

Authoritarianism's Role in National GDP

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Abstract:

This paper provides evidence that Democracy has a significant impact on GDP per capita. Using fixed effects panel data and linear probability regressions, the paper compares the effects of autocracy level on GDP per capita and GDP growth rates. To control for possible omitted variable bias in the regression, the paper includes oil production, population, working age ratio and historical military coups. Our preliminary results indicate that autocratic countries are more likely to experience decreases to the GDP when accounting for coups, working age population and oil production while democracies see the highest level of GDP growth per capita. Countries ruled by closed autocracies experience the most significant negative impacts of working age population and the impacts of coups on their economy but were able to combat this with the economic float of large quantities of oil production.

I. Introduction

The relationship between political regime and gross domestic product is a highly reviewed and noted empirical relationship within the field of regression economics. Over time the global cross-country political makeup has changed; now all countries within the Organization for Economic Co-operation and Development are democratic with most of the remaining autocratic countries in Southern Asia and Africa. As climate change bears down on the entirety of the globe and developing nations look to grow while also promoting sustainable habits of political regime and economic production, the relationship between political regime and GDP becomes an important entity of economic analysis. As developing nations look forward to the future, the importance of their political makeup weighs heavily on their economic outcomes.

This paper analyzes the correlation between the regressor, level of authoritarianism, and the regressand, GDP, to determine the extent of which political regime influences the monetary production of a country. We estimate that there is a positive relationship between democracy and GDP per capita, as a product of free market opportunities and personal freedoms. The more democratic the political regime of a country is, the higher the country's GDP will be controlling for outside factors such as oil production, population, military coups, and percentage of the population that is working age (age dependency ratio).

The relationship between GDP and democracy has been looked at before. Previous papers such as *Income and Democracy (2008)* by Daron Acemoglu and Simon Johnson, explore the variables of income and democracy level but flip the regressor and regressand from this paper's analysis. Instead, they look at the causal effect of income on democracy. This paper found that by running a fixed effects regression, “a cross-country correlation between income and democracy reflects a positive correlation between changes in income and democracy over the past 500 years.” (Acemoglu 2008)

Recently however, Daron Acemoglu released a paper, *Democracy Does Cause Growth (2019)* which returns to the relationship of the regressor, democracy, and the regressand, GDP, but instead explores the causal relationship of democracy on GDP; the same relationship as is explored within this paper. Acemoglu found that “Our baseline results show that democratizations increase GDP per capita by about 20 percent in the long run. We find similar effects using a propensity score reweighting strategy as well as an instrumental-variables strategy using regional waves of democratization.” (Acemoglu 2019)

Our results indicated that autocratic countries were more likely to experience shots to GDP because of their regime type, even when accounting for coups and working age population.

Our results also concluded that countries ruled by closed autocracies experienced the most significant negative impacts of working age population and the impacts of coups on their economy but were able to combat this with the economic float of large quantities of oil production.

There are several challenges present in exploring the causal relationship of authoritarianism on GDP. These will be controlled through the inclusion of possible omitted variables and fixed country and time (year) effects. The first challenge, as is seen in the reflection and complete switch in regressors and regressands between the 2008 and 2019 Acemoglu papers, is the genuine concern of simultaneous causality bias between the regressor (Political Regime) and the regressand (GDP) meaning that that GDP could possibly cause authoritarianism.

A second possible challenge is the influence of outside variables on the regression which may cause bias if omitted. This regression has included the possible omitted variables of age dependency ratio (population of working age), oil production in terawatt hours, country population and military coups. However, there is still a possibility of omitted variable bias from historical or cultural variables that have not been included in the regression (Acemoglu 2019). Historical or cultural omitted variables are accounted for by using country fixed effects in the panel regression.

A third concern that arises is autocorrelation between the variables as over time the previous year's values, for example GDP per capita and oil production, affect the future years value as well. Autocorrelation results in heteroskedasticity which affects the standard errors of the regression. The regression controls for this by using robust standard errors within normal

linear probability models but is solved for similarly using fixed time and country effects in the fixed effects regressions.

The fourth major concern is within the measurement of the autocratic level of the country. Given the subject of the variable there is inherent measurement uncertainty that comes with measuring the level of authoritarianism within a country. There may be changes within the score for the level of the regime that do not exactly correlate with the real-life effects of the political regime. The variable for regime has been re-coded as 4 binary variables for level of autocracy and democracy from their 0-100 rating democracy scale recognized by the Freedom House Index.

Finally, although time and country fixed effects have been controlled for, there is possible influence from time varying effects such as future projections about GDP and markets that may affect both the political regime of the country as well as the monetary GDP. These concerns are largely taken care of by running both fixed effects and normal linear probability models and comparing, but the possibility of unobservable physiological effects, both from the general population and the government, must be recognized.

The first strategies to control for these above concerns is the use of time and country fixed effects; or panel data regressions. The variables included in the regression inherently change over time and between different entities, i.e. countries. Completing the regressions using fixed effects for country and time entities assumes that there will be no lagging effects caused by differential GDP paths that occur simultaneously with differentiating autocratic changes in political regime.

The second strategy is to use instrumental variables. Instrumental Variables are used in, *Democracy Does Cause Growth* (Acemoglu 2019) to account for possible simultaneous causality

bias between income and democracy. Extrapolating outcomes using regional waves of political transitions as an instrument for country level-democracy (Huntington 1991, Markoff 1996).

Acemoglu's 2008 paper, *Income and Democracy*, measures the impact of income on democratic outcomes, accounting for the concern of simultaneous causality bias using past savings rates as an independent effect on income (Acemoglu 2008). This paper does not include instrumental variables within the regressions to estimate two stage least-squares beta coefficients. However, using the instrumental variable from *Democracy Does Cause Growth* (Acemoglu 2019), this paper uses military coups as a proxy for transition of political power which is an instrument for country level-democracy. Although it is most likely that a political regime change would come after a successful coup, both unsuccessful and successful coups were included in the regression model. The aftermath of a military coup, even if unsuccessful, can have substantial impact on the political regime and authoritative leader/body that would still act as an important proxy for political transition.

II. Data Description:

The data included in this paper is taken from the Our World in Data census bank. The political regime data included is taken from Our World in Data as well and is based on a global democracy scale that sets levels of autocracy/democracy. All variables and data are compared over the time span of 1960-2021. The regressand variable from this data is the GDP per capita. The main regressor is the political regime or autocracy level for each country within the given years. Autocracy is coded as a set of dummy variables (0-1) that includes closed autocracies and electoral autocracies based on the criteria of Luhrmann et al (2015). Democracy is also coded as a set of dummy variables (0-1) that includes electoral democracies and liberal democracies based

on the criteria of Luhrmann et al (2015). A closed autocracy has no multi-party elections to choose legislation or executive leader by citizens. An electoral autocracy has multi-party elections to choose legislation or executive leader by citizens; elections lack select freedoms that make them meaningful, free, and fair. Electoral democracies have meaningful, free, and fair multi-party elections to choose legislation and the executive leader. Liberal democracies have expanded individual and minority rights, equality within the law, and balance of power in courts, executive office, and legislation (Political n.d.).

The omitted variables included in this regression analysis consist of oil production in terawatt hours, country population and age dependency ratio, all of which are taken from Our World in Data sources and again run from 1960 to 2021. The oil production, coded as `oilproductiontwh`, has multiple, fill-in sourcing. The main source is BP oil which provides fossil fuel production data from 1965 onwards. However, since the data is from 1960 to 2021, the Shift Data portal provides long-term data that fills in the missing gaps of the BP data to maintain consistency with energy data sets on Our World in Data. The primary production of oil has been converted to terawatt-hours using the conversion factor: $1,000,000 / 3,600 \sim 278$. (Oil n.d.)

The age dependency ratio, coded as `working_age`, is the sum of the young population (under age 15) and elderly population (age 65 and over) relative to the working-age population (ages 15 to 64). Data are shown as the number of dependents per 100 working-age population. (Age n.d.)

The historic population variable is an estimate of the national population in millions and is coded as, `hist_est_pop_mil` in the regression model. The data used is from the United Nations Population Division which collects national census data and estimates for population statistics.

(Division n.d.) Population affects the workforce size and therefore the national GDP and must be included to compare per capita vs. net GDP and autocracy effects.

The proxy variable Coup is coded as a binary variable indicating if there was a coup in the country by year. This data comes from MilitaryCoups.org compiling data on military coups worldwide from 1950 to 2020. Our data excludes if there were more than 1 coups in a year by country, on the premise that coups have a long-term effect on regime type with impacts occurring for years. We have used this as a proxy for a change in regime types, assuming that countries with less freedoms are more likely to have a coup to achieve greater political freedoms.

In this paper, both panel regressions and linear probability regressions were run and compared. Figure 1. is the effect of autocracy on GDP using fixed effects and figure 2. is the effect of autocracy of GDP using the linear probability model. Figures 3. and 4. show the same regressions but instead look at the log of GDP to estimate growth percentages. Though both panel and linear regressions are estimated, the discussion and results generally use the data from the panel regressions.

Figures and Tables:

VARIABLES	(1)	(2)	(3)	(4)	(5)
	gdppercapita	gdppercapita	gdppercapita	gdppercapita	gdppercapita
closed_autocracies	-11,089*** (1,391)	-11,351*** (1,619)	-11,317*** (1,603)	-6,803*** (1,538)	-6,796*** (1,549)
electoral_autocracies	-9,715*** (1,435)	-9,603*** (1,539)	-9,585*** (1,529)	-6,319*** (1,494)	-6,317*** (1,496)
electoral_democracies	-8,030*** (1,307)	-8,468*** (1,387)	-8,468*** (1,385)	-6,811*** (1,305)	-6,813*** (1,304)
oilproductiontwh		8.236*** (2.112)	8.151*** (2.271)	6.441*** (2.074)	6.441*** (2.074)
hist_pop_est_mil			2.71e-06 (8.86e-06)	-1.15e-05 (8.62e-06)	-1.15e-05 (8.62e-06)
working_pop				-243.9*** (36.33)	-243.9*** (36.24)
coup					-80.29 (388.7)
Constant	18,821*** (1,101)	17,475*** (1,421)	17,375*** (1,331)	32,774*** (2,493)	32,772*** (2,491)
Observations	9,081	7,114	7,114	7,114	7,114
R-squared	0.066	0.154	0.154	0.251	0.251
Number of country_id	161	161	161	161	161

Robust standard errors in parentheses
 *** p<0.01, ** p<0.05, * p<0.1

Figure 1: Panel Data Regression. Excluded dummy variable is Liberal Democracy. Including time and country fixed effects. The dependent variable is GDP per capita in USD.

VARIABLES	(1)	(2)	(3)	(4)	(5)
	gdppercapita	gdppercapita	gdppercapita	gdppercapita	gdppercapita
closed_autocracies	-18,314*** (382.1)	-18,049*** (444.2)	-17,891*** (444.8)	-10,107*** (627.4)	-10,097*** (628.4)
electoral_autocracies	-19,774*** (343.4)	-19,463*** (358.9)	-19,492*** (357.5)	-11,615*** (494.1)	-11,612*** (494.3)
electoral_democracies	-17,455*** (330.1)	-17,484*** (331.7)	-17,137*** (330.1)	-12,556*** (367.1)	-12,557*** (367.1)
oilproductiontwh		4.443*** (0.214)	4.886*** (0.231)	3.924*** (0.198)	3.923*** (0.198)
hist_pop_est_mil			-1.09e-05*** (6.41e-07)	-1.39e-05*** (6.63e-07)	-1.39e-05*** (6.63e-07)
working_pop				-313.8*** (12.82)	-313.6*** (12.81)
coup					-212.7 (328.1)
Constant	25,892*** (295.9)	25,171*** (298.4)	25,378*** (298.3)	42,093*** (728.7)	42,081*** (728.3)
Observations	9,081	7,114	7,114	7,114	7,114
R-squared	0.315	0.366	0.376	0.534	0.534

Robust standard errors in parentheses
 *** p<0.01, ** p<0.05, * p<0.1

Figure 2: Linear Probability Model. Excluded regime dummy variable is Liberal Democracy. Without panel data fixed effects. Dependent variable is GDP per capita in USD.

VARIABLES	(1)	(2)	(3)	(4)	(5)
	lg_gdppercapit	lg_gdppercapit	lg_gdppercapit	lg_gdppercapit	lg_gdppercapit
closed_autocracies	-0.911*** (0.107)	-0.909*** (0.0930)	-0.877*** (0.0913)	-0.512*** (0.0770)	-0.511*** (0.0773)
electoral_autocracies	-0.756*** (0.113)	-0.643*** (0.0901)	-0.626*** (0.0887)	-0.362*** (0.0787)	-0.362*** (0.0787)
electoral_democracies	-0.487*** (0.0973)	-0.431*** (0.0796)	-0.431*** (0.0782)	-0.297*** (0.0656)	-0.297*** (0.0657)
oilproductiontwh		0.000491*** (0.000101)	0.000411*** (8.09e-05)	0.000272*** (7.72e-05)	0.000272*** (7.72e-05)
hist_pop_est_mil			2.57e-09*** (6.70e-10)	1.42e-09*** (3.72e-10)	1.42e-09*** (3.72e-10)
working_pop				-0.0198*** (0.00166)	-0.0197*** (0.00166)
coup					-0.00914 (0.0246)
Constant	9.273*** (0.0826)	9.178*** (0.0734)	9.083*** (0.0715)	10.33*** (0.124)	10.33*** (0.124)
Observations	9,081	7,114	7,114	7,114	7,114
R-squared	0.134	0.255	0.297	0.495	0.495
Number of country_id	161	161	161	161	161

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Figure 3: Panel Data using time and country fixed effects. Excluded regressor regime is Liberal Democracy. Dependent variable is the logarithmic change in GDP per capita in USD.

VARIABLES	(1)	(2)	(3)	(4)	(5)
	lg_gdppercapit	lg_gdppercapit	lg_gdppercapit	lg_gdppercapit	lg_gdppercapit
closed_autocracies	-0.911*** (0.107)	-0.909*** (0.0930)	-0.877*** (0.0913)	-0.512*** (0.0770)	-0.907*** (0.0241)
electoral_autocracies	-0.756*** (0.113)	-0.643*** (0.0901)	-0.626*** (0.0887)	-0.362*** (0.0787)	-0.932*** (0.0222)
electoral_democracies	-0.487*** (0.0973)	-0.431*** (0.0796)	-0.431*** (0.0782)	-0.297*** (0.0656)	-0.755*** (0.0188)
oilproductiontwh		0.000491*** (0.000101)	0.000411*** (8.09e-05)	0.000272*** (7.72e-05)	0.000316*** (1.30e-05)
hist_pop_est_mil			2.57e-09*** (6.70e-10)	1.42e-09*** (3.72e-10)	-1.29e-09*** (5.07e-11)
working_pop				-0.0198*** (0.00166)	-0.0339*** (0.000481)
coup					-0.0530 (0.0428)
Constant	9.273*** (0.0826)	9.178*** (0.0734)	9.083*** (0.0715)	10.33*** (0.124)	11.78*** (0.0276)
Observations	9,081	7,114	7,114	7,114	7,114
R-squared	0.134	0.255	0.297	0.495	0.714
Number of country_id	161	161	161	161	

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Figure 4: Linear regression model excluding panel data time and fixed effects. Excluded regressor is Liberal Democracy. Dependent variable is the logarithmic change in GDP per capita in USD.

Variable	Obs	Closed Autocracy		Obs	Electoral Autocracy	
		Mean	Std. dev.		Mean	Std. dev.
gdppercapita	3,037	7577.337	13317.73	2,650	6117.659	8969.993
oilproductiontwh	2,233	340.0431	929.5515	2,218	268.9121	754.0647
hist_pop_est_mil	3,802	30,400,000	1.43E+08	3,004	2.45E+07	5.84E+07
working_pop	3,802	76.47976	20.33651	3,004	78.71549	19.8655
coup	3,802	0.0573382	0.2325184	3.00E+03	4.03E-02	1.97E-01

	Obs	Electoral Democracy		Obs	Liberal Democracy	
		Mean	Std. dev.		Mean	Std. dev.
gdppercapita	1,656	8436.999	5948.553	1.74E+03	25891.81	12338.07
oilproductiontwh	1,692	176.9307	525.8348	1,568	305.7715	1027.366
hist_pop_est_mil	2,065	4.39E+07	1.55E+08	1,844	2.82E+07	5.01E+07
working_pop	2,065	67.74358	18.02317	1,844	52.72904	7.521101
coup	2,065	0.009201	0.0955025	1,844	0	0

Figure 5: Summary table of regressor, regressand and possible omitted variables. This table provides descriptive statistics for the four regime types that were analyzed in this paper, broken down into categories.

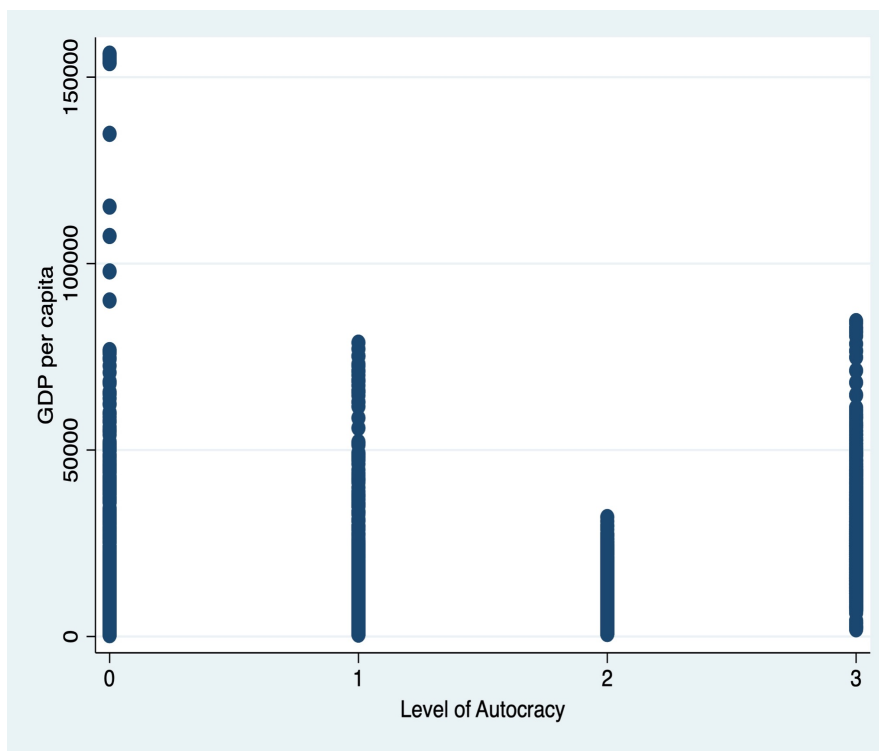


Figure 6: The scatter plot includes levels of autocracy: 0 - Closed Autocracy; 1 - Electoral Autocracy; 2 - Electoral Democracy; 3 - Liberal Democracy. The variance for GDP was higher for closed autocracies and although the regression data suggested that democracies lead to higher levels of GDP, the countries with the highest GDP per capita were closed autocracies. Electoral democracies had the lowest observations and hence the seemingly smaller GDP range

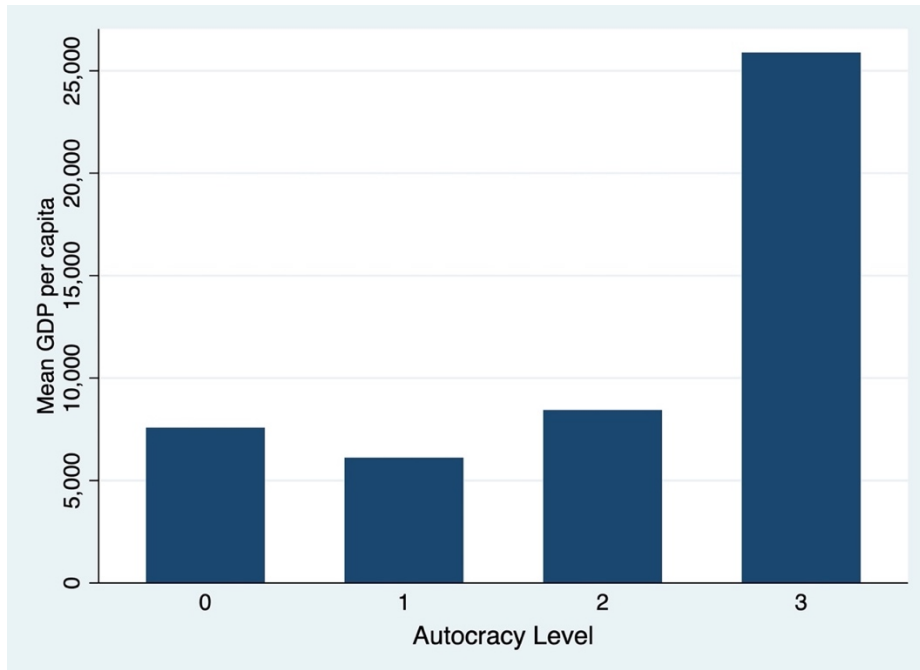


Figure 7: The bar graph includes levels of autocracy: 0 - Closed Autocracy; 1 - Electoral Autocracy; 2 - Electoral Democracy; 3 - Liberal Democracy. Although the range of GDP was the largest and the maximum GDP per capita was a closed autocracy (figure 6.), the mean GDP per capita followed a similar trend to the regression output, where increasing democracy level generally leads to a higher mean GDP per capita (except with electoral autocracies which have significantly less observations than closed autocracies (figure 4.). Liberal autocracies do include some of the largest countries (by population) in the world including the United States and most EU nations.

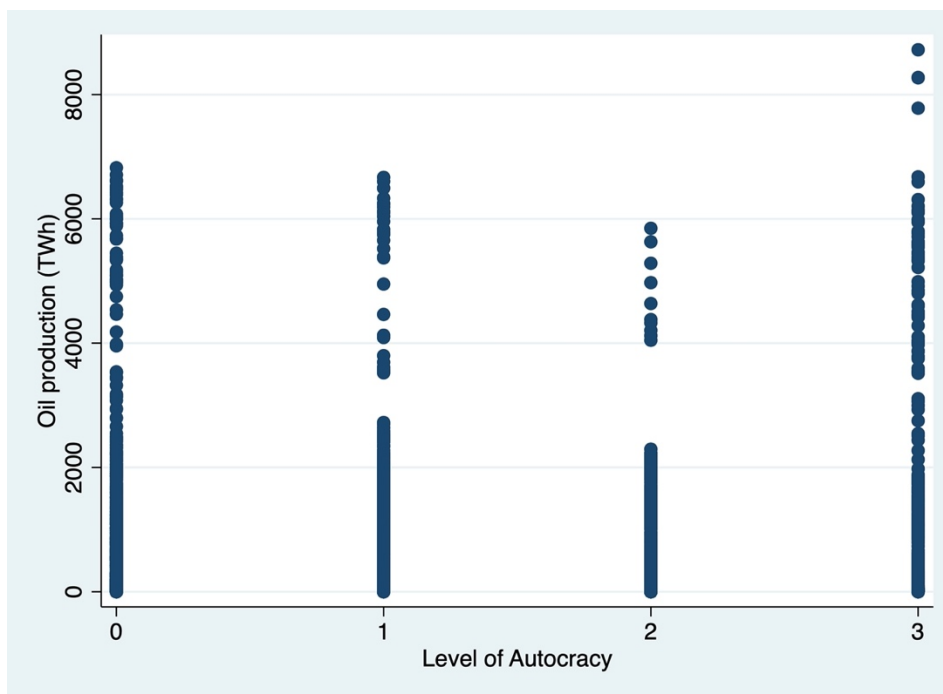


Figure 8: The scatter plot graph includes levels of autocracy: 0 - Closed Autocracy; 1 - Electoral Autocracy; 2 - Electoral Democracy; 3 - Liberal Democracy. Despite Democracy having the highest average GDP per capita the three most oil rich countries were Closed Autocracies. (n=7,711)

III. Results

Our regression model started looking solely at the impacts of regime type on Gross Domestic Product per capita in U.S. Dollars. The naive regression model: $GDP = \beta_0 + \beta_{regime} + U_i$. Our results indicated that liberal democracies had the highest GDP per capita, using both logarithmic and panel data fixed effects. Countries ruled by closed autocracies were most likely to have the lowest GDP per capita accounting for logarithmic dependent variable and panel data fixed effects. Our logarithmic regression provides a percent change in GDP by year when including time and year fixed effects with our panel data, accounting for annual growth in GDP per capita (figure 3.).

When accounting for regime type oil production measured in terawatt hours has a significant impact on GDP outcomes in all regime types, impacting most significantly electoral autocracies (figure 3.). This is consistent with our hypothesis that Closed Autocracies were the largest producers of oil (figure 5.). We found a positive relationship between oil production and GDP; this was most significant among electoral autocracies. Haber et al (2011) findings suggest that the relationship between total oil income and democratization is positive, suggesting the countries that we have categorized as electoral autocracies could be on a path towards democratization. The findings from Haber et al (2011) suggested that the general trend between oil income and regime type resulted in an increase in the likelihood that autocracies would transition to democratic regimes. Closed autocracies had the highest likelihood of experiencing a governmental coup in the scope of years that we observed (figure 5.). Our study used governmental coup as a proxy variable for a change in the freedoms of a country in response to governmental oppression. Although successful coups are typically the only coups that result in a change in regime type, unsuccessful coups have a substantial impact on the strength of the

regime and power of the government. When including coup in our regression we see a significant change in the coefficients on all four of the regime types, with a large leap in the fit of our regression, without accounting for time and country fixed effects (figure 4.). The coefficient on coup was not statistically significant at any level; this was to be expected of a proxy variable for changes in regime strength. Literature on the results of coups on regime strength remains few and far between. Derpanopoulos et al (2016) finds that while democracies are occasionally established in the wake of a coup, more frequently there is the creation of a new, harsher authoritarian regime. Bennett et al (2019) concluded that political corruption is worsened by successful military coups, while corruption is lessened by civilian coups that involve the political class. Both papers point to the validity of the use of coups as a proxy variable for change in regime strength consistent with our results (figure 4.). Countries ruled by autocracy had higher working age populations than democratic countries; our findings showed that countries with higher proportion of working age individuals showed decreases in GDP per capita (figure 4.).

When accounting for coups in the regression, it was found that countries with a higher working age population were more likely to experience drops in GDP per capita (figure 4.). Countries that experience more coups and had higher proportions of working age individuals tended to be autocratic regimes, these both decreased GDP on a per capita basis.

Our results indicated that autocratic countries were more likely to experience shots to GDP because of their regime type, even when accounting for coups and working age population. It is estimated that GDP increases 14 percent when considering the mean oil production in countries ruled by closed autocracy. Our results concluded that countries ruled by closed autocracies experienced the most significant negative impacts of working age population and the impacts of

coups on their economy but were able to combat this with the economic float of large quantities of oil production.

IV. Discussion:

With the ongoing changes in the climate and the resulting effects on developing nations, the importance of political regime's effect on GDP is necessary to understand the possible upcoming transitions in political power in developing nations. There are drastic differences in the effects of democracy on growth as is seen in figure 3. Democracy, at both the electoral and liberal level, causes higher GDP growth. The variation in GDP is the highest for closed autocracies (figure 6.) but this can be highly associated with oil production as is seen in figure 7. The level of oil and the GDP variance have a very similar distribution for autocracies. The reliance upon oil production for a large proportion of GDP in closed autocracies, will have interesting effects on the strength of their regimes as developed nations continue to pursue goals of decarbonization. It is possible that if oil prices drop as a result of decarbonization efforts the stability of these economies and regimes will begin to fragment resulting in changes in regime type.

Though it appears that GDP and democracy may not be correlated positively within the graph (figure 6.), the results of the regressions (figure 1. and figure 3.) show that there is a positive correlation. On top of that, though successful coups do not always cause a shift towards a democratic political regime (Bennet et al 2019), it is not unlikely that further political uprisings will occur as the effects of climate change become apparent and developing nations and their citizens are forced into survival situations, changing regimes as they go; providing an insight into the relationship between political structure changes and economic outcomes.

Our findings on the relationship between proportion of working age individuals in a nation and its GDP outcomes plays a role in understanding labor and macroeconomic trends in these countries. Our results suggest that higher proportions of working age individuals are correlated with lower GDP per capita estimates when holding constant for country population (figure 3. figure 5.). Closed autocracies had the highest average working age population and subsequently the lowest GDP when accounting for their oil production. This discrepancy could be attributed to lack of economic development in these countries outside of oil production and the undervaluation of workers. In a non-diverse economy, reliant on fossil fuels in a world focused on decarbonization, economic collapse nationwide is not out of the question when standards of living are propped upon fleeting amounts of natural resources in these countries.

Understanding the complexity of the relationship between autocracy and GDP is important for the transition of developing nations and the supporting aid provided by developed nations. The data analyzed in this paper shows the effect of autocracy on GDP growth when controlling for a major contributor to GDP and climate change, oil production. The regression also accounts for the history of the country both in time fixed effects and with a proxy to their political transitions through the coup variable. Between the inclusion of oil production and historical coups, the resulting effect of autocracy on GDP is statistically and economically significant (figure 3.). The important effects of oil production on autocracy and GDP show the vulnerability of developing or highly fossil fuel dependent nations and the growing momentum for decarbonization. If oil and autocracy level are seemingly related, then it will be important for developed nations to aid in the transition to sustainable sectors of the economy to mitigate economic and political fallout.

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Contributions:

I, Jonah Roberts, completed the regression coding, the abstract, the construction of the graphs and tables and helped write the introduction and discussion section for this paper.

I, Finn Warner, wrote the data description and results section, completed the literature reviews, helped hypothesize the proxy and instrumental variables and helped write the introduction and discussion sections.