Higher Education Effects Over Democracy Indicators

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Abstract: The purpose of this study is to examine the impact of higher education on democratic dynamics, specifically focusing on the number of national elections and the variety of political parties across 159 countries from 1990 to 2020. It aims to differentiate the effects of educational quantity from educational quality.

The research utilizes a cross-sectional dataset. To address endogeneity issues, such as reverse causality and omitted variable bias, the study employs spatial autoregressive (SAR) and spatial error models (SEM). These models account for spatial dependencies and regional political norms that influence democratic outcomes.

The results reveal distinct effects for education quantity and quality. A higher number of universities is associated with an increase in political parties, fostering pluralism, but does not significantly affect election frequency. Conversely, higher education quality positively correlates with election frequency and negatively with the number of parties, suggesting a "screening effect" that promotes institutional stability and consolidated party systems.

This paper contributes to the literature by disaggregating higher education into quantity and quality metrics. It provides a novel application of spatial econometrics to clarify the nuanced contributions of educational infrastructure to specific democratic indicators, offering a more sophisticated understanding than traditional aggregate measures.

For policymakers, the findings suggest that quantitative expansion of universities promotes political representation, while qualitative improvements are essential for institutionalizing electoral processes and reducing party fragmentation.

Keywords: democracy; higher education; elections; political parties; spatial econometrics; institutional quality.

JEL Classification: I23; I25; C31; D72; A12.

Introduction

This study investigates the impact of higher education on democratic dynamics, specifically the number of elections and political parties across 159 countries from 1990 to 2020. Education is disaggregated into quantity (institution counts) and quality (global rankings). While classic works argue that education enhances democratic values (Lipset, 1959), recent empirical studies present mixed findings (Acemoglu *et al.* 2005). We address this gap and the challenge of endogeneity by employing spatial autoregressive (SAR) and spatial error models (SEM) to account for regional dependencies. Our findings reveal that a higher number of universities is associated with an increase in political parties but has no significant effect on election frequency. Conversely, higher education quality positively influences elections while reducing party numbers, suggesting a "screening effect" where quality education fosters informed citizens and consolidated party systems. These results offer insights for policymakers aiming to strengthen democratic institutions. The paper is organized as follows: Section 2 reviews the literature; Section 3 summarizes data and sources; Section 4 presents the empirical framework; Section 5 discusses the estimation results; and

Section 6 concludes with policy implications and future research directions. Our methodology ensures robust findings by addressing spatial autocorrelation and potential reverse causality issues.

1. Literature Review

With more sophisticated econometric techniques, the literature exploring the nexus between education and democracy has expanded significantly. This section reviews this literature, organized into three areas: theoretical foundations of education's role in democracy, empirical challenges including endogeneity, and the impact of education on political participation and party systems. Our study builds on these works to examine how higher education quantity and quality affect the number of elections and political parties across 159 countries from 1990 to 2020.

Classic studies established a foundational link between education and democratic development. Lipset (1959) argues that education, particularly higher education, is a necessary condition for democracy, improving citizens' tolerance, civic engagement, and preference for democratic institutions. Similarly, Watt & Lerner (1961) and Apter (1961) suggest that education drives modernization, promoting values like civil liberties and political diversity. These works assert that higher education amplifies democratic tendencies by equipping individuals with critical thinking skills and awareness of democratic norms (see also Bobo & Licari, 1989; Golebiowska, 1995; Marquart-Pyatt & Paxton, 2006). Additionally, Glaeser et al. (2007) extend this argument by arguing that education enables citizens to recognize the benefits of democratic systems, increasing support for democracy over authoritarian regimes. Using data from the World Values Survey, General Social Survey, and DDB Needham Lifestyles Survey, they find that higher education is a necessary, but not sufficient, condition for democratic preferences.

On the other hand, recent empirical studies have analyzed the causal relationship between education and democracy, highlighting endogeneity as a key challenge. Glaeser et al. (2004), using the Freedom House Political Rights Index and education data from Barro & Lee (2000), find no robust evidence that education directly improves democratic outcomes, suggesting reverse causality where democratic institutions drive educational expansion. Similarly, Acemoglu et al. (2005) employ cross-sectional models to argue that an educated population does not necessarily lead to democracy, as unobserved factors (*e.g.*, economic development) may confound the relationship. Karış & Tandoğan (2019) reach similar conclusions, emphasizing the role of institutional contexts. To address endogeneity, some studies adopt advanced methodologies. Rodrigues (2023) uses historical missionary activity as an instrumental variable, finding a positive effect of education on democratic attitudes in Latin America. Sanborn & Thyne (2014) utilize panel data to demonstrate that education supports democratic transitions by encouraging institutional stability, particularly in post-authoritarian contexts. More recently, Le and Nguyen (2021) exploit compulsory schooling reforms across 39 countries as instruments, finding that education cultivates political interest and supportive attitudes toward political freedoms, though it does not significantly affect voting behavior itself. Dahlum and Knutsen (2022), in a comprehensive meta-analysis, conclude that the overall education–political regime relationship is positive but small and contingent on contextual factors such as the level of schooling and the prevailing regime type. These findings highlight the need for robust econometric techniques, which our study addresses through spatial autoregressive (SAR) and spatial error models (SEM).

Most of the literature focuses on overall democratic outcomes, but few studies explore education's impact on specific indicators such as election frequency and political party numbers, which are central to our analysis. Mattes & Luescher-Mamashela (2012), using the Afrobarometer data from Kenya and Tanzania, find that university-educated citizens exhibit stronger support for democracy, evidenced by higher electoral participation. Larreguy & Marshall (2017) extended the analysis, using quasi-experimental methods to show that education increases voter turnout and political engagement in African contexts. However, Croke et al. (2016) complicate this picture by finding that in electoral authoritarian regimes, education can lead to deliberate disengagement, as schooling under such conditions may signal the futility of political participation rather than empower it. This tension between education's mobilizing and demobilizing effects underscores the importance of institutional context — a gap that our study addresses by distinguishing between institutional quantity and academic quality across diverse regime types.

2. Methodology

2.1 Data

This section describes the cross-sectional dataset, sources, and variables used to analyze the relationship between tertiary education and democratic outcomes across 159 countries, with variables averaged from 1990 to 2020. The dataset integrates data on higher education quantity and quality with democracy indicators and control variables,

enabling robust econometric analysis. Below, we outline the dataset structure, detail the variables, and present descriptive statistics and preliminary visualizations.

The dataset comprises a cross-sectional structure for 159 countries, constructed by averaging all variables over the period 1990-2020 to capture long-run relationships. Data on tertiary education quantity and quality are sourced from global university databases, covering approximately 32,246 higher education institutions (universities, colleges, and institutes) across 214 countries, aggregated to the 159 countries in our sample based on data availability for democracy indicators. Missing data are handled by averaging available years within the period, with no interpolation applied to ensure data integrity. Valero (2019)

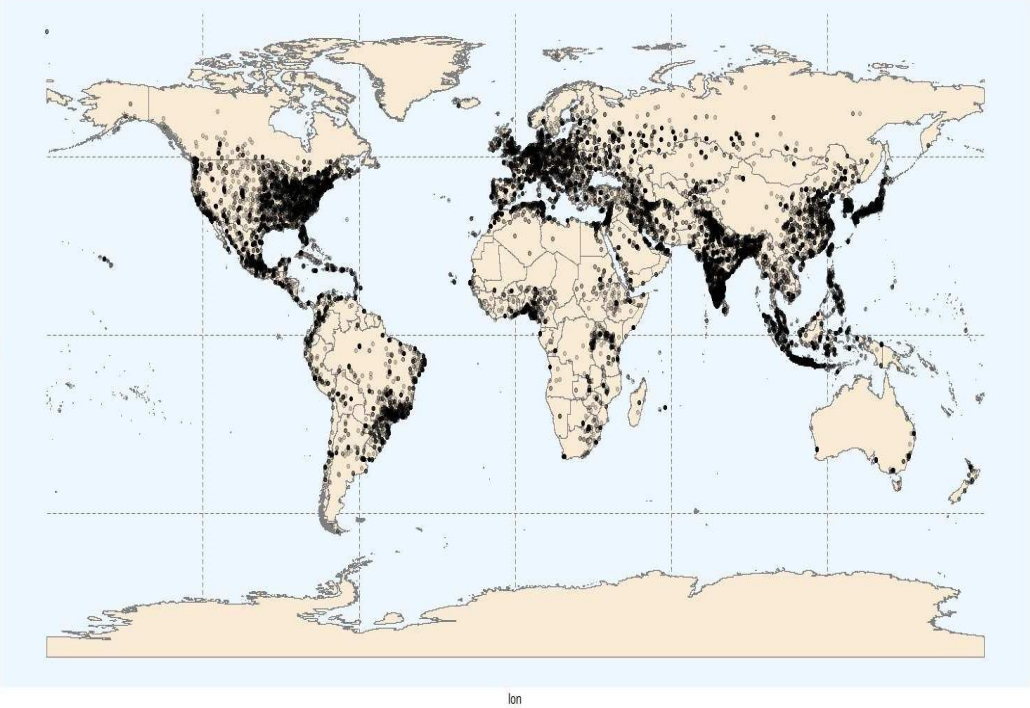
Democracy Indicators

The endogenous variables, representing democratic outcomes, are obtained from the Constituency Level Elections Archive (CLEA) (CLEA, 2019). The first variable, `elec_num`, denotes the number of national elections held from 1990 to 2017, covering 159 countries. The second variable, `pty_num`, represents the number of political parties active within a country over the same period. CLEA was selected for its comprehensive coverage and detailed election data, ensuring consistency across countries.

Tertiary Education Variables

The main exogenous variables capture tertiary education quantity and quality. For quantity, we use univ, the total number of higher education institutions per country in 2020, sourced from the *Ranking Web of Universities* (https://www.webometrics.info/en). This database includes 32,246 institutions across 214 countries, aggregated to country-level counts using geolocation data. Figure 1 illustrates the global distribution of these institutions.

Figure 1. Map of Universities Across the Globe



Source: QS World University Rankings and Times Higher Education (THE) World University Rankings

For quality, we use two proxies: dqs, the number of universities per country listed in the *QS World University Rankings*, and dshanghai, the number listed in the *Times Higher Education (THE) World University Rankings*. These rankings, covering 2011–2020 (Table 1), identify high-quality institutions based on academic reputation, research output, and teaching quality. We use raw counts of ranked universities rather than percentages to reflect absolute quality presence, though robustness checks with normalized measures are conducted. The choice of QS and THE rankings ensures global comparability, despite potential biases toward English-speaking and research-focused universities (Bömmel & Heineck, 2020).

Table 1. Data available for University Rankings

Year	THE	QS
2011	200	
2012	402	
2013	400	834
2014	400	863
2015	401	891
2016	800	916
2017	981	980
2018	1103	980
2019	1258	1021
2020	1397	1024

Source: QS World University Rankings and Times Higher Education (THE) World University Rankings

Control Variables

Control variables are sourced from two databases. From the World Development Indicators (WDI), we include:

- `log(gdp_p_pc)`: Natural logarithm of GDP per capita (constant 2015 USD), averaged over 1990–2020.
- `log(pop)`: Natural logarithm of population (millions), averaged over 1990–2020.
- `LIC, LMIC, UMIC`: Dummy variables for low-income, lower-middle-income, and upper-middle-income countries, respectively, based on WDI classifications, 2020. The high-income dummy is omitted to avoid multicollinearity.

From the Database of Political Institutions 2017 (DPI-2017) (Cruz *et al.* 2018), we include:

- `yrsoffc`: Number of years the chief executive has been in office, averaged over 1990 − 2017.
- `military`: Dummy variable indicating whether the chief executive is a military officer (1 =yes; 0 =no).
- `execrel`: Categorical variable for the religious nature of the ruling party (0 = none, 1 =Christian, 2 =Catholicism, 3 =Islam, 4 =Hindu, 5 =Buddhist, 6 =Jewish).
- `execrlc`: Categorical variable for the party's economic policy orientation (1 = right, 2 = center, 3 = left, 0 = no information, or NA = no executive).

These variables control for economic, demographic, and political factors on the analysis of the education-democracy relationship. For details on DPI variables, see Cruz et al. (2018); Scartascini et al. (2018).

2.2 Descriptive Analysis

Table 2. Summary Statistics

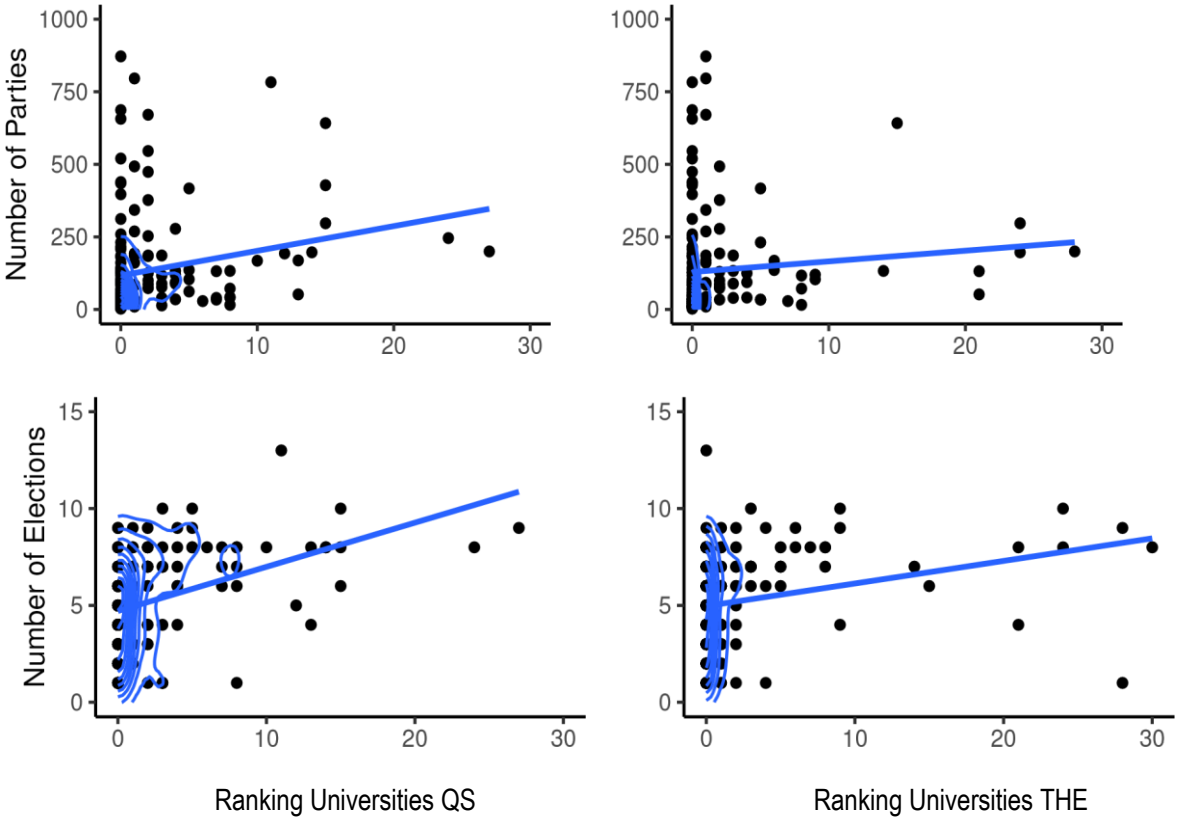
Statistic	N	Mean	St. Dev.	Min	Max
pty_num	170	261.9	830.8	3	9,353
elec_num	170	5.2	2.7	1	16
dqs	162	3.7	12.6	0	135
dshanghai	162	4.2	16.0	0	156
univ	162	169.4	604.9	1	5,021
gdp_pc	163	15,273	22,542	318	167,313
pop	166	27.986	96.389	10.237	1,139.727
nad1	169	16.9	16.1	1	85
yrsoffc	140	6.4	5.1	2.1	29.7
military	140	0.1	0.3	0.0	1.0
execrel	140	0.2	0.5	0.0	3.0
execrlc	139	1.3	0.9	0.0	3.0

Source: QS World University Rankings, Times Higher Education (THE) World University Rankings, World Development Indicators (WDI), and the Database of Political Institutions 2017 (DPI-2017).

Table 2 presents descriptive statistics for key variables. The mean number of elections (`elec_num`) is 5.2, with a maximum of 26, indicating significant variation in electoral frequency. The number of parties (`pty_num`) has a mean of 26.2. The average country has 169.4 universities (`univ`), with 3.7 and 4.8 in QS and THE rankings (`dqs`, `dthe`), respectively. GDP per capita and population show wide ranges, reflecting economic and demographic diversity.

To analyze in more detail the potential relationship between the democracy indicators and higher education quality, we present Figure 2. In this figure, we show a set of scatter plots of the relationship between each of the democracy indicators, i.e., the number of parties and the number of elections versus two variables that may capture the quality of tertiary education, i.e., the number of universities included into two main rankings, the QS and Shanghai rankings. Also, we include the center of mass of the relationship between the two variables we analyze, the center of mass are the areas where there is a large density of data in the relationship between variables. Furthermore, we include the fitted line to observe the sign of the correlation between those variables.

Figure 2. Scatter Plot of Universities Rankings vs. the Number of Elections and Parties



Source: QS World University Rankings, Times Higher Education (THE) World University Rankings, World Development Indicators (WDI), and the Database of Political Institutions 2017 (DPI-2017).

On the left column of the figure, we have the scatter plots for each democracy indicator and the number of universities included in the ranking QS; on the right column, we observe the scatter plots of the democracy indicators versus the number of universities included into the shanghai ranking.

According to the figure, we observe a positive relationship between the proxy of quality of tertiary education. Also, we notice that the number of elections is more strongly related to the ranking of universities than the number of parties. In other words, countries with a larger number of universities included in international rankings are countries that have more elections as well as number of parties; however, this last relationship is not as clear as the first one.

2.3 Methodology

This section shows the econometric approach to analyze the impact of higher education quantity and quality on democratic outcomes across 159 countries, using data averaged from 1990 to 2020. We present a baseline cross-sectional model and address endogeneity using spatial econometric models, ensuring robust causal inference. The

methodology accounts for spatial dependencies and unobserved factors, based on previous studies (Sanborn & Thyne, 2014; Rodrigues, 2023).

To examine the relationship between higher education and democracy, we specify the following cross-sectional model:

$$democracy_i = \beta_0 + \beta_1 ranking_i + \beta 2 log(univ)_i + X_i'\alpha + \varepsilon_i, \quad (1)$$

where $democracy_i$ represents the democracy indicators for country i; similarly, $elec\_num$ is number of national elections, 1990–2017, and pty_num is the number of political parties, 1990–2017, both sourced from the Constituency-Level Elections Archive (CLEA) (CLEA, 2019). The explanatory variable $ranking_i$ denotes the number of universities in country i listed in the QS World University Rankings (dqs) or the Times Higher Education World University Rankings ($dshanghai$), serving as proxies for tertiary education quality. The variable $log(univ)_i$ is the natural logarithm of the total number of universities, colleges, and institutes, sourced from the Ranking Web of Universities, capturing education quantity. The vector X_i' includes control variables averaged over 1990–2020: $log(gdp\_pc)$ which stands for the natural logarithm of GDP per capita in constant 2010 USD, $log(pop)$ is the natural logarithm of population in millions, nad1 is the number of administrative regions, yrsoffc represents the years the chief executive has been in office, military is a dummy for military chief executive, execrel is the religious nature of parties (categorical), and execrlc is the party economic policy orientation (categorical), sourced from the World Development Indicators and Database of Political Institutions 2017 (Cruz *et al.* 2018).

A key challenge in estimating equation (1) is endogeneity, which may arise from three sources: (1) reverse causality, where democratic institutions promote educational expansion; (2) omitted variables, such as cultural or historical factors influencing both education and democracy; and (3) measurement errors, particularly in ranking-based quality proxies. Ordinary Least Squares (OLS) estimation of equation (1) may yield biased coefficients if explanatory variables are correlated with the error term εi, leading to incorrect inferences about causal relationships (Acemoglu *et al.* 2005).

On the other hand, X_i' represents the set of control variables that might be related to the democracy indicators. Among these variables, we include the natural logarithm of population, $log(pop)$; the natural logarithm of the GDP per capita on constant dollars of 2010, $log(gdp\_pc)$; the number of administrative regions, $nad1$; the average years that the executive has been in the office, yrsoffc; the percentage of years where the chief executive was a military officer, military; the average religious nature of parties, execrel; and the average party orientation with respect to the economic policy, execrlc. All the variables are taken on average between 1990 and 2020 to capture the long-run effects among variables.

To address endogeneity, particularly spatial endogeneity due to geographic proximity and shared unobserved characteristics (*e.g.*, regional political norms or influence), we employ Spatial Autoregressive (SAR) and Spatial Error Models (SEM). Spatial dependence is critical in cross-country studies, as democratic outcomes in one country may influence or be influenced by those in neighboring countries (Sanborn & Thyne, 2014). The spatial weights matrix W is constructed based on contiguity criteria, in other words, W is a matrix fill with 1 and 0, where 1 represents that two countries share borders. In the case that countries are isolated, we complete the contiguity looking for their 3 nearest neighbors based on distance among their centroids.

The SAR model is specified as:

$$democracy_i = \beta_0 + \rho W_{\{ij\}} democracy_j + \beta_1 ranking_i + \beta_2 log(univ)_i + X_i'\alpha + \varepsilon_i, \quad (2)$$

where $\rho W_{ij} democracy_j$ is the spatially lagged dependent variable, and ρ quantifies the strength of spatial spillovers. A significant ρ indicates that democratic outcomes in country i are influenced by those in neighboring countries, potentially due to policy diffusion or regional norms (Fortunato & Panizza, 2015). By accounting for these spillovers, the SAR model provides more consistent estimates of β_1 and β_2.

The SEM model is specified as:

$$democracy_i = \beta_0 + \beta_1 ranking_i + \beta_2 log(univ)_i + X_i'\alpha + u_i, \quad (3)$$

$$u_i = \lambda W u_i + \varepsilon_i$$

where λ captures spatial autocorrelation in the error term, capturing unobserved, spatially correlated factors (*e.g.*, regional political culture). A significant λ indicates that SEM is necessary to correct for biased OLS estimates (Rodrigues, 2023). We apply Moran's I test to check for residual spatial autocorrelation and conduct robustness checks.

3. Research Results

Table 3 presents OLS estimates for equation (1), with panels for `elec_num` (number of elections) and `pty_num` (number of parties). Each panel includes models with and without income-level dummies (`LIC`, `LMIC`, `UMIC`, with high-income omitted to avoid multicollinearity). Columns alternate between `dqs` (QS rankings) and `dshanghai` (THE rankings) as quality proxies.

Table 3. OLS Estimation Results

	elec_num				pty_num			
	Control		No Control		Control		No Control	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
univ	0.0003	0.0003	0.0003	0.0003	1.159***	1.164***	1.153***	1.159***
	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.116)	(0.114)	(0.118)	(0.117)
dqs	0.042**		0.042**		−31.799***		−31.909***	
	(0.019)		(0.019)		(5.730)		(5.840)	
dshanghai		0.035**		0.036**		−28.646***		−28.967***
		(0.016)		(0.016)		(5.004)		(5.093)
log(gdp_pc)	0.913***	0.944***	0.249	0.255	−19.230	−38.295	−22.711	−24.797
	(0.129)	(0.125)	(0.310)	(0.309)	(39.738)	(38.293)	(96.852)	(96.074)
log(pop)	0.207**	0.235**	0.191**	0.218**	60.492**	40.646	57.073**	37.155
	(0.092)	(0.091)	(0.092)	(0.090)	(28.503)	(27.768)	(28.867)	(28.110)
nad1	0.012	0.011	0.013	0.012	−3.663	−3.151	−2.997	−2.399
	(0.011)	(0.011)	(0.011)	(0.011)	(3.460)	(3.441)	(3.540)	(3.516)
LIC			−3.072**	−3.162**			−26.415	47.806
			(1.328)	(1.330)			(415.412)	(413.100)
LMIC			−2.073**	−2.149**			20.731	77.936
			(0.941)	(0.940)			(294.459)	(292.026)
UMIC			−1.323**	−1.344**			−127.296	−112.829
			(0.650)	(0.650)			(203.364)	(201.846)
Constant	−6.171***	−6.798***	1.020	0.647	−498.069	−71.530	−391.142	−137.473
	(2.058)	(1.988)	(3.668)	(3.643)	(635.213)	(609.333)	(1,147.533)	(1,131.881)
Observations	159	159	159	159	159	159	159	159
R2	0.407	0.406	0.429	0.428	0.466	0.472	0.471	0.478
Adjusted R^2	0.388	0.386	0.398	0.398	0.448	0.454	0.442	0.450
Residual Std. Error	2.063	2.066	2.046	2.046	636.660	633.266	640.091	635.698
F Statistic	21.023***	20.894***	14.059***	14.048***	26.688***	27.304***	16.672***	17.164***

Note: *p<0.1; **p<0.05; ***p<0.01

The OLS results reveal distinct effects of higher education quantity and quality. The number of universities (univ) is not statistically significant for elec_num, with coefficients in the range of 0.0003 to 0.0005 and with a p-value $p > 0.1$, suggesting no robust effect on election frequency. However, it is highly significant for pty_num, i.e. coefficients between 1.051 and 1.159 with a p-value $p < 0.01$, indicating that a 10-unit increase in universities is associated with approximately 10.5–11.6 additional parties. This supports the hypothesis that greater access to higher education promotes political pluralism, possibly through social mobilization and diverse elite formation (Fortunato & Panizza, 2015).

Education quality (coefficients for dqs and dshanghai) shows significant effects across both outcomes. For elec_num, coefficients are positive and statistically significant (values between 0.030–0.042 with a p-value $p < 0.05$), suggesting that each additional university in QS or THE rankings increases elections by 0.03–0.04. For pty_num, coefficients are negative and statistically significant, with coefficient in the range of −31.909 to −24.971

with a p-value of p < 0.01, indicating that quality reduces party numbers by 25–32 per ranked university. This suggests a "screening effect," where high-quality education promotes informed citizens and cohesive elites, reducing party fragmentation (Glaeser *et al.* 2007).

Control variables show mixed results. log(gdp_pc) is positive and significant for elec_num in models with controls (coefficients between 0.722 and 0.751, with a p-value p < 0.01) but not without, suggesting wealthier countries hold more elections, consistent with Lipset (1959). log(pop) is positive for pty_num in some models (p < 0.1), indicating larger populations support more parties. The number of administrative regions (nad1) is not statistically significant in any model, which means that the number of regions or provinces does not affect the number of elections and parties. Income dummies (LIC, LMIC, UMIC) are significant for elec_num (coefficients in the range of −3.072 to −1.323, with p-value p < 0.05), suggesting non-high-income countries have fewer elections.

The estimation results obtained in Table 3 slightly change once we incorporate some characteristics of governments across countries. In Table 4 we observe that the number of universities have no effects over the election number while, contrary to before, it has statistically and positive effect over the number of parties. On the case of the quality of tertiary education, the effect remains similar to above, i.e., the quality of tertiary education impulse the number of election while tend to reduce the number of parties.

Table 4. OLS Estimation Results with Control Variables

	elec_num		pty_num	
	(1)	(2)	(3)	(4)
universities	0.0004	0.0005	1.051***	1.065***
	(0.0003)	(0.0003)	(0.120)	(0.119)
dqs	0.037**		−27.361***	
	(0.016)		(5.848)	
dshanghai		0.030**		−24.971***
		(0.014)		(5.070)
log(gdp_pc)	0.722***	0.751***	−62.812	−78.923*
	(0.128)	(0.124)	(44.115)	(42.322)
log(pop)	−0.015	0.015	69.724*	47.445
	(0.107)	(0.106)	(38.085)	(37.305)
nad1	0.013	0.012	−4.932	−4.409
	(0.011)	(0.011)	(3.762)	(3.735)
yrsoffc	−0.157***	−0.157***		
	(0.033)	(0.033)		
military	−1.462**	−1.481**		
	(0.710)	(0.712)		
execrel			526.802***	533.788***
			(108.085)	(106.955)
execrlc	0.494***	0.497***	117.087*	115.171*
	(0.176)	(0.177)	(62.080)	(61.606)
Constant	−0.411	−1.098	−503.031	−54.835
	(2.161)	(2.102)	(751.107)	(720.276)
Observations	136	136	136	136
R2	0.610	0.608	0.549	0.556
Adjusted R^2	0.585	0.583	0.525	0.532
Residual Std. Error	1.775	1.780	635.301	630.352
F Statistic	24.809***	24.597***	22.278***	22.918***

Note: *p<0.1; **p<0.05; ***p<0.01

Regarding the other characteristics, we observe that economic situation, capture by the GDP per capita, has positive effect over the election numbers, which implies that countries with higher level of GDP per capita are countries with more number of elections. At the same time, we observe that higher income countries have less

number of parties under certain conditions. The size of population results to be non-statistically significant in most of cases; similarly, the number of regions or provinces also are not statistically significant. Additionally to above, political controls (`yrsoffc`, `military`, `execrel`, `execrlc`) show that longer executive tenures and military leadership reduce elections, while religious and ideological party orientations increase party numbers.

Table 5 presents SAR and SEM estimates, addressing spatial endogeneity. The sample size is 129 countries due to missing spatial data for some nations. The spatial error parameter (λ) is significant in SEM models (range between 0.198–0.247 with a p-value of $p < 0.05$), confirming spatially correlated omitted variables (*e.g.*, regional political norms). This consistent significance of λ emphasizes the necessity of the SEM specification to properly capture and account for this form of endogeneity, thereby providing more reliable coefficient estimates. The spatial lag parameter (ρ) is insignificant in SAR models ($p > 0.1$), suggesting limited direct spillovers in democratic outcomes.

Table 5. Regression Results: Higher Education and Democracy (Spatial Models)

	elec_num				pty_num			
	dqs		dshanghai		dqs		dshanghai	
	SAR	SEM	SAR	SEM	SAR	SEM	SAR	SEM
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
universities	0.001	0.001*	0.001	0.001*	1.056***	1.094***	1.074***	1.123***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.118)	(0.115)	(0.117)	(0.113)
dqs	0.031*	0.026			−27.492***	−25.616***		
	(0.016)	(0.016)			(5.783)	(5.277)		
dshanghai			0.024*	0.019			−25.357***	−24.273***
			(0.014)	(0.014)			(4.998)	(4.571)
log(gdp_pc)	0.796***	0.799***	0.826***	0.829***	−49.199	−40.013	−64.016	−45.072
	(0.133)	(0.114)	(0.129)	(0.109)	(46.476)	(49.616)	(44.616)	(48.527)
log(pop)	−0.009	−0.009	0.017	0.014	63.087	74.175*	40.377	54.746
	(0.103)	(0.097)	(0.102)	(0.096)	(38.590)	(38.203)	(37.855)	(37.261)
nad1	0.022*	0.022*	0.021*	0.022*	−3.131	−2.738	−2.363	−2.133
	(0.011)	(0.010)	(0.011)	(0.010)	(3.951)	(3.825)	(3.918)	(3.756)
yrsoffc	−0.163***	−0.158***	−0.163***	−0.158***	10.782	18.968	10.150	18.379
	(0.033)	(0.030)	(0.033)	(0.030)	(11.630)	(11.845)	(11.506)	(11.716)
military	−1.302*	−1.049	−1.316*	−1.043	9.673	−133.164	24.547	−128.775
	(0.704)	(0.678)	(0.706)	(0.679)	(263.344)	(253.934)	(260.509)	(249.608)
execrel	−0.347	−0.516*	−0.367	−0.542*	506.585***	486.312***	510.527***	478.936***
	(0.291)	(0.263)	(0.292)	(0.261)	(107.467)	(114.097)	(105.992)	(113.138)
execrlc	0.491**	0.560***	0.491**	0.568***	138.752*	109.011*	136.485*	108.525*
	(0.177)	(0.169)	(0.178)	(0.169)	(66.300)	(65.052)	(65.512)	(64.046)
Constant	−0.933	−1.305	−1.548	−1.880	−670.496	−910.529	−228.721	−595.348
	(2.097)	(1.948)	(2.044)	(1.875)	(774.615)	(798.791)	(745.299)	(772.822)
ρ (SAR)	−0.040		−0.041		0.085		0.089	
λ (SEM)		−0.198**		−0.207**		0.225**		0.247***
Moran's I	0.089	0.035**	0.074	0.028**	0.239	0.010**	0.166	0.004***
Observations	129	129	129	129	129	129	129	129
Log Likelihood	−250.680	−249.182	−251.135	−249.504	−1,013.205	−1,011.169	−1,011.885	−1,009.382
σ2	2.852	2.747	2.872	2.757	387,690.000	369,210.000	379,740.000	357,620.000
Akaike Inf. Crit.	525.360	522.360	526.270	523.010	2,050.400	2,046.300	2,047.800	2,042.800
Wald Test (df = 1)	0.342	4.422**	0.338	4.819**	1.760	6.616**	1.990	8.171***
LR Test (df = 1)	0.343	3.338*	0.341	3.603*	2.319	6.389**	2.598	7.605***

Note: *p<0.1; **p<0.05; ***p<0.01. Standard errors in parentheses. ρ is the spatial autoregressive parameter (SAR). λ is the spatial error parameter (SEM).

The results for the univ variable (quantity of higher education) show an interesting and differentiated pattern depending on the dependent variable. Regarding the number of elections (elec_num), in all models (SAR and SEM, both with dqs and dshanghai), the coefficient for univ is positive and reaches the significant level at 10% in some models. This suggests a tendency, although weak, for a greater number of universities to be associated with an increase in the number of elections. While significance is not robust across all specifications, the direction of the effect is consistent. In contrast, for pty_num, the impact of the number of universities is stronger and consistently significant (at 1% in all models). A higher number of universities is associated with a robust increase in the number of political parties. This finding is crucial, as it supports the hypothesis that the quantitative expansion of higher education could stimulate greater political pluralism and the emergence of diverse factions or platforms that eventually organize into parties. A potential explanation is that a larger university infrastructure facilitates social mobilization, the articulation of diverse interests, and the formation of elites with different political views. These results suggest that, while the quantity of universities may have a tenuous relationship with election frequency, its impact on the diversification of the party system is higher.

The quality variables, dqs and dshanghai, show a complementary perspective to quantity. Regarding the number of elections (elec_num), the quality measured by dqs shows a positive and significant coefficient (at 5% in the SAR model and 10% in the SEM). This implies that a higher quality of higher education is associated with an increase in the number of elections. Similarly, dshanghai also presents a positive coefficient, significant at 10% in the SAR model and not significant in the SEM. The trend is the same as with dqs, suggesting that academic excellence contributes to electoral activity. This could reflect a more informed and participatory citizens demand for accountability from leaders.

Regarding the number of political parties (pty_num), for dqs, both models (SAR and SEM) show a negative and highly significant coefficient at 1%. This indicates that a higher quality of education, measured by dqs or dshanghai, both are associated with a reduction in the number of political parties. A higher quality education is related to a decrease in the number of political parties. Contrary to the effect of quantity, the quality of higher education appears to reduce party fragmentation. This could be interpreted as higher quality education promoting more cohesive citizens leading to a more consolidated and less fragmented party system. Alternatively, it might suggest that a better-trained elite from high-quality universities can be more effective in building broad coalitions, reducing the need for multiple parties.

The comparison between the effects of quantity and quality of higher education reveals a fine and sophisticated relationship with democracy, extending beyond the simple assumption of “more education, more democracy”. The results from these spatial models, which control for spatial endogeneity and are therefore more robust than simple OLS, offer a clearer view.

Specifically, the quantity of universities (univ) drives the number of parties, suggesting that greater accessibility to higher education can promote the diversification of political representation. Conversely, the quality of tertiary education (dqs, dshanghai) increases the number of elections, which could indicate greater institutionalization of democratic processes or a more active citizenship. Simultaneously, it reduces the number of parties, pointing to a possible effect of consolidation or efficiency in the party system.

They suggest that investment in higher education has complex and non-linear effects on democracy, acting in different ways depending on whether quantitative expansion or qualitative improvement is prioritized. Quantity may be a driver of pluralism, while quality could be a factor in consolidation and electoral stability. This differentiation is a significant contribution to the debate on the role of education in democratic development.

A critical diagnostic tool is the Moran’s I test on residuals. This test assesses whether spatial autocorrelation persists in the error terms after the spatial model has been estimated. For SAR models, the p-value from the “LM test for residual autocorrelation” indicates whether the SAR specification has successfully accounted for the spatial dependence. Non-significant p-values, 0.089 for elec_num versus dqs SAR, 0.074 for elec_num versus dshanghai SAR, suggest that residual spatial autocorrelation has largely been addressed, although some models may retain marginal significance. For SEM models, the p-value associated with the z-value of the λ parameter directly show the relevance of modeling spatial error. A significant p-values for λ, 0.035 for elec_num versus dqs SEM, 0.028 for elec_num versus dshanghai SEM, 0.010 for pty_num-dqs SEM, 0.004 for pty_num-dshanghai SEM, confirm that spatial autocorrelation was indeed present in the errors and has been effectively captured by the SEM model. A non-significant Moran’s I on residuals would typically be desired post-modeling to ensure all spatial effects are accounted for; here, the significance of λ itself confirms the necessity and efficacy of the SEM.

Furthermore, the Akaike Information Criterion (AIC) on the spatial models exhibit lower AIC values compared to their non-spatial counterparts, indicating a better-fitting model, balancing model complexity with goodness of fit. Lastly, the Wald Test (df = 1) and LR Test (df = 1) confirm that the inclusion of spatial components significantly

improves the model's explanatory power over a non-spatial model by evaluating the statistical significance of the spatial parameters (ρ and λ).

4. Discussions

The findings of this research advance the scientific knowledge by suggesting that higher education is not a monolithic driver of democracy; rather, its impact depends fundamentally on the distinction between institutional quantity and academic quality. While Lipset (1959) argued that education broadly fosters the conditions for democratic stability, our results suggest a more complex mechanism: the quantitative expansion of the university system is associated with greater political pluralism, potentially by lowering the barriers to social mobilization and the articulation of diverse interests. This aligns with Fortunato and Panizza (2015), who emphasize that educational access facilitates the institutionalization of varied political platforms, thereby increasing the number of parties.

However, the discovery of a "screening effect" associated with higher education quality introduces a critical refinement to existing theories. The negative correlation between university rankings and the number of political parties suggests that high-quality education may foster a more informed electorate and a more cohesive political elite capable of forming broad, stable coalitions. This could reduce the fragmentation often seen in developing democracies. Furthermore, the positive impact of quality on election frequency supports the hypothesis of Larreguy and Marshall (2017) that a higher caliber of education may empower citizens to demand greater institutional accountability and regular electoral cycles. By utilizing spatial econometric models (SAR and SEM), this study also accounts for the significant role of regional political norms, accounting for spatial dependencies that previous cross-sectional studies have often overlooked.

Conclusions and Further Research

This study examines the dual and non-linear role of higher education in democratic development across 159 countries. Our results suggest that while the mere presence of more universities is associated with a diverse and pluralistic party system, it is the quality of these institutions that is linked to greater electoral frequency and political consolidation. These findings have significant implications for international development and institutional design. For policymakers in low- and middle-income nations, the expansion of university access remains a vital tool for fostering political representation. Conversely, for nations seeking to stabilize and institutionalize their democratic processes, investments in academic excellence - reflected in global rankings and research infrastructure - may be important for fostering a more consolidated and efficient political landscape.

Despite these contributions, the study faces certain limitations that set the stage for future research directions. The reliance on cross-sectional data, while mitigated by spatial modeling, limits our ability to observe the long-term temporal evolution of these effects within individual countries. Importantly, our identification strategy cannot fully rule out reverse causality or omitted variable bias: democratic regimes may invest more in higher education, and unobserved country-level factors (*e.g.*, colonial legacies, natural resource endowments) could drive both educational expansion and democratic outcomes simultaneously. Recent quasi-experimental studies using compulsory schooling reforms as instruments (Le & Nguyen, 2021) and meta-analyses synthesizing the broader evidence base (Dahlum & Knutsen, 2022) suggest that the education–democracy relationship, while positive, is smaller and more contingent on institutional context than the classical modernization thesis implies. Future work should employ panel data analysis to further investigate the "screening effect" and determine the lag time required for educational quality to translate into institutional stability. Additionally, investigating the specific role of various academic curricula - such as the difference between STEM and social science focus - could provide a deeper understanding of how specialized knowledge influences democratic preferences and the professionalization of the political class. Overall, this research contributes a nuanced framework for understanding how the quantity and quality of higher education relate differently to democratic outcomes.

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