Research Article

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The Effect of Education on Democracy in Iran After the Revolution: An ARDL Model

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Abstract

This study examines the association between educational attainment at the primary, secondary, and tertiary levels and a legacy Freedom House measure of political rights and civil liberties in post-revolutionary Iran using an autoregressive distributed lag (ARDL) framework. The original outcome ratings range from 1 (greater freedom) to 7 (less freedom); accordingly, a negative coefficient corresponds to an improvement in the measured freedom outcome, not a deterioration. The reported coefficients suggest a negative association for secondary educational attainment in the dynamic specification and long-run equation, whereas the reported long-run coefficients for primary and tertiary attainment are not statistically significant. The coefficients for per capita income and government size are also negative in the reported long-run equation. These are conditional time-series associations rather than identified causal effects. The exact observation period, data construction, transformations and bounds-test specifications require confirmation against the original datasets and estimation outputs before these results can be treated as fully verified.

Keywords: Education; Democracy; Iran; ARDL Method.

1. INTRODUCTION

Economic development and political systems have a reciprocal relationship. The success and persistence of a political system, whether authoritarian or democratic, depend partly on economic development, economic efficiency, and the quality of government policy. Economic performance, in turn, depends on the political environment in which policies are formulated and implemented. Political institutions shape the incentives, opportunities, and constraints through which economic and social development occurs. The relationship is therefore neither exclusively economic nor exclusively political, and its direction may vary across historical settings. This interaction is particularly relevant to discussions of development and political change in Iran [1].

Different views exist concerning the relationship between democracy and economic development. Some scholars argue that material prosperity facilitates citizens' participation in political affairs and their influence over collective decisions. From this perspective, economic development creates conditions favorable to the emergence and consolidation of democracy. Lipset [2] identifies a strong association between economic development and democratic politics and emphasizes education as one component of that relationship. In his account, increasing wealth accompanies industrialization, the expansion of the middle class, and higher educational attainment. These changes can broaden opportunities for participation and strengthen the social foundations of democratic institutions. This argument concerns a set of connected social conditions rather than a claim that economic prosperity automatically produces democratic government.

Lipset [2] argues that education may broaden citizens' perspectives, encourage tolerance, reduce adherence to rigid extremist doctrines, and support informed electoral judgment. In this account, schooling can strengthen the reasoning skills needed to compare political alternatives and recognize the value of peaceful institutional procedures. Education may therefore help sustain democratic practices, although its contribution depends on the wider social and political environment. A highly educated population does not, by itself, guarantee democratic institutions or their survival. Glaeser et al. [3] likewise emphasize human capital in their analysis of institutions and growth. Their argument directs attention to the possibility that education can precede improvements in policy and institutional performance, rather than merely follow them. Political benefits associated with human capital may include more stable procedures for resolving disputes, stronger protection of property rights, and more predictable public decision-making. These proposed channels should be distinguished from evidence establishing a causal effect of education in any particular country.

A substantial body of scholarship links national development with democracy, while differing over the direction and conditions of that relationship. Huber et al. [4] emphasize the social changes accompanying development and the importance of understanding how those changes affect political power. Education, communication, and the expansion of organized social groups can influence political awareness, tolerance, and participation. Educational attainment is consequently one candidate explanation for variation in democratic development, rather than an isolated or universally decisive determinant. Recognizing its potential importance, this study distinguishes primary, secondary, and tertiary attainment. These levels may differ in their associations with political outcomes because they involve different experiences, skills, and opportunities for social participation.

This study uses an autoregressive distributed lag (ARDL) approach to examine schooling and measured freedom in Iran after the Islamic Revolution. The wider literature examines several related but distinct outcomes. McMahon [5] considers the social benefits of education in the development process. His discussion of educational externalities [6] distinguishes benefits accruing to the wider community from individual earnings returns. His subsequent analysis of higher education [7] concerns total returns and possible underinvestment; it is relevant to the broader rationale for educational investment rather than direct evidence about democratization in Iran. Glaeser et al. [8] examine why education may support democracy. Papaioannou and Siourounis [9] investigate economic and social factors associated with the third wave of democratization, whereas Mamoon and Murshed [10] connect education with institutional quality and growth. Kotzian [11] examines public support for liberal democracy, an attitudinal outcome that differs from national regime classification. Chzhen [12] addresses tolerance, political engagement, and understanding of democracy. Evans and Rose [13] study education and democratic support in sub-Saharan Africa. Crespo Cuaresma and Oberdabernig [14] examine transitions to sustained democracy, including the importance of the distribution of educational attainment. Doko [15] studies individual support for democracy in six Arab countries and shows why associations can depend on country controls. Murtin and Wacziarg [16] investigate the democratic transition over a longer historical perspective. Alemán and Kim [17] examine education's democratizing association, while Wang et al. [18] consider college education and democratic attitudes in China. Apergis [19] provides evidence from 161 countries. These studies differ in population, measurement, period, and identification strategy; their findings should not be treated as interchangeable estimates. The present analysis contributes a country-specific examination of education levels in Iran, without claiming that no earlier Iran-focused research exists.

The focus on the post-revolutionary period reflects the political changes that began in 1979 and the subsequent expansion of access to education. The World Bank series cited in the study record increases in several educational indicators: education expenditure as a share of total government expenditure rose from 18.3% in 1991 to 21.2% in 2019; the primary enrollment

ratio rose from 98.3% in 1980 to 110.7% in 2017; the secondary enrollment ratio increased from 44.09% in 1985 to 86.3% in 2017; and the tertiary enrollment ratio increased from 15.6% in 1995 to 68.1% in 2017 [20]. Enrollment ratios above 100% can occur when enrollment includes students outside the official age range, as in gross enrollment indicators. These enrollment measures provide descriptive context and must be distinguished from the adult attainment variables used in the regression. Exact indicator codes and historical data vintages remain necessary to reproduce the reported comparisons.

This study examines whether educational attainment at different levels is associated with the Freedom House measure in post-revolutionary Iran. Because multiple political, economic and institutional changes occurred over the study period, its observational time-series design cannot isolate an effect attributable to the revolution or establish that educational expansion caused democratic change.

The remainder of this paper is organized as follows. Section 2 outlines Iran's social and political environment. Section 3 reviews the literature on education and democracy and discusses the income and government-size controls. Section 4 presents the methodology and variable definitions, distinguishing the measured freedom outcome from broader democratic concepts. Section 5 reports and interprets the estimates, including the diagnostic and long-run results. Section 6 concludes by discussing the substantive findings and the qualifications required by the available data and model documentation.

2. SOCIAL AND POLITICAL ENVIRONMENT OF IRAN

The development of formal education and demands for constitutional government formed related parts of Iran's modernization. In the second half of the nineteenth century, new educational institutions served a relatively limited section of society, with Dar al-Funun providing an important example of formal technical education. Demands for limits on monarchical authority and a greater role for representative institutions subsequently became central to constitutional politics. These developments arose within broader intellectual, social, and international changes, including growing engagement with Europe. Their historical proximity does not, however, establish that educational institutions independently caused the emergence of democratic ideas. Education could provide opportunities for new political discussions while interacting with other sources of change. Iran's subsequent political history included recurring disputes over representation, authority, and the organization of government, culminating in the 1979 revolution and the establishment of the Islamic Republic. This background motivates the study of educational and political change while leaving the direction of their relationship open to investigation [1].

Religious institutions and beliefs have played important roles in Iranian public life, alongside substantial demographic and social changes. Table 1 summarizes population growth, the sex ratio, and urbanization across selected census years [21]. The urban share of the population increased, whereas population growth varied and the sex ratio generally declined across the displayed observations. These statistics describe demographic change; they do not directly measure political attitudes, religious commitments, or the preferences of particular age and gender groups. Nevertheless, changes in settlement patterns and access to education may alter opportunities for communication, employment, and collective participation. Political preferences within Iranian society should therefore be understood as diverse and potentially changing, rather than reduced to a fixed opposition between educated or urban citizens and religious citizens. Whether these demographic developments are associated with measured freedom is a separate empirical question.

Table 1. *Selected Demographic Statistics for Iran*

Demographic Index	1966	1976	1986	1996	2006	2016
Population growth rate (%)	3.1	2.7	3.9	1.5	1.6	1.2
Sex ratio	107	106	105	103	104	103
Urbanization rate (%)	37.9	47	54.3	61.3	68.5	74

Source: Statistical Center of Iran [21].

Note: sex ratio is the result of dividing the number of men by women multiplied by 100.

The post-revolutionary political system combines elections for the presidency and parliament with institutions exercising authority outside those elected offices. The Supreme Leader holds extensive powers and is selected through the Assembly of Experts rather than by a direct nationwide popular vote. Political debate has consequently involved disagreements over the distribution of authority, representation, and the scope of political freedoms. These disagreements cannot be mapped neatly onto a division between academics and clerics, since viewpoints within both groups vary. Nor should the existence of elections alone be equated with unrestricted political competition. For this study, the relevant distinction is between the presence of electoral institutions and the political rights and civil liberties captured by the selected outcome measure [22].

Educational provision also expanded after the revolution, increasing access to schooling and contributing to higher literacy. The selected census observations in Figure 1 show a sustained increase in literacy among people aged six years and older [21]. Greater literacy can facilitate access to information and participation in public discussion, but the figure does not measure changes in civic awareness or political preferences directly. It therefore cannot establish that literacy gains produced improvements in democracy. Educational development and political freedom may follow different paths

when institutional restrictions, economic conditions, and other social changes intervene. The contrast between educational expansion and the political indicators considered below provides the descriptive motivation for examining their conditional association.

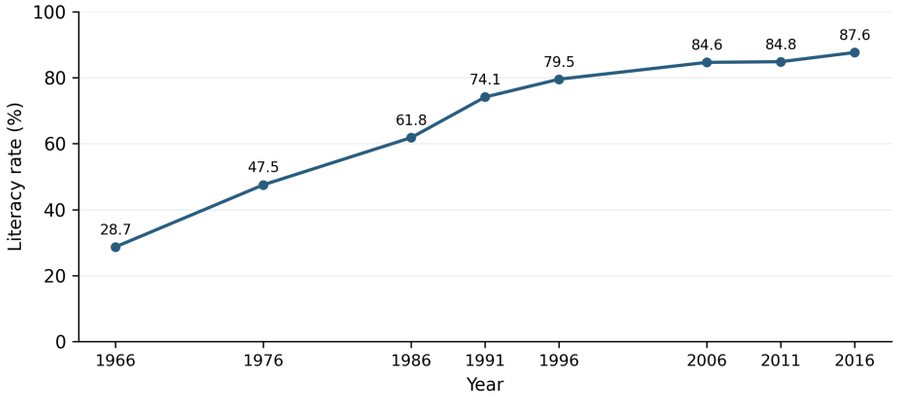


Figure 1. *Literacy Among People Aged Six Years and Older in Iran*

Source: Statistical Center of Iran [21].

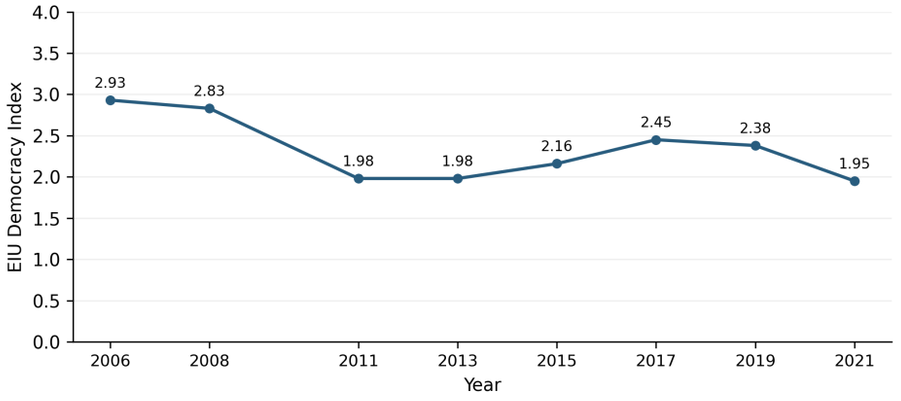


Figure 2. *EIU Democracy Index Scores for Iran*

Source: Economist Intelligence Unit [23].

The selected EIU Democracy Index observations in Figure 2 fluctuate but show an overall decline between 2006 and 2021. The 2021 report places Iran at a score of 1.95 and joint rank 154 among 167 countries and territories, within the authoritarian-regime category [23]. This descriptive index must not be confused with the Freedom House rating used in the regression: higher EIU scores indicate more democracy, whereas higher legacy Freedom House ratings indicate less freedom. Freedom House classifies Iran as Not Free in its 2023 assessment [22]. The Academic Freedom Index 2022 Update provides an additional, conceptually distinct measure of restrictions affecting universities and scholarly activity [24]. Together, these sources motivate questions about the relationship between educational expansion and political freedom, but they do not by themselves identify its causes. Education at different levels may have different associations with political outcomes, and those associations may depend on institutions and historical circumstances. The analysis therefore separates primary, secondary, and tertiary attainment rather than assuming that all schooling levels have the same relationship with the dependent measure.

3. LITERATURE REVIEW

John Dewey examines the relationship between education and democratic social life in Democracy and Education [25]. His account treats education as a process through which individuals acquire the capacity to participate in shared activities and interpret their experiences. A democratic society depends on communication across social groups and on opportunities for people to contribute to collective life. Education is therefore relevant not only to the transmission of knowledge but also to the development of habits of inquiry, cooperation, and judgment. From this perspective, schooling should do more than adjust individuals to existing social arrangements; it should help them understand and participate in the purposes those arrangements serve. The relationship also operates in the other direction, because democratic forms of association can broaden educational opportunities and expose individuals to more varied experiences. Barriers separating social classes or restricting access to learning can undermine these possibilities. Equal educational opportunity consequently concerns both access to institutions and

the quality of participation that those institutions make possible. This philosophical argument offers a rationale for examining education and democracy, but it does not predict that any increase in enrollment will automatically improve political rights. Curriculum, institutional organization, and opportunities to apply learning remain important contextual considerations. These distinctions are especially relevant when aggregate attainment measures are used as proxies for educational experience.

Friedman [26], in Capitalism and Freedom, also emphasizes education's potential contribution to a stable democratic society. He connects literacy, knowledge, and shared civic values with the conditions that make democratic cooperation possible. The argument concerns benefits extending beyond the individual learner, since informed participation can affect other members of society. Education may therefore influence political attitudes and civic understanding as well as private economic opportunities. This provides another rationale for examining educational attainment alongside political outcomes, while recognizing that the content and institutional context of schooling matter.

The important claim is that education influences political behavior. The benefits of education can come either from improved quality of participation by a particular group of citizens or from broader participation by the citizenry. The first channel is important if education equips citizens with the cognitive skills they need to participate effectively in a representative democracy. Cross-national studies have examined relationships among schooling, cognitive measures, and political conditions [27, 28]. In this channel, education increases citizens' ability to select capable leaders, understand the issues on which they will vote, scrutinize possible abuses of government power, and recognize corruption in leaders. The second channel is important when education improves citizens' interest and knowledge about political issues, their participation in the political process, and ultimately the effectiveness of their political participation [29].

Moreover, in the process of modernization, education can reduce class tensions and, in line with economic development that leads to greater economic security and higher income, contain the pressure of extremist groups by engaging the lower classes in this process and paving the way for democracy [30]. In this sense, education can be considered as a factor of social cohesion. Education brings people together and helps individuals to consider opposing viewpoints and get along with each other. This leads to democratic schooling in which learners are not alienated from one another and which rejects the exclusion of others in the name of community and collective self-understanding [31, 32].

Schooling, income, and career determine people's socioeconomic status, and citizens with greater education, wealth, and professional skills may be more likely to adopt participatory attitudes [33]. The resources and skills they acquire in their private lives may enable them to participate in politics. Barkan [34] examines race, issue engagement, and political participation using the 1987 General Social Survey, providing evidence from a particular survey setting rather than a universal ranking of the effects of literacy and income. The connection between higher education and political engagement is also examined by Hillygus [35].

The literature consequently addresses several different relationships between education and democracy. Barro [36] examines national determinants of democracy, while Glaeser et al. [8] develop an account of why education may sustain democratic participation. Bobba and Coviello [37] emphasize weak instruments and identification problems, highlighting the need for care in interpreting estimates as causal. Chong and Gradstein [38] investigate education and preferences for democracy at the individual level. Crespo Cuaresma and Oberdabernig [14] consider transitions to sustained democratic regimes. Evans and Rose [13] study support for democracy in sub-Saharan Africa, whereas Alemán and Kim [17] examine education's democratizing association across countries. Chzhen [12] considers tolerance, engagement, and democratic understanding. These distinctions matter because political preferences, participation, and regime characteristics are related but separate outcomes. Acemoglu et al. [39] question the inference that schooling necessarily causes democratization, reinforcing the importance of identification and unobserved country characteristics. The present time-series analysis therefore treats estimated coefficients as conditional associations and does not assume that all cited studies support the same causal proposition.

In addition to education, there are some other factors that influence democracy that cannot be ignored in research studies. Per capita income and size of government are such factors that have been used in some similar studies. We discuss these factors below.

Per capita income. The literature on the impact of economic growth on the modernization process has been expanding in recent decades. Based on modernization theory, economic strength -usually measured by per capita income- can reinforce democracy. The relationship between economic growth and democracy is widely discussed in economics and political science. An influential early contribution was made by Lipset [2]. His argument links socioeconomic development with conditions favorable to democratic political life. Przeworski and Limongi [40] put forward two main reasons for the possible relationship between economic growth and democracy: first, that democratic regimes are more likely to emerge in developed countries (endogenous mechanism), and second, that they can emerge independently of economic growth and development but are more likely to survive in developed countries (exogenous mechanism). Their distinction emphasizes that the emergence of democracy and its subsequent survival are separate outcomes and may have different relationships with prosperity. Barro [36], measuring living standards as real GDP per capita, found that wealthier regions were more likely to be democratic. Acemoglu et al. [41] distinguish the positive cross-country association between income and democracy from evidence of a causal income effect, which their country-fixed-effects analyses do not support. Many other researchers adhere to this idea that the propensity to transition to democracy is higher in wealthier nations [42–44]. Recently, the results of Geelmuyden Rød et al. [45] revealed that income is a robust factor for democratic survival.

Income is included as a control because modernization arguments connect material conditions with political organization. The proposed relationship is not limited to the resources available to governments. Rising income may change occupational opportunities, the distribution of social resources, and the capacity of citizens to organize and communicate. Such changes can affect the relationship between lower-income groups, the middle class, and established political authorities. In this account,

educational and economic development may interact with shifts in social stratification, potentially broadening participation and changing how conflicts are expressed or managed. These are proposed mechanisms rather than outcomes measured directly in the present study. Their operation depends on institutional conditions and on whether additional resources translate into meaningful opportunities for collective action. The political-development perspective discussed by Ghavam [30] provides context for considering these channels. However, neither aggregate income growth nor a change in social composition necessarily guarantees democratization. The estimated coefficient on income must therefore be interpreted as conditional on the other regressors and the selected dynamic specification, rather than as a comprehensive test of modernization theory.

Size of government. Government size is another potential control in an analysis of democracy. The impact of this variable on economic performance and, subsequently, on political development requires empirical assessment. Its association with measured freedom may be positive or negative, depending on the political institutions and the social and economic structure. One proposed mechanism is that a larger government may increase the likelihood that the sovereignty or ruling class will resist any democratic change, because the masses make more demands in a democracy, requiring the rulers to take on more responsibility, which reduces their private political and economic benefits. The effect of this variable on democracy depends on various factors, including economic structure, income levels, regime characteristics, and the accountability of public expenditure.

4. METHODOLOGY

Research on education and political participation suggests that schooling can provide resources relevant to voting and other civic activities. Direct pathways include the development of skills used to obtain information, evaluate political claims, communicate preferences, and participate in organizations. Writing, discussion, and the interpretation of public information may help individuals engage with political institutions. Education may also affect perceived civic responsibilities, confidence in participating, and beliefs about whether participation can make a difference. Indirect pathways concern the social opportunities associated with educational attainment. More highly educated individuals may enter occupations that provide higher income, wider networks, or organizational experience, each of which can support political involvement. These possibilities do not imply that every educational experience produces the same attitudes or that educated citizens always participate more. The availability of political opportunities and the institutional context can influence whether acquired resources are used. Me'mar [46] discusses political participation in Iran, providing a country-specific context for these considerations. Figure 3 summarizes the proposed distinction between objective resources and subjective orientations. The diagram presents explanatory hypotheses from the literature; the aggregate ARDL model does not directly estimate the individual pathways or establish mediation through voting behavior.

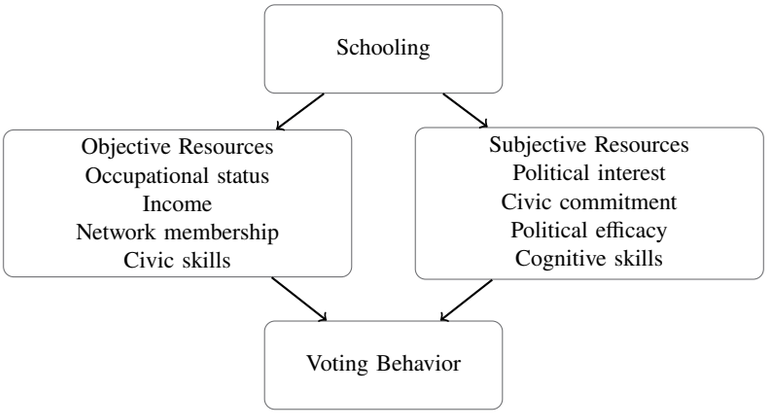


Figure 3. *Proposed Pathways Linking Education and Voting Behavior*

source: Authors' reviews

The choice of an econometric specification must account for both long-run relationships and short-run dynamics. A static regression may omit relevant adjustment processes, and conventional inference can be misleading when the integration properties of the series are not handled appropriately. These concerns do not imply that all Engle–Granger applications are invalid; rather, they emphasize the importance of the specification and sample used. Banerjee et al. [47] examine the consequences of simplified cointegration tests. The ARDL bounds-testing approach provides a related framework for testing level relationships when regressors may be a mixture of I(0) and I(1), subject to the required assumptions [48].

The basic econometric model is as follows:

$$y_t = a_0 + \sum_{j=0}^{p} \boldsymbol{b}_j^{\mathsf{T}} \boldsymbol{X}_{t-j} + \sum_{j=1}^{q} \lambda_j y_{t-j} + u_t. \tag{1}$$

Eq. (1) represents the general ARDL framework with the Freedom House outcome as the dependent series and education measures and controls as regressors. The precise lag polynomial, included deterministic terms, estimation dates, transformation rules and software version must be established from the original estimation output. ARDL is potentially suitable for a single-country time series with a mixture of I(0) and I(1) variables, provided no variable is I(2) and the model passes relevant specification

checks. Selection of lag lengths and small-sample inference must be documented rather than inferred solely from the dataset's single-country nature. In Eq. (1), y is the outcome series, X is a vector of explanatory series, p and q denote lag limits, and u is the disturbance. The coefficient vector attached to X allows each explanatory variable to have its own association with the outcome. This schematic equation defines the general modeling approach and does not substitute for a fully documented estimated specification.

The presence of cointegration among a set of economic variables provides the statistical framework for using the error correction model (ECM). The most important reason for this model is that it relates the short-run fluctuations of the variables to their long-run equilibrium values. However, it is possible that departures from equilibrium exist in the short-run. In this case, we can consider the error term u_t to be the "equilibrium error." The relationship between cointegration and the speed of convergence is discussed by Pesaran and Shin [49].

The equilibrium error can be used to connect short-run changes in the outcome with deviations from its long-run relation. For illustration, the simple residual u_t = y_t - b x_t enters the following single-regressor error-correction representation. This expression describes the adjustment principle; the actual multivariable model must include the appropriate regressors, lags, and deterministic terms.

$$\Delta y_t = a_0 + a_1 \Delta x_t + a_2 u_{t-1} + e_t, \qquad e_t \overset{\text{iid}}{\sim} (0, \delta^2). \tag{2}$$

In an appropriately specified error-correction representation, a negative and statistically significant coefficient on the lagged equilibrium error is consistent with adjustment toward an estimated long-run relation. The actual unrestricted error-correction specification, short-run differences, deterministic terms and definitions of every symbol must be checked against the original econometric output. In Eq. (2), the difference operator denotes a one-period change, the lagged residual measures the preceding disequilibrium, and the remaining disturbance represents innovations not explained by the included terms. A distributional notation alone does not establish that residual assumptions are satisfied.

In view of the theoretical literature and discussions on the determinants of democracy, the following econometric model is specified for Iran based on the ARDL approach Eq. (3).

$$\mathrm{DEM}_t = C + \sum_{i=1}^{3} a_i \mathrm{EDU}_{it} + b\mathrm{GDP}_t + g\mathrm{GOV}_t + \varepsilon_t. \tag{3}$$

In Eq. (3), DEM denotes the dependent Freedom House ratings series. Primary, secondary and tertiary educational attainment are explanatory variables; per capita income growth and government consumption expenditure as a share of GDP are controls. These variables are not additional dependent variables. Under the legacy 1–7 Freedom House coding, lower DEM values indicate greater political rights and civil liberties. Thus a negative slope coefficient is associated with greater measured freedom, holding the remaining regressors fixed. The use of growth rates, ratios and logarithms does not itself eliminate collinearity; the exact transformations and any multicollinearity assessment remain to be verified. Table 2 identifies the variables and their cited sources, including the attainment approach described by Barro and Lee [50]. The three education coefficients correspond to primary, secondary, and tertiary attainment; the income and government-consumption coefficients describe the included controls.

Table 2. *Variable Definitions and Sources*

Variable	Description	Source
Democracy	The average of two indices: political rights and civil liberties.	Freedom House [22]
Education	Highest educational level attained (primary, secondary, or post-secondary), expressed as a percentage of the population aged 25 years and older. The primary measure describes adults whose highest attainment is at the primary level in a given year; corresponding measures are used for secondary and higher education. Exact category boundaries and annual construction require confirmation.	Barro and Lee [50]
Per capita income	The growth rate of gross domestic product per person by purchasing power parity.	World Bank [20]
Size of government	government consumption expenditure as a percentage of GDP.	World Bank [20]

Source: Authors' compilation of cited sources.

The exact first and last estimation years, usable annual observation count, sources and retrieval dates for each variable, source-version identifiers, frequency conversions and any missing-data treatment are not fully documented in the available study materials. In particular, it is necessary to explain how the primary, secondary and tertiary attainment series for adults aged 25+ were assembled from Barro–Lee or related sources, whether categories are mutually exclusive, and whether interpolation/extrapolation was applied. These details matter because interpolation can alter serial dependence and apparent precision, while changes in definitions can affect comparability across years. A compiled annual data file and the estimation commands are needed to establish which observations underlie the reported regressions and to distinguish source revisions from analytical transformations.

The dependent variable represents political rights and civil liberties using the legacy Freedom House ratings. These annual assessments provide a longer historical perspective than several more recent democracy indicators, although the exact vintage used in this analysis requires documentation [22]. Under the legacy coding, each of the two ratings ranges from 1, indicating

greater freedom, to 7, indicating less freedom. The study describes DEM as their average. A decrease in DEM therefore indicates an improvement in the measured outcome; the direction is opposite to that of the EIU index displayed in Figure 2. Freedom House assesses political rights through electoral processes, political pluralism and participation, and the functioning of government. Civil liberties cover expression and belief, associational and organizational rights, the rule of law, and personal autonomy and individual rights. These are four civil-liberties categories, rather than three. In the historical rating system, average ratings from 1.0 to 2.5 indicated Free status, 3.0 to 5.0 indicated Partly Free status, and 5.5 to 7.0 indicated Not Free status. Recent reporting also presents aggregate point scores; those scores should not be substituted for the historical ratings without a documented conversion. Accordingly, the year coverage and measurement version are essential to interpretation. DEM is treated here as an indicator of measured freedom rather than an exhaustive measure of democratic institutions or political participation. The outcome cannot reveal whether changes reflect elections, expression, association, or another component unless those dimensions are analyzed separately.

5. FINDINGS

Table 3 reports the original augmented Dickey–Fuller test statistics and p-values. Under the specifications used in the original analysis, the reported classifications are I(0) for the democracy measure and per capita income series and I(1) for the other variables. These classifications remain provisional because the ADF deterministic components, selected lag lengths, underlying observations and possible structural breaks have not been documented. No I(2) series should enter a conventional ARDL bounds analysis.

Table 3. *Augmented Dickey–Fuller Unit-Root Test Results*

Variable	Statistic	p-value	Result
Democracy	-3.76	0.0302	I(0)
Primary education	-0.00005	0.9947	I(1)
Secondary education	2.46	0.9985	I(1)
Higher education	-1.96	0.3008	I(1)
Per capita income	-3.99	0.0177	I(0)
Size of government	-2.71	0.2359	I(1)

Source: Research findings.

Table 4 reproduces coefficients from the originally reported dynamic ARDL levels regression, with lags indicated in parentheses. Those levels-regression coefficients should not be equated with short-run multipliers of an error-correction model. In this specification, the second lag of primary attainment (-4.239; p = 0.0006) and contemporaneous secondary attainment (-1.138; p = 0.0003) are negative and statistically significant, while contemporaneous tertiary attainment (0.022; p = 0.8383) is not. Given the inverse orientation of DEM, negative coefficients correspond to associations with greater measured freedom. The cumulative short-run effects, correct differenced ECM representation and associated uncertainty require re-estimation or confirmation from the original output; they cannot be calculated reliably from this table alone.

Table 4. *Dynamic ARDL Levels Regression for Education and Measured Freedom*

Independent variables	Coefficients	t-statistics	p-value
Democracy (-1)	0.178	1.41	0.1693
Primary education	0.874	0.84	0.4068
Primary education (-1)	3.526	1.95	0.0612
Primary education (-2)	-4.239*	-3.92	0.0006
Secondary education	-1.138*	-4.12	0.0003
Higher education	0.022	0.20	0.8383
Per capita income	-0.441*	-5.62	0.0000
Per capita income (-1)	0.245*	3.5	0.0017
Size of government	-0.175*	-3.35	0.0024
Constant	-0.060	-0.09	0.9264
Trend	0.052*	4.42	0.0002
Adjusted R^2	0.86		
F-statistic	24.84*		0.0000

Source: Research findings.

Note: Lagged regressors are shown in parentheses. The original claim that all variables were logarithmically transformed has not been verified; the treatment of any zero or negative income-growth observations must be checked before asserting a log specification. * denotes p < 0.01 and ** denotes p < 0.05 in the original reporting; precise p-values are shown in the table. Reported coefficients and p-values have not been independently replicated.

The originally reported dynamic-level coefficients on per capita income growth and government size are negative contemporaneously. With the inverse Freedom House scale, these signs imply conditional associations with greater measured freedom,

rather than identified effects on democratic institutions. The lagged income coefficient is positive, so the income pattern must not be summarized by its contemporaneous term alone. The positive time-trend coefficient is associated with an increase in the adverse-oriented Freedom House rating, conditional on the regressors. No causal interpretation is warranted from the reported specification.

Time-series model adequacy requires assessment of serial correlation, heteroskedasticity, functional form, residual behavior, parameter stability and potential structural breaks. Table 5 reproduces the original diagnostic test statistics, but the exact test definitions, degrees of freedom and estimation sample have not been independently verified.

The p-values in Table 5 are above 0.05, indicating that these particular tests, as reported, did not reject their respective null hypotheses at that threshold. Failure to reject is not proof that assumptions hold or that the long-run relation is valid. In particular, the reported diagnostics do not replace CUSUM/CUSUMSQ or other stability assessments, structural-break analysis, alternative lag specifications or robustness checks.

Table 5. *Model Diagnostic Tests*

Test	Statistic	p-value
Serial correlation	0.03	0.9688
Functional form	0.7	0.4878
Normal distribution of residuals	0.47	0.7889
Heteroskedasticity	0.78	0.6421

Source: Research findings.

Table 6. *Long-Run Coefficients and Error-Correction Term*

Independent variables	Coefficients	t-statistics	p-value
Primary education	0.195	1.17	0.2501
Secondary education	-1.386*	-4.85	0.0000
Higher education	0.027	0.20	0.8398
Per capita income	-0.238*	-3.27	0.0030
Size of government	-0.213*	-3.37	0.0023
Constant	-0.073	-0.09	0.9265
Trend	0.064*	6.51	0.0000
ECM (-1)	-0.82*	-6.49	0.0000

Source: Research findings.

Note: * and ** are significant at the 1% and 5% levels respectively.

The original bounds-test calculation reports F = 5.28 against an upper critical bound of 5.23 at the stated 1% level (lower bound 3.93). The difference of 0.05 is very small. Whether this comparison supports cointegration depends on the applicable deterministic-case specification, number of level regressors, effective sample size and use of suitable finite-sample critical values. These inputs were not recoverable from the supplied manuscript. Consequently, the existence of a stable long-run relation should be considered provisional pending verification of the bounds-test setup and robustness to appropriate critical values.

As reported in Table 6, the secondary-attainment coefficient is -1.386 (p reported as 0.0000, conventionally $p < 0.0001$), while the coefficients for primary (0.195; $p = 0.2501$) and tertiary attainment (0.027; $p = 0.8398$) are not statistically significant. Because higher values of DEM denote lower freedom, the negative secondary coefficient is consistent with an association with greater measured freedom, conditional on model validity. Reported long-run coefficients for per capita income and government size are likewise negative. However, inference from this long-run specification depends on validating the claimed cointegrating relation and the underlying data transformations.

One possible interpretation of the secondary-attainment association is that schooling may develop civic competencies and opportunities for social participation. The present aggregate time-series model does not measure such mediating mechanisms, however, and cannot distinguish them from institutional changes, cohort effects or unobserved confounding.

A further possibility is that educational attainment covaries with social and political changes over time. The proposed civic-socialization channel remains a hypothesis, not an empirically identified mechanism in this study. Direct individual-level evidence would be required to evaluate that explanation.

The reported negative coefficients on the income and government-size controls correspond to conditional associations with lower values on the adverse-oriented Freedom House scale. They do not establish that increasing income or government expenditure causes democratization. Their signs may depend on the chosen period, measurement, unobserved structural changes and the model's dynamic specification. The positive reported trend coefficient is consistent with worsening freedom ratings over the modeled period, conditional on the other covariates.

Table 6 reports a lagged error-correction coefficient of -0.82 with a p-value shown as 0.0000. Its negative sign would be consistent with adjustment toward the estimated equilibrium if the underlying long-run relation and ECM specification are valid. A numerical reading as roughly 82% adjustment per period is conditional on the precise annual model parameterization and should not be treated as independently validated without the original ECM output and bounds-test verification.

6. DISCUSSION AND CONCLUSION

Education is a multidimensional issue in social and public policy. In terms of the assumption that educational content is consistent with democratic values, it can be said that school education may contribute directly or indirectly to democracy. A direct way is the teaching of democratic merits and views in the cognitive and value system of learners. Individuals learn their citizenship rights, their roles in society, the ability to interact with others, and values such as respect for others, recognition of opposing ideologies, the right to participate in collective decision-making, freedom of expression, etc., all of which are values rooted in democracy, through education.

The indirect way is primarily material resources and social opportunities that education opens to individuals. For example, as the level of literacy and schooling increases, the knowledge acquired can provide some other valuable resources such as social status, economic prosperity, and political power. In other words, education is one of the mechanisms to change the composition of class stratification in favor of the middle class (by moving members of the lower class up to the middle class), and since this part of society has experienced social advancement, it may seek to improve its status. To achieve this goal, greater participation in society and in collective decision-making processes is required. Thus, one of the characteristics of the middle class is that it may have incentives to participate in socioeconomic affairs, and may therefore seek opportunities to become more involved in its destiny and support its interests.

The post-1979 period saw substantial changes in Iran's educational participation and political environment. The reported estimates indicate that secondary attainment, unlike primary and tertiary attainment, has a statistically significant negative coefficient in the proposed long-run specification. Because the Freedom House rating is inversely oriented, this pattern is compatible with an association with greater measured political rights and civil liberties, conditional on the model. It does not demonstrate a causal effect of secondary education or justify an intervention on voting eligibility, which was not modeled. Interpretation is constrained by uncertain data vintages and annual construction, incomplete specification reporting, a marginal bounds-test comparison, and the absence of documented structural-break and parameter-stability analyses. Once these issues are resolved, future research could test educational mechanisms and potential heterogeneous associations using additional measurements and research designs.

Author Contributions

All authors contributed equally to this study and to the preparation of the manuscript. All authors read and approved the final version for publication.

Conflicts of Interest

The authors declare no conflicts of interest related to this research.

Data Availability Statement

The study draws on the public statistical and institutional sources identified in the text and reference list. The tables and figures present the reported summary observations and model results. The compiled annual estimation dataset and estimation code are not included in the manuscript; their provenance, construction, and availability require clarification before the reported estimates can be independently reproduced.

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