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Essays on human capital, growth and innovation: Political economy perspective

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Essays on Human Capital, Growth and Innovation: Political Economy Perspective

by

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Abstract: The dissertation explores the role of human capital, education, and political institutions in the process of economic and political development. The first chapter shows that economic development such as secondary school enrollment rates during the democratization period exerts long-lasting effects on growth, possibly by giving permanent birthmarks to newly minted democratic institutions. Specifically, democracies born in weak development tend to have weak institutions and slow growth, while in contrast, those with adequate development at the political transition time establish strong institutions and achieve faster growth. The second chapter explores the effect of curriculum control in schooling on national innovation and individual creativity. The evidence suggests that a more centralized curriculum control, as indicated by more centralized official curriculum design together with more frequent high-stakes achievement exams, tends to reduce individual creativity and weaken national innovation. The third chapter studies how state capacity affects the investment in human capital, economic growth and democratization. It shows that autocracy may not necessarily inhibit economic growth when a country is poor but the state capacity is strong, while democracy facilitates growth more when a country is rich. In particular, the relationship between state development and democratization follows an inverted U-shape.

Contents

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1. Is Democracy Good for Growth? — Institutional Quality Matters[1]

1.1. Introduction

While most people around the world believe that democracy improves living standards[2], experts in social sciences are not so sure. Theoretical debates on whether democracy enhances or hinders economic growth have been very extensive.[3] Substantial controversies also exist on the empirical side. For example, after analyzing 470 regressions from 81 studies, Doucouliagos and Ulubasoglu (2008) find most

[1]We thank Madhav Aney, Shou Chen, Chris Doucouliagos, Steven Durlauf, Jan Klingelhöfer, Zhenxiong Li, Jiaming Mao, Paul Raschky, Paul Schweinzer, Yang Xie, Chenggang Xu, and workshop participants at SMU, the 5th International Workshop on Economic Analysis of Institutions at Xiamen University, the 2017 Conference of the Society for Institutional and Organizational Economics (SIOE) at Columbia University, the 2017 Annual Australasian Public Choice Conference (APCC) at Deakin University, the 2018 China Meeting of the Econometric Society at Fudan University, and the 2018 International Conference on Economic Theory and Applications at Southwestern University of Finance and Economics for helpful comments and suggestions. All remaining errors are ours.

[2]Evidence from World Value Survey (2014) shows that about 79% of the global population wish to live in a democratic country. This preference is not only prevalent in countries with a long democratic tradition (United States 79%, Sweden 92%), but also in Islamic states (Pakistan 78%, Malaysia 87%), Africa (Rwanda 74%, Zimbabwe 86%), South America (Chile 83%, Ecuador 84%), and Asia (China 81%, South Korea 86%).

[3]For example, populism and other incentive distortions from the election system and interest groups may harm growth (March and Olsen, 1983; Olson, 1993; Persson and Tabellini, 1994; Besley and Coate, 1998; De Haan and Sturm, 2003; Huntington, 2006), while the growth-enhancing effects may come from more investment in public goods, better information and commitment, and more inclusive opportunities for the masses (Wittman, 1989; Olson, 1993; Saint-Paul and Verdier, 1993; Alesina et al., 1996; Benabou, 1996; Feng, 1997; Sen, 1999; Lizzeri and Persico, 2004; Acemoglu and Robinson, 2012).

estimated effects of democracy on economic growth are not significantly positive.[4] The recent literature, however, shows that democracy substantially promotes economic growth.[5] This new result is achieved through various channels such as constructing alternative democracy indicators, using advanced econometric techniques, or employing new instrumental variables.

So is democracy good for growth or not? Instead of trying to reach a universal yes or no conclusion, this paper tackles the issue from a novel perspective of institutional quality. Our basic hypothesis is that *democracies are born with unequal quality*; the birth conditions in terms of economic development leave permanent birthmarks to newly minted democratic institutions, which exert long-lasting effects on future economic growth.

Specifically, adequate development at the democratic transition period provides a strong foundation to establish growth-enhancing institutions, while democracies born in weak development situations tend to have weak institutions. Even though both are democracy by political definitions, their institutional quality may differ substantially in terms of capability to improve economic performance. For simplicity, the former type is labeled as ***Strong Democracy*** while the latter ***Weak Democracy***. So the main message of the paper is that Strong Democracy is good for growth, while Weak Democracy not.

The case study on Benin and Ghana in Session 1.6.3 well explains our idea. Here we briefly illustrate it. Benin and Ghana are located in West Africa and both became democracies in the 1990s. But economic growth in Benin didn't improve after democratization, while the opposite is true for Ghana. Figure 1.1 plots GDP per capita growth rates in Benin and Ghana respectively after controlling effects of growth dynamics, income level, and the time trend. Such discrepancy in growth could stem from the different improvement effects on the overall growth-enhancing

[4] This echoes some earlier studies such as Sirowy and Inkeles (1990); Przeworski, Limongi and Giner (1995); Hall and Jones (1999).

[5] See, for example, Minier (1998); Gerring et al. (2005); Persson (2005); Aghion, Alesina and Trebbi (2007*b*); Persson and Tabellini (2007, 2009); Madsen, Raschky and Skali (2015); Gründler and Krieger (2016); Acemoglu et al. (2019).

Figure 1.1.. GDP per capita Growth in Benin and Ghana

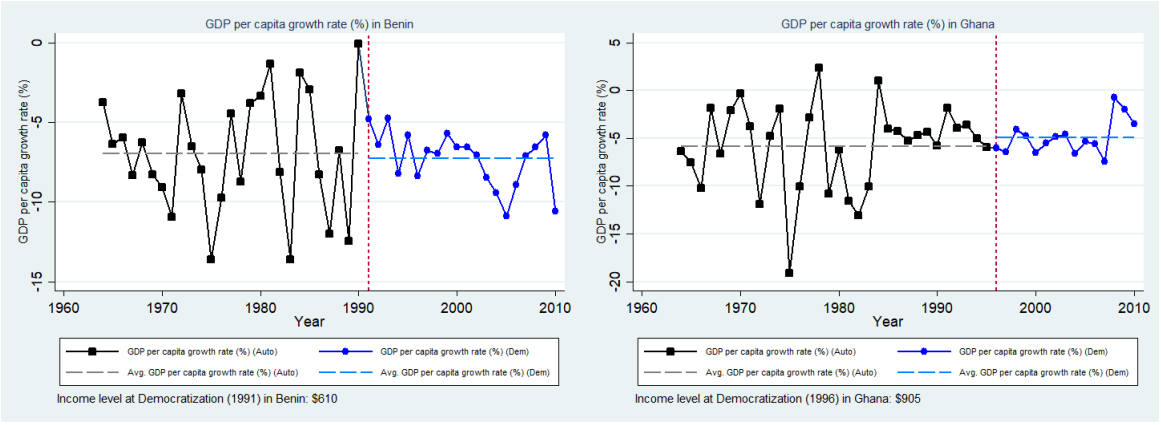
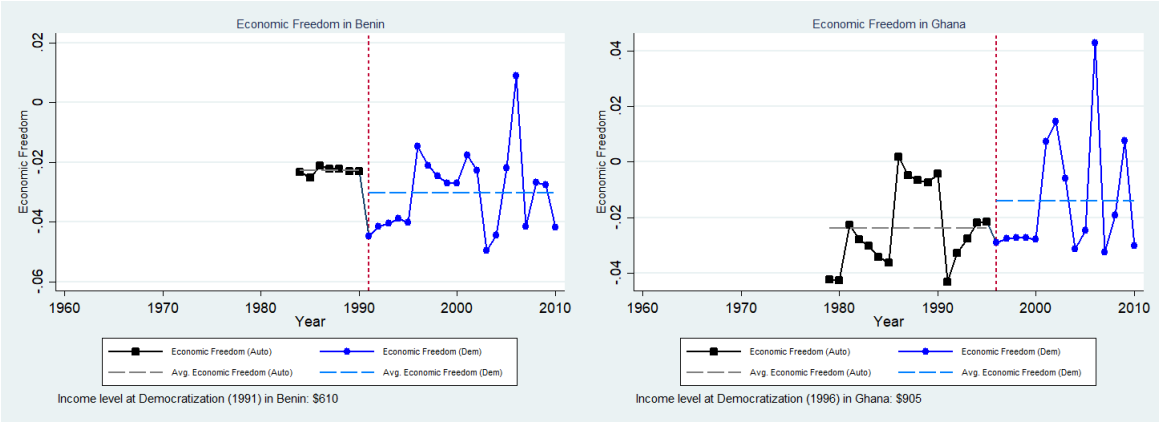


Figure 1.2.. Economic Freedom in Benin and Ghana



institutional qualities in Benin and Ghana. Although both countries dramatically improve their *de jure* political institutions measured by polity score and Freedom House indicators (Benin is actually better), only Ghana largely promotes the institutions that are crucial for economic growth. For example, like Figure 1.2 (follow the similar process in Figure 1.1) show, the average Economic Freedom[6] is worse off after democratization in Benin, while is better off in Ghana. The same patterns also exist in other growth-enhancing institutions such as government transparency and instability. In addition, on almost all dimensions of governance (WGI), Benin ranks the bottom when is compared with other stable democratic countries in Africa (Pinkston, 2016).

[6]Economic Freedom of the World Index provided by Gwartney et al. (2013) is a composite index on the institutional quality regarding the overall economic freedom.

Their strikingly different performances on these institutions, however, are not surprising based on our ideas, where Benin is categorized as Weak Democracy while Ghana as Strong Democracy given their development conditions during democratization. As shown in Panel A of Table 1.7.16, GDP level, human capital and the industry share are much lower in Benin than in Ghana at the transition time. For example, the population percentage with secondary schooling was only 8.65% in Benin but 43% in Ghana. The masses with poor human capital would have weak bargain powers in Benin. It is difficult for the whole society to build sound institutions to support the functioning of democracy even though there are good and formal political institutional framework on the surface. Even Benin is considered as a fully "free" democracy by Freedom House and its polity score has been above 6 since 2005, Pinkston (2016) finds that democratic governments in Benin are mainly controlled by government insiders and political elites are largely closed to those without preexisting ties to the state. In some sense, Benin is lack of the core of democracy. As Dahl (2005) argues, the elite rule is democratic only when the governing elite is open to individuals or representatives of previously marginalized groups. Unlike Benin, Ghana has a more open political elite.[7]

Our study focuses on the period of 1960-2010 and uses within estimators based on a dynamic growth model following Acemoglu et al. (2019). In the baseline results using GDP as the developmental indicator, the estimated effect of Strong Democracy on annual GDP growth is positive and significant, while that of Weak Democracy is not statistically different from autocracy. This pattern is robust to various alternative specifications. For example, when a more realistic indicator of development is used, which combines information on income, education, natural resource and inequality during the political transition period, about 45% of democratization cases in the sample are categorized as Weak Democracy and experience no improvement in growth compared with autocracies.

[7] Pinkston (2016) finds that nearly two-thirds of members of parliament in Benin are government insiders, while less than half are government insiders in Ghana.

The key insight of this paper is not simply that development matters,[8] but that development at the *critical junction* of the political transition time matters in an important way. During this democratization period, different groups in society usually negotiate with each other intensively to establish the fundamental institutions that make democracy work, but the political bargaining power of each group is often underpinned by its economic clout at that moment (Huang, 2012*a*). For example, if democratization occurs at the time when human capital has already become the main growth engine, the majority of population would have reached broad consensus on growth-enhancing institutional infrastructure; in contrast, when development is still weak, it is very likely that substantial conflicts between elites and the masses still exist even after democratization, which may lead to political and social instability and large policy swings between elitism and populism. So the economic structure during the transition time leaves deep birthmarks on new-born institutions, and exerts long-lasting effects on future growth beyond the typical transient influence of economic conditions in any arbitrary period.[9]

[8]The role of development in democracy is discussed extensively in the literature (Lipset, 1959; Martin, 1960; Barro, 1996, 2003; Glaeser et al., 2004; Galor and Moav, 2006; Glaeser, Ponzetto and Shleifer, 2007; Huang, 2012*b*,*a*; Murtin and Wacziarg, 2014; Madsen and Murtin, 2017).

[9]There are several reasons explaining why economic structures matter. First, economic structures influence the payoffs of elites and the masses in political transitions. As Acemoglu and Robinson (2005) argue, repression and coups are costly due to the disruption of economic life. In a more industrialized economy, the link between buyer and supplier networks are more complex. Their relationships rely more on investments in skill and relationship-specific capital. In addition, economic structures also affect bargaining power of the masses in political conflict and the redistribution for the elites in democracy. Human capital is inherently embodied in humans and cannot be easily centralized or controlled by ruling elites through coercion. It implies that the masses equipped with more human capital would negotiate with autocratic elites for democratization much easier. Also, human capital is useful only if the individual makes efforts but he or she would not do because of the high tax rates. It suggests that optimal tax rates for landowners are higher than the ones for physical or human capital owners in democracy. Second, when people have more human capital, it should be easier for them to resolve their disputes through negotiation and voting than than through violence (Martin, 1960). Third, human capital, accumulated from school system, is needed for courts to operate and to empower citizens to engage with government institutions. It is easy to spread the information about the government's malfeasance among educated persons. So, it is not surprising that many scholars allege that democracy is difficult to sustain in an agrarian society (Dahl, 1973; Moore, Friedman and Scott, 1993; Rueschemeyer et al., 1992). Acemoglu and Robinson (2006*a*, 2008) also emphasize that better quality of democracy could be induced from the better economic structures where there are more physical or human capital sectors and more complex production relations in economy. Because elites have less to gain using repressive methods in such economy.

The paper is also in line with the institution-matters literature (North, 1990; Acemoglu, Johnson and Robinson, 2001; Acemoglu and Robinson, 2012), since the developmental conditions at the transition time have to be embodied by institutions to exert long-term impacts. Our contribution to this literature is to present a tangible indicator of the overall institutional quality, namely the economic development at the democratization period, which is similar in spirit to using one's birth weight to predict her overall health. The underlying insight is that, it is not any specific institutions or any fixed dimension of their quality that matters *per se*, but their germinating conditions that matter. Every dynamically effective institution must adapt continuously in order to address ever-changing issues in a growing economy; if the general human capital of the masses is not high enough to design, fund, operate, and monitor the daily functioning of so many intermingled institutions in a complex economy, then sooner or later the wheel of growth would come to a halt. Results in this paper show that the initial economic development condition can be used as an extremely simple and objective criterion to predict the quality of democratic institutions and their effects on growth.

In addition, our study is related to a small group of literature that emphasizes that the quality of democracy is greatly influenced by the conditions during the political transition period. Yashar (1997) stresses that a high development of civil society during the political reform time constitutes a necessary condition for democratizing elites to form cross-class coalitions. Cervellati, Fortunato and Sunde (2014); Matteo Cervellati (2015) show that the violence during democratization has a long-lasting effect on the quality of democratic institutions. Besley and Persson (2018) propose that critical junctures in national political history are crucially important to later development. There could be radically different trajectories for the countries with similar initial levels of just above and below the threshold of the share of concerned citizens.[10] More broadly, Acemoglu and Robinson (2012) illustrate the

[10] In their setting, this type of citizens makes up a civil-society movement. These citizens not only care about their private consumption but also have intrinsic preferences for seeing strong executive constraints in place.

importance of the interaction between small institutional differences and critical junctures. Once a critical juncture occurs, the initial small institutional difference triggers distinct responses. Our contribution to this literature is to emphasize that economic structures at democratization leave permanent birthmarks to the functioning of democracy.

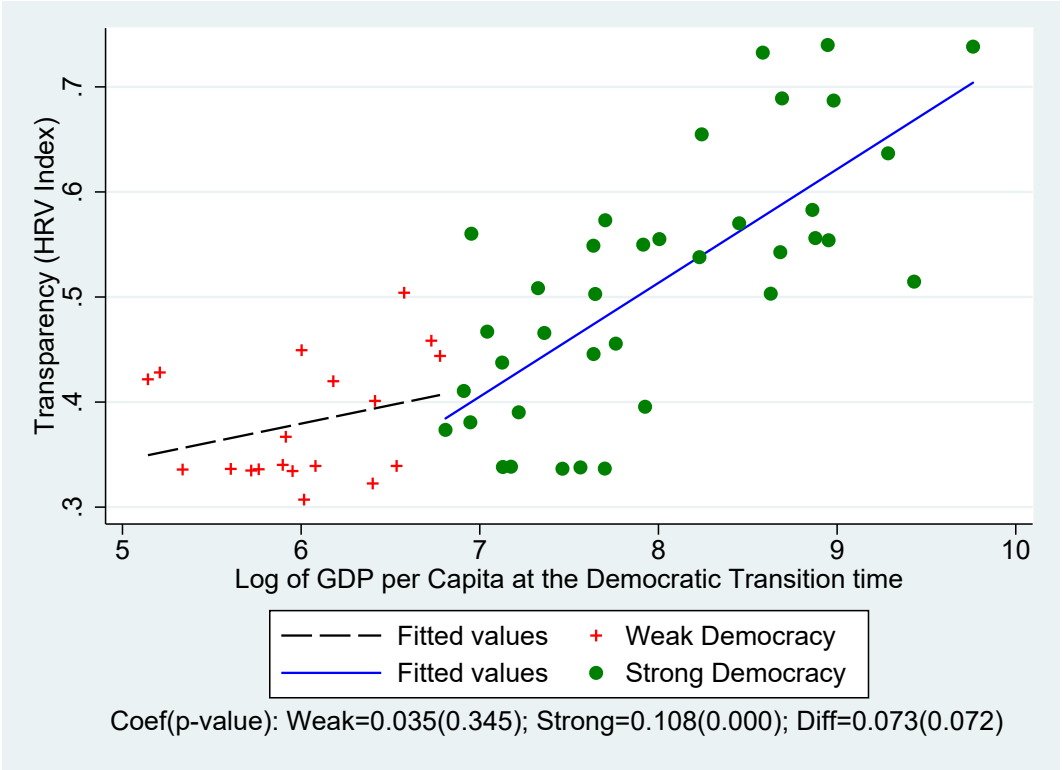
A first glance of data shows some preliminary evidence for our hypothesis that the initial development during the democratic transition period has lasting impacts on institutional quality. Figure 1.3 plots the relationship between log GDP per capita in the year of democratic transition of a country and the average level of government transparency after transition measured by HRV index.[11] It shows that countries with better development conditions during the transition period are more transparent in public affairs after democratization. For illustration purpose, the 25^{th} percentile of these initial GDP levels is used as the cutoff value to categorize Strong versus Weak Democracies. Significant differences between these two types can also be observed from their distinct fitted lines.[12]

Results from more sophisticated regressions in this paper also confirm that the quality of a broad range of institutions is indeed much higher in Strong Democracy than in both Weak Democracy and autocracy, while there are no significant differences between the latter two. Even though the quality of democratic institutions may improve over time through learning-by-doing (Gerring et al., 2005), we find that in this kind of nature versus nurture competition, nature dominates, where the quality of institutions is crucially shaped at birth and becomes consolidated over time possibly due to history dependence. And specific political forms such as presidential versus parliamentary or majoritarian versus proportional regimes (Persson, 2005) do not have significant effects either.

[11] The HRV index (Hollyer, Rosendorff and Vreeland, 2014) an objective measure of transparency using the quality of national data reported to international organizations, which predicts well of a country's law and order as well as bureaucratic quality. The GDP data are from World Bank Development Indicators and measured in 2010 US$.

[12] This pattern is robust to alternative indicators of institutional quality (such as corruption and regime instability) and initial development (such as school enrollment rates and industry share of GDP).

Figure 1.3.. Effects of Initial Development on Government Transparency



Salient differences between Strong and Weak Democracies also exist in other dimensions. For example, compared with autocracy, population growth is significantly lower in Strong Democracy, but significantly higher in Weak Democracy. Lower population growth is considered by Przeworski (2000) as a major channel for democracy to facilitate economic growth, which applies only to Strong Democracy in our results, while there are no significant differences between Weak Democracy and autocracy in fertility and child mortality rates. Political instability and social unrest are also much lower in Strong Democracy than in others.

Our main result is that Strong Democracy boosts economic growth but Weak Democracy does not, which is driven mainly by institutional quality difference originated from the initial development gap during democratization. This gives rise to an intriguing question: Is it better for a country to hurry into a Weak Democracy *now* or to wait and transit *later* to a Strong Democracy? Even though in reality political transitions are often unexpected and thus difficult to be planned well ahead, it is still affected by some common beliefs of society. For example, if many people

believe that transition to democracy is absolutely better for economic growth, then they are willing to incur great costs to facilitate such a transition as soon as possible regardless of development conditions. In contrast, if instead they believe the results demonstrated in this paper that only Strong Democracy is good for growth, then they may choose to change political regime only when the economic structure becomes ready for a direct transition to a Strong Democracy. Based on our simulation, this may indeed be better than rushing into a Weak Democracy from the economic growth perspective.[13] The optimal sequence between economic liberalization and democratization is also discussed by Epstein et al. (2006) and Persson and Tabellini (2006).

The rest of the paper is organized as follows. The next two sections describe data, the dynamic estimation model, and the benchmark results as well as a variety of robustness checks. Potential channels through which democracy affects growth are examined in the following two sections. Some policy implications of our regression results and further discussions are conducted in Section 6. The final section provides concluding remarks.

1.2. Data and Descriptive Statistics

We construct an annual panel data set from various sources. The dichotomous democracy index[14] (1 for democracy and 0 for autocracy) is from Acemoglu et al.

[13]Of course, in actual political choices, a society has to consider complicated trade-offs other than pure economic concerns. For example, some country may opt to transit to Weak Democracy even at the cost of having slower economic growth in the long run.

[14]There has been an active debate in political science on whether one should treat democratic transitions as events using dichotomous indicators. Huntington (1993); Przeworski (2000); Papaioannou and Siourounis (2008*b*); Cheibub, Gandhi and Vreeland (2010); Acemoglu et al. (2019) are proponents of using dichotomous measures, while Bollen and Paxton (2000); Dahl (2005) favor finer measures. The belief that democracy is an attribute that can be measured in all political regimes leads to assertions that would appear to violate common sense. Like Cheibub, Gandhi and Vreeland (2010) argue, "*if one believes that democracy can be measured over all regimes, one has to be prepared to argue that it makes sense to speak of positive levels of democracy in places like Bahrain, China in the 1970s, Chile under Pinochet or Brazil during the military dictatorship*". We use a dichotomous measure mainly because of two reasons. First, based on solid conceptual grounds, we believe that democracy is not a continuous attribute of all political regimes (democracies and autocracies). Second, given our research objective of estimating the dynamic evolution of annual

(2019), which draws from several widely used data sources, and contains the most updated information on political transition years.[15] We slightly modify it by using a 5-year smoothing condition to mitigate noises caused by temporary regime changes.[16] The political transition from autocracy to democracy occurs in the data when the annual democracy indicator of a country changes from 0 to 1, and this specific year is denoted as the transition year t_0.

The democracy index captures the main characteristics of electoral democracies, but leaves out other important institutional quality that may crucially affect growth, such as information transparency, the rule of law, or corruption. This motivates us to refine it by creating two sub-types of democracy, where *Strong Democracy* has strong institutions that promote growth, while *Weak Democracy*, in contrast, has weak institutions. Such categorization, though clear and desirable conceptually, is difficult to implement empirically because of the complexity of institutions. The innovation of our approach is to measure it indirectly, where the intuition is similar to using birth weight to predict a person's overall health. Even though the prediction is far from perfect, it is much better than no information at all.

Our basic hypothesis is that the developmental condition at this transition year (which corresponds to a person's birth weight) is of fundamental importance in affecting the long-term quality of a broad range of institutions (which corresponds to a person's overall health). If this is true, then we can use an appropriate threshold

growth during democratic transitions, it is crucial to identify the beginning of each democratization process. While our benchmark metric is dichotomous, in the appendix, we also allow the degree of *de jure* qualities of political institution (proxied by polity score or Freedom House score [normalized between 0 and 1]) in periods of democracy (i.e., when the democratization dichotomous variable is equal to one) to affect the performance of democracy on economic growth. Our results still hold.

[15]To reduce measurement error, Acemoglu et al. (2019) set a strict criterion and classify the country as democratic one only if Freedom House codes it as "Free"or "Partially Free," and Polity IV assigns it a positive score. They further revise the suspicious cases using other data sources. The regression results also support their claim that the alternative measures are more heavily affected by measurement error than their consolidated measure.

[16]Such smoothing is also adopted by Giavazzi and Tabellini (2005); Persson and Tabellini (2006, 2007); Papaioannou and Siourounis (2008*a*). Since it affects only a few countries, the main results are similar if the original data set is used. Alternative democracy data, including Polity IV, CGV (Cheibub, Gandhi and Vreeland, 2010), BMR (Boix, Miller and Rosato, 2013), and PS (Papaioannou and Siourounis, 2008*b*) are used for robustness checks.

of development in the transition year t_0 to categorize a democracy into either Strong or Weak group, and verify empirically the validity of such categorization.[17]

Specifically, two dummy variables $DStrong_{it}$ and $DWeak_{it}$ are created to denote *Strong Democracy* and *Weak Democracy* respectively in the following, where $Development_{i,t_0}$ is the development indicator for country i at the political transition time t_0.

$$DStrong_{it} = \begin{cases} 1 & \text{if } Democracy_{it} = 1 \text{ and } Development_{i,t_0} > Threshold, \\ 0 & \text{Otherwise.} \end{cases}$$

$$DWeak_{it} = \begin{cases} 1 & \text{if } Democracy_{it} = 1 \text{ and } Development_{i,t_0} \leq Threshold, \\ 0 & \text{Otherwise.} \end{cases}$$

The usual developmental indicators for solid democratization include per capita GDP, education, and industry share of GDP (Lipset, 1959; Huang, 2012*a*). Due to uneven data availability across countries and spanning several decades, the most widely available variable, GDP per capita from WDI, is used as the benchmark

[17] There are several reasons supporting to use these two types of democracy instead of democracy and the interaction term built by the development indicator for our study. First, we emphasize that the improvements of institutional qualities need some minimum level of development. Several theoretical models (Acemoglu and Robinson, 2006*a*; Robinson, 2008; Besley and Persson, 2018) propose that democracy functionally works as long as the power of the masses is larger than elites' in political equilibrium. It implies that countries with similar initial levels of just above and below the threshold of some condition can have radically different trajectories. Second, previous empirical studies, such as Aghion, Alesina and Trebbi (2007*a*), that fail to find the robust heterogeneous effect of democracy by using interaction term in regression also motivate us to try the different strategy. Recently, Hainmueller, Mummolo and Xu (2019) question the rationality of estimates from Multiplicative Interaction Models. They find that the potential assumptions of these models, such as a linear interaction effect that changes at a constant rate with the moderator, are often fragile. Instead of using standard multiplicative interaction model, they suggest that it is better to apply more flexible models, such as the binning estimator, to explore the conditional marginal effects. Third, according to our argument, development conditions at democratization influence the institutional qualities in democracy, through which affect economic performance. It may be difficult for the well-development country to greatly improve its qualities of institution by democratization because of reduced room for progress. Generally, great economic development conditions at democratization are more likely to have sound institutions. Thus, it is hard to advance by much when the institutional qualities in the country are not far from the top. Empirically, we also run regressions by controlling for democracy and its interaction with initial development conditions. The coefficients of these two are positive but insignificant in most cases.

indicator for development[18], while others are shown in the robustness check. The threshold to distinguish the two democratic types is essentially an empirical matter, which may vary with the specific developmental indicator used in estimation. So we typically report estimation results for a wide range of cutoffs as possible thresholds, where the cutoff yielding the most significant difference between the two types of democracy is used as the main threshold to anchor discussion and interpretation of results.

The main dependent variable *Growth* is the annual log difference of real per capita GDP from the 2015 edition of World Bank Development Indicators (WDI for short), which covers 171 countries from 1960 to 2010. Democratic transitions during this era are often considered as the Third-Wave democratization (Huntington, 1993), which exhibits some common features that are distinct from earlier waves. A few countries in this wave made political transitions before 1960 and thus have no GDP data in the transition year from WDI, which are difficult to categorize based on our criterion; dropping them as missing observations reduces the main sample to 153 countries.[19] The so-called old democratic countries, which became democracy before World War II and had never changed political regime in the sample years from 1960 to 2010, are categorized as Strong Democracy directly by definition. Robustness checks show that excluding them does not affect the main results, which are driven mostly by transitions in the Third-Wave democratization.[20]

[18]The Skeptics may question whether it is possible to use this extremely simple and rough criterion, GDP per capital at democratization, to distinguish Strong Democracy and Weak Democracy. This method definitely neglects many other factors (For example, geopolitical, ideological, and other ultra-economic elements.). In addition, higher GDP per capita does not definitely mean that the whole economy is human capital driving. Many resource-abundant countries are also relatively rich. Also, GDP per capita has no information on the distribution of income, which also influences the bargaining powers between the masses and elites. Ignoring these factors would, more or less, make our grouping strategy less clear-cut and weaken the differences between Strong and Weak Democracy. In other words, it would potentially make their differences on economic growth smaller and less significant. Since we find that Strong and Weak Democracy have significantly different effects on growth in regressions, this concern should be less important. Furthermore, to make up the shortcomings of using GDP as the single criterion, we also use other development indicators related to economic structures as criteria to categorize different types of democracy.

[19]Results are similar if filling the missing data with GDP values in 1960 or from other data sources.

[20]The within estimators used in the recent literature are mainly determined by countries with political regime changes during the sample period. So those without any political changes would have little effect on the estimated coefficients.

Significant differences between the two types of democracies are indeed evident in Table 1.7.1, which presents descriptive statistics of the main economic, demographic and institutional variables separately for Strong and Weak Democracies as well as autocracies.[21] Countries with Strong Democracy are on average more educated, having more market reforms, more open to trade, and having higher GDP per capita, higher investment, lower income inequality, lower rates of fertility, lower child mortality, and lower population growth than those with Weak Democracy. Not surprisingly, Strong Democracies also have better quality institutions as indicated by higher levels of economic freedom, better legal infrastructure, more transparency, higher political stability, less corruption, less social unrest and violence. The same pattern also applies to comparison between Strong Democracy and autocracy.

Differences between Weak Democracy and autocracy, however, are not so clear-cut. It is interesting to note that Weak Democracies are poorer, and have higher Gini coefficients, lower secondary enrollments and higher child mortality rates than autocracies, even though they have more economic freedom and market reforms. A related observation is that Weak Democracies also have worse legal infrastructure, higher corruption level, and higher political instability than autocracies.

1.3. Baseline Results

The effects of Strong and Weak Democracies on GDP growth are estimated using the following dynamic growth model with fixed country and time effects:

$$g_{it} = \beta_S DStrong_{it} + \beta_W DWeak_{it} + \sum_{j=1}^{3} \alpha_j g_{it-j} + \varphi y_{it-4} + \lambda_i + \delta_t + \varepsilon_{it}. \qquad (1.1)$$

The dependent variable g_{it} is the growth rate of per capita GDP in country i at time t, defined by $g_{it} = 100 * (y_{it} - y_{it-1})$ as in the literature, where y is natural logarithmic

[21] The threshold used is the 25^{th} percentile ($p25$) of GDP per capita levels of all democratic countries during their transition times. Among the 88 democratization cases in the data, 66 are categorized as Strong Democracy, while the rest 22 as Weak Democracy. The full list of detailed definition and source of all variables are in the Online Appendix.

form of GDP per capita. $DStrong_{it}$ and $DWeak_{it}$ are dummy variables defined earlier indicating Strong and Weak Democracies respectively. The dynamic process of growth is captured by three lags of GDP growth rate as well as a four-period lag of GDP, y_{it-4}.[22] The impact of any time-invariant country-specific characteristics such as geographic location, history, or culture is absorbed by country dummies λ_i, while any global trends of GDP growth are captured by year dummies δ_t. The residual term ε_{it} includes all other time-varying unobservable shocks to GDP growth, which are assumed to be orthogonal to democratic types conditional on the full list of control variables. Then the coefficients β_S and β_W can be estimated using the standard within estimator, which is shown to have consistent results compared with a range of alternative estimation methods in Acemoglu et al. (2019).

The dynamic structure of this model follows Acemoglu et al. (2019), except that the growth rate is used here instead of GDP level.[23] The model specification also shares similarity with Persson (2005) where multiple dummy variables of democratic forms are used. To deal with potential serial correlations, we follow the recent literature (Papaioannou and Siourounis, 2008*a*; Madsen, Raschky and Skali, 2015) to use clustered standard errors at the country level in all regressions.

[22] Sufficiently many lags of growth rates need to be included to eliminate the residual serial correlation in the error term, especially to remove the influence of the dip in growth rate that precedes democratization (Papaioannou and Siourounis, 2008*a*; Acemoglu et al., 2019). Results are similar when more than three lags of growth rates are used.

[23] Both variables would lead to identical estimates of democracy coefficients. Their equivalence is shown below. Equation (1.1) can be rewritten as

$$y_{it} - y_{it-1} = \beta_S DStrong_{it} + \beta_W DWeak_{it} + \sum_{j=1}^{3} \alpha_j (y_{it-j} - y_{it-j-1}) + \varphi y_{it-4} + \lambda_i + \delta_t + \varepsilon_{it},$$

which after re-arranging terms becomes

$$y_{it} = \beta_S DStrong_{it} + \beta_W DWeak_{it} + \sum_{j=1}^{4} \gamma_j y_{it-j} + \lambda_i + \delta_t + \varepsilon_{it},$$

where γ_j can be derived from α_j and φ.

1.3.1. Using GDP as Development Indicator

Estimation results based on Equation (1.1) are shown in Table 1.7.2, where per capita GDP in the political transition year is used as the economic development indicator to categorize Strong versus Weak Democracy.[24] In Column (3), for instance, when the threshold is set at the 25^{th} percentile (*p25*), the estimated coefficient of Strong Democracy is 1.394, which is statistically significant at the 1% level, while that of Weak Democracy, 0.048, is much smaller and insignificant. The results are quite similar when the threshold is lower, such as 20% in Column (2) and 15% in Column (1), while the differences between the two groups become smaller and less significant when the cutoffs are at higher levels. These results suggest that if the economic development in the political transitional year didn't pass a certain level, democracy *per se* does not facilitate growth, and in this specific case, 25% of per capita GDP seems to be the appropriate threshold, which is about 900 US dollars measured in year 2010.

For comparison, the last column uses a single democracy dummy; its estimated coefficient 0.919 is similar as in Acemoglu et al. (2019), which lies in-between those of Strong and Weak Democracies. In all columns, the coefficients of three lagged growth rates are significantly positive but well below 1, confirming the importance of the dynamic structure. The coefficients of y_{it-4} (4-year lagged GDP per capita) are always statistically negative, indicating the existence of conditional convergence in economic growth.

Using estimates in Column (3) as the benchmark, the long run effect of a permanent transition to Strong Democracy increases GDP per capita by 35.56%, while the effect of a Weak Democracy is only 1.22%.[25] This large discrepancy in growth

[24] We also use per capita GDP residual at democratization to group these two types of democracy. The residual information is obtained by removing the year effects through the regression. This process could further reduce the concern that per capita GDP is not comparable in different time or it tends to autocratically grow over time. The baseline results are quite similar to the ones in Table 1.7.2. See the appendix.

[25] The estimated long run effect of democracy is 21.24% in Acemoglu et al. (2019). The formula derivation is in the appendix.

effects among democratic countries suggests that a more careful categorization is warranted; without appropriate developmental readiness, switching to democracy may not facilitate economic growth.

1.3.2. Alternative Development Indicators

Table 1.7.3 shows regression results using alternative indicators of economic development during the political transition period to categorize the two types of democracies, including two education variables, natural resource share of GDP, the industry share of GDP, and income inequality. The overall results are quite similar to those in Table 1.7.2.

The first panel uses Secondary Enrollment Ratio as the indicator; significantly different effects on growth between Strong and Weak Democracies exist for almost all cutoff levels from the 10^{th} to 50^{th} percentile, where the coefficients of Strong Democracy are always positive and significant (from 1.044 in Column (1) to 1.638 in Column (9)), while those of Weak Democracy are not statistically different from zero across the board, even negative when the cutoffs are below the 20^{th} percentile.

These results are almost perfectly replicated in the second panel where Tertiary Enrollment Ratio is used. For example, results in Column (9) suggest that if a country's tertiary enrollment rate was below the sample median in the transition year, democracy has no significant effect on growth, while in sharp contrast, those with higher enrollment rates would enjoy an average of 1.404 percentage points increase of economic growth rate per year. These empirical estimates are in line with theoretical models emphasizing the crucial importance of human capital in the process of industrialization and democratization (Glaeser et al., 2004; Galor, 2007; Glaeser, Ponzetto and Shleifer, 2007; Huang, 2012*a*; Murtin and Wacziarg, 2014; Madsen and Murtin, 2017), suggesting that democracies without adequate mass education are not likely to improve economic growth.

Another commonly used indicator for economic development is the income share of natural resources in the economy. Countries with more advanced economy would rely more on human capital than oil, mineral or other natural resource, whereas those with heavy reliance on raw materials tend to gravitate towards rent-seeking activities and institutions.[26] To be consistent with other developmental indicators, we use (1 - Natural Resources Revenue Share of GDP) in the third panel. A striking difference between Strong and Weak Democracies is observed in Column (2) where their coefficients are respectively 1.188 and -1.319, both statistically significant. That is, democracy substantially reduces economic growth in countries among the top 15 percentile of reliance on natural resources. And countries above the median in natural resource dependence see no significant improvement on growth from democracy. These results are very similar to those using enrollment rates above.

The next panel uses the Industry Share of GDP as the indicator. The most significant difference is observed in Column (1) with 10% as cutoff, where the estimated effect of Strong Democracy on growth is 1.038, while that of Weak Democracy is -1.533, and both are significant. The effects are always positive and significant for Strong Democracy but insignificant for Weak Democracy in the other columns, even though the differences become less significant when the cutoffs are higher and thus the between-group gap becomes smaller.[27]

High economic inequality is often associated with low institutional quality and political instability.[28] In the last panel, (1 - Gini) is used as the developmental indicator, where the net Gini coefficient is from Standardized World Income Inequality Database (SWIID). The overall pattern is again similar to the other panels,

[26] This is widely recognized in the literature; see, for example, Sachs and Warner (1999, 2001); Arezki and Van der Ploeg (2011); Frankel (2012); and Hodler (2006); Bhattacharyya and Hodler (2010); Tsui (2011); Ross (2015); Farhadi, Islam and Moslehi (2015).

[27] Economic Complexity Index (ECI), like the Industry Share of GDP, also contains the information of economic structure. ECI is a measure of the relative knowledge intensity of an economy. It is built by considering the knowledge intensity of the products it exports (Hausmann et al., 2014). Using it to categorize the types of democracy, the patterns are similar to the ones using Industry Share of GDP, except that an appropriate cutoff is the percentile 15. See the appendix.

[28] See, for example, De Tocqueville (2003); Huntington (2006); Gradstein (2007, 2008); Sunde, Cervellati and Fortunato (2008); Cervellati, Fortunato and Sunde (2014); Jung and Sunde (2014); Krieger and Meierrieks (2016); Kotschy and Sunde (2017).

where for countries with income inequality higher than the median level, democracy doesn't improve growth.

At the 25^{th} percentile cutoff, the coefficient of Strong Democracy is 1.370 when the indicator is Secondary Enrollment Rate, 1.182 for Tertiary Enrollment Ratio, 1.142 for Natural Resource Share, 1.038 for Industry Share, and 1.120 for Income Inequality, while those of Weak Democracy are respectively 0.004, -0.066, 0.303, 0.222, and 0.326, all insignificant. Since the overall results are quite similar across these indicators, GDP per capita in the transition year with the 25% cutoff will be used as the benchmark to conduct other robustness checks; this choice is partially because per capita GDP by construction is meant to reflect the economy's overall situation, and also because of its wider availability in data.[29]

1.3.3. Alternative Democracy Indicators

One reason for the lack of consensus in the literature on the effects of democracy on growth is because the empirical results are often sensitive to how democracy is measured. This is understandable given that democracy is a complex concept itself, implemented in reality by various institutions that are difficult to quantify and compare across countries. The dichotomous democracy indicator and the transition year data used in the above tables are from Acemoglu et al. (2019), which combines information from several widely used data sets. Table 1.7.4 shows robustness of our results to these alternative democracy indicators.[30]

The first panel in Table 1.7.4 shows results using Polity IV data where we define $Democracy = 1$ if $polity2 > 0$, and $Democracy = 0$ if $polity2 \leq 0$ following Persson

[29] We are aware of the potential drawbacks of using GDP as the only developmental indicator. For example, high income may result from rich natural resources rather than better human capital or more advanced economy structure. Later in Session 1.6, GDP is combined with other variables to construct a more comprehensive indicator, and the overall regression results are indeed similar.

[30] Results using Freedom House data are also similar but not reported here since it does not contain political transition cases before 1972.

and Tabellini (2007) and Acemoglu et al. (2019).[31] Consistent with the literature using a single democracy dummy, a small and insignificant effect of democracy, 0.249, is reproduced in Column (7). In sharp contrast, for a range of cutoffs (from the 20^{th} to 40^{th} percentile), the coefficients of Strong Democracy are much larger and statistically significant, while those of Weak Democracy negative, and their differences are significant. At the 30^{th} percentile cutoff, for example, the estimated coefficient is 0.74 for Strong Democracy and -0.626 for Weak Democracy, and their gap 1.366 is similar in magnitude and significance to earlier estimates.

The overall pattern is similar in the following two panels using CGV (Cheibub, Gandhi and Vreeland, 2010) and BMR data (Boix, Miller and Rosato, 2013). Both have dichotomous democracy variables. The coefficients of Strong Democracy are much higher and more significant than those of a single democracy dummy, while those of Weak Democracy are insignificant, much smaller, and sometimes negative. At the 25^{th} percentile cutoff, for example, the estimated coefficients of Strong Democracy are 1.193 and 1.149 for CGV and BMR respectively, while those of Weak Democracy are -0.294 and -0.204, which again yield similar magnitude and significant levels in group differences.

The PS data (Papaioannou and Siourounis, 2008*b*) in the last panel consider only permanent transitions to democracy, which exclude many Weak Democracies because they on average have short lifespans and quick reversals to autocracies; this may be a reason why the coefficient of the single democracy dummy is much larger and more significant compared with other data sets. In other words, the democracy variable in PS data already weeds out the most fragile Weak Democracies and thus is closer in spirit to our definition of Strong Democracy.[32] But even in this case, the coefficients of Weak Democracy are insignificant for cutoffs below the 35^{th}

[31] Results are similar when a higher cutoff, $polity2 = 5$, is used instead. Detailed results are in the appendix. The sample size is smaller partially because the polity data set does not include some small countries.

[32] Note that their sample size 124 is much lower than ours. The PS data used here is updated to 2010 as in Pozuelo, Slipowitz and Vuletin (2016), where political situations have changed in a few countries and thus some permanent transitions considered earlier have to be corrected. Our definition of Strong and Weak Democracies, in contrast, is based on an ex ante criterion.

percentile, while those of Strong Democracy are always significant, suggesting that even for permanent transitions to democracy, development conditions matter for growth.

These results suggest that it is important to look into the heterogeneity issue more carefully in assessing the effects of democracy on growth, and our categorization based on developmental conditions during the transition year is robust to various indicators of democracy.[33]

1.3.4. Robustness to Special Cases

Table 1.7.5 shows several robustness checks routinely used in the literature. In the first column, results remain almost the same as before when countries with less than 20 observations are excluded, suggesting that the Nickell bias is indeed small.[34] In Column (2) the region-specific time trends are controlled, while in Column (3) interactions between a dummy of Soviet-related countries and year dummies of 1989, 1990, 1991, and post-1992 when these countries experienced political transitions are included. In both cases, the estimated coefficients are similar as before.[35]

When outliers in growth rates (observations with a standardized residual below the 5^{th} percentile or above the 95^{th} percentile) are dropped in Column (4), the estimated effect of Weak Democracy, -0.453, becomes significant, while that of Strong Democracy, 0.801, is still positive and significant, and their gap 1.254 is of similar scale to the benchmark result; this suggests that democratization without adequate economic development may actually hurt economic growth if we exclude the influence of extreme outliers. Results remain similar in the last column where all controls in the earlier columns are included.

[33] We also run all regressions using these democracy indicators with appropriate cutoffs. The results do not change largely.

[34] The Nickell bias arises from the lack of strict exogeneity in dynamic panel models (Nickell, 1981; Alvarez and Arellano, 2003), which decays sharply when the time horizon exceeds 20 periods (Judson and Owen, 1999).

[35] Result are again similar if excluding Soviet-related countries.

1.3.5. Endogeneity Issues

The dynamic panel data model (1.1) assumes that after controlling country and time fixed effects as well as the past growth rates and GDP level, a country's political regime choice is exogenous to the other unobserved variables that may affect growth. Although this is a quite reasonable assumption, it is always possible to think about some elements that make democratic transition endogenous to growth.[36] Since political and economic forces are typically entangled and clustering together, and the democratization process is often conducted through a broad and far-reaching transformation of the whole society, it is not easy to find very clean instrumental variables to estimate a pure causal effect of democracy. The best we can do is trying to utilize some reasonably exogenous variations in democratic choices.

One possible exogenous factor that affects political regime choice is the genetic distance across countries. Countries sharing common ancestors are more likely to choose similar political regimes. Moreover, genetically closely related populations are tend to have similar traits such as habits, beliefs, customs and values. In addition, there are more trust among people with common ancestors and they are more willing to share information (Guiso, Sapienza and Zingales, 2009). So, genetic relatedness is a summary measure for various cultural characteristics that are vertically transmitted across generations.[37] Genetic distance between two countries can instrument democracy (Spolaore and Wacziarg, 2016).

Historically, many democratic transitions happen in similar culture traditions (Madsen, Raschky and Skali, 2015). The recent example of democratic movement is the Arab Spring in the countries with close cultures. Furthermore, similar to their pre-

[36] For example, the presence of certain extremely visionary and able leaders may help increase GDP growth and push democratization at the same time; in this case, democracy does not affect growth *per se* but the leadership quality does. That is, if in the past several decades, capable individuals in autocratic countries are more likely to receive advanced education in the western democratic countries and thus adopt their political regimes, then in countries where these individuals become influential leaders, growth and democracy become hand-in-hand results.

[37] Spolaore and Wacziarg (2009, 2011, 2013) Bove and Gokmen (2018); Madsen and Farhadi (2018) find that genetic distance, a proxy of differences in societal norms, customs, and habits, obstacles the diffusion of development from the frontier country.

colonial countries in Latin America, Spain and Portugal transitioned to democracy during the 1970s and 1980s. Unlike other countries in Europe, these two countries have very different political trajectories. This phenomenon could be explained by the cultural proximity, which helps transmit the similar political ideas. For instance, Australia and New Zealand share similar political, cultural and genetic traditions with Western Europe; Latin American countries have close characteristics with South European countries; Singapore is similar to China, and so forth. Through personal communications between countries, democratization in one country usually incentives political reforms in similar countries.

Considering that genetic distance could obstacle to the spread of new information, ideas and political movements between different countries, it combined with foreign democratic situations should be a great instrument for domestic democracy. Additionally, unlikely linguistic and cultural distances, genetic distance is less directly affected by political and economic environments. In particular, we instrument the democracy level of a given country by the weighted average of foreign democracies, where the inverse genetic distance is used as the weight.[38]

The 2SLS estimators are reported in Table 1.7.6. In Column (1), the coefficients of Strong and Weak Democracies are respectively 3.61 and -2.631; though individually insignificant from that of autocracy, their difference is again significantly different from zero. Their magnitudes are larger than the baseline results, which is a quite typical pattern in the relevant literature (Madsen, Raschky and Skali, 2015; Acemoglu et al., 2019), consistent with the hypothesis that richer countries are more likely to become democratic but their growth rates are lower than others. When a single democracy dummy is instrumented, the coefficient in Column (2) is estimated less precisely.[39]

[38]The Weighted Genetic Distance across countries from Spolaore and Wacziarg (2016) is used to calculate the weights. According to Spolaore and Wacziarg (2009, 2016, 2018), the distance captures ancestral barriers between populations. Details are in the appendix.

[39]Precision is increased in Madsen, Raschky and Skali (2015) with 10-year average GDP levels and a much longer time horizon from 1820 to 2000.

Another possible source of exogenous variation in democracy is the influence of regional waves of democratization and reversal to autocracy (Gründler and Krieger, 2016; Acemoglu et al., 2019). We construct the average level of democratic indicators in foreign countries within the same region, and use their four lagged values as IVs for a specific country's democracy level. The coefficient of Strong Democracy in Column (3) is 3.883, significant at 5% level, while that of Weak Democracy is 0.699 and insignificant; their gap is also significant. The IV result for a single democracy dummy in Column (4) is again not significant.

In the last two columns, only countries that share similar political institutions at the beginning of the sample are used to construct the regional average values. The precision of regression results indeed improves a lot, where even the coefficient of the single democracy dummy becomes statistically significant as in Acemoglu et al. (2019); the coefficient of Strong Democracy is 1.967, again significant, while that of Weak Democracy is -0.499 and insignificant.

The overall pattern in these IV results is again similar to the benchmark results, where the estimated effects of Strong Democracy are positive and significant, while those of Weak Democracy remain insignificant and sometimes even negative. So the dynamic panel model is not much affected by the endogeneity issue and thus provides a reliable framework to estimate the effects of democratic types on growth.

1.4. Further Evidence

1.4.1. Controlling Current Economic Development

One may wonder whether it is the general economic development condition, not the institutional quality as proxied by development in the transition period, that really matters. This concern has already been taken into account in the model setup, since in all regressions we have already controlled an earlier per capita GDP level y_{it-4}, which should capture the direct effect of economic development on growth. But

to further address this issue, especially to capture the potentially nonlinear effects, we construct a dummy variable *poor_dummy* that equates to 1 if the development indicator is below a certain threshold in each period, and 0 otherwise.[40]

In Table 1.7.7, several development indicators, including GDP, secondary and tertiary enrollment rates, industry share of GDP, and urbanization rate, are used to construct the *poor_dummy*, where a range of thresholds from the 15^{th} to the 85^{th} of the relevant indicator in each year are used. In Panel A of Column (3), for example, the estimated coefficient of Strong Democracy is 1.698, again highly significant, while that of Weak Democracy is -0.179 and insignificant, where the difference is also highly significant; the coefficient of *poor_dummy* is -4.299 and highly significant, suggesting that poor development is hindering growth in general. In Panel B of the same column, the coefficients of Strong and Weak Democracies are respectively 1.574 and -0.315, with a similar pattern as in Panel A, while that of *poor_dummy* is insignificant from zero. Results in the rest panels are in general similar to the first two. So the baseline results continue to hold even when the current economic development level is further controlled in addition to the income level.

1.4.2. Compare With the Grouping Strategy Using GDP at Alternative Year

To further emphasize that the development condition in political transition year is more crucial than other years, we also use GDP per capital in fixed years such as 1960, 1965, 1970, 1975, etc as the key development conditions to group Strong Democracy and Weak Democracy. For comparison, the same value ($p25$ of GDP per capita in political transition years) as the threshold. We name this grouping strategy as the "Wrong" one, while our baseline grouping strategy as the "Right"

[40]This variable is thus constructed in a similar way as the two dummies of Strong and Weak Democracies, except that the latter are based on development in the transitional year, while the former is for each year.

one. There are four categories for democracies in these two grouping strategies, including, Strong Democracy in both strategies, Weak Democracy in both strategies, Strong Democracy in "Right" Strategy but Weak Democracy in "Wrong" one, and Weak Democracy in "Right" Strategy but Strong Democracy in "Wrong" one. If the information at democratization is more important, we should observe that the coefficient of the third case should be positive and significant, while the coefficient of the fourth case should be insignificant. The regression results are consistent with our prediction, which are displayed in Table 1.7.8.[41]

These results suggest that the development conditions in the *critical junction* of political transition period capture something important beyond pure development, which in our hypothesis is the quality of newly established institutions that are affected substantially by the birth conditions.

1.4.3. Controlling Democratic Stock and Formats

Another reasonable conjecture is that, even though development in the transitional time is crucial, the institutional quality may also improve over time after democratization through learning-by-doing. It is somewhat similar to the nurture versus nature issue in child development. For the effect of democracy on growth, is it possible that the birthmark impact of the initial developmental conditions may be mitigated over time?

To check this possibility, we use the Democratic Stock variable from Gerring et al. (2005) as an indicator for potential improvement of institutional quality after democratization. It is measured by the sum of each country's Polity2 score from 1900 to the present year with a 1% annual depreciation rate, and we update it to 2010 to match our sample period. In Column (1) of Table 1.7.9, the coefficients of Strong and Weak Democracies are respectively 1.204 and 0.07, very similar to the baseline results, while that of Democratic Stock is 0.005 and marginally significant. So the

[41] In 1995, there is no fourth case. It is also true in later years, which are not shown in the table.

accumulated democratic stock is indeed good for growth, but its effect is not as substantial as that of the initial development.[42]

An alternative direction explored in the literature is whether the specific formats of democratic institutions, such as presidential versus parliamentary or majoritarian versus proportional regimes, matter more than the difference between democracy and autocracy in general (Persson, 2005). This issue is also examined here in Table 1.7.9. In Column (2), three dummy variables representing Majoritarian, Proportional, and Mixed Election System are controlled; their coefficients are positive but insignificant, while those of Strong and Weak Democracies are 1.492 and -0.46 respectively, again similar as before. In Column (3), indicators of Parliamentary, Presidential, and Semi-Presidential regimes are included instead; their coefficients are negative, while those of Strong and Weak Democracies are 1.635 and -0.004. When all of these six dummy variables are included in Column (4), the overall pattern remains similar. In the last column, Democratic Stock is further added, and none of these specific institutional formats shows any significant effects, while the coefficients of Strong Democracy, 1.477, and Democratic Stock, 0.008, are still significant. These results demonstrate that once the initial development condition is controlled, the specific forms of democracy don't have significant effects on growth.

1.4.4. Controlling Economic and Demographic Variables

A common practice to check the robustness of empirical results is to control more variables for the purpose of mitigating the omitted variable problem. But the newly introduced variables may be *bad controls* since they could be part of the causal effect we aim to estimate (Angrist and Pischke, 2008). For this reason, the more comprehensive model specifications may not capture the full growth effect of democracy, though their comparison with the basic model illuminates potential mechanisms through which democracy may affect growth.

[42]For example, if the polity score increases from 0 to 6 (the median level in Weak Democracy) after democratization, the effect of 10 years democratic stock on growth is 0.287.

Table 1.7.10 shows results controlling for standard growth covariates (Papaioannou and Siourounis, 2008*a*; Barro, 2013; Acemoglu et al., 2019) including the trade share in GDP, investment rate, inflation rate, government spending, and enrollment rates of various school levels, fertility rate, and life expectancy. Specifically, four lags of each covariate are used to capture the dynamic process of growth.

The overall pattern and coefficient magnitudes are again very similar to the baseline results across all columns. Although the coefficients of all of these economic variables are not jointly significant *per se*, the 2nd and 3rd lags of growth rate variables lose significance compared with the baseline model, suggesting that their effects on current growth are partially or fully captured by earlier growth rates. In contrast, when only demographic variables are controlled in the last two columns, these earlier growth rates are still significant. The coefficients of Strong Democracy vary from 1.050 in Column (6) when secondary enrollment rate is controlled, to 1.693 in Column (2) when the investment rate is controlled, all statistically significant, while those of Weak Democracy range from -0.274 in Column (7) when tertiary enrollment rate is controlled, to 0.32 in Column (8) when fertility rate is controlled, all insignificant.

In summary, these results suggest that the distinct effects of Strong versus Weak Democracy on economic growth are quite robust, and can't be fully captured by standard economic, demographic, and political conditions. This motivates us to examine more carefully the potential transmission channels through which Strong Democracy facilitates economic growth while Weak Democracy does not.

1.5. Democracy on Growth: Mechanisms

In the following dynamic panel model, the dependent variable m_{it} is the potential channel that may be directly affected by Strong and Weak Democracies. Following Acemoglu et al. (2019), four of its lagged levels are controlled as well as four lagged per capita GDP to capture the dynamic process of each variable and the dynamic

effects of general development. The same set of country and time dummies are also included. This model is estimated by the within estimator.

$$m_{it} = \beta_S DStrong_{it} + \beta_W DWeak_{it} + \sum_{j=1}^{4} \alpha_j m_{it-j} + \sum_{j=1}^{4} \varphi_j y_{it-j} + \lambda_i + \delta_t + \varepsilon_{it}. \quad (1.2)$$

1.5.1. Institutional Channels

In Table 1.7.11, we explore the effects of Strong versus Weak Democracy on various institutional quality indicators, including economic freedom, legal institutions, political corruption, transparency, and instability. The values of all indicators are normalized between 0 and 1.

The Economic Freedom Index is a composite index on the institutional quality regarding the overall economic freedom (Krieger and Meierrieks, 2016; Kotschy and Sunde, 2017). It is composed of 42 variables in five general categories: size of government and taxation; private property and the rule of law; soundness of money; trade regulation and tariffs; regulation of business, labor and capital markets. Column (1) shows that economic freedom is indeed much higher in Strong Democracy than in Weak Democracy.

Two legal indicators developed by the Cline Center, legal infrastructure and legal order, are used to measure the rule of law. Column (2) shows that the legal infrastructure is higher in Strong Democracy but lower in Weak Democracy compared with autocracy, though in Column (3) differences in legal order are insignificant.[43]

In Column (4), the overall Political Corruption Index is significantly lower in Strong Democracy than in Weak Democracy, while there is no difference between Weak Democracy and autocracy.[44] Corruption often occurs where transparency is inad-

[43] Most indicators of the rule of law start much later (from 1990 or even 2000) or have smaller samples, which renders the dynamic panel data model less suitable. In cross-sectional results in the appendix, the rule of law is much higher in Strong Democracy than Weak Democracy.

[44] The same pattern holds true for each of the four sub-indexes covering corruption in judicial, public sector, legislature, and executive dimensions, where the difference is highest in executive corruption.

equate. This is confirmed in Column (5), where the HRV Index of transparency (Hollyer, Rosendorff and Vreeland, 2014) is significantly higher in Strong Democracy.[45]

An important function of democracy is to solve conflicts among different groups in a peaceful way. Too much instability would suggest a less effective political regime. Several variables are used to measure instability following Aisen and Veiga (2013). The Regime Instability Index reflects frequencies of constitutional changes, coups, cabinet changes, executive changes, and regime crisis; as shown in Column (6), it is much lower in Strong Democracy than autocracy and Weak Democracy. The Within-Regime Instability is measured by the number of legislative elections, fragmentation index, and government crises; as shown in Column (7), it is again significantly lower in Strong Democracy than Weak Democracy, even though higher than autocracy. These results suggest that Strong Democracy is much more effective in resolving substantial conflicts than Weak Democracy.[46]

The society-wide instability is captured by two variables: Social Unrest (Acemoglu et al., 2019) is a dummy variable where 1 means there is social unrest in that year, while the Violence Index measures the number of assassinations, revolutions, and wars. Results in the last two columns show that both indexes are much lower in Strong Democracy, while Weak Democracy and autocracy are not different from each other.

The overall pattern emerging from these results is very clear: The quality of economic, legal, political, and conflict resolution institutions is much higher in Strong Democracy than Weak Democracy. So the economic developmental condition during the transition period indeed exerts significant impacts on the institutional quality in many years after democratization, where adequate development during democratization is crucial for democracy to facilitate future economic growth.

[45] Similar results are also obtained using other transparency indicators in the appendix.

[46] The effects of violence or turmoils during the political transition time on future growth are studied by Huntington (1993), Cervellati and Sunde (2014), and Pozuelo, Slipowitz and Vuletin (2016) among others. Exploring the link between development and democratization scenarios seems to be a fruitful research topic.

There are a bit messy for the effects of Weak Democracy on these institutional qualities. Some institutions, such as economic freedom, violence and social unrest, are weakly improved; other are either weakly worse like political corruption and government transparency or greatly exacerbated like legal infrastructure. These phenomena could be explained by the sea-saw effect. As Acemoglu and Robinson (2010) discuss, there may be little influence on the general structure of institutions when specific institutional reforms are implemented but no fundamental political equilibrium changes. Since the masses have poor *de facto* political power in weak democratization, it should be difficult for the whole society to build strong foundations that make democracy works. Therefore, specific institution reforms may be ineffective because elites could take advantage of a multitude of alternative instruments to achieve their goals. In other words, without changing the power balance in society or the basic political equilibrium, taking away one instrument can simply lead to replace a new instrument.

The overall pattern found here also echoes the study of Acemoglu and Robinson (2006*a*, 2008); Acemoglu, Robinson and Torvik (2013). They propose that democratization needs not necessarily improve qualities of institution if the the change of *de jure* power distribution lead to an offsetting change in *de facto* political power distribution (e.g., in the forms of more lobbying, bribery, or brute force). We can see that weak democratization does not significantly improve the economic freedom; political corruption and government transparency become a bit worse. All these may imply that elites make great efforts to offset the reforms after democratization so that they can guarantee their *de facto* political power intact. However, it would be less likely to happen in strong democratization because economic structures at political transition time are better. Greater economic structures mean more physical or human capital-intensive sectors in the whole economy and production relations are also more complex. In this scenario, the masses have more political bargaining power and elites have less to gain through repressive methods.

So far we have provided the evidence of how different types of democracy are related to various institution mechanisms and thus may explain their different performances on growth. This is suggestive but gives no sense of their importance. We do a simple test that includes these institution mechanisms in growth regressions. If any of these were indeed a mechanism or mediator, when the corresponding variable was controlled in the growth regression, the effect of Strong Democracy would significantly reduce. The results are shown in Table 1.7.12. While many mechanisms have little influence on the growth pattern, the Strong Democracy coefficients are attenuated as we add economic freedom, government transparency (HRV index) and regime instability index. Also, the effect of Strong Democracy becomes insignificant when all institution-related variables are controlled. Economic freedom in particular seems to explain the bulk of the positive effect of Strong Democracy on growth (the coefficient on growth rate goes from a significant 1.394 to an insignificant 0.646). HRV index and regime instability index are also the important mechanisms since the influences of Strong Democracy on growth become less significant.

Besides institutional channels, we also explore the effect of Strong Democracy and Weak Democracy on other dimensions, including economic channels and demographic channels.

1.5.2. Economic Channels

Table 1.7.13 explores some potential economic channels. As to be expected from the lack of additional influences in Table 1.7.10 once lagged growth rates and GDP level are controlled, differences between Strong and Weak Democracies are not significant for trade share, investment rate, physical capital, TFP, market reform index, tax share, and tertiary enrollment rate.

However, they do differ from each other in other dimensions. Compared with Strong Democracy, the probability of having hyper-inflation[47] is much higher in Weak Democracy, and the government spending is much larger, together with higher primary and secondary enrollment rates as well as lower Gini coefficients.[48]

These results suggest that democracy without adequate economic development is likely to face heavy populism pressure to redistribute despite the lack of means to raise tax revenues (Persson and Tabellini, 1994; De Tocqueville, 2003; Huntington, 2006), which may lead to high inflation rates.

1.5.3. Demographic Channels

Differences in demographics are quite prevalent between Strong and Weak Democracies. In Table 1.7.14, the effect on population growth is negative for Strong Democracy but positive in Weak Democracy, both significantly different from autocracy. The population growth rate depends on both birth rate and death rate. Interestingly, Strong and Weak democracy have heterogeneous effects on them compared with autocracy: birth rates are much lower in Strong Democracy, while death rates are reduced more in Weak Democracy. So as a consequence, the population growth rate is reduced in Strong Democracies but increased in Weak Democracies. These results are broadly consistent with the populism tendency in Weak Democracies discussed above.

The fertility rate is also significantly lower in Strong Democracy than autocracy, so are infant and child mortality rates, while no significant differences are found between Weak Democracy and autocracy. The effects on life expectancy of the two democracies, though positive, are not statistically different from autocracy.

[47] It is a dummy variable equal to 1 if $CPI_{i,t} \geq 50\%$ and 0 otherwise.

[48] However, in Column (9) the overall human capital as measured by Aisen and Veiga (2013) is much lower in Weak Democracy, which combines the average years of schooling in the population over 25 years old, the returns to schooling, and labor force participation rate. Noticing the drop of sample size in Column (9), we repeat regressions on primary and secondary enrollment rates using the same sample, and results remain unchanged. The Online Appendix shows that Weak Democracy significantly lowers the labor participation rate, which may explain why higher enrollment rates and lower human capital stock coexist.

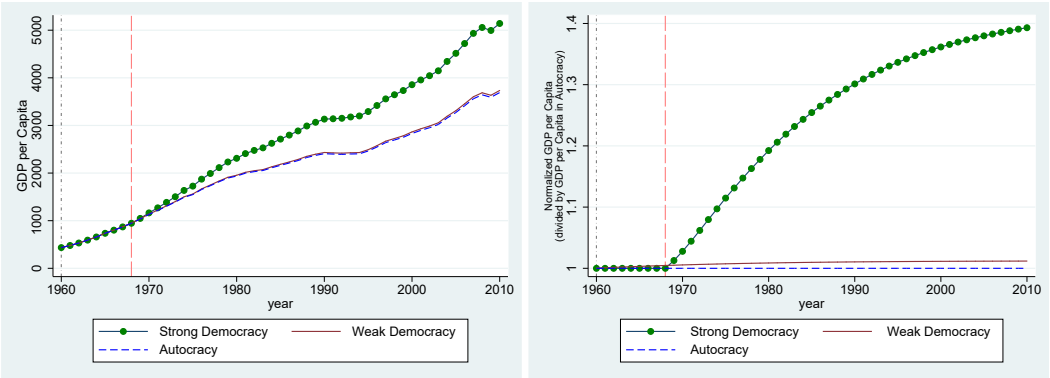


Figure 1.4.. Simulated GDP Paths of Strong Democracy, Weak Democracy, and Autocracy

1.6. Discussions and Policy Implications

1.6.1. Timing of Democratization: Now or Later?

Our results show that Strong Democracy boosts economic growth but Weak Democracy does not. This gives rise to an intriguing question: Shall a poor country democratize first but into a Weak Democracy, or improve economic development first to prepare for a later transition to a Strong Democracy?

A proper answer to such a question involves many dimensions beyond the scope of this paper. Here we only attempt to provide some simple conceptual exploration focusing on the perspective of economic growth. The growth trajectories of three political regime choices (namely Autocracy, Weak Democracy, and Strong Democracy) are simulated from 1960 to 2010 based on the baseline results in Column (3) of Table 1.7.2. At the starting point of 1960, country j is independent but under autocracy with GDP per capita at \$400, and the threshold GDP per capita of becoming a Strong Democracy is set at \$900 (the 25^{th} percentile). Results are plotted in the following two graphs, one with real GDP paths and the other with normalized paths against Autocracy.

On the Autocracy Path, the country never becomes democracy; the trajectory of its GDP per capita is the dashed line in both graphs. If it chooses to democratize immediately in 1960, it would follow the Weak Democracy Path along the solid line in the graphs. Since Weak Democracy has little impact on growth, it is almost

indistinguishable from the Autocracy Path. The Strong Democracy Path is the dotted line in the graphs, where the country stays in autocracy for the first several years, and then transits into Strong Democracy in 1968, the first period when its income per capita is over the threshold $900. From then on it embarks on a much higher growth path, surpassing Weak Democracy from 1969 and staying ahead of the other two paths with more than 37% higher GDP in 2010.

So from the economic growth perspective alone, not rushing to democracy may be a desirable strategy for countries with low development levels; it is beneficial to improve economic conditions first, and then jump onto the Strong Democracy Path of faster growth in many years to come.

1.6.2. A More Realistic Indicator for Weak Democracy

The main motivation for categorizing Weak and Strong Democracies in this paper is to show that democracy has heterogeneous effects on economic growth. Without adequate development, democratization itself does not improve growth. Then another question follows: how do we predict whether a country has the adequate development or not?

In our empirical results so far, a single variable is used as the developmental indicator to categorize Weak Democracy, which is mainly to guarantee simplicity, transparency, and objectivity. But it is far from being realistic because each variable alone can't capture the overall development that enables a country to establish growth-facilitating institutions after democratization. For example, even when a country is relatively rich, but if the income is mainly from natural resources, or if its people are still poorly educated, or if the inequality is very high, one may suspect that it is not ready yet to run a solid democracy that needs robust and enlightened public participation. So a more practical criterion should combine all useful information together.

There are many possible ways to combine various developmental indicators. Finding an optimal way to do this seems to be a fruitful topic for future research. As a first attempt, we use developmental variables in our earlier tables, namely, GDP, secondary enrollment ratio, tertiary enrollment ratio, the natural resource share of GDP, industry share of GDP, and the Gini coefficient at the transition period to categorize a country into Weak Democracy if any of these variables falls short of its specific threshold.[49]

Based on this combined indicator, Weak Democracy constitutes 45% of the sample, and the main results on growth effects and mechanisms are again similar to the benchmark. As shown in Table 1.7.15, the differences between Strong and Weak Democracy become even more striking in most cases.[50]

1.6.3. Comparison between Benin and Ghana

As an illustration on the relevance of our results, this subsection compares the political economy situations of Benin and Ghana in West Africa. Both countries went through democratization in the 1990s, and are considered as fully "free" democracies by Freedom House, while their polity scores have been above 6 since 2005. But economic growth in Benin didn't improve after democratization, while the opposite is true for Ghana. Figure 1.1 plots GDP per capita growth rates in Benin and Ghana respectively after controlling effects of growth dynamics, income level, and the time trend.

Such discrepancy in growth, however, is not surprising based on our results, where Benin is categorized as Weak Democracy while Ghana as Strong Democracy given their development conditions during democratization. As shown in Panel A of Table

[49]The threshold for each of these indicators is set at the cutoff that best separates Strong and Weak Democracy in growth effect as reported in Table 1.7.2 and 1.7.3, which are the 25^{th}, 20^{th}, 25^{th}, 15^{th}, 10^{th}, and 10^{th} percentiles, respectively.

[50]The full set of regression results are available upon request. Honduras, for example, is categorized into Weak Democracy by its high inequality and heavy reliance on natural resources (Auty, 2001), despite adequate income and schooling levels at the transition period. South Africa is another example. Both experience worse economic growth after democratization.

1.7.16, the GDP per capita of Benin at the political transition year 1991 is only 610, well below the threshold 900 adopted in our baseline results, while Ghana's GDP in the democratization year exceeds that level. Consistent with their differences in GDP levels, both human capital and the industry share are much lower in Benin than in Ghana at the transition time; for example, the population percentage with secondary schooling was only 8.65% in Benin but 43% in Ghana.

The overall institutional quality is also much lower in Benin than in Ghana, which is shown in Panel B of Table 1.7.16.[51] In Benin, the average Economic Freedom Indicator is worse off after democratization, and so are the other major institutions such as legal infrastructure, political corruption, transparency, and instability. While in contrast, most of these indicators become better in Ghana after the democratic transition. Benin is also ranked at the bottom among stable democratic countries in Africa on almost all dimensions of governance (WGI) (Pinkston, 2016).[52]

As the recent literature in political science and economics (Lindberg, 2006; Bank, 2007; Aryeetey and Kanbur, 2008; Bierschenk, 2009; World Bank, 2009; Polity, 2010; Bertelsmann, 2010*a*,*b*; Pinkston, 2016) has confirmed, the deep-rooted political economic structure has not been changed in Benin by its democratic transition, where the economy is almost entirely informal with low productivity, and the politics are controlled by a closed group of elite as government insiders relying on foreign aid and donations. In contrast, Ghana has robust private sectors that are capable of supporting healthy political competition to facilitate broad economic growth. A more disturbing observation is that other African democracies such as Kenya, Malawi, Senegal, and Zambia are more like Benin than Ghana (Pinkston, 2016), all of which are also categorized as Weak Democracy based on our grouping strategy. This suggests that the failure of democratization to improve growth is quite prevalent in countries with poor development.

[51] To precisely compare the effects of democratization on these indicators, we have removed other confounding influences from lagged levels, current and past incomes, as well as the time trend. In the appendix, we directly use raw data for comparison, and the patterns are similar; the corresponding indicators before and after democratization are also plotted.

[52] See the appendix for more details.

1.6.4. Weak Democracy and Partial Democracy

The concept of Weak Democracy is based on its (lack of) ability to improve economic growth, and the categorizing criterion is the overall institutional quality, which is proxied in this paper by economic development in the political transition period. It is different from Partial Democracy, which is defined from the political side as any country with a polity score between 1 and 7 (Epstein et al., 2006; Papaioannou and Siourounis, 2008*b*). Though motivated from different perspectives, these two concepts are closely related. For example, the median polity score of Weak Democracies based on the above combined index is 6, while that of Strong Democracies is 8, where the share of partial democracy is 87% in the group of Weak Democracy, and 57% in Strong Democracy.

This suggests that a country with weak development at transition time is more likely to see no significant improvement in economic growth and to end up in a partial democracy on the political side. Given that most democratization cases after 1960 are partial democracy (Epstein et al., 2006), and among them almost half are Weak Democracy, their economic and political situations seem to have distinct features from traditional democracies, and thus need more in depth research in future works.

1.6.5. Does Development Matter?

The main message of this paper is that adequate development during the transition time is important for democratization to facilitate future economic growth. Acemoglu et al. (2019) also find evidence that democracy is more conducive to growth in countries with more educated people than in others, but their estimated effect of development is quantitatively small.

In order to facilitate a direct comparison, we use the model setup of Acemoglu et al. (2019) and construct the interaction term of poor development and democracy

$$Interaction_{it} = Democracy_{it} * WeakDev_{it},$$

where *WeakDev* is a dummy variable that equals 1 if the development indicator at the transition time is below a threshold, and 0 otherwise. The only difference from Acemoglu et al. (2019) is the time at which development is measured: they use a range of fixed years such as 1960 or 1970 for all countries, while we use the political transition year for each country. In this specification, the coefficient of *Democracy* is equivalent to that of Strong Democracy in our basic set up, and the sum of coefficients of *Democracy* and *Interaction* is equal to that of Weak Democracy. In other words, the difference in coefficients between Strong and Weak Democracy is equivalent to the coefficient of *Interaction* here.

The results are presented in Table 1.7.17, where several variables are used to indicate poor development, including GDP, secondary and tertiary enrollment rates, natural resources rents of GDP, industry share of GDP, and net Gini coefficient. The estimated coefficients of this interaction term are significantly negative for all of these development indicators with appropriate cutoffs, and some of them have larger magnitudes than the democracy coefficient, meaning that under poor development the overall effect of democracy is negative. For example, in Panel B at the *p20* cutoff of secondary enrollment rate, the coefficient of Democracy is 1.294, while that of the interaction term with poor development is -1.562, meaning that the effect of democracy in a poor development country on growth is -0.268. In Panel E at the *p15* cutoff of industry share, the coefficient of Democracy is 1.065, while that of the interaction term with poor development is -1.920, making a net effect of -0.855. These results demonstrate that development indeed matters.

The main reason why these results differ from Acemoglu et al. (2019) is that the economic development indicators are measured at the *transition time*, while theirs in an arbitrarily fixed year.[53] So development matters most at the *critical junction* of the political transition time when different groups in society negotiate with

[53]Without properly considering GDP growth dynamics may also lead to biased estimates of democracy on economic performance. For example, the growth effects in Benin and Madagascar (Rodrik and Wacziarg, 2005) become insignificant after controlling growth dynamics and past income levels.

each other intensively to establish the fundamental institutions, since the political bargaining power of each group is often underpinned by its economic clout at that moment (Huang, 2012*a*).

1.7. Concluding Remarks

Is democracy a better political regime for economic prosperity than autocracies? This paper suggests that the answer depends on the economic development during the transition periods of democratization when the foundation of democratic institutions is laid. Countries already having an adequate economic structure for democracy, which are labeled Strong Democracy in the paper, grow faster after democratization compared with autocracies, while the others that are not so ready and thus called Weak Democracy, do not. Based on a combined developmental index containing information on income, education, natural resource reliance, and inequality, about 45% of democratization cases after 1960 are Weak Democracy.

The analysis of potential mechanism reveals that Weak Democracy is more populist in public policies, less transparent in government operations, weaker in legal infrastructure, higher in political corruption and social instabilities compared with Strong Democracy. This lower institutional quality in Weak Democracy is determined by the poor economic development in the political transition period, enabling it to affect future growth well beyond the typically temporary effect of economic development in routine times.

These results are consistent with both the modernization theory and the new institutional theory in that economic development affects the institutional quality, which in turns exerts substantial effects on future economic growth. During the crucial transitional period where new institutions are established, the overall economic structure has the kind of birthmark effects on the institutional quality. Once institutions are stabilized, however, the direct feedback from economic development is smaller, while the indirect effects through institutions become more dominant.

Some fruitful topics for future research include finding more accurate and practical criteria to help a country gauge the readiness for Strong Democracy, examination of the links between development and specific formats of democratization, and exploring ways to help a Weak Democracy improve its institutions and growth.

Table 1.7.1.. Summary Statistics

	Strong Democracy			Weak Democracy			Autocracy			Strong - Weak		
Variable	Obs.	Mean	(Std.)	Obs.	Mean	(Std.)	Obs.	Mean	(Std.)	Mean	(Std.)	p-value
Economic & Demographic Indicators												
GDP per capita Growth (%)	2,411	2.140	(4.459)	338	2.169	(4.762)	3,058	1.512	(8.054)	-0.029	(0.261)	0.456
GDP per Capita (2010 US$)	2,439	16942	(17712)	338	893	(1154)	3152	4610	(10465)	16049	(964)	0.000
Tax Revenue (%, GDP)	1,691	0.216	(0.093)	239	0.158	(0.087)	2,722	0.162	(0.096)	0.058	(0.006)	0.000
Government Spending (%, GDP)	2,322	16.536	(5.741)	325	15.860	(7.361)	2,906	15.707	(7.861)	0.675	(0.353)	0.028
Investment (%, GDP)	2,222	24.102	(7.136)	332	21.435	(11.162)	2,853	22.690	(13.830)	2.667	(0.458)	0.000
Trade (%, GDP)	2,401	76.968	(39.738)	325	70.983	(45.309)	3,001	75.706	(57.246)	5.986	(2.390)	0.006
TFP	1,854	0.931	(0.162)	160	0.974	(0.082)	1,697	1.076	(0.419)	-0.043	(0.013)	0.001
Gini	1,535	35.732	(10.175)	239	41.529	(6.963)	1,140	37.334	(9.426)	-5.797	(0.682)	0.000
Gross Enrollment Ratio, primary	2,002	102.989	(11.770)	262	90.362	(28.424)	2,612	88.774	(28.046)	12.627	(0.965)	0.000
Gross Enrollment Ratio, secondary	1,764	81.494	(26.862)	211	31.209	(19.623)	2,153	44.944	(31.585)	50.285	(1.908)	0.000
Child Mortality Rate	2,455	33.630	(37.129)	338	132.063	(62.650)	3,696	120.616	(87.680)	-98.433	(2.382)	0.000
Fertility Rate	2,402	2.743	(1.331)	338	5.394	(1.297)	4,256	5.069	(1.903)	-2.650	(0.077)	0.000
Population Growth	2,484	1.095	(1.022)	338	2.590	(0.820)	4,278	2.338	(1.716)	-1.495	(0.058)	0.000
Institutional Quality Indicators												
Economic Freedom	1,785	0.675	(0.151)	239	0.537	(0.105)	1,307	0.503	(0.176)	0.138	(0.011)	0.000
Market Reforms Index	1,860	0.558	(0.225)	223	0.492	(0.238)	2,953	0.213	(0.229)	0.066	(0.016)	0.000
Legal Infrastructure	2,019	0.340	(0.220)	322	0.113	(0.062)	3,367	0.136	(0.099)	0.228	(0.012)	0.000
Political Corruption	2,144	0.343	(0.302)	337	0.673	(0.213)	3,262	0.633	(0.236)	-0.330	(0.017)	0.000
Transparency (HRV Index)	1,346	0.556	(0.133)	291	0.380	(0.058)	1,633	0.378	(0.086)	0.175	(0.008)	0.000
Regime Instability Index	1,475	0.060	(0.087)	133	0.085	(0.129)	2,926	0.068	(0.119)	-0.026	(0.008)	0.001
Within Regime Instability Index	1,900	0.131	(0.122)	206	0.137	(0.139)	3,132	0.074	(0.098)	-0.005	(0.009)	0.281
Violence Index	1,464	0.034	(0.093)	128	0.041	(0.074)	2,880	0.063	(0.125)	-0.007	(0.008)	0.220
Social Unrest	2,345	0.198	(0.398)	321	0.277	(0.448)	3,214	0.279	(0.449)	-0.079	(0.024)	0.001

Note: All institution quality indicators are normalized between 0 and 1. See the text and Appendix for the full description of the variables and their corresponding sources. T tests are implemented to compare whether the differences between Strong and Weak Democracy groups are significantly different with zero.

Table 1.7.2.. Effects of Strong and Weak Democracies on GDP Growth: Baseline Results

	GDP Percentiles in Political Transition Period as Cutoffs						No Grouping
Dependent Variable:	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Growth Rate	p15	p20	p25	p30	p35	p40	
Strong Democracy	1.111***	1.279***	1.394***	1.258***	1.233***	0.906**	
	(0.339)	(0.346)	(0.362)	(0.371)	(0.398)	(0.356)	
Weak Democracy	0.219	0.079	0.048	0.496	0.615	0.930**	
	(0.484)	(0.420)	(0.382)	(0.412)	(0.401)	(0.427)	
Democracy							0.919***
							(0.303)
GDP Growth First Lag	0.165**	0.165**	0.165**	0.165**	0.165**	0.165**	0.165**
	(0.066)	(0.066)	(0.066)	(0.066)	(0.066)	(0.066)	(0.066)
GDP Growth Second Lag	0.045**	0.045**	0.045**	0.045**	0.045**	0.045**	0.045**
	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)
GDP Growth Third Lag	0.042**	0.042**	0.042**	0.041**	0.041**	0.041**	0.041**
	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)
GDP Fourth Lag	-3.904***	-3.903***	-3.920***	-3.913***	-3.913***	-3.862***	-3.864***
	(0.783)	(0.777)	(0.779)	(0.786)	(0.793)	(0.793)	(0.778)
Coef. Test (p-value):							
$\beta_S = \beta_W$	0.0955	0.0128	0.0039	0.1209	0.2303	0.9625	
Countries	153	153	153	153	153	153	153
Observations	5419	5419	5419	5419	5419	5419	5419
Adjusted R^2	0.151	0.151	0.152	0.151	0.151	0.151	0.151

Note: A full set of country and year fixed effects are controlled in all specifications. Robust standard errors for heteroscedasticity and serial correlation at the country level are in the parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 1.7.3.. Effects of Strong and Weak Democracies on GDP Growth: Alternative Development Indicators

Dependent Variable: Growth Rate	(1) p10	(2) p15	(3) p20	(4) p25	(5) p30	(6) p35	(7) p40	(8) p45	(9) p50
	Panel A: Secondary Enrollment Ratio Percentiles in Political Transition Period as Cutoffs								
Strong Democracy	1.044***	1.139***	1.294***	1.370***	1.271***	1.371***	1.318***	1.502***	1.638***
	(0.381)	(0.379)	(0.389)	(0.412)	(0.425)	(0.437)	(0.462)	(0.527)	(0.547)
Weak Democracy	0.116	-0.15	-0.268	0.004	0.37	0.32	0.478	0.486	0.428
	(0.713)	(0.723)	(0.558)	(0.513)	(0.481)	(0.451)	(0.431)	(0.389)	(0.382)
Coef. Test (p-value): $\beta_S = \beta_W$	0.2166	0.0905	0.0101	0.0202	0.1103	0.055	0.1279	0.0805	0.0427
Countries	148	148	148	148	148	148	148	148	148
Observations	4992	4992	4992	4992	4992	4992	4992	4992	4992
	Panel B: Tertiary Enrollment Ratio Percentiles in Political Transition Period as Cutoffs								
Strong Democracy	0.917**	1.074***	1.070***	1.182***	1.240***	1.206***	1.387***	1.377***	1.404***
	(0.360)	(0.357)	(0.372)	(0.382)	(0.404)	(0.411)	(0.434)	(0.465)	(0.500)
Weak Democracy	0.356	-0.169	0.11	-0.066	0.103	0.281	0.192	0.354	0.423
	(0.654)	(0.583)	(0.557)	(0.521)	(0.434)	(0.445)	(0.403)	(0.382)	(0.373)
Coef. Test (p-value): $\beta_S = \beta_W$	0.4259	0.0472	0.1081	0.03	0.0266	0.0797	0.0198	0.0492	0.0729
Countries	140	140	140	140	140	140	140	140	140
Observations	4792	4792	4792	4792	4792	4792	4792	4792	4792
	Panel C: Non-Natural Resources Share of GDP in Political Transition Period as Cutoffs								
Strong Democracy	1.053***	1.188***	1.086***	1.142***	1.153***	1.097***	1.209***	1.275***	1.500***
	(0.320)	(0.319)	(0.308)	(0.316)	(0.331)	(0.337)	(0.365)	(0.372)	(0.386)
Weak Democracy	-1.105	-1.319*	0.289	0.303	0.460	0.667	0.615	0.580	0.459
	(0.919)	(0.703)	(0.848)	(0.692)	(0.576)	(0.519)	(0.453)	(0.449)	(0.422)
Coef. Test (p-value): $\beta_S = \beta_W$	0.0237	0.0009	0.3588	0.2456	0.2661	0.4491	0.2677	0.2051	0.0568
Countries	145	145	145	145	145	145	145	145	145
Obs.	5005	5005	5005	5005	5005	5005	5005	5005	5005
	Panel D: Industry Share of GDP Percentiles in Political Transition Period as Cutoffs								
Strong Democracy	1.038***	1.065***	1.027***	1.038**	1.126***	1.169***	1.266***	1.069**	1.149***
	(0.377)	(0.385)	(0.379)	(0.400)	(0.402)	(0.412)	(0.440)	(0.411)	(0.437)
Weak Democracy	-1.533**	-0.855	-0.07	0.222	0.061	0.142	0.132	0.537	0.512
	(0.638)	(0.637)	(0.892)	(0.689)	(0.666)	(0.606)	(0.546)	(0.575)	(0.530)
Coef. Test (p-value): $\beta_S = \beta_W$	0.0002	0.0048	0.2284	0.2624	0.1359	0.1232	0.077	0.4069	0.3086
Countries	138	138	138	138	138	138	138	138	138
Observations	4801	4801	4801	4801	4801	4801	4801	4801	4801
	Panel E: Economic Equality (1-Gini) in Political Transition Period as Cutoffs								
Strong Democracy	1.030***	1.076***	1.049***	1.120***	1.264***	1.324***	1.266***	1.325***	1.506***
	(0.376)	(0.391)	(0.397)	(0.418)	(0.415)	(0.430)	(0.457)	(0.464)	(0.514)
Weak Democracy	-0.184	-0.064	0.291	0.326	0.102	0.195	0.408	0.365	0.374
	(0.424)	(0.378)	(0.478)	(0.436)	(0.490)	(0.479)	(0.457)	(0.447)	(0.398)
Coef. Test (p-value): $\beta_S = \beta_W$	0.0121	0.0105	0.1541	0.1245	0.043	0.0553	0.1453	0.1037	0.0602
Countries	132	132	132	132	132	132	132	132	132
Observations	4514	4514	4514	4514	4514	4514	4514	4514	4514

Note: A full set of country and year fixed effects are controlled in all specifications as well as three lags of growth rates and the fourth lag of GDP per capita. Standard errors robust against heteroscedasticity and serial correlation at the country level are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 1.7.4.. Effects of Strong and Weak Democracies on GDP Growth: Alternative Democracy Indicators

	GDP Percentiles in Political Transition Period as Cutoffs						No Grouping
Dependent Variable:	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Growth	p15	p20	p25	p30	p35	p40	
	Panel A: Democracy Indicator from Polity						
Strong Democracy	0.429	0.535*	0.626*	0.740**	0.659*	0.760**	
	(0.311)	(0.315)	(0.317)	(0.327)	(0.341)	(0.379)	
Weak Democracy	-0.632	-0.747	-0.679	-0.626	-0.358	-0.326	
	(0.685)	(0.622)	(0.537)	(0.475)	(0.456)	(0.512)	
Democracy							0.249
							(0.271)
Coef. Test (p-value): $\beta_S = \beta_W$	0.1413	0.0545	0.0277	0.0132	0.0614	0.1016	
Countries	128	128	128	128	128	128	128
Observations	4689	4689	4689	4689	4689	4689	4689
	Panel B: Democracy Indicator from CGV						
Strong Democracy	0.970**	1.064**	1.193**	0.942*	0.845*	0.756	
	(0.449)	(0.484)	(0.524)	(0.502)	(0.506)	(0.505)	
Weak Democracy	-0.387	-0.297	-0.294	0.184	0.335	0.469	
	(0.458)	(0.371)	(0.360)	(0.472)	(0.476)	(0.477)	
Democracy							0.592*
							(0.331)
Coef. Test (p-value): $\beta_S = \beta_W$	0.0259	0.0189	0.0157	0.2486	0.4402	0.662	
Countries	150	150	150	150	150	150	150
Observations	4694	4694	4694	4694	4694	4694	4694
	Panel C: Democracy Indicator from BMR						
Strong Democracy	0.836*	1.080**	1.149**	1.159**	0.921*	0.801	
	(0.447)	(0.487)	(0.519)	(0.557)	(0.542)	(0.553)	
Weak Democracy	0.079	-0.244	-0.204	-0.004	0.359	0.544	
	(0.542)	(0.465)	(0.409)	(0.402)	(0.456)	(0.463)	
Democracy							0.691**
							(0.337)
Coef. Test (p-value): $\beta_S = \beta_W$	0.2675	0.0442	0.0375	0.085	0.4164	0.7119	
Countries	151	151	151	151	151	151	151
Observations	4957	4957	4957	4957	4957	4957	4957
	Panel D: Democracy Indicator from PS						
Strong Democracy	1.310***	1.320***	1.105***	1.064**	1.053**	1.065**	
	(0.473)	(0.489)	(0.409)	(0.427)	(0.438)	(0.473)	
Weak Democracy	0.39	0.597	1.243	1.307	1.305*	1.246*	
	(0.651)	(0.603)	(0.903)	(0.801)	(0.747)	(0.637)	
Democracy							1.144***
							(0.427)
Coef. Test (p-value): $\beta_S = \beta_W$	0.2095	0.2994	0.8799	0.7683	0.748	0.7969	
Countries	124	124	124	124	124	124	124
Observations	4472	4472	4472	4472	4472	4472	4472

Note: A full set of country and year fixed effects are controlled in all specifications as well as three lags of growth rates and the fourth lag of GDP per capita. Standard errors robust against heteroscedasticity and serial correlation at the country level are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 1.7.5.. Effects of Strong and Weak Democracies on GDP Growth: Using More Controls

Dependent Variable: Growth Rate	(1) At Least 20 Obs.	(2) Regional Trends	(3) Soviet Dummies	(4) Outlier Excluded	(5) Including All
Strong Democracy	1.398***	1.229***	1.135***	0.801***	0.701***
	(0.366)	(0.342)	(0.341)	(0.261)	(0.262)
Weak Democracy	0.044	0.04	0.104	-0.453*	-0.403
	(0.381)	(0.553)	(0.369)	(0.234)	(0.309)
GDP Growth First Lag	0.168**	0.160**	0.165**	0.189***	0.188***
	(0.068)	(0.062)	(0.066)	(0.017)	(0.016)
GDP Growth Second Lag	0.043**	0.023	0.047**	0.040***	0.027*
	(0.021)	(0.022)	(0.020)	(0.013)	(0.015)
GDP Growth Third Lag	0.045**	0.041**	0.046***	0.014	0.02
	(0.018)	(0.019)	(0.017)	(0.013)	(0.015)
GDP Fourth Lag	-3.921***	-4.646***	-3.730***	-2.413***	-2.665***
	(0.782)	(0.745)	(0.779)	(0.317)	(0.407)
Coef. Test (p-value): $\beta_S = \beta_W$	0.0038	0.0376	0.0202	0.0001	0.004
Countries	141	153	153	153	141
Observations	5284	5419	5419	4879	4759
Adjusted R^2	0.152	0.197	0.156	0.249	0.269

Note: Column (1) excludes countries with less than 20 observations of the dependent variable. Column (2) adds regional trends. Column (3) adds interactions between a dummy for Soviet-related countries and dummies for the years 1989, 1990, 1991, and post-1992. Column (4) removes observations with a standardized residual estimated below percentile 5 or above percentile 95. In Column (5), all factors controlled are controlled. A full set of country and year fixed effects are controlled in all specifications. Standard errors robust against heteroscedasticity and serial correlation at the country level are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 1.7.6.. Effects of Strong and Weak Democracies on GDP Growth: Using Instrumental Variables

Dependent Variable:	(1)	(2)	(3)	(4)	(5)	(6)
Growth Rate	Genetic Distance Weighted		Regional Democracy Average		Region+Initial Political Regime	
Strong Democracy	3.61		3.883**		1.967**	
	(3.363)		(1.697)		(0.833)	
Weak Democracy	-2.631		0.699		-0.499	
	(3.433)		(1.833)		(1.808)	
Democracy		21.604		2.01		1.657**
		(39.357)		(1.390)		(0.788)
Coef. Test (p-value): $\beta_S = \beta_W$	0.0938		0.0875		0.1525	
Hansen test (p-value)	0.1298	0.3934	0.0073	0.1475	0.016	0.0324
F Tests in First Stage:						
IV for Strong Democracy	2.585		2.916		9.047	
IV for Weak Democracy	1.500		3.562		3.326	
IV for Democracy		0.736		5.783		12.53
Partial R^2 for Strong Democracy (p-value)	0.0237		0.0761		0.179	
Partial R^2 for Weak Democracy (p-value)	0.0400		0.1460		0.1110	
Partial R^2 for Democracy (p-value)		0.0009		0.0426		0.1040
Countries	146	146	149	149	149	149
Observations	5,271	5,271	5,241	5,241	5,206	5,206

Note: All columns present results using the 2SLS method. A full set of country and year fixed effects are controlled in all specifications as well as three lags of growth rates and the fourth lag of GDP per capita. Standard errors robust against heteroscedasticity and serial correlation at the country level are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 1.7.7.. Effects of Strong and Weak Democracies on GDP Growth: Controlling Development

Dependent Variable: Growth Rate	(1) p15	(2) p25	(3) p35	(4) p45	(5) p55	(6) p65	(7) p75	(8) p85
	Panel A: Using GDP per Capita Percentiles for Poor Dummy							
Strong Democracy	1.245***	1.333***	1.698***	1.622***	1.483***	1.434***	1.363***	1.400***
	(0.386)	(0.383)	(0.434)	(0.430)	(0.389)	(0.351)	(0.356)	(0.366)
Weak Democracy	-0.135	-0.094	-0.179	-0.103	-0.022	0.009	0.029	0.072
	(0.404)	(0.436)	(0.465)	(0.437)	(0.412)	(0.395)	(0.387)	(0.385)
Poor Dummy	-3.765***	-4.533***	-4.299***	-3.362***	-2.661**	-1.593**	-1.049	-1.428**
	(0.915)	(1.231)	(1.282)	(0.927)	(1.025)	(0.713)	(0.719)	(0.556)
Coef. Test (p-value): $\beta_S = \beta_W$	0.0056	0.007	0.0018	0.0026	0.0039	0.0026	0.0044	0.0047
	Panel B: Using Secondary Enrollment Rate Percentiles for Poor Dummy							
Strong Democracy	1.596***	1.600***	1.574***	1.491***	1.437***	1.581***	1.601***	1.597***
	(0.536)	(0.537)	(0.556)	(0.531)	(0.497)	(0.511)	(0.536)	(0.537)
Weak Democracy	-0.294	-0.311	-0.315	-0.266	-0.322	-0.289	-0.316	-0.318
	(0.428)	(0.425)	(0.430)	(0.427)	(0.421)	(0.416)	(0.427)	(0.429)
Poor Dummy	-0.413	-0.103	0.218	1.225***	1.708***	1.267**	0.125	-0.139
	(0.719)	(0.439)	(0.451)	(0.426)	(0.552)	(0.508)	(0.442)	(0.321)
Coef. Test (p-value): $\beta_S = \beta_W$	0.0057	0.0051	0.0072	0.0091	0.0058	0.0041	0.0051	0.0053
	Panel C: Using Tertiary Enrollment Rate Percentiles for Poor Dummy							
Strong Democracy	1.218***	1.227***	1.179**	1.164**	1.221***	1.224***	1.226***	1.207***
	(0.462)	(0.459)	(0.455)	(0.477)	(0.462)	(0.456)	(0.459)	(0.455)
Weak Democracy	-0.342	-0.421	-0.409	-0.370	-0.377	-0.394	-0.390	-0.394
	(0.407)	(0.400)	(0.388)	(0.399)	(0.401)	(0.408)	(0.405)	(0.409)
Poor Dummy	-0.558	0.191	0.744	0.513	0.182	-0.311	-0.215	-1.129***
	(0.362)	(0.492)	(0.598)	(0.615)	(0.581)	(0.469)	(0.491)	(0.357)
Coef. Test (p-value): $\beta_S = \beta_W$	0.0080	0.0049	0.0053	0.0093	0.006	0.0055	0.0056	0.0062
	Panel D: Using Industry Share of GDP Percentiles for Poor Dummy							
Strong Democracy	1.725***	1.723***	1.744***	1.764***	1.809***	1.802***	1.862***	1.887***
	(0.502)	(0.500)	(0.504)	(0.519)	(0.522)	(0.520)	(0.505)	(0.491)
Weak Democracy	-0.235	-0.225	-0.217	-0.220	-0.227	-0.230	-0.189	-0.167
	(0.409)	(0.417)	(0.431)	(0.434)	(0.436)	(0.438)	(0.443)	(0.437)
Poor Dummy	-0.515	-0.469	-0.364	-0.690**	-0.706**	-0.689*	-1.084***	-0.999**
	(0.413)	(0.320)	(0.351)	(0.304)	(0.328)	(0.352)	(0.390)	(0.498)
Coef. Test (p-value): $\beta_S = \beta_W$	0.0013	0.0016	0.0020	0.00220	0.0020	0.0020	0.0015	0.0010
	Panel E: Using Urbanization Rate Percentiles for Poor Dummy							
Strong Democracy	1.394***	1.424***	1.394***	1.354***	1.363***	1.395***	1.427***	1.396***
	(0.362)	(0.363)	(0.361)	(0.369)	(0.355)	(0.363)	(0.374)	(0.364)
Weak Democracy	0.034	0.024	0.067	0.034	0.016	0.049	0.036	0.046
	(0.382)	(0.398)	(0.380)	(0.377)	(0.379)	(0.383)	(0.384)	(0.382)
Poor Dummy	-0.261	-0.609	-0.309	1.690	1.280*	-0.098	1.132*	0.253
	(0.777)	(0.600)	(0.852)	(1.340)	(0.751)	(0.662)	(0.675)	(0.396)
Coef. Test (p-value): $\beta_S = \beta_W$	0.0037	0.0033	0.0046	0.0050	0.0035	0.0039	0.0032	0.0039

Note: For each period, the Poor Dummy is equal to 1 if the economic development indicator of a country is lower than the threshold percentile specified in each column, and 0 otherwise. A full set of country and year fixed effects are controlled in all specifications as well as three lags of growth rates and the fourth lag of GDP per capita. Standard errors robust against heteroscedasticity and serial correlation at the country level are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 1.7.8.. Effects of Strong and Weak Democracies on GDP Growth: Compare Two Grouping Strategies

Dependent Variable:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	GDP per Capita in Fixed Year to Group Democracy							
Growth Rate	1960	1965	1970	1975	1980	1985	1990	1995
Strong Democracy In Both Strategies (β_S)	0.783***	1.085***	1.198***	1.292***	1.438***	1.402***	1.406***	1.399***
	(0.287)	(0.329)	(0.368)	(0.362)	(0.378)	(0.384)	(0.375)	(0.369)
Weak Democracy In Both Strategies (β_W)	0.306	0.302	0.145	0.196	0.271	0.086	0.031	0.044
	(0.367)	(0.358)	(0.424)	(0.418)	(0.393)	(0.391)	(0.402)	(0.381)
Strong Democracy In "Right" Strategy	2.690***	2.852***	2.255***	2.284***	4.795***	2.553**	1.137***	1.149***
But Weak Democracy In "Wrong" Strategy	(0.675)	(0.851)	(0.621)	(0.611)	(0.665)	(1.129)	(0.298)	(0.295)
Weak Democracy In "Right" Strategy	0.871	0.810	0.487	0.599	0.639	0.744	0.202	
But Strong Democracy In "Wrong" Strategy	(1.002)	(0.992)	(0.864)	(0.874)	(0.953)	(0.917)	(0.756)	
Coef. Test (p-value): $\beta_S = \beta_W$	0.2590	0.0723	0.0380	0.0286	0.0160	0.0069	0.0050	0.0042
Countries	79	83	93	98	114	123	141	149
Observations	3,625	3,793	4,153	4,308	4,742	4,956	5,284	5,393
Adjusted R^2	0.136	0.153	0.112	0.112	0.122	0.132	0.151	0.153

Note: A full set of country and year fixed effects are controlled in all specifications as well as three lags of growth rates and the fourth lag of GDP per capita. Standard errors robust against heteroscedasticity and serial correlation at the country level are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 1.7.9.. Effects of Strong and Weak Democracies on GDP Growth: Controlling Democratic Formats

Adding Covariates:	(1) Democratic Stock	(2) Majoritarian versus Proportional	(3) Parliamentary versus Presidential	(4) All forms of Democracies	(5) All Covariates
Strong Democracy	1.204***	1.492**	1.635***	1.717***	1.477**
	(0.358)	(0.609)	(0.461)	(0.655)	(0.645)
Weak Democracy	0.07	-0.46	-0.004	0.156	0.256
	(0.376)	(0.606)	(0.441)	(0.707)	(0.694)
Democratic Stock	0.005*				0.008**
	(0.002)				(0.004)
Majoritarian		0.172		0.258	0.484
		(0.640)		(0.647)	(0.635)
Proportional		1.192		1.341	1.299
		(1.161)		(1.190)	(1.053)
Mixed Election System		0.363		0.706	0.694
		(0.737)		(0.815)	(0.783)
Parliamentary			-1.046	-2.415**	-1.304
			(0.669)	(1.212)	(1.006)
Presidential			-1.263**	-1.533	-0.26
			(0.625)	(1.125)	(0.971)
Semi-Presidential			-0.605	-0.623	0.433
			(0.839)	(1.197)	(1.117)
Coef. Test (p-value): $\beta_S = \beta_W$	0.0128	0.0046	0.0055	0.0369	0.1009
Countries	150	149	153	149	149
Observations	5222	3830	5049	3830	3777
Adjusted R^2	0.159	0.105	0.133	0.106	0.112

Note: A full set of country and year fixed effects are controlled in all specifications as well as three lags of growth rates and the fourth lag of GDP per capita. Standard errors robust against heteroscedasticity and serial correlation at the country level are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 1.7.10.. Effects of Strong and Weak Democracies on GDP Growth: Controlling Economic and Demographic Variables

Adding Covariates:	(1) Log of Trade Share	(2) Log of Investment Rate	(3) Log of Inflation Rate	(4) Log of Gov Spending	(5) Log of Primary Enrollment	(6) Log of Secondary Enrollment	(7) Log of Tertiary enrollment	(8) Fertility Rate	(9) Log of Life Expectancy
Strong Democracy	1.574***	1.693***	1.422***	1.606***	1.259***	1.050*	1.449**	1.111***	1.306***
	(0.537)	(0.489)	(0.386)	(0.487)	(0.471)	(0.576)	(0.720)	(0.375)	(0.353)
Weak Democracy	-0.185	-0.064	-0.143	-0.191	-0.217	-0.022	-0.274	0.32	-0.151
	(0.377)	(0.382)	(0.408)	(0.392)	(0.389)	(0.541)	(0.637)	(0.383)	(0.414)
GDP Growth First Lag	0.149**	0.200***	0.148**	0.154*	0.234***	0.217***	0.278***	0.157**	0.159**
	(0.075)	(0.047)	(0.073)	(0.078)	(0.035)	(0.038)	(0.038)	(0.068)	(0.067)
GDP Growth Second Lag	0.027	0.007	0.037	0.021	-0.037	-0.026	-0.034	0.044**	0.046**
	(0.024)	(0.024)	(0.023)	(0.021)	(0.035)	(0.042)	(0.037)	(0.020)	(0.020)
GDP Growth Third Lag	0.014	0.015	0.025	0.025	-0.004	-0.046	-0.016	0.038**	0.041**
	(0.021)	(0.022)	(0.017)	(0.020)	(0.026)	(0.031)	(0.031)	(0.018)	(0.018)
GDP Fourth Lag	-3.617***	-3.513***	-4.479***	-3.549***	-4.773***	-5.049***	-5.790***	-4.285***	-3.802***
	(0.698)	(0.669)	(0.955)	(0.674)	(0.748)	(0.926)	(1.153)	(0.799)	(0.789)
Sum of Covariate Coefficients	0.013	0.007	-0.007	-0.003	-0.006	-0.006	0.002	-0.516	0.023
p-value (Covariate)	0.140	0.162	0.126	0.292	0.394	0.195	0.607	0.009	0.334
Coef. Test (p-value): $\beta_S = \beta_W$	0.005	0.0025	0.0032	0.0034	0.0089	0.1498	0.0772	0.0975	0.003
Countries	150	146	153	146	146	142	134	149	149
Observations	5038	4696	5243	4895	3444	2594	2286	5286	5289
Adjusted R^2	0.14	0.16	0.154	0.131	0.179	0.171	0.258	0.157	0.156

Note: In each column, four lags of the covariate specified in each column label are controlled, and the sum of their coefficients is reported as well as the p-value for joint significance. A full set of country and year fixed effects are controlled in all specifications. Standard errors robust against heteroscedasticity and serial correlation at the country level are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 1.7.11.. Potential Mechanisms by Quality of Institutions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dependent Variable:	Economic Freedom	Legal Infra -structure	Legal Order	Political Corruption	Transparency (HRV Index)	Regime Instability Index	Within Regime Index	Violence Index	Social Unrest
Strong Democracy	0.010***	0.002*	0.00	-0.007**	0.007***	-0.031***	0.065***	-0.009*	-0.120***
	(0.003)	(0.001)	(0.001)	(0.003)	(0.002)	(0.010)	(0.011)	(0.004)	(0.038)
Weak Democracy	0.001	-0.003***	0.00	0.005	-0.001	0.00	0.102***	-0.002	-0.006
	(0.002)	(0.001)	(0.001)	(0.005)	(0.002)	(0.017)	(0.016)	(0.003)	(0.043)
Coef. Test (p-value): $\beta_S = \beta_W$	0.0038	0.0028	0.4226	0.0466	0.0079	0.1051	0.021	0.165	0.0452
Countries	98	128	127	133	106	148	147	150	144
Observations	2878	4596	4549	4631	2728	4111	3963	4349	4722
Adjusted R^2	0.969	0.886	0.995	0.886	0.896	0.032	0.147	0.19	0.089

Note: Four lags of dependent variables as well as four lags of GDP per capita are controlled in each column. A full set of country and year fixed effects are controlled in all specifications. Standard errors robust against heteroscedasticity and serial correlation at the country level are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 1.7.12.. Effects of Strong and Weak Democracies on GDP Growth: Controlling for Institutional Quality Variables

	Dependent Variable: GDP Growth									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Control Variable:	Economic Freedom	Legal Infra -structure	Legal Order	Political Corruption	Transparency (HRV Index)	Regime Instability Index	Within Regime Index	Violence Index	Social Unrest	All
Strong Democracy	0.646	1.624***	1.744***	1.710***	1.374**	1.239**	1.676***	1.267***	1.424***	-0.061
	(0.422)	(0.489)	(0.475)	(0.402)	(0.593)	(0.513)	(0.547)	(0.467)	(0.456)	(0.950)
Weak Democracy	0.317	0.173	-0.173	0.029	0.348	-0.015	0.583	-0.336	0.154	1.022
	(0.359)	(0.407)	(0.463)	(0.387)	(0.475)	(0.405)	(0.489)	(0.411)	(0.389)	(0.619)
Economic Freedom	9.623***									9.398***
	(1.681)									(2.025)
Legal Infrastructure		5.729								7.208
		(3.988)								(4.957)
Legal Order			6.083***							2.058
			(2.214)							(5.251)
Political Corruption				0.687						-1.118
				(1.353)						(2.565)
Transparency (HRV Index)					8.402**					5.843**
					(3.208)					(2.884)
Regime Instability Index						-8.727***				-5.122**
						(1.758)				(2.288)
Within Regime Instability Index							-4.357***			-2.550
							(1.373)			(1.617)
Violence Index								-12.015***		-2.887
								(3.485)		(2.603)
Social Unrest									-1.433***	-1.071***
									(0.283)	(0.323)
Coef. Test (p-value): $\beta_S = \beta_W$	0.5370	0.0207	0.0046	0.0018	0.1610	0.0412	0.0691	0.0062	0.0252	0.3360
Countries	98	128	127	133	106	148	148	150	145	77
Observations	3,226	4,693	4,646	4,770	3,082	4,258	4,166	4,521	4,932	1,693
Adjusted R^2	0.168	0.159	0.161	0.150	0.126	0.134	0.113	0.130	0.159	0.143

Note: A full set of country and year fixed effects are controlled in all specifications. Robust standard errors for heteroscedasticity and serial correlation at the country level are in the parentheses.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 1.7.13.. Potential Mechanisms by Economic Variables

Dependent Variable:	(1) Market Reform Index	(2) Log of Tax Share	(3) Log of Gov Spending	(4) Hyper-Inflation (Dummy)	(5) Log of Gini (Net)	(6) Log of Primary Rate	(7) Log of Secondary Rate	(8) Log of Tertiary Enrollment	(9) Log of Human Capital	(10) Log of Physical Capital	(11) Log of Trade Share	(12) Log of Investment Rate	(13) Log of TFP
Strong Democracy	1.185**	2.682	0.665	-0.040***	0.366	0.698*	1.144	0.91	0.002	0.001	1.454	3.293**	-0.125
	(0.495)	(2.138)	(1.212)	(0.012)	(0.758)	(0.397)	(0.901)	(1.044)	(0.002)	(0.001)	(1.348)	(1.552)	(0.409)
Weak Democracy	0.747	3.569	6.539*	0.01	-2.110***	2.701***	3.379***	-0.402	-0.005***	0.001	2.201	4.964	0.696
	(0.498)	(2.328)	(3.676)	(0.010)	(0.605)	(0.771)	(1.014)	(1.579)	(0.002)	(0.002)	(1.549)	(3.940)	(0.654)
Coef. Test (p-value):													
$\beta_S = \beta_W$	0.4851	0.7532	0.1093	0.0012	0.0106	0.0185	0.0815	0.4824	0.0185	0.965	0.6961	0.6871	0.2883
Countries	122	110	146	143	117	146	138	130	84	134	150	146	88
Observations	3816	3868	4879	4310	2115	3305	2412	2132	2887	3998	5030	4678	3145
Adjusted R^2	0.912	0.62	0.67	0.46	0.895	0.948	0.972	0.974	0.986	0.997	0.732	0.582	0.91

Note: Four lags of dependent variables as well as four lags of GDP per capita are controlled in each column. A full set of country and year fixed effects are controlled in all specifications. Standard errors robust against heteroscedasticity and serial correlation at the country level are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 1.7.14.. Potential Mechanisms by Demographic Variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent Variables:	Log of Fertility Rate	Log of Mortality Rate (infant)	Log of Mortality Rate (child)	Log of Birth Rate	Log of Death Rate	Log of Population Growth Rate	Log of Life Expectancy
Strong Democracy	-0.283**	-0.243***	-0.379**	-0.460***	0.022	-0.061**	0.023
	(0.136)	(0.084)	(0.157)	(0.170)	(0.182)	(0.026)	(0.022)
Weak Democracy	-0.155	-0.15	-0.325	0.097	-0.750**	0.077**	0.081
	(0.149)	(0.096)	(0.210)	(0.184)	(0.299)	(0.035)	(0.050)
Coef. Test (p-value):							
$\beta_S = \beta_W$	0.4685	0.43	0.8186	0.0198	0.0215	0.0021	0.2678
Countries	149	153	153	152	152	153	149
Observations	5285	5233	5233	5349	5349	5409	5289
Adjusted R^2	0.994	0.999	0.998	0.988	0.991	0.835	0.998

Note: Four lags of dependent variables as well as four lags of GDP per capita are controlled in each column. A full set of country and year fixed effects are controlled in all specifications. Standard errors robust against heteroscedasticity and serial correlation at the country level are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 1.7.15.. Effects of Strong and Weak Democracies on GDP Growth and Mechanisms: Combined Developmental Indicator

	Panel A: Baseline Regression and Robustness Checks			
	(1)	(2)	(3)	(4)
Dependent Variable: Growth	Baseline	Adding Democratic Stock	Adding All forms of Democracies	IV Regional+Initial Political Regime
Strong Democracy	1.689***	1.474***	2.313***	2.580**
	(0.420)	(0.418)	(0.808)	(1.021)
Weak Democracy	0.129	0.127	0.113	-1.530
	(0.334)	(0.330)	(0.558)	(2.350)
Coef. Test: $\beta_S = \beta_W$	0.0011	0.0045	0.0061	0.0817
Countries	156	153	152	150
Observations	5470	5266	3863	5218

	Panel B1: Potential Economic Channels						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Economic & Demographic Mechanisms	Market Reform	Log Tax Share	Log Gov. Spending	Hyperinflation (dummy)	Log of Gini	Log Secondary Enrollment	Log Tertiary Enrollment
Strong Democracy	1.258**	2.893	0.188	-0.041***	0.361	0.670	0.634
	(0.562)	(2.581)	(1.364)	(0.014)	(0.805)	(0.859)	(1.123)
Weak Democracy	0.750	3.069	5.352*	-0.005	-1.913***	3.493***	0.211
	(0.459)	(1.908)	(2.907)	(0.011)	(0.583)	(0.996)	(1.390)
Coef. Test: $\beta_S = \beta_W$	0.4462	0.9507	0.0910	0.0361	0.0219	0.0234	0.8074
Countries	125	112	149	146	118	140	131
Observations	3850	3892	4915	4361	2133	2425	2142

	Panel B2: Potential Institutional Channels								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Institutional Mechanisms	Economic Freedom	Legal Infrastructure	Legal Order	Political Corruption	Transparency (HRV)	Regime Instability	Within Regime Instability	Violence Index	Social Unrest
Strong Democracy	0.009***	0.002*	0.000	-0.011***	0.008***	-0.030**	0.020	-0.013***	-0.111***
	(0.002)	(0.001)	(0.001)	(0.003)	(0.003)	(0.014)	(0.013)	(0.005)	(0.043)
Weak Democracy	0.004	-0.001	0.000	0.004	0.000	0.015	0.067***	0.001	-0.045
	(0.002)	(0.001)	(0.001)	(0.004)	(0.002)	(0.014)	(0.012)	(0.004)	(0.039)
Coef. Test: $\beta_S = \beta_W$	0.1137	0.0415	0.8311	0.0048	0.0076	0.0195	0.0040	0.0154	0.2321
Countries	100	131	130	136	108	141	149	153	147
Observations	2912	4647	4600	4682	2762	3300	3968	4385	4773

Note: For growth regressions, three lags of growth rates and the fourth lag of GDP per capita are controlled. For mechanism regressions, four lags of dependent variables as well as four lags of GDP per capita are controlled in each column. A full set of country and year fixed effects are controlled in all specifications. Standard errors robust against heteroscedasticity and serial correlation at the country level are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 1.7.16.. Development and Institutional Quality in Benin and Ghana

Panel A: Development Conditions at Political Transition Time

	Transition Year	GDP per Capita	Secondary Enrollment Ratio	Average Years of Secondary Schooling	Percentage with Secondary Schooling	Tertiary Enrollment Ratio	Industry value added (% of GDP)	Net Gini (%)	Natural Resources Rents (% of GDP)
Benin	1991	610.09	16.87	0.57	8.65	2.42	11.98	-	7.54
Ghana	1996	905.20	37.06	2.38	42.95	-	26.56	35.77	19.00

Panel B: Growth and Quality of Institutions Before and After Democratization

		Time Period	Growth	Economic Freedom	Legal Infra structure	Legal Order	Political Corruption	Transparency (HRV Index)	Regime Instability Index	Within Regime Instability Index	Violence Index	Social Unrest
Benin	Autocracy	1960-1990	-6.947	-0.023	0.007	0.001	0.003	-0.009	-0.026	-0.078	-0.009	-0.067
	Weak Democracy	1991-2010	-7.289	-0.030	-0.002	-0.002	-0.001	-0.011	-0.023	0.015	-0.009	-0.208
	Difference		-0.342	-0.007	-0.009	-0.003	-0.004	-0.002	0.003	0.093	0.000	-0.141
Ghana	Autocracy	1960-1995	-5.814	-0.024	-0.004	-0.002	0.012	-0.013	0.043	-0.079	0.001	-0.051
	Strong Democracy	1996-2010	-4.927	-0.014	-0.005	0.005	-0.007	-0.012	-0.020	-0.028	-0.008	-0.185
	Difference		0.887	0.010	-0.001	0.007	-0.019	0.001	-0.063	0.051	-0.009	-0.134
Median Level Difference In Third Democratization Wave			0.655	0.003	0.000	0.000	-0.003	0.000	-0.016	0.047	-0.002	-0.076

Note: The values of indicators in panel B are obtained by removing the influences of time trends, income level, and their past levels.

Table 1.7.17.. Effects of Democracy on Growth: Development in Political Transition Time Matters

Dependent	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Variable: Growth	p10	p15	p20	p25	p30	p35	p40	p45	p50
	Panel A: Weak Development Dummy by GDP in Transition Period								
Democracy	1.073***	1.111***	1.279***	1.394***	1.258***	1.233***	0.906**	1.002***	0.949**
	(0.322)	(0.339)	(0.346)	(0.362)	(0.371)	(0.398)	(0.356)	(0.382)	(0.400)
Dem*WeakDev	-1.020*	-0.892*	-1.200**	-1.346***	-0.762	-0.618	0.024	-0.136	-0.045
	(0.588)	(0.532)	(0.476)	(0.459)	(0.488)	(0.513)	(0.514)	(0.503)	(0.488)
Countries	153	153	153	153	153	153	153	153	153
Observations	5419	5419	5419	5419	5419	5419	5419	5419	5419
	Panel B: Weak Development Dummy by Secondary Enrollment Ratio in Transition Period								
Democracy	1.044***	1.139***	1.294***	1.370***	1.271***	1.371***	1.318***	1.502***	1.638***
	(0.381)	(0.379)	(0.389)	(0.412)	(0.425)	(0.437)	(0.462)	(0.527)	(0.547)
Dem*WeakDev	-0.928	-1.289*	-1.562**	-1.365**	-0.901	-1.051*	-0.840	-1.016*	-1.210**
	(0.747)	(0.756)	(0.599)	(0.582)	(0.561)	(0.543)	(0.549)	(0.577)	(0.592)
Countries	148	148	148	148	148	148	148	148	148
Observations	4992	4992	4992	4992	4992	4992	4992	4992	4992
	Panel C: Weak Development Dummy by Tertiary Enrollment Ratio in Transition Period								
Democracy	0.917**	1.074***	1.070***	1.182***	1.240***	1.206***	1.387***	1.377***	1.404***
	(0.360)	(0.357)	(0.372)	(0.382)	(0.404)	(0.411)	(0.434)	(0.465)	(0.500)
Dem*WeakDev	-0.561	-1.243**	-0.960	-1.249**	-1.137**	-0.925*	-1.195**	-1.023**	-0.981*
	(0.703)	(0.621)	(0.594)	(0.570)	(0.507)	(0.524)	(0.507)	(0.516)	(0.543)
Countries	140	140	140	140	140	140	140	140	140
Observations	4792	4792	4792	4792	4792	4792	4792	4792	4792
	Panel D: Weak Development Dummy by Non-Natural Resources Share of GDP in Transition Period								
Democracy	1.053***	1.188***	1.086***	1.142***	1.153***	1.097***	1.209***	1.275***	1.500***
	(0.320)	(0.319)	(0.308)	(0.316)	(0.331)	(0.337)	(0.365)	(0.372)	(0.386)
Dem*WeakDev	-2.158**	-2.507***	-0.798	-0.839	-0.692	-0.430	-0.594	-0.695	-1.041*
	(0.944)	(0.740)	(0.866)	(0.720)	(0.620)	(0.566)	(0.533)	(0.546)	(0.542)
Countries	145	145	145	145	145	145	145	145	145
Observations	5005	5005	5005	5005	5005	5005	5005	5005	5005
	Panel E: Weak Development Dummy by Industry Share of GDP in Transition Period								
Democracy	1.038***	1.065***	1.027***	1.038**	1.126***	1.169***	1.266***	1.069**	1.149***
	(0.377)	(0.385)	(0.379)	(0.400)	(0.402)	(0.412)	(0.440)	(0.411)	(0.437)
Dem*WeakDev	-2.571***	-1.920***	-1.097	-0.816	-1.065	-1.027	-1.134*	-0.532	-0.636
	(0.666)	(0.669)	(0.907)	(0.725)	(0.710)	(0.662)	(0.636)	(0.639)	(0.623)
Countries	138	138	138	138	138	138	138	138	138
Observations	4801	4801	4801	4801	4801	4801	4801	4801	4801
	Panel F: Weak Development Dummy by Economic Equality (1-Gini) in Transition Period								
Democracy	1.030***	1.076***	1.049***	1.120***	1.264***	1.324***	1.266***	1.325***	1.506***
	(0.376)	(0.391)	(0.397)	(0.418)	(0.415)	(0.430)	(0.457)	(0.464)	(0.514)
Dem*WeakDev	-1.214**	-1.140**	-0.758	-0.794	-1.163**	-1.128*	-0.858	-0.961	-1.131*
	(0.477)	(0.439)	(0.529)	(0.514)	(0.569)	(0.584)	(0.586)	(0.586)	(0.597)
Countries	132	132	132	132	132	132	132	132	132
Observations	4514	4514	4514	4514	4514	4514	4514	4514	4514

Note: A full set of country and year fixed effects are controlled in all specifications as well as three lags of growth rates and the fourth lag of GDP per capita. Standard errors robust against heteroscedasticity and serial correlation at the country level are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

2. Curriculum Control and Innovation[1]

2.1. Introduction

Innovations improve the living standards of human beings by creating and introducing new goods and services (Schumpeter and Opie, 1961). Nelson and Phelps (1966); Lucas Jr (1978); Murphy, Shleifer and Vishny (1991); Gennaioli et al. (2012); Jones (2016) emphasize that the human capital for innovation plays a unique role in shaping the creativity of the country and promoting the prosperity of the entire economy.

The foundations of innovation—curiosity, imagination, risk-taking, and collaboration—are in our bones and part of our human nature and experience. Human beings are born with the desire and potential to create and innovate, dream and imagine, and challenge and improve the status quo. The potential can be suppressed or amplified by our experiences (Zhao, 2012).

Schools should be the primary institution for the person beyond the family, and therefore, the primary place that shapes the experiences the person has. Economists generally agree that schooling helps people accumulate human capital and benefits innovation (Hanushek and Kimko, 2000; Vandenbussche, Aghion and Meghir,

[1] I am greatly indebted to my advisor, Fali Huang, and to Jungho Lee and Madhav S. Aney for their extremely valuable guidance and supervision. I have benefited from discussions with Luca Facchinello, Tomoki Fujii, Paoli Chang, Ryan Decker, Yubo Tao, and workshop participants at SMU for helpful comments and suggestions.

2006; Madsen, 2014; Cinnirella and Streb, 2017), but it is not clear what kind of school education can best cultivate the quality of human capital for innovation. Scholars in education emphasize that the types of education institutions matter. For example, Au (2007); Bonawitz et al. (2011); Kapur (2014, 2016); Zhao (2017) point out that tightly controlled standardized curricula and rigorously watched and frequently administered high-stakes achievement tests tend to emphasize rote learning and diminish students' natural curiosities and suppress their imaginations. They could squelch creativity in the long run.

This paper empirically explores the effect of one specific education structure – curriculum control degree or the degree of governments control what children learn in school – on innovation or creativity. I argue that such control is exercised through two interconnected measures, as follows: (1) the development of centralized official curriculum standards, and (2) the use of high-stakes achievement tests[2] to enforce such standards.[3] More centralized official curriculum standards potentially bring more unified learning menus to children. Moreover, implementing high-stakes testing would push teachers to instruct students by narrowing the knowledge the curriculum describes, especially when the achievement test performances are used as the crucial criteria for students' promotion, graduation, and admission.

Tighter curriculum control will spread rote learning, suppress children's curiosity and imagination, and impair the development of their critical and independent thinking (LeTendre, 1999; Doyon, 2001; Au, 2007; Bonawitz et al., 2011; Kapur, 2014, 2016). In addition, intensive high-stakes examinations and comparisons are not favorable to the cultivation of their self-confidence (Loveless, 2006). However, diverse and open minds, curiosity, imagination, critical thinking, and self-confidence are core elements of innovation. Therefore, more centralized curriculum control

[2]Testing becomes high stakes when the outcomes are used to make decisions about promotion, admissions, graduation, and salaries.

[3]For common standards to be truly enforced, high-stakes testing seems to be an inevitable tool (Hamilton, Stecher and Yuan, 2008).

could lead to less quality of human capital for innovation and eventually undermine the country's innovation.

The regression results suggest that more centralized curriculum control is associated with less national innovation, measured by the various quality of patent variables and other innovation-related indicators at the country level.[4] The results are quite robust when I control for other important variables that influence innovation.

I also examine the within-country variation of occupational choices among immigrants born in the United States and in the countries of origin. These immigrants work in the United States, but many of them receive schooling in different education systems. This analysis further minimizes the effects of potentially omitted factors in the cross-country regressions. My argument predicts that people receiving education from countries with lower curriculum control should work in research-oriented occupations, which require creative and independent thinking, more frequently than those raised in the traditions of countries with higher curriculum control.

Using U.S. Census data, I find that people receiving schooling from less curriculum-controlled education systems are more likely to become scientists and researchers. Furthermore, to solve the endogenous issue and reduce omitted variables' biases, I use exogenous land productivity distribution within the country as the instrumental variable (IV).[5] This factor could be an important exogenous determinant that shapes the political power distribution on education institutions between the central and local regions during the early period. Current education structures at least partially resemble these initial structures. Thus, I expect the country where there is a high dispersed land productivity in different regions has a highly decentralized education system, or more specifically, a low curriculum control degree. Considering that

[4]Non-patent indicators used to measure innovation include the quality of academic publications, a number of top brands and innovative companies, and a number of famous universities.

[5]Exogenous land productivity distribution is measured by the standard deviation of crop yield (measured by the standard deviation of the Caloric Suitability Index, CSI) in the post-1500 period. This indicator is from Galor and Ömer Özak (2015). By focusing on potential crop yield, based on agri-climatic characteristics that are unaffected by human intervention, they argue that the CSI could be used as an exogenous proxy for land productivity. I employ the standard deviation of the index as the exogenous proxy of the observability of land productivity. See Section 2.6.2 for detailed discussions.

these immigrants get schooling from their original countries but work in the United States, the effect of this IV should mainly work through schooling instead of other channels, such as political structures in their original countries. The two-stage least squares (2SLS) regression results are consistent with the ordinary least squares (OLS) ones, suggesting that high curriculum control degree causally impairs the individual's creativity.

I give some preliminary evidence on the micro-foundations of curriculum control for innovation. More specifically, I investigate the roles of curriculum control in teaching practices, student learning experiences, and the formations of the individual's beliefs and values on career related to creativity. I find that teacher-centered approaches are more popular in countries with more centralized curriculum control. In such education environments, students have fewer opportunities to discuss issues with teachers. They probably mainly focus on textbooks or mechanically memorize what the instructor lectures in class. It is consistent with my finding on the relationship between curriculum control and critical thinking in teaching at the country level, which shows that more centralized curriculum control is associated with lower critical thinking score.[6] Not surprising, under the education with centralized curriculum control, students have the less positive attitude toward learning and lower self-confidence. These eventually would be less favorable for the development of their creativity. In addition, I also find that there are systematic associations between curriculum control and the individual's beliefs and values on careers. In more decentralized curriculum-control countries, people are more likely engaged in creative tasks at work. They tend to believe that it is important for the career that provides the opportunity to use their own initiatives.

This paper makes several contributions. To the best of my knowledge, it is the first study to systematically explore the relationship between the degree of government-controlled curriculum and innovation or creativity. Gennaioli et al. (2012); Madsen

[6]Critical thinking score in teaching is extracted from *The Global Competitiveness Report in 2018.*

(2014); Cinnirella and Streb (2017) stress the importance of schooling for human capital and innovation. They contend that education will play an increasing role in the economy when innovation becomes more important as the country approaches the global technological frontiers. I refine their arguments and emphasize that education structure matters. It is an independent factor shaping creativeness. Importantly, decentralized curriculum control in education is beneficial for innovation or creativity, while rigid national control is not. The indicator I build, curriculum control index, can measure the degree of governments control what children learn in school.

The study implies that the approach to reforming the education system should be cautious. Poor international testing (i.e., Trends in International Mathematics and Science Study [TIMSS], Programme for International Student Assessment [PISA]) performances in some developed countries, like the United Kingdom, United States, and Australia, have created incentives to implement some education policies, such as national standard curriculum and high-stakes tests.[7] These may be the misleading policies because they could have negative effects on the long-run creativity development of children, and then the country's innovation. Clearly, the serious education issues in some developed countries need to be solved, but the reform measures they carry out should be circumspect. Directly copying the policies executed in some Asian countries with remarkable test performances may be problematic. Although these policies might promote students' test performances, they may simultaneously squelch the development of children's creativity. Since developed countries are already around the global technological frontiers, human capital for innovation would be crucially important. Interestingly, homogeneous official curricula with high-stakes examinations, as well as the rigid admission policies in higher education, have already been criticized in many Asian countries (LeTendre, 1999; Doyon, 2001; Davey, De Lian and Higgins, 2007; Dello-Iacovo, 2009; Kamens, 2016).

[7] See Porter et al. (2011) for the United States, Polesel, Rice and Dulfer (2014) for Australia, and James et al. (2011) for the United Kingdom.

This paper is related to the studies that explore the determinants of inventors. Aghion et al. (2016); Akcigit, Grigsby and Nicholas (2017) find various factors and circumstances have profound impacts on the probability of becoming an innovator, including family backgrounds, rule of law, property right protection, culture, and so on. This study adds a new and important macro-environment—educational structure, especially official curriculum design and the corresponding exam policies. More decentralized curriculum design with flexible evaluation policies would facilitate more children developing the potential capacities to become inventors in the future.

My study also complements a small body of literature that explores the content of education on the development of economy and politics. For example, Cantoni and Yuchtman (2013) illustrate that educational content can play an important role in the process of economic development. Fuchs-Schündeln and Masella (2016) examine the impact of socialist education on the likelihood of the individual to obtain a college degree and on labor market outcomes in East Germany after reunification. Cantoni et al. (2017) study the causal effect of school curricula on students' political attitudes in China. Instead of investigating the effect of educational content, I consider one specific educational organization, the degree of governments control educational content, on the influence of innovation and creativity. Decentralized curriculum control with flexible evaluation criteria would enhance and expand (or at least not impair) human talents instead of standardizing them.

The only article I find that is very relevant to mine is Chang and Huang (2014), who discuss the degree of centralization imposed on the curriculum on the country's talent distribution and comparative advantage. Unlike their study, which theoretically explores the endogenous choice of education policy and the two-way causal relationship between trade and education systems, I empirically examine the effect of curriculum design interconnected with high-stakes testing on innovation.

By exploring the origins of the education organization to build IV, this paper connects the studies of the historical roots of the education system (Pritchett, 2002; Goldin and Katz, 2003; Lindert, 2004; Gallego, 2010; Ansell and Lindvall, 2013). I

show that political decentralization during the early time could be one of the major factors determining the decentralized structure of education. This is in line with the studies by Lindert (2004); Gallego (2010), who argue that the expansion of education in Prussia and the United States during the 19^{th} century was closely related with the power balance on education policies between the central and the local. To build a valid IV, I take advantage of exogenous differences in the deviation of land productivity in the post-1500 period constructed by Galor and Ömer Özak (2015). I find that the low agricultural observability (higher standard deviation in the farming sector across regions within the country) is positively associated with high political decentralization and decentralized curriculum control. It also echoes the recent study on the historical roots of political institutions. The observability of agricultural output at early time is one of the important factors affecting the information collection cost of the ruling elites. This observability is shaped by technological and geographic factors (Huning and Wahl, 2016; Mayshar, Moav and Neeman, 2017; Ahmed and Stasavage, 2017).

By investigating the side effects of the homogeneous learning experiences of students, I firmly confirm some educators' opinions (Au, 2007; Liu and Neilson, 2011; Zhao, 2012; Polesel, Rice and Dulfer, 2014; Feniger, Israeli and Yehuda, 2016). They have criticized a centralized curriculum design with high-stakes testing for having negative effects on learning, including curriculum narrowing, the spread of the cramming teaching style, high pressure on both students and teachers, low self-confidence among students, low interest in learning, and so on. These detrimental effects on students will produce fewer creative talents.

The structure of the paper is as follows: Section 2 presents the argument for how curriculum control and innovation can be related. Section 3 introduces the data, while Section 4 shows the baseline results. Section 5 provides a series of robustness checks. Section 6 investigates the occupational choices of various ethnic groups in the United States. It also discusses potential IV and provides 2SLS regression results. Section 7 presents some mechanisms of the curriculum control through

which affect innovation. Section 8 discusses policy applications, and Section 9 concludes.

2.2. The Economic Argument

In modern society, school has become one of the primary institutions that shapes people's thinking abilities, habits, values, and preferences, while it provides knowledge and skills (Glaeser, Ponzetto and Shleifer, 2007; Acemoglu and Autor, 2011; Oreopoulos and Salvanes, 2011; Huang, 2012*b*,*a*; Ito, Kubota and Ohtake, 2015; Meyer, 2017). The curriculum is the main medium through which the school transmits knowledge, experience, and values to children and influences their developments.[8] The nation-state, through a variety of political processes, exercises control over what children should learn. However, there are considerable differences in how states exercise this control. These differences, for example, include which level of educational authority is responsible for designing the curriculum and what kinds of policies are used to evaluate students.

A homogeneous curriculum could improve the likelihood that the same contents are taught and the similar manners are delivered to students if it is effectively implemented throughout the country. On the one hand, it contributes to the fusion of people with different backgrounds and strengthens people's common values and national identities, as well as equips people with a few desirable skills; On the other hand, too many common standards reduce diversity in talents. Being creative is being different, deviating from the norm. But common standards ask for conformity and tend to demand a uniform way of thinking, learning, and demonstrating one's learning (Zhao, 2017). The homogeneous learning experiences among people shaped by the education system may be an obstacle for innovation. Because it is

[8]For example, Cantoni et al. (2017) find that a major textbook reform in China between 2004 and 2010 had the effect of shaping students' political attitudes. The changes in the textbooks' content are reflected in students' factual knowledge. Cantoni and Yuchtman (2013) illustrate that educational content can play an important role in the process of economic development. Huang (2012*b*) argues that what is taught (general or specific education) greatly influences one's skills in a broad range of tasks, including political rent-seeking abilities.

difficult for people with similar minds to diverge into new ideas.[9] Diverse knowledge and perspectives are crucial ingredients in the innovation process (Kerr, 2008; Stuen, Mobarak and Maskus, 2012), especially when technical bottlenecks become increasingly complex; thus, the paradigm of solo geniuses has slowly been replaced by that of large teams and networks (Hargadon, 2003; Barabási, 2005; Jones, 2009).

A centralized official curriculum is usually associated with high-stakes examinations.[10] Using external examinations is an efficient way of checking whether the school follows the official curriculum.[11] The exam would further strengthen the link between the official curriculum and what children actually learn when the test performance is used as the main criterion for promoting students to the next grade or next education level. For example, admission examinations for universities in many East Asian countries are widely seen as "the baton of education", determining education policies in the primary- and secondary-level education. They are the yardsticks by which schools are evaluated.[12]

The interconnection between the centralized official curriculum and frequently high-stakes and curriculum-based examination will bring more detrimental effects and hamper innovation or creativity. First, unified official curricula with high-stakes exams would lead to curriculum narrowing (Au, 2007; Zhao, 2012; Polesel, Rice and Dulfer, 2014). The desire to perform best on exams carries the highest stakes for students, but the schools receive the most attention and resources. Other knowledge that is not tested becomes peripheral and disposable.[13] However, the loss of the

[9] Insights from knowledge recombination theory suggest that more knowledge from distant sources is associated with greater idea generation and creative attainments (Fleming, 2001; Saxenian, 2005; Agrawal et al., 2011; Franzoni, Scellato and Stephan, 2014).

[10] As observed by Clune (1993), and shared by others, high-stakes student examinations are a key component, perhaps the cornerstone, of the centralized version of systemic educational policy.

[11] There is also evidence that the alignment of the curriculum with high-stakes achievement testing may result in greater curriculum consistency within and across schools, ensuring a command of agreed competencies and transferability of experiences across regions (Clarke et al., 2003; Crocker, 2005; Jones, 2007).

[12] In fact, the selective examination for the university is so powerful that researchers believe many educational reforms aimed at a more flexible and less pressured approach to developing students' personalities cannot be fully implemented if the examination as the main admission policy is not changed (Doyon, 2001; Dello-Iacovo, 2009).

[13] For example, Au (2008); David (2011) find that the high-stakes testing programs spawned by the No Child Left Behind Act in the United States have resulted in drastic changes to the proportions

principle of children's entitlement to a broad, balanced, and rich curriculum may be not conducive to cultivating creativity (Ravitch, 2010; Zhao, 2012).

Second, centralized curricula with high-stakes exam are usually associated with a instructor-centered teaching style and rote learning method (Cunningham and Sanzo, 2002; Au, 2008). Teachers may find it is more efficient to instill knowledge and improve their exam performances by using the cramming style and drilling through repetitive exercises focusing on exam questions.[14] The widespread of rote learning suppresses the development of children's critical and independent thinking. In addition, high pressures to cover the content required to produce passing test scores override the desire to stimulate children's imagination and curiosity (Zhao, 2012). Students under such education system have little freedom and opportunity to pursue their individual interests and potentials. Lack of imagination, curiosity, critical and independent thinking would be harmful to cultivate the spirit of innovation (Zhao and Meyer, 2013).

Third, Loveless (2006) points out that centralized education systems with high-density examinations produce higher TIMSS scores, but students own lower self-confidence. The loss of confidence may lead from what Feniger, Israeli and Yehuda (2016) call "the power of number". One dimension of the power of numbers is the use of comparisons. It is easy to assess who is smart or clumsy by the number—test scores. Students living test-orient environment could easily lose confidence by intensive exams and comparisons. But, self-confidence is a key factor in the success of doing innovative jobs.[15] The loss of confidence as a result of pursuing test scores

of time allocated to different subject areas, with the content of the tests largely determining the curriculum, especially in schools identified as being low performing. Barlow (2003) notes that the social sciences, arts, and physical education have all seen reductions in the time allocated to them as a result of the demands of high-stakes testing programs.

[14]For example, Cunningham and Sanzo (2002) find that high-stakes testing impacts negatively on creative and effective teaching, leading to cramming for tests rather than instruction.

[15]Bénabou and Tirole (2002) emphasize the crucial role played by self-confidence in motivation. Morale is universally recognized as key to writing a great book, doing innovative research, and setting up a firm. Hirshleifer, Low and Teoh (2012) examine that firms with overconfident CEOs obtain more patents and patent citations, and achieve greater innovative success for given research and development (R&D) expenditure.

would be detrimental to the individual's innovation activities. From these analyses, the hypothesis below is made:

- *More centralized official curriculum design combined with more frequently high-stakes achievement tests in the education system would lead to less innovation or creativity.*

2.3. Data: Curriculum Control and Innovation

In this section, I briefly introduce the key indicator, curriculum control, and the variables used to measure different dimensions of innovation at the country level. The detail construction process of key variables and information on all the variables used are given in the appendix.

2.3.1. Curriculum Control: Official Curricula and High-Stakes Exams

I collect the information on the education authorities that are responsible for designing the official curriculum and the for the student's admission, promotion, and graduation policies in primary, lower and upper secondary education. In terms of admission, graduation, and promotion policies, I focus on the role of achievement tests and collect the information on which level of educational authority designs and controls examinations. As argued before, more centralized official curriculum design combined with high-stakes achievement tests administered by a higher level of the education authority would put greater pressure on both teachers and students to concentrate on the materials the official curriculum describes, which, to a larger extent, homogenizes children's learning experience across the country.

The main documents used include the following: *World Survey of Education—International Handbook of Education Systems* (published in 1982), *International Encyclopedia of National Systems of Education* (published in 1995), and *World*

Data on Education (sixth edition, published in 2006). I also use many supplementary materials.[16] By using these documents published in different periods, I construct related indicators in the 1980s, 1990s, and 2000s.

I build the indicators to measure the degree of government control official curriculum design and exam, respectively. In each period, I firstly construct $OfficialCurr_{it}$ to measure the overall degree of the official curriculum control, where i indexes the country, and t indexes the time period. It is built by averaging the degree of the official curriculum control, $OfficialCurr_{jit}$, in primary, lower and upper secondary education, where j indexes the educational cycle. In each cycle, I identify the educational authority that plays a key role in the official curriculum design. Next, I find other lower educational authorities that also have influences on the official curriculum. Based on the combinations between the major authority and other subordinate lower educational authorities, I code the indicator $OfficialCurr_{jit}$. There are two principles of coding. The higher level the dominant government, the stronger centralizing force in the official curriculum, and therefore the higher value of $OfficialCurr_{jit}$. Lower educational authorities are the decentralizing forces and they tend to introduce heterogeneity in the official curriculum. Condition on the dominant authority, the lower level the educational authority in the decentralizing force, the stronger decentralizing force in the official curriculum, and therefore the lower value of $OfficialCurr_{jit}$. Table 2.9.1 shows the coding process and the corresponding examples in the 1990s. In each cycle, $OfficialCurr_{jit}$ is categorized into seven levels, where 1 is the most decentralized, 7 is the most centralized, and 2–6 are at the intermediate levels.[17]

Next, the degree of examination control, $ExamControl_{it}$, is built. It is obtained by averaging the indicator measured achievement exam controls, $ExamControl_{jit}$,

[16] These auxiliary documents are mainly used to supplement or check the indicators I build. They include TIMSS Curriculum Survey Data (2003 and 2007), *The Education Systems of Europe* (published in 2015), *International Encyclopedia of Education* (third edition, published in 2010), *World Higher Education Database*, and Helms (2008). See the detail descriptions in the appendix.

[17] For example, the official curricula of each educational cycle in Canada and the United States during the 1990s are the most decentralized, while they are the most centralized in Egypt and Senegal.

for promotions, graduation, and admissions in the three educational cycles. More specifically, $ExamControl_{jit}$ represents exam policies within the educational cycle (for promotion) and at the end of the cycle (for the graduation and the admission to the next level). In each cycle, I collect the information about the educational authorities that control examinations. There could be several examinations in each educational cycle. Generally, each examination is controlled by one educational authority. By combining all of these authorities in these examinations for each cycle and identifying the centralizing and decentralizing forces, I can code the indicator $ExamControl_{jit}$. The coding process is similar to $OfficialCurr_{jit}$, which is shown in Table 2.9.1. In each cycle, $ExamControl_{jit}$ is categorized into nine levels, where 1 is no exam[18], 2–3 represents high decentralization, 8–9 represents high centralization, and 4–7 represents the intermediate levels.[19] I do not consider admission policies besides exams because it is difficult to know whether and how schools rely on these "soft" criteria. In addition, it is challenging to find credible data source.[20]

As discussed above, the two dimensions, $OfficialCurr_{it}$ and $ExamControl_{it}$, interconnect with each other to enhance what children learn in the official curriculum. I construct one index, $CurrControl_{it}$, to represent *curriculum control* degree through

[18]Only a few countries do not use achievement tests as main assessment methods. For example, in most provinces of Canada, universities use the grade point average (GPA) in secondary school plus other admission criteria, such as recommendation letters or personal statements, to select students. I also group the countries where universities use aptitude tests to select students into this type (e.g., Sweden). Because the aptitude exams are not directly related to the knowledge students learn in the official curriculum. Therefore, there is no such an enhanced effect on official curriculum.

[19]For example, during the basic education stage (primary and lower secondary) in the 1990s, many developed countries seldom use achievement tests as the main criteria to promote students within the education cycle and to select them to the next education cycle, while examinations are quite popular in many developing countries, especially in African countries. In addition, achievement tests are the common criteria at the end of the upper secondary in both rich and poor countries.

[20]Besides exams and GPA, there are several other criteria, including ethnicity, family income, previous work, past service or volunteer work, recommendations, applicant letters or written rationales, and so on (Helms, 2008). In the appendix, using the recent survey data on the other criteria employed to determine access to tertiary education (OECD, 2012), I consider those criteria that could measure potential abilities of students (ethnicity and family income are not considered) and code them as another dimension (only 29 observations). The results are similar when I use the composited indicators by combining official curriculum, exam, and other admission criteria through the principal component analysis (PCA). See the results in the appendix.

the principal component analysis (PCA) technique.[21] The variable is normalized to the unit interval, where 0 is most decentralized and 1 is most centralized. It turns out that $CurrControl_{it}$ is stable in different periods. Figure 2.1 show the relationships of curriculum control in each country between different periods and the global trends of $OfficialCurr_{it}$, $ExamControl_{it}$, and $CurrControl_{it}$. The curriculum control is relatively stable in each county. According to the global trend, there is an increasing interest in using standardized tests to evaluate students around the world, although the design of the official curriculum has been slowly decentralized. This shift is partly attributed to the technological advances that make it easier to test large populations of students regularly (OECD, 2012; Hanushek, Link and Woessmann, 2013). I discuss this issue in Section 2.8.

Since $CurrControl_{it}$ influences national innovation 10 or even 20 years later, the information on curriculum control degree in the 1980s and 1990s would affect the country's innovation performance after 2000. I use the average of $CurrControl_{it}$ in the 1980s and 1990s as the appropriate indicator to represent the overall degree of curriculum control in the country.[22] In total, I identify the degree of curriculum control in about 180 countries.[23] Curriculum controls are highly diverse around the world during the 1980s and 1990s, as shown in Figure 2.2. The United States, Canada, and Australia have extremely decentralized curriculum controls, while cur-

[21] The first principal component explains about 70% of the common variance of the two indicators. As the principal component reflects the overall degree of curriculum control degree, I expect it to have the strongest effects on the outcomes of interest. For robustness, other methods are also used to construct a single variable that represents curriculum control degree, e.g., an equally weighted average of $OfficialCur$ and $ExamControl$, or a multiplication of $OfficialCurr$ and $ExamControl$ (after normalizing these two indicators between zero and one). They generate similar significant results presented in the following sections, although the estimated coefficients I concern are different. In addition, I also directly use $OfficialCurr$ and $ExamControl$ to run regressions. Both indicators have great influences on innovation. The effects of the former one are quite stable in all regressions, while the effects of the later one become insignificant in some robustness checks. I present a broad set of results using these three methods in the appendix.

[22] Jones (2010) finds that innovators generally have great achievements in knowledge when they are between 30 and 50 years old.

[23] Some scholars also construct curriculum related indicators. For example, Stevenson and Baker (1991); Chang and Huang (2014). But, the sample sizes in these studies are very small (from 14 to 36). In addition, they mainly focus on the official curriculum and pay little attention to the exam. The curriculum control index I build is highly correlated with the curriculum-related indexes in these previous studies.

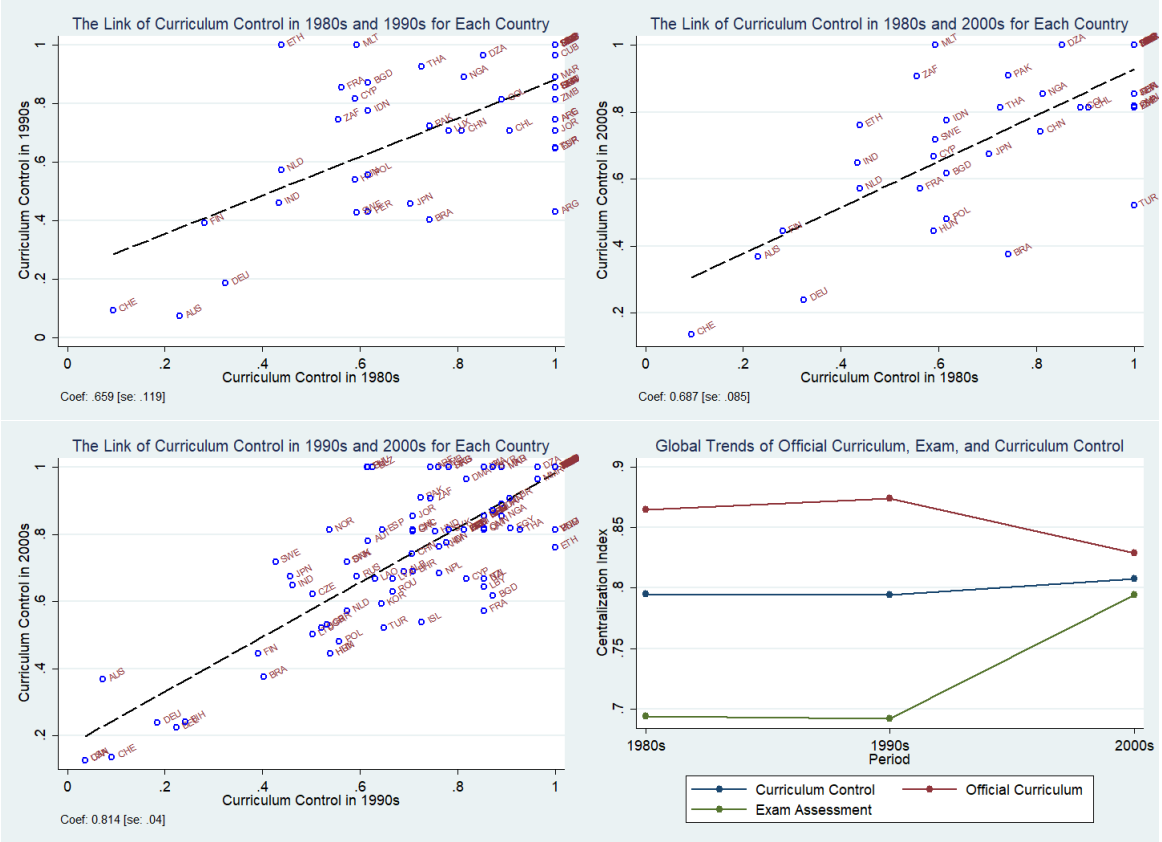


Figure 2.1.. Trends of Curriculum Control And Its Sub-indicators.

riculum controls in most African countries and some Asian countries are extremely centralized.

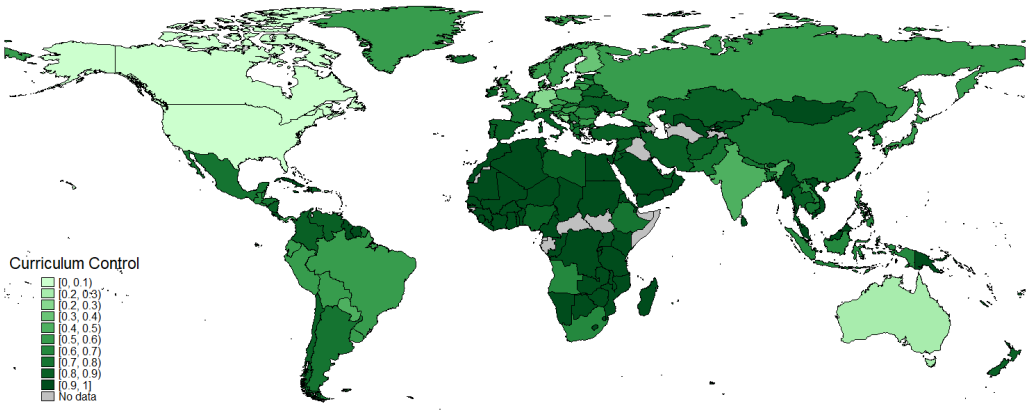
2.3.2. Innovation Indicators: Patent and Other Non-Patent Indicators

Innovations are multidimensional.[24] I collect various innovation indicators from broad data sources to capture different dimensions of innovation. For each indicator, I use one observation to represent the country's innovation.[25] To easily compare, I normalize all these indicators to the interval [0, 100], where 0 is the lowest level of

[24]For example, Schumpeter and Opie (1961) categorize innovation into four types, as follows: process innovation, product innovation, exploitation of new markets, and organizational innovation.

[25]For most innovation-related indicators, I use the average levels from 2005 to 2010 as the proxies for national innovation. But brand and innovative company rankings data are only available in recent years. I respectively use the average amounts of brands between 2007 and 2017, and the average amounts of innovative companies between 2010 and 2017 to represent national innovation. See the appendix for the detailed descriptions.

Figure 2.2.. Curriculum Control around the World during the 1980s and 1990s.



innovation while 100 is the highest one. I mainly rely on patent-related indicators as the proxy of innovation level in the country and use others for robustness checks.[26]

2.3.2.1. Patent

To measure national innovation, I employ the quality rather than the quantity of patents as the proxy of inventiveness.[27] Following the patent literature (Hall, Jaffe and Trajtenberg, 2001; Squicciarini, Dernis and Criscuolo, 2013; Kwon, Lee and Lee, 2017), the quality indicators, including the Hirsch index (H-index), share of breakthrough inventions, and average citations of patents, are used to measure national innovation.[28] I mainly rely on the patent data from the United States Patent

[26]Patent data remain a widely accepted resource for the study of innovation (Kortum, 1993; Hall, Jaffe and Trajtenberg, 2001; Squicciarini, Dernis and Criscuolo, 2013; Aghion et al., 2016; Cinnirella and Streb, 2017; Kwon, Lee and Lee, 2017).

[27]Hall, Jaffe and Trajtenberg (2001); Squicciarini, Dernis and Criscuolo (2013) find that around 80% patents have no citation.

[28]The Hirsch index is defined to be the largest number h such that the inventor has at least h patents with h or more citations (Hirsch, 2005). It thereby de-emphasizes the number of citations to a one's most-cited patent. Ellison (2013) uses it to measure the productivity of professors, and Kwon, Lee and Lee (2017) employ it to be the measure of the nation's innovative strength. The share of breakthrough inventions is defined as the proportion of patents that have the top 5% of citations in their technological fields. They are the most influential, innovative, and original patents and can be taken as "creative innovations" (Acemoglu, Akcigit and Celik, 2014). The average citation of a patent is defined as total citations divided by total amounts of patents in a given period. See the data source and detailed construction processes in the appendix.

and Trademark Office (USPTO).[29] In the robustness checks, European Patent Office (EPO) data are also used.[30]

2.3.2.2. Non-Patent Indicators

Other non-patent indicators associated with innovation or creativity are also used. These include average citations of journal publications, top universities or innovative companies or brands (per million population).

2.3.3. Link Between Curriculum Control and Innovation

A first glance at the data shows some preliminary evidence to support my argument. Figure 2.3 plot the relationship between curriculum control index (*CurrControl*) and several national innovation variables. In each graph, there is a strong and negative relationship between curriculum control and innovation, suggesting that greater control of what children learn in school is negatively associated with national inventiveness. However, the negative relationships could be driven by some outliers in the graphs, such as the United States. In addition, various factors that influence the innovation are not considered. I deal with these issues in the formal regression analyses in the next three sections.

2.4. Baseline Regressions

In this section, I formally check my argument. There are many factors affecting the country's innovation. GDP per capita (log form) and average years of schooling

[29]The USPTO patent data are from Kwon, Lee and Lee (2017). They revise some mistakes in USPTO files and match the patent's inventor with nationality, which greatly reduces the burden of my work.

[30]Since the United States is the largest technology consumer market in the world, it has commonly been assumed in prior studies that all important innovations have been patented by the USPTO (Hall, Jaffe and Trajtenberg, 2001; Griffith, Harrison and Van Reenen, 2006; Kwon, Lee and Lee, 2017). In addition, there are more patent observations in the USPTO than in the EPO.

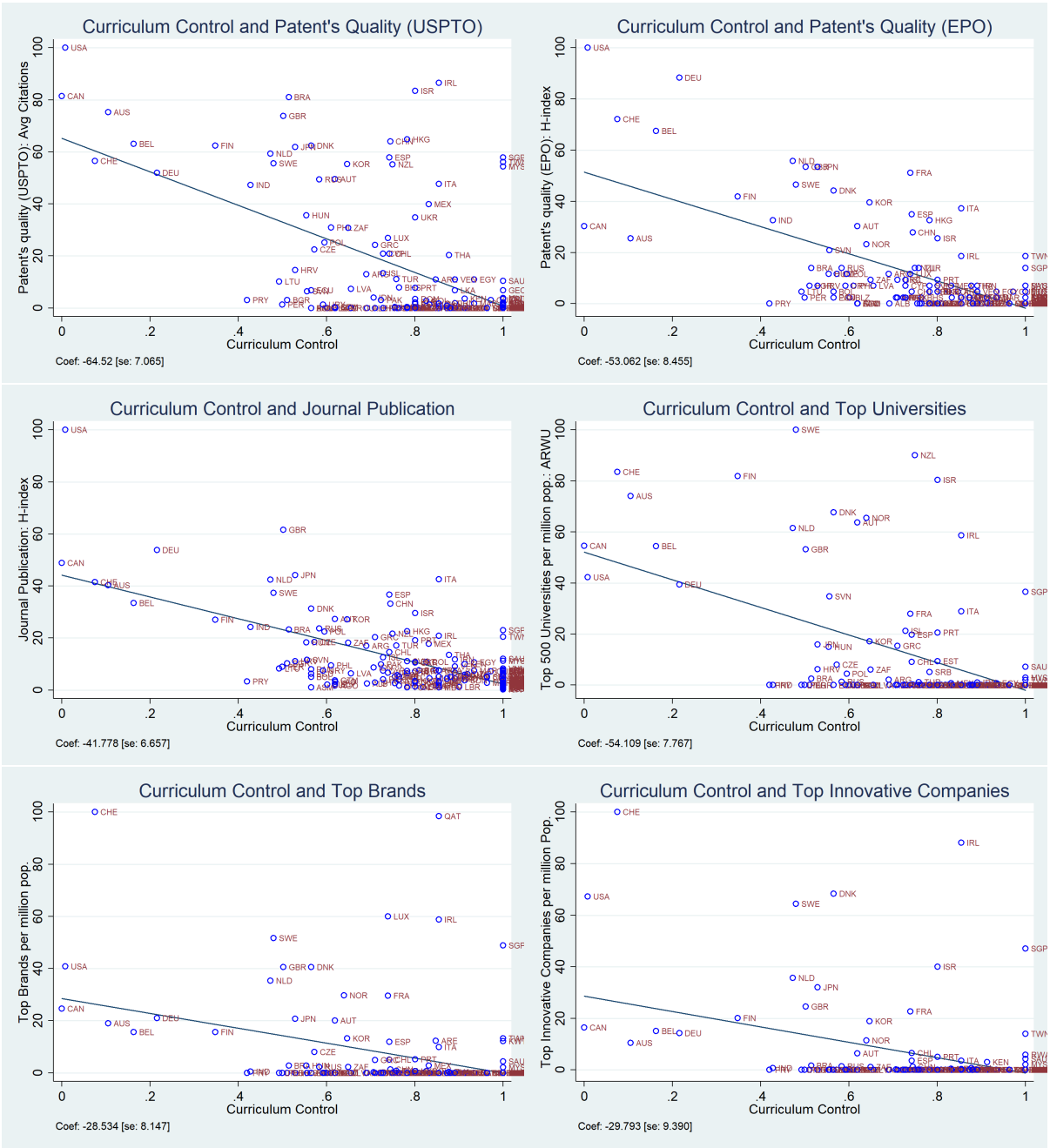


Figure 2.3.. Curriculum Control and National Innovation.

(log form) are considered, trying to control for the effects of the economic development on innovations. Generally speaking, better economic development is positively associated with a higher level of innovation, probably because countries with higher development comprise better-educated people with more resources. In addition, continent dummies are included. Continent fixed effects are vulnerable to unobserved factors that affect all countries on the continent similarly. Such unobserved factors, including culture, deeper historical conditions, bio-geographical conditions or intra-continental diffusion, may affect innovation. Therefore, the following cross-country regression model is used:

$$Innovaton_{i,2005-2010} = \beta_0 + \beta_1 CurrControl_i + \beta_2 X_{1990-2005} + Continent_i + \upsilon_i \tag{2.1}$$

i is the country. National innovation is measured by the average innovation level between 2005 and 2010.[31] *CurrControl* is the measure of the degree of curriculum control, combining information on the level of the education authority controlling curriculum design and examination policies for students' promotions, graduations, and admissions. X is the vector of the control variables. In the basic regression, I mainly include GDP per capita and average years of schooling. To reduce endogenous issues, the average values between 1990 and 2005 are employed. *Continent* comprises a set of dummy variables for continents.[32] In addition, υ_i is the error term, reflecting innovation factors that are idiosyncratic to country i, as well as omitted variables, and misspecification of the functional form. According to the argument, I predict that $\beta_1 < 0$, indicating that more centralized curriculum control is associated with a lower level of national innovation.

[31] The reason for choosing 2005 is that the effect of curriculum control in the 1980s and 1990s on national innovation should work after 2000 even 2005 when these educated children become adults and get careers. In addition, some important covariates, like rule of law, are only available in very few countries before 2000. Also, most non-patent indicators, like innovative companies, brands, and universities, are only available after 2005. I also try 2000 or 2010 as the cutoff year when the data are available. The regression results are similar.

[32] Africa is the benchmark dummy.

Table 2.9.2 displays the results using patent indicators (both USPTO and EPO)[33], and non-patent indicators[34] as proxies of national innovation. No matter which innovation indicator is used, $\beta_1 < 0$ always holds, where the coefficients of $CurrControl$ vary from -22.028 (Column (10)) to -53.062 (Column (6)). This suggests that the centralized curriculum control is negatively correlated with innovation. Remarkably, $CurrControl$ itself accounts for almost 30% of the cross-country variation in innovation, when H-index of the patent in USPTO is used, reported in Column (1). This implies that curriculum control is one of the key factors in national creativeness.

As argued before, the reasons behind this relationship could be that centralized official curriculum design enforced with high-stakes achievement tests reduces diversity in talents. Being creative means deviating from the norm. However, homogeneous learning experiences will lead to conformity, and to some extent, uniform ways of thinking. Standardized testing rewards those who conform and penalizes those who deviate. As a result, those who happen to do well on that this specific assessment, exam, are considered good and successful, while those who do less well are considered to be at risk, regardless of their other strengths.[35] Those other talents will eventually be devalued, suppressed, and left to wither. In addition, high-stakes testing forces teachers and schools to focus on what is tested and spend less time on what is not. Singling out a few subjects through national standards and testing necessarily leads to a narrower curriculum and an overall depressed education experience.[36] Consequently, common standards could result in distortions of the purpose of education, which is not beneficial to cultivating a diverse and creative citizenry, and not favorable to the development of national innovation in the long run.

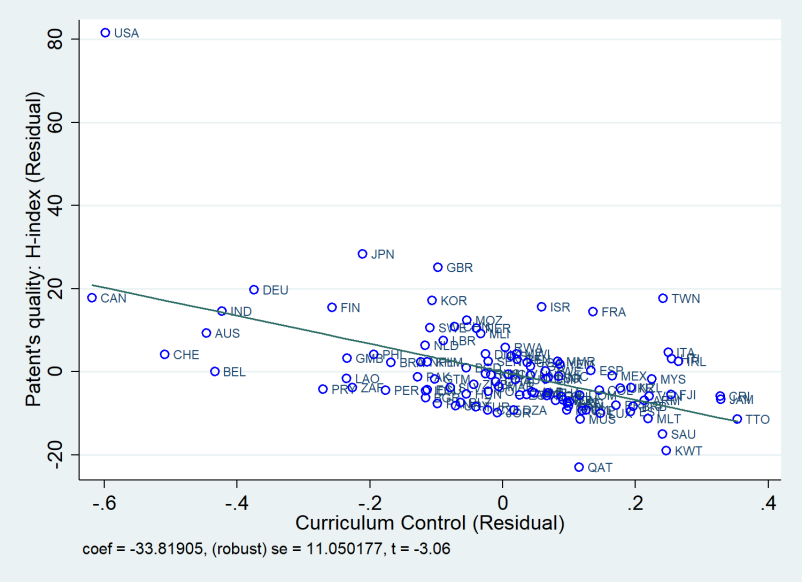
[33]These include the Hirsch index, share of breakthrough inventions, and average citations per patent.

[34]They includes the quality of publications (measured by average citations), famous innovative companies per capita, well-known brands per capita, and prominent universities per capita.

[35]For example, a child who is extremely talented in art but cannot pass the reading test required by the government is deemed inadequate. A child who can write very imaginative essays or fictions but cannot write the way standardized tests want is also deemed inadequate. These "at-risk" children are then forced to fix their "deficiencies" instead of developing their strengths.

[36]In Section 2.7, I show that students educated in more centralized curriculum-control environments enjoy their studies less and they have less self-confidence on learning.

Figure 2.4.. AV Plot of national Patent Quality (Measured by the Hirsch index [H-index]) on Curriculum Control (Table 2.9.2, Column (2))



The relationship between curriculum control and innovation estimated in Column (2) is depicted in the added variable (AV) plot in Figure 2.4. By removing the effects of income, schooling, and continents, the visible negative link between curriculum control and national innovation becomes very striking. However, several outliers are also visible. Likewise, the United States is a visible outlier, as it has extremely high innovation performance. Qatar could be another one. Such outliers, however, are not what drives the results, as shown in the next section. Income levels in most regressions are significantly and positively related to innovation. This is reasonable since countries with more financial resources should have a stronger capacity to innovate.

To summarize, the degree of controlling what children learn in school is negatively associated with various innovation indicators, which is consistent with my argument. In the next section, I check whether the basic results hold by controlling for various covariates, by using different sample sizes and regression models, as well as by implementing outlier tests.

2.5. Robustness Checks

In the first two subsections, I use regressions to condition on a range of national characteristics and assess the independent relationship between *CurrControl* and *Innovation*; moreover, I check whether β_1 changes when the specific national characteristic is considered. I use the H-index of patents (from the USPTO) as the main national innovation indicator and display the results using other innovation indicators in the appendix. In the next two subsections, different sample sizes, regression models, and outlier tests are used for further robustness checks.

2.5.1. Controlling for Non-Human Capital Indicators

Innovation is complicated and affected by various factors. Market size may be one of the key factors influencing innovation. A larger market size would bring more profits for companies and incentives for innovation activities (Jones and Romer, 2010). In addition, a larger population promotes innovation by supplying a higher potential quality of human capital. Endogenous growth theory emphasizes the role of economies of scale in innovation.[37] Empirically, Acemoglu and Linn (2004) and Aghion et al. (2016) show that market size is a crucial factor for innovation in the pharmaceutical and auto industries, respectively. Total population, as the proxy of market size, is controlled and the result is reported in Column (2).[38] The coefficient of *CurrControl* is not significantly changed.

Akcigit, Grigsby and Nicholas (2017) find that densely populated U.S. states are more inventive. The agglomeration literature has long argued that physical proximity promotes creativity, the exchange of ideas, and the spillovers of knowledge

[37] Many fully specified idea-based growth models assume that innovation is an increasing function of the number of people with whom an individual can share ideas. See Romer (1990); Grossman and Helpman (1994).

[38] I also control for GDP as the measure of market size. The result is similar, as reported in the appendix.

capital among inventors.[39] I control for the urbanization ratio and report the result in Column (3).[40] There is no change on my main concern.

One important way of expanding the market size is through access to other geographical regions. This increases both the market size for innovation and the potential flow of knowledge spillovers. Perlman (2015); Donaldson and Hornbeck (2016) find strong effects on invention and agglomeration from the 19th-century development of railroads. Infrastructure indicators, including railway and road density, as well as the share of internet users are controlled.[41] From Column (4), these indicators have little influence on the coefficient I am concerned.

There is a vast literature relating access to capital and innovation.[42] Easier access to credit enables the initiation of capital-intensive projects and provides funding of R&D (Aghion, Howitt and Mayer-Foulkes, 2005; Ang and McKibbin, 2007). Private credit to GDP is controlled in Column (5).[43] The coefficient of *CurrControl* shows little change.[44]

One potential explanation for country-level innovation differences is that innovative places are relatively more open to unconventional and disruptive technological ideas. Those places are also more willing to encourage and protect inventions. Religion and institutions are important dimensions through which societal attitudes and environments shape innovation. A recent set of studies has directly addressed the question of whether religiosity promotes or inhibits innovation.[45] Following

[39] See Carlino and Kerr (2015) for a survey.

[40] By controlling for population density, I find no different result. It is displayed in the appendix.

[41] I extract the indicators from Desmet, Ortuño-Ortín and Wacziarg (2017).

[42] Lamoreaux, Levenstein and Sokoloff (2004) find that the venture-style provision of capital dramatically reduced financing constraints for inventors in Cleveland, an important Second Industrial Revolution city. According to Kortum and Lerner (2000), venture capital had a strong causal impact on patenting rates in the United States in the late 20^{th} century.

[43] Acemoglu and Johnson (2005); Ang and McKibbin (2007); Madsen et al. (2010) use this indicator as the proxy of national financial development.

[44] Capital that is more directly related to innovation is the amount of financial resources used in the process of innovation. But it may be a "bad" control since *CurrControl* could affect R&D spending. For example, researchers that are educated in decentralized education systems may have flexible minds and other strong abilities that are crucial for innovation. It may be relatively easy for such researchers to generate brand-new ideas and create breakthrough innovations. Investors should be more willing to direct resources to these individuals for higher financial returns.

[45] Bénabou, Ticchi and Vindigni (2015) conclude that the relationship is robust and strongly negative.

Acemoglu, Akcigit and Celik (2014); Akcigit, Grigsby and Nicholas (2017), I construct a Hirschman–Herfindahl Index (HHI) of religious membership to capture the toleration of different beliefs within the country.[46] The coefficient of *CurrControl* changes little, as displayed in Column (6).

Institutions are important to innovation. For example, sound property rights protection encourages innovators to work on risky projects where the potential return is higher and reduces uncertainty about possible appropriation.[47] Moreover, effectiveness in protecting innovators depends on strong legislative and political systems. The country's ability to implement the law depends on the quality of government agencies, such as the judiciary, as well as political stability. Rule of law from the Worldwide Governance Indicators (WGI) Project is considered in Column (7). There is no change on the coefficient of curriculum control.[48]

In Column (9), the coefficient of *CurrControl* is still significant when the controls in the previous columns are included together.

In summary, these results suggest that *CurrControl* could be an independent factor that influences innovation, and the effect seems to be quite robust.

2.5.2. Controlling for Human Capital Indicators

Innovation relies on the high quality of talents in the country. In this subsection, I test whether *CurrControl* independently influences innovation by controlling for

[46] Mathematically, $HHI_{i,region} = 1 - \sum share_{i,j}^2$, where $share_{i,j}$ is the proportion of the population in country i believes in religion j. It captures the religious diversity, and therefore, the extent to which different beliefs are tolerated within countries. This variable could measure the degree of openness to disruptive ideas, as a conduit to innovation (Acemoglu, Akcigit and Celik, 2014).

[47] Coe, Helpman and Hoffmaister (2009) find that strong patent protection is associated with higher returns to R&D. However, there are some controversies on the degree of patent protection on innovation. See Chen and Puttitanun (2005), Qian (2007), and Madsen et al. (2010).

[48] In the appendix, a similar result is obtained when I control for private property rights protection, which is extracted from Bertelsmann Stiftung's Transformation Index (BTI). In addition, civil liberties, such as freedoms of speech, press, assembly, and travel, are likely to enhance the diffusion of new ideas into and within a country. Protection of civil liberties presumably increases the variety and improves the selection of ideas, both of which are the central elements in the processes of technological change (Knutsen, 2015; Serafinelli and Tabellini, 2017). Civil liberty from Freedom House is controlled, and the result is reported in the appendix. There is no remarkable effect on the estimate I am concerned with.

several indicators measuring different dimensions of human capital. The results are displayed in Table 2.9.4.

Vandenbussche, Aghion and Meghir (2006), among others, think that innovation is more related to higher education than the basic one. The quantity indicator measuring higher education is sometimes also used as a proxy of quality of human capital (Gallego, 2010). Average years of tertiary schooling is controlled, as reported in Column (1). There is little change on the coefficient of curriculum control.

Migration could boost innovation by bringing new ideas, expertise, and specialized labor to the country. Recent empirical studies confirm that highly skilled migrants promote the production of patents and knowledge creation (Hunt and Gauthier-Loiselle, 2010; Kerr and Lincoln, 2010; Stuen, Mobarak and Maskus, 2012; Moser, Voena and Waldinger, 2014; Bosetti, Cattaneo and Verdolini, 2015). The international migrant stock is controlled, and the result is displayed in Column (2). Again, the result is robust.[49]

Hanushek and Kimko (2000); Vandenbussche, Aghion and Meghir (2006); Breton (2011); Hanushek and Woessmann (2012) emphasize that the quality rather than the quantity of human capital is crucial for the economy. They argue that academic performance, like the examination score, should be an appropriate proxy for the quality of human capital. The international test score at the secondary school level is used to capture the quality of human capital.[50] The result is reported in Column (3). The coefficient of *CurrControl* is stable.

When all these human capital variables are included in Column (4), the coefficient of *CurrControl* is still negative and significant, implying that curriculum control could shape the quality of human capital directly associated with innovation. The smaller coefficient also suggests that some of these indicators could be potential channels through which curriculum control affects innovation. For example, it is

[49]There is no influence on the coefficient of curriculum control if I control for the share of migrant stock (divided by total population) instead of migrant stock.

[50]The data are from Altinok, Diebolt and Demeulemeester (2014). They merge all existing regional and international student achievement tests and provide a data set of indicators measuring the quality of student achievement for 111 countries between 1965 and 2010.

likely that a decentralized curriculum design with flexible promotion and admission policies will attract skillful immigrants who want their children to study in an environment where students have enough time and opportunity to find and pursue their interests, enhance their curiosity and creativity, and strengthen their abilities of independent and critical thinking.[51]

2.5.3. Other Robustness Checks

2.5.3.1. Different Sample Sizes

In this subsection, I explore whether the result is influenced by the specified sample. The findings are presented in Table 2.9.5.

The United States, Canada, and Australia have the most decentralized education systems in the world. Innovative activities in these countries are also very energetic. Column (1) documents that the negative and significant result is not only driven by the Neo-Europes. When I exclude the United States, Canada, Australia, and New Zealand, the estimate is still significant. In Column (2), I further drop European countries. Although it becomes smaller, the coefficient remains significant.

The countries with large populations should have relatively significant bodies of talent. Even when education systems in populous countries are not decentralized, the human capital for innovation embedded in the talented individuals may not be seriously impaired, since intelligence quotient (IQ), one important factor shaping human capital, to some extent, is innately determined by genes (Devlin, Daniels and Roeder, 1997). This implies that the result may collapse in densely populated countries. However, Column (3) shows that this is not the case. After removing small countries[52], the effect of *CurrControl* is almost unchanged.

Curriculum controls in poor countries, like many African countries, are quite centralized. Official curricula are usually designed by central governments and they are

[51] I do find that more the country with decentralized curriculum control in education system is associated with more immigrant stocks. This pattern seems quite robust.

[52] I define that the country is small if its population is lower than the global median level.

more willing to use national-level examinations to evaluate students. These poor countries, in general, have few high-quality patents. To check whether the result is driven by these poor countries, I only include relatively rich countries[53] in Column (4). There is little change in the estimate.

In short, I find that the results are robust in different sample sizes.

2.5.3.2. Outlier Tests

In this subsection, I check whether the result is impaired by removing extreme observations. There are some visible outliers in Figure 2.3 and Figure 2.4. It is necessary to check whether the results are disproportionately influenced by extreme points. The observations with the standard deviation of regression residuals (from Column (2) in Table 2.9.2) between the 5^{th} percentile and 95^{th} percentile are used to run the regression. The result is displayed in Column (5). The coefficient of *CurrControl* is still significant and does not change much.[54]

2.5.3.3. Other Regression Models

In this subsection, I use other regression models to explore the robustness of my argument. Since the dependent variables are always non-negative, a regression model commonly used to deal with censored data is the Tobit model. Column (6) reports the result using this model. The estimate is quite similar to the corresponding one in Column (2) in Table 2.9.2.This suggests that the link between curriculum control and innovation is insensitive to the models used.[55]

[53] I define that the country is rich if its income level is higher than the global median level.

[54] The results are also robust by using other techniques to identify extreme observations, like Cook's distance and leverage. In addition, to mitigate the influences of the extreme observations, the natural logarithmic form of the innovation indicator is used. I also directly exclude some observations with extreme innovation levels (either extremely high or extremely low). The coefficients of *CurrControl* are still highly significant. See the appendix.

[55] I also employ a truncated regression model to deal with this issue. In addition, three nonlinear models (the zero-inflated negative binomial model, standard negative binomial model, and Poisson model) are used. These models deal with the excessive number of zeros or over-dispersion. In all these robustness checks, the significant and negative coefficients, β_1, are obtained. See the appendix.

Overall, the regression results are robust in almost all the regressions when conditioning on different national characteristics, different sample sizes, and non-outliers, as well as using distinct regression models. Therefore, the evidence in this section confirms a strong correlation between curriculum control and innovation.[56]

Ansell and Lindvall (2013) emphasize whether teachers are state, regional, or municipal employees, and the influences of different educational authorities on the salaries of teachers are crucial for national control over education. In the appendix, I also run the regressions using both curriculum control index and centralization index in educational finance (see the building process in the appendix) and find that both greatly affects innovation. Although these two indicators are overlapping, they are different. For example, in Australia, curriculum control is quite decentralized, but the federal government controls large financial resources for education. On contrary, in China, the central government has the great influence on curriculum, while regional and local governments are responsible for financing primary and secondary education.

In the next section, I will provide the within-country evidence and explore the effect of curriculum control on the occupation choices of immigrants in the U.S. who may get educations from their original countries.

2.6. Within-Country Evidence: The U.S. Census in 2000

Cross-country analysis may fail to control fully for source differences between countries. However, I can examine the effect of curriculum control within a given country, thereby holding other sources of country-fixed factors constant. Furthermore, by exploring within-country variation, I can rule out alternative explanations based on differences in, for example, diffusion costs or geography.

[56] In the appendix, I use other innovation indicators to implement all these robustness checks. The results are similar, although some are not so robust.

2.6.1. OLS Regressions

My argument emphasizes that decentralized curriculum control in education cultivates the creativity. This implies that people educated in such systems have a high probability of choosing research-oriented occupations that require independent thought and deviation from traditional ways of doing things. The unique feature of the United States as a country of immigrants from all over the world makes it an interesting object in studying the effect of curriculum control. This approach is inspired by Roland and Gerard (2017), who exploit this feature to study the effect of culture on economic growth and innovation. Following them, I use ethnicity, age, gender, birthplace, year of immigration, and educational attainment from the 5% public micro-data (IPUMS) of the U.S. Census in 2000. Ethnicity is based on the respondent's self-report country of ancestry. The sample includes only employed males aged 25 to 60 who have non-missing information on ancestors (country of origin).[57]

One of the important differences among people born in the United States or not is that they receive schooling from different education systems. This difference could affect their propensities to choose research-oriented occupations. To formally check it, I estimate the following OLS regression:

$$ROO_i = X_i\theta + \beta_1 CurrControl_i + Born_i + \varepsilon_i \tag{2.2}$$

where i indexes individuals; ROO is a dummy variable, which is equal to 1 if an individual has a research-oriented occupation and 0 otherwise; $Born$ is also a dummy variable and is equal to 1 if an individual was born in the United States and

[57] Following Roland and Gerard (2017), I constrain the sample to the individuals with non-missing ethnicity information because I focus only on individuals who associate with particular countries (which could be different from the United States). I exclude women, those who are unemployed, and other ages to minimize the various possible selection effects. In addition, I exclude the individual who moved to the United State before the age of 18. These persons probably also received some education in the United States.

0 otherwise; $CurrControl_i$ is the degree of curriculum control in education system for individual i has experienced. It is curriculum control in the United States if individual i was born there, while it is the one in the country of origin if individual i was born outside the United States;[58] and the vector X includes controls like age, age squared, and a set of dummies for educational attainment, as well as other variables for further robustness checks.

My argument predicts that β_1 should be negative. Panel A of Table 2.9.6 presents estimates of β_1 in regression (2.2). In Column (1), I only control for the basic covariates. The coefficient of $\hat{\beta}_1$ is significantly negative, indicating that those educated from decentralized curriculum-control countries are more likely to get research-oriented occupations than the ones educated from centralized curriculum-control countries.

Next, I add a set of dummies of ethnic groups (corresponding to the country of origin). These dummies capture the fixed factors within each ethnic group, such as culture and parenting styles. The coefficient of $\hat{\beta}_1$in Column (2) is still significant and negative.

$\hat{\beta}_1$ could possibly capture other effects instead of the effect of curriculum control. For example, language differences could confound the result. Compared with new immigrants, the natives are more skilled in communicating with others using English. This advantage is beneficial for locals to find the jobs they prefer. In Column (3), I control for the linguistic distance between the United States and the country that individual i was born. The coefficient of curriculum control is still highly significant.[59] Finally, I include both dummies of ethnic groups and linguistic distance. The curriculum control is still negatively associated with the propensity of the individual to choose research-oriented occupations.

[58]Because of the lack of further information, I have to assume that those who were not born in the United States are educated in their country of origins.

[59]The data of the linguistic distance index are from Desmet, Ortuño-Ortín and Wacziarg (2017). A high value represents a large difference in the languages between the United States and the country individual i was born.

2.6.2. Instrumental Variable and the IV Regressions

Although I show that curriculum control is associated with the individual's creativity, measured by research-oriented occupation choice, still, some omitted variables that are not considered may impair the results. In addition, it is possible that some more fundamental variables simultaneously influence both individual's creativity and the education system.[60] Therefore, an instrumental variable is needed to solve these issues and identify the causal relationship between curriculum control and creativity.

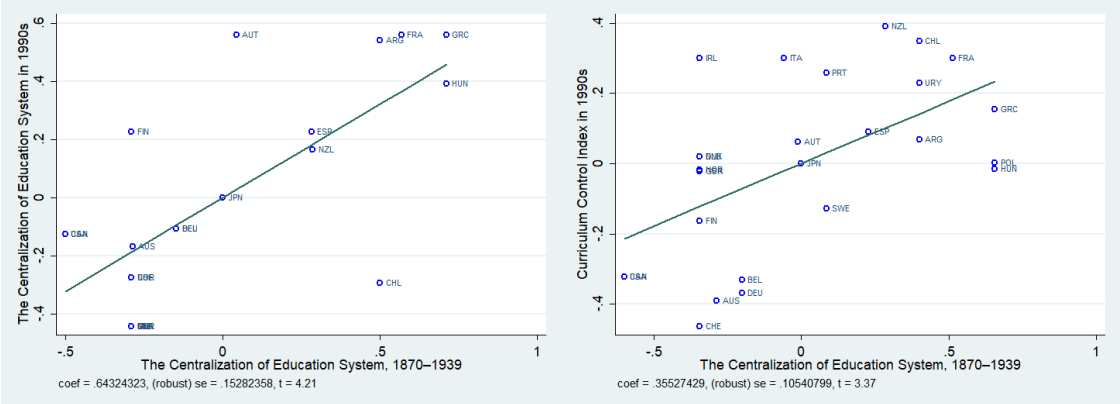
2.6.2.1. The Political Factors Influencing the Choice of Education System

The education system is highly persistent. Figure 2.5 plots the relationships between the primary education centralization index in the early period (between 1870 and 1939) and educational administrative centralization index, as well as curriculum control index in the 1990s by controlling for continents effects. The primary education centralization index in the early period is extracted from Ansell and Lindvall (2013). They rely primarily on evidence of whether teachers were central, regional, or municipal employees, as well as the influence that national school inspectors and other national agencies had over hiring, promotions, salaries, and other employment conditions.[61] The indicator that is closely related to their index should be an administrative concentration in education, which measures central authorities for hiring, firing, and setting terms of reference for local employment in education

[60] For example, industrial elites may have great powers to shape both the education system and national economic development strategy. Beauchamp (1987) illustrates that business leaders in Japan bluntly expressed the unhappiness in industrial circles with the democratically oriented schools (transplanted from the United States) and called for an educational system that was more closely allied to the needs of industry during the post-occupation period. In practice, it meant more and better vocational courses and a higher degree of professionalization at the university level.

[61] They build this centralization index between 1879 and 1939 for 27 countries. It is a binary variable that separates highly centralized national education systems—where teachers were state employees or local and regional institutions had little influence over hiring decisions, promotions, salaries, and employment conditions—from those controlled at the local or regional level. I average the index from 1879 to 1939 and take it as the measurement of educational centralization degree for each country in the early period.

Figure 2.5.. Plots of the Centralization of Education (Left) and Curriculum Control (Right) in the 1990s on the Centralization of Primary Education in the Early Period Conditioning on Continent Dummies.



system without making any reference to lower level authorities (Ivanyna and Shah, 2014). The education centralization index in administration in the 1990s is built by myself and normalized to the interval [0,1], where 1 is the most centralized and 0 is the most decentralized.[62]

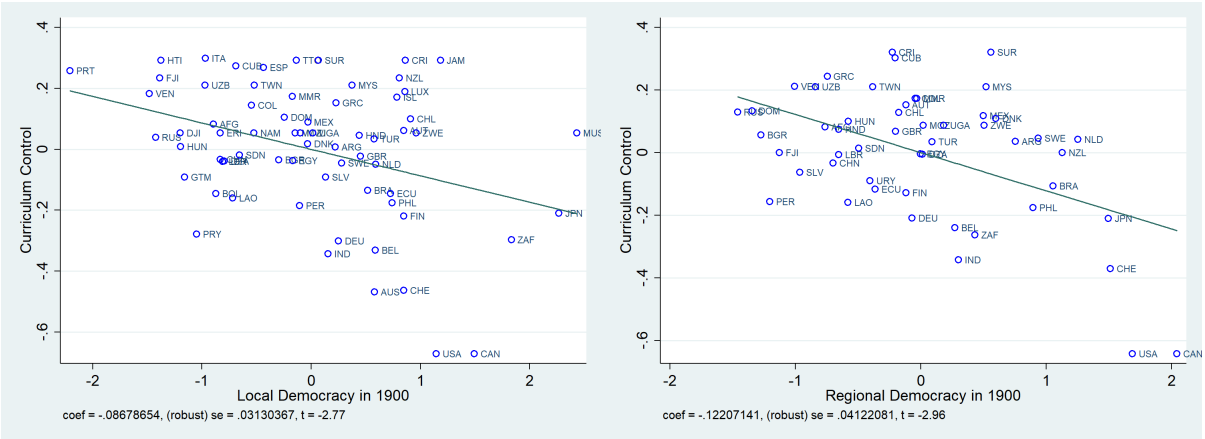
A strong visible positive link between centralization of primary education in the early period and education centralization index in administration in the 1990s emerges in Figure 2.5 (left), implying a high degree of persistence in cross-country differences.[63] The pattern is also true between the centralization index in the early time and the curriculum control index in the 1990s, showing in Figure 2.5 (right).

The results give hints for finding the historical roots education structure, curriculum control degree. Lindert (2004) finds that the United States, Canada, and Prussia had decentralized political systems in the 19^{th} century, where local elites and citizens controlled educational decisions and policies in politics. Even today, education systems in these countries are quite decentralized. In other words, the decentralized education system partly stems from decentralized federal systems (Goldin and Katz, 2008; Ansell and Lindvall, 2013). Gallego (2010) finds that the degree of political

[62] I build this variable by using the information from the book *International encyclopedia of national systems of education*. See the details in the appendix.

[63] From the result of regressing the educational administrative centralization index in the 1990s to the centralization of primary education in the early period, it explains 46% of the cross-country variation.

Figure 2.6.. Early Political Decentralization and Curriculum Control Conditioning on Continent Dummies



decentralization[64] has a positive and significant influence on more advanced levels of schooling. Ansell and Lindvall (2013) demonstrate that federalism, which served to protect the political interests of local actors from centralizing forces, negatively influenced the centralization of primary education before World War II.

Condition on continent dummies, Figure 2.6 plots the link between early political decentralization developments[65][66] and *CurrControl*, suggesting that a higher quality of political decentralization is associated with more decentralized curriculum control.

The recent literature on political decentralization finds that a high quality of political decentralization leads to greatly effective governance.[67] It is possible that the high

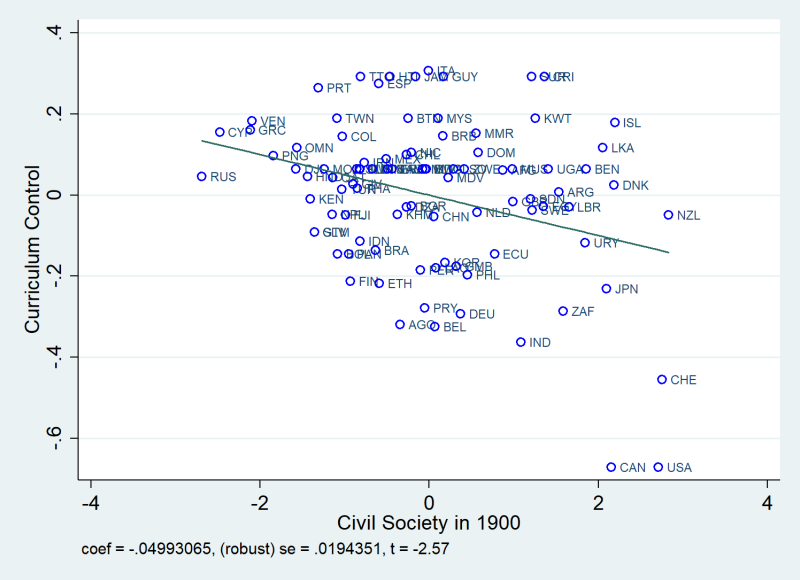
[64] Gallego (2010) emphasizes that political decentralization is related more to the measure of local democracy and argues that this distinction is important because the lack of local checks and balances is one of the factors that explain why some theories predict a potentially negative effect of decentralization on education and other social outcomes (Bardhan and Mookherjee, 2000; Bardhan, 2002; Gennaioli and Rainer, 2003). Political decentralization combines both centralization of local authority and local democracy.

[65] I follow the definition of Gallego (2010). Political decentralization is measured by the local or regional democracy development, defined by the degree that citizens could select their local or regional governments. The data are from the V-Dem Project. See the details in the appendix.

[66] The initial or early time is defined as the period that the schooling starts to play a great role in the formation of human capital. Cinnirella and Streb (2017) illustrate that the Second Industrial Revolution can be seen as a transition period when it comes to the role of human capital. As in the subsequent 20^{th} century, the quality of basic education was associated with both workers' productivity and firms' R&D processes. It should be reasonable to set 1900 as an initial year. Ansell and Lindvall (2013) also document that central governments sought to increase their influence over the education systems during the late 19^{th} and early 20^{th} centuries.

[67] For example, Albornoz and Cabrales (2013) find that decentralization is associated with lower (higher) levels of corruption for sufficiently high (low) levels of political competition. See Mookherjee (2015) for the recent literature review.

Figure 2.7.. Early Civil Society Development and Curriculum Control Conditioning on Continent Dummies



quality of local democracy would bring local citizens more confidence to govern by themselves and support a decentralized education system. The quality of political decentralization could be influenced by the active civil society and efficient competition in elections. Figure 2.7 describes the relationship between early civil society development[68] and *CurrControl* by controlling for continent dummies, indicating that more active civil society in the early period is highly correlated with less centralized curriculum control.

Widespread corruption is another important reason for implementing more centralized and rigid assessment policies. For example, to curb severe corruption, most ex-Soviet countries have recently tended to use unified national entrance examinations to select students for universities (Orkodashvili, 2010; Osipian, 2012; Orr et al., 2017). In China, it is always a serious concern on the reform of admission policies in higher educations, since the masses are worried that other methods besides unified examinations would lead to more corruptions and advantages for children of wealthy parents (Dello-Iacovo, 2009; Liu, 2012). The similar concern also existed

[68]There are several indicators measuring civil society development in the V-Dem Project, including the civil society participation index, the frequency of civil society organizations being consulted by governments, and civil society organizations' participatory environment. I build one composite indicator by combining all of these variables through PCA. The data in 1900 are used to measure early civil society development.

in Japan during the 1960s (Beauchamp, 1987; Doyon, 2001). So, potential corruption during the early stage of schooling expansion may also influence the choice of education system.[69][70]

In short, political factors, such as political decentralization, corruption, and civil society in the early period, could be potentially important factors influencing the education system. The slow change of political institutions may also partially explain why the education system is persistent.

2.6.2.2. Exogenous Variations: Deviation of the CSI

The political factors considered are endogenous. My strategy is to find the exogenous factor that affects these local institutions in the early period, thereby influencing the past and current education system, more specifically, curriculum control. Equation 2.2 describes the relationship between *CurrControl* and individual's creativity. In addition, I have

$$CurrControl_i = \alpha_C + \gamma_C EarlyIns\_Struc_i + X_i^{'}\pi_C + \upsilon_{iC}$$

$$EarlyIns\_Struc_i = \alpha_P + \gamma_P ExoVar_i + X_i^{'}\pi_P + \upsilon_{iP}$$

CurrControl denotes curriculum control at the current time, *EarlyIns_Struc* measures local institutions during the early period, and *ExoVar* is the exogenous variation that influences these local institutions. X is a vector of covariates that affect all the variables.

The exogenous variation is inspired by the studies of Mayshar, Moav and Neeman (2017); Ahmed and Stasavage (2017). Mayshar, Moav and Neeman (2017) argue

[69] In the equilibrium, it is possible that both centralized and decentralized education system are associated with low level of corruption. Different societies choose distinct education systems based on their initial social and political environments. For example, citizens in countries with low-level corruptions may have more confidence to self-governance and prefer decentralized education systems and flexible admission tools, while the masses in countries with high-level corruption would prefer more centralized, rigid, and unified admission policies to curb corruption. Thus, corruption in the early period could be a good predictor for the choice of education system.

[70] Unfortunately, there is no such indicator to measure the educational corruption during the initial period.

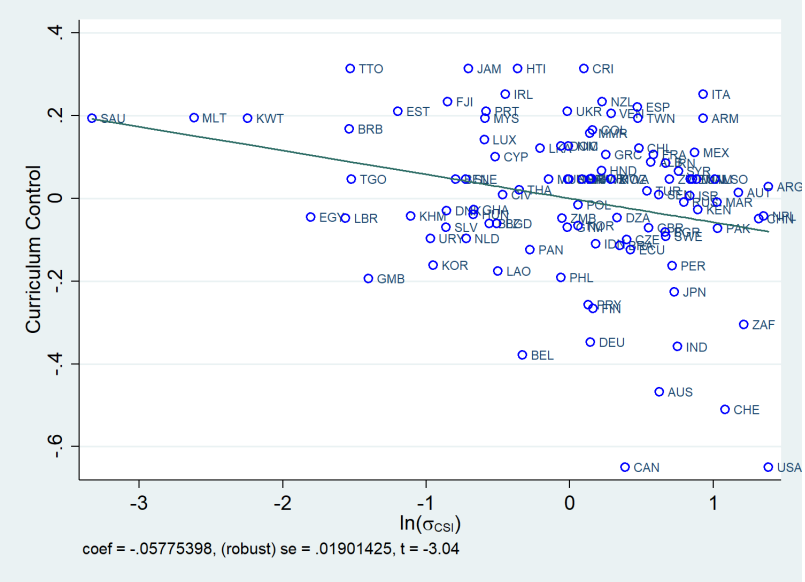
that the ability for the early central state to appropriate revenues from the agricultural sector is influenced by the transparency of farming, which in turn, is affected by geography and technology. In other words, the observability of agricultural production can greatly influence the rise of local and central autocracy in the early time.[71]

One of the exogenous variations that affects the observability of the farming sector across regions in the early period is exogenous land productivity distribution within the country. It could be captured by the standard deviation of the CSI, or σ_{CSI}, built by Galor and Ömer Özak (2015).[72] Taxation from agriculture should be the main financial resources for the government before the industrialization. The taxation revenue could be greatly influenced by σ_{CSI}. For example, the central ruler may have difficulty collecting precise information on the agricultural sector when σ_{CSI} is high. Because it becomes challenging for central officials to evaluate the reliability of information related to local agricultural productions providing by local officials, especially when there is no advanced technology to measure and predict weather and climate, and the central government has to heavily rely on comparison with other regions to mitigate information asymmetries. Thus, it may be not easy to form a strong centralized state due to weak tax collection abilities. Furthermore, to solve the issue of information asymmetry, the central ruler may have to share the power with local governments or even non-rulers (Ahmed and Stasavage, 2017).

[71] They argue that the success of early central states, such as ancient Egypt, was due to the high global transparency (through the irrigation system) that enabled the central authority to keep the subordinated intermediary lords at bay and extract a larger share of revenue from the periphery to the center.

[72] They report the number of calories that could be produced in a given area before and after the Columbian Exchange. CSI provides the average caloric yield per hectare per year for each grid cell on a resolution of 300 arc seconds (0.083 degrees or around 85 km^2). The average is derived from the caloric suitability of all 49 crops for which the Global Agro-Ecological Zones project of the Food and Agriculture Organization provides global crop yield estimates and that can be grown in the area of a state. They argue that by focusing on potential crop yield, based on agri-climatic characteristics that are unaffected by human intervention, CSI could be viewed as an exogenous proxy for land productivity.

Figure 2.8.. σ_{CSI} and Curriculum Control Conditioning on Continent Dummies



In other words, lower transparency of farming could be related to more political decentralization.[73]

In short, σ_{CSI} could be used as an exogenous variation that influences the early political decentralization, through which, affects the education system.[74] Higher σ_{CSI} would be favorable to the establishment of more decentralized education structure. Figure 2.8 plots the relationship between σ_{CSI} and *CurrControl* in the baseline sample conditioning on continent dummies.

2.6.2.3. IV Regression Results

I use σ_{CSI} as introduced in the previous subsection to instrument *CurrControl*.[75] I narrow the sample and only investigate individuals who were not born in the United

[73] Ahmed and Stasavage (2017) find that there is a correlation between exogenous localized variation in potential agricultural suitability and the presence of council governance. In council government, the power of the ruler is relatively constrained since the authority is vested in a council.

[74] I use σ_{CSI} during post-1500. This is more related to political development in the early period (e.g., 1900). Plus, after the Columbian exchange, many of the crops were quickly transplanted between the Old and New Worlds (Galor and Ömer Özak, 2015). Mayshar, Moav and Neeman (2017) find increase the availability of crop after Columbian exchange has great influences on political structures in some regions. In the rest of the paper, I mainly use the standard deviation of the average calorie as the IV. The standard deviation of the maximum calorie is also employed, the results are quite similar.

[75] I use the logarithmic form of σ_{CSI} , since there are no theoretical reasons for preferring the level as a determinant of *CurrControl* rather than the log, and using the log ensures that the extreme values do not play a disproportionate role.

States. The advantage of exploring this sub-sample is that these individuals work in the United States but get education from their own countries. Therefore, the effect of σ_{CSI} on their occupation choices is probably mainly through schooling, rather than other channels, such as political structures in their original countries.

The results are consistent with the argument, which is reported in Panel B of Table 2.9.6.[76] The effects seem to be larger than those in the OLS ones. For example, the first column is the basic 2SLS result and the coefficient of *CurrControl* is -0.086, which is much larger (absolute value) than the one in the OLS (-0.010), indicating that measurement error in *CurrControl* that creates attenuation bias is likely to be more important than the reverse causality and omitted variables biases. From the first stage, there is a strong and negative relationship between σ_{CSI} (log form) and *CurrControl*, which is consistent with the analysis in the previous subsection. A larger σ_{CSI} may be beneficial for constructing a more decentralized education system.

2.7. Intermediate Channels

In this section, I investigate the roles of curriculum control on teaching practices, learning experiences of students, and formations of people's beliefs and values on careers. Through these explorations, I give some preliminary evidence about the micro-foundations of curriculum control on innovation.

I mainly estimate the following OLS regression in the following three subsections:

$$Y_i = X_i\theta + \beta_1 CurrControl_i + \varepsilon_i \tag{2.3}$$

i indexes individuals. Y is the variable I will explore. It could be the indicator measuring teaching practice, student's attitude to study, or career values. $CurrControl_i$

[76] In Column (2), I control for the indicator of individualistic culture from Hofstede and Hofstede (2001), an important ethnic fixed factor, instead of a set of ethnic group dummies to avoid multicollinearity.

is the curriculum control index for the country that i is living. The vector X includes the micro-variables related to i, which are specified in each subsection. Table 2.9.7 presents the estimates of β_1 in regression (2.3).

2.7.1. The Effect of Curriculum Control on Teaching Practices

More centralized curriculum control would lead to more teacher-centered instructional approaches in an effort to transmit the content required by the official curriculum and tests. Peterson (1979); Bonawitz et al. (2011); Agrawal et al. (2011); Kapur and Bielaczyc (2012); Kapur (2014, 2016); Zhao (2017) explain that these teaching approaches are effective in promoting rapid and efficient learning of the target material and may boost achievement test scores. However, they also find that teacher-centered methods inhibit curiosity and creativity since instruction necessarily limits the range of hypotheses children consider and their attempt to explore novel situations.[77]

I employ the information about teaching practices on the percent of time lecturing and group activities from the Progress in International Reading Literacy (PIRLS) in 2006 to check my argument.[78] Following Algan, Cahuc and Shleifer (2013), I control for student characteristics (test scores in reading achievement, age, gender, immigrant status, parental education, number of books at home, and parental socioeconomic background), teacher characteristics (age, gender, education, and experience), and class characteristics (class size, average, and standard deviation in reading test scores) in regression (2.3). Columns (1)–(2) document the effects of

[77] Buchsbaum et al. (2011) show that, in situations where the experimenter adopted the role of an instructor and directly gave instructions and demonstrations, children were more likely to imitate the instructor than in other conditions. But, they were found to be less likely to explore and come up with novel solutions. Students in the direct instruction condition were initially more successful in solving well-structured problems (Kapur and Bielaczyc, 2012). However, in the end, their performance on tasks that required deeper conceptual understandings was inferior to students under the learning condition where learners persisted in generating and exploring representations and solution methods for solving complex, novel problems.

[78] PIRLS is devoted to reading by fourth graders, and it reports detailed information on teaching practices. The data are extracted from Algan, Cahuc and Shleifer (2013).

curriculum control on teaching practices. The results suggest that teachers spend more time conducting group discussions in more decentralized curriculum-control education systems, while they tend to spend more time in lecturing in more centralized curriculum-control systems.

In the next three columns, I examine the robustness of the relationships by using the teacher survey data from the Civic Education Study (CES) in 1999.[79] The survey includes the questions about teaching practices, such as the frequencies of teachers lecturing, of students taking notes or group activities.[80] By merging with student survey data, student characteristics (age, gender, immigrant status, number of books at home, and education of the parents), teacher characteristics (age, gender, education, years of experience, trust, and attitudes toward cooperation), and school characteristics (class size, public school, and social capital at the school level) are controlled in regression (2.3). Column (3) shows a negative correlation between curriculum control and the conducting of group discussions in the class. In Column (4)–(5), there are positive associations between curriculum control and the frequencies of teachers lecturing and students taking notes from the board.

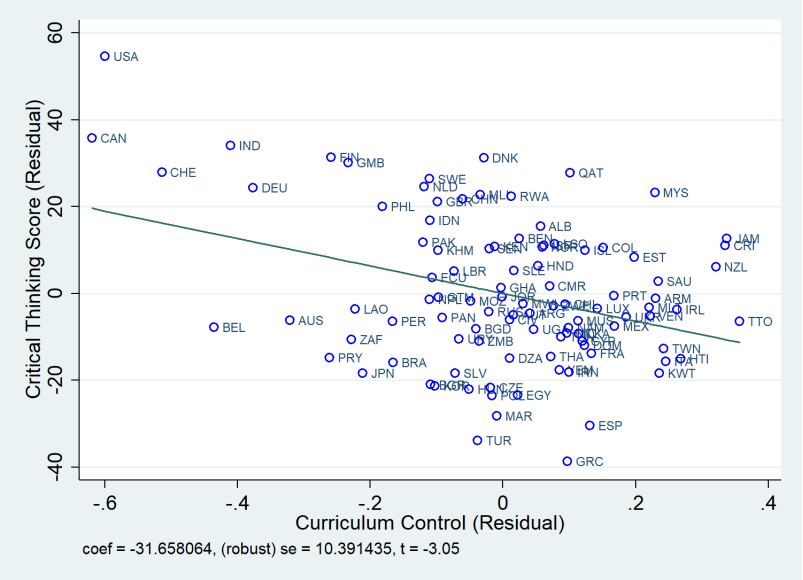
These results are consistent with my argument. In a more centralized curriculum-control educational environment, students work in groups less frequently and have fewer opportunities to ask teachers questions. These teacher-centered instructional approaches probably lead to cramming teaching styles. Rote learning methods will popular among students (Au, 2007). Here, I provide some empirical evidence on the effect of curriculum control on the popularity of critical thinking in teaching at the country level. I use the following regression model:

$$CriticalThink_i = \beta_0 + \beta_1 CurrControl_i + \beta_2 X_{1990-2005} + Continent_i + \upsilon_i \quad (2.4)$$

[79] CES ran in 1999 in 25 countries to assess the level of civic knowledge of mostly 14-year-olds in the eighth and ninth grades.

[80] The data are extracted from Algan, Cahuc and Shleifer (2013).

Figure 2.9.. AV Plot of the Critical Thinking in Teaching on Curriculum Control (Table 2.9.8, Column (1))



It is similar to the regression model (2.1) except that the dependent variable is the indicator measuring the critical thinking teaching in each country.[81] The results are displayed in Table 2.9.8. The baseline result is shown in Column (1), implying that more centralized curriculum control is associated with less critical thinking in teaching. The relationship between curriculum control and critical thinking in teaching estimated in Column (1) is depicted in the added variable (AV) plot in Figure 2.9. The visible negative link between curriculum control and critical thinking teaching style is very striking. It echoes the findings using teaching survey data at the individual level. I also present some robustness checks by controlling for other covariates specified in each column. It indicates that the pattern is quite stable.

[81] The critical thinking teaching data is from the *Executive Opinion Survey* in *The Global Competitiveness Index Report* in 2018. Response to the survey question "In your country, how do you assess the style of teaching?" [1 = frontal, teacher based, and focused on memorizing; 7 = encourages creative and critical individual thinking]. The score is normalized between 0 and 100.

2.7.2. The Effect of Curriculum Control on Learning Experiences of Students

Soaked in the centralized curriculum control system and instructed by the teacher-center approach, it should be not surprising that students are less interested in studying. Negative learning attitude weakens children's curiosity and imagination. In addition, when children are judged by a single criterion like test performance, they are constantly asked to be compared with their peers. They are rewarded or punished accordingly. The result is that most children will be worse than the few top performers in the class, school, or city. Most children learn to internalize a sense of inferiority and eventually lose self-confidence (Zhao, 2012; Loveless, 2006). This is not good for their career developments in the future, especially for the careers rely more on creativity abilities. Bénabou and Tirole (2002) emphasize that self-confidence is crucially important in engaging in creative work, such as writing a great book, doing innovative research, or setting up a firm. Hirshleifer, Low and Teoh (2012) find that firms with overconfident CEOs obtain more patents and patent citations, and achieve greater innovative success for given research and development (R&D) expenditure.

The survey data from TIMSS in 2007 are used to investigate the influence of curriculum control on the learning experiences of students, more specifically, the self-confidence of students and their attitudes toward learning.[82] The controls for student, teacher, and classroom characteristics are similar to those used in CES. Column (6)–(7) report the effects of curriculum control on student's attitude[83] toward science and self-confidence in studying it.[84] Students learning in more centralized

[82]The data are extracted from Algan, Cahuc and Shleifer (2013).

[83]The positive attitude index is built by TIMSS, combining the information related to the following statements: "I enjoy learning this subject," "This subject is boring," and "I like this subject." Response options were "Strongly agree" to "Strongly disagree" on a 4-point Likert scale, with the variable of "This subject is boring" having a reverse scale.

[84]There are more observations in science survey data. Similar patterns are also obtained by using survey data in math. See the appendix.

curriculum-control educational environments have less positive attitude toward the subject they learn, and they feel less confident.

2.7.3. The Effect of Curriculum Control on Career Values

Schooling shapes people's beliefs, social values, and preferences (Algan, Cahuc and Shleifer, 2013; Ito, Kubota and Ohtake, 2015; Cantoni et al., 2017). The rigidity and prescriptiveness of the curriculum, along with the sustainability of the effects over time, suppresses learners' autonomy. Curriculum-based tests reward those who conform and penalize those who deviate. As a result, students are taught to do things in a certain way that helps them achieve high test scores, and they learn not to deviate. However, asking questions and challenging the status quo are the hallmarks of innovation, which are in direct conflict with the spirit of standardized tests. Those who survive and thrive in a test-taking culture may have learned to conform and internalized a sense of obedience. The beliefs and values shaped by schooling will probably influence their careers and career values.

I explore the effect of curriculum control on career values by examining the values that individuals report as being important to career. Career values are measured by using the following survey question from the World Values Survey (WVS): "It is important in a job to give an opportunity to use initiative." Respondents respond "yes" (denote 1) or "not" (denote 0) in the question. I also explore the nature of their tasks at work. There are 10 levels, where 1 denotes mostly routine tasks while 10 denotes mostly not routine tasks.[85]

The respondent's characteristics (gender, age, squared age, a set of dummies for educational attainments and income levels) and the dummies for different survey years are controlled in regressions using model (2.3). The results are reported in Column (8)–(9) in Table 2.9.7. Individuals educated in a decentralized curriculum-

[85] I use the data from the fifth and sixth waves of the WVS.

control system are more frequently doing creative tasks at work. They are more likely to believe that it is important to use initiative in their jobs.

In the appendix, I also show that curriculum control is systematically associated with parenting styles by examining the values that parents report as being important to teach their children. The parents educated in a decentralized curriculum-control system believed that imagination and independence were important for their children, and they generally disagreed that obedience is a important quality.

2.8. Policy Application

It seems to be a consensus among researchers, policymakers, and the public that schooling is an important pillar for innovation and economic prosperity. However, it seems unclear which type of education is more beneficial to innovation.

Many policymakers, especially in the Western world, admire the impressive performances of some Asian countries on international examinations (Xiang and Yeaple, 2018) and they implement the policies learned from these countries, like national curriculum and high-stakes tests, and hope that these policies will improve the test performances of their students, strengthen the quality of their human capital, and eventually boost their national innovation and economic prosperity.[86]

Standard curricula with high-stakes tests will push teachers and students to concentrate on the knowledge the official curriculum describes and promote efficiency.

[86]For example, the United States introduced a national curriculum (the Common Core State Standards) in 2010 to compete successfully in the global economy (Porter et al., 2011). Australia marked a turning point in its educational history with the endorsement by Australian education ministers of a national curriculum in 2010. The rationales behind it are similar to that in the United States (Polesel, Rice and Dulfer, 2014). Another example is the United Kingdom. Recently, they review their national curriculum and stressed the features of international comparison and efficiency, as follows: "ensure that the content of our National Curriculum compares favorably with the most successful international curricula in the highest performing countries; set rigorous requirements for pupil attainment, which measure up to those in the highest performing countries in the world" (James et al., 2011). For these countries with traditionally decentralized education structures, in the pursuit of efficiency, equity, and national consistency, these reforms on the standards and curricula will essentially serve the same educational diet for a whole nation and homogenize children's learning (Zhao, 2012).

These policies may increase learning efficiency and could be favorable to the improvement of the test performances of students (Zhao and Meyer, 2013). However, they are costly. There are side effects ignored by many policymakers. For instance, Au (2007, 2008); Zhao (2012); Polesel, Rice and Dulfer (2014) argue that these policies will lead to curriculum narrowing, thereby pushing teachers to schedule more time to cover the material on the test and ignore the non-core knowledge in the curriculum. Classroom instruction will be transformed into test preparation, which may lead to higher popularity of rote learning, thereby suppress critical and creative thinking, and diminishes students' natural curiosity and joy for learning in its own right. Some critics have observed the recent decline of creativity of children in the United States and attributed it to the trend of more centralized curriculum design and high-stakes exams (Liu and Neilson, 2011; Christensen, 2015).

This study empirically confirms that there is a huge hidden cost in implementing centralized official curricula with high-stakes testing. Such practices impair creativity. I do not suggest that policymakers should ignore the low achievements of children's learning, or especially, their unsatisfactory performances in examinations. However, they should be more cautious about the policies they develop and be aware of the benefit they would gain and cost they would pay. Like medical products, they can cause damage while providing a cure. A medicine that is effective in treating heart problems for some people can be deadly to others. In other words, what works for some may hurt others.

Zhao and Meyer (2013); Kamens (2016) suggest that, instead of focusing on curriculum and test policies, the government should pay more attention to preschool education and socioeconomic policies that alleviate inequality. In addition, one of the important reasons that countries tend to implement more standard curricula and more unified assessment policies is addressing the ills that plague education systems, namely those of equity, quality, and efficiency (Beauchamp, 1987; Helms, 2008; Dello-Iacovo, 2009; Orkodashvili, 2010; Osipian, 2012). For example, Japan quickly returned to a more centrally controlled education system after implementing

the education reform by experts from the United States after World War II. Japanese seem to enjoy "equality of opportunity" because of substantially equal physical facilities throughout the country, a uniform curriculum administered by a single Ministry of Education, equal access to the same textbooks, teachers of relatively equal competence, and a uniform set of national standards (Beauchamp, 1987). Similarly, many ex-Soviet countries, like Russia and Georgia, have recently transited to more centralized curriculum control and uniform university entrance exam to solve the growing corruption in their education systems (Orr et al., 2017). Thus, macro-policies beyond education reforms are needed to deal with these problems. Otherwise, policymakers and the public will have the tendency to agree to more centralized education policies to pursue efficiency, equity, and national consistency, which will harm the innovation capacity and weaken economic growth in the long run.

2.9. Conclusion

Innovation is the key long-term pillar for the economy, and it grows more important when the country is approaching global technical frontiers (Romer, 1990; Aghion and Howitt, 1992; Grossman and Helpman, 1994; Acemoglu, Aghion and Zilibotti, 2006). Schooling is becoming increasingly indispensable for cultivating human capital, which is crucial for innovation (Madsen et al., 2010; Zhao, 2012; Madsen, 2014; Jones, 2016). This paper explored one specified educational structure, curriculum control, in its effect on creativity. I found that a centralized curriculum design paired with high-stakes achievement tests is negatively associated with creativeness. Curriculum control seems to be an independent factor that affects innovation, and this has not been explored by previous work.

The relationship still holds even when international test scores and tertiary schooling are controlled, which highlights that curriculum control affects the quality of human capital that is crucial for innovation. This dimension is not fully explained by the

two indicators, both of which are the measures of quality of human capital. More decentralized curriculum control, which has fewer negative effects on children's imagination, creativity, self-confidence, and critical thinking, is better for innovation.

To solve the endogenous issue, I employed the exogenous land productivity distribution as the IV. This IV captures the exogenous difference of the observability of agricultural productivity across regions within the country, which is proxied by the standard deviation of CSI or σ_{CSI} built by Galor and Ömer Özak (2015). The IV regressions identify that centralized curriculum control casually weakens the individual's creativity, measured by research-oriented occupations.

This study questioned education reforms in many developed countries that once had decentralized education systems but implemented education policies like national curricula and high-stakes tests in recent years. The adverse side effects of these policies in education have been largely ignored. These adverse effects, including curriculum narrowing, the spread of rote learning, talent homogenization, and suppression of curiosity, would impair national innovation in the long run. The reform taken in education should be more cautious.

Further research should theoretically explore the factors determine the equilibrium of the education system. Equally importantly, the mechanisms through which the curriculum control influences innovation need to be further investigated.

Table 2.9.1.. Coding Process for Official Curriculum and Exam Control

Official Curriculum (1990s) [$OfficialCurr_{jit}$]				Exam for Promotion, Graduation, and Admission (1990s) [$ExamControl_{jit}$]			
Dominated Government	Other Lower Edu Authority	Example	Value	Dominated Government	Other Lower Edu Authority	Example	Value
Central	No	Afghanistan [Primary]	7	Central	No	Benin [Primary]	9
	Regional	China [Upper Secondary]	6		Regional	China [Upper Secondary]	8
	Regional & Local	Argentina [Primary]	5		School	Indonesia [Upper Secondary]	7
	Regional & Local & School	Finland [Upper Secondary]	4				
Regional	No	Bosnia-Herzegovina [Lower Secondary]	3	Regional	No	India [Lower Secondary]	6
	Local	Germany [Primary]	2		Local	Russia [Lower Secondary]	5
	Local & School	Canada [Upper Secondary]	1				
				Local	No	Japan [Lower Secondary]	4
					School	South Korea [Lower Secondary]	3
				School	No	Afghanistan [Primary]	2
				No	No	Finland [Lower Secondary]	1

Note: This table shows the coding process of $OfficialCurr_{jit}$ and $ExamControl_{jit}$ in the 1990s.

Table 2.9.2.. OLS: The Effect of Curriculum Control on Innovation Measured by Different Innovation Indicators

	Patent: USPTO				Patent: EPO			Non-Patent Indicators			
Dependent Variable:	(1) H-index	(2) H-index	(3) Breakthrough Patent Share	(4) Avg. Citations	(5) H-index	(6) Breakthrough Patent Share	(7) Avg. Citations	(8) Journal Citations	(9) Innovative Company	(10) Famous Brand	(11) Famous University
Curriculum Control (β_1)	-27.498***	-33.819***	-38.190***	-52.854***	-52.737***	-53.062***	-37.580***	-28.099***	-29.195**	-22.028**	-41.417***
	(7.383)	(11.050)	(8.801)	(10.865)	(10.981)	(8.861)	(6.750)	(6.690)	(13.070)	(10.458)	(7.969)
GDP Per (Log)		4.284***	6.648***	8.590***	6.002***	6.994***	12.346***	0.413	4.795***	10.068***	8.092***
		(1.450)	(2.077)	(2.862)	(1.686)	(1.950)	(2.892)	(1.949)	(1.556)	(3.409)	(2.058)
Avg Schooling (Log)		2.653	-1.996	3.699	-0.539	-0.667	3.165	-5.955	0.038	-7.570**	-3.255
		(2.169)	(3.618)	(4.507)	(2.337)	(3.186)	(3.970)	(3.877)	(2.439)	(3.651)	(3.668)
Asia		-2.936	-4.922	-1.774	-5.430	-8.890***	-6.466	-8.953**	-5.996*	-5.387*	-9.533***
		(3.228)	(3.047)	(4.535)	(3.325)	(2.995)	(5.244)	(4.494)	(3.026)	(2.984)	(3.168)
Americans		-10.353***	-9.553**	-15.828***	-15.196***	-18.720***	-15.828**	2.427	-11.329***	-11.425***	-15.983***
		(3.031)	(4.777)	(4.956)	(3.815)	(4.182)	(6.121)	(5.646)	(3.918)	(4.141)	(4.299)
Europe		-11.907*	-3.397	-5.385	-5.343	-4.137	-6.210	3.997	-4.716	-3.445	1.692
		(6.660)	(6.513)	(7.633)	(6.657)	(7.009)	(7.229)	(6.395)	(6.453)	(5.935)	(6.687)
Oceania		-13.704*	-12.193*	-1.325	-20.206**	-22.765**	-28.227***	2.925	-18.266**	-14.563**	25.348
		(7.051)	(6.365)	(11.189)	(8.999)	(10.882)	(8.166)	(6.756)	(7.773)	(6.896)	(20.202)
Observations	178	108	108	108	108	108	108	108	108	108	108
R-squared	0.291	0.493	0.383	0.554	0.632	0.555	0.614	0.236	0.320	0.443	0.561

Note: All regressions are cross-country with one observation per country. The dependent variable is specified in each column. Robust standard errors are in the parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 2.9.3.. Robustness Check: The Effect of Curriculum Control on Innovation

	Dependent Variable: Patent's Quality (H-index, USPTO)							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Control Variable:		Pop.	Urban--ization	Infra--structure	Credit Share	Religion Diversity (HHI Index)	Rule of Law	All
Curriculum Control (β_1)	-33.819***	-26.129***	-35.920***	-35.540***	-33.173***	-33.769***	-30.448***	-19.122**
	(11.050)	(9.120)	(11.217)	(13.330)	(10.759)	(10.913)	(10.559)	(9.223)
GDP per (Log)	4.284***	4.631***	4.479***	3.420	2.327*	4.914***	1.534	4.783
	(1.450)	(1.247)	(1.638)	(2.502)	(1.307)	(1.721)	(1.382)	(3.039)
Avg Schooling (Log)	2.653	3.211	2.324	1.361	1.224	1.151	2.243	5.388
	(2.169)	(2.144)	(2.120)	(3.584)	(1.988)	(2.429)	(2.000)	(4.330)
Population (Log)		2.404***						3.527***
		(0.651)						(1.204)
Urbanization Ratio (Log)			-1.788					-2.189
			(2.045)					(4.277)
Road Network Density (Log)				-0.003				-0.013
				(0.019)				(0.018)
Rail Network Density (Log)				-0.001				0.007
				(0.012)				(0.014)
Internet users (Log)				0.027				-0.009
				(0.016)				(0.020)
Credit to private sector (Log)					3.370***			-0.503
					(1.229)			(2.090)
Religion HHI Index						-9.742		-14.435**
						(6.334)		(6.526)
Rule of Law							4.808***	8.556***
							(1.434)	(2.903)
Continent Dummies	✓	✓	✓	✓	✓	✓	✓	✓
Observations	108	108	107	72	107	108	108	72
R-squared	0.493	0.555	0.513	0.548	0.531	0.509	0.529	0.675

Note: All regressions are cross-country with one observation per country. The dependent variable is H-index of the patent from USPTO. The covariate specified in each column is controlled. Robust standard errors are in the parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 2.9.4.. Robustness Check: The Effect of Curriculum Control on Innovation by Controlling for Human Capital Indicators

	Dependent Variable: Patent's Quality (H-index, USPTO)			
	(1)	(2)	(3)	(4)
Control Variable:	Tertiary	Immigrant Stock	Test Score	All
Curriculum Control (β_1)	-32.964***	-28.693***	-29.581***	-25.654***
	(10.758)	(8.468)	(10.162)	(8.887)
GDP per (Log)	3.914***	2.823**	5.923***	3.948**
	(1.394)	(1.114)	(2.109)	(1.822)
Avg Schooling (Log)	1.430	2.904	16.049**	8.795
	(2.184)	(2.186)	(6.391)	(6.274)
Tertiary Schooling (Log)	1.413			3.313
	(1.332)			(3.539)
International Migrant Stock (Log)		2.413***		2.832**
		(0.863)		(1.159)
Test Score (Log)			36.888***	32.318***
			(9.489)	(9.287)
Continent Dummies	✓	✓	✓	✓
Observations	108	107	62	61
R-squared	0.496	0.574	0.624	0.687

Note: All regressions are cross-country with one observation per country. The dependent variable is H-index of the patent from USPTO. The covariate specified in each column is controlled. Robust standard errors are in the parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 2.9.5.. Robustness Check: The Effect of Curriculum Control on Innovation--Different Sample Sizes, Outlier Obs. and Different Model

	Dependent Variable: Patent's Quality (H-index, USPTO)					
	(1) Drop Neo-Europes	(2) Drop Europe & Neo-Europes	(3) Only Large Pop. Countries	(4) Only Rich Countries	(5) Drop Extreme Observations	(6) Alternative Model: Tobit
Curriculum Control (β_1)	-19.474***	-14.704*	-35.848**	-30.467***	-25.317***	-34.650***
	(5.649)	(8.058)	(14.664)	(10.238)	(4.302)	(10.436)
GDP per (Log)	3.244***	1.885	6.461***	7.304*	3.377***	6.506***
	(1.226)	(1.300)	(1.958)	(4.060)	(0.833)	(2.022)
Avg Schooling (Log)	2.219	3.844**	0.276	28.657***	0.872	5.365
	(1.861)	(1.919)	(2.326)	(8.770)	(1.534)	(4.073)
Continent Dummies	✓	✓	✓	✓	✓	✓
Observations	104	76	70	56	98	108
R-squared	0.470	0.374	0.537	0.572	0.583	-

Note: All regressions are cross-country with one observation per country. The dependent variable is H-index of the patent from USPTO. Robust standard errors are in the parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 2.9.6.. The Propensity to Choose Research-Oriented Occupations in the United States

Panel A: OLS (Whole Sample)				
	(1)	(2)	(3)	(4)
Control Variable:		Ethnic Group Dummies	Linguistic Distance (from the U.S.) Index	All
Curriculum Control (β_1)	-0.010***	-0.014***	-0.010***	-0.011***
	(0.002)	(0.003)	(0.002)	(0.004)
Observations	1,400,302	1,400,302	1,396,487	1,396,487
R-squared	0.053	0.054	0.053	0.054

Panel B: 2SLS (Sub-sample, Not Born in the U.S.)				
	(1)	(2)	(3)	(4)
Control Variable:		Culture	Linguistic Distance (from U.S.) Index	All
Second Stage: Regression of Research-oriented Occupation on Curriculum Control				
Curriculum Control (β_1)	-0.086***	-0.270***	-0.071***	-0.233***
	(0.015)	(0.054)	(0.012)	(0.045)
First Stage: Regression of Curriculum Control on log σ_{CSI}				
σ_{CSI} (Log)	-0.024***	-0.008***	-0.031***	-0.010***
	(0.001)	(0.001)	(0.001)	(0.001)
Observations	265,969	252,995	262,202	250,683
R-squared	0.132	0.035	0.136	0.063
1st stage F-stat	2067	207.9	2707	330.7
Partial R2	0.00928	0.00121	0.0155	0.00182

Note: The table reports the estimates of parameter β_1 in specification (2.2). The dependent variable is a dummy variable and equal to 1 if the individual has a research-oriented occupation. The definition of research-oriented occupations includes Life, Physical, and Social Science Occupations (codes 160–196 in the 2000 Census occupational classification system recorded in the IPUMS variable OCC). Ethnicity is based on the respondent's self-reported ancestry or ethnic origin (IPUMS variable ANCESTR1). The covariates controlled in each regression are specified in the paper. Robust standard errors are in the parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 2.9.7.. The Effects of Curriculum Control on Teaching Practices, Attitudes of Students, and Career Values

	Teaching Practices					Students' Experences		Careers and Values	
	PIRLS (2006)		CES (1999)			TIMSS (2007, Science)		WVS (5-6 waves)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Group Activities	Lecturing	Group Discussions	Lecturing	Take Notes	Positive Attitude	Self-Confidence	Creative Task (vs. Routine Task)	Important: Use Initiative
Curriculum Control (β_1)	-0.093***	0.041***	-0.124***	0.521***	0.360***	-0.350***	-0.132***	-0.789***	-0.619***
	(0.003)	(0.003)	(0.022)	(0.026)	(0.032)	(0.013)	(0.012)	(0.034)	(0.018)
Observations	90,804	90,804	68,694	68,561	65,939	76,789	76,673	104,552	52,798
R-squared	0.060	0.021	0.153	0.057	0.014	0.027	0.015	0.099	0.035

Note: The table reports the estimate of parameter β_1 in specification (2.3). The dependent variable is specified in each column. The covariates controlled in each regression are specified in the paper. Robust standard errors are in the parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 2.9.8.. The Effect of Curriculum Control on Critical Thinking in Teaching

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Control Variable:		Pop.	Urban--ization	Infra--structure	Credit Share	Religion Diversity (HHI Index)	Rule Of Law	Tertiary	Test Score
Curriculum Control (β_1)	-20.374***	-23.942***	-20.572***	-20.221**	-19.445***	-19.980***	-16.639***	-21.034***	-18.380**
	(6.687)	(6.911)	(6.722)	(7.812)	(6.877)	(6.375)	(5.866)	(6.811)	(7.512)
GDP Per (Log)	2.615*	2.382*	3.543**	-1.658	2.179	3.357**	-0.403	2.966*	5.729**
	(1.541)	(1.428)	(1.625)	(2.522)	(1.976)	(1.492)	(2.111)	(1.516)	(2.163)
Avg Schooling (Log)	3.305	3.283	3.574	0.743	3.141	1.541	2.875	4.556	18.678**
	(2.833)	(2.736)	(2.944)	(4.241)	(2.759)	(2.903)	(2.640)	(3.637)	(7.244)
Population (Log)		-1.203							
		(0.763)							
Urbanization Ratio (Log)			-2.991						
			(2.042)						
Road Network Density (Log)				0.037*					
				(0.022)					
Rail Network Density (Log)				-0.020					
				(0.015)					
Internet Users (Log)				0.027					
				(0.022)					
Credit To Private Sector (Log)					0.938				
					(1.806)				
Religion HHI Index						-13.179**			
						(5.760)			
Rule Of Law							5.271***		
							(1.773)		
Tertiary Schooling (Log)								-1.315	
								(1.742)	
Test Score (Log)									-22.346
									(13.744)
Continent Dummies	✓	✓	✓	✓	✓	✓	✓	✓	✓
Observations	100	100	99	71	99	100	100	100	61
R-squared	0.471	0.485	0.476	0.472	0.473	0.499	0.511	0.473	0.536

Note: All regressions are cross-country with one observation per country. The dependent variable is the critical thinking in teaching extracted from The Global Competitiveness Index in 2018. The critical thinking score ranges from 0 to 100. A higher score means a greater level of critical thinking in teaching. In the baseline regression, only income and averaging schooling are controlled. In robustness checks, other covariates specified in columns are controlled. Robust standard errors are in the parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

3. Economic Growth and Democratization —The Legacy of State History

3.1. Introduction

There is a large and growing literature on the links between the state capacity, political regimes, and economic performance in both economic and political realms (Acemoglu, 2005; Besley and Persson, 2010; Acemoglu and Robinson, 2012; Johnson and Koyama, 2017; Borcan, Olsson and Putterman, 2018).

One branch of studies focuses on the effects of the state institutions on growth and contend that the strong state capacity, which provides indispensable public goods, plays a great role in economic prosperity, most notably among states in East Asia (Easterly, 1995; Mattingly, 2017), while a large body of work emphasizes that a lack of state capacity is the main barrier to economic development in African countries. The weak state has a limited capacity to tax and regulate and, consequently, to support economic development (Aghion and Howitt, 2006; Acemoglu et al., 2014; Acemoglu, Garcia-Jimeno and Robinson, 2015).

Another branch of study stresses that it is important for economic growth that there are checks and balances and limits on elites' predatory behaviors (Papaioannou and Siourounis, 2008*a*; Acemoglu and Robinson, 2012; Gründler and Krieger, 2016;

Acemoglu et al., 2019). However, it is still highly controversial whether democracy has significant and positive effects on economic growth in poor countries (Huntington, 1993; Barro, 1999; Huang, 2012*a*; Acemoglu et al., 2019).

This paper discusses the links between state strength, political regimes, and economic development. More specifically, I explore when the ruling elites in autocracy provide public goods – in this context, public education – to influence the accumulation of human capital and economic growth through state capacity[1], as well as the role of state development in democratization.

Human capital, one of the important engines for economic growth, is largely built by public education systems (Hanushek and Kimko, 2000; Jones and Romer, 2010; Jones, 2016). There are two types of education, general vs specific, discussed in this paper. General education increases one's general ability to master new knowledge and technologies but is costly. By contrast, specific education improves one's specific ability is thus less costly. Such education is not broad enough to facilitate further learning and to adopt new technologies (Becker, 1964; Bertocchi and Spagat, 2004; Krueger and Kumar, 2004; Huang, 2012*b*). Equally important, general education increases one's general productivity in solving problems, implying that it also enhances one's skills in extracting gains and defending one's interests in political conflicts. Better educated people are more effectively organized and more politically active (Bennett Jr, 1967; Meyer and Rubinson, 1975; Glaeser, Ponzetto and Shleifer, 2007; Huang, 2012*b*; Van de Werfhorst, 2017). However, specific education does not necessarily improve one's political rent-seeking skills and organizational efficiency.

With this background, I establish a model to explore the effects of state capacity and political regimes on economic performance. Initially, there are two groups, elites and the masses, in a poor autocratic society. Individuals of these two groups are

[1]Note that I do not intend to claim that state capacity only works through education on growth or that education and state capacity are the only two important factors related to growth. Rather, my aim is to build a framework grounded in reasonable assumptions that focus on state capacity and educational differences and lays a theoretical foundation for the empirical analysis.

endowed with one unit of raw labor. In addition, elites also inherit their parents large amounts of wealth that could be used to invest in both physical and human capital (either specific or general). Human capital and physical capital are used for production. Human capital could be accumulated in private or public education system.

It is beneficial for the ruling elites in a poor autocratic country to provide public specific education for the masses when the state is developed. Equipped with specific human capital, the masses would produce more by using mature technologies. It allows the ruling class to collect greater tax revenues by strong and capable state. In other words, by providing specific education to the masses, the privileged class not only extracts more tax revenues but also promotes economic growth.

The ruling elites, however, may not support public general education for the masses even though they equipped with general human capital could produce much more by using advanced technologies. Because the general education is more costly. What's more important, getting general education improves the abilities of the masses to defend their own interests. It would reduce the ruling elites' political rents and erode their political privileges. Moreover, when the masses have enough financial resources to get the general education, elites may even impede the masses access to such education by propaganda. The effectiveness of propaganda depends on the capabilities of state apparatus. These policies would prolong their autocratic rule at the cost of economic development, especially when the economy is approaching the technological frontiers.

Unlike autocracy, democracy has different public education policies. In democracy, when the state is powerful, the masses can extract wealth from elites to improve their livings above subsistence levels as soon as possible. Using bequests, the masses receive specific education first since it is less costly and then general education. It ensures that the economy grows sustainably.

Although democracy has no advantage to provide public specific education in the poor country, democracy would support general education and promote growth as

general human capital gradually becomes the main engine of the economy. In other words, democratic institutions work better at the later stage of economic development.

It also implies that to ensure sustained economic growth, a political transition in the autocratic country is needed when the country is rich. I thus turn to explore the conditions related to political reform. More specifically, I mainly examine the role of state development in democratization.

The effect of state development on democratization is subtle due to its conflicting roles. On the one hand, a powerful state extracts a large share of income from the masses, which incentives them to rebel. On the other hand, with strong state apparatus, the ruling elites can easily repress their rebellions. The masses must face this dilemma. It hints that there could be a non-linear relationship between state development and democratization. Although the theoretical model cannot definitively clarify the relationship, I find a robust hump-shaped relationship between state development measured by the duration of statehood history and democratization in the subsequent empirical study. In other words, the extractive capacity (one dimension of state capacity) is dominant and provokes the masses to rebel when state development is below some threshold, while the coercive capacity (another dimension of state capacity) becomes the main driving force and dilutes the masses' resistance when the state development is above the threshold.

Consequently, there is a paradox in the effects of the state development on economic performance. In the early development stage, a powerful autocratic state bring benefits to the whole economy by supporting public specific education. But as the autocratic country becomes rich and the main growth source shifts to general human capital, political reform would be needed. By removing the obstacles to support general education and cultivate general human capital, democracy would further promote economic growth. The strong state, however, which previously was of the great benefit to the whole economy, becomes an impediment to democratization, and thus retarding economic development later.

Subsequent regression results confirm the predictions obtained from the theoretical model. There are heterogeneous effects of state development and democracy on the economic performance. In particular, state development has the great influence on growth in the early stage, while democracy plays better role in the late stage. Additionally, there is a hump-shape relationship between state development and democratization.

There are several contributions in the study. It echoes the argument that powerful state benefits economic growth, especially in the early stage, while democracy promotes growth in the late stage (Evans, 1994; Easterly, 1995; Rodrik, 1997; Rodrik and Wacziarg, 2005; Papaioannou and Siourounis, 2008*a*; Acemoglu, Gallego and Robinson, 2014; Meyersson, 2015; Mattingly, 2017; Acemoglu et al., 2019). More specifically, I emphasize the roles of state development, political regimes in the accumulation of different types of human capital. Furthermore, I point out that a well-developed autocratic state may be an obstacle to democratization, through which hinders the economic performance when the country is rich. This finding complements the study of Borcan, Olsson and Putterman (2018) and Lagerlöf (2016), who find that the intermediate level of state development benefits the economic performance most in the long run. In the model, I explain this phenomenon by considering the capacity and willingness of the state to support different types of education, as well as the hump-shaped effect of state development on political reform. In addition, the finding of such non-linear relationship contributes to a small group literature that explores the role of state development in democratization (Hariri, 2012; Lagerlöf, 2016). I find that this inverted-U shaped association stems from the conflicting effects between extract capacity and coercive capacity, both of which are positively related to state development.

The rest of the paper is organized as follows. Section 2 discusses the literature on state institution, democracy, and growth. Section 3 sets up the model, first analyzes the roles of state development and democracy in economic performance through public education, then looks at the political reforms. Section 4 provides data sources

and descriptive statistics. In Section 5, I present the growth regression model and test the theoretical prediction. Next, I turn to present the transition regression model and mainly explore the role of the state development in democratization. Section 6 concludes. Main proofs are relegated to the appendix.

3.2. Literature Review

This paper belongs to a large amount of literature connecting state capacity, democratization, and economic development.

The highly developed state is able to enforce law and order, regulate economic activity, and provide public goods. Less developed states are detrimental to economic development because they discourage the ruler from investing in public goods due to the limitation of collecting taxes (Besley and Persson, 2014; Acemoglu et al., 2014; Hanson, 2014; Acemoglu, Garcia-Jimeno and Robinson, 2015; Dincecco and Katz, 2016; Johnson and Koyama, 2017). A series of work argues that a key to the economic success of East Asian economies is that they all had states with a great deal of capacity (Evans, 1994; Easterly, 1995; Rodrik, 1997; Rodrik, Subramanian and Trebbi, 2004; Mattingly, 2017), while the economic failure of many African or Latin American nations is due to their limited state capacity (Evans, 1994; Herbst, 2000; Aghion and Howitt, 2006; Acemoglu et al., 2014). This argument receives empirical support from many studies (Nunn, 2008; Nunn and Wantchekon, 2011; Michalopoulos and Papaioannou, 2013*a*,*b*; Lu, Luan and Sng, 2016; Bandyopadhyay and Green, 2016), which confirm a positive association between state development (or political centralization) and economic prosperity.

Saint-Paul and Verdier (1993); Benabou (1996); Lizzeri and Persico (2004); Acemoglu and Robinson (2012) argue that democracy contributes to economic growth by implementing the rule of law, limiting the power of rulers, and incentivizing to offer public goods. But it is still controversial. March and Olsen (1983); Olson (1993); Besley and Coate (1998); Huntington (2006) are worried that democracy

may strengthen the pressure of distorting redistribution, which leads to potential political gridlock and weakens the positive effects of democracy on economic performance. Both sides could find empirical evidence to support their arguments. Helliwell (1994), Barro (1996), Tavares and Wacziarg (2001), Giavazzi and Tabellini (2005), and Murtin and Wacziarg (2014) find that democratization brings little benefits to economic growth. But, more recent work (Papaioannou and Siourounis, 2008*a*; Meyersson, 2015; Gründler and Krieger, 2016; Acemoglu et al., 2019) finds that political reform promotes economic development. Aghion, Alesina and Trebbi (2007*b*); Huang (2012*a*) attempt to reconcile both sides and emphasize that democracy may have great effects on rich countries but not poor ones.

No matter state capacity or political democracy, the important channels through which they work on economic growth are to provide the public education (Tavares and Wacziarg, 2001; Lindert, 2004; Bates, 2006; Besley and Persson, 2011; Fukuyama, 2014). Education helps people accumulate human capital. A broad amount of growth literature, typically abstracting political regimes, also emphasize the essential role of human capital in economic take-off and growth (Nelson and Phelps, 1966; Hanushek and Kimko, 2000; Galor and Moav, 2004; Glaeser, Ponzetto and Shleifer, 2007; Campante and Glaeser, 2009). Moreover, human capital is not only one important input of production but also one great factor determining the country's technology absorptive capacity and innovation (Madsen et al., 2010; Ang and Madsen, 2011; Madsen, 2014). It becomes more important as an economy is approaching the world technological frontier (Galor and Tsiddon, 1997; Acemoglu, Aghion and Zilibotti, 2006).

Becker (1964); Bertocchi and Spagat (2004); Krueger and Kumar (2004); Huang (2012*b*) emphasize that general human capital, which is cultivated through general education, is closely related to the ability to learn new technology and innovation. Moreover, general education not only improves one's general abilities in learning leading-edge knowledge and adopts new technologies but also strengthens one's skills of extracting gains and defending one's interests when there are political

conflicts (Glaeser, Ponzetto and Shleifer, 2007; Huang, 2012*a*; Van de Werfhorst, 2017). Therefore, the political privileges of ruling elites in the autocratic country may be threatened when the masses receive the general education. In other words, the masses equipped with general human capital could weaken the ability of elites to collect the tax, and also raise the probability of ruling elites to become political losers (Acemoglu and Robinson, 2006*b*). Thus, it may be difficult for the autocratic country to provide this type of public education even its state is well-developed and has the capacity to support it. However, the democratic country would remove obstacles for the cultivation of general human capital, which promotes the abilities of the masses to adopt new technologies, igniting the new growth engine when the economy is close to the world technological frontier.

To achieve sustainable economic growth in the autocratic country, the political reforms may be needed when the country is rich and gradually relies more on general human capital rather than specific one. I turn to discuss the literature on democratization.

It is a little surprising that there are few studies about the role of state development in democratization. It should be an important question. If strong state in autocracy could boost economic growth, especially at the early growth stage (Bockstette, Chanda and Putterman, 2002; Lagerlöf, 2016; Borcan, Olsson and Putterman, 2018), and democracy promotes economic performance at the later growth stage (Aghion, Alesina and Trebbi, 2007*b*), the political reform has to be implemented to make sure the sustained economic growth when the economy gradually approach technological frontiers. The role of state development in political reform should be explored.

As I know, only Hariri (2012) and Lagerlöf (2016) show that early statehood is associated with less democracy in modern times. In society with short statehood history, the ruling class does not have very powerful capacity to control the masses. It is relatively easy to transfer democracy when the masses are given the opportunity.

In this article, I show that the link between state development and democratization is a little subtle. It is hump-shaped.

3.3. The Model

3.3.1. The Basic Environment

There are overlapping generations with a fixed population. For simplicity, I normalize it to 1. Each individual in generation t lives for two periods, investing human capital in childhood (at time t) if there is a bequest and participating in production at adulthood (at time $t+1$). They are homogeneous on their abilities.

Technology and Endowment. In every period the economy produces a single homogeneous good that can be used for consumption and investment. The production at time $t+1$ is

$$Y_{t+1} = H_{t+1}^{\alpha} K_{t+1}^{1-\alpha},$$

where H_{t+1} is the aggregate stock of human capital and K_{t+1} is the aggregate stock of physical capital. For simplicity, I assume that physical capital depreciates fully after one period that is equivalent to an individual's adulthood.

The total amount of human capital H_{t+1} is composed of three distinct forms, the amount of population receiving general education L_{gt+1}, task-specific education L_{st+1}, no education and using raw labor (endowed by nature), L_{ut+1}, respectively. So,

$$H_{t+1} = A_{t+1} L_{gt+1} + A_t L_{st+1} + L_{ut+1},$$

where $L_{ut+1} + L_{st+1} + L_{gt+1} = 1$. It means that the amount of population who receive education cannot exceed the whole population. Here, $A_{t+1} > A_t > 1$, indicating that individual investing in general education is more productive. It could be understood as workers with general human capital can access the current knowledge stock, while those with specific human capital can only take advantage of the knowledge

stock in the previous period. It captures a key difference between these two kinds of human capital. General human capital allows one to transform new knowledge into productivity, whereas specific human capital improves productivity by using mature technologies (Becker, 1964; Bertocchi and Spagat, 2004; Krueger and Kumar, 2004; Huang, 2012*b*). More importantly, this formula also emphasizes one important characteristic of human capital proposed by Galor and Tsiddon (1997); Galor and Moav (2004); Oded et al. (2011). Human capital is embedded in human. There are natural restrictions that subject its accumulation at the individual level to diminishing returns. Then, the aggregate stock of human capital would be larger if the accumulation of human capital would be widely distributed among members in society.[2] The knowledge stock A_t grows at a constant rate, g, which means $A_{t+1} = A_t(1+g)$.[3]

Preference. Individuals are identical in preferences, which are represented by a log-linear utility function

$$u^i_{t+1} = (1-\beta)logc^i_{t+1} + \beta log(z + b^i_{t+1}),$$

where c^i_{t+1} is the adulthood consumption (at time $t+1$) of individual i in generation t, b^i_{t+1} is one's bequest for offspring, $\beta \in (0,1)$ indicates the relative weight of bequest, and $z > 0$ represents some threshold level of income.

The budget constraint is $c^i_{t+1} + b^i_{t+1} \leq I^i_{t+1}$, where I^i_{t+1} is individual i's income at adulthood. As a result of utility maximization, one's optimal bequest is $b^i_{t+1} = max\{\beta(I^i_{t+1} - z(1-\beta)/\beta), 0\}$. So, only when an individual's income is higher than a certain level indicated by $Z \equiv z(1-\beta)/\beta$, would there be any resources left as

[2] Galor, Moav and Vollrath (2009); Baten and Hippe (2018) provide empirical evidence and find that inequality in land distribution has a negative correlation with human capital formation and the long-run economic growth in the United States and Europe, respectively.

[3] A more realistic assumption is that the knowledge stock A_t grows at an endogenously determined speed g such that $g_{t+1} = \Phi(L_{gt})$, where $\Phi' > 0$ and $\Phi(0)$ is a small positive number. It means the speed of knowledge accumulation is strictly increasing in general human capital L_{gt}, but constant with regard to the stock of specific skills. This reflects the fact that general human capital is more effective in generating new knowledge than specific skills. My main conclusions still hold under this assumption.

bequest. The bequest b^i_{t+1} can be invested in physical capital or human capital for the next generation.

Suppose individual i in generation t who equips with specific (general) human capital is $l^i_{st+1} \in \{0,1\}$ ($l^i_{gt+1} \in \{0,1\}$). The aggregate general and specific human capital are, correspondingly, $L_{gt+1} = \int_0^1 l^i_{gt+1}\,\mathrm{d}i$ and $L_{st+1} = \int_0^1 l^i_{gt+1}\,\mathrm{d}i$.

Assume m^i_{kt} represents the amount of resources invested in the physical capital for individual i in generation t. The aggregate physical capital by domestic investment is thus $K^D_{t+1} = \int_0^1 m^i_{kt}\,\mathrm{d}i$. Specifically, when $b^i_t < c_{st}$, $m^i_{kt} = b^i_t$; when $c_{st} \leq b^i_t < c_{gt}$ and the individual decides to invest in specific education, $m^i_{kt} = b^i_t - c_{st}$; when $b^i_t \geq c_{gt}$ and the individual decides to invest in general education, $m^i_{kt} = b^i_t - c_{gt}$.

3.3.2. The Political Economy Model

3.3.2.1. Autocratic Environment

In the beginning of the political economy, each individual $i \in \{e, p\}$, where e denotes that the individual belongs to the ruling elites, and p represents that the individual belongs to the masses. Suppose the share of elites in society is ρ. The total amount of population of the masses and elites are $(1-\rho)$ and ρ, respectively. Initially, there are B_0 amount of wealth in society. Each elite member is endowed with an identical amount of wealth $b^e_0 = B_0/\rho$. The masses are endowed no wealth. Elites could invest physical capital, human capital (specific or general) but no investment activities are involved for the masses at the beginning.

At the beginning, elites control state apparatus. State capacities sourced from the state apparatus are the abilities of state institutions to effectively implement official goals (Evans, Rueschemeyer and Skocpol, 1985; Fukuyama, 2014). State capacity is multi-dimensions. Generally, there are three interdependent dimensions: extractive capacity, coercive capacity, and administrative capacity (Hanson, 2014;

Johnson and Koyama, 2017).[4] Relying on the state apparatus, ruling elites have the capacities to collect tax, protest themselves against external and internal threats, maintain internal order, as well as produce and deliver public goods and services. I use a predetermined variable, duration of statehood history, as functions of these three dimensions of state capacity.[5] A long history of statehood enables the state government to solidify power and create a strong bureaucracy, and to strengthen its fiscal capability (Chhibber, 1997; Bockstette, Chanda and Putterman, 2002; Chanda and Putterman, 2007; Putterman and Weil, 2010). So, statehood history is positively associated with the three dimensions of state capacity.

In autocracy, the elite has political power and could tax the masses. The tax-extracting ability of an elite member at time $t+1$ for generation t is $\lambda^e_{it+1} = \frac{\tau(l^e_{gt+1})}{d(\bar{l}^p_{gt+1},\chi)}$. It is increasing in the elite's general human capital, l^e_{gt+1}. $d(\bar{l}^p_{gt+1},\chi)$ denotes the ability of the masses to counteract the elite's political ruling and rent-seeking capacity, which is increasing in the average general human capital of the masses, $\bar{l}^p_{gt+1}$, but decreasing in the state's extract capacity originated from statehood history, χ. χ ranges from 0 to 1, where 0 means the lowest state development and 1 means the highest state development. For simplicity, I assume that $d(\bar{l}^p_{gt+1},\chi) = d(\bar{l}^p_{gt+1})/\chi$ and $d(0,\chi) = d(0)/\chi = 1/\chi$ for normalization. So, the tax capacity of an elite is

$$\lambda^e_{it+1} = \frac{\chi\tau(l^e_{gt+1})}{d(\bar{l}^p_{gt+1})} = \chi\xi,$$

where $\xi = \frac{\tau(l^e_{gt+1})}{d(\bar{l}^p_{gt+1})} \in \{\frac{\tau(0)}{d(1)}, \frac{\tau(0)}{d(\delta)}, \frac{\tau(0)}{d(0)}, \frac{\tau(1)}{d(1)}, \frac{\tau(\delta)}{d(0)}, \frac{\tau(1)}{d(0)}\}$, and $0 < \delta < 1$.[6] Let $\frac{\tau(0)}{d(1)} = \underline{\underline{\xi}}$, $\frac{\tau(0)}{d(\delta)} = \underline{\xi}_\delta$, $\frac{\tau(0)}{d(0)} = \frac{\tau(1)}{d(1)} = \underline{\xi}$, $\frac{\tau(\delta)}{d(0)} = \bar{\xi}_\delta$, and $\frac{\tau(1)}{d(0)} = \bar{\xi}$, it is easy to confirm that

[4] Extractive capacity is the ability to tax revenues. Coercive capacity is the ability to protect against external and internal threats, maintain internal order. Administrative capacity is the ability to collect information, to develop policy, to produce and deliver public goods and services. These three dimensions are interdependent with each other. Extractive and coercive capacities are likely prerequisites for higher levels of administrative capacity. A high level of extractive capacity requires at least some level of administrative capacity. Coercive capacity requires revenues and administrative reach into society. Moreover, all three of these dimensions require adequate information about, and control over, territories and populations (Hanson and Sigman, 2013).

[5] I don't explore the dynamic change of state capacity and the interaction of state capacity and political regimes. Since state capacity is quite stable within the country, it could be a reasonable assumption.

[6] It would be explained in the next section.

$\underline{\underline{\xi}} < \underline{\xi}_{\delta} < \underline{\xi} < \bar{\xi}_{\delta} < \bar{\xi}$. The tax-extracting ability of the state, controlled by elites, is

$$\lambda_{t+1}^{e\_total} = \rho\lambda_{it+1}^{e} = \rho\chi\xi,$$

$\lambda_{t+1}^{e\_total}$ measures the *de facto* extractive capacity of government ruled by elites. It is composed of two parts, $\rho\chi$, unchangeable and determined by the state history; $\frac{\tau(l_{gt+1}^{e})}{d(\bar{l}_{gt+1}^{p})} = \xi$, changeable and influenced not only by the general human capital of the ruling elites but also the general human capital of the masses.

An elite individual gets a tax revenue $\chi\xi I_{t+1}^{p\_total}$, where $I_{t+1}^{p\_total}$ denotes the aggregate income of the masses. The total tax revenue of the elite group is $\chi\rho\xi I_{t+1}^{p\_total}$. It is clear that, *ceteris paribus*, a higher χ, meaning higher state development (indicates stronger extractive capacity), will help elites collect more tax revenues.

General human capital enhances an individual's political bargaining ability as represented by the tax-generating skill $\tau(l_{gt+1}^{e})$ of the elite and the tax-evading skill $d(\bar{l}_{gt+1}^{p})$ of the masses, while specific human capital is not or at least less effective in doing so. This is a natural implication of the essence of general human capital. General human capital increases one's ability to transform knowledge into productivity in whatever task at hand, the specific human capital, by contrast, only increases one's productivity in the specific task (Glaeser, Ponzetto and Shleifer, 2007; Huang, 2012*b*; Van de Werfhorst, 2017).

3.3.3. Economic Development and Educational Change

Production. Production is operated in a perfectly competitive environment. Given the prices of the four factors $\{r_{t+1}, w_{ut+1}, w_{st+1}, w_{gt+1}\}$, producers in period $t+1$ choose the amounts of physical capital and three types of human capital to maximize profits. That is,

$$\{K_{t+1}^{*}, L_{ut+1}^{*}, L_{st+1}^{*}, L_{gt+1}^{*}\} = \arg max\, H_{t+1}^{\alpha} K_{t+1}^{1-\alpha} - r_{t+1}K_{t+1} - w_{st+1}L_{st+1} - w_{gt+1}L_{gt+1} - w_{ut+1}L_{ut+1}$$

$$s.t.\ L_{ut+1} + L_{st+1} + L_{gt+1} = 1,$$

where $H_{t+1} = L_{ut+1} + A_{t+1}L_{gt+1} + A_tL_{st+1}$. The inverse demand functions for these production factors are

$$r_{t+1} = (1-\alpha)k_{t+1}^{-\alpha},$$

$$w_{st+1} = \alpha A_t k_{t+1}^{1-\alpha},$$

$$w_{gt+1} = \alpha A_{t+1} k_{t+1}^{1-\alpha},$$

$$w_{ut+1} = \alpha k_{t+1}^{1-\alpha},$$

where $k_{t+1} = K_{t+1}/H_{t+1} = \frac{K_{t+1}}{L_{ut+1}+A_{t+1}L_{gt+1}+A_tL_{st+1}}$ is the ratio between the stock of aggregate physical capital and the aggregate human capital.

Suppose it is an open and small economy, capital is perfectly mobile internationally and the world interest rate is constant over time at a global level. Then,

$$r_{t+1} = r,$$

where r is the interest rate in the global world. International capital mobility implies therefore that the ratio of physical capital to human capital in production, k_{t+1}, is constant over time. In particular, $k_{t+1} = k(r) = \left(\frac{r}{1-\alpha}\right)^{-\frac{1}{\alpha}}$, $w_u = w_u(r) = \alpha\left(\frac{r}{1-\alpha}\right)^{-\frac{1-\alpha}{\alpha}}$, $w_{st+1} = w_{st+1}(r,A_t) = \alpha A_t\left(\frac{r}{1-\alpha}\right)^{-\frac{1-\alpha}{\alpha}}$, and $w_{gt+1} = w_{gt+1}(r,A_{t+1}) = \alpha A_{t+1}\left(\frac{r}{1-\alpha}\right)^{-\frac{1-\alpha}{\alpha}}$.

Investment in Human and Physical Capital. The general education is costly and requests people to learn a broad and abstract knowledge base while the specific education is cheap and only cover a narrow and practical knowledge (Huang, 2012*b*; Van de Werfhorst, 2017). Suppose the learning costs of specific and general education are c_{st} and c_{gt}, respectively. Specifically, I assume that $c_{st} = a_s w_{st+1} < c_{gt} = c_{st} + a_g w_{gt+1}$, where $0 < a_s < 1$, $0 < a_g < 1$, and $c_{gt} < w_{gt+1}$.[7] It makes sure that

[7] This assumption is similar to Oded et al. (2011). They suppose that the acquisition of education is associated with a fixed cost, which reflects the indivisibility of human capital formation. In their setting, the fixed cost of education is a weighted average of the payments to labors in society.

the general education is much costlier than the specific one. This assumption also guarantees that the masses with bequests would invest in specific education first when the country is not rich and technology is not so advanced. In any period t, the bequest $b_t^i \geq 0$, $i \in \{p,e\}$, is allocated among human and physical capital to maximize the pretax income $\{I_{ut+1}^{i*}, I_{st+1}^{i*}, I_{gt+1}^{i*}\}$ where[8]

$$I_{ut+1}^{i*} = rb_t^i + w_u,$$

$$I_{st+1}^{i*} = r(b_t^i - c_{st}) + w_{st+1}, \text{ where } b_t^i - c_{st} \geq 0,$$

$$I_{gt+1}^{i*} = r(b_t^i - c_{gt}) + w_{gt+1}, \text{ where } b_t^i - c_{gt} \geq 0,$$

Define $\psi_{mn}^i = I_{mt+1}^{i*} - I_{nt+1}^{i*}$, where $m,n \in \{g,s,u\}$. The decision of investing either specific and general human capital depends on whether $\psi_{su}^i > 0$ or $\psi_{gs}^i > 0$, respectively. As long as Assumption (1) and Assumption (2) are satisfied, individuals would invest in specific (general) education when $b_t > c_{st}$ ($b_t > c_{gt}$).

Assumption 1. $a_s \leq \frac{1}{r}\left(1 - \frac{1}{A_t}\right)$.[9]

Assumption 2. $a_g \leq \frac{1}{r}\left(1 - \frac{1}{1+g}\right)$.[10]

Let $a_s = \frac{1}{r}\left(1 - \frac{1}{A_{t^*}}\right)$, when $t > t^*$, the technology used in society is higher than A_{t^*}, indicating the return of human capital (specific and general) is high enough, they would invest in specific human capital when $b_t > c_{st}$. Under these two assumptions, without considering extractive revenues, the ruling elites would invest in general education when $A_t \geq A_{t*}$, while the masses receive no education due to $b_t^p = 0$. However, considering the extractive revenue, ruling elites would invest in general

[8] The decisions of the masses would be the same when after-tax incomes are analyzed. Although they would keep larger share of income if the average level of general human capital of the masses were improved, individual would not consider this effect and take the extractive share as given. The decisions of elites on the investment of human capital should be earlier when the tax revenue is considered. So, the conditions found here are sufficient ones.

[9] If $b_t^i \geq c_{gt}$, individual would invest in specific education when $w_{st+1} - w_u \geq rc_{st} \Rightarrow c_{st} \leq \frac{\alpha(A_t-1)}{r}\left(\frac{r}{1-\alpha}\right)^{-\frac{1-\alpha}{\alpha}} \Rightarrow a_s \leq \frac{1}{r}\left(1 - \frac{1}{A_t}\right)$.

[10] The person whose bequest is larger than c_{gt} would invest in general education if $w_{gt+1} - w_{st+1} \geq (c_{gt} - c_{st})r \Rightarrow a_g \leq \frac{1}{r}(1 - \frac{A_t}{A_{t+1}}) = \frac{1}{r}(1 - \frac{1}{1+g})$, where $c_{gt} = c_{st} + a_g w_{gt+1} = a_s w_{st+1} + a_g w_{gt+1}$.

human capital earlier. Especially, when the state development is higher, the improvement of the extractive ability of the elite by equipping general human capital is larger, the elite would invest in general human capital earlier.[11] Here, I focus on the case that $b_0^e > c_{g1}$, $a_s \leq \frac{1}{r}\left(1-\frac{1}{A_0}\right)$ and $a_g \leq \frac{1}{r}\left(1-\frac{1}{1+g}\right)$, which makes sure that the ruling elites would invest in general education at the beginning.

As the economy grows, the ruling elites could find that it could be beneficial to support public education for the masses under some conditions.

Elites Support Public Specific Education. Under autocracy, the ruling elites controlling well-developed state may find that it is beneficial to support public specific education for the masses with no bequests. The masses equipped specific human capital will promote economic growth and enlarge the whole economy pie. The elites could collect more tax revenues, although they have to finance the public education system. The ruling elites try to maximize $\{\pi_{gt+1}^e, \widetilde{\pi}_{gt+1}^e\}$, $\pi_{gt+1}^e$is the after-tax income of the elite by supporting no public education, and $\widetilde{\pi}_{gt+1}^e$, the after-tax income of the elite by supporting public specific education, where

$$\pi_{gt+1}^e = w_{gt+1} + (b_t^e - c_{gt})r + \chi\bar{\xi} I_{t+1}^{p\_total} = w_{gt+1} + (b_t^e - c_{gt})r + \chi\bar{\xi}(1-\rho)w_u,$$

$$\begin{aligned}\widetilde{\pi}_{gt+1}^e &= w_{gt+1} + \left(b_t^e - c_{gt} - \frac{1-\rho}{\rho}c_{st}\right)r + \chi\bar{\xi}\bar{I}_{t+1}^{p\_total} \\ &= w_{gt+1} + \left(b_t^e - c_{gt} - \frac{1-\rho}{\rho}c_{st}\right)r + \chi\bar{\xi}(1-\rho)w_{st+1}.\end{aligned}$$

[11] Suppose after-tax income of the elite would be $\pi_{ut+1}^e = w_u + rb_t^e + \underline{\xi}\chi(1-\rho)w_u$ if there is no investment in human capital, and $\pi_{gt+1}^e = w_{gt} + r(b_t^e - c_{gt}) + \bar{\xi}\chi(1-\rho)w_u$ if the elite receives general education. Thus, $\Delta\pi_{t+1}^e = \pi_{gt+1}^e - \pi_{ut+1}^e = w_{gt} - w_u - r(a_s w_{st+1} + a_g w_{gt+1}) + (\bar{\xi} - \underline{\xi})\chi(1-\rho)w_u = w_u A_{t+1}\left(1 - \frac{1}{A_{t+1}} - r\left(\frac{a_s}{1+g} + a_g\right) + (\bar{\xi} - \underline{\xi})\chi(1-\rho)\frac{1}{A_{t+1}}\right)$. Without considering the extractive revenue, when $1 - \frac{1}{A_{t+1}} - r\left(\frac{a_s}{1+g} + a_g\right) \geq 0$, it would be definitely beneficial for the elite to invest in general human capital. $1 - \frac{1}{A_{t+1}} - r\left(\frac{a_s}{1+g} + a_g\right) + (\bar{\xi} - \underline{\xi})\chi(1-\rho)\frac{1}{A_{t+1}} \geq 0$ has to be satisfied if the tax revenue is considered, which is earlier to eligible. Besides, when state development (χ) is stronger and the improvement of political rent-seeking capacity by general human capital, measured by $\bar{\xi} - \underline{\xi}$, is larger, it would be easier to be satisfied.

Assumption 3. $a_s \leq \frac{1}{r}\left(1-\frac{1}{A_t}\right)\rho\chi\bar{\xi}$.[12]

Since $a_s = \frac{1}{r}\left(1-\frac{1}{A_{t^*}}\right)$ and $\rho\chi\bar{\xi} < 1$, the inequality would be more easily to satisfy when A_t and χ are larger. Let $a_s = \frac{1}{r}\left(1-\frac{1}{A_{t_s^*}}\right)\rho\chi\bar{\xi} = \frac{1}{r}\left(1-\frac{1}{A_{t^*}}\right)$, where $t_s^* = t(\chi, A_{t^*})$, $\frac{\partial t_s^*}{\partial \chi} < 0$. When $t > t_s^*$, the ruling elites would support public specific education even $b_t^p = 0$. Intuitively, when the return of specific human capital is higher, the ruling class would collect a larger share of revenues from the masses if the state, measured by χ, is more powerful.

So, strong state will be beneficial for economic growth when the autocratic country is poor and the masses have no bequests. Specifically, let $\chi_s^* = \chi(A_{t^*}, A_t) = \frac{1-1/A_{t^*}}{1-1/A_t}\frac{1}{\rho\bar{\xi}}$, where $\frac{\partial \chi_s^*}{\partial A_t} < 0$. χ_s^* is the threshold of state development. When $\chi \geq \chi_s^*$, ruling elites would support public specific education. Additionally, as technologies progress, the cutoff would become lower and even less-developed state probably finances specific education for the masses.

The Economy Grows Faster By Supporting Public Specific Education. When the relative return of human capital is becoming relatively higher (i.e., A_t is large), the aggregate stock of human capital would become larger by the support of ruling elites on public specific education, then promote economic performance. Theoretically, it means GDP without public specific education, Y_{t+1}, would be smaller than $\tilde{Y}_{t+1}$, where ruling elites provide the free public specific education to the poor. It is easy to verify that $Y_{t+1} = \rho[w_{gt+1} + (b_t^e - c_{gt})r] + (1-\rho)w_u$ is smaller than $\tilde{Y}_{t+1} = \rho\left(w_{gt+1} + \left(b_t^e - c_{gt} - \frac{1-\rho}{\rho}c_{gt}\right)r\right) + (1-\rho)w_{st+1}$ as long as $w_{st+1} - w_u \geq c_{st}r$. Assumption (1) guarantees that this inequality would be satisfied.

Intuitively, human capital cannot be separated from the human. The investment of human capital is accumulated in each individual with the diminishing return. Then, the aggregate stock of human capital would be larger if the accumulation of human capital would be widely distributed among members in society (Oded et al., 2011).

[12] It would be worthy to support public specific education if $c_{st} \leq \rho\chi\bar{\xi}\frac{(1-A_t)\alpha}{r}\left(\frac{r}{1-\alpha}\right)^{-\frac{1-\alpha}{\alpha}} \Rightarrow a_s \leq \frac{1}{r}\left(1-\frac{1}{A_t}\right)\rho\chi\bar{\xi}$.

Elites Don't Support Public General Education. Unlike the situation that ruling elites actively support specific education, they may be unwilling to support general public education. Although this policy could enlarge the pie of the whole economy[13], the extractive ability of the elite would be impaired by the masses equipped general human capital. It is possible that the net tax revenues may be shrunk down. Mathematically, I need to compare π^e_{gt+1}, the income of the elite by supporting no public education, and $\widehat{\pi}^e_{gt+1}$, the income of the elite by supporting public general education. The below assumption ensures that the ruling class doesn't support general education.

Assumption 4. $\underline{\xi} \leq \frac{\bar{\xi}}{1+g}\left(1+\frac{g}{A_t}\right)+\frac{g}{(1+g)\rho\chi}$.[14]

Assumption (4) requires $\underline{\xi}$ is small enough, which indicates that the improvement of the general human capital of the masses would greatly enhance their abilities to evade extractive tax. Note that, as the country uses more advanced technology (means that A_t and A_{t+1} are larger), Assumption (4) is more difficult to be satisfied. But, considering that autocratic governments generally implement propaganda policies in education (Testa, 2018), which impairs the accumulation of general human capital of the masses, it may be reasonable to assume that ruling class in autocracy is not willing to support public general education. So, one of the sufficient assumption to guarantee this is

Assumption 5. $\underline{\xi} \leq \frac{1}{1+g}\left(\bar{\xi}+\frac{g}{\rho}\right)$.

[13] Suppose that Y_{t+1} and $\tilde{Y}_{t+1}$ are GDP with and without supporting public general education. It is easy to find that $Y_{t+1} = \rho[w_{gt+1} + (b^e_t - c_{gt})r] + (1-\rho)w_u$ and $\tilde{Y}_{t+1} = \rho\left(w_{gt+1} + \left(b^e_t - c_{gt} - \frac{1-\rho}{\rho}c_{gt}\right)r\right) + (1-\rho)w_{gt+1}$. As long as $w_{gt+1} - w_u \geq c_{gt}r$, $Y_{t+1} \leq \tilde{Y}_{t+1}$ would be satisfied. This is one of the assumption that makes sure the investment of general education is valuable when b_t is larger than c_{gt}.

[14] The assumption that the ruling elites don't support this type of education is $\pi^e_{gt+1} - \widehat{\pi}^e_{gt+1} = \frac{1-\rho}{\rho}c_{gt}r + \chi(1-\rho)(\bar{\xi}w_u - \underline{\xi}w_{gt+1}) \geq 0$, where $\pi^e_{gt+1} = w_{gt+1} + (b^e_t - c_{gt})r + \chi\bar{\xi}(1-\rho)w_u$, $\widehat{\pi}^e_{gt+1} = w_{gt+1} + \left(b^e_t - c_{gt} - \frac{1-\rho}{\rho}c_{gt}\right)r + \chi\underline{\xi}(1-\rho)w_{gt+1}$. Through some algebraic operations, I can find that $rc_{gt} \geq \rho\chi\alpha\left(\frac{r}{1-\alpha}\right)^{-\frac{1-\alpha}{\alpha}}(A_{t+1}\underline{\xi} - \bar{\xi})$. After plugging $c_{gt} = a_s w_{st+1} + a_g w_{gt+1} = \alpha\left(\frac{r}{1-\alpha}\right)^{-\frac{1-\alpha}{\alpha}}(a_s A_t + a_g A_{t+1})$ into the inequality, the following one would be obtained: $r(a_s A_t + a_g A_{t+1}) \geq \rho\chi(A_{t+1}\underline{\xi} - \bar{\xi}) \Rightarrow \underline{\xi} \leq \frac{r(a_s A_t + a_g A_{t+1})}{\rho\chi A_{t+1}} + \frac{\bar{\xi}}{A_{t+1}} = \frac{r}{\rho\chi}\left(\frac{a_s}{1+g} + a_g\right) + \frac{\bar{\xi}}{A_t}$. Next, I plug Assumption (2) and Assumption (3) and into this inequality. So, $\underline{\xi} \leq \frac{r}{\rho\chi}\left(\frac{1}{1+g}\frac{1}{r}\left(1-\frac{1}{A_t}\right)\rho\chi\bar{\xi} + \frac{1}{r}\left(1-\frac{1}{1+g}\right)\right) + \frac{\bar{\xi}}{A_t} = \frac{\bar{\xi}}{1+g}\left(1+\frac{g}{A_t}\right) + \frac{g}{(1+g)\rho\chi}$

As the country is becoming rich and $b_t^p > 0$, the autocratic government can reduce the financial support but still ensures that $b_t^p + \frac{1-\rho}{\rho}\tilde{m}_{st} = c_{st}$, where $\tilde{m}_{st}$ is the amount of money each elite has to pay to support the public education for the masses. Elites would not finance the masses anymore when $b_t^p \geq c_{st}$, since the masses can fully bear expenditure on education. So, the role of state capacity in the promotion of economic growth would become weak through public education.

Elites Implement Propaganda Policies In Education System. When $b_t^p \geq c_{gt}$, the poor can afford the expenditure on general education. However, the autocratic government realizes that the masses equipped with general human capital would weaken their tax collection abilities and reduce their extractive revenues. They could implement propaganda policies in the education system.[15] In fact, authoritarian states often use public schools to promote compliance with autocratic power structures and state-sanctioned ideologies. Curricula and textbooks there are generally embedded with propaganda, which aims to instill the masses social, moral, and civic values that help solidify their rule (Lindert, 2004; Cantoni et al., 2017; Testa, 2018). Additionally, autocratic governments can also shape the education style by not encouraging individual initiative and independent thinking (Fuchs-Schündeln and Masella, 2016).

The effects of these policies are determined by the ability of the state to penetrate the education system, collect information, channel the information it prefers to the masses, and block those it dislikes from the masses. This ability is closely related to the state's administrative capacity. These policies could retard the effect of general human capital of the masses on the improvement of their political anti-rent-seeking skills or organizing efficiency. Influenced by propaganda policies, the masses could not fully equip with the general human capital. Instead of receiving 1 unit by each one, I suppose only $\delta \in (0,1)$ unit is obtained.[16]

[15] Propaganda is the collection of techniques to channel information in populations for the benefit of certain groups or individuals at the expense of others (Marlin, 2007).

[16] It may be reasonable to assume that $\delta = \delta(\chi)$, where $\delta'(\chi) < 0$, meaning the more powerful state impairs the accumulation of general human capital of the masses more seriously. But, the conclusions in growth part are not changed without these settings. The theoretical analysis in

In other words, these propaganda policies impair not only the abilities of the masses to defend themselves in political conflicts[17], but also their labor productivity.[18] These policies stabilize the autocratic system, but at the same time, would harm the whole economy when the general human capital is gradually becoming the main engine of growth.

To sum up, in the early development stage, autocracy itself may not impede economic growth, and the powerful state could promote growth by support public specific education. But, in the late stage, when the masses can support general education, autocracy may discourage the accumulation of general human for the masses capital and inhibit economic development, and the powerful state may not benefit economic growth.

Democracy, Education Policy, and Economic Performance. In democracy, the masses could transfer some financial resources from elites by the extractive capacity of the state. It would speed up the accumulation of b_t^p when the masses have no or few bequests. Through bequests, the masses indirectly finance their offspring, and improve both the income level of the masses and the whole economic growth when their offspring can finance themselves for education by these bequests. The stronger the state is, the more the bequests of the masses would be accumulated, the earlier that $b_t^p > c_{st}(b_t^p > c_{gt})$ would be satisfied, and also the earlier the masses would receive the education.

When $b_t^p \geq c_{gt}$, the role of the state capacity by transferring revenue to the masses to support education, as well as to promote economic performance would become weak. But democracy, by eliminating the restrictions in education, still has strong

political transition part is still similar to the case without considering these propaganda policies, although it would become more complicated.

[17]When the masses have no general human capital, their relative collective action ability is $\frac{\varphi(\bar{l}_{gt+1}^p)}{\varphi(\bar{l}_{gt+1}^e)} = \frac{\varphi(0)}{\varphi(1)} = \underline{\phi}$. $\frac{\varphi(1)}{\varphi(1)} = \bar{\phi}$ and $\frac{\varphi(\delta)}{\varphi(1)} = \phi_\delta$ are, correspondingly, their relative collective action ability with and without propaganda policies, where $\underline{\phi} < \phi_\delta < \bar{\phi}$.

[18]Fuchs-Schündeln and Masella (2016) find that propaganda-based education in East Germany negatively impacted labor productivity after reunification.

and positive influences on the accumulation of general human capital and economic development. According to this analysis, the following proposition is obtained.

Proposition 3.1. *Suppose Assumption (1)–(4) hold, there are heterogeneous effects of political regimes and state development on economic growth in different stages of economic development.*

- *In the early stage of economic development, autocracy itself may not impede economic growth and strong state could boost growth by supporting public specific education when the masses cannot afford it.*
- *In the late stage of economic development, however, autocracy has no incentive to support general education and may impair the masses to receive it through propaganda, which would inhibit economic growth. The role of state in development becomes weaker as the masses could afford the education by themselves. Democracy, by supporting general education, will play a greater role in economic development.*

To achieve sustainable economic development, the political transition is needed in the autocratic country when it becomes rich. I discuss this in the next section. Specifically, I would like to investigate the role of state development in democratization.

3.3.4. The Environment of Political Transition

The establishment and transition of political regimes are shaped by the powers balance between the two groups (elites, and the masses). Consistent with the horizon of economic decisions in the overlapping generation model, the length of an individual's adulthood, which corresponds to one period in the model, is also used as the horizon for a political decision.

The fighting capability of the ruling class originated from the wealth and human capital is

$$v^{e}_{t+1} = \varphi(\bar{l}^{e}_{gt+1}) I^{e\_total}_{t+1}. \tag{3.1}$$

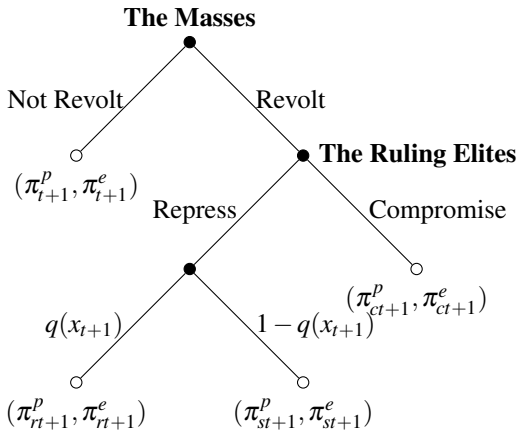


Figure 3.1.. The Political Game Between the Ruling Elites and the Masses

The fighting capability of the mass class originated from the wealth and human capital is

$$v^p_{t+1} = \varphi\left(\bar{l}^p_{gt+1}\right) I^{p\_total}_{t+1}. \tag{3.2}$$

I assume that fighting capability mainly depends on the group wealth and average level of general human capital. It increases in the total pretax incomes in the groups. $\varphi(\cdot)$ is the group's organizing effectiveness and increases in the average general human capital in the group due to the ability to find methods to solve coordination problems.

The Action and Payoff of Political Transition. The transition of political regime follows the political game described in Figure 3.1.

In each period, the masses may choose either to obey the current political order or to revolt. In response to revolt, the incumbent rulers, ruling elites, can either repress the masses, or compromise. When compromise is proposed and accepted, the political regime transits from autocracy to democracy. This will lead to a peaceful transition to the democratic regime. After the democratization, the policies would be made by the median voter, a representative member of the masses. However, when elites choose to repress, the masses may either surrender immediately so that the autocracy continues as before or continue to revolt so that an open fight breaks out, where the result of fighting is determined by the fighting capabilities of two parties (as given by equation (3.1) and equation (3.2)) and the incumbency advantage of the

ruling elites influenced by the effectiveness of state apparatus. The relative fighting power of the masses group[19] is denoted by

$$x_{t+1} = \frac{v^p_{t+1}}{v^e_{t+1}} = \frac{\varphi\left(\bar{l}^p_{gt+1}\right) I^{p\_total}_{t+1}}{\varphi(\bar{l}^e_{gt+1}) I^{e\_total}_{t+1}} = \hat{I}^{total}_{t+1}\phi_{t+1},$$

where $\hat{I}^{total}_{t+1} = \frac{I^{p\_total}_{t+1}}{I^{e\_total}_{t+1}}$, $\phi_{t+1} = \frac{\varphi(\bar{l}^p_{gt+1})}{\varphi\left(\bar{l}^e_{gt+1}\right)}$, and $\phi_{t+1} \in \{\frac{\varphi(0)}{\varphi(1)}, \frac{\varphi(0)}{\varphi(0)}, \frac{\varphi(\delta)}{\varphi(1)}, \frac{\varphi(1)}{\varphi(1)}\}$. Let $\underline{\phi} = \frac{\varphi(0)}{\varphi(1)}$, $\phi_\delta = \frac{\varphi(\delta)}{\varphi(1)}$, $\bar{\phi} = \frac{\varphi(0)}{\varphi(0)} = \frac{\varphi(1)}{\varphi(1)}$, it is easy to verify that $\underline{\phi} < \phi_\delta < \bar{\phi}$.

The probability of the elite group winning the fight and preserving the current political regime with repression is determined by a standard contest function (Skaperdas, 1992; Huang, 2012*a*):

$$Pr(elite, win) = \frac{\upsilon(\chi)v^e_{t+1}}{\upsilon(\chi)v^e_{t+1} + v^p_{t+1}} = \frac{1}{1 + \upsilon^{-1}(\chi)x_{t+1}} = q(x_{t+1}),$$

where $\upsilon(\chi)$ indicates the effectiveness of the ruling group's repressive apparatus. It is a form of incumbency advantage as it increases the incumbent's winning probability in the fight beyond its fighting capability originated from the wealth and human capital v^e_{t+1}. I suppose that $\upsilon(\chi)$ measures the coercive capacity of state apparatus. It is the function of state development[20], where $\upsilon'(\chi) > 0$, $\upsilon(\chi) > 1$, and $\lim_{\chi \to 0} \upsilon(\chi) = 1$.

Under the autocratic regime, individual in the masses have to pay tax $\lambda^{e\_total}_{t+1} I^p_{t+1}$, and each elite receives a net tax revenue $\lambda^e_{it+1} I^{p\_total}_{t+1}$. Their payoffs under no revolt are their after-tax incomes

$$\pi^p_{t+1} = (1 - \lambda^{e\_total}_{t+1}) I^p_{t+1},$$

[19] I ignore the random shock (the unexpected events, e.g. natural disasters, the sudden death of the ruler.) that influences the ability of collective action of the masses. Brückner and Ciccone (2011); Jia (2014); Chen (2015) find that some unexpected events could solve the plight of collective actions of the masses and trigger the political change. However, these random factors don't impair the main conclusions.

[20] Hariri (2012) documents that powerful precolonial state is harder to be colonized because centralized authority under a single ruler enabled polities to respond decisively and mount coordinated resistance. It is natural to assume that the duration of statehood history is one of the key factors that determines the coercive capacity of the state.

$$\pi^e_{t+1} = I^e_{t+1} + \lambda^e_{it+1} I^{p\_total}_{t+1}.$$

When compromise is achieved, the masses gain political power. This means the masses stop paying the exploitative tax $\lambda^{e\_total}_{t+1} I^p_{t+1}$ and can extract revenue from elites. Each elite has to pay tax $\lambda^{p\_total}_{t+1} I^e_{t+1}$, and each member in the masses receives a net tax revenue $\lambda^p_{it+1} I^{e\_total}_{t+1}$. Specifically, their payoffs under compromise are

$$\pi^p_{ct+1} = I^p_{t+1} + \lambda^p_{it+1} I^{e\_total}_{t+1},$$

$$\pi^e_{ct+1} = (1 - \lambda^{p\_total}_{t+1}) I^e_{t+1}.$$

When the revolt is repressed successfully, the incomes of the two groups are

$$\pi^p_{rt+1} = \pi^p_{t+1} / \theta_{t+1},$$

$$\pi^e_{rt+1} = \pi^e_{t+1},$$

where $\theta_{t+1} = \theta(\bar{l}_{gt+1}) = \theta\left((1-\rho)\bar{l}^p_{gt+1} + \rho \bar{l}^e_{gt+1}\right) > 1$[21], indicating that the fighting cost increases in the average general human capital in society.[22] For simplicity, I assume that the losers have to pay the fighting cost.

When the revolt succeeds, the masses gain political power, so that their incomes are

$$\pi^p_{st+1} = \pi^p_{ct+1},$$

$$\pi^e_{st+1} = \pi^e_{ct+1} / \theta_{t+1}.$$

It is useful to find the conditions when the masses revolt, and that the ruling elites would compromise when facing the rebellions of the masses. The following proposition illustrates these conditions.[23]

[21] $\theta_{t+1} \in \{\theta(0), \theta(\rho), \theta(\rho + (1-\rho)\delta), \theta(1)\}$. Let $\theta(0) = \theta_0$, $\theta(\rho) = \theta_\rho$, $\theta(\rho + (1-\rho)\delta) = \theta_\delta$, $\theta(1) = \theta_1$. It is easy to verify that $\theta_0 < \theta_\rho < \theta_\delta < \theta_1$.

[22] To simplify the analysis, I normalize the repression costs of specific human capital and physical capital to 0, the loss of general human capital should be larger than other capital types in the fighting.

[23] See the detailed analysis in Appendix C.1.

Proposition 3.2. *The masses will revolt when*

$$x_{t+1} \geq x_{t+1}^{p*},$$

where $x_{t+1} = \hat{I}_{t+1}^{total}\phi_{t+1}$, $x_{t+1}^{p*} = \upsilon(\chi)\left(\frac{1}{\lambda_{t+1}^{e\_total}} - 1\right)\left(1 - \frac{1}{\theta_{t+1}}\right) - \frac{\lambda_{t+1}^{p\_total}}{\lambda_{t+1}^{e\_total}}\phi_{t+1}$, $\lambda_{t+1}^{e\_total} = \frac{\rho\chi\tau(l_{gt+1}^{e})}{d(\bar{l}_{gt+1}^{p})}$, *and* $\lambda_{t+1}^{p\_total} = \frac{(1-\rho)\chi\tau(l_{gt+1}^{p})}{d(\bar{l}_{gt+1}^{e})}$. *When the masses revolt, the compromise would be realized when*

$$x_{t+1} \geq x_{t+1}^{e*},$$

where $x_{t+1}^{e*} = \frac{1}{\frac{1}{\upsilon(\chi)}\left(\frac{1}{\lambda_{t+1}^{p\_total}} - 1\right)\left(1 - \frac{1}{\theta_{t+1}}\right) - \frac{\lambda_{t+1}^{e\_total}}{\lambda_{t+1}^{p\_total}}\frac{1}{\phi_{t+1}}}$.

When the relative wealth of the masses, $\hat{I}_{t+1}^{total}$, and their relative collective action capacity, ϕ_{t+1}, are higher, the rebellion and the subsequent political reform may occur with larger probability. At the same time, the peaceful democratization also would more probably happen.

Next, I will explore the effects of the state capacity (extractive capacity χ, and coercive capacity, $\upsilon(\chi)$) on democratization.

The Non-linear Effects of State Capacity on Democratization. According to Proposition (3.2), to analyze the influence of state capacity on political reform, I should check its effects on x_{t+1}^{p*} and x_{t+1}^{e*}. Equivalently, I only need to investigate χ and $\upsilon(\chi)$ on the effects of $L_{t+1}^{p*} = \upsilon(\chi)\left(\frac{1}{\lambda_{t+1}^{e\_total}} - 1\right)\left(1 - \frac{1}{\theta_{t+1}}\right)$ (for the masses) and $L_{t+1}^{e*} = \frac{1}{\upsilon(\chi)}\left(\frac{1}{\lambda_{t+1}^{p\_total}} - 1\right)\left(1 - \frac{1}{\theta_{t+1}}\right)$ (for elites). It is easy to verify that $\frac{\partial L_{t+1}^{e*}}{\partial\chi} < 0$. As the state is stronger, the ruling elites are more willing to repress.[24]

The effect of state capacity on the action choices of the masses is a bit complicated. Through some algebraic operations, I obtain

$$\frac{\partial L_{t+1}^{p*}}{\partial\chi} = \frac{\Theta_{t+1}\upsilon(\chi)(1-\eta_{t+1}\chi)}{\eta_{t+1}\chi}\left(\frac{\upsilon'(\chi)}{\upsilon(\chi)} - \frac{1}{\chi(1-\eta_{t+1}\chi)}\right),$$

[24] Since $\frac{\partial x_{t+1}^{e*}}{\partial L_{t+1}^{e*}} < 0$, then $\frac{\partial x_{t+1}^{e*}}{\chi} > 0$ when $\frac{\partial L_{t+1}^{e*}}{\partial\chi} < 0$. As the state is more powerful, x_{t+1}^{e*} becomes larger. It would be more difficult to satisfy the condition $x_{t+1} - x_{t+1}^{e*} \geq 0$.

where $\eta_{t+1} = \frac{\rho\tau(l^e_{gt+1})}{d(\bar{l}^p_{gt+1})}$, $\Theta_{t+1} = 1 - \frac{1}{\theta_{t+1}}$.

The sign of $\frac{\partial L^{p*}_{t+1}}{\partial \chi}$ is determined by the sign of $\frac{\upsilon'(\chi)}{\upsilon(\chi)} - \frac{1}{\chi(1-\eta_{t+1}\chi)}$. Intuitively, I have to compare two opposite effects of state capacity on L^{p*}_{t+1}. On the one hand, a higher extractive capacity of the state means more brutal exploitation and fewer share of after-tax incomes are left to the masses, which induces them to rebel; On the other hand, higher coercive capacity of the state indicates a lower probability that the masses would win the fighting if they revolt. The masses must face the dilemma.

Theoretically, $\frac{\upsilon'(\chi)}{\upsilon(\chi)} - \frac{1}{\chi(1-\eta_{t+1}\chi)} < 0$ if χ is small and close to zero if $\lim_{\chi\to 0}\upsilon(\chi) < +\infty$. It is a reasonable assumption that the marginal improvement of coercive capacity should be not infinite even when the state development is very low and around 0. It means $\frac{\partial L^{p*}_{t+1}}{\partial \chi} < 0$. This implies that conditioning on a small χ, the masses would be more willing to revolt as χ become larger and elites are more likely to compromise. However, it is difficult to conclude that this trend would be continuous. Two different scenarios are demonstrated in the Figure 3.2.[25] In the first scenario, the effect of state development on democratization is non-linear. There is a threshold, χ^*. The net effects of state development on political reform are different below and above this cutoff. In the second scenario, $\frac{\upsilon'(\chi)}{\upsilon(\chi)} - \frac{1}{\chi(1-\eta_{t+1}\chi)} < 0$ holds between 0 and 1, implying that higher state development benefits political reform.

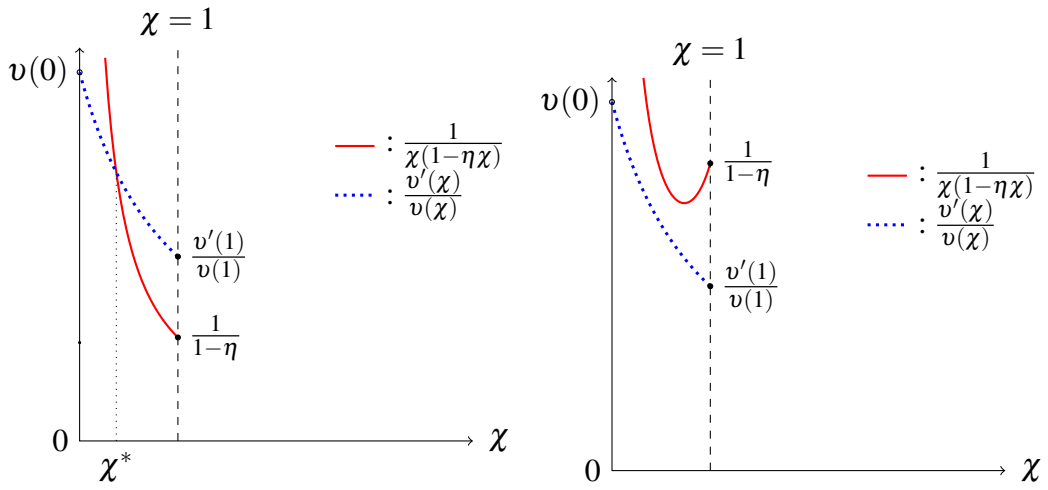
In reality, most of the countries that have long statehood histories are autocracy or democratized very later[26], which may imply that their coercive capacities are so strong and eventually leads to the silence of the masses.[27] Hariri (2012) finds that precolonial state development was an impediment to the development of democracy outside Europe since the country with higher state development in precolonial time facilitated the repression of internal opposition. Besides, it also fended off

[25]There are some other scenarios. For example, these two curves $\frac{\upsilon'(\chi)}{\upsilon(\chi)}$ and $\frac{1}{\chi(1-\eta_{t+1}\chi)}$, could intersect multiple times between 0 and 1. I explore this possibility in the empirical analysis.

[26]Acemoglu and Robinson (2002) observe that many countries located in Africa become democracy earlier and easier, most of which have low state development. In contrast, the countries located in East Asia, having a long history of agricultural civilization and developed state, don't have democratization or reform very late.

[27]One sufficient condition is $\frac{\upsilon'(1)}{\upsilon(1)} - \frac{1}{1-\eta_{t+1}} > 0$, which makes sure that $\frac{\upsilon'(\chi)}{\upsilon(\chi)} - \frac{1}{\chi(1-\eta_{t+1}\chi)} > 0$ when χ is very high.

Figure 3.2.. Two Scenarios: The Conflict Effects of Extractive Capacity and Coercive Capacity on Democratization



(a) If $\eta < \frac{1}{2}$ **(b)** If $\eta > \frac{1}{2}$

Europeans more effective and then the diffusion of European institutions and ideas became more difficult. So, at least in some range, when state capacity is strong, it is difficult for the masses to rebel, which indicates that $\frac{\upsilon'(\chi)}{\upsilon(\chi)} - \frac{1}{\chi(1-\eta_{t+1}\chi)} > 0$ when χ is high enough.

It may be useful to first check the state development in current autocracies and democracies in different regions. Compared with Sub-Saharan Africa and the American continent, Asia and Europe share relatively similar natural environments and are favorable to diffusion of agricultural technologies, then have longer agricultural civilizations and stronger state capacity (Diamond, 1998). I categorize countries into two groups: the old world[28] and the new world.[29] In each group, the countries are further classified into democracy and autocracy during the third democratization wave[30] according the data from Papaioannou and Siourounis (2008*b*). Figure 3.3 describes the state capacities measured by state antiquity among these groups.[31]

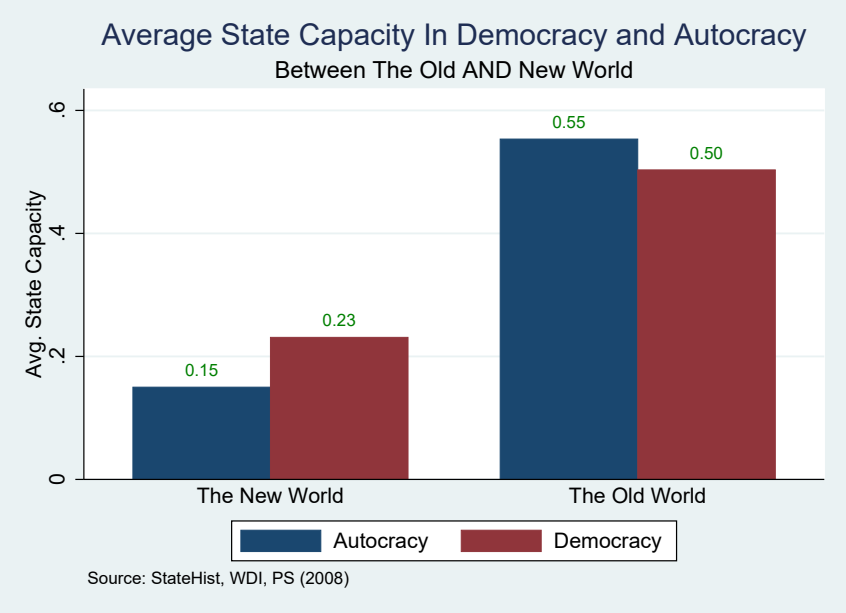
[28]They include East Asia & Pacific, Europe & Central Asia, Middle East & North Africa, and South Asia.

[29]They include North America, Latin America & Caribbean, and Sub-Saharan Africa.

[30]I ignore the countries that democratized before 1970. In the subsequent empirical study, I also focus on the third wave cases.

[31]The measure of state antiquity (*StateHist*) is developed by Bockstette, Chanda and Putterman (2002). See the detail in Section 3.4.

Figure 3.3.. State Capacity and Democratization



The state development in democracy is higher than the one in non-democracy in the new world while the opposite is true in the old world. In addition, state development in the old world is much higher than the one in the new world. Table 3.6.1 documents the statistical description.

It seems to imply that the intermediate level of state capacity is most favorable for the democratization. In the new world, most countries have relatively shorter agricultural civilizations and less developed states. Higher state development benefits political reform. In the old world, however, countries have longer agricultural civilizations and much more powerful states. Lower state development is favorable for political transition.

From the scattered evidence, it is possible that $\frac{\upsilon'(\chi)}{\upsilon(\chi)} - \frac{1}{\chi(1-\eta_{t+1}\chi)} > 0$ when χ is high enough and the following assumption is satisfied.

Assumption 6.
$$\begin{cases} \frac{\upsilon'(\chi)}{\upsilon(\chi)} \leq \frac{1}{\chi(1-\eta_{t+1}\chi)} & if\ \chi \leq \chi^*, \\ \frac{\upsilon'(\chi)}{\upsilon(\chi)} > \frac{1}{\chi(1-\eta_{t+1}\chi)} & if\ \chi > \chi^*. \end{cases}$$

When χ is smaller than χ^*, the threshold of revolting (x_{t+1}^{p*}) will become smaller as χ increases due to the dominant effect of the extractive capacity of the state. The masses are more willing to overthrow tyranny. However, once χ exceeds χ^*, x_{t+1}^{p*}

will become larger as χ further increases due to the dominant effect of the coercive capacity of the state. The masses are less willing to rebel because they are more likely to be repressed. In other words, there is resistance where there is oppression, but there is silence where there is extremely harsh repression. I summarize these in the following conjecture.

Conjecture 3.1. *If Assumption (6) holds, there would be a threshold χ^*. Below it, the extractive capacity of the state is dominant and the masses are more willing to rebel as χ is higher, while the coercive capacity of the state is dominant beyond that threshold and they have to endure the oppression system as χ is further higher. So, the relationship between state development and democratization should be hump-shaped.*

I will test this conjecture in the later section. Additionally, linear and cubed relationships between state development and political reform will be also tested for the robustness checks.

Next, I briefly discuss the effect of the distribution of wealth, accumulation of general human capital of the masses, and natural resources on democratization.

The Effects of Distribution of Wealth on Democratization. The wealth distribution contributes to the political change. For example, suppose t is not far from t_0 and b_t^e is so small that $c_{st} < b_t^e < c_{gt}$. It is possible that $x_{t+1} > x_{t+1}^{p*}$ would be satisfied and the masses would revolt very early.

The Effects of Distribution of General Human Capital on Democratization. At first glance, it seems that the masses equipped with general human capital should benefit democratization. But, it is not so obvious. On the one hand, the masses get general education would improve their relative fighting power $x_{t+1}$and they tend to gain more once in democracy, which would motivate them to revolt; On the other hand, general education also improve their anti-rent-seeking abilities and they would keep more share of income in autocracy, which would demotivate them to revolt. It is not clear which one dominates.

The Effects of Natural Resources on Democratization. For simplicity, the natural resources are only endowed for the ruling elites in autocracy. Assume that the total natural revenue is $R_{t+1} \geq 0$. It is easy to verify that $\frac{\partial x_{t+1}^{i*}}{\partial R_{t+1}} = 0$, where $i \in \{e, p\}$. I only need to analyze $\frac{\partial \hat{I}_{t+1}^{total}}{\partial R_{t+1}}$. Since $\hat{I}_{t+1}^{total} = \frac{I_{t+1}^{p\_total}}{I_{t+1}^{e\_total} + R_{t+1}}$, then $\frac{\partial \hat{I}_{t+1}^{total}}{\partial R_{t+1}} < 0$. It means that the rebellions of the masses would delay and elites are more willing to repress in cases of political conflicts in the autocratic country with more natural resources.

3.4. Data and Statistical Description

To measure the level of state development, I employ state antiquity index ($StateHist$) developed by Bockstette, Chanda and Putterman (2002), which fits the setting best. $StateHist$ index ranges from 0 to 1. A higher value indicates higher state development.[32] It is fixed within the country. I am interested in the effect of state development, χ, on economic performance and political transition.

The dependent variable in the growth regression model is the annual log difference in GDP per capita. The data is from World Development Indicators of World Bank (2015 edition) covering the period 1960-2010. The dichotomous democracy data extracted from Papaioannou and Siourounis (2008*b*)-then PS - is mainly used as the proxy of political regime in the paper.[33] The democracy indicator that measures many things may overlap the concept of the state development. PS try to balance narrow definition (CGV, BMR, and Polity IV) and broad definition (Freedom House) of democracy (Munck and Verkuilen, 2002; Papaioannou and Siourounis, 2008*b*). Additionally, I don't analyze the conditions of the stability of democracy and the effect of political stability on growth in the model. It is equivalent to assume that democracy is permanent. Therefore, democracy from PS is the best

[32] $StateHist$ is built based on the assumption that the longer the statehood history is, the more authoritative the state institutions become. There are three factors increasing $StateHist$: the amount of time a government above the tribal level existed during 1 to 1950; the amount of time the government was not controlled by foreign authorities; and the share of territory of the current country that was ruled by this government *(Bockstette, Chanda and Putterman, 2002; Chanda and Putterman, 2007; Putterman and Weil, 2010; Borcan, Olsson and Putterman, 2018).*

[33] Following them, I focus on permanent democratization. $Democracy = 1$ if they regard the country as permanent democracy or always democracy, $Democracy = 0$ for autocratic countries.

one and consistent with the model. In the robustness checks, democracy data from Acemoglu et al. (2019) (ACE), Cheibub, Gandhi and Vreeland (2010) (CGV), Boix, Miller and Rosato (2013) (BMR), Freedom House (FH) and Polity IV (POL), are also used.[34]

The important variables in the model are the learning costs of specific and general education. Past school enrollment rates (primary, secondary, and tertiary) are used as the rough proxies for learning costs. Enrollment rates are determined by many variables, including the return of human capital, education policies of governments, various fees, and family backgrounds, etc,. One of the key factors influencing enrollment rates is the learning cost.

The dependent variable in the political transition regression is a dummy variable in 1973[35] constructed by using PS data set. It equates to 1 if the autocratic country experienced democratic transition between 1973 and 2010 (dichotomous democracy indicator changes from 0 to 1) and 0 otherwise. The distribution of human capital may influence the relative power of the masses. Educational inequality could be a proxy of the human capital gap between the masses and elites. This indicator is extracted from V-Dem Project.[36] The rest of the indicators, including the covariates used in growth and political transition regressions, and their data sources are displayed in Appendix A.6.

Table 1.7.1 in Appendix C.6 presents the descriptive statistics for the main indicators used separately for democracies and non-democracies. The raw data show several well-known patterns, including, for example, that democracies are richer and

[34] I extract all these data from Acemoglu et al. (2019). The first three democracy indicators are the dichotomous type, while the last two are not. They transfer non-dichotomous type into the dichotomous one. For Freedom House, the country is coded as democracy if it is "free" or "partial free". For Polity IV, it is coded as democracy if democracy score is positive.

[35] The reason to use the situation in 1973 is that countries start to transit to democracy during the third democratization wave after that year.

[36] Educational Gini (G^h) combines information of average year schooling and percentages of the population in different education levels. Mathematically, $G^h = \frac{1}{2\bar{H}} \sum_{i=0}^{3} \sum_{j=0}^{3} |\hat{x}_i - \hat{x}_j| n_i n_j$, where $\bar{H}$ represents average years of schooling in the population aged 15 years and over, i and j ($i \neq j$) denote different levels of education, n_i and n_j represent the attainment per level of education, and $\hat{x}_i$ and $\hat{x}_j$ are the cumulative average years of schooling at each education level. See the details from Checchi (2006) and Castelló-Climent (2008).

have more educated populations. One interesting thing is that education inequalities are much smaller in democratic countries. There seems to be no difference in state development between non-democracies and democracies.

3.5. Regression Models and Results

3.5.1. Growth Regressions

To test the main conclusion summarized in Proposition 3.1, I use the following growth regression model:

$$\begin{aligned} g_{it} =& \beta_1 Democracy_{it} + \beta_2 StateHist_i + \beta_3 Democracy_{it} * EconLevel_{i1980} + \\ & \beta_4 StateHist_i * EconLevel_{i1980} + \sum_{j=1}^{3} \alpha_j g_{it-j} + \varphi y_{it-4} + \sum_{j=1}^{4} \gamma_j X_{it-j} + \mu\lambda_i + \delta_t + \varepsilon_{it}, \end{aligned} \tag{3.3}$$

where $g_{it} = 100 * (y_{it} - y_{it-1})$, y is the log form of GDP per capita, $EconLevel_{i1980}$[37] is the economic level of country i in 1980.[38] I use secondary enrollment rate as the main proxy of economic level. In the robustness checks shown in the appendix , other economic level indicators, such as GDP per capita, average years of secondary schooling, technological distance[39], and percentage with secondary schooling are used. $StateHist_i$, representing state development, is a time-invariant variable. X_{it-j} are the vector of control variables. I mainly control learning costs, represented by past (4 lags) enrollment rates (3 levels). λ_i includes the country fixed factors that

[37] To easily explain the coefficients, I normalize the economic level indicators into a unit interval, where 0 denotes the lowest economic level while 1 denotes the highest one.

[38] The reason to choose the economic level in 1980 is that it eases the endogenous issue. Additionally, there are not so many missing data in 1980. The results are robust by using other year data as the proxies of the economic level. See the robustness checks in Appendix C.6.

[39] It is defined as the ratio of income level between the given country and the United States.

are popularly used in growth literature.[40] δ_t denotes time effects. Random error is represented by ε_{it}.

In the first column of Table 3.6.2, only the indicators related to democracy are included in the regressions. Both democracy and its interaction with economic level are positive but not significant. In the next column, state development and its interaction are further added, the signs of democracy and its interaction are unchanged. State development has a significantly positive and large effect on growth while its interaction with economic level is negative but insignificant. It seems to imply that as the economy level is high, the stimulating effect of state development on economic development is weakened.

In the model, the learning costs of education are emphasized. Enrollment rates (primary, secondary and tertiary), denoted by $\sum_{j=1}^{4} \gamma_j X_{it-j}$, are used to roughly measure them. These indicators are further incorporated and reported in Column (3). State development plays great roles in the economy when the country is poor while the effect of democracy is negligible. However, as the economy develops, the roles of democracy and state development in economic growth are reversed, where democracy gradually becomes a strong impetus while capable state retires to the secondary role. It is consistent with Proposition 3.1. This is the baseline result and the pattern does not change after the 4 lagged investment rates (log form) are controlled.[41]

Autocracy could perform well when it owns a powerful state during the early development stage. It well explains why four tigers, followed by China and Vietnam, all of which own long statehood histories, achieve economic miracles when they were or are autocracies, whereas African and Latin democratic countries, many of which

[40] They include latitude, average distance to sea coast or river, the share of tropical land, the share of population living in the tropic areas, dummy indicator imply the colonial situations, language fractionalization index, religion fractionalization index, ethnic fractionalization index, the share of Muslims population, the share of Buddhist and Confucian population, the executive constraint in the independent year, region indicators (following the World Bank classification). The detailed data source could be found in Data Appendix C.8.

[41] I also control other indicators that are commonly used in growth literature, such as fertility rate, trade share (%, GDP), government spending (%, GDP), inflation rate, and life expectancy. The patterns still hold. See the results in Table C.3.5 in the appendix.

have no such strong states, don't achieve impressive economic performances. The ruling elites have great incentives to offer some basic public good, in the setting, specific education, to equip the masses in the autocratic country when the state is powerful. It could help the masses master the mature technologies, which not only incentives economic performance but also benefits ruling elites by collecting more tax revenues.

However, when the country becomes richer and is approaching technological frontiers, general human capital, which is good at absorbing advanced technologies and also contributes to innovation, would become the engine of the economy. Compared with democracy, autocracy may not willing to provide public general education to equip the masses because it would erode the extractive power of the elites and their ruling foundations. Democracy would become more and more important when innovations rather than imitations play greater roles in the economy since it supports the freedom of education and releases the productivity.[42]

The baseline results are also robust by using other economic level indicators[43], other democracy indicators[44], and IVs[45]. So, it may be safe to say that the baseline results are valid. Autocracy with the well-developed state could promote economic prosperity when the country is poor while the democracy could greatly stimulate economic growth when the country is rich. To grow sustainably, democratization may be needed for the autocratic country. What role does state development play in democratization? I explore the transition regressions in the next subsection.

[42] In the appendix, I show that democratization dramatically improves the academic freedom and information freedom measured by various indicators extracted from V-Dem Project.
[43] See Appendix C.2.1.
[44] See Appendix C.2.2.
[45] See Appendix C.2.3.

3.5.2. Transition Regressions

In this subsection, I explore whether the state development in the autocratic country has a great influence on the political transition. More specifically, I would like to explore the non-linear relationship between state development and democratization.

In the model, I make a conjecture that the state development has a hump-shaped link with democratization.[46] The inequality of human capital between the masses and elites may also matter for the political transition. Natural resources play negative roles in political reform.

To test these predictions and hypothesis obtained from the model, I follow Papaioannou and Siourounis (2008*b*) and use a similar probit model:

$$\begin{aligned} &P(Democratization_i = 1 | SC_i, Edu_{i,1973}, EduGini_{i,1973}, X_{i,1973}, \lambda_i) = \\ &G(\beta_0 SC_i + \beta_1 SC_i^2 + \beta_2 Edu_{i,1973} + \beta_3 EduGini_{i,1973} + \beta_4 X_{i,1973} + \beta_5 \lambda_i + \varepsilon_i), \end{aligned} \tag{3.4}$$

where $Democratization_i$ is a dummy variable. It equates to 1 if the autocratic country i has the political reform[47] between 1973 and 2010, 0 otherwise. Edu_i represents the level of human capital. I use three enrollment rate indicators. The average schooling years in population[48] is used for robustness check.

The distribution of human capital, influencing the relative power of the masses, may affect democratization. $EduGini_i$, measuring the inequality of education, could be a proxy of the human capital gap between elites and the masses. Population and GDP measure the country size, which may be related to state capacity; Urbanization ratio and GDP per capita measure the level of economic development and some dimen-

[46] I also check whether they have a linear or cubed relationship in the appendix. See Table C.5.1 - C.5.6. In the linear model, I don't find the significant effect of state development on political transition in almost all regressions. When incorporating SC, SC^2, and SC^3, however, the state-development-related coefficients are significant in some regressions. However, the values of these coefficients indicate that the state development plays a significant but negative role in democratization when $0 < \chi \leq 1$ in all these cases. It seems to imply that only SC considered in the regression should be better. However, I already showed that linear relationship between SC and democratization is not clear and the results are not consistent. I believe that it is not a good regression model when SC, SC^2, and SC^3 are controlled.

[47] Political reform data is extracted from Papaioannou and Siourounis (2008*b*).

[48] It is from Barro-Lee education data set.

sions of economic structures; Oil dummy represents natural resources.[49] They are incorporated in X_i. I also control for the indicators measured country fixed factors denoted by λ_i in robustness checks.[50] For all variant indicators, the values in 1973 are used in the regressions.

In the first column of Table 3.6.3, only SC, SC^2 and secondary enrollment rate are used in the regression. An inverted-U relationship between state development and democratization is confirmed. Further controlling for 3 enrollment rates and education inequality, this non-linear association is not affected, which are shown in Column (2) and (3). Column (3) is the baseline result. The turn point of the effect of SC on democratization is around 0.4, Below it, higher state development induces political reform, while the opposite is true beyond this turn point. It is consistent with the patterns shown in Figure 3.3 and Table 3.6.1. The baseline result also implies that education inequality plays a negative and significant role in democratization.

In the next two columns, urbanization ratio, GDP per capita are controlled separately. The hump-shaped relationship between state development and political reform still holds. Primary and tertiary enrollment rates have opposite impacts on the political transition. The possible reason is that the masses with higher education may have more general human capital while they with lower education may only be equipped with specific human capital.

In Column (7), the natural resource, measured by the oil dummy, is added in the regression. Consistent with the prediction of the model, it is difficult for the country with more natural resources to transit to democracy.

The regression result is reported in Column (8) by controlling for population and GDP, measuring the country size. No clear effects of country size on democratiza-

[49] It equates to 1 for all current and former OPEC members, 0 otherwise.

[50] I follow Papaioannou and Siourounis (2008*b*) and include latitude, average distance to sea coast or river, the share of tropical land, the share of population living in the tropic areas, dummy indicator implying the colonial situations, language fractionalization index, religion fractionalization index, ethnic fractionalization index, the share of Muslims population, the share of Buddhist and Confucian population, the executive constraint in the independent year. Please see the details from Data Appendix C.8.

tion are found. All these variables are added in the regressions and the results are shown in the last two columns.[51] The predictions are still robust.

3.5.2.1. Robustness Checks: Controlling for Various Fixed Factors

To check whether the predictions hold after adding various fixed factors, instead of employing the three enrollment rates, I controlling for average schooling years in regressions.[52] First, I replicate the regression results in Table 3.6.3. The results are displayed in the odd columns in Table 3.6.4. The results are consistent with Table 3.6.3. The effect of average year of schooling on democratization is not clear. It may imply that this indicator, at most, measures the mixed of specific and general human capital. Next, various fixed factors are controlled and results are reported in the even columns, finding that they are quite similar to the corresponding ones without controlling for these fixed factors.

The results are also robust by using other regression model[53], other democracy indicators, and IVs for democracy.[54]

To sum up, below some threshold (around 0.4-0.5), higher state development leads to a larger probability of democratization, while the relationship is reversed when the state development is beyond that threshold. In other words, there is resistance where there is oppression, but there is silence where there is severe suppression. More equality distribution of human capital contributes to political reform. Natural resources are negatively related to the establishment of the democratic system.

[51] I don't add GDP, GDP per capita, and population into regression at the same time due to the multicollinearity issue.

[52] The main reason for using one indicator as the proxy of the average level of human capital in regression is that it is impossible to estimate the coefficients using the three education indicators due to the failure of convergence.

[53] See results in Appendix C.4.1

[54] See results in Appendix C.4.2

3.6. Conclusion

This paper establishes a simple model in which the coevolution of economic and political development is driven by state strength, the distinct technical features of the two types of human capital (specific and general), and the potential political conflicts between elites and the masses.

During the early economic development stage, an autocratic and powerful state may find that it is beneficial to support public specific education that generates little threat to the political privileges of the ruling elites. The masses equipped with specific human capital take advantage of well-established technologies to make the whole economic pie larger. It allows the ruling elites to extract greater tax revenues by the strong state apparatus.

As the economy grows and approaches the world's technological frontiers, the economy gradually relies more on general human capital rather than specific one, because general human capital has the advantage to adapt and use advanced technologies. However, the ruling elites in the autocratic country are not willing to support public general education since the masses with general human capital would improve not only their productivity but also, more importantly, their skills in defending their own interests in the case of political conflicts. To maintain their rule, the ruling class may implement propaganda policies to weaken the influence of general education on the masses even when they can afford general education. It will inhibit the economic performance.

When the state is not so powerful, political democratization is achieved and economic progress is continuous supporting by the democratic institutions. Otherwise, political conflicts may occur, which would lead to repression as well as to subsequent economic stagnation. The empirical section has shown that the powerful state has great impacts but political regimes (autocracy vs. democracy) has little impact on economic growth during the early development stage, while democracy

has greater positive effects but the state itself has weak effects on growth in the late development stage.

This paper highlights the subtle role of state development in smoothing political transitions that facilitate economic development. For example, an intermediate level of state development is favorable to political reform. In a society with a very long statehood history, it is difficult for the masses to prevail when they revolt because the ruling elites controlling the powerful state apparatus can effectively repress them. Expecting it, the masses are not willing to revolt. In a weak state, however, the extractive ability of the state is not so high, the masses suffer little loss and have no urgent desire to revolt. A political transition may not occur even though they might have a relatively high probability of prevailing. The masses are willing to rebel when the state development is at a medium level. In this scenario, they endure relatively larger losses from exploitative taxes and have a greater chance of prevailing due to the relatively limited coercive ability of the ruling elites. This implies a hump-shaped link between state development and democratization.

This paper's analytical framework may also prove useful in understanding the long-term effects of state development on economic performance. A long state history may benefit growth when an autocratic country is poor, but it will eventually become a stumbling block when the country is rich and a political transition is needed for the sustainable economic development. This echoes the study of Lagerlöf (2016) and Borcan, Olsson and Putterman (2018) on the non-linear relationship between state development and economic prosperity. In the model, I explain this phenomenon by considering the capacity and willingness of the state to support various types of public education, as well as the non-linear effect of state development on political reform in modern society.

Table 3.6.1.. The Statistical Description on State Capacity in the Old and New World

	Old World				New World			
	Obs	Mean	Std. Dev.	p-value	Obs	Mean	Std. Dev.	p-value
Total	47	0.496	0.216		56	0.208	0.175	
Autocracy	20	0.553	0.201		21	0.150	0.091	
Democracy	27	0.454	0.221		35	0.243	0.203	
Difference: Auto - Dem		0.099		0.060		-0.093		0.027

Table 3.6.2.. Heterogeneous Effects of Democracy and State Capacity on Growth

	(1)	(2)	(3)	(4)
Dependent Variable:	Dem &	Dem&SC&		Add Edu
Growth Rate	Interaction	Interaction	Add Edu	& Invest
Democracy (Dem)	0.110	0.101	-1.214	-0.932
	(0.941)	(0.843)	(0.896)	(0.895)
Dem*$EconLevel$	0.806	1.007	3.515**	2.841*
	(1.356)	(1.363)	(1.568)	(1.564)
State Capacity (SC)		3.224***	4.865***	5.239***
		(1.136)	(1.256)	(1.506)
SC*$EconLevel$		-2.131	-4.220**	-4.451**
		(1.611)	(1.766)	(2.003)
Observations	4194	3883	2942	2804
Adjusted R^2	0.147	0.195	0.223	0.201

Note: This table presents estimates of the effects of democracy and state capacity on annual GDP per capita growth. Normalized economic level indicator (secondary enrollment rate in 1980) interacted with Democracy (PS) and State Capacity (*StateHist*) are controlled. 4 lagged education indicators (log form), including primary, secondary, and tertiary rates are controlled in the third column. 4 lagged investment rates (log) are further added in the fourth column. In all specifications, various factors are considered to control for country and year fixed effects. Standard errors robust against at the country level are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 3.6.3.. Cross-Country Regressions on the Likelihood of Successful Democratic Transition

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
		3 Edu.				Urbanization	Oil	GDP	All	All
Democracy from: PS	Sec. Enroll	Enroll	EduGini	Urbanization	GDP per	&GDP per	Dummy	&Pop.	(no GDP per)	(no GDP)
SC	4.423*	2.85	5.377*	5.272*	8.716**	8.804**	5.445*	9.018**	9.124**	9.050**
	(2.541)	(2.770)	(3.120)	(3.161)	(3.808)	(3.970)	(3.169)	(3.927)	(4.051)	(4.007)
SC^2	-5.650*	-3.802	-7.205*	-7.047*	-9.629**	-9.717**	-7.321**	-9.660**	-9.845**	-9.733**
	(2.951)	(3.147)	(3.679)	(3.702)	(4.074)	(4.168)	(3.677)	(4.074)	(4.145)	(4.074)
Secondary Enrollment	0.594***	0.019	0.089	0.160	0.400	0.440	0.063	0.423	0.471	0.459
	(0.182)	(0.381)	(0.436)	(0.448)	(0.443)	(0.534)	(0.445)	(0.475)	(0.556)	(0.557)
Primary Enrollment		0.151	-0.675	-0.63	-2.029***	-2.043***	-0.487	-1.993***	-1.983***	-1.968***
		(0.579)	(0.652)	(0.659)	(0.733)	(0.750)	(0.685)	(0.746)	(0.768)	(0.764)
Tertiary Enrollment		0.389*	0.383	0.469*	0.381	0.397	0.387	0.381	0.371	0.382
		(0.229)	(0.250)	(0.280)	(0.326)	(0.308)	(0.255)	(0.307)	(0.307)	(0.311)
Edu Gini			-0.035**	-0.033**	-0.064***	-0.063***	-0.034**	-0.063***	-0.062***	-0.062***
			(0.013)	(0.014)	(0.021)	(0.022)	(0.013)	(0.021)	(0.021)	(0.021)
Urbanization				-0.283		-0.136			-0.161	-0.134
				(0.441)		(0.658)			(0.656)	(0.650)
GDP per					-0.082	-0.021				-0.031
					(0.319)	(0.460)				(0.517)
Oil							-1.213**		-0.717	-0.682
							(0.616)		(0.815)	(0.792)
GDP								-0.123	0.015	
								(0.385)	(0.543)	
Pop.								0.039	-0.089	-0.084
								(0.323)	(0.527)	(0.266)
Pseudo R^2	0.159	0.196	0.366	0.370	0.501	0.501	0.384	0.501	0.504	0.504
Observations	72	63	59	59	47	47	59	47	47	47

Note: This table presents cross-section probit estimates. The dependent variable equals 0 for always autocratic countries and takes on the value 1 if a country was non-democratically governed before 1973 but permanently abandoned autocratic rule between 1973 and 2010. The main independent variables are State Capacity (*StateHist*) and its square, enrollment rate (including primary, secondary, and tertiary), and education inequality. Urbanization ratio, GDP per capita, natural resource (oil dummy), country size (measured by GDP and population) are controlled for further robustness checks. The Data Appendix gives detailed variable sources. Standard errors robust against at the country level are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 3.6.4.. Cross-Country Regressions on the Likelihood of Successful Democratic Transition by Controlling for Country Fixed Factors

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Democracy from: PS	Avg. Schooling		Edu Gini		Urbanization		GDP per		Oil Dummy	
SC	4.878*	9.801**	5.632*	11.969**	4.984*	13.218**	7.625**	12.693*	5.902**	10.887*
	(2.627)	(3.986)	(2.929)	(5.923)	(2.945)	(6.403)	(3.503)	(7.032)	(2.984)	(6.420)
SC^2	-5.666*	-10.930***	-6.958**	-11.010**	-6.477*	-12.999**	-8.432**	-10.224	-7.287**	-10.774*
	(2.958)	(3.964)	(3.335)	(5.054)	(3.325)	(5.681)	(3.808)	(6.301)	(3.385)	(5.852)
Avg. Schooling	1.124***	1.414**	0.466	0.207	0.234	-0.112	-0.026	-0.002	0.375	-0.185
	(0.367)	(0.595)	(0.630)	(0.815)	(0.669)	(0.744)	(0.742)	(0.800)	(0.644)	(0.765)
EduGini			-0.030*	-0.048	-0.033*	-0.036	-0.046**	-0.063**	-0.033*	-0.087**
			(0.018)	(0.031)	(0.018)	(0.028)	(0.023)	(0.028)	(0.019)	(0.036)
Urbanization					0.377	1.291**				
					(0.306)	(0.600)				
GDP per							0.051	-0.392		
							(0.229)	(0.387)		
Oil Dummy									-1.139**	-2.668***
									(0.529)	(0.881)
Latitude		-0.024		-0.039		-0.064*		-0.063		-0.017
		(0.018)		(0.025)		(0.034)		(0.046)		(0.026)
Distance to Coast/River		0.000		-0.001		0.000		-0.001		-0.001
		(0.001)		(0.001)		(0.001)		(0.001)		(0.001)
Tropics Land (%)		0.933		2.145		-0.486		6.048		6.290*
		(2.663)		(2.914)		(3.654)		(4.754)		(3.624)
Tropics Pop. (%)		0.477		-0.271		2.804		-5.224		-4.832
		(2.757)		(2.722)		(3.509)		(4.560)		(3.601)
Colony Dummy		-1.905**		-1.903**		-2.635**		-1.141		-1.610**
		(0.785)		(0.822)		(1.195)		(1.012)		(0.814)
Executive Constraint		-0.618		-0.501		-0.394		-0.758		-1.181
(independence)		(0.936)		(0.975)		(0.946)		(1.034)		(1.062)
Language Fractionalization		1.044		1.679		0.804		0.081		3.283*
		(0.933)		(1.243)		(1.160)		(0.865)		(1.952)
Religion Fractionalization		-1.318		-1.378		-0.217		-5.284**		-3.171*
		(1.049)		(1.248)		(1.463)		(2.162)		(1.703)
Ethnic Fractionalization		-1.775		-1.677		-3.129		4.362		-1.553
		(1.511)		(1.845)		(2.161)		(2.860)		(2.543)
Muslims pop. (%)		-0.006		-0.005		-0.003		-0.022		-0.011
		(0.010)		(0.013)		(0.016)		(0.016)		(0.015)
Buddhist&Confucian & Chondogyo		-0.022**		-0.053***		-0.042**		0.090		-0.073***
& Shintoist. Pop. (%)		(0.009)		(0.019)		(0.019)		(0.072)		(0.025)
Pseudo R^2	0.294	0.496	0.351	0.548	0.366	0.591	0.374	0.534	0.375	0.595
Observations	64	58	59	54	59	54	49	45	59	54

Note: This table presents cross-section probit estimates by controlling for various country fixed factors. The dependent variable equals 0 for always autocratic countries and takes on the value 1 if a country was non-democratically governed before 1973, but permanently abandoned autocratic rule between 1973 and 2010. The main independent variables are State Capacity (*StateHist*), its square, average years of schooling, and education inequality. Urbanization ratio, GDP per capita, natural resource (oil dummy), country size (measured by GDP and population) are controlled for further robustness checks. The Data Appendix gives detailed variable sources. Standard errors robust against at the country level are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

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A. The First Chapter Appendix

A.1. The List of Countries Ranked by GDP at Democratic Transition

Table A.1.1.. The List of Countries Ranked by GDP at Democratic Transition in 1960-2010

Country	Democratic Period	GDP at Transition	Percentile (%)	Country	Democratic Period	GDP at Transition	Percentile (%)
Mozambique	1994-2010	171.1502	1	Guatemala	1986-2010	2073.067	51
Ethiopia	1995-2004	182.9408	2	El Salvador	1982-2010	2092.554	52
Burundi	2003-2010	207.8334	3	Ukraine	1994-2010	2173.163	53
Liberia	2004-2010	272.1501	4	Fiji	1970-2005	2207.626	54
Sierra Leone	2001-2010	305.0988	5	Colombia	1960-2010	2213.223	55
Malawi	1994-2010	318.2459	6	Belize	1981-2010	2262.883	56
Mali	1992-2010	363.9949	7	St. Vincent & Grenadines	1979-2010	2287.068	57
Nepal	1991-2010	370.3171	8	Dominican Republic	1978-2010	2347.866	58
Niger	1991-2010	384.5782	10	Panama	1960-1967	2350.482	60
Sierra Leone	1961-1966	398.1468	11	Kiribati	1979-2010	2456.222	61
Bangladesh	1991-2010	404.564	12	Micronesia, Fed. Sts.	1991-2010	2461.609	62
Central African Republic	1993-2002	410.1606	13	Marshall Islands	1991-2010	2627.455	63
Madagascar	1993-2008	437.1914	14	Peru	1960-1967	2629.225	64
Botswana	1966-2010	483.0933	15	Paraguay	1993-2010	2736.968	65
Guinea-Bissau	1994-2010	602.3344	16	Congo, Rep.	1992-1996	2766.262	66
Lesotho	1993-2010	688.4974	19	Turkey	1961-2010	2996.58	69
Pakistan	1988-1998	718.3286	20	Namibia	1990-2010	3507.484	70
Kyrgyz Republic	2005-2010	747.5656	21	Macedonia, FYR	1991-2010	3630.235	71
Kenya	2002-2010	836.2352	22	Peru	1980-2010	3749.998	72
Comoros	1990-2010	841.7672	23	Bulgaria	1991-2010	3798.164	73
Senegal	2000-2010	877.9714	24	Panama	1994-2010	4683.453	74
Ghana	1996-2010	905.201	26	Serbia	2006-2010	4896.824	76
Cabo Verde	1991-2010	934.6758	27	St. Kitts and Nevis	1983-2010	5280.635	77
Zambia	1991-2010	1002.85	28	Romania	1990-2010	5345.854	78
Georgia	1995-2010	1011.536	29	Antigua and Barbuda	1981-2010	5556.531	79
Zimbabwe	1978-1986	1040.175	30	Trinidad and Tobago	1962-2010	5589.407	80
Thailand	1974-2010	1046.25	31	Suriname	1988-2010	5799.678	81
Djibouti	1999-2009	1078.589	32	South Africa	1994-2010	5896.009	82
Moldova	1994-2010	1089.854	33	Poland	1990-2010	5953.034	83
Nicaragua	1990-2010	1143.267	35	Russian Federation	1993-2003	7056.162	85
Albania	1992-2010	1243.135	36	Argentina	1983-2010	7173.555	86
Nigeria	1999-2010	1247.828	37	Suriname	1975-1979	7612.023	87
Nigeria	1960-1965	1297.827	38	Korea, Rep.	1988-2010	7688.563	88
Papua New Guinea	1975-2010	1306.062	39	Cyprus	1975-2010	7726.054	89
Mongolia	1993-2010	1363.651	40	Slovak Republic	1993-2010	7792.297	90
Bolivia	1982-2010	1519.169	41	Mexico	1997-2010	7947.241	91
Honduras	1982-2010	1573.672	43	Palau	1994-2010	9434.41	93
Armenia	1991-2010	1598.556	44	Croatia	2000-2010	10572.83	94
Guatemala	1966-1973	1726.455	45	Portugal	1976-2010	10779.3	95
Guyana	1992-2010	1741.748	46	Czech Republic	1993-2010	12277.41	96
Nigeria	1979-1983	1926.418	47	Venezuela, RB	1960-2008	12468.84	97
Vanuatu	1980-2010	2070.262	48	Spain	1978-2010	17343.84	98
Indonesia	1999-2010	2071.238	49	Bahamas, The	1973-2010	19434.7	99

Note: GDP per capita data are from WDI (2015).

A.2. The List of Strong and Weak Democracies Grouped by Combined Development Indicators

Table A.2.1.. Strong and Weak Democracies Grouped by Combined Development Indicators at Democratic Transition

Countries with Weak Democracy (39)		Countries with Strong Democracy (46)	
Bangladesh	Mozambique	Albania	Mexico
Benin	Namibia	Antigua and Barbuda	Micronesia, Fed. Sts.
Botswana	Nepal	Argentina	Moldova
Burundi	Niger	Armenia	Mongolia
Central African Republic	Papua New Guinea	Bahamas, The	Nicaragua
Colombia	Peru	Belize	Nigeria
Congo, Rep.	Senegal	Bulgaria	Panama
Cyprus	Sierra Leone	Cabo Verde	Paraguay
Djibouti	Solomon Islands	Croatia	Poland
Ethiopia	South Africa	Czech Republic	Portugal
Fiji	Suriname	Dominica	Romania
Guinea-Bissau	Uganda	Dominican Republic	Russian Federation
Haiti	Vanuatu	Georgia	Slovak Republic
Honduras	Zambia	Ghana	Spain
Kenya	Zimbabwe	Guatemala	Vincent and the Grenadines
Kyrgyz Republic		Guyana	Suriname
Lesotho		Indonesia	Thailand
Liberia		Kiribati	Trinidad and Tobago
Madagascar		Korea, Rep.	Turkey
Malawi		Macedonia, FYR	Ukraine
Mali		Marshall Islands	Venezuela, RB

Note: The five indicators used to categorize strong and weak democracy are GDP per capita, secondary enrollment rate, tertiary enrollment rate, Gini coefficient, and natural resources.

A.3. Further Robustness Checks for Growth Regressions

A.3.1. More Robustness Checks to the Baseline Results

Table A.3.1 contains more robustness checks to the baseline results. In Panel A, the missing values of GDP at political transitions before 1960 are filled with data in 1960. The number of countries goes up to 180. In Panel B, the original democracy data from Acemoglu et al. (2019) are used, where the gap between Strong and Weak Democracy is significant even at the 30% cutoff. In Panel C, a higher cutoff in polity score, 5, is used to construct the democracy dummy, which is also adopted in other studies (Glaeser, Ponzetto and Shleifer, 2007; Polity, 2014). The number of countries increases to 138, and the coefficients of Strong Democracy become a bit larger, varying from 0.626 (in Column (1)) to 0.908 (in Column (5)). In Panel D, we check our results by using Freedom House data set. The cutoff, 3.5, is employed to build the dichotomous democracy indicator.[1] When the threshold of initial GDP is set below the percentile 25, the effect of Strong Democracy on growth is larger than 1% and is significantly higher than Weak Democracy. In Panel E, more growth lags (6, 9, 12, and 15, respectively) are further controlled in the benchmark regression. In all of these panels, the overall results remain similar to those in the main paper.

There are further check the robustness. In Table A.3.2, per capita GDP residual at democratization is used to categorize Strong Democracy and Weak Democracy. The residual GDP information is obtained by removing the year effect through the regression. This process could further reduce the concern that per capita GDP (real) is not comparable in different time or it tends to autocratically grow over time. The

[1] It seems to be relatively high if the cutoff is 5 (the cutoff between "Partial Free" and "Not Free"). For example, there are more than 20% inconsistent observations between the democracy from Boix, Miller and Rosato (2013) and Freedom House, where the latter categorizes more than 90% of these controversial observations into democracy but Boix, Miller and Rosato (2013) classifies these into autocracy. When the cutoff is set at 3.5, the different observations are reduced to less than 10%.

results are quite similar to the ones using per capita GDP to group these two types of democracy.

In Table A.3.3, we use an alternative indicator to capture the economic structure, Economic Complexity Index (ECI). ECI is a measure of the relative knowledge intensity of an economy. It is built by considering the knowledge intensity of the products it exports (Hausmann et al., 2014). Using it to categorize the types of democracy, the patterns are similar to the ones in baseline results, except that an appropriate cutoff is the percentile 15.

In Table A.3.4, we allow the degree of *de jure* qualities of political institution (proxied by polity score or Freedom House score [normalized between 0 and 1]) in periods of democracy (i.e., when the democratization dichotomous variable is equal to one) to affect the performances of Strong Democracy and Weak Democracy on economic growth by interacting the democracy quality indicator. Our results still hold.

Table A.3.1.. The Baseline Results: More Robustness Checks 1

	GDP Percentiles in Political Transition Period as Cutoffs					
Dependent Variable:	(1)	(2)	(3)	(4)	(5)	(6)
Growth	p15	p20	p25	p30	p35	p40
	Panel A: Filling Missing GDP Data by Values in 1960					
Strong Democracy	1.137***	1.238***	1.044***	0.821***	0.921***	0.821**
	(0.301)	(0.323)	(0.325)	(0.307)	(0.321)	(0.352)
Weak Democracy	0.084	0.137	0.619*	0.883**	0.800**	0.872**
	(0.412)	(0.345)	(0.372)	(0.386)	(0.373)	(0.338)
Coef. Test (p-value): $\beta_S = \beta_W$	0.0243	0.0104	0.3432	0.8936	0.7957	0.9104
Countries	180	180	180	180	180	180
Observations	6261	6261	6261	6261	6261	6261
	Panel B: Original Democracy Indicator Used without Smoothing					
Strong Democracy	1.023***	1.112***	1.116***	1.204***	1.117***	1.115***
	(0.292)	(0.303)	(0.313)	(0.334)	(0.335)	(0.363)
Weak Democracy	-0.018	-0.134	0.106	0.143	0.434	0.511
	(0.450)	(0.409)	(0.367)	(0.321)	(0.364)	(0.353)
Coef. Test (p-value): $\beta_S = \beta_W$	0.0307	0.0063	0.0179	0.0106	0.1268	0.197
Countries	152	152	152	152	152	152
Observations	5399	5399	5399	5399	5399	5399
	Panel C: Democracy Indicator from Polity Data with 5 as Cutoff					
Strong Democracy	0.626*	0.685**	0.812**	0.819**	0.908**	0.856**
	(0.320)	(0.339)	(0.356)	(0.379)	(0.395)	(0.402)
Weak Democracy	-0.424	-0.253	-0.436	-0.211	-0.234	-0.004
	(0.485)	(0.356)	(0.342)	(0.357)	(0.354)	(0.366)
Coef. Test (p-value): $\beta_S = \beta_W$	0.0665	0.0427	0.0085	0.0433	0.0299	0.1072
Countries	138	138	138	138	138	138
Observations	5062	5062	5062	5062	5062	5062
	Panel D: Democracy Indicator from Freedom House with 3.5 as Cutoff					
Strong Democracy	1.139**	1.268**	1.258**	0.826*	0.977**	1.011**
	(0.481)	(0.528)	(0.544)	(0.428)	(0.453)	(0.487)
Weak Democracy	-0.266	-0.181	0.004	0.642	0.502	0.532
	(0.389)	(0.323)	(0.376)	(0.491)	(0.455)	(0.419)
Coef. Test (p-value): $\beta_S = \beta_W$	0.0239	0.0183	0.0538	0.7374	0.3766	0.3661
Countries	160	160	160	160	160	160
Observations	4548	4548	4548	4548	4548	4548
	Panel E: Controlling Different Lags of Growth					
	3 lags	6 lags	9 lags	12 lags	15 lags	
Strong Democracy	1.394***	1.394***	1.663***	1.277***	1.636***	
	(0.362)	(0.382)	(0.449)	(0.450)	(0.518)	
Weak Democracy	0.048	0.039	0.075	-0.065	-0.18	
	(0.382)	(0.387)	(0.443)	(0.469)	(0.558)	
Coef. Test (p-value): $\beta_S = \beta_W$	0.0039	0.0047	0.0066	0.0234	0.011	
Countries	153	153	151	149	146	
Observations	5419	5006	4582	4152	3719	

Note: A full set of country and year fixed effects are controlled in all specifications. From Panel A to Panel D, three lags of growth rates and the fourth lag of GDP per capita are controlled. In Panel E, more lags of growth rates and corresponding GDP per capita are included. Standard errors robust against heteroscedasticity and serial correlation at the country level are reported in the parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A.3.2.. More Robustness Check: Using Residual GDP to Group Strong and Weak Democracy

Dependent Variable: Growth Rate	(1) p10	(2) p15	(3) p20	(4) p25	(5) p30	(6) p35	(7) p40	(8) p45	(9) p50
	GDP per Capita (Residual) in Political Transition Period as Cutoffs								
Strong Democracy	1.073***	1.153***	1.289***	1.394***	1.197***	1.140***	0.950**	1.031***	0.906**
	(0.322)	(0.344)	(0.343)	(0.362)	(0.366)	(0.398)	(0.366)	(0.385)	(0.409)
Weak Democracy	0.054	0.184	-0.02	0.048	0.559	0.705*	0.895**	0.851**	0.926**
	(0.562)	(0.439)	(0.451)	(0.382)	(0.414)	(0.400)	(0.422)	(0.396)	(0.379)
Coef. Test (p-value): $\beta_S = \beta_W$	0.0848	0.0525	0.0105	0.0039	0.1882	0.3997	0.9164	0.7251	0.9705
Countries	153	153	153	153	153	153	153	153	153
Observations	5419	5419	5419	5419	5419	5419	5419	5419	5419
Adjusted R^2	0.151	0.151	0.1514	0.1516	0.1509	0.1507	0.1506	0.1507	0.1506

Note: A full set of country and year fixed effects are controlled in all specifications as well as three lags of growth rates and the fourth lag of GDP per capita. Standard errors robust against heteroscedasticity and serial correlation at the country level are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A.3.3.. More Robustness Check: Using ECI to Group Strong and Weak Democracy

Dependent Variable: Growth Rate	(1) p10	(2) p15	(3) p20	(4) p25	(5) p30	(6) p35	(7) p40	(8) p45	(9) p50
	Economic Complexity Index (ECI) in Political Transition Period as Cutoffs								
Strong Democracy	1.284***	1.433***	1.485***	1.424***	1.591***	1.292***	1.286**	1.247**	1.488***
	(0.431)	(0.444)	(0.464)	(0.481)	(0.530)	(0.479)	(0.499)	(0.526)	(0.560)
Weak Democracy	-0.424	-0.447	-0.186	0.226	0.269	0.700	0.763	0.823*	0.724
	(0.528)	(0.469)	(0.484)	(0.493)	(0.458)	(0.563)	(0.509)	(0.486)	(0.458)
Coef. Test (p-value): $\beta_S = \beta_W$	0.0053	0.0015	0.0063	0.0498	0.0393	0.3820	0.3990	0.4940	0.2290
Countries	115	115	115	115	115	115	115	115	115
Observations	3,926	3,926	3,926	3,926	3,926	3,926	3,926	3,926	3,926
Adjusted R^2	0.158	0.159	0.158	0.158	0.158	0.158	0.157	0.157	0.158

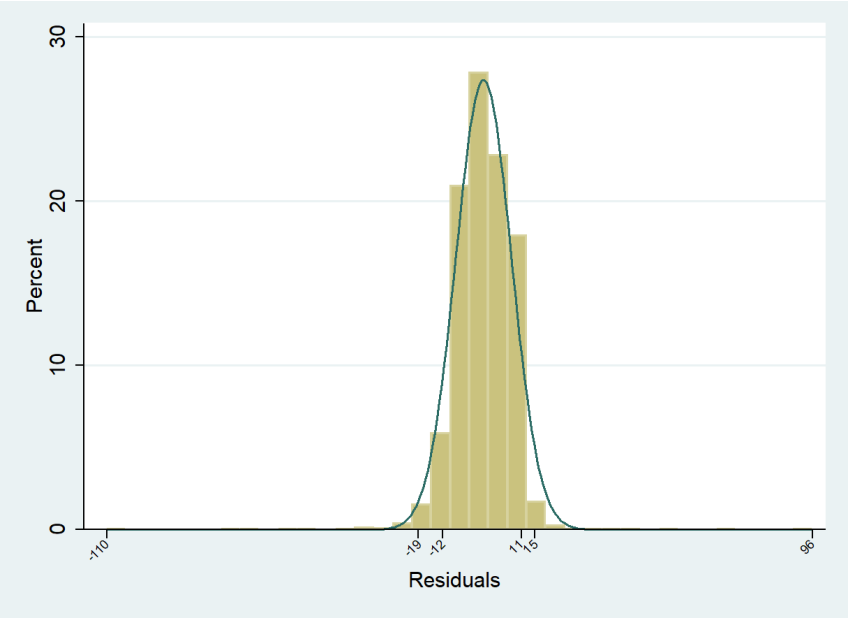
Note: A full set of country and year fixed effects are controlled in all specifications as well as three lags of growth rates and the fourth lag of GDP per capita. Standard errors robust against heteroscedasticity and serial correlation at the country level are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A.3.4.. Effects of Strong and Weak Democracies on GDP Growth: Interacted With Democracy Quality

	(1)	(2)	(3)	(4)
	GDP per Capita in Political Transition Period at $P25$ as Cutoff			
	Interacted with Democracy Quality Specified in Each Column			
Dependent Variable: Growth Rate	Normalized Polity	Normalized Freedom House	Normalized Civil Liberty	Normalized Political Right
Strong Democracy Interacted	1.829***	2.141***	2.009***	1.854***
with Democracy Quality (β_S)	(0.518)	(0.607)	(0.625)	(0.516)
Weak Democracy Interacted	-0.023	0.007	0.083	-0.009
with Democracy Quality (β_W)	(0.449)	(0.589)	(0.632)	(0.415)
Coef. Test (p-value): $\beta_S = \beta_W$	0.00467	0.00782	0.0198	0.00355
Countries	134	153	153	153
Observations	4,878	4,697	4,697	4,697
Adjusted R^2	0.164	0.161	0.161	0.162

Note: A full set of country and year fixed effects are controlled in all specifications as well as three lags of growth rates and the fourth lag of GDP per capita. Standard errors robust against heteroscedasticity and serial correlation at the country level are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Figure A.1.. Growth Residual Distribution



A.3.2. Dropping Extreme Observations

Figure A.1 shows the growth residual distribution from the baseline regression. There are indeed some extreme observations. In the graph, the lowest number -100 is far below the 1st percentile level -19, while the highest residual 95 is well above the 99th percentile at 15. The 5th percentile value is -12 while the 95th is 11. To avoid the influences of such extreme values, we run the baseline regression using observations with standardized residuals between the 1^{th}percentile and the 99^{th} percentile (then $p99$) as well as other ranges. The results are displayed in Table A.3.5. When a small amount of extreme observations are dropped (the first column), the patterns are the same as the baseline one. However, as more outlier observations are removed as in Column (2)-Column (6), the coefficients of Weak Democracy become significantly negative, indicating that Weak Democracy may actually hurt economic performance. And the differences between Strong and Weak Democracy become much more striking. This pattern is also robust to other regression setups reported in the paper.[2]

[2]Results are available upon request.

Table A.3.5.. Effects of Strong and Weak Democracies on GDP Growth without Extreme Observations

	(1)	(2)	(3)	(4)	(5)	(6)
	Dropping Extreme Observations with Residuals outside Specified Ranges					
Dependent Variable: Growth	P1-P99	P5-P95	P10-P90	p15-p85	P20-P80	P25-P75
Strong Democracy	0.957***	0.801***	0.623**	0.738***	0.763***	0.803***
	(0.284)	(0.261)	(0.253)	(0.261)	(0.249)	(0.228)
Weak Democracy	0.051	-0.453*	-0.635**	-0.570**	-0.807***	-0.742***
	(0.312)	(0.234)	(0.259)	(0.282)	(0.279)	(0.266)
Coef. Test (p-value): $\beta_S = \beta_W$	0.0216	0.0001	0.0001	0.0002	0.0000	0.0000
Countries	5311	4879	4337	3795	3253	2711
Observations	153	153	153	152	152	150
Adjusted R^2	0.1904	0.2486	0.2961	0.3355	0.379	0.4407

Note: A full set of country and year fixed effects are controlled in all specifications as well as three lags of growth rates and the fourth lag of GDP per capita. Standard errors robust against heteroscedasticity and serial correlation at the country level are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

A.3.3. Calculating Long-Run Growth Impact

The growth regression model we used is:

$$g_{it} = \beta_S DStrong_{it} + \beta_W DWeak_{it} + \alpha_1 g_{it-1} + \alpha_2 g_{it-2} + \alpha_3 g_{it-3} + \varphi y_{it-4} + \lambda_i + \delta_t + \varepsilon_{it}.$$

To find the impact of democracy on income in the long run, we re-arrange the regression model after substituting $g_{it} = 100(y_{it} - y_{it-1})$ into the above equation

$$\begin{aligned} 100y_{it} = \beta_S DStrong_{it} + \beta_W DWeak_{it} + 100(1+\alpha_1)y_{it-1} + 100(\alpha_2 - \alpha_1)y_{it-2} + \\ 100(\alpha_3 - \alpha_2)y_{it-3} + (\varphi - 100\alpha_3)y_{it-4} + \lambda_i + \delta_t + \varepsilon_{it}. \end{aligned}$$

Suppose when $t \to +\infty$, the income level will reach the long run equilibrium values, y_S^* for Strong Democracy and y_W^* for Weak Democracy, respectively. Then the long-run growth effect of Strong Democracy is obtained by

$$
\begin{aligned}
LongEffect_{DStrong} &= 100(y_S^* - y_0) \\
&= \frac{100\hat{\beta}_S}{100 - 100(1 + \hat{\alpha_1} + \hat{\alpha_2} - \hat{\alpha_1} + \hat{\alpha_3} - \hat{\alpha_2} + 0.01\hat{\varphi} - \hat{\alpha_3})} \\
&= \frac{100\hat{\beta}_S}{-\hat{\varphi}} \\
&= \frac{100\hat{\beta}_S}{\mid \hat{\varphi} \mid},
\end{aligned}
$$

since $\hat{\varphi} < 0$ is always true for the coefficient of the 4th-lagged GDP per capita. Similarly, the long-run growth effect of Weak Democracy is

$$
LongEffect_{DWeak} = 100(y_W^* - y_0) = \frac{100\hat{\beta}_W}{-\hat{\varphi}} = \frac{100\hat{\beta}_W}{\mid \hat{\varphi} \mid}.
$$

A.3.4. Sensitivity Analysis for Separating the Effects of Democratizations and Reversals

An implicit assumption in the baseline regression is that the effects of democratization and the reversal are of the same magnitude but with opposite signs. To check whether this assumption is reasonable, we consider the following generalization of our model:

$$
\begin{aligned}
g_{it} = {} & \beta_S DemStrong_{it} + \gamma_S SReversal_{it} + \beta_W DemWeak_{it} \\
& + \gamma_W WReversal_{it} + \sum_{j=1}^{3} \alpha_j g_{it-j} + \varphi y_{it-4} + \lambda_i + \delta_t + \varepsilon_{it},
\end{aligned} \tag{A.1}
$$

where *DemStrong*, *DemWeak*, *SReversal*, *WReversal* represent respectively the cumulative number of strong democratization, weak democratization, and their reversals for country i at time t. We need to check whether $\beta_S + \gamma_S = 0$ and $\beta_W + \gamma_W = 0$ to assess whether their effects are indeed of the same magnitude but with the

opposite signs. The two conditions do hold in Table A.3.6, where results of this generalized model are presented using different cutoffs.

Table A.3.6.. Effects of Strong and Weak Democracies on GDP Growth with Reversals

Dependent Variable:	(1)	(2)	(3)	(4)	(5)	(6)
Growth	p15	p20	p25	p30	p35	p40
DemStrong	1.071***	1.235***	1.353***	1.243***	1.221***	0.890**
	(0.363)	(0.371)	(0.387)	(0.397)	(0.425)	(0.390)
SReversal	-1.334***	-1.554***	-1.634***	-1.108**	-1.088**	-0.858*
	(0.509)	(0.549)	(0.552)	(0.439)	(0.456)	(0.447)
DemWeak	0.162	0.041	0.011	0.399	0.528	0.860*
	(0.515)	(0.446)	(0.405)	(0.429)	(0.419)	(0.447)
WReversal	-0.600	-0.251	-0.245	-1.373	-1.440	-1.540
	(1.818)	(1.266)	(1.265)	(1.111)	(1.082)	(1.041)
Coef.Test (p-value): $\beta_S = \beta_W$	0.1036	0.0160	0.0051	0.093	0.1893	0.9546
Coef.Test (p-value): $\beta_S + \gamma_S = 0$	0.6296	0.5833	0.6288	0.7822	0.7905	0.9516
Coef.Test (p-value): $\beta_W + \gamma_W = 0$	0.8183	0.8741	0.8595	0.3988	0.4176	0.5300
Countries	153	153	153	153	153	153
Observations	5419	5419	5419	5419	5419	5419
Adjusted R^2	0.1507	0.1511	0.1513	0.1508	0.1507	0.1504

Note: A full set of country and year fixed effects are controlled in all specifications as well as three lags of growth rates and the fourth lag of GDP per capita. Standard errors robust against heteroscedasticity and serial correlation at the country level are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

A.3.5. The Process of Building IVs

Suppose the genetic distance of country j to country i is $Gene_{ij}$. It is normalized to the interval [0, 1] by a reverse order based on

$$\widehat{Gene}_{ij} = \frac{max\{Gene_{ij}\} - Gene_{ij}}{max\{Gene_{ij}\} - min\{Gene_{ij}\}},$$

and then used to calculate the genetic weight δ_{ij} via

$$\delta_{ij} = \frac{\widehat{Gene}_{ij}}{\sum_{k\neq i}^{k\in G_i} \widehat{Gene}_{ik}}$$

to ensure that the weights sum up to 1 for each country i, where G_i is the set of genetically related countries of country i. Through this transformation, the closer the genetic distance between country i and country j, the higher the weight of country j for country i. Finally, the genetic weighted instruments $\widehat{DStrong}_{it}^{F,IV}$ and $\widehat{DWeak}_{it}^{F,IV}$ are computed as follows

$$\widehat{DStrong_{it}}^{F,IV} = \sum_{j\neq i}^{j\in G_i} \delta_{ij} DStrong_{jt},$$

$$\widehat{DWeak_{it}}^{F,IV} = \sum_{j\neq i}^{j\in G_i} \delta_{ij} DWeak_{jt}.$$

The Regional Democratization Wave IVs are constructed as follows. Let R denote a set of regions. Each country i belongs to one region r, where N_{rt} is the number of countries in region r at time t. The two instrumental variables $DStrong_{it}^{F,IV}$ and $DWeak_{it}^{F,IV}$ are calculated via

$$DStrong_{it}^{F,IV} = \frac{1}{N_{rt}-1} \sum_{j\neq i, i\in R, j\in R} DStrong_{jt},$$

$$DWeak_{it}^{F,IV} = \frac{1}{N_{rt}-1} \sum_{j\neq i, i\in R, j\in R} DWeak_{jt}.$$

Alternatively, if only countries with the same initial political institution in the region are influential, we can calculate another set of IVs in a similar way. Let the initial political institution of country i is D_{it_0}, where t_0 is the initial time of the sample. N'_{rt} is the number of countries in the same region with the same initial political institution. Then, $\widetilde{DStrong_{it}}^{F,IV}$ and $\widetilde{DWeak_{it}}^{F,IV}$ are calculated via

$$\widetilde{DStrong_{it}}^{F,IV} = \frac{1}{N'_{rt}-1} \sum_{\substack{j\neq i, i\in R, j\in R \\ D_{jt_0}=D_{it_0}}} DStrong_{jt},$$

$$\widetilde{DWeak_{it}}^{F,IV} = \frac{1}{N'_{rt}-1} \sum_{\substack{j\neq i, i\in R, j\in R \\ D_{jt_0}=D_{it_0}}} DWeak_{jt}.$$

A.3.6. IV Regressions by Using Alternative Cultural and Regional Information

In the main paper, we report results using genetic distance from Spolaore and Wacziarg (2016) and regional data provided by WDI to build IVs. Here, we use

alternative genetic distance from Spolaore and Wacziarg (2016) and regional data provided by Quality of Government Dataset (QOG) to construct IVs. The results are still similar, which are shown in Table A.3.7.

Table A.3.7.. Effects of Strong and Weak Democracies on GDP Growth: Using Other Instrumental Variables

Dependent Variable:	(1)	(2)	(3)	(4)	(5)	(6)
Growth Rate	Genetic Distance (all groups)		Region (QOG)		Region(QOG)+Initial Political Institution	
Strong Democracy	4.563		4.736*		3.102**	
	(7.046)		(2.463)		(1.335)	
Weak Democracy	-0.969		0.881		0.066	
	(4.061)		(1.889)		(1.739)	
Democracy		-3.634		3.601*		2.706**
		(9.303)		(1.930)		(1.174)
Coef. Test (p-value): $\beta_S = \beta_W$	0.236	0.236	0.0944	0.0944	0.116	0.116
Hansen test (p-value)	0.0484	0.0910	0.000142	0.00151	0.000413	0.00112
F Tests in First Stage (p-value):						
IV for Strong Democracy	2.526		2.155		6.555	
IV for Weak Democracy	1.256		3.516		2.700	
IV for Democracy		1.396		5.555		12.57
Partial R^2 for Strong Democracy (p-value)	0.0135		0.0970		0.199	
Partial R^2 for Weak Democracy (p-value)	0.0564		0.143		0.108	
Partial R^2 for Democracy (p-value)		0.00257		0.0692		0.128
Countries	144	144	149	149	148	148
Observations	5,248	5,248	5,237	5,237	5,149	5,149

Note: All columns present results using the 2SLS method. A full set of country and year fixed effects are controlled in all specifications as well as three lags of growth rates and the fourth lag of GDP per capita. Standard errors robust against heteroscedasticity and serial correlation at the country level are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

A.4.2. World Governance Indicators for Africa's Democracies

This table compares Benin and Ghana with other African democratic countries.

Table A.4.1.. World Governance Indicators for Africa's Democracies: Average from 1996 to 2010

Country	Freedom House	Polity Score	Rule of Law	Control of Corruption	Government Effectiveness	Regulatory Quality	Voice and Accountability
Benin	2.10	6.33	-0.47	-0.58	-0.44	-0.38	0.26
Ghana	2.20	5.60	-0.10	-0.16	-0.05	-0.15	0.22
Other Democratic Countries in Africa							
Cabo Verde	1.23	9.33	0.46	0.73	0.09	-0.18	0.79
Lesotho	3.17	6.67	-0.13	0.01	-0.24	-0.53	-0.14
Namibia	2.30	6.00	0.17	0.38	0.15	0.19	0.36
Senegal	3.13	5.33	-0.16	-0.25	-0.23	-0.23	0.03
South Africa	1.67	9.00	0.09	0.42	0.61	0.55	0.68

A.4. More Evidence on Benin and Ghana

A.4.1. Graphs Related with Two Countries: Benin and Ghana

These graphs plot the institutional qualities in Benin and Ghana, with a focus on the average performances before and after democratization. To precisely explore the effect of political transition on the influence of these indicators, we remove the dynamic effects of the corresponding indicator and income, as well as the effect of time trend.

Figure A.2.. Institutional Quality Indicators in Benin

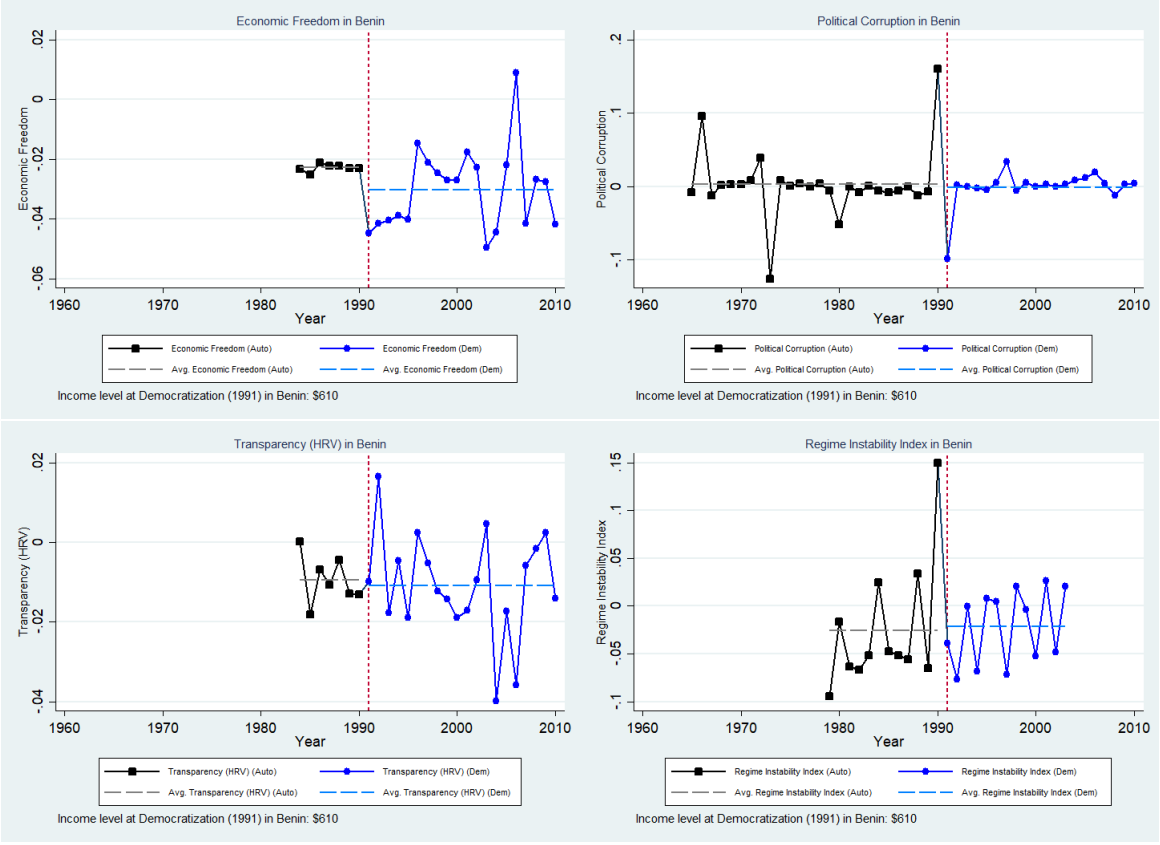
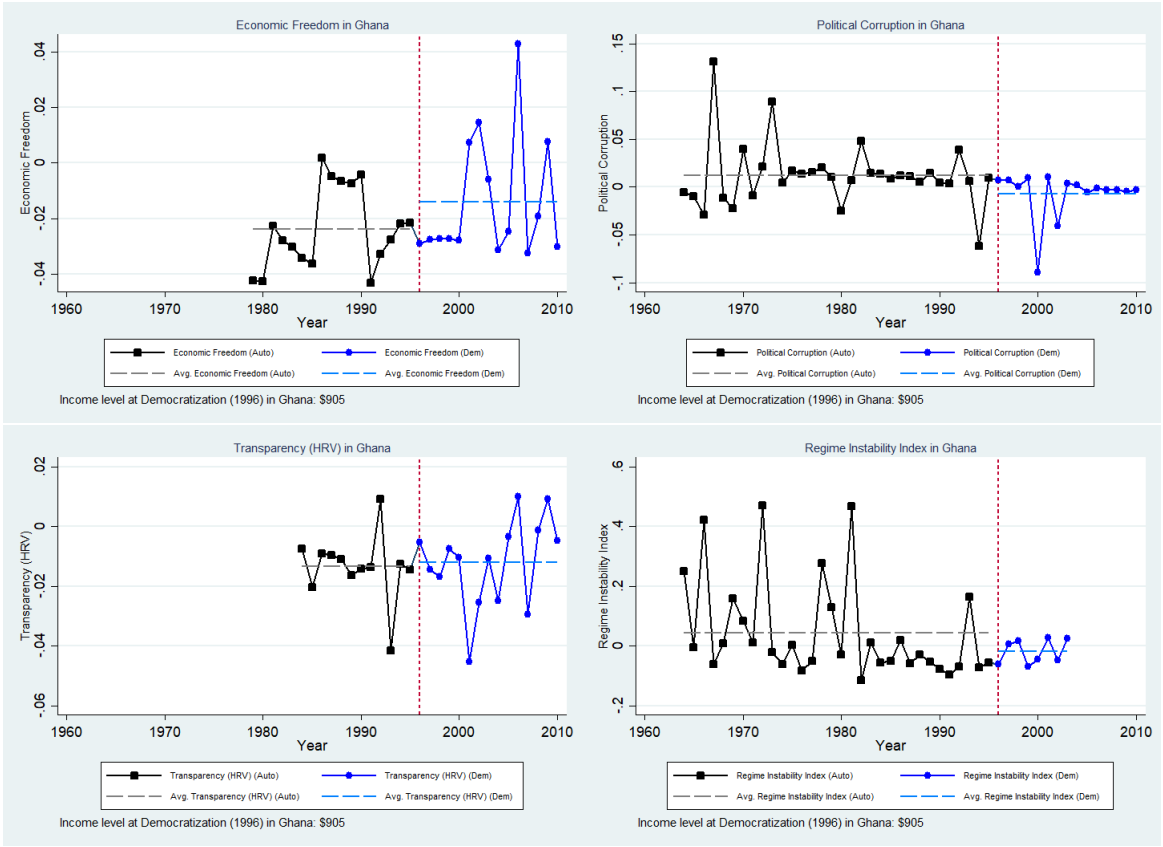


Figure A.3.. Institutional Quality Indicators in Ghana



A.4.3. Growth and Quality of Institutions before and after Democratization: Benin and Ghana

This table reproduces Panel B in Table 14 of the main text using raw data. The basic pattern remains.

Table A.4.2.. Growth and Quality of Institutions before and after Democratization: Benin and Ghana

			(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
		Time Period	Growth	Economic Freedom	Legal Infrastructure	Legal Order	Political Corruption	Transparency (HRV Index)	Regime Instability Index	Within Regime Instability Index	Violence Index	Social Unrest
Benin	Autocracy	1960-1990	0.511	0.470	0.173	0.363	0.596	0.375	0.054	0.034	0.005	0.188
	Weak Democracy	1991-2010	0.946	0.511	0.220	0.584	0.667	0.401	0.045	0.224	0.000	0.050
	Difference		0.435	0.041	0.047	0.221	0.071	0.026	-0.009	0.190	-0.005	-0.138
Ghana	Autocracy	1960-1995	-0.493	0.312	0.082	0.493	0.688	0.359	0.109	0.036	0.019	0.250
	Strong Democracy	1996-2010	2.670	0.633	0.110	0.598	0.614	0.374	0.036	0.148	0.000	0.000
	Difference		3.163	0.321	0.028	0.105	-0.074	0.015	-0.073	0.112	-0.019	-0.250
Median Level Difference in Third Democratization Wave			0.655	0.156	0.020	0.133	-0.005	0.040	-0.011	0.107	0.000	-0.071

A.5. Further Robustness Checks for Mechanism Regressions

A.5.1. The Effects on Rule of Law

To explore the effects of Strong Democracy and Weak Democracy on the rule of law measured by other indicators in the literature, we use the cross-country regression model from Sunde, Cervellati and Fortunato (2008) $m_i = \beta_S DStrong_i + \beta_W DWeak_i + \alpha\lambda_i + \varepsilon_i$, where m_i is the average level of rule of law between 2005 and 2010,[3] and λ_i is the vector of other control variables. Rule of law indicators are from Skaaning (2010), Freedom House, Worldwide Governance Indicator, Welzel (2013), and Quality of Governance data set. Results in Table A.5.1 show that the rule of law is much higher in Strong Democracy than Weak Democracy, and their gaps are always significant.

A.5.2. The Effects on Human Capital Related Indicators

The first three columns in Table A.5.2 replicate results on human capital in Table 10 of the paper using the same smaller sample. The main pattern still holds, where even though enrollments of primary and secondary schools are increased more in Weak Democracy, the human capital stock is lower. Note that the human capital stock per capita combines information on average schooling, return of education, as well as labor share in the whole population. In Column (4), we find that Weak Democracy reduces the labor participation rate[4], while Strong Democracy does not. This result may reconcile the seemingly inconsistent results between different indicators of human capital.

[3] We choose 2005 as the baseline year because afterwards there is no change in political institutions in most countries, and most indicators for rule of law are available only from 2000.

[4] Labor participation rate is the proportion of the population aged 15 and older and economically active.

Table A.5.1.. Effects of Strong and Weak Democracies on Rule of Law

Rule of Law Indicator	(1) Bertelsmann Stiftung	(2) Freedom House	(3) Worldwide Governance Indicator	(4) Christian Welzel	(5) Quality of Governance
Strong Democracy	3.046***	6.856***	0.880***	0.177***	0.117***
	(0.268)	(0.593)	(0.165)	(0.033)	(0.040)
Weak Democracy	2.110***	4.837***	0.332*	0.065*	0.015
	(0.352)	(0.786)	(0.185)	(0.037)	(0.038)
Tropical Land Share	0.038	-2.996	-0.196	-0.025	-0.225
	(1.062)	(3.235)	(1.073)	(0.220)	(0.243)
Tropical Population Share	-0.675	0.829	-0.457	-0.104	0.034
	(1.019)	(3.168)	(1.039)	(0.213)	(0.233)
Language Fractionalization	-0.143	1.656	0.017	-0.004	0.013
	(0.542)	(1.216)	(0.345)	(0.071)	(0.068)
Religion Fractionalization	1.016**	2.314**	0.397	0.071	0.069
	(0.507)	(1.001)	(0.294)	(0.060)	(0.064)
Ethnic Fractionalization	-0.045	-3.420**	-0.881**	-0.167*	-0.167*
	(0.644)	(1.362)	(0.435)	(0.089)	(0.087)
Oil Dummy (OPEC Related)	0.126	0.226	0.468	0.096	0.023
	(0.305)	(1.059)	(0.389)	(0.080)	(0.075)
Coef. Test (p-value): $\beta_S = \beta_W$	0.0098	0.0174	0.0061	0.0051	0.0097
Observations	95	127	127	125	104
Adjusted R^2	0.585	0.641	0.411	0.399	0.415

Note: Standard errors robust against heteroscedasticity and serial correlation at the country level are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A.5.2.. Effects of Strong and Weak Democracies on Human Capital Indicators

Dependent Variable:	(1) Log of Human Capital per capita	(2) Log of Primary Enrollment	(3) Log of Secondary Enrollment	(4) Log of Labor Participation Rate
Strong Democracy	0.002	1.192*	1.859	0.069
	(0.003)	(0.632)	(1.208)	(0.083)
Weak Democracy	-0.006*	5.197***	3.471***	-0.291**
	(0.003)	(1.951)	(1.091)	(0.145)
Coef.Test (p-value):$\beta_S = \beta_W$	0.1164	0.0435	0.2975	0.0243
Countries	80	80	80	125
Observations	1371	1371	1371	3751

Note: A full set of country and year fixed effects are controlled in all specifications as well as four lags of GDP per capita and dependent variables. Standard errors robust against heteroscedasticity and serial correlation at the country level are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

A.6. Data Sources

Indicators from World Development Indicators (2015 Edition): **Birth Rate, Death Rate, Enrollment Rates, Fertility Rat**e, **GDP per capita, Government Spending Share of GDP, Inflation Rate, Industry Share of GDP, Investment Rate, Life Expectancy, Mortality Rate, Natural Resources Share of GDP, Population Growth Rate, Regional Area (WDI), Trade Share of GDP, Urbanization Rate, Agriculture Share of GDP, Labor Participation Rate, Manufacturing Share of GDP.**

Indicators from Quality of Government Data Set: **HRV (Transparency) Index, Economic Freedom, Forms of Democracy**[5]**, Ethnic Fractionalization, Language Fractionalization, Religion Fractionalization, Rule of Law, Regional Area (QOG).**

Indicator from World Bank Governance Index Data Set: **Rule of Law, Control of Corruption, Government Effectiveness, Regulatory Quality, Voice and Accountability.**

Indicators from Acemoglu et al. (2019): **Democracy, Market Reform Index, Social Unrest, Tax Revenue, TFP, Tropics Land Share, Tropics Population Share.**

Indicators from Aisen and Veiga (2013): **Human Capital per capita, Physical Capital per capita, Regime Instability Index, Within Regime Instability Index, Violence Index.**

Alternative Democracy indicators are from Boix, Miller and Rosato (2013), Cheibub, Gandhi and Vreeland (2010), Papaioannou and Siourounis (2008*b*), and Polity IV.

Democratic Capital (Democratic Stock) is extracted from Gerring et al. (2005).

Hyperinflation is a dummy variable, which is equal to 1 if the inflation rate (CPI) exceeds 50%, and 0 otherwise.

[5]We combine Regime Institutions (Cheibub, Gandhi and Vreeland, 2010), Political System (The Database of Political Institutions), and Institution (Bormann and Golder, 2013) to construct dummy variables of Parliamentary Democracy, Mixed (semi-presidential) democracy and Presidential democracy. Electoral System (Bormann and Golder, 2013) and Electoral Family (Norris, 2009) are used to generate three dummy variables to represent Majoritarian Election System, Proportional Election System, and Mixed System.

Two rule of law related indicators are from Nardulli, Peyton and Bajjalieh (2013):

Legal Infrastructure refers to a set of entities and processes that are essential to the creation, development, and operation of a viable legal order. Infrastructures include legal educational programs, vehicles to conduct formalized legal discourse, and bodies that regulate legal professionals.

Legal Order refers to a distinctive type of rule-based governance, one that relies on (1) transparent and formally institutionalized rules to order human behavior and interactions and (2) the structured deployment of coercion to enforce rules.

Net Gini Coefficient is from Solt (2016).

Soviet-Related Countries include Ex-Yugoslav countries, Ex-Soviet countries, and Soviet satellite countries. Ex-Yugoslav countries include: Bosnia & Herzegovina, Croatia, Macedonia, Serbia & Montenegro, Slovenia. Ex-Soviet countries include: Estonia, Latvia, Lithuania, Kazakhstan, Kyrgyz Republic, Tajikistan, Turkmenistan, Uzbekistan, Armenia, Azerbaijan, Georgia, Russian Federation, Belarus, Moldova, Ukraine. Ex-Soviet satellite countries: Albania, Poland, Bulgaria, Romania, Czech Republic, Hungary, Slovak Republic.

Two Genetic Distance related indicators are from Spolaore and Wacziarg (2016):

Weighted Genetic Distance (main group) represents the expected genetic distance between two randomly selected individuals, one from each country. Individual is only selected by the main group in each country.

Weighted Genetic Distance (all groups) represents the expected genetic distance between two randomly selected individuals, one from each country. Individual is selected from all groups in each country.

Political Corruption Index is from V-Dem Project Coppedge et al. (2017). The index is the average of public sector corruption index, executive corruption index , the indicator for legislative corruption, and the indicator for judicial corruption.

Oil Dummy is from Cervellati et al. (2014), indicating members and former members of OPEC.

Share of Labor in Agriculture is from Wingender (2014). The share of the labor force employed in agriculture.

B. The Second Chapter Appendix

B.1. The Construction Processes for the Key Indicators

B.1.1. Curriculum Control Index

To measure the degree of curriculum control, I collect information about different levels of educational authorities influence the formation of the official curriculum and achievement examinations mainly from *International Handbook of Education Systems* (published in 1983), *International Encyclopedia of National Systems of Education* (published in 1995), and *World Data on Education: Sixth Edition 2006-2007* (UNESCO). I construct the indicator in the three periods: the 1980s, the 1990s, the 2000s. The documents in different periods could also be used to check whether the education system is persistent. Additional materials are also used, including: *International Perspectives on Higher Education Admission Policy: A Reader* (published in 2016), *Education at a Glance* (1999-2017), *Curriculum Survey* (2003, 2007) in *Trends in International Mathematics and Science Study* (TIMSS), *The Education Systems of Europe* (published in 2007), *International Encyclopedia of Education* (published in 2010), *World Higher Education Database*, and Helms (2008).

First, I build an indicator $OfficialCurr_{jit}$ to measure different educational authorities controlling the design of the official curriculum. i indexes the country, j

indexes the specified educational cycle, including primary, lower secondary, and upper secondary education, t indexes the time period. As described in Section 2.3.1, after identifying the centralizing and decentralizing forces in each educational cycle, I code $OfficialCurr_{jit}$ from 1 to 7, where 1 is the most decentralized and the local government and the school are the main authorities to design official curriculum while 7 is the most centralized and the central government dominates the design process. To measure the overall control of the official curriculum in the country, I construct an indicator, $OfficialCurr_{it}$ by averaging $OfficialCurr_{jit}$ in these three educational cycles.

Next, I construct an indicator $ExamControl_{jit}$ to incorporate different educational authorities control and design exams. In each cycle, students generally take several exams for different purposes. The exam, in many countries, is an important criterion for assessing whether students can be promoted to the next grade. It is also used to evaluate whether students could graduate from schools in most countries. Another important role of the exam is to select students to enter the next education cycle. I combine the information about exam control for promotion, graduation, and admission of the next cycle to build $ExamControl_{jit}$. For example, in upper secondary school, the information on exam control includes exam policies within the cycle (for promotion), and at the end of the cycle (for graduation and for college admissions).[1]

As described in Section 2.3.1, after identifying the centralizing and decentralizing forces in each educational cycle, I code $ExamControl_{jit}$ from 1 to 9, where 1 means no exam[2], 2 means that the school designs the exam, while 9 means that the central government dominates the exam design. Like the previous one, I build an indicator $ExamControl_{it}$ to capture the overall exam control by averaging $ExamControl_{jit}$ in these three educational cycles.

[1]These exams would force both teachers and students to pay more attention to the knowledge that would be tested. They tend to homogenize the learning experiences of students.

[2]I focus on the achievement exam, since this exam type is closed related to the official curriculum, and code the aptitude exam as no exam. Only a few countries use the aptitude exam as an important criterion for selecting students, such as the United States and Sweden.

The interconnection of $OfficialCurr_{it}$ and $ExamControl_{it}$ determine what children actually learn in school. To construct the index $CurrControl_{it}$ to measure the curriculum control degree in country i during period t, I use the technique of principal component analysis (PCA) to combine these two indicators. I extract the first component and normalize it between 0 and 1, where 0 is the most decentralized and 1 is the most centralized.[3]

In many developed countries, such as the United States, other criteria except for the exam are also used for admission. Some of these criteria, such as work experience, recommendation letter, personal statement, interview, and extracurricular activities, can measure the potential abilities of students.[4] These admission policies are important because they motivate teachers and students don't only focus on the official curriculum and examination and could benefit student's all-round development. However, it is difficult to know whether these criteria are important or not in the admission process. In addition, most documents I find don't describe such policies.

As a supplement, I construct an additional indicator $OtherCriteria_{ik}$ to capture these criteria except for the exam by using the document *Education at a Glance 2012*[5], where i indexes the country, and k indexes the specified criterion for the college admission. The data are only available for about 30 countries. Four levels, not important, low important, moderately important, and very important, are set for these criteria. To be consistent with the encoding of the previous two indicators, $OtherCriteria_{ik}$ is equal to 1 if criterion k is very important, 2 if it is moderately important, 3 if it is low important, 4 if it is not important, and 5 if it is not used as the criterion. By averaging all these criteria, I build one index $OtherCriteria_i$ to measure the importance of the criteria except for the exam in the college admission.

[3]There are other ways to combine these two indicators. For example, after normalizing $OfficialCurr_{it}$ and $ExamControl_{it}$ in the unit interval, I can use the average of these two indicators as the measurement of curriculum control degree. In addition, the multiplication of these two could also be a proxy of curriculum control degree. I find the similar patterns using these two alternative curriculum control indexes. See the appendix.

[4]The admission policies, such as family income, ethnic, and disable, aiming to protect the poor or vulnerable groups to maintain social justice, are not directly related to the abilities of students.

[5]It collects the criteria used by tertiary institutions to determine access to the first stage of tertiary education in main OECD countries during 2011.

I composite one new indicator by combining the information of $OfficialCurr_{it}$, $ExamControl_{it}$, and $OtherCriteria_i$ using PCA. After normalizing it to the unit interval, I use it for further robustness checks. The results are consistent with the baseline ones, which are reported in the appendix.

B.1.2. Patent Indicators

I mainly use the patent data from USPTO.[6] In robustness checks, EPO data are also used. More and higher-quality patents in the country imply the stronger technological strengths. The number of patents granted per capita is not a good measure of innovation, as there are no citations for approximately 80% of patents (Hall, Jaffe and Trajtenberg, 2001; Squicciarini, Dernis and Criscuolo, 2013), implying that most of which may have little value. I use 3 indicators to measure the quality of patent in the country, including the Hirsch index, the share of breakthrough inventions, and the average citations per patent. To minimize the truncation issue, I only count the amounts of citations within 5 years after the patent is granted.[7]

Hirsch index (H-index), initially constructed by Hirsch (2005), is recently introduced in economics. H-index is defined as a number h which at least h patents have at least h citations. This measure balances the quantity and quality of patents and de-emphasizes the patent with high citations (Ellison, 2013; Kwon, Lee and Lee, 2017). To build H-index for each country-year, I calculate H-index by using patents and their citations in all sectors. In the regressions, I mainly rely on the average of H-index between 2005 and 2006 as the proxy of national innovation.[8]

The share of breakthrough patents in each country-year is employed to indicate the quality of patents in the country. The breakthrough patent is defined as the one with

[6]The data are from Kwon, Lee and Lee (2017). They revise some mistakes in USPTO files and match the patent's inventor with nationality, which extremely reduces the burden of my work.

[7]The patent receives most of the citations within 5 years (Hall, Jaffe and Trajtenberg, 2001; Squicciarini, Dernis and Criscuolo, 2013). Squicciarini, Dernis and Criscuolo (2013) find that patents in different sectors have quite different citation patterns and they suggest that it is better to build different quality-related indicator across industries. In the alternative construction process, I also construct these indicators at the industry level. The regression results are even better.

[8]Due to the truncation issue, only the data up to 2006 could be used.

the top 5 % citations in its technological field.[9] After identifying these superstar patents, I divided the amount of these patents by the total patents in each country-year. In regressions, I use its average between 2005 and 2006 as the measurement of innovation. One drawback of this indicator is that it would dramatically bias up patent's quality of the country that has a few patents but occasionally owns one or two breakthrough ones.[10] One strategy I used is to drop the extreme observations that are above the percentile 99.

The average citations of patents in each country-year is used. It is created by the total citations divided by the total patents in the country each year. The average level in the last two years is used to run regressions. Like the previous indicator, this indicator overestimates the innovation of the country that has several patents but occasionally owns one or two patents with extreme high citations. I use the same strategy to remove these observations.

B.1.3. Non-Patent Indicators

B.1.3.1. Publication Indicators

The academic publication could be one of the important dimensions of national creativity. I use country-level data from SCImago Journal & Country Rank data set (SJR). SJR is a publicly available portal that includes the journals and country scientific indicators developed from the information contained in the Scopus® database (Elsevier B.V.). Citation data is drawn from over 21,500 titles from more than 5,000 international publishers and country performance metrics from 239 countries worldwide. Citations per document and Hirsch index between 2005 and 2010 are used to measure the quality of publication quality in the country.[11]

[9] Acemoglu, Akcigit and Celik (2014) also use it as the measure of the quality of innovation.

[10] I find that some countries have fewer than 10 patents but one or two of them are breakthrough ones in some years. However, even in the United States, the most innovative country in the world, averagely only less than 5% patents could be identified as breakthrough ones each year. Therefore, the inclusion of extreme observations can seriously pollute the regression results.

[11] See the details from their website: `https://www.scimagojr.com/aboutus.php/`.

B.1.3.2. University Rankings: Top Universities Per Capita

The amounts of worldwide top universities of the country should be an important dimension that indicates its creativity. Research strength (measured by publications of its academic staffs) is an indispensable element of becoming a top university. But other factors, such as coordination and connection among different disciplines for interdisciplinary researches, and ongoing incentives for its academic development, are also very important and demonstrate the management and organizational creativity.

I use the number of global top 500 universities per capita in the country as the proxy to measure national creativity. There are several data sources used, including Academic Ranking of World Universities (ARWU), QS World University Rankings, CWTS Leiden Ranking, and University Ranking by Academic Performance (URAP). Different data sources focus on different aspects of the university, but one of the common factors that all of them consider is the publication.

ARWU considers every university that has any Nobel Laureates, Fields Medalists, highly cited researchers, or papers published in Nature or Science. In addition, universities with a significant amount of papers indexed by Science Citation Index-Expanded (SCIE) and Social Science Citation Index (SSCI) are also included.[12] The data is available from 2004 to 2017. I mainly use it to construct the indicator as the proxy of national creativity.

The following three data sets are used for further robustness checks. The results are quite similar, which are available upon request. QS World University Ranking compiles using six simple metrics that capture university performance, including academic reputation, employer reputation, faculty-student ratio, citations per faculty, international faculty ratio, and international student ratio.[13] The CWTS Leiden Ranking is based exclusively on bibliographic data from the Web of Science

[12] See the detail Methodology from the website: `http://www.shanghairanking.com/ARWU-Methodology-2017.html/`.

[13] See the detail Methodology from the website: `https://www.topuniversities.com/qs-world-university-rankings/methodology/`.

database produced by Clarivate Analytics. They use the science citation index expanded, the social sciences citation index, and the arts as well as humanities citation index.[14] University Ranking by Academic Performance (URAP) focuses on academic quality. The ranking is completely based on objective data obtained from reliable open sources. The system ranks the universities according to multiple criteria, which capture the scientific productivity, quality, and international acceptance.[15]

B.1.3.3. Brand (Innovative Company) Rankings: Top Brands (Innovative Companies) Per Capita

Patent or academic articles could be seen as the intermediate process of innovation. Whether it could be transferred to the new and commercially successful products depends on entrepreneurship. Only the entrepreneurs, who take risks and have great abilities to integrate and coordinate different inputs to new products, as well as have superb marketing skills, could succeed and create great businesses. Therefore, the number of famous brands or innovative companies in the country[16] indicates broader dimensions of innovation, including scientific innovation, organizational and management innovation, and marketing innovation. I pool several data sources to calculate the number of brands and innovative companies for each country, respectively.[17]

For brand rankings, I use the information from BrandFinance, Forbes, FutureBrand, Interbrand, European Brand Institute, and SyncForce.

[14] See the detail Methodology from the website: `http://www.leidenranking.com/information/indicators/`.

[15] See the detail Methodology from the website: `http://www.urapcenter.org/2017/methodology.php?q=3/`.

[16] I don't use some popular company rankings that focus on scales, assets, sales etc., because these rankings do not directly consider the company's innovation abilities.

[17] The data for most of these rankings are only available the top 100 or even 50 brands or innovative companies in the global world. Many countries have no companies in rankings. But it doesn't mean that there is no innovation capacity there. To reduce the potential bias, I pool different ranking sources together.

BrandFinance calculates the brand value using the Royalty Relief methodology which determines the value a company would be willing to pay to license its brand as if it did not own it. This approach involves estimating the future revenue attributable to a brand and calculating a royalty rate that would be charged for the use of the brand.[18]

Forbes estimates the brand values on their financial merits instead of consumer surveys. They rely on revenue and earnings before interest and taxes. They allocate a percentage of those earnings to the brand based on the role brands play in each industry.[19]

Interbrand ranks the brand considering whether it is truly global, whether it has successfully transcended geographic and cultural boundaries, and whether it will have expanded across the established economic centers of the world and entered the major growth markets.[20]

European Brand Institute uses an in-house methodology to calculate value and rankings based on factors including market value, brand revenue, and overall sales.[21]

FutureBrand builds the FutureBrand Index based on the assumption that there is a difference between perception and financial performance of companies. To construct the ranking, 3,004 members of the "informed public" – i.e. people in professional jobs, including top leaders and managers – in 17 countries around the world (among them the US, Germany, UK, France, Japan, China and South Africa) were asked to rate the global top 100 companies by market capitalization on 18 attributes, e.g. "Trust", "Respect", "Authenticity", "Personality" and "Innovation".[22]

[18] See the detail Methodology from the website: `http://brandirectory.com/methodology/`.

[19] See the detail Methodology from the website: `https://www.forbes.com/sites/kurtbadenhausen/2017/05/23/the-worlds-most-valuable-brands-2017-by-the-numbers/#52d98e9303d1/`.

[20] See the detail Methodology from the website: `http://interbrand.com/best-brands/best-global-brands/methodology//`.

[21] See the detail Methodology from the website: `https://www.rankingthebrands.com/The-Brand-Rankings.aspx?rankingID=221&nav=category/`.

[22] See the detail Methodology from the website: `https://www.branding-institute.com/rated-rankings/rated-ranking-futurebrand-index-2015/`.

SyncForce ranks the brand or company based on all Ranking listings on their website. The position per brand is based on the number of listings, the position per ranking and the importance of a certain ranking (global, continental, national).[23]

For top innovative company rankings, I use information from Thomson Reuters (also named Clarivate), Forbes, BCG, MIT review, and Fast Company.

Thomson Reuters (Clarivate) analyzes patent and citation data across four main criteria: volume, success, globalization, and influence. It ranks companies or institutes by using data source from Derwent World Patents Index, Derwent Innovation, and Derwent Patents Citations Index.[24]

Forbes relies on investors' ability to identify firms they expect to be innovative now and in the future. Companies are ranked by their innovation premium: the difference between their market capitalization and a net present value of cash flows from existing businesses (based on a proprietary formula from Credit Suisse HOLT). The difference between them is the bonus given by equity investors on the educated hunch that the company will continue to come up with profitable new growth.[25]

BCG ranking is based on a survey of 1,500 senior executives representing a wide variety of industries in every region and on respondents' picks and three financial measures: three-year growth in total shareholder return, revenue, and margins.[26]

MIT review claims not to have counted patents, but "rather have asked whether a company had made strides in the past year that will define its field" and to "highlight where important innovations are happening right now". The companies listed are

[23]See the detail Methodology from the website: https://www.rankingthebrands.com/The-Brand-Rankings.aspx?rankingID=30&nav=category/.

[24]See the detail Methodology from the website: http://top100innovators.clarivate.com/content/methodology/.

[25]See the detail Methodology from the website: https://www.forbes.com/sites/innovatorsdna/2015/08/19/how-we-rank-the-worlds-most-innovative-companies-2015/#13e574165f8c/.

[26]See the detail Methodology from the website: http://newsyoucanuse.axa.com/what-to-make-of-bcgs-new-50-most-innovative-companies-list//.

nothing more than a subjective evaluation of a non-representative small group: MIT Technology Review's editorial staff.[27]

Fast Company creates topographical maps of innovation across more than 40 sectors of the economy to identify the most relevant trends—along with the companies instigating or best capitalizing on them.[28]

The brief statistical description of various bands and innovative companies rankings is reported in Table B.1.1. I count the amount of brands and companies that are once included in these listings after removing the duplicate ones, which is reported in the second to last column. It seems that brand rankings only change slightly between years, which is demonstrated in the last column. It is reasonable because building a famous brand may require a long time.

After removing the replicated observations and calculating the number of well-known brands (innovative companies), I divide them by the total population of the country. These two indicators, top brands and top innovative companies per capita, are used as the proxies of national innovation.

Table B.1.1.. Statistical Description on Brands and Innovative Companies

	Data Source	Time Period	Obs. in Each Year	Total Obs.	Net Obs.	$\frac{\text{Net Obs.}}{\text{Total Obs.}}$
Brand	BrandFinance	2007-2017	500	5250	1035	0.197
	Forbes Brand	2013-2017	100	500	128	0.256
	SyncForce	2007-2017	100	1100	277	0.252
	Interbrand	2007-2017	100	1100	146	0.133
	European Brand Institute	2011-2017	100	700	131	0.187
	FutureBrand Index	2014-2016	100	300	125	0.417
Innovative Company	Clarivate	2011-2017	100	700	196	0.280
	Forbes	2014, 2015, 2017	100	300	160	0.533
	BCG	2010, 2012-2016	50	250	110	0.440
	MIT review	2011-2016	50	300	203	0.677
	Fast Company	2010-2012, 2015-2016	100	500	207	0.414

[27] See the detail Methodology from the website: `https://www.branding-institute.com/rated-rankings/rated-ranking-50-smartest-companies-2015/`.

[28] See the detail Methodology from the website: `https://www.fastcompany.com/3056777/how-fast-company-picked-2016s-most-innovative-companies/`.

B.1.4. Financial and Administrative Centralization Index in Education

I mainly rely on the book, *International Encyclopedia of National Systems of Education* (published in 1995), to build the indicators measuring financial and administrative centralization in education. *World Survey of Education–International Handbook of Education Systems* (published in 1982) is as a complementary material. *International Encyclopedia of National Systems of Education* documents which level of government has the main responsibility to support basic education (the primary and secondary). In most cases, it does not separately discuss the financial responsibilities in primary and secondary education. The building process is similar to the one of building $OfficialCur$. I identify all governments that play roles in financing basic education and classify them into centralizing and decentralizing forces. The indicator is categorized into 7 levels, where 1 is the most decentralized (only the local government finances education), 7 is the most centralized (only the central government supports education), and 2-6 are at the intermediate levels. I normal this indicator into the unit interval, where 0 is the most financial decentralization and 1 is the most centralization in education.

Using the same materials and method, I also construct administrative centralization in education. Although *International Encyclopedia of National Systems of Education* explicitly discusses the administration in education, there is no clear definition on it. Administration in education could be a broad concept that includes the development of examination and grading standards, earmarked grants, teacher training, school inspectorates, regulation of teacher salaries, and employment conditions. It may be a narrow concept that only refers to hiring, firing, and setting terms of reference for educational employees. Considering related information in different countries is provided by different experts, there would be measurement errors in this index.

B.2. Further Robustness Checks: Using H-index as Innovation

Table B.2.1.. Robustness Check: The Effect of Curriculum Control on Innovation Controlling for Other Covariates

	Dependent Variable: Patent's Quality (H-index, USPTO)					
	(1)	(2)	(3)	(4)	(5)	(6)
Control Variable:	GDP	Pop. in Larger City	Broadcast	Road	Property Right	Civil Liberty
Curriculum Control	-26.146***	-35.589***	-35.235***	-34.409***	-31.150***	-31.317***
	(9.366)	(12.643)	(11.542)	(12.217)	(11.011)	(11.322)
GDP per (Log)	2.188*	4.835**	1.484	6.162***	1.853	3.586***
	(1.121)	(1.886)	(1.943)	(1.501)	(1.410)	(1.301)
Avg Schooling (Log)	3.395	1.133	2.894	-0.212	1.864	1.937
	(2.169)	(2.228)	(2.615)	(3.656)	(1.960)	(1.825)
GDP (Log)	2.480***					
	(0.655)					
Pop. Share in Larger Cities (Log)		1.654				
		(1.772)				
Broadband Subscriptions (Log)			1.830***			
			(0.618)			
Railway Density (Log)				0.013		
				(0.011)		
Road Density (Log)				0.025*		
				(0.014)		
Property Rights					0.204***	
					(0.063)	
Civil Liberty						-2.217***
						(0.816)
Continent Dummies	✓	✓	✓	✓	✓	✓
Observations	108	83	97	72	107	108
R-squared	0.551	0.520	0.535	0.567	0.520	0.512

Note: All regressions are cross-country with one observation per country. The dependent variable is H-index of the patent from USPTO. The covariate specified in each column is controlled. Robust standard errors are in the parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table B.2.2.. Robustness Check: Further Outlier Tests, Alternative Regression Model

	Dependent Variable: Patent's Quality (H-index, USPTO)					
	(1)	(2)	(3)	(4)	(5)	(6)
	Log	Positive	Outlier Tests: Drop Extreme Residuals			Truncated
	Dependent	Dependent	Outside Values	Cooked Distance	Leverage	Regression
Curriculum Control	-2.347***	-35.265***	-22.038***	-21.457***	-21.457***	-77.704**
	(0.467)	(10.998)	(4.169)	(4.640)	(4.640)	(31.979)
GDP per (Log)	0.628***	4.890**	2.563***	3.511***	3.511***	19.841*
	(0.184)	(2.025)	(0.874)	(0.895)	(0.895)	(10.917)
Avg Schooling (Log)	0.396	6.238	1.464	0.573	0.573	93.389**
	(0.308)	(4.215)	(1.643)	(1.533)	(1.533)	(46.254)
Continent Dummies	✓	✓	✓	✓	✓	✓
Observations	108	85	103	103	103	85
R-squared	0.671	0.496	0.556	0.540	0.540	-

Note: All regressions are cross-country with one observation per country. The dependent variable is H-index of the patent from USPTO. Robust standard errors are in the parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table B.2.3.. Robustness Check: Other Methods to Build Curriculum Control, Control for Curriculum-related Indicators

	Dependent Variable: Patent's Quality (H-index, USPTO)								
Control Variable:	(1)	(2) Pop.	(3) Urban--ization	(4) Infra--structure	(5) Credit Share	(6) Religion Diversity (HHI Index)	(7) Rule of Law	(8) Tertiary	(9) Test Score
Panel A: Curriculum Control Built by Combining Official Curriculum, Exam Control, and Other Criteria (PCA)									
Curriculum Control	-54.941**	-34.941*	-55.072**	-55.598**	-47.252*	-54.895**	-55.261**	-48.738*	-54.870**
	(24.941)	(18.913)	(25.779)	(25.688)	(25.170)	(25.546)	(24.766)	(23.577)	(26.524)
Continent Dummies	×	×	×	×	×	×	×	×	×
Observations	28	28	28	27	28	28	28	28	28
R-squared	0.595	0.706	0.595	0.664	0.621	0.599	0.613	0.638	0.595
Panel B: Curriculum Control Built by Averaging Normalized *OfficialCurr* and Normalized *ExamControl*									
Curriculum Control	-28.581***	-20.274***	-30.714***	-28.970**	-28.209***	-28.944***	-25.475***	-27.564***	-22.947***
	(9.706)	(7.599)	(9.921)	(11.619)	(9.178)	(9.635)	(9.015)	(9.301)	(7.646)
Continent Dummies	✓	✓	✓	✓	✓	✓	✓	✓	✓
Observations	108	108	107	72	107	108	108	108	62
R-squared	0.447	0.518	0.464	0.487	0.494	0.467	0.494	0.452	0.584
Panel C: Curriculum Control Built by Multiplying Normalized *OfficialCurr* and Normalized *ExamControl*									
Curriculum Control	-16.313***	-10.507**	-18.139***	-21.947***	-15.341***	-16.531***	-14.058***	-15.258***	-18.386***
	(5.889)	(4.182)	(6.064)	(8.224)	(5.306)	(5.884)	(5.263)	(5.459)	(5.636)
Continent Dummies	✓	✓	✓	✓	✓	✓	✓	✓	✓
Observations	108	108	107	72	107	108	108	108	62
R-squared	0.373	0.482	0.383	0.468	0.411	0.391	0.433	0.381	0.575
Panel D: Using Normalized *OfficialCurr* and Normalized *ExamControl* as the Proxies of Curriculum Control									
Normalized *OfficialCurr*	-28.637***	-23.763***	-29.337***	-28.556***	-27.970***	-28.149***	-26.179***	-28.115***	-24.119***
	(8.788)	(7.425)	(8.886)	(10.097)	(8.651)	(8.672)	(8.531)	(8.662)	(8.354)
Normalized *ExamControl*	-6.761*	-4.139	-7.920*	-7.141	-6.405	-7.091*	-6.010	-6.534	-5.959
	(4.060)	(3.422)	(4.101)	(5.403)	(3.975)	(4.056)	(3.925)	(4.004)	(4.829)
Continent Dummies	✓	✓	✓	✓	✓	✓	✓	✓	✓
Observations	108	108	107	72	107	108	108	108	62
R-squared	0.531	0.591	0.548	0.581	0.568	0.542	0.563	0.533	0.645
Panel E: Control for Financial Centralization in Education									
Curriculum Control	-26.833**	-23.421**	-29.448***	-33.749**	-28.004***	-26.360**	-25.647**	-26.036**	-25.868**
	(10.776)	(9.528)	(10.638)	(13.276)	(10.505)	(10.399)	(10.547)	(10.507)	(10.709)
Financial Centralization in Education	-13.628***	-7.110	-12.205***	-4.422	-10.322**	-14.267***	-10.501**	-13.486***	-7.634
	(4.682)	(4.337)	(4.486)	(7.731)	(4.214)	(4.600)	(4.436)	(4.687)	(5.118)
Continent Dummies	✓	✓	✓	✓	✓	✓	✓	✓	✓
Observations	108	108	107	72	107	108	108	108	62
R-squared	0.514	0.558	0.526	0.546	0.539	0.532	0.541	0.518	0.623

Note: All regressions are cross-country with one observation per country. The dependent variable is H-index of the patent from USPTO. In the baseline regression, only income and averaging are controlled. In robustness checks, other covariates specified in columns are controlled. Robust standard errors are in the parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

B.3. Further Robustness Checks: Using Other Innovation Indicators

Table B.3.1.. Further Robustness Check: The Effect of Curriculum Control on Innovation Measured by Other Indicators

Control Variable:	(1) Pop.	(2) Urban--ization	(3) Infra--structure	(4) Credit Share	(5) Religion Diversity (HHI Index)	(6) Rule of Law	(7) All
Panel A: Breakthrough Patent Share (USPTO) As the Dependent Variable							
Curriculum Control	-26.839***	-40.954***	-39.570***	-39.531***	-26.781***	-37.651***	-20.214*
	(7.899)	(8.290)	(10.637)	(8.478)	(8.578)	(8.627)	(10.153)
Observations	108	107	72	107	77	108	60
Panel B: Avg. Citations (USPTO) As the Dependent Variable							
Curriculum Control	-32.455***	-54.448***	-47.804***	-48.946***	-51.841***	-46.354***	-11.399
	(9.487)	(11.338)	(13.371)	(11.280)	(11.133)	(11.053)	(11.403)
Observations	108	107	72	107	108	108	72
Panel C: H-index (EPO) As the Dependent Variable							
Curriculum Control	-42.100***	-53.034***	-51.632***	-49.110***	-51.593***	-47.445***	-32.432***
	(10.094)	(11.582)	(12.887)	(11.339)	(11.211)	(11.075)	(12.012)
Observations	108	107	72	107	108	108	72
Panel D: Breakthrough Patent Share (EPO) As the Dependent Variable							
Curriculum Control	-50.151***	-53.794***	-54.519***	-49.958***	-53.145***	-47.481***	-46.053***
	(9.863)	(9.428)	(11.214)	(9.750)	(9.392)	(9.193)	(12.938)
Observations	108	107	72	107	108	108	72
Panel E: Avg. Citations (EPO) As the Dependent Variable							
Curriculum Control	-32.375***	-37.084***	-33.593***	-34.768***	-36.850***	-33.349***	-34.176***
	(7.674)	(7.216)	(6.644)	(7.306)	(7.152)	(7.399)	(10.452)
Observations	108	107	72	107	108	108	72
Panel F: Avg. Citations of Publication As the Dependent Variable							
Curriculum Control	-38.248***	-29.718***	-17.464**	-26.611***	-28.810***	-21.588***	-16.233**
	(8.053)	(7.134)	(7.145)	(7.549)	(6.582)	(7.302)	(7.306)
Observations	108	107	72	107	108	108	72
Panel G: Amounts of Innovative Companies per capita As the Dependent Variable							
Curriculum Control	-28.876**	-30.507**	-31.897*	-27.882**	-29.150**	-24.768*	-26.408
	(14.329)	(13.515)	(18.277)	(13.516)	(13.472)	(13.482)	(20.874)
Observations	108	107	72	107	108	108	72
Panel H: Amounts of Famous Brands per capita As the Dependent Variable							
Curriculum Control	-27.938**	-23.498**	-28.254*	-23.315**	-22.427**	-20.606*	-26.210
	(11.556)	(10.868)	(14.881)	(10.666)	(10.765)	(10.614)	(17.152)
Observations	108	107	72	107	108	108	72
Panel I: Amounts of Famous Universities per capita As the Dependent Variable							
Curriculum Control	-41.133***	-41.301***	-33.961***	-39.157***	-40.996***	-33.197***	-28.364**
	(8.894)	(8.603)	(10.798)	(8.984)	(8.413)	(8.089)	(10.816)
Observations	108	107	72	107	108	108	72

Note: All regressions are cross-country with one observation per country. The dependent variable is specified in each panel. The covariate specified in each column is controlled. Continent dummies are controlled in each regression. Robust standard errors are in the parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table B.3.2.. Further Robustness Check (Control Human Capital Covariates): Curriculum Control and Innovation measured by Other Indicators

	(1)	(2)	(3)	(4)
Control Variable:	Tertiary Schooling	Immigrant Stock	Test Score	All
	Panel A: Breakthrough Patent Share (USPTO) As the Dependent Variable			
Curriculum Control	-37.026***	-32.325***	-31.450***	-28.552**
	(8.920)	(7.967)	(11.739)	(11.982)
Observations	108	107	62	61
	Panel B: Avg. Citations (USPTO) As the Dependent Variable			
Curriculum Control	-50.413***	-39.913***	-33.265**	-25.439*
	(11.345)	(9.716)	(13.022)	(14.495)
Observations	108	107	62	61
	Panel C: H-index (EPO) As the Dependent Variable			
Curriculum Control	-52.215***	-44.305***	-55.565***	-48.332***
	(11.443)	(9.731)	(12.293)	(11.166)
Observations	108	107	62	61
	Panel D: Breakthrough Patent Share (EPO) As the Dependent Variable			
Curriculum Control	-53.696***	-50.841***	-54.981***	-52.081***
	(9.560)	(10.282)	(12.694)	(13.687)
Observations	108	107	62	61
	Panel E: Avg. Citations (EPO) As the Dependent Variable			
Curriculum Control	-37.067***	-36.506***	-43.862***	-42.049***
	(6.834)	(8.137)	(9.457)	(10.695)
Observations	108	107	62	61
	Panel F: Avg. Citations of Publication As the Dependent Variable			
Curriculum Control	-30.447***	-33.022***	-22.614***	-26.542***
	(6.981)	(7.884)	(6.792)	(7.359)
Observations	108	107	62	61
	Panel G: Innovative Companies per capita As the Dependent Variable			
Curriculum Control	-28.831**	-27.156**	-28.359	-26.493
	(14.066)	(13.560)	(19.765)	(20.824)
Observations	108	107	62	61
	Panel H: Famous Brands per capita As the Dependent Variable			
Curriculum Control	-23.714**	-22.844**	-24.836	-26.640
	(11.167)	(11.162)	(16.079)	(16.995)
Observations	108	107	62	61
	Panel I: Amounts of Famous Universities per capita As the Dependent Variable			
Curriculum Control	-40.940***	-36.855***	-38.671***	-35.836**
	(8.863)	(9.587)	(12.903)	(14.148)
Observations	108	107	62	61

Note: All regressions are cross-country with one observation per country. The dependent variable is specified in each panel. The covariate specified in each column is controlled. Continent dummies are controlled in each regression. Robust standard errors are in the parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table B.3.3.. Further Robustness Check (Innovation measured by Other Indicators): Different Sample Size, Outlier Obs. and Different Models

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Different Sample Sizes				Outlier Obs.			
	Drop Neo- -Europes	Further Drop Europe	Only Large Pop.	Only Rich Countries	Log Dependent	Positive Dependent	Drop Extreme Residual	Tobit Model
	Panel A: Breakthrough Patent Share (USPTO) As the Dependent Variable							
Curriculum Control	-28.304**	-24.051	-37.048***	-37.533**	-2.365***	31.138**	-43.961***	-99.797***
	(11.513)	(16.343)	(11.664)	(17.491)	(0.441)	(12.032)	(6.923)	(5.715)
Observations	104	76	70	56	108	25	98	108
	Panel B: Avg. Citations (USPTO) As the Dependent Variable							
Curriculum Control	-36.705***	-35.033**	-48.431***	-43.584**	-2.646***	-51.459***	-54.027***	-55.069***
	(12.416)	(16.512)	(13.290)	(17.106)	(0.706)	(11.779)	(10.702)	(11.330)
Observations	104	76	70	56	108	74	98	108
	Panel C: H-index (EPO) As the Dependent Variable							
Curriculum Control	-48.435***	-22.142**	-59.326***	-54.761***	-2.002***	-57.083***	-39.734***	-53.294***
	(10.352)	(9.469)	(14.367)	(12.531)	(0.391)	(11.766)	(8.941)	(11.025)
Observations	104	76	70	56	108	74	98	108
	Panel D: Breakthrough Patent Share (EPO) As the Dependent Variable							
Curriculum Control	-52.995***	-29.347***	-65.016***	-51.150***	-2.513***	-40.856***	-50.975***	-99.675***
	(11.421)	(11.016)	(9.480)	(13.284)	(0.398)	(14.214)	(9.089)	(20.115)
Observations	104	76	70	56	108	30	98	108
	Panel E: Avg. Citations (EPO) As the Dependent Variable							
Curriculum Control	-44.159***	-33.905**	-39.628***	-36.582***	-0.841	-39.568***	-28.873***	-37.350***
	(9.497)	(14.313)	(8.947)	(8.880)	(0.738)	(7.190)	(6.388)	(8.083)
Observations	104	76	70	56	108	85	98	108
	Panel F: Avg. Citations of Publication As the Dependent Variable							
Curriculum Control	-32.050***	-29.963**	-29.180***	-16.046*	-0.579***	-28.603***	-26.898***	-28.603***
	(9.722)	(14.842)	(8.959)	(8.010)	(0.139)	(6.912)	(4.817)	(6.682)
Observations	104	76	70	56	108	108	98	108
	Panel G: Amounts of Innovative Companies per capita As the Dependent Variable							
Curriculum Control	-25.369	-5.502	-42.057**	-23.534	-3.903***	-23.791	-14.088***	-61.771***
	(17.625)	(5.232)	(16.743)	(19.445)	(0.766)	(26.068)	(2.954)	(18.354)
Observations	104	76	70	56	108	35	98	108
	Panel H: Amounts of Famous Brands per capita As the Dependent Variable							
Curriculum Control	-21.502	-3.587	-35.583**	-18.236	-2.996***	-26.865	-19.191***	-41.770***
	(15.521)	(3.847)	(14.149)	(14.935)	(0.617)	(18.733)	(4.622)	(14.748)
Observations	104	76	70	56	108	41	98	108
	Panel I: Amounts of Famous Universities per capita As the Dependent Variable							
Curriculum Control	-38.656***	-4.573	-44.033***	-32.021**	-3.776***	-34.815**	-40.725***	-57.288***
	(10.587)	(3.040)	(7.863)	(13.076)	(0.869)	(12.935)	(7.312)	(13.075)
Observations	104	76	70	56	108	43	98	108

Note: All regressions are cross-country with one observation per country. The dependent variable is specified in each panel. In the baseline regression, only income and averaging are controlled. In robustness checks, other covariates specified in columns are controlled. Continent dummies are controlled in each regression. Robust standard errors are in the parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

B.4. Potential Channels: Further Evidence–The Effect of Curriculum Control on Parenting Styles

The beliefs and values shaped by schooling not only influence their work characteristics and career values but also influence parenting styles, as well as affect the investments to instill values in their children.

I explore the effect of curriculum control on parenting styles by examining the values that parents report as being important to teach their children. Parenting styles are measured by using the following survey question from the World Values Survey (WVS)[29]: "Here is a list of qualities that children can be encouraged to learn at home. Which, if any, do you consider especially important?" Respondents are then given a list of the following eleven traits: (i) Obedience, (ii) feeling of responsibility, (iii) tolerance/respect for others, (iv) unselfishness/generosity, (v) imagination, (vi) independence, (vii) self-expression, (viii) determination/perseverance; (ix) hard work, (x) thrift, and (xi) religious faith. Respondents respond "yes" to any of the traits they feel are important to instill in their children. I mainly focus on the effects of curriculum control on imagination, obedience, and independence, which are crucial for creativity.

The respondent's characteristics (gender, age, squared age, a set of dummies for educational attainment and income level) and the dummies for different survey years are controlled in regression using model (2.3). The results are reported in Column (3)–(5) in Table B.4.1. Parents educated in a decentralized curriculum-control system believe that imagination and independence are important for their children, and they generally disagree that obedience is an important quality.

I also show that parents who receive schooling in a flexible system tend to believe that "feelings of responsibility," "tolerance/respect for others," "determina-

[29] I use the data from the fifth and sixth waves of the WVS.

tion/perseverance", and "unselfishness" are important, while "hard work", "thrift", and "religious faith" are not. They have no strong preferences for other qualities. These results are presented in Column (6)–(12).

Table B.4.1.. The Effect of Curriculum Control on Students' Experiences and Parenting Styles

	Attitudes of Students					Parenting Styles						
	TIMSS (2007, Math)					WVS (5-6 waves)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Dependent Variable:	Positive Attitude	Self-Confidence	Imagination	Obedience	Independence	Hard Work	Responsibility	Tolerance	Thrift	Determination	Religious Faith	Unselfishness
Curriculum Control	-0.411***	-0.008	-0.244***	0.177***	-0.183***	0.276***	-0.085***	-0.103***	0.047***	-0.158***	0.295***	-0.033***
	(0.015)	(0.013)	(0.005)	(0.005)	(0.006)	(0.006)	(0.005)	(0.005)	(0.005)	(0.006)	(0.005)	(0.005)
Observations	51,904	51,741	140,850	140,848	140,853	140,860	140,859	140,857	140,854	140,854	140,849	140,852
R-squared	0.036	0.034	0.031	0.039	0.022	0.023	0.019	0.012	0.012	0.017	0.038	0.005

Note: The table reports the estimate of parameter β_1 in specification (2.3). The dependent variable is specified in each column. The covariates controlled in each regression are specified in the paper. Robust standard errors are in the parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

B.5. Data Source

Indicators from World Development Indicators (2015 Edition): **GDP, Population, GDP per capita, Urbanization Rate, International Migrant Stock, Domestic Credit to Private Sector (%, GDP), Population in Urban Agglomerations of More Than 1 Million (%, population), Individuals using the Internet (%, population), Fixed Broadband Subscriptions (per 100 people).**

Indicators from Desmet, Ortuño-Ortín and Wacziarg (2017): **Paved Roads Network Density (km per sq km of land area), Paved Roads Network Density (km per 1000 inhabitant), Rail Network Density (km per sq km of area), Rail Network Density (km per 1000 inhabitants), Share of Protestants in the Population, Share of Roman Catholics in the Population, Share of Muslims in the Population, Share of Other Religions in the Population, Dummy for OECD (2000), Continent Dummies, Linguistic Distance Index (plurality languages).**

Indicators from Galor and Ömer Özak (2015): **Average Crop Yield (post-1500CE), Standard Deviation of Average Crop Yield (post-1500CE), Individualism.**

Indicators from Quality of Government Data Set: **Property Rights Protection, Language Fractionalization, Religion Fractionalization, Ethnic Fractionalization, Religion Share (%, population), Civil Liberty.**

Indicators from V-Dem Project: **Local Election Quality, Regional Election Quality, Civil Society Development.**[30]

Indicators from Barro and Lee (2013): **Percentage of Population with Primary Education, Percentage of Population with Secondary Education, Percentage of Population with Tertiary Education, Average Years of Schooling Attained, Average Years of Tertiary Schooling Attained.**

Indicators from Roland and Gerard (2017): **the United States Census Data.**

[30]The first one is built by combining two indicators that measure "local government elected" and "sub-national elections free and fair" using PCA. The second one is constructed by combining two indicators that measure "regional government elected" and "sub-national elections free and fair" using PCA. The last one is built by combining three indicators that measure "civil society consultation", "civil society participatory environment", and "engaged society" with PCA.

The indicator from Altinok, Diebolt and Demeulemeester (2014): **Test Performance in Secondary Education.**

Indicator from World Bank Governance Index Data Set: **Rule of Law.**

All data about **CES**, **TIMSS**, and **PIRLS** are from Algan, Cahuc and Shleifer (2013).

Career, Values, and Parenting Styles are from **WVS data**.[31]

[31] They could be downloaded from `http://www.worldvaluessurvey.org/WVSDocumentationWVL.jsp`.

C. The Third Chapter Appendix

C.1. The Proof of Proposition 3.2

First, let's find the condition that the masses start to revolt. They will revolt if the expected payoff of revolting should be larger than no action. So,

$$(1-\lambda_{t+1}^{e\_total})I_{t+1}^{p} \leq q(x_{t+1})\frac{(1-\lambda_{t+1}^{e\_total})I_{t+1}^{p}}{\theta_{t+1}} + (1-q(x_{t+1}))\left(I_{t+1}^{p} + \lambda_{it+1}^{p} I_{t+1}^{e\_total}\right)$$

$$\Rightarrow (1-\lambda_{t+1}^{e\_total})\theta_{t+1} \leq q(x_{t+1})(1-\lambda_{t+1}^{e\_total}) + \theta_{t+1}(1-q(x_{t+1}))\left(1+\lambda_{t+1}^{p\_total}\frac{I_{t+1}^{e\_total}}{I_{t+1}^{p\_total}}\right)$$

$$\Rightarrow (1-\lambda_{t+1}^{e\_total})\theta_{t+1} \leq q(x_{t+1})(1-\lambda_{t+1}^{e\_total}) + \theta_{t+1}(1-q(x_{t+1}))\left(1+\frac{\lambda_{t+1}^{p\_total}}{x_{t+1}}\frac{\varphi_{t+1}^{p}}{\varphi_{t+1}^{e}}\right)$$

$$\Rightarrow (1-\lambda_{t+1}^{e\_total})\theta_{t+1} \leq \frac{1-\lambda_{t+1}^{e\_total}}{1+x_{t+1}\upsilon^{-1}(\chi)} + \theta_{t+1}\frac{x_{t+1}\upsilon^{-1}(\chi)}{1+x_{t+1}\upsilon^{-1}(\chi)}\left(1+\frac{\lambda_{t+1}^{p\_total}}{x_{t+1}}\frac{\varphi_{t+1}^{p}}{\varphi_{t+1}^{e}}\right)$$

$$\Rightarrow x_{t+1} \geq \upsilon(\chi)\frac{(1-\lambda_{t+1}^{e\_total})(\theta_{t+1}-1)}{\lambda_{t+1}^{e\_total}\theta_{t+1}} - \frac{\lambda_{t+1}^{p\_total}\varphi_{t+1}^{p}}{\lambda_{t+1}^{e\_total}\varphi_{t+1}^{e}}$$

$$= \upsilon(\chi)\left(\frac{1}{\lambda_{t+1}^{e\_total}}-1\right)\left(1-\frac{1}{\theta_{t+1}}\right) - \frac{1-\rho}{\rho}\frac{\lambda_{t+1}^{p\_total}}{\lambda_{t+1}^{e\_total}}\frac{\varphi_{t+1}^{p}}{\varphi_{t+1}^{e}}.$$

Suppose $x_{t+1}^{p*} = \upsilon(\chi)\left(\frac{1}{\lambda_{t+1}^{e\_total}}-1\right)\left(1-\frac{1}{\theta_{t+1}}\right) - \frac{1-\rho}{\rho}\frac{\lambda_{t+1}^{p\_total}}{\lambda_{t+1}^{e\_total}}\frac{\varphi_{t+1}^{p}}{\varphi_{t+1}^{e}}$. Therefore, when $x_{t+1}^{p*} - x_{t+1} \leq 0$, the masses will revolt.

Next, I turn to find the condition that elites decide to repress. Similarly, the expected payoff of the repression for the ruling elites should be larger than the compromise. Then,

$$q(x_{t+1})(I^e_{t+1}+\lambda^e_{it+1}I^{p\_total}_{t+1})+(1-q(x_{t+1}))\frac{I^e_{t+1}-\lambda^{p\_total}_{t+1}I^e_{t+1}}{\theta_{t+1}}>I^e_{t+1}-\lambda^{p\_total}_{t+1}I^e_{t+1}$$

$$\Rightarrow \theta_{t+1}\left((1-\lambda^{p\_total}_{t+1})I^e_{t+1}-q(x_{t+1})(I^e_{t+1}+\lambda^e_{it+1}I^{p\_total}_{t+1})\right)<(1-q(x_{t+1}))(1-\lambda^{p\_total}_{t+1})I^e_{t+1}$$

$$\Rightarrow \theta_{t+1}\left((1-\lambda^{p\_total}_{t+1})-q(x_{t+1})(1+\lambda^{e\_total}_{t+1}x_{t+1}\phi^{-1}_{t+1})\right)<(1-q(x_{t+1}))(1-\lambda^{p\_total}_{t+1}),$$

where $\phi_{t+1}=\frac{\varphi^p_{t+1}}{\varphi^e_{t+1}}$, and $\frac{\lambda^e_{it+1}I^{p\_total}_{t+1}}{I^e_{t+1}}=\lambda^e_{it+1}\frac{I^{p\_total}_{t+1}\varphi^p_{t+1}}{I^e_{t+1}\varphi^e_{t+1}}\frac{\varphi^e_{t+1}}{\varphi^p_{t+1}}=\lambda^{e\_total}_{t+1}x_{t+1}\frac{\varphi^e_{t+1}}{\varphi^p_{t+1}}$.

$$\Rightarrow \theta_{t+1}<\frac{(1-q(x_{t+1}))(1-\lambda^{p\_total}_{t+1})}{(1-\lambda^{p\_total}_{t+1})-q(x_{t+1})(1+\lambda^{e\_total}_{t+1}x_{t+1}\frac{\varphi^e_{t+1}}{\varphi^p_{t+1}})}=\frac{1}{1-\frac{\upsilon(\chi)}{x_{t+1}}\frac{\lambda^{p\_total}_{t+1}+\lambda^{e\_total}_{t+1}x_{t+1}\frac{\varphi^e_{t+1}}{\varphi^p_{t+1}}}{1-\lambda^{p\_total}_{t+1}}}$$

$$\Rightarrow x_{t+1}\leq x^{e*}_{t+1}=\frac{1}{\frac{1}{\upsilon(\chi)}\left(\frac{1}{\lambda^{p\_total}_{t+1}}-1\right)\left(1-\frac{1}{\theta_{t+1}}\right)-\frac{\lambda^{e\_total}_{t+1}}{\lambda^{p\_total}_{t+1}}\frac{\varphi^e_{t+1}}{\varphi^p_{t+1}}}.$$

Then, elites would compromise when $x_{t+1}>x^{e*}_{t+1}$ if the masses revolt.

C.2. Robustness Checks in Growth Regressions

C.2.1. Using Other Economic Level Indicators

In the baseline regressions, secondary enrollment rate in 1980 is used as a proxy of economic level. I employ GDP per capita, technological distance, average years of secondary schooling, and percentage with secondary schooling as alternative proxies of economic level. The results are reported in Table C.2.1.[1] Heterogeneous effects of democracy and state development on growth could be observed, which is consistent with the patterns shown in Table 3.6.2.

C.2.2. Using Other Democracy Indicators

In the baseline regressions, the democracy data from Papaioannou and Siourounis (2008*b*) is used. Considering the results may be sensitive to the democracy indicators chosen, in Table C.2.2, alternative dichotomous democracy indicators, from Acemoglu et al. (2019) (ACE), Boix, Miller and Rosato (2013) (BMR), Cheibub, Gandhi and Vreeland (2010) (CGV), Polity IV (POL), and Freedom House (FH), are employed to implement the regressions. The main patterns are the same. In addition, the significant and negative effect of democracy on growth in the poor country could be found when democracy indicators from Polity IV and CGV are used. So, the results are not sensitive by using different democracy indicators.

C.2.3. Using IVs for Democracy

One possible concern is that democratization may be an endogenous process, influenced by economic level (Gründler and Krieger, 2016; Acemoglu et al., 2019). Following recent studies (Acemoglu et al., 2019), regional democratization waves

[1]Economic level indicators in 1975, 1990, 2000, 5 years past, and the previous year are also used for further robustness checks. The results are reported in Appendix C.6.

are used to construct IVs.[2] The results are reported in Table C.2.3. P-values of the first stage and Sargan test are displayed at the bottom of the table. The state development is beneficial to growth, especially in the poor country, while democracy strongly boosts economic performance in the rich country. The coefficients of $Dem*EconLevel$ are larger than the ones in the baseline OLS regressions, indicating that there could be a downward bias introduced by time-varying unobservable or the possibility of attenuation in the previous estimates due to measurement error in the index of democracy.

[2]The regional classification is from Quality of Government data set (QOG). The whole world is divided into 10 areas. See the details in Data Appendix. The four lags of the average level of democracy in foreign countries within the same region are employed to build instrumental variables of democracy. Similarly, the four lags of average foreign democracy interacted with economic level indicators are used to as the IVs of interaction between democracy and economic level.

Table C.2.1.. Heterogeneous Effects of Democracy and State Capacity on Growth by Controlling for Different Interaction Terms

	(1)	(2)	(3)	(4)
	EconLevel in 1980 is Specified in Each Column			
Dependent Variable: Growth Rate	GDP per Capita	Technological Distance	Avg Secondary Year Schooling	Percentage with Secondary Schooling
Democracy (Dem)	-0.272	0.869***	-0.332	-0.449
	(0.691)	(0.312)	(0.665)	(0.759)
Dem*$EconLevel$	3.939**	8.868**	2.592**	2.516*
	(1.902)	(4.144)	(1.268)	(1.371)
State Capacity (SC)	3.417***	2.272***	7.054***	6.436***
	(0.969)	(0.640)	(1.627)	(1.714)
SC*$EconLevel$	-4.584**	-12.425***	-7.349***	-5.861***
	(1.839)	(4.040)	(2.191)	(2.151)
Observations	2761	2761	2760	2760
Adjusted R^2	0.217	0.216	0.241	0.239

Note: This table presents estimates of the effects of democracy and state capacity on annual GDP per capita growth by using economic level indicators to build interaction terms. Normalized economic level indicator (in 1980), which are specified in each column, interacted with Democracy (PS) and State Capacity (*StateHist*) are controlled. 4 lagged education indicators (log form), including primary, secondary, and tertiary rates are controlled. In all specifications, various factors are considered to control for country and year fixed effects. Standard errors robust against at the country level are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table C.2.2.. Heterogeneous Effects of Democracy and State Capacity on Growth by Using Different Democracy Indicators

	(1)	(2)	(3)	(4)	(5)
	Democracy Indicator is Specified in Each Column				
Dependent Variable: Growth Rate	ACE	CGV	BMR	POL	FH
Democracy (Dem)	-1.124*	-1.751**	-0.929	-1.076**	0.069
	(0.621)	(0.687)	(0.757)	(0.533)	(0.817)
Dem*$EconLevel$	3.399***	3.388***	2.636*	2.990***	0.995
	(1.144)	(1.187)	(1.365)	(0.977)	(1.261)
State Capacity (SC)	4.458***	4.078***	4.023***	4.549***	3.805***
	(1.055)	(0.996)	(1.077)	(1.029)	(0.987)
SC*$EconLevel$	-3.328**	-2.684*	-2.504	-3.406**	-2.582*
	(1.557)	(1.565)	(1.655)	(1.582)	(1.540)
Observations	3189	3038	2955	3184	3189
Adjusted R^2	0.219	0.211	0.21	0.218	0.216

Note: This table presents estimates of the effects of democracy and state capacity on annual GDP per capita growth using different Democracy indicators specified in each column. Normalized economic level indicator (secondary enrollment rate in 1980) interacted with Democracy and State Capacity (*StateHist*) are controlled. 4 lagged education indicators (log form), including primary, secondary, and tertiary rates are controlled. In all specifications, various factors are considered to control for country and year fixed effects. Standard errors robust against at the country level are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table C.2.3.. Heterogeneous Effects of Democracy and State Capacity on Growth by Instrumenting Democracy

Dependent Variable: Growth	(1)	(2)	(3)	(4)	(5)	(6)
Democracy from:	PS	ACE	CGV	BMR	POL	FH
Democracy	-0.097	-0.048	-2.421	-2.44	1.267	-2.082
	(1.921)	(2.442)	(2.012)	(3.380)	(3.543)	(7.229)
Dem*$EconLevel$	7.247**	8.270**	9.762**	10.838**	9.982**	4.688
	(3.489)	(3.775)	(4.034)	(4.863)	(4.986)	(5.635)
State Capacity (SC)	6.900***	5.932***	6.410***	5.883***	6.158**	3.919***
	(2.042)	(1.774)	(1.922)	(2.116)	(2.417)	(1.063)
SC*$EconLevel$	-7.249**	-5.110**	-4.522*	-3.438	-5.716*	-2.37
	(2.947)	(2.450)	(2.444)	(2.519)	(3.268)	(1.818)
IVs for Democracy	0.056	0.0188	0.0209	0.155	0.1362	0.4009
IVs for Dem*$EconLevel$	0.2624	0.0386	0.0223	0.0808	0.4982	0.0563
Sargan Test (p-value)	0.0241	0.1176	0.1723	0.7484	0.0555	0.1668
Adjusted R^2	0.177	0.15	0.161	0.15	0.043	0.217
Observations	2942	3186	3035	2952	3181	3098

Note: This table presents estimates of the effects of democracy and state capacity on annual GDP per capita growth by instrumenting democracy. political regimes (democracy used is specified in each column) of the countries within same region (categorized by QOG) are used to build IV. 4 lagged foreign democracy variables are used in the first stage of 2SLS regressions. Sargan test and corresponding p-value are reported for overidentification issue. Normalized economic level indicator (secondary enrollment rate in 1980) interacted with Democracy and State Capacity (*StateHist*) are controlled. 4 lagged education indicators (log form), including primary, secondary, and tertiary rates are controlled in each column. In all specifications, various factors are considered to control for country and year fixed effects. Standard errors robust against at the country level are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

C.3. Further Robustness Checks for Growth Regressions

C.3.1. Using Economic Level Indicators in Other Years

Table C.3.1.. Heterogeneous Effects of Democracy and State Capacity on Growth by Controlling for Economic Level Indicators in 1975

	(1)	(2)	(3)	(4)
	EconLevel in 1975 is Specified in Each Column			
Dependent Variable: Growth Rate	GDP per Capita	Technological Distance	Avg Secondary Year Schooling	Percentage with Secondary Schooling
Democracy (Dem)	-0.222	0.685**	-0.287	-0.502
	(0.549)	(0.264)	(0.672)	(0.794)
Dem*$EconLevel$	3.568**	7.677*	2.788**	2.770*
	(1.728)	(4.306)	(1.354)	(1.451)
State Capacity (SC)	3.345***	2.121***	5.939***	5.717***
	(0.841)	(0.620)	(1.590)	(1.651)
SC*$EconLevel$	-4.908**	-12.948**	-6.111***	-5.138**
	(1.895)	(4.981)	(2.179)	(2.094)
Observations	2623	2623	2724	2724
Adjusted R^2	0.218	0.216	0.241	0.24

Note: This table presents estimates of the effects of democracy and state capacity on annual GDP per capita growth by using economic level indicators to build interaction terms. Normalized economic level indicator (in 1975), which are specified in each column, interacted with Democracy (PS) and State Capacity (*StateHist*) are controlled. 4 lagged education indicators (log form), including primary, secondary, and tertiary rates are controlled. In all specifications, various factors are considered to control for country and year fixed effects. Standard errors robust against at the country level are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table C.3.2.. Heterogeneous Effects of Democracy and State Capacity on Growth by Controlling for Economic Level Indicators in 1990

	(1)	(2)	(3)	(4)
	EconLevel in 1990 is Specified in Each Column			
Dependent Variable: Growth Rate	GDP per Capita	Technological Distance	Avg Secondary Year Schooling	Percentage with Secondary Schooling
Democracy (Dem)	-0.758	0.751***	-0.875	-1.142
	(0.629)	(0.284)	(0.913)	(1.023)
Dem*$EconLevel$	4.326**	4.583**	3.192**	3.169**
	(1.678)	(1.895)	(1.505)	(1.539)
State Capacity (SC)	3.441***	2.817***	7.020***	5.849***
	(0.826)	(0.647)	(1.830)	(1.866)
SC*$EconLevel$	-2.902**	-6.254***	-6.881***	-4.869**
	(1.434)	(1.743)	(2.361)	(2.251)
Observations	2918	2918	2760	2760
Adjusted R^2	0.222	0.221	0.241	0.239

Note: This table presents estimates of the effects of democracy and state capacity on annual GDP per capita growth by using economic level indicators to build interaction terms. Normalized economic level indicator (in 1990), which are specified in each column, interacted with Democracy (PS) and State Capacity (*StateHist*) are controlled. 4 lagged education indicators (log form), including primary, secondary, and tertiary rates are controlled. In all specifications, various factors are considered to control for country and year fixed effects. Standard errors robust against at the country level are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table C.3.3.. Heterogeneous Effects of Democracy and State Capacity on Growth by Controlling for Economic Level Indicators in 2000

	(1)	(2)	(3)	(4)
	EconLevel in 2000 is Specified in Each Column			
Dependent Variable: Growth Rate	GDP per Capita	Technological Distance	Avg Secondary Year Schooling	Percentage with Secondary Schooling
Democracy (Dem)	-0.901	0.748***	-0.749	-0.643
	(0.569)	(0.283)	(0.893)	(0.812)
Dem*$EconLevel$	4.699***	4.832**	3.047**	2.719**
	(1.601)	(1.953)	(1.480)	(1.335)
State Capacity (SC)	2.832***	2.709***	7.470***	5.397***
	(0.848)	(0.652)	(2.032)	(1.695)
SC*$EconLevel$	-1.584	-5.903***	-7.601***	-4.694**
	(1.379)	(1.898)	(2.618)	(2.189)
Observations	2949	2949	2764	2764
Adjusted R^2	0.226	0.224	0.241	0.24

Note: This table presents estimates of the effects of democracy and state capacity on annual GDP per capita growth by using economic level indicators to build interaction terms. Normalized economic level indicator (in 2000), which are specified in each column, interacted with Democracy (PS) and State Capacity (*StateHist*) are controlled. 4 lagged education indicators (log form), including primary, secondary, and tertiary rates are controlled. In all specifications, various factors are considered to control for country and year fixed effects. Standard errors robust against at the country level are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table C.3.4.. Heterogeneous Effects of Democracy and State Capacity on Growth by Controlling for 5-Lagged Economic Level Indicators

	(1)	(2)	(3)	(4)
	EconLevel in 2000 is Specified in Each Column			
Dependent Variable: Growth Rate	GDP per Capita	Technological Distance	Avg Secondary Year Schooling	Percentage with Secondary Schooling
Democracy (Dem)	-0.837	0.756***	-0.467	-1.223
	(0.751)	(0.274)	(0.981)	(1.312)
Dem*$EconLevel$	4.703**	4.197**	2.488	3.226
	(2.172)	(1.839)	(1.661)	(1.955)
State Capacity (SC)	4.277***	2.714***	6.275***	6.035***
	(0.832)	(0.628)	(1.680)	(2.123)
SC*$EconLevel$	-5.190***	-7.408***	-6.116***	-5.203*
	(1.443)	(1.865)	(2.273)	(2.789)
Observations	2936	2936	2745	2745
Adjusted R^2	0.224	0.222	0.240	0.239

Note: This table presents estimates of the effects of democracy and state capacity on annual GDP per capita growth by using economic level indicators to build interaction terms. Normalized economic level indicator (5-lagged), which are specified in each column, interacted with Democracy (PS) and State Capacity (*StateHist*) are controlled. 4 lagged education indicators (log form), including primary, secondary, and tertiary rates are controlled. In all specifications, various factors are considered to control for country and year fixed effects. Standard errors robust against at the country level are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

C.3.2. Controlling For Other Growth Covariates

Table C.3.5.. Heterogeneous Effects of Democracy and State Capacity on Growth by Controlling for Growth Covariates

	(1)	(2)	(3)	(4)	(5)
Dependent Variable:	Control	Control	Control	Control	Control
Growth Rate	Fertility	Trade	Gov. Spending	Inflation	Life Exp.
Democracy (PS)	-0.898	-0.709	-0.538	-1.273	-0.995
	(0.874)	(0.901)	(0.873)	(0.879)	(0.876)
State Capacity	4.223***	6.016***	5.790***	5.098***	4.462***
	(1.215)	(1.679)	(1.773)	(1.261)	(1.292)
Dem*$EconLevel$	2.600*	2.721*	2.284	3.562**	2.926*
	(1.527)	(1.541)	(1.534)	(1.528)	(1.515)
SC*$EconLevel$	-3.610**	-5.119**	-5.314**	-4.654***	-3.783**
	(1.690)	(2.072)	(2.322)	(1.766)	(1.766)
Adjusted R^2	0.229	0.213	0.212	0.222	0.228
Observations	2942	2844	2803	2923	2942
Democracy (CGV)	-1.179*	-1.775**	-1.421**	-1.783**	-1.535**
	(0.685)	(0.753)	(0.671)	(0.690)	(0.660)
State Capacity	4.240***	4.767***	5.122***	4.334***	3.854***
	(0.984)	(1.416)	(1.483)	(0.996)	(1.147)
Dem*$EconLevel$	2.278*	3.424***	2.591**	3.416***	2.860**
	(1.182)	(1.230)	(1.110)	(1.175)	(1.130)
SC*$EconLevel$	-3.208**	-2.966	-3.969*	-3.157**	-2.511
	(1.428)	(1.875)	(2.054)	(1.554)	(1.632)
Adjusted R^2	0.218	0.202	0.194	0.210	0.218
Observations	3038	2938	2900	3019	3038
Democracy (ACE)	-0.837	-0.932	-0.588	-1.147*	-1.119*
	(0.605)	(0.632)	(0.630)	(0.601)	(0.598)
State Capacity	4.460***	4.916***	5.266***	4.665***	4.221***
	(1.042)	(1.527)	(1.593)	(1.052)	(1.124)
Dem*$EconLevel$	2.631**	3.115***	2.465**	3.395***	3.138***
	(1.105)	(1.119)	(1.137)	(1.103)	(1.103)
SC*$EconLevel$	-3.644**	-3.420*	-4.347**	-3.718**	-3.106*
	(1.458)	(1.941)	(2.130)	(1.541)	(1.569)
Adjusted R^2	0.226	0.210	0.204	0.218	0.226
Observations	3189	3087	3049	3170	3189
Democracy (BMR)	-0.444	-0.901	-0.486	-0.936	-0.761
	(0.729)	(0.743)	(0.758)	(0.739)	(0.761)
State Capacity	4.302***	4.618***	5.136***	4.293***	3.920***
	(1.042)	(1.533)	(1.613)	(1.077)	(1.200)
Dem*$EconLevel$	1.598	2.581*	1.783	2.607**	2.216
	(1.341)	(1.306)	(1.360)	(1.308)	(1.343)
SC*$EconLevel$	-3.157**	-2.675	-3.896*	-3.005*	-2.438
	(1.507)	(2.025)	(2.216)	(1.645)	(1.692)
Adjusted R^2	0.217	0.202	0.194	0.209	0.217
Observations	2955	2856	2818	2937	2955
Democracy (POL)	-0.701	-0.563	-0.486	-1.113**	-1.071*
	(0.542)	(0.570)	(0.527)	(0.520)	(0.546)
State Capacity	4.593***	4.752***	5.274***	4.773***	4.299***
	(1.048)	(1.512)	(1.576)	(1.027)	(1.081)
Dem*$EconLevel$	2.068**	2.111**	1.917**	3.015***	2.658***
	(1.008)	(0.955)	(0.920)	(0.963)	(0.966)
SC*$EconLevel$	-3.744**	-3.274	-4.293**	-3.822**	-3.155**
	(1.505)	(1.976)	(2.154)	(1.567)	(1.572)
Adjusted R^2	0.226	0.209	0.204	0.218	0.225
Observations	3184	3082	3044	3166	3184
Democracy (FH)	0.339	0.203	0.700	0.066	0.542
	(0.786)	(0.836)	(0.814)	(0.823)	(0.804)
State Capacity	3.963***	4.094***	4.606***	4.036***	3.588***
	(0.997)	(1.440)	(1.506)	(0.984)	(1.022)
Dem*$EconLevel$	0.312	0.696	-0.070	1.031	0.204
	(1.204)	(1.251)	(1.214)	(1.270)	(1.216)
SC*$EconLevel$	-3.126**	-2.524	-3.653*	-3.020**	-2.447
	(1.411)	(1.910)	(2.077)	(1.518)	(1.492)
Adjusted R^2	0.223	0.206	0.201	0.216	0.223
Observations	3189	3087	3049	3170	3189

Note: This table presents estimates of the effects of democracy and state capacity on annual GDP per capita growth by controlling for growth covariates. Democracy indicator is used specified in each panel. Normalized economic level indicator (secondary enrollment rate in 1980) interacted with Democracy and State Capacity (*StateHist*) are controlled. 4 lagged education indicators (log form), including primary, secondary, and tertiary rates are controlled in each column. Other covariates are controlled specified in each column. In all specifications, various factors are considered to control for country and year fixed effects. Standard errors robust against at the country level are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

C.4. Robustness Checks in Transition Regressions

C.4.1. Using Other Regression Models

One concern about the results is that it may be sensitive to the regression model used. To address this issue, the following linear regression model is employed:

$$\begin{aligned} Democracy_{it} =& \alpha Democracy_{it-5} + \beta_0 SC_i + \beta_1 SC_i^2 + \beta_2 Edu_{it-5} + \\ & \beta_3 EduGini_{it-5} + \beta_4 X_{it-5} + \beta_5 \lambda_i + \beta_6 Time + \varepsilon_i, \end{aligned} \tag{C.1}$$

where $Democracy_{it} = 1$ if country i is democracy at time t, and 0 if it is autocracy. Democracy data is from Papaioannou and Siourounis (2008*b*). One five-lagged *Democracy* is controlled due to the high correlation between the current and previous political regime.[3] Other variables are the same with the previous probabilistic model except that the corresponding five-lagged values are used in these variables. Various country fixed factors and time effects are also controlled. The inverted-U links between state development and democratization are quite significant, which are displayed in Table C.4.1.

C.4.2. Using IVs and Other Democracy Indicators

There could be some other possible concerns in the linear regression model. First, there could be a serious endogeneity issue. Second, the results may be sensitive to the democracy indicators used.

Following the growth regression strategy, foreign democracies are used to build IVs[4] and the regression results by controlling for fixed factors (country and time) are reported in Table C.4.2. They are quite similar to the results in Table C.4.1, indicating that the endogeneity concern is not a serious issue.

[3] I don't use annual data to do regressions. By doing so, several lagged democracy variables have to be controlled, but it is not convenient to use IV method to deal with these dynamic terms in subsequent regressions.

[4] The average level of ten-lagged and fifteen-lagged foreign democracies in the same region (QOG) are used.

Using other democracy indicators (including FH, POL, BMR, CGV, and ACE), I run the OLS regressions by controlling education structure, education inequality, time effects, as well as various fixed factors. The results are reported in Column (1)–(5) in Table C.4.3, which are consistent with the results using democracy indicator from Papaioannou and Siourounis (2008*b*), although some of hump-shaped relationships are not significant. Next, the 2SLS regression results are displayed in Column (6)–(10), which are quite similar to the OLS ones. Therefore, I can confirm that the results are insensitive to various indicators of democracy and the endogenous issue is not serious.

Table C.4.1.. Regressions on Democratization by Controlling Country Fixed Factors

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Democracy from: PS	Sec. Enroll	3 Edu	Edu Gini	Urbani--zation	GDP per	GDP & Pop.	Oil Dummy	All (no GDP per)	All (no GDP)
SC	0.377**	0.409**	0.575***	0.480**	0.458**	0.450**	0.487**	0.445**	0.455**
	(0.178)	(0.174)	(0.204)	(0.190)	(0.189)	(0.190)	(0.188)	(0.195)	(0.196)
SC^2	-0.354*	-0.369*	-0.629***	-0.440**	-0.419*	-0.454**	-0.452**	-0.449**	-0.414*
	(0.204)	(0.201)	(0.215)	(0.214)	(0.214)	(0.214)	(0.211)	(0.220)	(0.221)
L5.Democracy	0.793***	0.783***	0.784***	0.777***	0.789***	0.780***	0.778***	0.777***	0.787***
	(0.029)	(0.030)	(0.036)	(0.029)	(0.031)	(0.032)	(0.029)	(0.032)	(0.031)
L5.Secondary	0.027	0.009	-0.018	-0.027	-0.021	-0.013	-0.023	-0.02	-0.028
	(0.017)	(0.028)	(0.045)	(0.031)	(0.033)	(0.032)	(0.031)	(0.032)	(0.033)
L5.Primary		-0.016	-0.067	-0.019	-0.032	-0.048	-0.007	-0.036	-0.026
		(0.043)	(0.104)	(0.040)	(0.046)	(0.045)	(0.040)	(0.047)	(0.049)
L5.Tertiary		0.018	0.028	0.014	0.024	0.010	0.022	0.003	0.017
		(0.013)	(0.020)	(0.015)	(0.017)	(0.018)	(0.014)	(0.019)	(0.017)
L5.EduGini				-0.002*	-0.003**	-0.003**	-0.002*	-0.002**	-0.002**
				(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
L5.Urbanization				0.024				0.028	0.034
				(0.026)				(0.029)	(0.029)
L5.GDP per					-0.013				-0.016
					(0.013)				(0.016)
L5.GDP						-0.003		-0.002	
						(0.014)		(0.018)	
L5.Pop.						0.019		0.018	
						(0.014)		(0.016)	
Oil Dummy							-0.038	-0.041	-0.023
							(0.039)	(0.045)	(0.043)
Latitude	-0.002***	-0.002***	-0.001**	-0.002***	-0.001**	-0.001**	-0.002***	-0.001**	-0.001**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Distance to Coast/River	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Tropics Land (%)	-0.028	-0.027	-0.022	-0.020	-0.007	0.011	-0.006	0.028	0.002
	(0.111)	(0.117)	(0.197)	(0.109)	(0.103)	(0.112)	(0.107)	(0.117)	(0.105)
Tropics Pop. (%)	0.094	0.098	0.080	0.092	0.058	0.042	0.075	0.032	0.054
	(0.106)	(0.109)	(0.196)	(0.109)	(0.107)	(0.114)	(0.107)	(0.118)	(0.109)
Colony Dummy	-0.097**	-0.087**	-0.087**	-0.058	-0.053	-0.047	-0.057	-0.042	-0.049
	(0.040)	(0.044)	(0.038)	(0.044)	(0.044)	(0.043)	(0.043)	(0.045)	(0.046)
Executive Constraint (independence)	0.034	0.032	0.018	0.028	0.014	0.019	0.020	0.024	0.022
	(0.024)	(0.023)	(0.023)	(0.024)	(0.022)	(0.022)	(0.024)	(0.023)	(0.024)
Language Fractionalization	-0.029	-0.031	0.074*	-0.020	-0.015	-0.024	-0.018	-0.032	-0.023
	(0.039)	(0.039)	(0.039)	(0.038)	(0.039)	(0.038)	(0.038)	(0.038)	(0.039)
Religion Fractionalization	-0.053	-0.028	0.032	0.005	-0.004	-0.027	-0.001	-0.023	0.005
	(0.048)	(0.056)	(0.057)	(0.055)	(0.055)	(0.054)	(0.055)	(0.059)	(0.059)
Ethnic Fractionalization	-0.067	-0.073	-0.136*	-0.062	-0.022	-0.016	-0.039	-0.021	-0.032
	(0.061)	(0.062)	(0.068)	(0.061)	(0.061)	(0.058)	(0.061)	(0.060)	(0.062)
Muslims Pop. (%)	-0.001**	-0.001*	-0.001	0.000	0.000	0.000	0.000	-0.001	0.000
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Buddhist&Confu. & Pop. (%)	-0.001*	-0.001*	0.000	-0.001*	-0.001*	-0.001*	-0.001*	-0.001*	-0.001
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Adjusted R^2	0.808	0.802	0.806	0.810	0.806	0.806	0.810	0.806	0.805
Observations	673	649	397	609	574	574	609	574	574

Note: This table presents OLS regressions by controlling for various fixed factors. The dependent variable equals 0 when the country is autocratic while 1 when the country is democracy. Democracy is from PS. The main independent variables are State Capacity (*StateHist*), its square, education indicators (including primary, secondary, and tertiary enrollment rate), and education inequality. Urbanization ratio, GDP per capita, natural resource (oil dummy), country size (measured by GDP and population) are controlled for further robustness checks. 5-lagged variant variables are used. The Data Appendix gives detailed variable sources. Standard errors robust against at the country level are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table C.4.2.. IV Regressions on Democratization by Controlling for Country Fixed Factors

Democracy from: PS	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
IV (QOG)	Sec. Enroll	3 Edu	EduGini	Urbani--zation	GDP per	GDP & Pop.	Oil Dummy	All (no GDP per)	All (no GDP)
SC	0.375**	0.417**	0.503***	0.494***	0.470**	0.484**	0.509***	0.497**	0.471**
	(0.166)	(0.167)	(0.181)	(0.181)	(0.190)	(0.206)	(0.183)	(0.220)	(0.197)
SC^2	-0.355*	-0.380*	-0.470**	-0.457**	-0.438**	-0.498**	-0.476**	-0.511**	-0.435**
	(0.193)	(0.196)	(0.204)	(0.205)	(0.210)	(0.232)	(0.207)	(0.249)	(0.220)
L5.Democracy	0.802***	0.776***	0.761***	0.765***	0.786***	0.754***	0.756***	0.727***	0.777***
	(0.069)	(0.078)	(0.083)	(0.084)	(0.126)	(0.141)	(0.082)	(0.150)	(0.131)
L5.Secondary	0.025	0.008	-0.023	-0.028	-0.023	-0.011	-0.023	-0.012	-0.028
	(0.019)	(0.032)	(0.035)	(0.034)	(0.038)	(0.041)	(0.036)	(0.042)	(0.038)
L5.Primary		-0.016	-0.017	-0.018	-0.03	-0.05	-0.009	-0.041	-0.026
		(0.050)	(0.048)	(0.049)	(0.052)	(0.054)	(0.049)	(0.055)	(0.053)
L5.Tertiary		0.018	0.020	0.014	0.024	0.007	0.021	-0.003	0.017
		(0.014)	(0.014)	(0.016)	(0.017)	(0.023)	(0.014)	(0.026)	(0.019)
L5.EduGini			-0.002*	-0.002*	-0.003**	-0.003**	-0.002*	-0.003*	-0.003**
			(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
L5.Urbanization				0.022				0.025	0.032
				(0.029)				(0.032)	(0.031)
L5.GDP per					-0.016				-0.017
					(0.019)				(0.022)
L5.GDP						-0.002		0.005	
						(0.024)		(0.030)	
L5.Pop.						0.020		0.015	
						(0.019)		(0.023)	
Oil Dummy							-0.038	-0.048	-0.022
							(0.039)	(0.056)	(0.046)
Latitude	-0.002***	-0.002***	-0.002***	-0.002***	-0.001**	-0.002**	-0.002***	-0.002**	-0.001**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Distance to	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Coast/River	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Tropics Land (%)	-0.029	-0.024	-0.019	-0.017	-0.009	0.022	0.000	0.056	0.004
	(0.109)	(0.118)	(0.113)	(0.113)	(0.116)	(0.139)	(0.115)	(0.161)	(0.123)
Tropics Pop. (%)	0.093	0.096	0.091	0.091	0.059	0.036	0.073	0.019	0.053
	(0.104)	(0.109)	(0.110)	(0.111)	(0.109)	(0.126)	(0.113)	(0.141)	(0.113)
Colony Dummy	-0.094**	-0.089*	-0.063	-0.06	-0.054	-0.052	-0.061	-0.049	-0.052
	(0.044)	(0.046)	(0.046)	(0.046)	(0.047)	(0.047)	(0.046)	(0.050)	(0.049)
Executive Constraint	0.032	0.036	0.028	0.032	0.017	0.027	0.027	0.038	0.026
(independence)	(0.031)	(0.033)	(0.031)	(0.033)	(0.038)	(0.043)	(0.031)	(0.045)	(0.040)
Language	-0.032	-0.035	-0.02	-0.024	-0.02	-0.034	-0.024	-0.045	-0.028
Fractionalization	(0.038)	(0.040)	(0.039)	(0.039)	(0.042)	(0.046)	(0.039)	(0.049)	(0.043)
Religion	-0.047	-0.025	0.004	0.008	0.003	-0.026	0.002	-0.031	0.008
Fractionalization	(0.049)	(0.058)	(0.057)	(0.057)	(0.061)	(0.066)	(0.059)	(0.075)	(0.066)
Ethnic	-0.065	-0.078	-0.060	-0.066	-0.025	-0.027	-0.048	-0.034	-0.035
Fractionalization	(0.063)	(0.066)	(0.064)	(0.064)	(0.067)	(0.067)	(0.065)	(0.068)	(0.067)
Muslims Pop. (%)	-0.001*	-0.001	0.000	0.000	0.000	0.000	0.000	-0.001	0.000
	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Buddhist&Confu.	-0.001	-0.001	-0.001*	-0.001*	-0.001*	-0.001*	-0.001*	-0.001	-0.001
& Pop. (%)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
First Stage (p-value)	0.0000	0.0000	0.0002	0.0002	0.0049	0.0002	0.0126	0.0167	0.0058
Sargan test (p-value)	0.9306	0.9042	0.6693	0.5848	0.4734	0.6765	0.5024	0.4589	0.3512
Adjusted R^2	0.805	0.799	0.806	0.806	0.802	0.803	0.806	0.802	0.802
Observations	665	641	601	601	567	567	601	567	567

Note: This table presents 2SLS regressions by controlling for various fixed factors. The dependent variable equals 0 when the country is autocratic while 1 when the country is democracy. Democracy is from PS. The main independent variables are State Capacity (*StateHist*), its square, education indicators (including primary, secondary, and tertiary enrollment rate), and education inequality. Urbanization ratio, GDP per capita, natural resource (oil dummy), country size (measured by GDP and population) are controlled for further robustness checks. 5-lagged variant variables are used. The Data Appendix gives detailed variable sources. Sargan test is implemented for overidentification issue and the p-value is reported. Standard errors robust against at the country level are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table C.4.3.. OLS and 2SLS Regressions on Democratization by Using Other Democracy Indicators

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
				OLS					IV-2SLS			
Democracy from:	PS	FH	POL	BMR	CGV	ACE	PS	FH	POL	BMR	CGV	ACE
SC	0.485**	0.468**	0.419*	0.386	0.28	0.276	0.503***	0.380*	0.358*	0.351	0.273	0.205
	(0.187)	(0.199)	(0.230)	(0.252)	(0.271)	(0.238)	(0.181)	(0.216)	(0.198)	(0.255)	(0.309)	(0.201)
SC^2	-0.449**	-0.514**	-0.363	-0.389	-0.262	-0.247	-0.470**	-0.504**	-0.314	-0.355	-0.251	-0.185
	(0.210)	(0.205)	(0.261)	(0.282)	(0.290)	(0.261)	(0.204)	(0.250)	(0.225)	(0.291)	(0.336)	(0.220)
L5.Democracy	0.778***	0.597***	0.622***	0.609***	0.631***	0.659***	0.761***	0.724***	0.670***	0.568***	0.555***	0.730***
	(0.029)	(0.054)	(0.044)	(0.044)	(0.046)	(0.042)	(0.083)	(0.141)	(0.094)	(0.121)	(0.115)	(0.085)
L5.Secondary	-0.022	0.106***	-0.02	0.054	0.008	-0.010	-0.023	0.117**	-0.018	0.052	0.008	-0.021
	(0.031)	(0.037)	(0.046)	(0.040)	(0.043)	(0.049)	(0.035)	(0.049)	(0.045)	(0.042)	(0.050)	(0.049)
L5.Primary	-0.016	-0.236***	-0.095	-0.191***	-0.164**	-0.099	-0.017	-0.226***	-0.094	-0.206***	-0.188**	-0.081
	(0.039)	(0.050)	(0.065)	(0.061)	(0.064)	(0.061)	(0.048)	(0.085)	(0.071)	(0.073)	(0.079)	(0.065)
L5.Tertiary	0.020	0.021	0.025	0.016	0.044**	0.024	0.020	-0.003	0.025	0.026	0.056**	0.026
	(0.014)	(0.020)	(0.020)	(0.022)	(0.020)	(0.020)	(0.014)	(0.020)	(0.018)	(0.024)	(0.025)	(0.018)
L5.EduGini	-0.002*	0.000	-0.003**	-0.001	-0.001	-0.002	-0.002*	0.000	-0.003*	-0.002	-0.001	-0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)
Latitude	-0.002***	0.000	-0.001*	0.000	0.000	-0.001	-0.002***	0.000	-0.001	0.000	0.000	-0.001*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Distance to Coast/River	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Tropics Land (%)	-0.023	-0.163	0.104	-0.014	0.089	0.032	-0.019	-0.213	0.076	-0.05	0.111	-0.014
	(0.107)	(0.218)	(0.143)	(0.175)	(0.142)	(0.133)	(0.113)	(0.147)	(0.129)	(0.186)	(0.175)	(0.111)
Tropics Pop. (%)	0.092	0.084	-0.019	0.067	0.003	0.029	0.091	0.114	0.003	0.107	-0.005	0.062
	(0.106)	(0.215)	(0.147)	(0.173)	(0.137)	(0.133)	(0.110)	(0.133)	(0.130)	(0.182)	(0.163)	(0.107)
Colony Dummy	-0.060	0.022	-0.064	-0.038	-0.045	-0.06	-0.063	-0.001	-0.055	-0.036	-0.051	-0.046
	(0.043)	(0.042)	(0.041)	(0.056)	(0.055)	(0.041)	(0.046)	(0.037)	(0.040)	(0.063)	(0.065)	(0.036)
Executive Constraint	0.022	0.036	0.043	0.019	-0.014	0.042	0.028	-0.006	0.026	0.02	-0.008	0.025
(independence)	(0.023)	(0.033)	(0.030)	(0.036)	(0.037)	(0.029)	(0.031)	(0.029)	(0.032)	(0.044)	(0.043)	(0.027)
Language	-0.015	0.009	0.027	-0.071	-0.033	0.004	-0.020	0.041	0.018	-0.074	-0.040	0.012
Fractionalization	(0.039)	(0.069)	(0.047)	(0.055)	(0.055)	(0.046)	(0.039)	(0.054)	(0.044)	(0.060)	(0.062)	(0.042)
Religion	0.000	0.078	-0.082	-0.040	-0.060	-0.055	0.004	0.140**	-0.057	-0.033	-0.066	-0.034
Fractionalization	(0.053)	(0.060)	(0.059)	(0.068)	(0.071)	(0.066)	(0.057)	(0.062)	(0.062)	(0.073)	(0.085)	(0.061)
Ethnic	-0.053	-0.069	-0.073	-0.065	-0.065	-0.054	-0.060	-0.081	-0.053	-0.073	-0.074	-0.045
Fractionalization	(0.060)	(0.084)	(0.082)	(0.086)	(0.081)	(0.074)	(0.064)	(0.078)	(0.082)	(0.094)	(0.094)	(0.068)
Muslims Pop. (%)	0.000	-0.002***	-0.001*	-0.002**	-0.002**	-0.001**	0.000	-0.001	-0.001	-0.002**	-0.002**	-0.001*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Buddhist&Confu	-0.001**	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001*	0.000	-0.001	-0.001	-0.001	-0.001*
& Pop. (%)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
First Stage (p-value)							0.0002	0.0013	0.0001	0.0011	0.0001	0.0000
Sargan test (p-value)							0.6693	0.4585	0.8120	0.1539	0.0169	0.6717
Adjusted R^2	0.810	0.701	0.661	0.647	0.672	0.676	0.806	0.712	0.652	0.639	0.660	0.665
Observations	609	638	651	575	576	659	601	457	631	561	562	645

Note: This table presents OLS and corresponding 2SLS regressions (QOG) by controlling for various fixed factors and using various democracy indicators. The dependent variable equals 0 when the country is autocratic while 1 when the country is democracy. Democracy indicators are specified in the columns. The independent variables are State Capacity (*StateHist*), its square, education indicators (including primary, secondary, and tertiary enrollment rate), and education inequality. 5-lagged variant variables are used. The Data Appendix gives detailed variable sources. Sargan test is implemented for overidentification issue and the p-value is reported in bottom lines. Standard errors robust against at the country level are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

C.5. Further Robustness Checks for Transition Regressions

The transition regression models used are the same except that I explore SC, SC^2, and SC^3 (or only SC) instead of SC and SC^2 in regressions. The results are displayed in Table C.5.3-Table **??**. In most cases, there are no significant and robust linear relationships between state development and democratization. By controlling for SC, SC^2, and SC^3, state development related coefficients are significant in some regressions. However, it turns out that it is a good model when I further carefully analyze the values of these coefficients.

Suppose the coefficients of SC, SC^2, and SC^3 are β_{SC}, β_{SC^2}, and β_{SC^3}, respectively. In all the regressions with some significant estimated $\hat{\beta}_{SC}$, $\hat{\beta}_{SC^2}$, and $\hat{\beta}_{SC^3}$, I find that $\hat{\beta_{SC}} > 0$, $\hat{\beta}_{SC^2} < 0$, and $\hat{\beta}_{SC^3} > 0$. Additionally, $\hat{\beta}_{SC} + \hat{\beta}_{SC^2} < 0$ and $\hat{\beta}_{SC^2} + \hat{\beta}_{SC^3} < 0$. It is easy to verify that two turn points (A_1 and A_2) of the function $f(SC) = \beta_{SC}SC + \beta_{SC^2}SC^2 + \beta_{SC^3}SC^3$ are $A_1 = \frac{-\beta_{SC^2} - \sqrt{\beta_{SC^2}^2 - 3\beta_{SC}\beta_{SC^3}}}{3\beta_{SC}}$ and $A_2 = \frac{-\beta_{SC^2} + \sqrt{\beta_{SC^2}^2 - 3\beta_{SC}\beta_{SC^3}}}{3\beta_{SC}}$.[5] Therefore, between these two points, $f'(SC) < 0$. Since $\frac{-\beta_{SC^2} - \sqrt{\beta_{SC^2}^2 - 3\beta_{SC}\beta_{SC^3}}}{3\beta_{SC}} < 0$ and $\frac{-\beta_{SC^2} + \sqrt{\beta_{SC^2}^2 - 3\beta_{SC}\beta_{SC^3}}}{3\beta_{SC}} > 1$[6], $f'(SC) < 0$ in the whole range of SC (from 0 to 1). This indicates that only controlling for SC could be a better regression model. But I have shown that the coefficients of SC are insignificant in almost all regression when only SC is controlled. So, I ignore these two cases and conclude that incorporating both SC and SC^2 is an appropriate regression model.

[5] For all these coefficients, $\beta_{SC^2}^2 - 3\beta_{SC}\beta_{SC^3} > 0$.

[6] This inequality could be obtained because $\beta_{SC} > 0$ and $\beta_{SC} + \beta_{SC^2} < 0$.

C.5.1. Only Control SC

Table C.5.1.. Cross-Country Regressions on the Likelihood of Successful Democratic Transition by Controlling for State Development

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Democracy from: PS	Sec. Enroll	3 Edu	EduGini	Urbanization	GDP per	Urbanization &GDP per	Oil	GDP &Pop.	All (no GDP per)	All (no GDP)
SC	-0.303	-0.414	-0.846	-0.805	0.266	0.274	-0.898	0.621	0.595	0.617
	(0.655)	(0.669)	(0.795)	(0.780)	(0.905)	(0.919)	(0.804)	(1.339)	(1.346)	(1.348)
Secondary	0.564***	-0.036	-0.016	0.073	0.090	0.112	-0.05	0.127	0.155	0.136
	(0.167)	(0.376)	(0.419)	(0.439)	(0.477)	(0.539)	(0.422)	(0.494)	(0.555)	(0.559)
Primary		0.059	-0.688	-0.633	-2.111***	-2.117***	-0.485	-2.088***	-2.068***	-2.041***
		(0.597)	(0.680)	(0.687)	(0.752)	(0.757)	(0.716)	(0.756)	(0.773)	(0.765)
Tertiary		0.473**	0.522**	0.632**	0.708**	0.717**	0.523**	0.697**	0.695**	0.713**
		(0.212)	(0.221)	(0.263)	(0.319)	(0.313)	(0.222)	(0.305)	(0.312)	(0.320)
EduGini			-0.028**	-0.026*	-0.060***	-0.059***	-0.027**	-0.060***	-0.059***	-0.060***
			(0.014)	(0.014)	(0.018)	(0.019)	(0.014)	(0.017)	(0.018)	(0.019)
Urbanization				-0.355		-0.074			-0.109	-0.068
				(0.460)		(0.651)			(0.644)	(0.647)
GDP per					-0.285	-0.252				-0.310
					(0.326)	(0.423)				(0.440)
Oil Dummy							-1.139*		-0.465	-0.422
							(0.630)		(0.747)	(0.743)
GDP								-0.326	-0.243	
								(0.342)	(0.431)	
Pop.								0.225	0.146	-0.109
								(0.341)	(0.456)	(0.246)
Pseudo R-sq	0.118	0.181	0.319	0.327	0.442	0.443	0.337	0.442	0.443	0.445
Observations	72	63	59	59	47	47	59	47	47	47

Note: This table presents cross-section probit estimates only controlling *SC*. The dependent variable equals 0 for always autocratic countries and takes on the value 1 if a country was non-democratically governed before 1973, but permanently abandoned autocratic rule between 1973 and 2010. The main independent variables are State Capacity (*StateHist*), its square, enrollment rate (including primary, secondary, and tertiary), and education inequality. Urbanization ratio, GDP per capita, natural resource (oil dummy), country size (measured by GDP and population) are controlled for the further robustness checks. The Data Appendix gives detailed variable sources. Standard errors robust against at the country level are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table C.5.2.. Cross-Country Regressions on the Likelihood of Successful Democratic Transition by Controlling for State Development

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Democracy from: PS	Avg. Schooling	EduGini	Urbanization	GDP per	Urbanization &GDP per	Oil Dummy	GDP &Pop.	All (no GDP per)	All (no GDP)
SC	0.017	-0.364	-0.621	0.243	-0.075	-0.433	0.389	0.184	0.187
	(0.651)	(0.689)	(0.727)	(0.801)	(0.856)	(0.696)	(0.832)	(0.932)	(0.932)
Avg. Schooling	1.081***	0.545	0.262	-0.109	-0.347	0.457	-0.091	-0.725	-0.722
	(0.380)	(0.671)	(0.721)	(0.860)	(0.844)	(0.686)	(0.861)	(0.910)	(0.908)
EduGini		-0.023	-0.027	-0.041	-0.049*	-0.026	-0.041	-0.061**	-0.062**
		(0.019)	(0.020)	(0.026)	(0.027)	(0.020)	(0.026)	(0.030)	(0.030)
Urbanization			0.465		0.697			0.721	0.775
			(0.324)		(0.532)			(0.583)	(0.602)
GDP per				0.116	-0.212				-0.083
				(0.281)	(0.390)				(0.367)
Oil Dummy						-1.031*		-1.730*	-1.702*
						(0.609)		(0.952)	(0.943)
GDP							0.127	-0.032	
							(0.260)	(0.358)	
Pop.							-0.169	-0.098	-0.138
							(0.342)	(0.397)	(0.170)
Pseudo R-sq	0.257	0.298	0.321	0.297	0.321	0.318	0.299	0.373	0.373
Observations	64	59	59	49	49	59	49	49	49

Note: This table presents cross-section probit estimates only controlling *SC*. The dependent variable equals 0 for always autocratic countries and takes on the value 1 if a country was non-democratically governed before 1973, but permanently abandoned autocratic rule between 1973 and 2010. The main independent variables are State Capacity (*StateHist*), its square, average schooling year, and education inequality. Urbanization ratio, GDP per capita, natural resource (oil dummy), country size (measured by GDP and population) are controlled for further robustness checks. The Data Appendix gives detailed variable sources. Standard errors robust against at the country level are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table C.5.3.. Cross-Country Regressions on the Likelihood of Successful Democratic Transition by Controlling for Country Fixed Factors

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Democracy from: PS	Avg. Schooling	EduGini	Urbanization	GDP per	Urbanization &GDP per	Oil Dummy	GDP &Pop.
SC	0.004	2.06	1.39	5.470*	4.669*	1.752	3.751
	(1.281)	(1.657)	(1.706)	(3.133)	(2.789)	(1.898)	(3.593)
Avg. Schooling	1.722***	0.663	0.586	0.236	-0.245	0.152	-0.332
	(0.583)	(0.838)	(0.838)	(0.878)	(0.977)	(0.739)	(1.099)
Latitude	-0.015	-0.031	-0.047*	-0.070**	-0.128***	-0.024	-0.093**
	(0.015)	(0.020)	(0.024)	(0.034)	(0.049)	(0.023)	(0.039)
Distance to Coast/River	0.000	-0.001	0.001	-0.001	0.000	-0.001	-0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Tropics Land (%)	1.112	2.237	0.599	6.595	4.731	5.919*	6.673
	(2.657)	(2.692)	(3.172)	(4.023)	(4.072)	(3.352)	(4.598)
Tropics Pop. (%)	0.444	-0.246	1.777	-4.549	-2.266	-4.190	-3.763
	(2.775)	(2.579)	(3.126)	(3.913)	(4.307)	(3.351)	(4.703)
Colony Dummy	-1.172*	-1.224	-1.688*	-0.227	-1.946	-1.176	-0.537
	(0.696)	(0.825)	(0.990)	(0.901)	(1.598)	(0.880)	(1.035)
Executive Constraint	-1.035	-0.727	-0.794	-0.424	-2.071	-1.509	-0.809
(independence)	(0.827)	(0.942)	(0.945)	(1.170)	(1.834)	(1.093)	(1.419)
Language Fractionalization	1.191	1.653	1.291	0.725	-0.194	2.600	0.394
	(0.894)	(1.247)	(1.274)	(2.122)	(3.573)	(1.601)	(3.344)
Religion Fractionalization	-2.281**	-2.543**	-1.775*	-5.900**	-6.504***	-4.057***	-6.660***
	(0.945)	(1.024)	(1.053)	(2.544)	(2.203)	(1.544)	(2.487)
Ethnic Fractionalization	-1.009	-0.841	-2.044	2.974	3.015	-0.058	2.148
	(1.299)	(1.596)	(1.979)	(3.799)	(5.438)	(2.173)	(5.746)
Muslims Pop. (%)	-0.001	-0.003	0.000	-0.021	-0.016	-0.007	-0.014
	(0.009)	(0.012)	(0.012)	(0.016)	(0.019)	(0.014)	(0.018)
Buddhist&Confu.	-0.020**	-0.050***	-0.041**	0.042	0.024	-0.072***	0.068
Pop. (%)	(0.009)	(0.017)	(0.016)	(0.073)	(0.082)	(0.022)	(0.081)
EduGini		-0.039	-0.030	-0.058*	-0.076*	-0.077**	-0.072
		(0.031)	(0.030)	(0.035)	(0.045)	(0.032)	(0.047)
Urbanization			1.022		2.957*		
			(0.639)		(1.527)		
GDP per				-0.281	-1.254**		
				(0.424)	(0.610)		
Oil Dummy						-2.963***	
						(0.857)	
GDP							-0.113
							(0.454)
Pop.							0.586
							(0.539)
Pseudo R-sq	0.431	0.483	0.513	0.489	0.545	0.549	0.501
Observations	58	54	54	45	45	54	45

Note: This table presents cross-section probit estimates by controlling for various fixed factors and *SC*. The dependent variable equals 0 for always autocratic countries and takes on the value 1 if a country was non-democratically governed before 1973, but permanently abandoned autocratic rule between 1973 and 2010. The main independent variables are State Capacity (*StateHist*), its square, average schooling year, and education inequality. Urbanization ratio, GDP per capita, natural resource (oil dummy), country size (measured by GDP and population) are controlled for further robustness checks. The Data Appendix gives detailed variable sources. Standard errors robust against at the country level are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

C.5.2. Control For SC, SC^2, and SC^3

Table C.5.4.. Cross-Country Regressions on the Likelihood of Successful Democratic Transition by Controlling for SC, SC^2, and SC^3

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Democracy from: PS	Sec. Enroll	3 Edu	EduGini	Urbanization	GDP per	Urbanization &GDP per	Oil Dummy	GDP &Pop.	All (no GDP per)	All (no GDP)
SC	10.733*	9.005	13.989**	13.772**	12.855*	13.233*	13.012**	15.860*	15.738*	15.757*
	(6.195)	(6.375)	(6.204)	(6.262)	(7.550)	(7.504)	(6.186)	(8.617)	(8.595)	(8.631)
SC^2	-23.015	-20.946	-31.712**	-31.221*	-23.218	-24.224	-28.884*	-30.654	-30.34	-30.512
	(15.637)	(16.085)	(16.127)	(16.117)	(22.753)	(21.985)	(15.803)	(24.093)	(23.629)	(23.742)
SC^3	12.726	12.727	18.233	17.970	10.710	11.421	16.081	16.467	16.160	16.377
	(11.143)	(11.347)	(11.823)	(11.752)	(17.803)	(17.140)	(11.535)	(18.542)	(18.111)	(18.191)
Secondary	0.614***	0.015	0.120	0.185	0.404	0.460	0.095	0.451	0.503	0.488
	(0.190)	(0.370)	(0.414)	(0.431)	(0.439)	(0.529)	(0.421)	(0.479)	(0.572)	(0.574)
Primary		0.181	-0.591	-0.554	-2.049***	-2.069***	-0.447	-1.967***	-1.961***	-1.945***
		(0.585)	(0.668)	(0.674)	(0.724)	(0.739)	(0.701)	(0.725)	(0.748)	(0.743)
Tertiary		0.397*	0.415	0.500*	0.451	0.476	0.415	0.495	0.494	0.508
		(0.223)	(0.254)	(0.278)	(0.389)	(0.361)	(0.255)	(0.372)	(0.363)	(0.369)
EduGini			-0.032**	-0.031**	-0.061***	-0.059***	-0.031**	-0.059***	-0.057***	-0.057***
			(0.013)	(0.013)	(0.021)	(0.022)	(0.013)	(0.020)	(0.021)	(0.021)
Urbanization				-0.268		-0.182			-0.181	-0.155
				(0.453)		(0.655)			(0.657)	(0.654)
GDP per					-0.076	0.004				-0.095
					(0.319)	(0.456)				(0.464)
Oil Dummy							-1.168**		-0.674	-0.642
							(0.587)		(0.785)	(0.768)
GDP								-0.180	-0.053	
								(0.346)	(0.480)	
Pop.								-0.012	-0.125	-0.186
								(0.340)	(0.516)	(0.274)
Pseudo R-sq	0.172	0.209	0.385	0.388	0.505	0.506	0.398	0.510	0.512	0.512
Observations	72	63	59	59	47	47	59	47	47	47

Note: This table presents cross-section probit estimates by controlling for SC, SC^2, and SC^3. The dependent variable equals 0 for always autocratic countries and takes on the value 1 if a country was non-democratically governed before 1973, but permanently abandoned autocratic rule between 1973 and 2010. The main independent variables are State Capacity (*StateHist*), its square, average schooling year, and education inequality. Urbanization ratio, GDP per capita, natural resource (oil dummy), country size (measured by GDP and population) are controlled for further robustness checks. The Data Appendix gives detailed variable sources. Standard errors robust against at the country level are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table C.5.5.. Cross-Country Regressions on the Likelihood of Successful Democratic Transition by Controlling for SC, SC^2, and SC^3

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Democracy from: PS	Avg. Schooling	EduGini	Urbanization	GDP per	Urbanization &GDP per	Oil	GDP &Pop.	All (no GDP per)	All (no GDP)
SC	6.569	10.496*	11.835*	11.581*	10.879*	8.878	11.929*	11.619*	11.516
	(6.301)	(6.243)	(6.539)	(6.655)	(6.550)	(6.091)	(7.082)	(7.059)	(7.067)
SC^2	-10.245	-20.208	-25.593	-20.143	-19.615	-15.456	-21.196	-22.006	-21.736
	(15.540)	(15.193)	(16.524)	(16.931)	(17.262)	(14.873)	(17.819)	(18.291)	(18.358)
SC^3	3.325	9.592	13.989	8.841	8.833	5.951	9.680	10.972	10.789
	(10.892)	(10.679)	(11.749)	(12.434)	(12.893)	(10.533)	(13.119)	(13.449)	(13.517)
Avg. Schooling	1.119***	0.460	0.162	-0.089	-0.297	0.380	-0.090	-0.719	-0.724
	(0.368)	(0.621)	(0.658)	(0.739)	(0.738)	(0.637)	(0.737)	(0.798)	(0.798)
EduGini		-0.030*	-0.034*	-0.046**	-0.052**	-0.033*	-0.045**	-0.063**	-0.064**
		(0.018)	(0.018)	(0.023)	(0.024)	(0.019)	(0.023)	(0.027)	(0.027)
Urbanization			0.470		0.550			0.583	0.627
			(0.327)		(0.546)			(0.586)	(0.591)
GDP per				0.120	-0.141				0.035
				(0.234)	(0.366)				(0.372)
Oil						-1.095**		-1.738**	-1.715**
						(0.516)		(0.746)	(0.742)
GDP							0.148	0.080	
							(0.234)	(0.371)	
Pop.							-0.155	-0.177	-0.103
							(0.304)	(0.401)	(0.187)
Pseudo R-sq	0.295	0.358	0.378	0.379	0.392	0.377	0.380	0.437	0.437
Observations	64	59	59	49	49	59	49	49	49

Note: This table presents cross-section probit estimates by controlling SC, SC^2, and SC^3. The dependent variable equals 0 for always autocratic countries and takes on the value 1 if a country was non-democratically governed before 1973, but permanently abandoned autocratic rule between 1973 and 2010. The main independent variables are State Capacity (*StateHist*), its square, average schooling year, and education inequality. Urbanization ratio, GDP per capita, natural resource (oil dummy), country size (measured by GDP and population) are controlled for further robustness checks. The Data Appendix gives detailed variable sources. Standard errors robust against at the country level are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table C.5.6.. Cross-Country Regressions on the Likelihood of Successful Democratic Transition by Controlling for SC^3, SC^2, SC, and Other Covariates

	(1)	(2)	(3)	(4)	(5)	(6)
Democracy from: PS	Avg. Schooling	EduGini	Urbanization	GDP per	Oil Dummy	GDP &Pop.
SC	15.083*	19.997*	29.342**	24.064*	16.839*	22.139
	(8.264)	(10.837)	(12.996)	(12.435)	(10.029)	(14.714)
SC^2	-26.085	-36.791	-61.424*	-47.039	-30.94	-37.095
	(21.018)	(27.575)	(31.603)	(32.061)	(25.831)	(48.454)
SC^3	11.065	19.200	35.124	28.276	15.198	14.603
	(15.119)	(19.700)	(21.954)	(23.758)	(18.658)	(39.568)
Avg. Schooling	1.356**	0.098	-0.558	-0.197	-0.264	-2.069
	(0.622)	(0.846)	(0.788)	(0.822)	(0.779)	(2.362)
EduGini		-0.053*	-0.050*	-0.069**	-0.091***	-0.128*
		(0.028)	(0.028)	(0.028)	(0.035)	(0.072)
Urbanization			1.567**			
			(0.722)			
GDP per				-0.271		
				(0.396)		
Oil					-2.718***	
					(0.922)	
GDP						-0.156
						(0.429)
Pop.						1.614
						(1.453)
Latitude	-0.024	-0.033	-0.066*	-0.058	-0.010	-0.200
	(0.018)	(0.023)	(0.039)	(0.044)	(0.025)	(0.198)
Distance to Coast/River	0.000	-0.001	0.000	-0.001	-0.001	-0.004
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.003)
Tropics Land (%)	1.104	2.480	0.921	7.164	6.281*	14.535
	(2.662)	(2.736)	(2.997)	(4.575)	(3.794)	(11.945)
Tropics Pop. (%)	0.103	-1.114	0.697	-6.710	-5.251	-11.893
	(2.770)	(2.726)	(3.041)	(4.650)	(3.981)	(11.109)
Colony Dummy	-1.845**	-1.781**	-2.829**	-0.875	-1.516*	-3.339
	(0.767)	(0.826)	(1.302)	(0.986)	(0.820)	(2.453)
Executive Constraint	-0.536	-0.481	-0.408	-0.501	-1.211	-3.587
(independence)	(0.932)	(0.984)	(1.022)	(1.049)	(1.086)	(4.089)
Language	1.153	2.018*	1.042	0.504	3.584*	-6.203
Fractionalization	(1.018)	(1.226)	(1.393)	(1.469)	(2.014)	(10.925)
Religion	-1.599	-2.006	-1.312	-6.188**	-3.596*	-12.393
Fractionalization	(1.173)	(1.511)	(1.837)	(2.428)	(1.998)	(10.703)
Ethnic	-1.653	-1.405	-2.779	4.394	-1.381	12.135
Fractionalization	(1.562)	(1.919)	(2.087)	(3.717)	(2.537)	(17.060)
Muslims Pop. (%)	-0.007	-0.007	-0.005	-0.026	-0.011	-0.025
	(0.010)	(0.014)	(0.015)	(0.018)	(0.015)	(0.039)
Buddhist&Confu.	-0.021**	-0.049***	-0.041**	0.075	-0.070***	0.282
Pop. (%)	(0.009)	(0.017)	(0.018)	(0.077)	(0.023)	(0.281)
Pseudo R-sq	0.500	0.557	0.609	0.546	0.600	0.575
Observations	58	54	54	45	54	45

Note: This table presents cross-section probit estimates by controlling for various fixed factors and SC, SC^2, and SC^3. The dependent variable equals 0 for always autocratic countries and takes on the value 1 if a country was non-democratically governed before 1973, but permanently abandoned autocratic rule between 1973 and 2010. The main independent variables are State Capacity (*StateHist*), its square, average schooling year, and education inequality. Urbanization ratio, GDP per capita, natural resource (oil dummy), country size (measured by GDP and population) are controlled for further robustness checks. The Data Appendix gives detailed variable sources. Standard errors robust against at the country level are reported in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

C.6. Summary Statistics for the Main Indicators

Table C.6.1.. Summary Statistics for the Main Indicators

	Non-Democracies					Democracies				
Variable	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max
Variant Indicators										
GDP per Capita (2010 US$)	3,128	4784	10700	115.44	115003	3,057	15478	16776	169	110001
Investment Share of GDP	2,849	22.57	13.86	-13.41	219.07	2,871	23.80	7.23	0	93.13
Primary Enrollment Rate	2,570	89.46	27.91	2.83	211.30	2,550	102.22	13.36	29.16	165.65
Secondary Enrollment Rate	2,116	44.61	31.14	0	115.97	2,249	79.23	27.71	5.13	162.61
Tertiary Enrollment Rate	2,001	11.12	13.11	0	119.78	2,028	31.00	23.03	0	102.73
Avg. Years of Sec. Schooling (25+)	609	1.05	1.13	0.02	6.89	597	2.51	1.41	0.09	6.90
Education Inequality	2,891	52.16	23.51	8.92	99.80	2,675	24.55	13.99	3.77	90.10
Invariant Indicators										
State Capacity (at 2010)	41	0.35	0.26	0.02	0.92	87	0.38	0.25	0.01	0.98
Latitude	54	18.24	16.81	-26.65	53.55	97	20.17	28.51	-41.81	67.47
Distance Coast/River	51	514.36	545.13	14.18	2291.68	88	232.52	370.08	7.95	2385.58
Tropics Land (%)	51	0.57	0.48	0	1	88	0.44	0.47	0	1
Tropics Pop. (%)	51	0.56	0.49	0	1	88	0.43	0.48	0	1
Colony Dummy	54	0.78	0.42	0	1	97	0.55	0.50	0	1
Executive Constraint (independence)	43	0.23	0.22	0	1	76	0.44	0.39	0	1
Language Fractionalization	50	0.50	0.27	0.01	0.92	94	0.33	0.27	0.00	0.90
Religion Fractionalization	53	0.43	0.23	0.00	0.78	98	0.44	0.23	0.00	0.86
Ethnic Fractionalization	53	0.54	0.25	0.04	0.93	98	0.39	0.24	0.00	0.88
Muslims Pop. (%)	45	45.56	41.85	0	99.93	88	11.17	24.76	0	99.76
Buddhist& Confucian & Chondogyo & Shintoist. Pop. (%)	45	7.92	22.63	0	94.99	88	4.34	18.83	0	95.83

Note: The table presents the statistics separately for non-democracies (country-years for which the dichotomous democracy measure is 0), democracies (country-years for which the dichotomous democracy measure is 1). See the Appendix C.8 for the full description of the variables and their corresponding sources.

C.7. The Roles of Political Regimes in Academic and Information Freedom

Economic prosperity is inseparable from the general human capital. General human capital is one of the important sources for innovation and adoption of new production and organization techniques. To cultivate the high quality of general human capital, it is crucial to encourage individual initiative and independent thinking during schooling and to remove the propaganda-based curriculum that aims to indoctrinate pupils with a heavy dose of obedient and patriotic conditioning. In addition, information freedom, such as freedoms of speech and press, enhances the diffusion of new ideas among the masses, as well as enables better comparisons of different ideas, both of which can improve the quality of human capital and are central elements in processes of technological change (Knutsen, 2015).

Here, I provide some empirical evidence on the roles of democracy (PS) in academic and information freedom. In the following dynamic panel regression model, the dependent variable $Freedom_{it}$ is the indicator that measures academic or information freedom, which is extracted from V-Dem Project.[7] Four of its lagged levels are controlled as well as four lagged per capita GDP to capture the dynamic process of freedom and the dynamic effects of general development. The set of country and time dummies are also included. This model is estimated by the within estimator.

$$Freedom_{it} = \beta_1 Democracy + \sum_{j=1}^{4} \alpha_j Freedom_{it-j} + \sum_{j=1}^{4} \varphi_j y_{it-j} + \lambda_i + \delta_t + \varepsilon_{it}.$$

The results are displayed in Table C.7.1, including both OLS results and corresponding 2SLS ones. Clearly, democracy improves academic freedom, media freedom, and freedom of speech. At the same time, it also reduces the censorship and media bias.

[7] See the explanations of these indicators in the Data Appendix.

Table C.7.1.. Effects of Democracy (PS) in Academic Freedom and Information Freedom

Dependent Variable:	(1) Freedom Of Expression And Alternative Sources Of Information Index	(2) Freedom Of Academic And Cultural Expression	(3) Harassment Of Journalists	(4) Media Self-censorship	(5) Media Bias	(6) Print And Broadcast Media Critical	(7) Print And Broadcast Media Perspectives	(8) Freedom Of Discussion For Men	(9) Freedom Of Discussion For Women	(10) Government Censorship Effort (Media)
					Panel A: OLS Panel Regression					
Democracy	0.044***	0.249***	0.149***	0.165***	0.198***	0.142***	0.171***	0.288***	0.239***	0.228***
	(0.009)	(0.047)	(0.038)	(0.038)	(0.045)	(0.040)	(0.040)	(0.054)	(0.045)	(0.041)
Countries	143	143	143	135	143	143	143	143	143	135
Observations	5202	5202	5202	4940	5202	5202	5202	5202	5202	4940
Adjusted R^{2}	0.921	0.911	0.894	0.892	0.895	0.905	0.905	0.904	0.905	0.887
					Panel B: IV Panel Regression					
Democracy	0.107***	0.557***	0.312***	0.289***	0.424***	0.333***	0.293***	0.667***	0.447***	0.520***
	(0.023)	(0.106)	(0.086)	(0.082)	(0.094)	(0.102)	(0.080)	(0.144)	(0.097)	(0.111)
Hansen Test (P-value)	0.254	0.573	0.512	0.0334	0.0901	0.123	0.105	0.240	0.593	0.226
1st Stage F-stat	8.865	11.10	13.58	13.27	11.71	13.83	14.14	8.653	10.67	9.449
Partial R2	0.116	0.128	0.165	0.187	0.154	0.176	0.173	0.0993	0.135	0.139
Countries	142	142	142	134	142	142	142	142	142	134
Observations	5,130	5,130	5,130	4,868	5,130	5,130	5,130	5,130	5,130	4,868
R-sq	0.918	0.908	0.894	0.893	0.894	0.905	0.906	0.900	0.905	0.885

Note: Four lags of dependent variables as well as four lags of GDP per capita are controlled in each column. A full set of country and year fixed effects are controlled in all specifications. Standard errors robust against heteroscedasticity and serial correlation at the country level are reported in parentheses. Panel A reports the OLS regression results. Panel B reports the IV regression results, instrumenting democracy by using 4 lagged regional wave of democratizations. Only countries that share similar political regimes at the beginning of the sample are used to construct the regional average values. The regional classification is from QOG. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

C.8. Data Sources

The indicator from Bockstette, Chanda and Putterman (2002): **StateHist.**[8]

Indicators from World Development Indicators (2015 Edition): **Enrollment Rates (including primary, secondary, and tertiary), Fertility Rat**e, **GDP per capita, Government Spending Share of GDP, Inflation Rate, Investment Rate, Life Expectancy, Population, Regional Area (WDI), Trade Share of GDP, Urbanization Rate.**

Indicators from Quality of Government Data Set: **Regional Area**[9]**, Average Schooling Years in the Population (15 Years Old and Above**).

Indicators from V-Dem Project: **Colonial Origin, Educational Gini**[10]**, Ethnic Fractionalization**[11]**, Freedom of Academic and Cultural Expression**[12]**, Freedom of Discussion for Men**[13]**, Freedom of Discussion for Women**[14]**, Freedom of Expression and Alternative Sources of Information Index**[15]**, Government Censorship Effort in Media**[16]**, Harassment of Journalists**[17]**, Language Frac-**

[8]It is a 0-1 index that increases in the following factors: the amount of time a government existed above the tribal level during the years 1 to 1950 CE; the amount of time this government was locally based rather than foreign-based; and the percentage of the territory of the modern country that was ruled by this government.

[9]There are 10 areas, including Eastern Europe and post Soviet Union (including Central Asia); Latin America (including Cuba, Haiti & the Dominican Republic); North Africa & the Middle East (including Israel, Turkey & Cyprus); Sub-Saharan Africa; Western Europe and North America (including Australia & New Zealand); East Asia (including Japan & Mongolia); South-East Asia; South Asia; The Pacific (excluding Australia & New Zealand); The Caribbean (including Belize, Guyana & Suriname, but excluding Cuba, Haiti & the Dominican Republic).

[10]Gini coefficient of educational inequality estimated from average education data using the method suggested by Thomas, Wang and Fan (2001) and Checchi (2006).

[11]The definition of ethnicity involves a combination of racial and linguistic characteristics.

[12]It measures the degree of academic freedom and freedom of cultural expression related to political issues.

[13]It measures the degree of men openly discuss political issues in private homes and in public spaces.

[14]It measures the degree of women openly discuss political issues in private homes and in public spaces.

[15]It combines 9 freedom indicators to measure the degree of government respect press and media freedom, the freedom of ordinary people to discuss political matters at home and in the public sphere, as well as the freedom of academic and cultural expression.

[16]It measures the degree of governments attempt to censor the print or broadcast media.

[17] It measures the degree of individual journalists harassed by governmental or powerful nongovernmental actors while engaged in legitimate journalistic activities.

tionalization[18]**, Media Bias**[19]**, Media Self-Censorship**[20]**, Print and Broadcast Media Critical**[21]**, Print and Broadcast Media Perspectives**[22]**, Religion Fractionalization**[23]**, Share of Muslims Population**[24]**.**

Indicators from Acemoglu et al. (2019): **Distance to Coast or River, Latitude, Share of Tropics Population, Share of Tropics Land.**

Indicators from Papaioannou and Siourounis (2008*b*): **Democracy**[25]**, Executive Constraints at Independence**[26]**, Share of Confucian and Buddhist Population.**

The indicator from Cervellati et al. (2014): **Oil Dummy.**[27]

Alternative Democracy indicators are from Acemoglu et al. (2019), Boix, Miller and Rosato (2013), Cheibub, Gandhi and Vreeland (2010), **Freedom House**, **and Polity IV.**

[18]It reflects the probability that two randomly selected people from a given country will not belong to the same linguistic group.

[19]It measures the degree of media bias against opposition parties or candidates.

[20]It measures the degree of self-censorship among journalists when reporting on issues that the government considers politically sensitive.

[21]It measures the degree of the major print and broadcast outlets criticize the government.

[22]It measures the degree of the major print and broadcast media that represent a wide range of political perspectives.

[23]It reflects the probability that two randomly selected people from a given country will not belong to the same religious group.

[24]Muslims as a percentage of the population in 1980.

[25]I mainly use it as the main indicator to measure democracy. It is a dichotomous indicator, which equates to 1 if the country had permanent democratization and the year after or if it is always democratic country, and equates to 0 if the country is autocracy. Other cases (including the countries experienced political setbacks, the countries with stable intermediate between autocracy and democracy, the countries with borderline democratization) are set as missing values.

[26]Average value during the first ten post-independence years. If the data for the first 10 years after independence is missing, I average over the first ten years of available data. The measure is normalized to lie between 0 and 1.

[27]It is equal to 1 if it is the current and the former OPEC member, 0 otherwise.