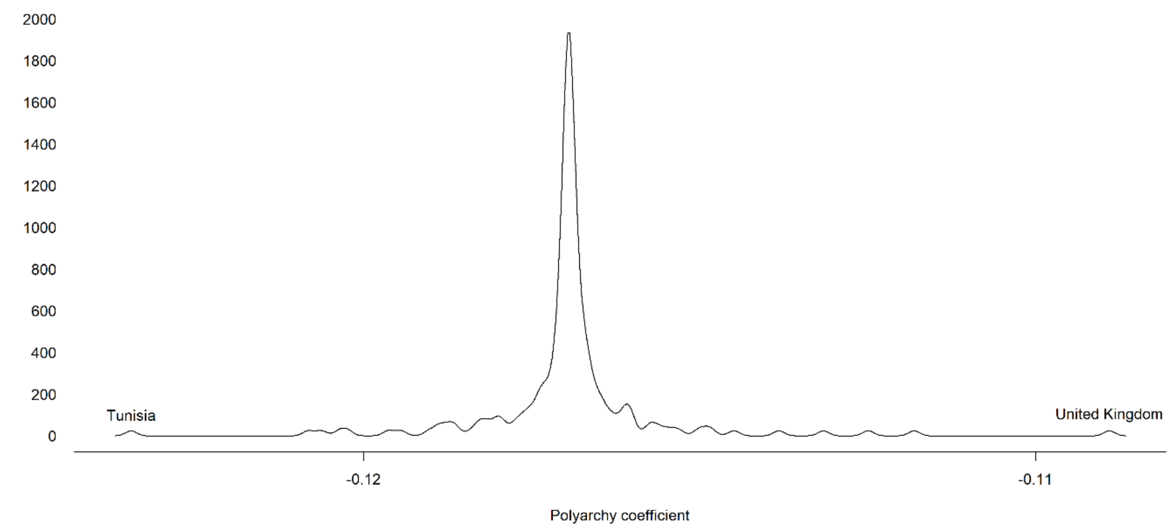


Figure A.3: Varying Samples: Distribution of democracy stock coefficient when omitting countries (top) and entire regions (bottom) for Ln energy consumption


2000
1800
1600
1400
1200
1000
800
600
400
200
0
Tunisia
United Kingdom
-0.12
-0.11
Polyarchy coefficient

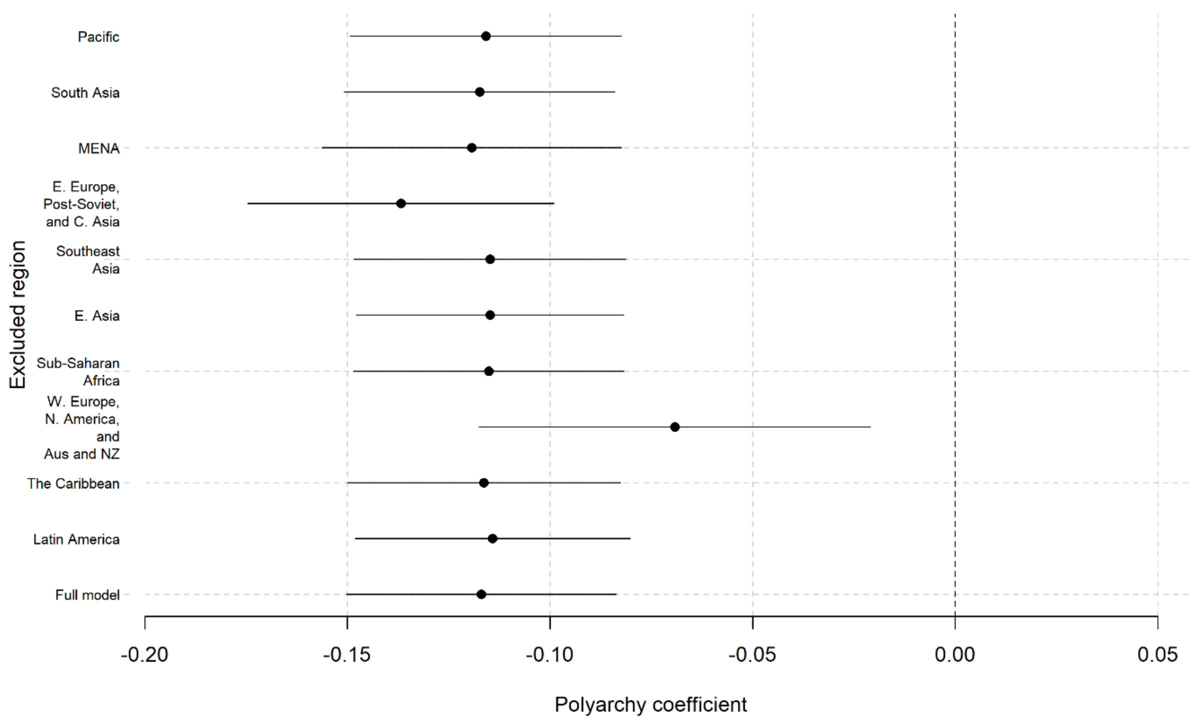
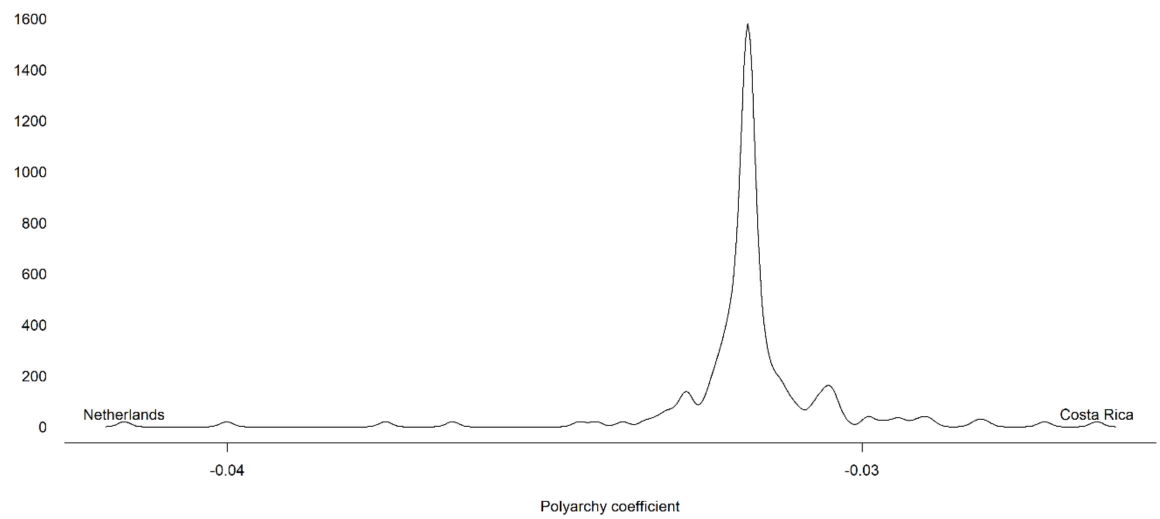

Pacific
South Asia
MENA
E. Europe, Post-Soviet, and C. Asia
Southeast Asia
E. Asia
Sub-Saharan Africa
W. Europe, N. America, and Aus and NZ
The Caribbean
Latin America
Full model
Excluded region
-0.20
-0.15
-0.10
-0.05
0.00
0.05
Polyarchy coefficient

Figure A4: **Varying Samples: Distribution of democracy stock coefficient when omitting countries (top) and entire regions (bottom) for Ln iron and steel production**



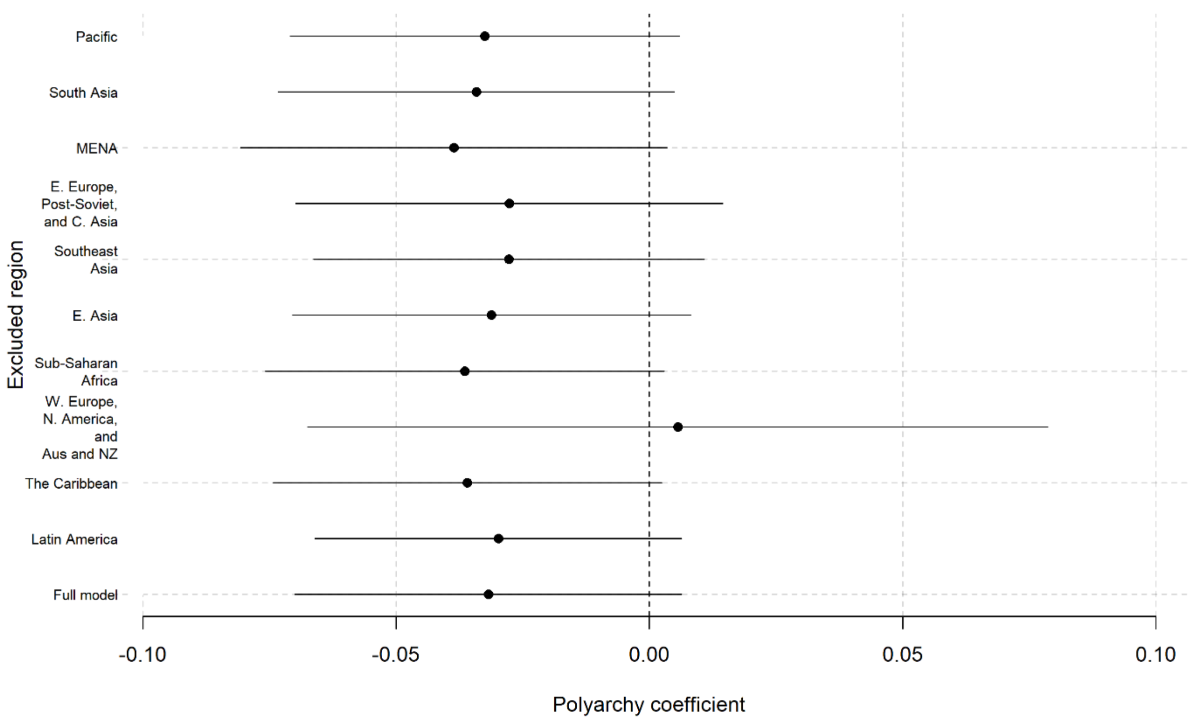
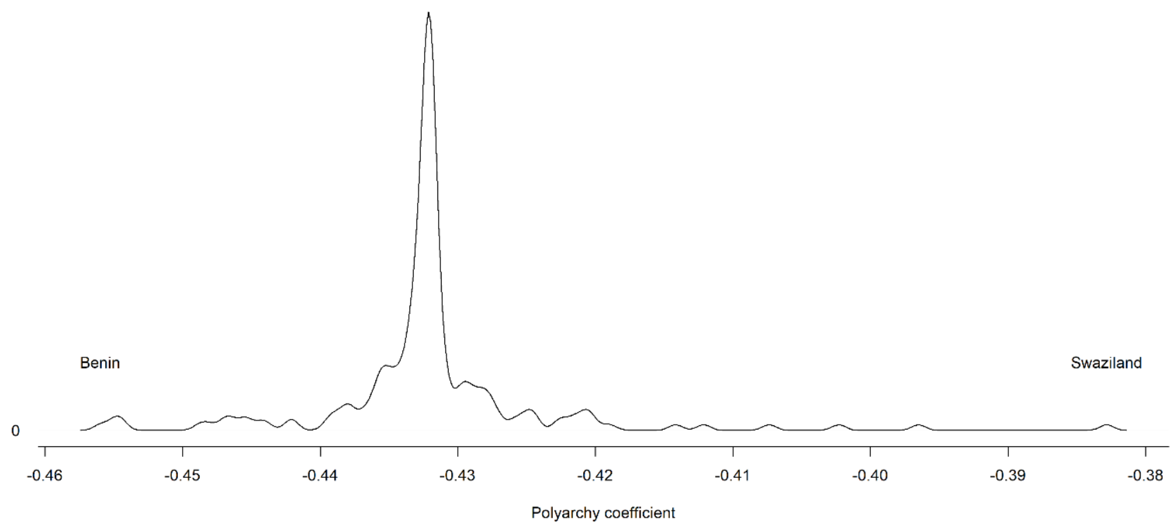


Figure A.5: Varying Samples: Distribution of democracy stock coefficient when omitting countries (top) and entire regions (bottom) for manufacturing value added



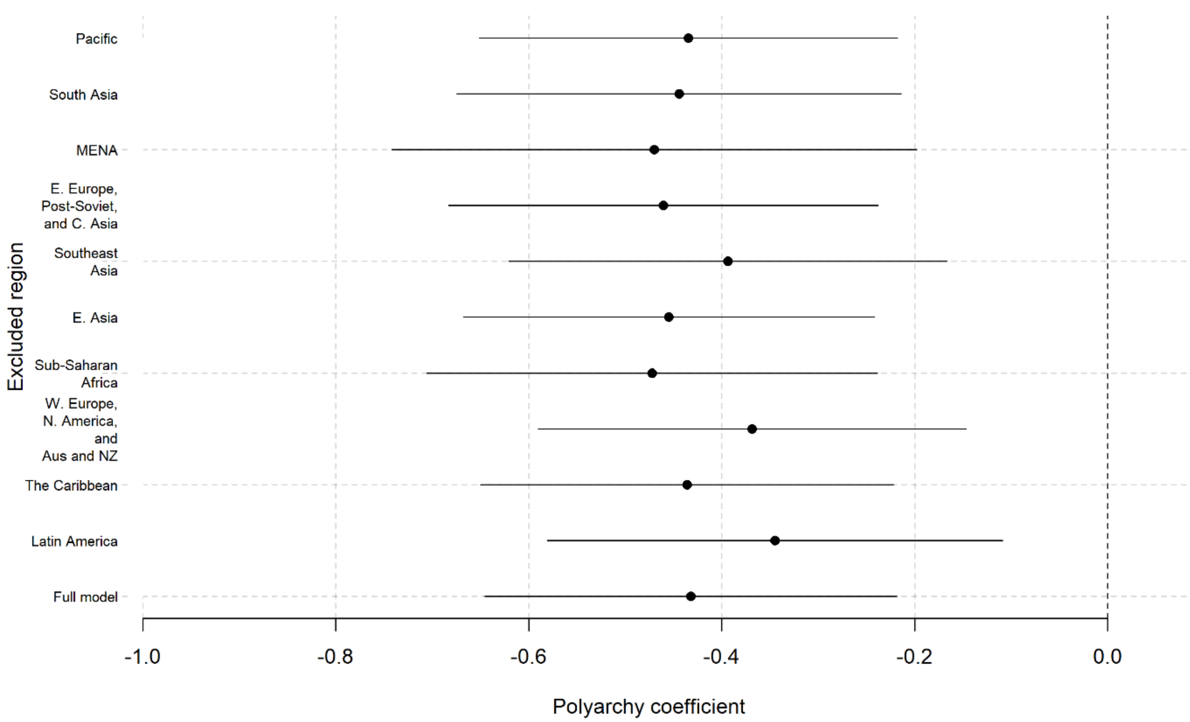


Table A.4: Including the lagged dependent variable as regressor. Robustness test on Polyarchy Stock with 5 percent depreciation rate.

	5 years as the panel unit				10 years as the panel unit			
Dependent variable:	Ln Railway freight	Ln energy consumption	Ln iron and steel prod.	Manufacturing value added	Ln Railway freight	Ln energy consumption	Ln iron and steel prod.	Manufacturing value added
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Stock Polyarchy 5 % depr.	-0.008	-0.047	-0.033	-0.147	-0.010	-0.083	-0.058	-0.308
	(-0.87)	(-4.30)	(-2.78)	(-1.98)	(-0.65)	(-4.34)	(-2.77)	(-2.56)
Ln GDP pc	0.060	-0.088	0.240	1.092	0.046	-0.220	0.414	1.701
	(1.11)	(-1.53)	(3.79)	(2.77)	(0.51)	(-2.21)	(3.51)	(2.61)
Ln Population	-0.031	0.120	0.289	1.137*	-0.133	0.129	0.447	1.987*
	(-0.49)	(2.67)	(4.63)	(1.87)	(-1.33)	(1.62)	(4.16)	(1.88)
Lagged D.V.	0.838	0.821	0.858	0.660	0.724	0.675	0.737	0.493
	(29.44)	(42.47)	(60.76)	(17.07)	(15.68)	(18.66)	(27.91)	(11.72)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1096	2638	2694	1143	575	1364	1393	538
R^2	0.905	0.954	0.906	0.623	0.845	0.919	0.845	0.445

Note: Ordinary least squares regression. T-statistics from country clustered standard errors in parentheses. All variables are averaged across the (5/10-year) time periods. Right-side variables lagged by one period. Omitted: country and year fixed effects, constant

Table A.5: Taking averages across longer time intervals.

	5-year averages				*10-year averages*			
	Ln Railway freight	Ln energy consumption	Ln iron and steel prod.	Manufacturing value added	Ln Railway freight	Ln energy consumption	Ln iron and steel prod.	Manufacturing value added
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Stock Polyarchy 1 % depreciation	-0.06	-0.12	-0.04	-0.32	-0.06	-0.12	-0.05	-0.28
	(-2.62)	(-7.03)	(-2.19)	(-3.14)	(-2.59)	(-6.62)	(-2.46)	(-2.58)
Ln GDP pc	0.58	0.37	1.66	2.74	0.50	0.28	1.69	2.97
	(3.03)	(1.75)	(7.88)	(3.10)	(2.62)	(1.28)	(8.27)	(2.97)
Ln Population	4.92	11.81	7.26	25.19	3.42	10.08	7.77	26.53
	(2.42)	(7.67)	(4.26)	(2.89)	(1.78)	(6.47)	(4.64)	(2.63)
Constant	-11.38	-26.83	-25.57	-60.40	-6.86	-22.39	-26.87	-64.58
	(-2.26)	(-6.47)	(-5.73)	(-2.38)	(-1.46)	(-5.42)	(-6.08)	(-2.30)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Countries:	92	175	181	165	92	175	181	165
Years:	1853 1989	1818 2009	1818 2009	1963 2014	1858 1989	1818 2009	1818 2009	1968 2009
Observations	1,180	2,779	2,836	1,304	647	1,494	1,524	682
R^2	0.95	0.92	0.88	0.77	0.95	0.92	0.89	0.79

Note: OLS regressions. T-statistics from country clustered standard errors in parentheses. All variables are averaged across the (5/10-year) time periods. Right-side variables lagged by one period. *Omitted:* country and year fixed effects, constant

Table A.6: Including multiple lags of the dependent variable as regressors (5- and 10-year panels).

	Dependent variable:							
	5-year averages panel				*10-year averages panel*			
	Ln Railway freight	Ln energy consumption	Ln iron and steel prod.	Manufacturing value added	Ln Railway freight	Ln energy consumption	Ln iron and steel prod.	Manufacturing value added
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Stock Polyarchy 1 % depreciation	-0.004	-0.023	-0.014	-0.169	-0.007	-0.037	-0.026	-0.246
	(-0.740)	(-5.501)	(-2.603)	(-3.347)	(-0.935)	(-5.105)	(-2.832)	(-2.92)
Ln GDP pc	0.066	0.021	0.325	1.069	0.149	-0.058	0.502	1.67
	(0.994)	(0.333)	(4.629)	(2.356)	(1.275)	(-0.538)	(4.221)	(2.286)
Ln Population	0.113	2.739	2.524	8.042	-0.384	3.001	4.221	14.082
	(0.168)	(5.206)	(5.164)	(1.389)	(-0.351)	(3.777)	(5.132)	(1.552)
DV lagged 1 time period	0.918	0.947	0.988	0.703	0.696	0.656	0.735	0.45
	(16.810)	(21.744)	(37.417)	(9.932)	(12.882)	(18.302)	(29.348)	(7.858)
DV lagged 2 time periods	-0.121	-0.172	-0.165	-0.093				
	(-2.441)	(-5.544)	(-8.670)	(-1.414)				
Constant	1.124	-5.441	-7.388	-17.642	2.366	-5.246	-12.047	-32.836
	(0.670)	(-3.921)	(-5.787)	(-1.169)	(0.852)	(-2.537)	(-5.532)	(-1.409)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Countries:	91	173	179	161	91	175	181	161
Years:	1863 1989	1828 2009	1828 2009	1973 2014	1868 1989	1828 2009	1828 2009	1978 2009
Observations	1,007	2,464	2,515	972	575	1364	1393	538
R^2	0.989	0.982	0.969	0.914	0.979	0.963	0.942	0.843

Note: Ordinary least squares regression. T-statistics from country clustered standard errors in parentheses. All variables are averaged across the 5-year time periods. Right-side variables lagged by one time period. *Omitted:* country and year fixed effects, constant

Table A.7: Robustness test on benchmark models, using different democracy measures.

	Dependent variable:							
	Ln Railway freight	Ln energy consumption	Ln iron and steel prod.	Manufacturing value added	Ln Railway freight	Ln energy consumption	Ln iron and steel prod.	Manufacturing value added
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Stock BMR	-0.04	-0.06	-0.01	-0.14				
1 % depr.	(-3.37)	(-6.81)	(-0.94)	(-1.97)				
Stock Lexical					-0.004	-0.01	-0.001	-0.01
1 % depr.					(-1.84)	(-5.44)	(-0.57)	(-0.99)
Ln GDP pc	0.60	0.27	1.55	2.83	0.50	0.21	1.50	2.19
	(3.51)	(1.26)	(7.65)	(3.11)	(2.70)	(1.03)	(8.10)	(2.92)
Ln Population	0.52	1.52	1.09	3.56	0.52	1.56	1.15	2.87
	(3.61)	(7.34)	(5.84)	(3.14)	(3.80)	(7.43)	(6.30)	(2.95)
Constant	-6.15	-14.52	-19.17	-44.40	-4.01	-13.64	-19.04	-28.54
	(-3.19)	(-5.16)	(-7.76)	(-2.74)	(-2.07)	(-4.84)	(-8.01)	(-1.99)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Countries:	92	164	171	151	92	176	185	165
Years:	1851 1993	1816 2007	1816 2007	1960 2007	1851 1993	1816 2012	1816 2012	1960 2016
Observations	4,820	11,981	12,270	4,236	4,817	13,431	13,794	5,810
R^2	0.96	0.91	0.88	0.77	0.96	0.91	0.88	0.75

Note: Ordinary least squares regression. T-statistics from country clustered standard errors in parentheses. Right-side variables lagged by five years. *Omitted:* country and year fixed effects, constant

Table A.8: Robustness test on benchmark models, using stock autocracy instead of stock democracy

	Dependent variable:			
	Ln Railway freight	Ln energy consumption	Ln iron and steel prod.	Manufacturing value added
	(1)	(2)	(3)	(4)
Stock autocracy 1 % depr.	0.026	0.074	0.005	0.196
	(2.189)	(5.790)	(0.342)	(2.662)
Ln GDP pc	0.454	0.172	1.511	2.362
	(2.488)	(0.809)	(7.906)	(3.180)
Ln Population	0.489	1.311	1.166	2.445
	(2.537)	(6.387)	(6.321)	(3.277)
Constant	-5.080	-12.995	-19.369	-39.547
	(-2.185)	(-4.738)	(-8.198)	(-3.078)
Country FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Countries:	92	175	181	165
Years:	1852 - 1993	1816 - 2012	1816 - 2012	1960 - 2017
Observations	5,476	13,291	13,559	6,005
R^2	0.944	0.911	0.875	0.747

Note: Ordinary least squares regression. T-statistics from country clustered standard errors in parentheses. Right-side variables lagged by five years. *Omitted:* country and year fixed effects, constant. Autocracy stock calculations are based on (an inverted version of) the Polyarchy measure from V-Dem

Table A.9: Robustness test of benchmark models, excluding countries with socialist legal origin

	Dependent variable:			
	Ln Railway freight	Ln energy consumption	Ln iron and steel prod.	Manufacturing value added
	(1)	(2)	(3)	(4)
Stock Polyarchy 1 % depreciation	-0.057	-0.124	-0.030	-0.392
	(-2.486)	(-7.105)	(-1.472)	(-3.503)
Ln GDP pc	0.522	0.267	1.599	2.475
	(2.967)	(1.337)	(8.230)	(3.386)
Ln Population	0.494	1.272	1.053	2.357
	(2.749)	(6.571)	(5.968)	(3.112)
Constant	-4.928	-11.947	-18.940	-23.224
	(-2.151)	(-4.607)	(-8.189)	(-1.913)
Country FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Countries:	89	162	162	159
Years:	1852 - 1993	1816 - 2012	1816 - 2012	1960 - 2017
Observations	5,344	12,688	12,701	5,858
R^2	0.947	0.915	0.875	0.748

Note: Ordinary least squares regression. T-statistics from country clustered standard errors in parentheses. Right-side variables lagged by five years. *Omitted:* country and year fixed effects, constant

Table A.10: Robustness test of benchmark models, excluding all observations with the value 0 on iron and steel production.

	Dependent variable:		
	Ln iron and steel production		
	(1)	(2)	(3)
Stock Polyarchy 1 % depreciation	-0.07	-0.09	-0.06
	(-4.91)	(-3.81)	(-3.93)
Ln GDP pc	1.34		1.71
	(4.70)		(5.51)
Ln Population	1.09		1.20
	(4.99)		(4.74)
GDP pc growth			2.36
			(2.00)
Resource income % GDP			-0.01
			(-1.79)
Rigorous and impartial public administration			-0.11
			(-1.49)
Government ownership in the economy			-0.08
			(-1.70)
Ln time in sample			0.43
			(0.71)
Constant	-17.33	0.90	-21.68
	(-5.81)	(1.89)	(-6.38)
Country FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Countries:	108	109	99
Years:	1816 - 2012	1816 - 2012	1816 - 2011
Observations	6,102	6,471	5,340
R^2	0.91	0.87	0.91

Note: Ordinary least squares regression. T-statistics from country clustered standard errors in parentheses. Right-side variables lagged by five years. *Omitted:* country and year fixed effects, constant

Table A.11: Alternative hypotheses, using other institutional dimensions than democracy vs autocracy.

	Ln railway freight			*Ln energy consumption*			*Ln iron and steel prod.*			*Manufacturing value added*		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Semi-presidentialism	0.063	-0.395	0.109	-0.002	-0.421	0.289	0.099	0.342	0.361	-1.105	-0.96	-0.464
	(0.335)	(-1.78)	(0.72)	(-0.01)	(-1.05)	(0.84)	(0.21)	(0.65)	(0.91)	(-0.9)	(-0.72)	(-0.48)
Presidentialism	0.023	-0.224	-0.064	0.165	-0.282	0.802	-0.244	-0.34	-0.458	-3.379	1.566	-1.396
	(0.106)	(-1.17)	(-0.32)	(0.58)	(-0.67)	(1.865)	(-0.46)	(-0.6)	(-1.09)	(-1.87)	(0.755)	(-0.87)
Semi-monarchy	-0.16	-0.18	-0.115	-1.479	-0.381	0.156	-0.89	0.254	-0.402	4.435	-0.56	0.716
	(-0.99)	(-1.02)	(-0.68)	(-3.73)	(-0.49)	(0.31)	(-1.28)	(0.35)	(-0.98)	(0.76)	(-0.39)	(0.77)
Personalist rule	0.159	-0.333	0.002	-0.087	-0.234	0.405	-0.281	0.136	-0.142	-3.132	-1.411	-2.03
	(0.507)	(-2.31)	(0.013)	(-0.39)	(-0.67)	(1.14)	(-0.55)	(0.33)	(-0.45)	(-2.16)	(-1.2)	(-1.52)
Military rule	0.181	-0.248	0.039	0.132	-0.008	0.632	-0.005	0.337	-0.021	-2.136	-0.785	-1.147
	(1.219)	(-2.43)	(0.325)	(0.477)	(-0.03)	(1.732)	(-0.01)	(0.817)	(-0.06)	(-1.63)	(-0.71)	(-0.88)
Absolute monarchy	0.298	0.363	0.229	-0.998	0.033	-0.24	-0.948	0.044	-0.581	3.351	-2.758	-2.589
	(3.104)	(0.83)	(0.782)	(-2.97)	(0.07)	(-0.42)	(-1.56)	(0.082)	(-1.26)	(0.559)	(-2.15)	(-2.22)
Oligarchy	0.107	0.383	0.297	-0.18	0.203	0.844	-0.238	-0.264	-0.329	1.123	0.164	1.424
	(1.104)	(1.096)	(1.34)	(-1.05)	(0.414)	(2.028)	(-0.49)	(-0.48)	(-0.96)	(3.108)	(0.13)	(1.169)
Ln GDP pc	0.885	0.274	0.354	0.258	0.645	0.096	-0.24	1.447	1.504	0.927	3.606	2.166
	(2.5)	(1.399)	(1.583)	(1.033)	(2.514)	(0.397)	(-0.49)	(5.07)	(7.54)	(0.64)	(2.31)	(2.0)
Ln Population	0.756	2.23	1.337	1.685	0.794	2.082	2.019	1.439	1.543	9.33	5.292	6.503
	(1.677)	(3.277)	(3.056)	(6.602)	(1.787)	(5.541)	(3.45)	(4.13)	(5.606)	(3.984)	(3.53)	(4.286)
Constant	-8.911	-17.351	-11.025	-13.325	-10.139	-18.122	-14.101	-22.699	-23.096	-86.155	-64.142	-68.213
	(-1.74)	(-2.69)	(-2.48)	(-5.32)	(-2.1)	(-4.32)	(-2.11)	(-5.51)	(-7.37)	(-2.8)	(-3.23)	(-3.31)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sample:	Dem.	Aut.	Both	Dem.	Aut.	Both	Dem.	Aut.	Both	Dem.	Aut.	Both
Countries:	54	69	82	100	128	161	100	128	161	90	90	155
Years:	1864	1851	1851	1816	1816	1816	1816	1816	1816	1960	1960	1960
	1993	1993	1993	2006	2006	2012	2006	2006	2012	2006	2006	2017
N	1988	1898	3932	3585	5859	10668	3585	5864	10673	1633	1727	4970
Adj. R-squared	0.972	0.932	0.949	0.953	0.912	0.905	0.915	0.813	0.874	0.814	0.822	0.762

Note: T-statistics from country clustered standard errors in parentheses. Right-side variables lagged by five years. Omitted country and year fixed effects, constant

References

Comin, Diego, Bart Hobijn (2009). "The CHAT Dataset". *NBER Working Paper 15319*

Coppedge, Michael, John Gerring, Carl Henrik Knutsen, Staffan I. Lindberg, Svend-Erik Skaaning, Jan Teorell, David Altman, Michael Bernhard, M. Steven Fish, Agnes Cornell, Sirianne Dahlum, Haakon Gjerløw, Adam Glynn, Allen Hicken, Joshua Krusell, Anna Lührmann, Kyle L. Marquardt, Kelly McMann, Valeriya Mechkova, Juraj Medzihorsky, Moa Olin, Pamela Paxton, Daniel Pemstein, Josefine Pernes, Johannes von Römer, Brigitte Seim, Rachel Sigman, Jeffrey Staton, Natalia Stepanova, Aksel Sundström, Eitan Tzelgov, Yi-ting Wang, Tore Wig, Steven Wilson, and Daniel Ziblatt. 2018. V-Dem Dataset v8.

Fariss, Christopher J., Charles D. Crabtree, Therese Anders, Zachary M. Jones, Fridolin J. Linder and Jonathan N. Markowitz. 2017. "Latent Estimation of GDP, GDP per capita, and Population from Historic and Contemporary Sources." Working paper.

Maddison Project Database, version 2018. Bolt, Jutta, Robert Inklaar, Herman de Jong and Jan Luiten van Zanden (2018), "Rebasing 'Maddison': new income comparisons and the shape of long-run economic development", *Maddison Project Working paper 10*

Mauro, Paolo, Rafael Romeu., Ariel Binder, Asad Zaman (2015). "A modern history of fiscal prudence and profligacy". *Journal of Monetary Economics*, 76, 55-70.

Miller, Michael K. (2015) "Democratic Pieces: Autocratic Elections and Democratic Development since 1815". *British Journal of Political Science 45(3),* 501 – 530.

Sarkees, Meredith, Frank Wayman (2010). *Resort to War: 1816 – 2007*. Washington DC: CQ Press.

The World Bank. *World Development Indicators*. Washington, D.C.: The World Bank (producer and distributor). http://data.worldbank.org/data-catalog/world-development-indicators [14-08-2018]

Teorell, Jan, Michael Coppedge, Staffan Lindberg, Svend-Erik Skaaning (2018). "Measuring Polyarchy Across the Globe, 1900–2017". *Studies in Comparative International Development*. 1 – 25.