

On the distribution of education and democracy [☆]

Amparo Castelló-Climent ^{*}

Institute of International Economics, University of Valencia, Campus dels Tarongers 46022 Valencia — Spain

Received 22 July 2007; accepted 30 October 2007

Abstract

This paper empirically analyzes the influence of education on democracy by controlling for unobservable heterogeneity and by taking into account the persistency of some of the variables. The most novel finding is that an increase in the education attained by the majority of the population is what matters for the implementation and sustainability of democracy, rather than the average years of schooling. We show this result is robust to issues pertaining omitted variables, outliers, sample selection, or a narrow definition of the variables used to measure democracy.

© 2007 Elsevier B.V. All rights reserved.

JEL classification: O10; P16

Keywords: Democracy; Political economy; Education inequality; Dynamic panel data model

1. Introduction

A quick glance at the initial years of schooling and subsequent political regimes across countries strongly supports Lipset (1959) hypothesis that high educational standards are one of the basic conditions for sustaining a democracy. For instance, all the countries with an average of at least 4 years of schooling in 1960 are nowadays stable

democracies, whereas the countries with less than 1 year of education in 1960 remained authoritarian regimes during the period 1960–2000. This simple observation in favour of the so called modernization theory has been corroborated by thorough empirical evidence (e.g. Barro, 1999, and Glaeser et al., 2004). However, Acemoglu et al. (2005, 2006) recently challenged the view that development is a prerequisite for a country to become a democracy. More specifically, in Acemoglu et al. (2005) the authors point out that previous cross-country estimations that find a positive correlation between education and democracy could be biased as a result of omitting variables.

In this paper we find that, even when controlling for country-specific effects, the level of development, and in particular, a more equal distribution of education, has been an outstanding determinant for the implementation and sustainability of democracies during the post-war period. Mainly, this paper departs from the previous literature in two ways. Firstly, from a methodological point of view, we use the system GMM estimator, which in addition to controlling for country-specific effects, it

[☆] I am grateful to the editor, Lant Pritchett, and two anonymous referees, for their valuable comments and suggestions. I would also like to thank Rafael Doménech, Javier Andrés, Manuel Arellano, Steve Bond, Jose E. Boscá, Javier Ferri, Eduardo Ley and seminar participants at the IIE, at the 21st Annual Congress of the European Economic Association (Vienna) and at the 2007 Royal Economic Society Conference (Warwick) for their helpful comments. Financial support from the Spanish Ministry of Education and Science Grant SEJ2004-01959 and from the Juan de la Cierva Program is also gratefully acknowledged.

^{*} Instituto de Economía Internacional, Universidad de Valencia, Campus dels Tarongers 46022 Valencia—Spain. Tel.: +34 96 382 8438; fax: +34 96 382 8434.

E-mail address: amparo.castello@uv.es.

has also been proved to perform better than the first-difference estimator in Monte Carlo simulations when variables are highly persistent (see [Blundell and Bond, 1998](#)) and measured with error (see [Hauk and Wacziarg, 2006](#)). Secondly, we complement the measure of average years of schooling, commonly used in the previous literature, with measures of the distribution of education. The advantage of controlling for the distribution of education is that the average years of schooling do not provide information on whether a restricted group of highly educated individuals has more influence on democracy than a large mass of moderately educated citizens. For instance, an increase in the average years of schooling could be driven by an increase in the education attained by a minority elite, which might not encourage a democratic regime. In fact, in societies where the distribution of education is highly unequal, the educated elite is more likely to perpetuate in power because a mass of low or uneducated individuals is easier to suppress, since they have less access to information and, therefore, will be less critical of the abuse of power. Moreover, a more equalitarian distribution of education increases social cohesion, which makes it easier to reach an understanding.

This paper is related to some recent developments in the political economy literature, which present inequality as the new key dimension in the theories on political transition from dictatorship to democracy (e.g. [Acemoglu and Robinson, 2000, 2001](#) and [Boix and Garicano, 2002](#)). However, most of these models focus on the distribution of income and wealth, while our approach is entirely related to the distribution of education. Thus, the evidence found in this paper is more closely related to the predictions made by [Bourguignon and Verdier \(2000\)](#), in which oligarquic societies that start with a more equal distribution of education democratize sooner. Specifically, in the model by [Bourguignon and Verdier \(2000\)](#), political participation depends on the level of education, and the educated elite, who rule the country, evaluate the incentives of subsidizing the education of the poor. Increasing education for the non-educated may raise output due to a technological externality. However, by extending education to the masses, the elite loses political control. Starting from an oligarquic regime, it is shown that a more equalitarian distribution of education will lead a society to democratize sooner, since demands for redistribution will be lower and the economic gains of the education externality compensate the loss of political control. The distribution of endowments is also the underlying determinant of political change in [Rajan and Zingales \(2006\)](#), where the initial distribution of education determines political

“constituencies” among population subgroups and their preferences over policies. In their model the economy has three constituencies; the oligopolist, the educated and the uneducated. The authors show that if a society starts out with a small educated “middle class” that enjoys substantial rents, in order to prevent the elite from losing privileges and the small educated “middle class” from losing income, these constituencies will form a coalition against any political reform that benefits the uneducated poor, maintaining the status quo and blocking any institutional change.

In line with these predictions, the novel finding of this paper is that the distribution of education matters for democracy. For a sample of 104 countries over the period 1965–2000, our results imply that a more equal distribution of education, namely a more educated majority, is a better predictor of democracy than an increase in the average years of education. We show this result is robust to an array of sensitivity tests. Firstly, in order to reduce the problem of endogenous variables and reverse causation suggested by models in which education inequality, democracy and growth influence each other (e.g. [Bourguignon and Verdier, 2000](#)), we look at the countries that were dictatorships at the beginning of the period. Then, we analyze whether education has been an important factor for these countries in order to abandon the autocratic regime. Moreover, lagged levels of the explanatory variables are also used as instruments to mitigate reverse causation. Secondly, we check whether the effect of education on democracy depends on the level of development. Thirdly, we control for a broad number of variables that have been found by the literature to be relevant for democracies (e.g. [Barro, 1999](#)) and for time invariant variables that proxy for earlier institutions (see [Acemoglu et al., 2001 and 2006](#)). Fourthly, we complement the analysis by using the measures of democracy and institutions suggested by [Glaeser et al. \(2004\)](#) and alternative measures of education inequality computed by [Castelló and Doménech \(2002\)](#). Finally, we check the robustness of the results to the presence of atypical observations. In all exercises we find that an increase in the amount of education attained by the majority of the population stimulates democracy.

The rest of the article is organized as follows. The next section describes the data and the econometric technique used. Section 3 presents the main result of the paper which states a positive relationship between a more equal distribution of education and the level of democracy. Section 4 examines the robustness of this result. Finally, the last section summarizes the conclusions reached.

2. Model and data

2.1. The econometric model

As proposed by Acemoglu et al. (2005), this paper analyzes the relationship between education and democracy by estimating the following dynamic model:

$$Democracy_{i,t} = \beta Democracy_{i,t-\tau} + \gamma Education_{i,t-\tau} + \alpha_i + \xi_t + \varepsilon_{i,t} \quad (1)$$

where i is the country, t is the period and τ is the time lag. The variable *Democracy* lagged τ periods enters the set of explanatory variables to capture the characteristic of persistency in democracies. The coefficient of interest is γ , which reflects whether *Education* has any effect on democracies. The measure of education will include the level of education as well as its distribution. We also control for time, ξ_t , and country-specific effects, α_i . Therefore, the advantage of estimating a panel model is that we can control for unobservable variables that are country-specific and whose omission – e.g. in a pure cross-sectional regression – may bias the estimated coefficients.

The most common approach to estimating a dynamic panel data model has been the first-difference Generalized Method of Moments (GMM) estimator proposed by Arellano and Bond (1991). However, although the first-difference GMM estimator deals properly with the problem of unobservable heterogeneity, it has some shortfalls when it comes to estimating Eq. (1). The first has to do with the characteristic of persistency of the variables included in this equation. These variables, particularly educational measures, vary significantly across countries but remain quite stable within a country. For instance, 36 out of the 104 countries in the sample display the same value in the political rights index in 1970 and in 2000, which implies that the variation in democracy during this period is null for these countries. In the case of education, the characteristic of persistency is also relevant. For instance, more than 85% of the variation in education is cross-sectional, whereas the explanatory power of time dummies in a regression where the dependent variable is the average years of schooling is less than 1%. Thus, by taking first differences most of the variation in the data, which comes from variability across countries, disappears. This fact may indeed increase the measurement error bias by increasing the variance of the measurement error relative to the variance of the true signal (Griliches and Hausman, 1986). Moreover, Blundell and Bond (1998) point out that when explanatory variables are persistent, the lagged levels of the explanatory variables are weak instruments for the

variables in differences. They show that in small samples the shortcoming of weak instruments translates into a large finite sample bias.

Therefore, an econometric technique that exploits the bulk of the variation in the data would be preferable in order to improve the precision of the estimated coefficients. In this paper we use the system GMM estimator which in addition to estimating the equations in first differences, also estimates equations in levels, which are instrumented with the lagged first differences of the corresponding explanatory variables. In order to use these additional instruments, we need the identifying assumption that the first differences of the explanatory variables are not correlated with the specific effect, that is, although the specific effect may be correlated to the explanatory variables, the correlation is supposed to be constant over time. Therefore, the additional moment condition for the equation in levels is:

$$E[\Delta W_{i,t-\tau}(\alpha_i + \varepsilon_{i,t})] = 0 \quad (2)$$

where $W = [\text{Democracy Education}]$.¹

Blundell and Bond (1998) show that in Monte Carlo simulations the system GMM estimator performs better than its first-difference counterpart when the additional moment conditions required for the system GMM are valid. We test the validity of the moment conditions by using the conventional test of overidentifying restrictions proposed by Sargan and Hansen and by testing the null hypothesis that the error term is not second order serially correlated. Furthermore, we test the validity of the additional moment conditions associated with the level equation using the Hansen difference test.

2.2. The data

The most common measure of democracy used in the literature is the Freedom House Political Rights Index. The

¹ Acemoglu et al. (2006) argue against the use of the system GMM estimator in analyzing the relationship between per capita income and democracy stating that the stationary condition displayed in Eq. (2) would not hold in this context. They argue that a five-year income growth is unlikely to be orthogonal to the democracy country-fixed effect. Nevertheless, even if this condition did not hold and the system GMM estimator were inconsistent in large samples, in a context where variables are highly persistent and measured with error, Monte Carlo simulations show that the system GMM estimator clearly outperforms the first-difference GMM in terms of bias properties. The reason is that the system GMM estimator addresses the weak instrument problem of the first-difference estimator and reduces the exacerbation of the measurement error bias, which makes the former a better estimator in practice for small samples (see Hauk and Wacziarg, 2006).

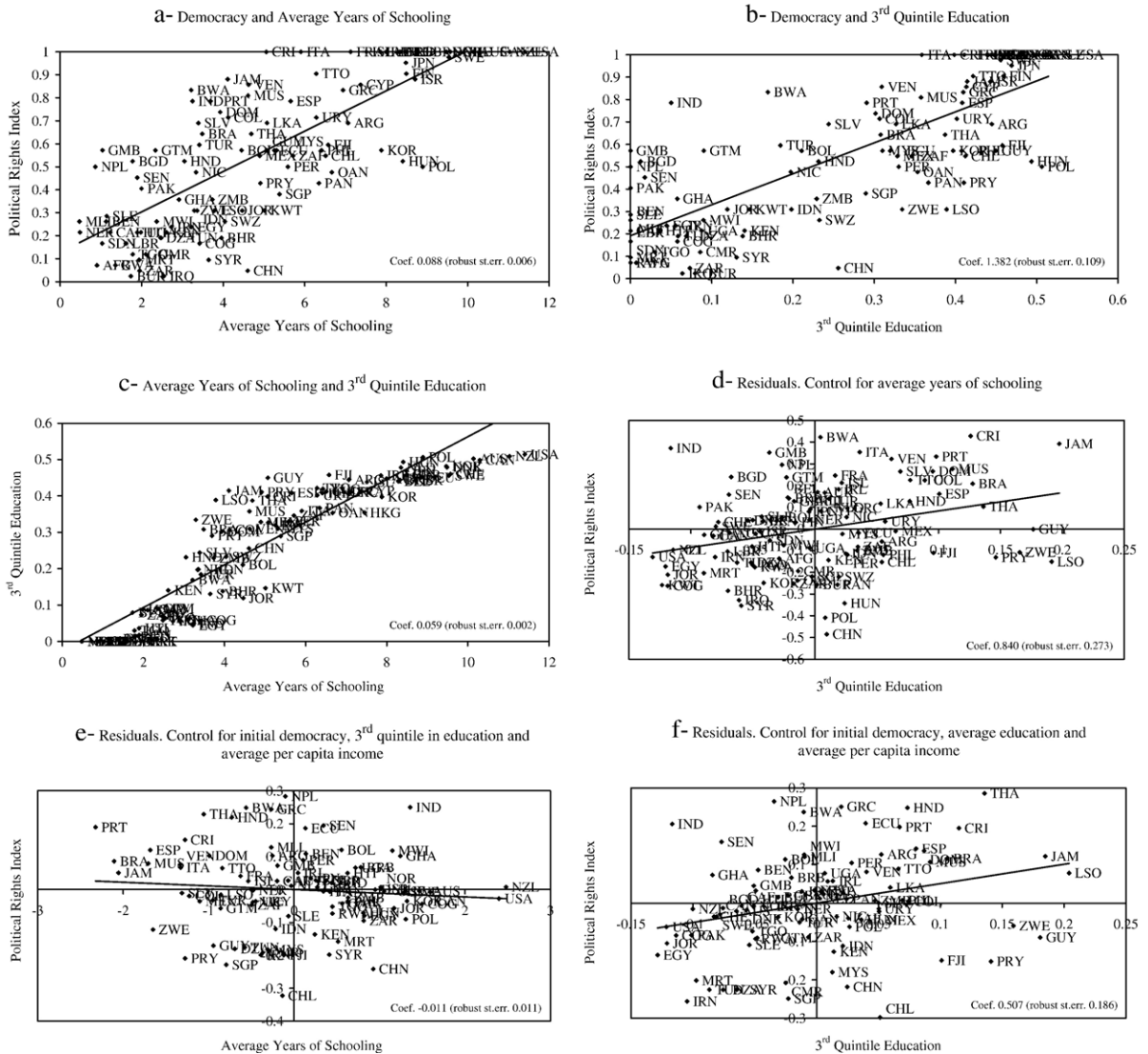


Fig. 1. Democracy and education averaged over the period 1970–2000.

Freedom House measures freedom using the political rights and civil liberties indexes. These variables range from 1 to 7, indicating more freedom the closer the value is to 1.²

² The ratings are determined by a checklist of 25 questions. The political rights questions are grouped into three sub-categories: electoral process, political pluralism and participation, and the functioning of government. The civil liberties questions are grouped into four sub-categories: freedom of expression and belief, association and organization rights, rule of law and personal autonomy and individual rights. The sum of each country's sub-category scores translates to a rating from 1 to 7, with a greater value indicating less freedom. A more detailed explanation can be found in <http://www.freedomhouse.org>.

These measures are available for several countries from 1972 to 2003.³ In line with Barro (1999) and Acemoglu et al. (2005) we complement these measures with the related variables from Bollen (1990) for 1960 and 1965 and normalize the variables to range from 0 to 1, where the greater the value the more democratic a set of institutions is.

The measures of education include the average years of education of the population 25 years and over (*Average Educ*) from Barro and Lee (2001). Additionally, we will control for the distribution of education with the share of education attained by the least educated 60% of individuals

³ We use the data from the Freedom House in 1972 for 1970.

in the society — cumulative third quintile in the distribution of education (*3rd Quintile Educ*). The counterpart of this measure for income inequality could be the “share of the middle class in income” used by Barro (1999), though it is defined as the three middle quintiles of income. Then, we will check the robustness of the results with other standard measures of inequality such as the Gini coefficient in the distribution of education and the ratio between the bottom 20% of individuals with the lowest education to the top 20% with the highest level of schooling, all of which are computed by Castelló and Doménech (2002). The time span is a five-year panel from 1960 to 2000.

3. Education and democracy

As preliminary evidence, Fig. 1 shows the correlation between the variables of interest averaged over the period 1970–2000. Broadly, the figure shows that although there is strong positive correlation between average years of schooling and the index of political rights, once the initial level of democracy and the level of development are accounted for, this relationship disappears. On the contrary, the positive association between a more equitable distribution of education, measured through the third quintile, and democracy holds even when taking into account additional controls.⁴

Table 1 presents the results from estimating Eq. (1) under different assumptions regarding the error term. Column (1) shows the results in the existing literature that do not control for country-specific effects, that is, the estimated equation assumes that $\alpha_i=0$. In line with previous findings, results show that the correlation between the average years of schooling and the measure of democracy is positive and statistically significant, suggesting that more education is related to more democracy. We

⁴ Following Hauk and Wacziarg (2006) we compute the OLS estimator applied to a cross-section with variables averaged over the period (between estimator). The result shows that the share of education attained by the third quintile is more relevant when it comes to explaining democracy than the average years of schooling:

$$\begin{aligned} \text{Democracy}_{i,1970-2000} &= 0.108_{(0.03)} \\ &+ 0.449 \text{ Democracy}_{i,1970}_{(0.05)} \\ &+ 0.010 H_{i,1970-2000}_{(0.01)} \\ &+ 0.691 \text{ 3rdQuintile}H_{i,1970-2000}_{(0.20)} \end{aligned}$$

where $Nob=100$, $R^2=0.817$ and the standard errors are shown in parenthesis. The result holds if we control for per capita income and for regional dummies and if we measure the average years of education (H) and the percentage of education attained by 60% of the population (3rdQuintileH) at the beginning of the period to reduce endogeneity problems.

obtain similar results if we check the modernization theory by measuring education with the third quintile in the distribution of education (column (2)).⁵ The results, however, differ when both variables are included in the set of controls. In this case, the estimated coefficient and significance of the average years of education decrease substantially, while the quantitative effect of the third quintile on democracy remains sizeable (column (3)).

Nevertheless, the positive effect of education on democracy has been challenged recently by the results obtained by Acemoglu et al. (2005), who state that previous findings could be biased due to a problem of omitted country-specific effects. Certainly, the results show that by controlling for country-specific effects with the fixed effect or first-difference GMM estimators a completely different picture emerges. Specifically, column (4) shows that when we control for country-specific effects using the fixed effect estimator the estimated coefficients of the educational variables reverse sign and become negative, although they are not statistically significant.⁶ Likewise, the positive and significant effect of education on democracy also disappears when we estimate Eq. (1) with the first-difference GMM estimator (column (5)). In view of similar results, Acemoglu et al. (2005) conclude that “*this strongly suggests that the cross-sectional relationship between education and democracy is driven by omitted factors influencing both education and democracy rather than a causal relationship (p. 48)*”.

However, an alternative interpretation is that when variables are highly persistent (variation over time accounts for less than 1% of the total variation in education) and measured with error, the fixed effect estimator, by exploiting the within country variation in the data, may exacerbate the measurement error bias. Additionally, the first-difference GMM estimator may also suffer from a problem of weak instruments, biasing the first-difference GMM estimator towards the fixed effect counterpart.⁷ In fact, in Monte Carlo simulations Hauk and Wacziarg

⁵ We can calculate the “steady state” effect as $\gamma/(1-\beta)$, to compute the long run effect, if causal, from education to democracy. The estimated values of the parameter imply that an increase in one standard deviation in the years of education (about 2.9 years) would increase the long run value of democracy by 0.26. In the case of the third quintile the magnitude of the effect is quite similar to the average effect; a one standard deviation increase in the third quintile (0.19) is estimated to increase the long term value of democracy by 0.26 ($(0.412/(1-0.702)) * 0.19$).

⁶ Note that the positive effect of education on democracy disappears with the fixed effect estimator, which relies on the within country variation in the data and does not use instrumental variables.

⁷ Bobba and Coviello (2006) also highlight the problem of weak instruments and weak identification in the results of Acemoglu et al. (2005) results.

Table 1
Democracy and education

	Pooled OLS			FE	Dif GMM	System GMM			Different samples. System GMM			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	Dictatorships	Developed	Developing	Non-oil
Democracy _{<i>t</i>-5}	0.702 ^a (0.031)	0.702 ^a (0.031)	0.689 ^a (0.032)	0.399 ^a (0.037)	0.528 ^a (0.080)	0.647 ^a (0.059)	0.651 ^a (0.059)	0.649 ^a (0.058)	0.590 ^a (0.060)	0.592 ^a (0.112)	0.585 ^a (0.065)	0.629 ^a (0.065)
Average Education _{<i>t</i>-5}	0.027 ^a (0.004)		0.010 ^b (0.005)	-0.005 (0.015)	0.006 (0.036)	0.026 ^a (0.007)		0.004 (0.011)	0.000 (0.014)	0.006 (0.009)	-0.013 (0.015)	0.001 (0.011)
3rd Quintile Education _{<i>t</i>-5}		0.412 ^a (0.058)	0.295 ^a (0.083)	-0.017 (0.148)	0.059 (0.219)		0.510 ^a (0.164)	0.414 ^a (0.152)	0.479 ^a (0.173)	0.189 ^b (0.091)	0.611 ^a (0.170)	0.458 ^a (0.160)
Constant	0.055 ^b (0.022)	0.090 ^a (0.022)	0.074 ^a (0.022)	0.438 ^a (0.086)		0.099 ^a (0.036)	0.093 ^b (0.044)	0.100 ^b (0.035)	0.116 ^b (0.045)	0.261 ^a (0.058)	0.160 ^a (0.052)	0.125 ^a (0.036)
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R ²	0.71	0.71	0.72	0.24								
Countries	104	104	104	104	102	104	104	104	73	23	69	92
Observations	764	764	764	764	659	764	746	764	528	179	505	676
AR (2) test					[0.604]	[0.697]	[0.776]	[0.758]	[0.830]	[0.317]	[0.735]	[0.728]
Hansen <i>J</i> test					[0.186]	[0.110]	[0.043]	[0.199]	[0.940]	[1.000]	[0.975]	[0.380]
Difference Hansen						[0.501]	[0.023]	[0.405]	[1.000]	[1.000]	[1.000]	[0.615]

Robust standard errors in parenthesis. a, b and c are 1, 5 and 10% significance level respectively. *Democracy* is measured through the political rights index. *Education* includes the average per years of schooling of the population 25 years and over and the percentage of education attained by the 60% of the population. The instruments for column (5)–(12) are the levels of the explanatory variables lagged two periods and further lags until a maximum of 5. In addition to these variables, the system GMM also uses as instruments for the level equations the explanatory variables in the first differences lagged one period.

(2006) show that in a similar cross-country growth regression framework with persistent variables, the gains from reducing omitted variable bias under fixed-effects are more than offset by an increase in the exacerbation of the measurement error bias, which makes using the fixed effect estimator in this context unadvisable. Moreover, even if the model is dynamic they show that the first-difference GMM estimator does not perform better in terms of bias properties. For example, the Monte Carlo simulations regarding the effect of human capital accumulation on growth display a sizeable negative bias associated with the problem of weak instruments.

Therefore, in order to address these shortcomings we can use the system GMM estimator, which reduces the potential biases and imprecision associated with the first-difference estimator when variables are persistent. In fact, when we control for country-specific effects and take into account the cross-country variation in the data, the results are akin to those obtained by Barro (1999), Glaeser et al. (2004, 2007) and Papaioannou and Siourounis (2005), who provide evidence of a positive impact of education on democracy. As shown in columns (6–7), the coefficient of the average years of education is positive and statistically significant at the 1% level and the same is true for the distribution of education. However, when both measures are included in the regression (column (8)), while the coefficient of the average years of education drops markedly and is no longer statistically significant, the

coefficient of equality in the distribution of education changes only slightly.⁸

In sum, this preliminary evidence directs our attention to the education attained by the majority of the society as the relevant educational variable when it comes to stimulating democracy.

4. Robustness of the results

The evidence found in the previous section reveals two novel findings. The first shows that even when controlling for fixed omitted variables, more education is related to a greater degree of democracy. The second leads to the suggestion that a more equal distribution of education is the relevant educational variable in

⁸ The reliability of the results depend on the validity of the instruments. We report the diagnostic tests at the bottom of the table. The *p*-values of the AR (2) test, the Hansen *J* test and the Hansen Difference test suggest that the instruments are valid. Moreover, although there is not a formal test for the stationary condition, we have split the whole sample into 6 sub-periods of equal length (e.g. 1960–1975, 1965–1980, 1970–1985, 1975–1990, 1980–1995, 1985–2000), since an estimated coefficient of the third quintile that is monotonously increasing or decreasing over time could be signalling that this condition does not hold. Using the system GMM estimator and controlling for year dummies, the estimated coefficients for the third quintile are 1.228, 0.413, 1.001, 1.111, 0.340, and 0.796 respectively. Thus, these results provide evidence that there is no sign of any increasing or decreasing trend over the period, which suggests that the stationary condition could hold in this context.

Table 2
Democracy and education: Additional explanatory variables

Additional controls	Political rights		Civil rights	
	AR (2) test		AR (2) test	
	3rd Quintile Education _{t-5}	Hansen, Difference Hansen	3rd Quintile Education _{t-5}	Hansen, Difference Hansen
System GMM estimator. Dependent variable is democracy				
lny _{t-5}	0.396^b (0.184)	[0.69] [0.26,0.88]	0.254^b (0.122)	[0.48] [0.29, 0.86]
lnsk _{t-5}	0.738^a (0.145)	[0.64] [0.22,0.78]	0.525^a (0.099)	[0.44] [0.31, 0.30]
Urbanization rate _{t-5}	0.455^a (0.143)	[0.76] [0.16, 0.27]	0.317^a (0.091)	[0.19] [0.30, 0.32]
Population _{t-5}	0.441^a (0.153)	[0.73] [0.29, 0.86]	0.366^a (0.097)	[0.37] [0.41, 0.86]
Life expectancy _{t-5}	0.359^a (0.103)	[0.67] [0.19, 0.18]	0.364^a (0.068)	[0.18] [0.19, 0.35]
Infant mortality _{t-5}	0.417^a (0.153)	[0.72] [0.14, 0.20]	0.381^a (0.106)	[0.17] [0.44, 0.83]
Education gap _{t-5}	0.313^a (0.110)	[0.74] [0.17, 0.40]	0.182^b (0.087)	[0.18] [0.29, 0.65]
Gini _{t-5} ^y	0.603^a (0.286)	[0.21] [0.99, 1.00]	0.585^a (0.193)	[0.42] [0.99, 1.00]
3rd quintile _{t-5} ^y	0.642^a (0.218)	[0.77] [1.00, 1.00]	0.440^b (0.215)	[0.97] [1.00, 1.00]
Ethnolinguistic _{t-5}	0.466^a (0.150)	[0.69] [0.21]	0.413^a (0.106)	[0.37] [0.19]
Muslims _{t-5}	0.469^b (0.187)	[0.76] [0.09]	0.354^b (0.148)	[0.19] [0.08]

Endowments and historical variables. OLS estimator. Dependent variable is democracy

	3rd Quintile Education _{t-5}	Observations <i>R</i> ²	3rd Quintile Education _{t-5}	Observations <i>R</i> ²
In settler mortality	0.456^a (0.091)	386 [0.60]	0.389^a (0.069)	386 [0.66]
Population density ₁₅₀₀	0.442^a (0.076)	473 [0.60]	0.377^a (0.060)	473 [0.66]
ExCons independence	0.280^a (0.077)	473 [0.61]	0.263^a (0.059)	473 [0.66]
Latitude	0.406^a (0.059)	748 [0.71]	0.349^a (0.045)	748 [0.77]
Oil	0.406^a (0.058)	764 [0.72]	0.351^a (0.044)	764 [0.77]
Common-law	0.411^a (0.058)	764 [0.71]	0.354^a (0.044)	764 [0.77]
All fixed variables	0.383^a (0.107)	378 [0.60]	0.346^a (0.082)	378 [0.67]

Robust standard errors in parenthesis. a, b and c are 1, 5 and 10% significance level respectively. *Democracy* is measured through the political rights and the civil liberties indexes. The estimated coefficients shown are those of the 3rd quintile in the distribution of education. The definition of the remaining controls is in the text.

determining democracy. In this section we study the robustness of the aforementioned results.

4.1. Different samples

In the first place we remove the economies that were already democracies at the beginning of the period to tackle the problem of reverse causation. Then, we

examine whether within dictatorships an improvement in the education attained by the majority has had a positive and significant effect on democracy. Thus, in column (9) we include only the countries that enter the sample as dictatorships in line with [Papaioannou and Siourounis' \(2005\)](#) classification. The results show that previous findings were not driven by reverse causation; whereas the coefficient of the average years of schooling

is not statistically significant, the estimated effect of a more equal distribution of education on democracy is even greater than that found in the sample as a whole.

Next, we analyze whether the relationship between education and democracy depends on the level of development (columns (10)–(11)). The results show that although the positive association between a better distribution of education and democracy holds in developing as well as in advanced societies, this effect is stronger in developing countries with an estimated coefficient of 0.611 compared to 0.189 in developed societies.

Finally, in the last column we exclude oil exporting countries from the base sample since the impact of development on democracy in these economies may be through a channel other than the accumulation of human and physical capital.⁹ In fact, in most of these countries the level of education is quite low and the degree of inequality in the distribution of education is quite high. Moreover, considering that many oil exporting countries have not become democracies, these countries could possibly be influencing our results. As displayed in column (12), the estimated coefficient of the third quintile is positive and statistically significant; which suggests that our previous findings were not driven by the specific characteristics of these economies.

4.2. Omitted variables

We then proceeded to test the robustness of the results to different controls. This exercise is important because if other variables that affect democracy and that are related to education are omitted from the analysis, the estimated coefficient of the education variables could be biased.

Therefore, in Table 2 we control for a broad range of potential determinants of democracy suggested by the existing literature. The additional controls are added one by one and enter the equation lagged by one period. In the interest of saving space, we only show the estimated coefficients of the third quintile.¹⁰ The political rights index is used to measure democracy and we also check the robustness of the results with the civil liberties index. Additional controls include the log of per capita income, since income is the other important variable – apart from education – suggested by the modernization hypothesis to be highly related to democracy; the log of the investment share of GDP; the urbanization rate, since the European democratization process in the eighteenth and

nineteenth century has been argued to be influenced by the industrial revolution and subsequent urbanization; a measure of the country size, such as population size; two health indicators measured by the log of life expectancy at birth and the infant mortality rate as additional proxies for the standard of living; the gap between male and female schooling measured by the average years of primary education for the population aged 25 years and over, as suggested by Barro (1999); the income Gini coefficient and the share of income accruing to 60% of the population, since the measure of human capital inequality could be picking up an income inequality effect, which may also be an important factor in determining the propensity of a country to abandon an autocratic regime (e.g. Acemoglu and Robinson, 2000, 2001); a measure of ethnolinguistic fractionalization, since greater population heterogeneity may be a handicap when it comes to sustaining a democracy and the percentage of Muslims in the society, as previous researchers have found a negative correlation between Muslim countries and democracy.¹¹

The results suggest that controlling for any of these potential determinants of democracy does not change the main result of the paper. In all cases, the coefficient of the third quintile in the distribution of education remains positive and statistically significant, which confirms that the results of the previous section are not due to the omission of relevant variables related to education and democracy.¹²

¹¹ The source of these variables is the PWT 6.1 by Heston, Summers and Aten (2002) for the log of per capita income, the log of the investment rate and population size. The urbanization rate, ethnic fractionalization and the infant mortality rate are taken from the Global Development Growth Data Base compiled by Easterly and Sewadeh (2002). The life expectancy source is the World Development Indicators 2004 and the percentage of Muslims in the total population is taken from La Porta et al. (1999). The measures of income inequality are taken from Deininger and Squire (1996) and updated by the UNU/WIDER-UNDP World Income Inequality Data Base (2000). Only data defined as “high quality” are included. Moreover, a value of 0.066 has been added to the Gini coefficient based on expenditure in order to make the figures comparable to measures of income inequality, as is common in the literature.

¹² Due to the criticism of measurement error in the Deininger and Squire (1996) data set on income inequality, we have also tested the robustness of the results with the Estimated Household Income Inequality (EHII) measure computed by Galbraith and Kum (2005). This measure has larger coverage and overcomes some inconsistencies in Deininger and Squire’s (1996) data. The results suggest that income and education inequality have an independent effect on democracy, in most cases both the estimated coefficients of the income and education inequality measures are statistically significant when they enter together in the set of controls. In particular, when we control for income inequality with the EHII measure, the estimated coefficient of the third quintile in the distribution of education is 0.634 (st. err. 0.171) with the political rights index and 0.480 (st. err. 0.122) with the civil liberties index, whereas the estimated coefficient of the income inequality index is -0.011 (st. err. 0.005) and -0.012 (st. err. 0.004) respectively.

⁹ Oil exporters include Algeria, Cameroon, Congo, Mexico, Trinidad and Tobago, Ecuador, Venezuela, Bahrain, Indonesia, Iran, Iraq and Kuwait.

¹⁰ When we include both, average and distribution of education, the estimated coefficient of the average years of schooling is never statistically significant.

Furthermore, Acemoglu et al. (2005) suggest that country-fixed effects could be capturing omitted factors that have influenced the joint evolution of economic and political development. In fact, Acemoglu et al. (2006) find that country fixed-effects, estimated from the relationship between income and democracy, are highly related to historical variables that characterized earlier institutions. Thus, if these variables are driving the positive influence of the education attained by the majority of a society on democracy, we should find that once we control for these variables the positive effect vanishes. In order to check this hypothesis, the lower part of Table 2 displays the results when historical and endowment variables, which are time invariant, are controlled for. Given that the time invariant variables enter as proxies of α_i , we can estimate Eq. (1) by OLS. In the first place, we include the log of settler mortality as the first time invariant variable, since Acemoglu et al. (2001) use mortality faced by European colonizers as a proxy for early institutions.¹³ Likewise, we also control for the density of the indigenous population in 1500 and for the executive constraints at independence together with the year of independence. Moreover, geography and endowments have also been argued to influence the type of colonization and, therefore, previous institutions. Hence, we include latitude from the equator and oil exporting countries in the set of explanatory variables. Finally, we control for the quality of the legal system since, according to La Porta et al. (1998), it is related to the legal origin. In particular, these authors find that the common-law system is better at protecting property rights.¹⁴ The results show that controlling for historical or endowment variables, which have been suggested to be related to unobservable omitted fixed-effects, does not change our result. The estimated coefficient of the third quintile is always statistically

significant at the 1% and its value with the political rights index ranges from 0.280 to 0.456. Moreover, it is worth noting that the estimated value with the system GMM, displayed in column (8) of Table 1, ranges within this interval (0.414). Therefore, the results suggest that our main finding is not driven by omitted variables that could have influenced both the political and economic development of societies.

4.3. Alternative measures of democracy and education inequality

We have also tested the robustness of the results to alternative measures of democracy suggested by Glaeser et al. (2004) and different measures of the distribution of education computed by Castelló and Doménech (2002). The broader set of alternative measures of political institutions includes the Polity composite democracy index, computed by subtracting the autocracy score from the democracy score. Both autocracy and democracy variables take values from 0 to 10, where higher values show a greater degree of democracy. A measure on constraints on the executive, which assesses the extent of institutionalized constraints on the decision making powers of chief executives. Its value ranges from 1 to 7, where the greater the value the higher the constraints on the executive. These measures are taken from Polity IV. Moreover, an alternative measure of autocracy, taken from Przeworski et al. (2000), is also used. This variable ranges from 0 to 2 indicating a higher level of autocracy the higher the value.¹⁵

Columns (1)–(3) of Table 3 show that the influence of the education attained by 60% of the population on democracy holds when we use different variables that measure the degree of autocracy or democracy in societies, the coefficient of the third quintile in the distribution of education is always positive (negative in case of autocratic regimes) and statistically significant at standard levels. Thus, previous results were not due to a narrow definition of democracy.

Likewise, in the second part of Table 3 we have examined the robustness of the results to alternative measures of equality in the distribution of education. Up to now we have measured the distribution of education with the standard cumulative third quintile, which measures the share of the education attained by the least educated sixty per cent of individuals. However, one might think that, according to Lipset's view, what

¹³ The interesting idea of Acemoglu et al. (2001) is that in places where Europeans faced high mortality rates, settlers implemented extractive states that transferred resources rapidly to the metropolis. This strategy resulted in poor institutions that did not introduce protection of private property. On the contrary, when settlers faced low risk of mortality, they stayed in the colony and established European institutions that enforced the rule of law. Furthermore, the authors find evidence that early institutions have persisted to the present.

¹⁴ The source of these data is Acemoglu et al. (2001) for the Mortality rate faced by the European colonizers; Acemoglu et al. (2002) for Population density in 1500; Polity IV for the Constraints on the Executive at Independence and the CIA World Factbook (2004) for the Year of Independence. Latitude from the Equator and Oil exporting countries are taken from Easterly and Sewadeh (2002). Finally, the legal origin, measured by countries that have the British or Common law legal system is from La Porta et al. (1999).

¹⁵ For a more comprehensive definition of variables see Marshall and Jaggers (2003) and Przeworski et al. (2000).

Table 3

Democracy and education (alternative measures of democracy and the distribution of education. System GMM)

	Polity IV		Przeworski et al.				
	Democracy	Executive Constraint	Autocracy	Electoral rights			
	(1)	(2)		(3)	(4)	(5)	(6)
Democracy _{<i>t-5</i>}	0.736 ^a (0.065)	0.675 ^a (0.067)	0.364 ^a (0.095)	0.618 ^a (0.060)	0.637 ^a (0.057)	0.629 ^a (0.056)	0.636 ^a (0.060)
Average education _{<i>t-5</i>}	-0.153 (0.212)	0.001 (0.080)	-0.018 (0.034)	-0.010 (0.019)	-0.021 (0.016)	-0.013 (0.014)	0.009 (0.008)
3rd Quintile Education _{<i>t-5</i>}	7.284 ^b (3.695)	2.280 ^c (1.260)	-1.272 ^a (0.475)		0.334 ^b (0.141)		
3rd Quintile Years _{<i>t-5</i>}				0.074 ^b (0.033)	0.056 ^b (0.027)		
Gini Education _{<i>t-5</i>}						-0.584 ^a (0.143)	
Bottom ₂₀ /Top ₂₀ Education _{<i>t-5</i>}							0.351 ^a (0.123)
Constant	0.094 ^a (0.679)	1.072 ^a (0.291)	0.868 ^a (0.157)	0.162 ^a (0.055)	0.152 ^a (0.050)	0.571 ^a (0.138)	0.150 ^a (0.040)
Time dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Countries	102	102	99	104	104	104	104
Observations	713	713	513	764	764	764	746
AR (2) test	[0.347]	[0.275]	[0.129]	[0.683]	[0.739]	[0.740]	[0.680]
Hansen <i>J</i> Test	[0.179]	[0.189]	[0.262]	[0.260]	[0.870]	[0.141]	[0.286]
Difference Hansen	[0.388]	[0.094]	[0.362]	[0.733]	[1.000]	[0.098]	[0.544]

Robust standard errors in parenthesis. a, b and c are 1,5 and 10% significance level respectively. The instruments are the levels of the explanatory variables lagged two periods and all further lags until a maximum of 5 as well as the variables in the first differences lagged one period.

should matter for democracy is the average years of education of the majority of the society instead of the share of education attained by the masses. Hence, in column (4) we test the robustness of the results to an absolute measure defined as the average years of schooling attained by the least educated sixty per cent of citizens. In line with the previous findings, the results reveal that the education of the average citizen is what matters for democracy, not the average education across all citizens; the estimated coefficient of the third quintile, measured in years of schooling, is positive and statistically significant, whereas the average years of education of the total population is not related to democracy. Moreover, not only the average years of schooling of the median matter for democracy, but also how education is distributed among the population. Column (5) shows that both the years of schooling and the share of education attained by the least educated 60% of individuals matter for democracy.

Furthermore, the distribution of education is also found to be relevant with other standard measures of inequality such as the Gini coefficient or the ratio of the bottom to top quintile. Specifically, the results show that a more unequal distribution of education has a negative impact on democracy. In column (6) the estimated

coefficient of the Gini index is negative and statistically significant at the 1% level whereas average years of schooling seem to have no impact on democracy. Another standard measure of inequality is the ratio of the share of education of the bottom 20% of individuals with the lowest education to the top 20% with the highest level of schooling.¹⁶ The results displayed in column (7) suggest that a greater share of education attained by the bottom quintile relative to that of the elite stimulates democratic institutions or, the other way around, the concentration of education in a few individuals does not promote democracy.

4.4. Atypical observations

Finally, we check if the results are influenced by the presence of atypical observations. In order to control for outliers, firstly, we re-estimate the regression in column (8) of Table 1 by removing one country at a time. Then,

¹⁶ Other papers have used the top to bottom quintile in the distribution of income as a measure of inequality. However, in our case, since there are some countries with a value of zero for the bottom quintile in the distribution of education, we have computed a measure of equality instead.

we remove the 5 countries with the highest average values of the third quintile and the 12 countries with a value of zero in the third quintile. Finally, we repeat the exercise by ruling out the countries whose residuals exceed more than three times the estimated standard error of the residuals. In all cases the coefficient of the third quintile is positive and statistically significant, suggesting that the results are unlikely to be driven by outliers.

We have also run a robust regression procedure of column (3) in Table 1, which gets Cook's D values and then drops any observation if its Cook's D value is greater than 1. Although the results show a greater estimated coefficient for lag democracy and lower coefficients for both educational variables compared to those obtained in column 3, the only educational variable that has a statistically significant effect on democracy is the third quintile.

5. Conclusions

One of the empirical regularities in political economy, which refers to the positive association between education and democracy, has been challenged recently by Acemoglu et al. (2005). These authors point out that previous empirical evidence could suffer from potential omitted variable bias. As a result, when these authors control for country-specific effects, the positive association between education and several measures of democracy disappears.

This paper makes a methodological contribution to this debate by using the system GMM estimator, which addresses the key econometric problems in estimating the effect of education on democracy: short time dimension with highly persistent variables. Interestingly, even when controlling for country-specific effects, the results with the system GMM estimator reveal that education stimulates democratic institutions in line with the findings of Barro (1999) and Glaeser et al. (2004, 2007).

Furthermore, this paper goes one step further and examines whether the distribution of education plays an important role in this analysis. The answer is yes. The results provide extensive evidence that a more equal distribution of education is what matters for democracy, that is, the implementation and sustainability of democracies need the support of the majority of the society. In fact, when measures of the distribution of education are accounted for, the effect of the average years of schooling on democracy vanishes. We find this result to be robust to different samples, additional controls, different measures of democracy and education equality and to the presence of atypical observations.

This finding is in line with Lipset's view, who states that "*education presumably broadens men's outlooks, enables them to understand the need for norms of tolerance, restrains them from adhering to extremist and monistic doctrines, and increases their capacity to make rational electoral choices.* (1959, p. 79)" Therefore, if formal education provides political attitudes conducive to democracy, the likelihood of a country establishing and maintaining a democratic regime will be higher the larger the educated population in the society. Likewise, the results found in this paper also support the predictions of those models in which a more equal distribution of education accelerates the transition from an oligarchic regime to a democracy (e.g. Bourguignon and Verdier, 2000) and facilitates economic and political reforms (e.g. Rajan and Zingales, 2006).

Overall, the quite robust effect of the distribution of education on democracy found in this paper suggests that future research should pay more attention to the education attained by the majority of the society as a potential determinant of the degree of democracy. In particular, the novelty of the results and the scarcity of extensive theoretical background break new frontiers for further research.

References

- Acemoglu, D., Robinson, J.A., 2000. "Why did the West extend the franchise? Democracy, inequality, and growth in historical perspective". *Quarterly Journal of Economics* 115 (4), 1167–1199.
- Acemoglu, D., Robinson, J.A., 2001. "A theory of political transitions". *American Economic Review* 91 (4), 938–963.
- Acemoglu, D., Johnson, S., Robinson, J.A., 2001. The colonial origins of comparative development: an empirical investigation. *American Economic Review* 91, 1369–1401.
- Acemoglu, D., Johnson, S., Robinson, J.A., 2002. Reversal of fortune: geography and institutions in the making of the modern world income distribution. *Quarterly Journal of Economics* 118, 1231–1294.
- Acemoglu, D., Johnson, S., Robinson, J.A., Yared, P., 2005. From education to democracy? *American Economic Review Papers and Proceedings* 95 (2), 44–49.
- Acemoglu, D., Johnson S., Robinson J.A., Yared P., 2006. "Income and Democracy". Mimeo, MIT.
- Arellano, M., Bond, S., 1991. Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *Review of Economic Studies* 58, 277–297.
- Barro, R.J., 1999. Determinants of democracy. *Journal of Political Economy* 107, S158–S183.
- Barro, R., Lee, J.-W., 2001. International data on educational attainment: updates and implications. *Oxford Economic Papers* 53, 541–563.
- Blundell, R., Bond, S., 1998. Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics* 87, 115–143.
- Bobba, M., Coviello, D., 2006. Weak instruments and weak identification in estimating the effects of education on democracy. *Inter-American Development Bank Working Paper: No 569*.
- Boix, C., Garicano L., 2002. "Democracy, Inequality and Country-Specific Wealth". Mimeo, University of Chicago.

- Bollen, Kenneth A., 1990. Political democracy: conceptual and measurement traps. *Studies in Comparative International Development* 25, 7–24.
- Bourguignon, F., Verdier, T., 2000. Oligarchy, democracy, inequality and growth. *Journal of Development Economics* 62, 285–313.
- Castelló, A., Doménech, R., 2002. Human capital inequality and economic growth: some new evidence. *Economic Journal* 112, 187–200.
- Deininger, K., Squire, L., 1996. A new data set measuring income inequality. *World Bank Economic Review* 10, 565–591.
- Easterly, W., Sewadeh, M., 2002. Global Development Growth Data Base. World Bank.
- Galbraith, J.K., Kum, H., 2005. Estimating the inequality of household incomes: a statistical approach to the creation of a dense and consistent global data set. *Review of Income and Wealth* 51, 115–143.
- Glaeser, E.L., La Porta, R., Lopez-de-Silanes, F., Shleifer, A., 2004. Do institutions cause growth? *Journal of Economic Growth* 9, 271–303.
- Glaeser, E.L., Ponzetto, G., Shleifer, A., 2007. Why does democracy need education? *Journal of Economic Growth* 12, 77–99.
- Griliches, Z., Hausman, J., 1986. Errors in variables in panel data. *Journal of Econometrics* 31, 93–118.
- Hauk, W.R., Wacziarg R., 2006. “A Monte Carlo Study of Growth Regressions.” Mimeo, Stanford University.
- Heston, A., Summers, R., Aten, B., 2002. Penn World Tables Version 6.1, CICUP.
- La Porta, R., Lopez-de-Silanes, F., Shleifer, A., Vishny, R., 1998. Law and finance. *Journal of Political Economy* 106, 1113–1155.
- La Porta, R., Lopez-de-Silanes, F., Shleifer, A., Vishny, R., 1999. The quality of government. *Journal of Law Economics and Organization* 15, 222–279.
- Lipset, S.M., 1959. Some social requisites of democracy: economic development and political legitimacy. *American Political Science Review* 53, 69–105.
- Papaioannou, E., Siourounis, G., 2005. “Economic and Social Factors Driving the Third Wave of Democratization”, mimeo London Business School.
- Przeworski, A., Alvarez, M., Cheibub, J.A., Limongi, F., 2000. *Democracy and Development: Political Institutions and Material Well-Being in the World, 1950–1990*. Cambridge University Press, NY.
- Rajan, R., Zingales, L., 2006. The persistence of underdevelopment: institutions, human capital, or constituencies? NBER Working Paper, p. 12093.