

From Education to Democracy:

Does Educational Dispersion Matter?

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Abstract: In this thesis I explore the relationship between the dispersion of educational attainment within a country and the quality of democratic institutions. The relationship between the mean level of educational attainment and the quality of institutions has been deeply explored and debated in the literature, but very little work has been done examining the effect of the dispersion around that mean. In this paper I expand Glaeser et al.'s (2006) theoretical model on the channel through which education impacts democracy to include an impact of the spread of education. To test this theory in the data I then create two measures of educational dispersion from the Barro-Lee (1996) education dataset and examine their impact on democracy using several of the specifications that are typical in the literature on this subject. I find that educational dispersion does have a significant effect, mostly in line with priors, which is robust to a number of empirical specifications.

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I. Introduction

In this paper I explore the relationship between the dispersion of educational attainment and the quality of democratic institutions. The hypothesis that higher levels of educational attainment are a boon to democracy has deep roots in western thinking, dating back to Aristotle. As the United States State Department writes in their “Principles of Democracy”, “There is a direct connection between education and democratic values: in democratic societies, educational content and practice support habits of democratic governance.” It continues “This educational transmission process is vital in a democracy because effective democracies are dynamic, evolving forms of government that demand independent thinking by the citizenry. The opportunity for positive social and political change rests in citizens' hands”(P.1). The belief that democracy relies on high levels of educational attainment more than other systems of governance have been widely expanded upon in the Political Science and Economics literature.

Seymour Lipset (1959) was among the first to note the extensive evidence demonstrating the positive relationship between education and democracy. He pointed to a wide variety of surveys suggesting that one of the most important factors predicting democratic values in individuals is their level of educational attainment. He also argued that a high *average* level of education at the country level was a necessary if not sufficient condition for successful democratic institutions in countries around the world. Indeed, much of the literature has followed in this tradition when examining the relationship between education and democracy. In this paper I build on much of that work by expanding some of the theoretical models and empirical specifications examined by the literature to include the *dispersion* of education as an additional explanatory factor

for the quality of democratic institutions, and find evidence that it deserves a more prominent position in the literature. This section of the literature contains important policy implications, as forming effective policies to promote democracy and economic growth in the developing world is a major area of focus for economics policy makers.

This thesis builds more directly on the work of Glaeser et al.(2006) who constructed a theoretical model of the relationship between democracy and education in an attempt to motivate their empirical conclusions that the average level of educational attainment influences the extent to which a country's institutions are democratic in nature. Their model is based on the fundamental principle that education has a socializing impact on citizens, allowing them to derive higher benefits from interpersonal interactions. This in turn gives them greater incentive to participate in government, and this high level of participation is the foundation upon which democracy is built. I expand upon this model by formalizing the notion that the benefits to interpersonal interactions depend not only on the average level of education in a group, but also on the dispersion around that mean. In theory, people get the most benefits from interacting with those whom they are close to in terms of educational attainment, holding constant the mean level of education.¹ Specifically, using the framework of their model, I modify the function that defines the benefits people receive from political participation to make these benefits depend negatively on the dispersion of education around the mean. I then prove that, given this model, higher levels of dispersion in educational attainment lead to a

¹ For example this theory holds that two tenth graders, possessing ten years of education each, receive greater benefits from their interactions than would the holder of a PhD (approximately 20 years of education) and someone who has never attended school. This is rooted in the idea that the educations of the two people in an interaction are complimentary.

lower equilibrium political participation rate, resulting in a lower prevalence of democratic institutions.

In order to test this theory empirically, I construct two measures of dispersion in educational attainment using the Barro-Lee dataset—a Gini coefficient and a fractionalization index. The Gini coefficient is defined as the area under the Lorenz curve and is a measure of distribution commonly used in income inequality research. The fractionalization index is defined as one minus the sum of the squared percentiles of the population in different educational attainment categories. It is often used as a measure of ethnic diversity, and is also called a Herfindahl index when used to measure industry concentration.

These two measures are necessarily imperfect as the limitations of the dataset prevent any sort of exact analysis of educational distribution. As such, they capture very different elements of the distribution of educational attainment within a country. In fact, they are highly negatively correlated due to their different treatments of countries in the sample with extremely low levels of education. The fractionalization index measure treats such countries as extremely equal societies because they tend to have their populations highly concentrated in the no education and primary education only groupings. The Gini coefficient, on the other hand treats such societies as extremely unequal because a very small proportion of the population (anyone above those population groupings) control a disproportionately large share of the educational attainment within the population. The differences between the two measures is a limitation of this paper in the sense that it prevents definitive conclusions about the effect of educational distribution, as the conclusions drawn depend on which measure is used. However, it is also a strength

because it allows my empirical models to explore the effects of distributions in multiple ways.

Using those two measures, I run cross-country panel regressions estimating empirical specifications from several prominent papers in the literature² and then examine augmented specifications including the measures of country-level dispersion in educational achievement. I find strong evidence across a number of specifications both excluding and including time fixed effects suggesting that country-level dispersion in educational attainment is associated with changes in the democratic nature of institutions, as reported by the widely used Polity IV data set. Given the strong potential for reverse causality issues in this line of research, determining causality with complete certainty is clearly an issue, but in keeping with the methods laid out by Glaeser et al. (2006), I show that the 1960 levels of average education and dispersion in education are predictive of long-term changes (1960-2005) in political outcome variables while the reverse is not true in most specifications. This is suggestive evidence that education is plausibly the causal factor impacting political institutions and not the other way around.

While the results suggest that educational dispersion is a significant factor in political outcomes at the country level, the results I get using my two measures of inequality are, as expected given their highly negative correlation, conflicting as to the direction of the effect. The Gini coefficient measure of inequality is consistently positively associated with lower levels of democracy and higher levels of autocracy. The

² Glaeser et al. (2004) which looks at five-year changes in political outcome variables across a panel of countries as a function of education levels, starting levels of political institutions and income levels as well as country fixed effects. Acemoglu (2005) which includes time fixed effects in the above model and Glaeser et al. (2006) which looks at long-run (40 years) changes in the variables to suggest that the direction of causality runs from education to democracy and not vice-versa.

fractionalization index, on the other hand, has the opposite effect, with high levels of fractionalization associated with high levels of democracy. The imperfectness of the measures makes this uncertainty unavoidable, and leaves open a number of questions for further research, including the appropriateness of both measures, and the effects seen when other measures of inequality are used.

Institutions are treated as important in many different parts of the economics literature, and so understanding the causes of good institutions is important to many areas of research. While democracy does not always line up well with good institutions, and similarly, autocracy does not always mean bad institutions, unwrapping the complicated relationship between economic growth, democracy, and education holds a great deal of promise for finding more effective policies to help spur growth around the world. In this paper I hope that I provide a convincing case that the dispersion of education deserves to be considered along with the average level of education when discussing the attributes of a country that affect its potential for achieving democracy. As this line of research is advanced, hopefully the nature of the relationship will be more fully fleshed out, allowing for powerful policy implications of this work. In light of their potential impact on the quality of institutions, the differences between policies that attempt to promote increases in the average level of education of a country and those which attempt to do so while also promoting equality in educational attainment across the national population can be critical.

The rest of the paper is laid out as follows. In section II, I look at the extensive economics literature on the relationship between education and democracy in order to position my work in the broader context of the larger debate about the role of education

in economic development in general and democracy in particular. In section III, I expand on the theoretical model laid out in Glaeser et al. (2006) who formalize the link between the average level of educational attainment and the democracy of institutions. In section IV, I discuss the data sources in greater depth, and delve more deeply into the two measures of educational inequality I used for the empirical portion of my research. In section V, I briefly describe the empirical specifications that I use for the body of the empirical work. In section VI lay out the results and in section VII I report my conclusions.

II. Literature Review

The strong correlation between income, educational outcomes and the quality of institutions across countries has a large body of empirical evidence. However the causal relationships among these factors are empirically difficult to tease out, and the literature has divided greatly around this point. On one side you have Acemoglu et al.(2005), who argue that schooling and democracy are not the critical factors, but are merely related byproducts of deeper long-run causes that also influence growth and democracy. On the other side of the literature are Lipset and his followers, including Glaeser et al.(2004,2007), who argue for schooling as a cause of democracy, and democracy as a cause of growth. They focus much less on deep-lying causes and more on the current state of a country. I will briefly discuss both sides of the literature, although as this paper follows more directly from Glaeser et al. I focus more on that particular branch. I will briefly discuss both schools as this paper incorporates pieces of both although it follows more closely from the work of the Lipset and Glaeser school.

The idea that improvements in education and the development of the human capital stock lead to long run increases in the quality of a nations institutions is widespread. The theory is often credited to Lipset (1959, 1960), who considered himself to be following in the footsteps of Aristotle. He considered many factors of “economic development” as important to the sustainability of democratic systems, among them wealth, industrialization, urbanization and crucially education.³ His justification was the idea that a more educated citizenry tends to resolve disputes through peaceful means rather than violence, meaning an increased inclination towards institution friendly behaviors—voting rather than staging a coup. He wrote “Education presumably broadens men’s outlooks, enables them to understand the needs for norms of tolerance, restrains them from adhering to extremist and monistic doctrines, and increases their capacity to make rational electoral choices.”⁴

Lipset began to study evidence by looking at responses to survey data that questioned peoples’ beliefs in democratic ideals such as attitudes towards minorities, tolerance of opposition, and support for multiple or single party forms of rule. He cited studies showing that the single most important factor in whether one possesses democratic values is level of education. He also looked briefly at country level data on levels of education and democracy, and concluded that “If we cannot say that a ‘high’ level of education is a sufficient condition for democracy, the available evidence does

³ See Lipset(1959), p.75 for a more general discussion of many factors of “Educational Development” that impact democratic institutions

⁴ See Lipset(1959) p.78 and Glaeser et al. p.81-83 for a more detailed discussion of reasons for the correlation between education and political participation although this paper does discuss this at some length later.

suggest that it comes close to being a necessary condition in the modern world” (p. 80).

This work became the foundation for an entire portion of the literature.

Almond and Verba (1989, 1 ed. 1963), began to explore the reasons for this connection, hypothesizing that a civic culture was a necessary condition for political participation, and that education, while not the only factor impacting the development of this culture, was an important factor. They also were the first to attempt a systematic collection of data on political participation.

Barro(1997, 1999) looked at a wide variety of standard of living variables as predictors of democracy, and found education, specifically primary education to be an important factor in democracy. He was also the first to discuss inequality in years of schooling, considering them briefly in order to show that his finding that a large male-female education gap was harmful to democratic outcomes was not merely standing in as a proxy for educational inequality.

Glaeser, Ponzetto and Shleifer (2006) in a paper entitled “Why does democracy need education?” attempted to dive further into the reasons for education to cause democracy and build a theoretical model to explain them. They first argue that at least in the case of education and democracy the causal factor can be determined. They show that for a cross-section of countries 66% of the variance in the change in democracy from 1960 to the Polity IV index can be explained by their levels of democracy in 1960 and the amount of schooling in 1960. The same two factors explain only 3% of the change in schooling over that time period suggesting that education strongly predicts a move towards more democracy, but that the initial levels do little to predict changes in human capital formation.

They then explore some theories about why education increases civic participation and the empirical evidence in support of such theories. Their theories try to explain why education raises both social interaction generally, and involvement in politics more specifically. On a general level they emphasize that one of the main goals of education is socialization, in their words “teaching people how to interact successfully and productively with others”(82). This socialization allows for more efficient information transfers among individuals, raising the benefits and lowering the costs of social interactions in general. More specifically they argue that education often stresses the benefits of political participation as a portion of the curriculum. In this way education may have direct benefits to democratic tendencies beyond merely facilitating social interactions.

Using a wide variety of survey data, they demonstrate strong correlations between education and participation in a wide variety of social groups, everything from voting to church attendance to community work is highly correlated with education, and anti-social behavior such as giving someone the finger is negatively correlated with education. They also mention studies done by Milligan, Moretti and Oreopoulous (2004) and Dee (2004) which seem to show that the relationship is causal by using exogenous increases in education caused by compulsory schooling or junior/community colleges to predict voting. Glaeser et al. argue that the wide variety of evidence, specifically the volume of evidence suggesting that education increases all sorts of social interactions, including explicitly non-political ones, supports the hypothesis that the more general effect of socialization is the more powerful cause of increases in democracy, and not more specific points about democracy emphasized during schooling.

Glaeser et al. then set up a model which puts into place these theories, that higher education leads to greater benefits to interpersonal interactions, and that regimes with highly concentrated power such as dictatorships provide greater incentives to a smaller, more exclusive group of insiders, and regimes with less concentrated power like democracies provide weaker incentives to a greater number of people. They show that for a homogenous population, the chance that a more democratic regime will defeat a less democratic one increases as the level of human capital in the society rises.

However, this is not the only viewpoint prevalent in the literature. In particular a paper entitled “From Education to Democracy?”(2005) by Acemoglu, Johnson, Robinson and Yared provides a strong counterpoint to Lipset-Glaeser hypothesis that the relationship among these variables goes beyond correlation and into causation.

Acemoglu et al. argue that the causes of democracy and growth are situated much deeper in a countries history, and that the correlations amongst the factors examined by Glaeser and others are spuriously generated by their relationship to these long-term causes. Using slight variations in datasets they find that the Glaeser results do not hold up when time fixed-effects are included. They argue that this shows that some “deep” factors are causing all of the factors to develop over time, and that the correlations observed are factors of this continued development. In this paper I use empirical specifications both with and without time fixed effects in order to account for this possibility as it relates to educational dispersion.

The literature has also begun to explore the effects of the dispersion of educational attainment on both economic growth and democracy. Castello and Doménech (2002) used an education Gini coefficient similar to the one I construct in this paper in

order to estimate the impact of educational inequality on growth rates. Their theory is based around the idea that wealth inequality is an important factor driving long run growth and that income inequality fails to capture all of the aspects of wealth inequality, because different levels of human capital are a form of wealth inequality. They find that education inequality does seem to have a negative impact on growth rates and that this result seems to be acting through the channels both of resource allocation and reducing investment rates. They also include income inequality in their regressions and find that educational inequality is the more robust indicator of growth rates.

Castelló-Climent (2007) began to investigate the role of educational dispersion on democracy rates. His paper relied primarily on two measures of dispersion in education—the mean level of education among the least educated 60% of the population, and the share of education controlled by the least educated 60% of the population. He found that when these measures of educational dispersion were included in regression models, not only did they have a statistically significant impact on democracy (with higher inequality associated with lower democracy), but also the average level of educational attainment was insignificant when this control was included. My work builds on this paper by formalizing this relationship between the dispersion of educational attainment and democracy through the use of a theoretical model. I also use two different measures of dispersion of educational attainment that capture more and different aspects of the distribution than use of just the third quintile share and level of education do.

The debate over the causes of progress, both economically and politically, in countries around the world is a critical one for policymakers, and my paper fits right into the debate. While my work adheres closely to the Glaeser et al. school I am using some

of the empirical specifications from Acemoglu's paper in order to evaluate them as well, both with a slightly wider base of data, and with the additional factor of the distribution of education. I hope that by doing this I can make a significant contribution to this debate, and continue working towards the goals of illuminating the causes of growth.

III. Theoretical Model

A. Model Setup

The model employed follows directly from the work of Glaeser et al. (2006), and both the setup and proof mirror their work closely. I assume that a country's population is of measure one, with average human capital \bar{h} and variance of human capital σ_h . I define regimes, as they did, in terms of their set G of insiders with $g \in [0,1]$ the measure of the set, or in other words the size of the regime. Then $g = 0$ would be a perfect dictatorship and $g = 1$ would be a perfect democracy.

Critically, each decision maker is of measure zero and so does not determine the probability that the regime succeeds. Thus they do not base decisions about whether to participate in the regime on the chances of success for a particular regime. Instead participation is based on the incentives provided to individuals by regimes. In the Glaeser et al. model these incentives take three forms. First, regimes punish insiders who do not fight for the regime, with the idea being that smaller regimes punish dissenting insiders more stringently. Secondly, regime insiders participating provide motivation for others to participate, through persuasion and shaming of non-participants. Lastly, there are individual specific costs associated with political participation. Since the model only

cares about the net benefits of participation, whether I consider each factor to be benefits, costs, or a mixture of the two is not important.

As mentioned previously, the increased importance of social pressures and incentives in small groups leads to their increased ability to motivate insiders. As Glaeser et al. write in the way of motivation “This assumption sets up the basic tradeoff between smaller and larger regimes. Small regimes provide strong incentives to a small base. Larger (i.e. more democratic) regimes provide weaker incentives but to a larger potential base of supporters.” (p.57) To introduce this formally, I follow their lead and define that insiders who fail to support the regime suffer an expected utility loss $p(g)$ for all $g \in [0,1]$ such that:

$$p(g) > 0 \text{ and } p'(g) < 0.$$

That function deals with the society level incentives provided for people to participate. There are also local incentives as mentioned above that take the form of insiders motivating their peers to participate as well. Glaeser et al. write “Precisely because of their local nature, these benefits depend not on the aggregate size of the regime, but on the rate of participation $a \in [0,1]$, which captures the share of friends who turn out to support a regime and provide motivation, or identically the probability that each friend turns out”(p. 58). They also argue that these benefits are a function of human capital, specifically \bar{h} . They argue that higher human capital makes people both better at convincing their peers to participate, and reap higher benefits when they do participate.

I extend this model to include an effect for the variance in the level of education. This effect occurs on both of their proposed avenues through which education leads to increased participation. First, when the spread in education is less, people are more able

to convince others to participate because they associate with them more closely and are able to provide more individual specific reasons for participation. Second, less variance in education makes people more likely to reap the benefits of participation because part of this benefit accrues due to interpersonal interaction, interactions which are more likely to reach mutual understanding and appreciation when the variance in education is low.

Glaeser et al. write “It is more appealing to participate in a collective activity the more educated a person is, and the more educated the other participants are”(p.58). I agree and add the additional condition that holding such things constant, it is more appealing to participate in a collective activity the less the spread of education is between a person and the group in the activity and the less the spread amongst all the participants. Formally, I

model these benefits as a twice continuously differentiable function $b\left(\frac{a\bar{h}}{\sigma_h}\right)$ such that

$b(0) = 0$ and for all $a \in [0,1]$, $\bar{h} \geq 0$ and $\sigma_h \geq 0$:

$$b'\left(\frac{a\bar{h}}{\sigma_h}\right) > 0 \text{ and } b''\left(\frac{a\bar{h}}{\sigma_h}\right) < 0.$$

B. Group Equilibrium

Based on the above equations I can say that the participation rate a is determined endogenously based on the potential punishments and benefits to participation. Formally, in a societal equilibrium:

$$a = F\left(p(g) + b\left(\frac{a\bar{h}}{\sigma_h}\right)\right).$$

Following in the footsteps of Glaeser, I make two reasonable assumptions about the distribution of costs c to guarantee the uniqueness of the equilibrium:

1. c has a connected support C that includes the range of $\left(p(g) + b \left(\frac{a\bar{h}}{\sigma_h} \right) \right)$.
2. c has a continuously differentiable density $f(c)$ such that $f'(c) \leq 0$ for all $c \in C$.

The first assumption, simply put, means that amongst every group there are some people participating and some not participating, regardless of the exogenous parameters of the model. The second assumption means that the costs associated with bringing new members into a regime are weakly convex with the size of the group. As a regime grows in number, the costs associated with recruiting each new member increase. I will now prove the following:

Theorem 1: *There exists a unique group equilibrium $a(g, \bar{h}, \sigma_h) \in (0, 1)$ such that*

$$\partial a / \partial g < 0, \partial a / \partial \bar{h} > 0 \text{ and } \partial a / \partial \sigma_h > 0.$$

Proof: A group equilibrium is a static point for the equality $a = F \left(p(g) + b \left(\frac{a\bar{h}}{\sigma_h} \right) \right)$,

meaning that it is a root of the auxiliary function:

$$Q(a; g, \bar{h}, \sigma_h) = F \left(p(g) + b \left(\frac{a\bar{h}}{\sigma_h} \right) \right) - a,$$

which is twice continuously differentiable with respect to a because both b and F are defined to be twice continuously differentiable. I then take the derivatives to find that the first derivative with respect to a is:

$$Q_a = \frac{\bar{h}}{\sigma_h} f b' - 1$$

and the second derivative with respect to a is:

$$Q_{aa} = \frac{\bar{h}^2}{\sigma_h^2} f b'' + \frac{\bar{h}^2}{\sigma_h^2} f' (b')^2.$$

Since $b'' < 0$ and $f' < 0$, the above expression is less than zero. Assumption 1 then implies that:

$$Q(0; g, \bar{h}, \sigma_h) = F(p(g)) > 0 \text{ and}$$

$$Q(1; g, \bar{h}, \sigma_h) = F\left(p(g) + b\left(\frac{\bar{h}}{\sigma_h}\right)\right) - 1 < 0$$

because by assumption 1 the range of F is between zero and one. Then since Q is continuous, there exists at least one root $\hat{a} \in (0, 1)$. Because $Q(0; g, \bar{h}, \sigma_h) > 0$, and I have shown concavity for all points, it must be that $Q_a(\hat{a}; g, \bar{h}, \sigma_h) < 0$. It then follows from the concavity shown above that the root \hat{a} is unique. That $Q_a(\hat{a}; g, \bar{h}, \sigma_h) < 0$ at the equilibrium point shows the stability of the equilibrium point.

I can then examine the properties of the equilibrium. By the implicit function theorem, I know that the equilibrium participation rate is a differentiable function $a(g, \bar{h}, \sigma_h)$, which satisfies $Q_a(a(g, \bar{h}, \sigma_h); g, \bar{h}, \sigma_h) = 0$. It is easily shown that:

$$Q_g = f p' < 0$$

$$Q_{\bar{h}} = \frac{a}{\sigma_h} f b' > 0$$

$$Q_{\sigma_h} = a \bar{h} f b' \left(\frac{-1}{\sigma_h^2} \right) < 0$$

whose signs follow from $f > 0$, $p' < 0$, $a > 0$, $\sigma_h > 0$, $b' > 0$, $\bar{h} > 0$. Then I take the gradient to see that:

$$\frac{\partial a}{\partial g} = -\frac{Q_g}{Q_a} = -\frac{f p'}{\frac{\bar{h}}{\sigma_h} f b' - 1} = \frac{f p'}{1 - \frac{\bar{h}}{\sigma_h} f b'} < 0$$

$$\frac{\partial a}{\partial h} = -\frac{Q_h}{Q_a} = \frac{\frac{a}{\sigma_h} fb'}{1 - \frac{h}{\sigma_h} fb'} > 0$$

$$\frac{\partial a}{\partial \sigma_h} = -\frac{Q_{\sigma_h}}{Q_a} = \frac{a \bar{h} fb' \left(\frac{-1}{\sigma_h^2} \right)}{1 - \frac{h}{\sigma_h} fb'} < 0$$

as desired. Q.E.D.

IV. Data

The data for the empirical portion of this paper is drawn from a number of sources. Data Table 1 displays summary statistics for all relevant data for the year 2000. My research relies on two primary measures of the quality of institutions, the autocracy and democracy scores assigned to countries by the Polity IV dataset (Jaggers and Marshall, 2003). This widely used dataset provides such scores for a wide cross-section of countries for 1950-2009, with each score taking a value between 0 and 10. GDP data is taken from the Penn World Tables (Heston, Summers, and Aten, 2011), and covers a similarly wide cross-section of countries across the years 1950-2004. Educational averages are pulled from the Barro-Lee dataset (1996 originally). In a series of robustness checks I also use data on educational quality pulled from the World Development Indicators, and income Gini data from the “All the Gini s” dataset created by Milanovic (2005) for the World Bank.

The empirical research relies on two separate measures of the inequality of education within a country. Although the Barro-Lee dataset represents the best available country level source of education data, it contains data only on the levels of education for

different groups, as well as the percentiles of the population in different education categories.⁵ It does not provide variances at the country level, and so I instead rely on calculating two measures of the inequality of education within a country.

The first is a Gini coefficient. A Gini coefficient (Gini, 1912) is a measure of inequality commonly used to describe income inequality. The coefficient is based on the Lorenz curve, which plots the proportion of the country's total education on the vertical axis, controlled by the bottom x percent of the population, where x is the value on the horizontal axis. In chart 1 I plot the Lorenz curve for Spain for the year 2000 and also the perfect equality curve. In a society with perfect equality in education, each person's education is the same and so the bottom 1% of the population controls 1% of the total education, the bottom 50% controls 50%, and the Lorenz curve is a straight line. The Gini coefficients for other societies are then defined as the area below this curve, but above the country's curve so that 0 is perfect equality, and 1 perfect inequality, i.e. one person controls all of a country's education. Thus in chart 1, the Gini coefficient is the area between the two lines.

Since the data does not have individual level data, I calculate a discrete form of the Lorenz curve for each country, using the information given in the dataset about percentiles of the population with a maximum level of schooling achieved, and the average number of years of schooling for that percentile. Barro and Lee include population percentiles for all 7 groups—no schooling, primary school incomplete,

⁵ The dataset contains the seven categories, “No Schooling”, “Total Primary”, “Completed Primary”, “Total Secondary”, “Completed Secondary”, “Total Tertiary”, “Completed Tertiary”, but I adjust these by subtracting each of the completed categories from the total for that category so that I have “Primary Dropout” and “Completed Primary” as my two categories. This way the total across all categories is the entire population with no one double counted.

primary school complete, secondary school incomplete, secondary school complete, higher education incomplete, higher education complete. However, they only include average years for each pair grouped together, i.e. average years of primary schooling lumps those who dropout of primary schooling with those who complete it. In order to add several more data points to our Lorenz curve to give a smoother curve, I assume that the dropouts have half as many years of schooling as those completing each level.

The second measure of inequality that I formed is a fractionalization index. This measure of inequality is commonly used as a measure of racial inequality in societies, and is also called a Herfindahl index when used to measure the concentration of industries. A fractionalization index is created by taking one minus the sum of the squares of the proportion of the population in each of a number of groups.⁶ In this case I sum the square of the population percentile for each of the seven education categories listed above. In chart 2 I show the percentiles for Spain in the year 2000. The fractionalization is computed by squaring the height of each column. Therefore, a fractionalization coefficient of zero would mean that the population has perfect equality, in the sense that all of its members are grouped within the same population grouping, while a high fractionalization index indicates that the population is evenly spread across a number of groupings.

Although the two measures are meant to capture the same idea, the inequality of the education in a country, they do it in very different ways, and in fact are strongly negatively correlated, due primarily to how they rate very low education countries, which

⁶ The exact equation is $\sum_i p_i^2$ where p_i represents the proportion of the population in population subdivision i , where each category is a different level of highest educational attainment.

are quite prevalent in the sample. Table 2 displays pair wise correlations for all variables used in the research for the year 2000. The fractionalization index rates countries with very low education as very “equal” relative to the rest of the countries because they tend to have extremely large percentages of people clustered in the “no education” category, meaning that the other percentiles are very small, and leading to a low score. For example of the lowest 104 fractionalization indices among country-year pairs in the sample, none has more than 10% of the population with any education at all, and none has an average total years of schooling of greater than one year. On the other hand, these data points rate quite poorly in Gini coefficient, among the same group of countries none has a Gini coefficient below .94, almost two standard deviations above the mean. This is because in the countries where large proportions of the country are uneducated, by definition the small proportion of the country which does have education controls 100% of the countries education, meaning that the country has a very high Gini coefficient.

This relationship is further enforced by looking at Table 3. This table displays the top ten and bottom ten countries in both fractionalization and Gini coefficient. Looking at the countries listed as the ten highest Gini coefficients, the countries are quite poor and are predominantly low education. Nine of these same countries appear on the list of the countries with the lowest fractionalizations, although they are in slightly different orders. This relationship does not hold nearly as strongly at the other end of both indices, as I can see from looking at the list of the bottom 10 countries by Gini coefficient, none of which match up with the top 10 countries by Fractionalization index. In Chart 3, I show the scatter plot for the two measures for 2000 to demonstrate the nature of this correlation. Interestingly, the relationship, while clearly negative in the global sample looks

somewhat non-linear. There is a large cluster of countries with a low Gini and a high fractionalization, which appear to represent an inflection point in the global sample. This group of countries has some of the highest fractionalization indices, and relatively low Gini coefficients, but not the lowest seen in the sample. Examining the countries around the inflection point reveals that they tend to have populations that are relatively evenly distributed among the education categories, hence the high fractionalization. However, these countries tend to have their highest population concentrations in the “Primary School Dropout Category”, so that they are still relatively high in Gini coefficient terms because they have a large proportion of their population with very low education.⁷

The nature of regression analysis dictates that in using two so strongly negatively correlated measures of inequality in education I will find results suggesting that if one measure of inequality has a positive impact on democracy, the other has a negative impact. One of the ways to judge these measures is to consider their relationship to the average level of education. The Gini coefficient is highly negatively correlated with the average level of education; in contrast the fractionalization coefficient is highly positively correlated with the average. In this way, the Gini coefficient perhaps meshes more closely with priors of what inequality means, as the extremely low education countries are not commonly referred to as having high equality.

V. Empirical Specification

For the empirical specifications in this paper I will look at the determinants of changes in democracy focusing primarily on both the level and dispersion of education.

⁷ I discuss the repercussions of the non-linearity for my regression analysis later in this paper.

In order to control for unobserved traits that vary across countries, all regressions will be panel regressions with country fixed effects. The baseline model is:

$$\Delta P_{i,t} = \beta_0 + \beta_1 P_{i,t} + \beta_2 educ_average_{i,t} + \beta_3 educ_dispersion_{i,t} + \beta_4 \log GDP_{i,t} + \beta_5 x_i + \varepsilon_{i,t}.$$

$\Delta P_{i,t} = P_{i,t+5} - P_{i,t}$ and $P_{i,t}$ represents one of the political outcome variables of country i at time t , either the democracy score or autocracy score. I include the lagged value of the political outcome variable on the right hand side of the equation to allow for both the persistence of institutions (both democratic and anti-democratic) as well as the tendency of institutions to exhibit convergence towards the mean.⁸ $educ_average_{i,t}$ represents the average level of schooling in country i at time t . β_2 therefore represents the effect of increasing the average level of education on institutional outcomes. $educ_dispersion_{i,t}$ is either the educational Gini coefficient or the educational fractionalization index as discussed above in the data section.⁹ β_3 then represents the main area of interest of this paper, i.e. the effect of increasing the level of educational dispersion on political outcomes. Although the Glaeser et al. (2006) model which I expand in Section II does not include any role for the level of income in a country, both Glaeser et al. and others (e.g. Acemoglu et al., 2005) have traditionally included this information in empirical work, and I follow this tradition here.¹⁰ x_i represents a full set of country fixed effects.

⁸ This follows the methods of Glaeser et al. (2006) and Acemoglu (2005) who include the starting level of institutions for the same reason.

⁹ In one specification I include both the Gini coefficient and the fractionalization index in order to look at the combined effects. This is a simple modification of the baseline model, but due to the high correlation between the two variables I do not generally include both in the regressions.

¹⁰ It is plausible to assume that income might be a source of bias if excluded from these regressions, as income is highly correlated with both the level of human capital and the quality of institutions found in a country. The high availability of data for GDP leads me

If the model presented in Section III is correct then I expect higher human capital to lead to more democratic outcomes, and for higher human capital dispersion to lead to less democratic outcomes. Therefore, the expectation is that β_2 will be positive if the political outcome variable in the given regression is the democracy score, and negative if the outcome variable is the autocracy score. All of this is limited to the extent that the variable I am using in the regression, i.e. the average level of schooling in the country accurately reflects the true human capital stock in the society.¹¹ Similarly, I expect that β_3 will be negative if the political outcome variable is democracy score, and positive if it is autocracy score. The caveat that this is limited to the extent to which the variables I have constructed measure true educational dispersion is more important here than with the educational average. The dispersion of education is a difficult thing to measure especially without individual level data on education to capture the full distribution within a country. The negative correlation between the two measures constructed above is a strong indication that neither measure perfectly captures the full extent of educational dispersion, and so interpreting the empirical results as a direct reflection on the theoretical model produced above is challenging.

I also follow from the work of Acemoglu et al. (2005) by running specifications that include time fixed effects. As discussed in the literature review, Acemoglu et al. argued that the results found by Glaeser, Lipset and others in support of the idea that education was a proximate cause of democratic outcomes were the result of spurious correlation caused by rises in the levels of both education and democracy over time. He

to include it as a control across all empirical specifications while other controls with more restrictive data are put in the Robustness Checks section of the paper.

¹¹ I attempt to control for the quality of education, one other major factor impacting the human quality stock, in the robustness checks section of this paper.

included time fixed effects in his regressions as a way to check for this effect. I simply expand the model above so that the full model is:

$$\Delta P_{i,t} = \beta_o + \beta_1 P_{i,t} + \beta_2 educ_average_{i,t} + \beta_3 educ_dispersion_{i,t} + \beta_4 \log GDP_{i,t} + \beta_5 x_i + \beta_6 \mu_t + \varepsilon_{i,t}$$

where μ_t represents a full set of time fixed effects intended to capture any common movements in the level of democracy across countries. I am therefore able to control for any correlation caused by long-term changes in both the left hand and right hand side variables.

VI. Results

A. Results

In empirical testing, I run a series of regressions designed to first recreate the important results demonstrating the effect of the mean level education on democracy, and then to include both of my measures of educational inequality in order to test their effects.

The first regression I estimate follows from the work of Glaeser et al. (2004), who estimate five-year changes in political institutions as a function of initial education levels, initial income levels, initial levels of political institutions, and country fixed effects. All regressions also include constants that are not shown, as they have little meaning in the context of this model. Due to increases in the quality of the data available, my sample includes more than double their 499 observations, and although I estimate a lower effect than they found, my sample does confirm their result that the educational average has a statistically significant effect on five-year changes in institutions (See Table 4, columns 1 and 2). These effects are in the direction predicted by the Glaeser et al. model, and by

extension by the model presented above, in that they suggest that higher levels of education lead to higher levels of democracy and lower levels of autocracy, i.e. more democratic institutions. It is also worth noting here the strong convergence effect for institutions present throughout these results. This effect is in line with the findings of Glaeser et al. and others who have noted that institutions tend to show relative convergence over time with good institutions decaying and bad institutions building up towards the mean.

Having recreated their results successfully, I rerun the two regressions using both measures of inequality separately (See Table 1, columns 3-6). The Gini coefficient shows a strong negative(although not quite significant) effect for 5-year changes in democracy score, and a strong and significant positive effect on 5-year changes in autocracy score.¹² These effects are in the direction predicted by the model in the sense that high “inequality” tends to lead to higher autocracy and lower democracy, i.e. less democratic institutions. Conversely, because of the strong negative relation between fractionalization index and Gini coefficient, I find the opposite sign on results when measuring inequality with the fractionalization index. The implications of this will be discussed later. Additionally, both the education level and the institutional convergence effect remain significant and fairly close to the previously predicted effect across all of the results shown here.

¹² I discuss the size and economic significance of the coefficients at length after presenting the time fixed-effects model

I also include regression models in which I include both measures of educational inequality.¹³ Because the measures are highly correlated, this will tend to lead to multicollinearity issues resulting in inflated standard errors and insignificant results. However, because they are not perfectly correlated and I believe that they capture different properties of the dispersion of different educational distributions, including them both to look at their combined effects is worthwhile. Column 7 in Table 4 shows the results using democracy score as the political outcome variable. The institutional convergence effect remains highly statistically significant in this specification, and the average level of educational attainment is weakly significant, but neither measure of educational dispersion is statistically significant. While both coefficients decrease slightly from the models including only one measure, they are still roughly the same magnitude and the same sign, suggesting that both measures of the dispersion in the distribution may have an effect. This possibility is reinforced by the specification relying on the autocracy as the political institution variable (Column 8). In this specification both measures of educational dispersion are statistically significant, with coefficients that are again similar to specifications including only either one or the other measure. Once again, the two measures have opposite signs suggesting that high inequality in a Gini coefficients sense is good for autocracy while high inequality in a fractionalization sense is bad for

¹³ Due to the non-linearity between the two measures there may be some concern about including both in the same regression. The non-linearity is largely accounted for by differences in the average level of education, because the countries causing the non-linearity tend to be high fractionalization but low Gini due to their low average level of education. Because my regressions control for the average years of schooling, they should account for this. Additionally the inclusion of country fixed effects should help control for any differences.

autocracy. Note that I again reserve discussion about the size of the coefficients until after the next regression model.

The evidence arising from the Glaeser et al. regression model as reproduced above has been disputed by Acemoglu et al.(2005), who argued that the results found were a result of omitting time effects from the regression so that “it reflects the over-time increase in education and democracy at the world level over the past 35 years”. When time fixed effects are included in the regression, Acemoglu et al. find no statistically significant effect of the average level of educational attainment on democracy, and often find that the sign is opposite of that found when time fixed-effects are not included. I reproduce that regression below in columns 1 and 2 of Table 5. In both the democracy score and autocracy score regressions only the institutional convergence effect is statistically significant. In both cases I find that the educational average is not only statistically insignificant, but now has the opposite sign of that predicted by the Glaeser et al. model. In the democracy score regression, the negative coefficient on educational average suggests that higher levels of education lead to decreases in the level of democracy, and similarly the positive coefficient in the autocracy score regression suggests that higher levels of education lead to increases in the level of autocracy, although again these results are not significant. The Time Fixed Effects row contains the results of an F-Test for the joint significance of the year dummies in the regression. Consistent with the Acemoglu hypothesis that the results found in the baseline regression presented in Table 1 are the results of spurious correlation due to rising levels of both democracy and education over time, the time fixed effects are jointly highly statistically significant. The coefficients on GDP are not significant in either regression.

I now add measures of educational inequality to the regression in order to investigate whether Acemoglu et al.'s critique of Glaeser et al.'s results also invalidate the significance of the measures of educational inequality. In columns 3 and 4 I include the Gini coefficient for educational inequality. Looking at the coefficients for the institutional convergence effect, they are largely unchanged by the inclusion of the Gini coefficient in both regressions. In the Democracy Score regression (column 3), I find that the coefficient on the average level of education remains insignificant, although still with the opposite sign of that predicted by the theoretical model. The coefficient on the education Gini is statistically significant (at the 10% level), and has the sign predicted by the theoretical model, with the negative sign suggesting that higher levels of inequality lead to changes toward less democratic institutions. Similarly in the Autocracy Score regression, the coefficient on educational average has a sign the opposite of that predicted by the theoretical model, although now this coefficient is statistically significant (at the 5% level). Once again, the coefficient on the education Gini is statistically significant (now at the 1% level), and has the correct sign as predicted by the model, as the positive sign suggests that higher levels of education inequality lead to higher levels of autocracy. In both regressions the time fixed effects remain jointly highly statistically significant, and the coefficient on GDP is statistically insignificant in both regressions.

I next reexamine the results using the fractionalization measure of educational inequality in place of the Gini coefficient. In column 5, the democracy score regression results seem to largely support the Acemoglu et al. hypothesis. Neither the educational average, nor the educational fractionalization is statistically significant. In fact, only the institutional convergence effect has a statistically significant effect in this regression

model, and the time fixed effects are jointly highly significant. In the autocracy score regression, the educational average remains statistically insignificant, as does the coefficient on GDP. Similarly, both the coefficient on the starting level of autocracy and the joint test of all year dummies remain highly statistically significant. However the education fractionalization coefficient is now statistically significant. Consistent with the relationship between the fractionalization and Gini measures of educational inequality, the coefficient on fractionalization is negative, suggesting that higher levels of fractionalization lead to lower levels of autocracy.

I also include specifications in which I include both measures of dispersion in educational attainment. As discussed above, while the two measures are highly correlated leading to high standard errors in this specification, including both does give additional information as to the partial effect of each of the two measures. In column 7, I use Democracy Score as my political outcome variable and find that only the institutional convergence and the education Gini are statistically significant. The coefficients on education Gini and education fractionalization are both negative, suggesting that higher inequality as captured by both measures does have a negative impact on democracy, even allowing for time fixed effects. Consistent with Acemoglu et al. (2005)'s hypothesis, the average educational attainment does not have a statistically significant effect here. However, when Autocracy Score is used as the outcome variable, both the educational average and both measures of dispersion in education are statistically significant. Intriguingly, the coefficient on the average level of educational attainment is the opposite of that predicted by Glaeser et al.(2006)'s model as adapted in this paper. This is consistent with Acemoglu's hypothesis that higher levels of education may not be

causing increases in democracy over time. Both measures of the dispersion in educational attainment are statistically significant, and with signs consistent with the majority of the other results in this paper, i.e. a higher Gini coefficient is associated with higher autocracy, while higher fractionalization is associated with lower autocracy. Thus the results demonstrating the significance of measures of educational dispersion are largely robust to the inclusion of time fixed effects.

The coefficients are also economically quite significant, and due to their similarity in magnitude to the results found under the baseline specification, I include a discussion of only the coefficients from this model. I will discuss the coefficients in the regressions including both measures of dispersion (columns 7 and 8), but the coefficients in the regressions that only include either one measure or the other are also quite similar. A one standard deviation increase in the education Gini (the standard deviation across all observations is .166) leads to a five-year change in the democracy score of -.427.¹⁴ However, because the democracy score measure only allows for whole unit changes, it makes more sense to consider it in that context. An increase of .389 in the Gini leads to a one unit decrease in the democracy score over five years. To put this difference in context, the difference of .389 is slightly larger than the difference between the USA and Liberia in the year 2000 (The exact difference is .381). Since the scale of the democracy score is only 0 to 10, a one unit change over five years represents a real and significant change. To put this change in context, the USA scores a 10 in democracy in 2000. Countries with a 9 in democracy include India, Thailand, Poland, France, South Africa and Chile. The effect is even larger for the Autocracy score, where it requires only an

¹⁴ The standard deviation of the democracy score across all observations is about 4.23, this corresponds with about a tenth of a standard deviation decrease over five years.

increase of .262 to increase the autocracy score by one unit. The difference of .262 is approximately the same as the difference between the USA and Malawi for the year 2000. Once again to contextualize, the United States is a 0 in autocracy. Countries with a 1 include Niger, Ghana, Turkey, Iran, Albania and Indonesia.

The effects of changing the fractionalization index are more modest. The standard deviation of the fractionalization index across the entire dataset is .198, so a one standard deviation increase in the fractionalization index is associated with a five-year decrease of .114 in the democracy score. This coefficient is not statistically significant, and also has low economic significance, as it requires a change outside the bounds of the measure to generate a unit change in the democracy score. However, fractionalization has a larger impact on the autocracy score, as a change of .538 is required to generate a one unit change in autocracy over five years. The size of the difference is slightly smaller than the size of the difference between the country with the lowest fractionalization for the year 2000 (Yemen), and that with the highest fractionalization (Panama), with the exact difference between the two being .573. This is obviously a large difference in fractionalization, but again, a one unit change in the political outcome variable over five years is quite large. While the changes caused by changes in the fractionalization index are economically less significant, in the context of the limited scale of both the democracy and autocracy score they are still reasonably large.

I run one additional regression specification in an attempt to argue that this relationship is causal and not merely a correlation. Here I follow the work of Glaeser et al. (2006) who use long run changes in the variables to argue for the direction of causality. I first reproduce similar regression results to their model, and then include

measures of educational inequality. In reproducing their model, I expand the sample due to increases in data availability. Whereas their results look at long-run changes from 1960-2000, I am able to increase the sample of countries by looking at changes from 1960-2005, and between this and increases in data quality, my sample includes 87 observations, up from 65 in their original paper.

Using the identical model from Glaeser et al., I find results that are quite similar to their original results. Looking at Table 6, column 1, Educational Average in 1960 is a very strong long run predictor of democratic outcomes across countries, with the results statistically significant at the 1% level. I also find that the convergence effect is both strong and highly statistically significant over this long time frame as well. The R^2 of this regression is also quite high, with 55% of the variation in changes in democracy score over this time period being explained by just the 1960 levels of education and democracy, as well as the included constant. Contrasted with that I have the results in column 2, which shows the long run change in education regressed on the 1960 levels of education and democracy. Here I have 104 observations, compared to the 68 in the original paper, but once again find similar results. Neither the level of education, nor the level of democracy is a statistically significant predictor of changes in the level of education between 1960 and 2005. I find an R^2 of only .3%, a stark contrast to the quality of the fit in the previous regression. The contrast between these two results is seen in Chart 4 and Chart 5. Chart 4 shows the long run change in democracy plotted against the educational average in 1960. The slope of the line is clear and positive. Chart 5 shows the long run change in the average level of educational attainment plotted against the 1960 level of democracy. The results look like noise primarily, and there is little to suggest any sort of

relationship. While this evidence is in no way conclusive about the direction of the causality, it does offer a suggestion that education leads to democracy, while no such evidence exists in the opposite direction.¹⁵

I now extend this analysis to include measures of educational inequality. The results remain quite similar for the long term changes in the democracy score and the educational average. For the long-term change in the democracy score, the convergence effect remains quantitatively quite similar, and is still highly significant. By including the Gini Coefficient for education, I lower the coefficient on the educational average significantly, but I still observe the positive effect predicted by our theoretical model, and it is still highly statistically significant. Additionally, the coefficient on the educational Gini has the sign predicted by our theoretical model and is highly statistically significant. The R^2 is also again quite high, showing that these factors predict future long-term changes in the democracy score quite well. When I once again reverse the regression to investigate whether democracy score can effectively predict long-term changes in the educational average (column 4), I find similar results to the previous regression. Both the coefficient on level of education and democracy score are extremely similar to the model which excluded the educational Gini, and the R^2 is quite similar as well. I also find that the educational Gini is statistically significant. In an effort to demonstrate that the reverse relationship does not also exist, I rerun the regression on the educational average including the education Gini. Similar to the regression in column 2, all the factors are statistically insignificant, and the low R^2 in the regression demonstrates that the factors

¹⁵ See Papaioannou and Siourounis (2005) for a more detailed look at the issue. They focus on the so-called “third wave of democratization” and find a strong predictive effect of education on the permanence of transitions from education to democracy.

have very low predictive power for future changes in the level of education. This evidence, in conjunction with the regressions reproducing the Glaeser et al. results suggest that the changes in the distributional moments of education, i.e. the average level and its dispersion, are causing the changes in the outcome variables and not the other way around, but the evidence, while suggestive, is not conclusive.

I also run regressions on the long run change in education Gini . In column 5, I run the regression using the starting levels of the education average, the education Gini , and the democracy score. In column 6, I drop the educational average from the regression, in order to gain a clearer picture of the effect of institutions on long run changes in the inequality of schooling. In both regressions, I find that the coefficient on the starting level of the education Gini is statistically significant and negative. This is a product of a convergence effect that naturally takes place over time, as countries with the highest starting levels of inequality see the greatest progress towards greater equality. In column 5, when the starting average level of education is included in the regression, both the coefficient on the democracy score and the education average are statistically significant. The positive coefficient on the democracy score suggests that countries with higher democracy experience trends towards greater inequality over time. This coefficient, although statistically significant, is quite small in magnitude, since democracy scores only range from 0 to 10. A change from the lowest democracy score to the highest only increases the change in the Gini coefficient by .07. Since this effect is also in the opposite direction of the effect found in the baseline regression models presented above, I find it less convincing evidence that the causality is running from institutions to education and not the other way around. Furthermore, when the

educational average is dropped from the regression, I find that the effect of the democracy score is statistically insignificant. The statistically significant negative coefficient on the average level of education in Column 5 is not surprising as countries with higher average levels of education might be expected to trend towards greater equality over time as these would tend to be societies with greater emphasis on education.

I also examine these results graphically. Chart 6 shows the long run change in democracy plotted against the 1960 level of the education Gini. The results look reasonably negatively sloped, suggesting that educational inequality does have some causal effect on the change in democracy over a long time frame. In Chart 7, I plot the long run change in the education Gini against the 1960 level of democracy. Here, the result is less clear than in Chart 5 with the educational average. While the line is fairly flat, it does have some slope, and the quality of the fit is fairly high. This suggests that there may be some amount of reverse causality running from democracy to educational dispersion. If we consider both the average level of educational attainment and the dispersion of education to be parts of human capital, there seems to be a larger body of evidence suggesting that human capital changes cause changes in the democracy of institutions than evidence suggesting the reverse is true. While this evidence is hardly conclusive, it does suggest that this research is not overly compromised by reverse causality concerns.

B. Robustness Checks

I check these results as much as possible for robustness to two different factors. The first is the quality of education provided in the country. This is plausibly correlated with both the education level and the equality of education, as societies that place greater emphasis on the importance of schooling may tend to have high quality education, as

well as high levels of education and low levels of inequality in education. I use data on both the percent of teachers who have formal training and the public spending on education as proxies for education quality. The first statistic represents the percent of primary school teachers who have received the minimum training required in that country.¹⁶ The second statistic represents the amount of public spending on education as a percent of GDP and hopefully captures elements of quality associated with the depth of a country's commitment to education as a whole. Looking at the sample correlations (Table 2), both measures of education quality are negatively correlated with the education Gini, suggesting that the expected relationship between inequality and quality holds in the data. Similarly, both are positively correlated with the average years of education as expected. It seems plausible to argue that education quality may be a factor affecting democracy since the theoretical model established by Glaeser et al. hypothesizes that human capital causes democracy, and educational quality is an important factor in human capital formation.¹⁷

Due to the lack of data points for the educational quality data leading to a lack of observations for each country, I use pooled OLS regressions for this portion of the analysis. Column 3 contains results for the baseline OLS regression restricted to the sample that contains data for the percent of trained teachers. The extreme restrictions of the data come into play here, as I have an extremely limited sample of only 29 observations, leading to no statistically significant results. Column 4 shows the results

¹⁶ Full description reads: "Trained teachers in primary education are the percentage of primary school teachers who have received the minimum organized teacher training (pre-service or in-service) required for teaching in their country."

¹⁷ See Hanushek and Woessmann (2007) for a discussion of the role of educational inequality in economic growth.

when the percent of trained teachers is included in the regression model. The limited number of data points is still a significant factor, but it is worth noting that the coefficients differ very little from the model where the educational quality indicator is excluded. The coefficient on the percent of trained teachers has the predicted sign (although statistically insignificant), i.e. higher quality of education means higher human capital all else being equal, which will lead to better democratic outcomes through the channel proposed in the Glaeser et al. model. While the results are not shown, the same effect is seen when using the change in autocracy score as the outcome variable or using the fractionalization index as the measure of educational inequality.

In columns 5 and 6 I show the baseline regression and the regression including the public spending on education (as a percent of GDP) limited to the sample for which I have data for this variable. For this alternate measure of the quality of schooling, the sample sizes are much larger, and thus I again find that the institutional convergence effect is robustly significant across the two specifications. However, with the larger sample sizes, I see that for this measure of the quality of schooling, the coefficient on education Gini remains significant even when the measure of quality of schooling is included. Taken together, these two measures of educational quality suggest that the main results presented in this paper are not driven by a spurious correlation with educational quality. While the data sets for these variables are very limited, the evidence available suggests that the size and significance of the effect attributed to educational inequality is robust to inclusion of educational quality variables where reasonable sample sizes are available.

The second factor that I examine in this section is income inequality.¹⁸ Income inequality is quite likely to be positively correlated with educational inequality, as both are most likely symptoms of wholesale societal inequality. Looking at the sample correlations in Table 2, this relationship is as expected, with the income Gini and the education Gini positively correlated. The expected relationship with the outcome variables also appears, as income Gini is negatively correlated with democracy and positively correlated with autocracy, suggesting that high inequality is associated with bad democratic outcomes. While the theoretical model put into place in this paper and Glaeser et al. does not give income inequality a role, the effect might act quite similarly to that of educational inequality. It also might act by increasing growth rates, as argued in Castelló and Doménech (2002) which then leads to higher levels of democracy.

Once again, I first run a baseline regression (pooled) of the five year change of the democracy score on the main variables of interest, limiting the sample to observations containing income Gini data (column 1). In this specification, the coefficient on education Gini is insignificant but the value is close to that seen consistently throughout the other models, and the sign is that expected given the empirical results in the main portion of the paper. Only the institutional convergence effect is significant in this specification. When the income Gini data is included (column 2), it is highly insignificant and appears to have a very small impact on the change in political outcomes. While the coefficient on education Gini is still insignificant it has the anticipated sign, and the magnitude of the effect is in line with that seen in the baseline regression. While this

¹⁸ Discussions about the effect of income inequality on growth go back as far as Kuznets(1955). Muller(1988) looked at the relationship between income inequality and democracy, finding that low levels of income inequality were an important causal factor predicting the stability of democracies.

evidence is inconclusive, it seems that the inclusion of measures of income inequality do not have a large effect on the measured impact of educational inequality. In order to reach more definitive conclusions more data is required.

VII. Conclusion

In this paper I examine the impact of the dispersion of educational attainment on the quality of institutions as measured by the extent of democracy. I lay out a theoretical model outlining the channel through which both the average level of education and the dispersion of education impact political participation, and consequently the extent of institutional democracy. I test this theory in the data by constructing two measures of educational dispersion—an educational Gini coefficient and an educational fractionalization index—and run several empirical specifications using these two measures. In the results, I consistently find a relatively strong and significant effect of educational dispersion on democracy. My results indicate a high Education Gini seems to be a causal predictor of lowering democracy and raising autocracy. This result follows the predictions of my model that high inequality is bad for democracy, and vice versa. In contrast, given the strongly negative correlation between my two measures of educational dispersion, high fractionalization seems to be a *positive* predictor of democracy, in contrast to the model presented herein.

Ultimately, the imperfection of these two measures in terms of capturing the true value of educational dispersion makes commenting on the exact nature of its effect difficult. However, the significance of the results even when time fixed-effects are included in the specification, which eliminates the significance of the educational

average, suggests that the dispersion of education does have a real effect on democracy. In contrast to Acemoglu et al.'s (2005) critique that the observed relationship between human capital and democracy is spurious, my findings suggest that adopting a broader concept of human capital, that not only incorporates the average level of educational attainment but also its dispersion, can be important in arguments defending human capital as a determinant of democracy. Indeed, more research needs to be done in terms of other measures of the distribution of education within a country in order to find out which parts of a country's educational system are most important for generating democratic institutions. This research holds the possibility of leading to better policies to help generate democracy around the globe.

Table 1
Year 2000 Summary Statistics

Variable Name	Mean	Standard Deviation	Minimum	Maximum
Democracy Score	5.777	3.881	0	10
Autocracy Score	1.808	2.757	0	10
Education Gini	0.599	0.132	0.349	0.933
Education Fractionalization	0.721	0.110	0.266	0.839
Average Years of Education	7.009	2.895	0.892	13.004
Log GDP	8.673	1.169	6.158	10.783
GDP Gini	39.645	10.885	23.737	64.600
Percent Trained Teachers	15.305	32.472	0	100
Public Spending On Education (% of GDP)	4.419	1.645	1.323	9.861

Democracy Score and Autocracy Score variables are taken from the Polity IV database. Education Gini and Education Fractionalization data are constructed as discussed in the data section. Average Years of Education data is taken from Barro-Lee. GDP data taken from the Penn World Tables. GDP Gini data is taken from the All the Ginis database. Percent of Trained Teachers and Public Spending on Education data taken from the Global Development Indicators.

Table 2
Pairwise Correlations

	Democracy Score	Autocracy Score	Education Gini	Education Fractionalizi ation	Average Years of Education	Log GDP	GDP Gini	Percent Trained Teachers	Public Spending On Education (%)
Democracy Score	1								
Autocracy Score	-0.906	1							
Education Gini	-0.628	0.567	1						
Education Fractionalizi ation	0.475	-0.464	-0.766	1					
Average Years of Education	0.654	-0.565	-0.889	0.748	1				
Log GDP	0.563	-0.399	-0.630	0.581	0.740	1			
GDP Gini	-0.177	0.101	0.270	-0.023	-0.336	-0.236	1		
Percent Trained Teachers	0.288	-0.147	-0.168	0.098	0.197	0.369	0.050	1	
Public Spending On Education (%) of GDP)	0.153	-0.108	-0.102	0.029	0.163	0.129	0.019	-0.035	1

Table 3
2000 Gini and Fractionalization Summary
Top Ten and Bottom Ten Countries

Top 10 Gini		Bottom 10 Gini		Top 10 Fractionlization		Bottom 10 Fractionalization	
Niger	0.920	Armenia	0.349	Panama	0.839	Yemen	0.266
Mali	0.914	Czech Republic	0.371	Philippines	0.834	Niger	0.302
Mozambique	0.893	Barbados	0.393	Saudi Arabia	0.830	Mali	0.322
Afghanistan	0.886	Hungary	0.398	Chile	0.826	Mozambique	0.343
Gambia	0.883	Lithuania	0.412	Spain	0.824	Gambia	0.351
Sierra Leone	0.869	USA	0.422	Bolivia	0.820	Sierra Leone	0.439
Benin	0.859	Tajikistan	0.425	Peru	0.818	Afghanistan	0.441
Cote d'Ivoire	0.851	Fiji	0.426	Singapore	0.817	Burundi	0.466
Burundi	0.843	Estonia	0.430	Jamaica	0.817	Benin	0.494
Nepal	0.840	Australia	0.430	Colombia	0.817	Cote d'Ivoire	0.519

Table 4
Baseline Results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent Variable	5 Year Change in Democracy Score	5 Year Change in Autocracy Score	5 Year Change in Democracy Score	5 Year Change in Autocracy Score	5 Year Change in Democracy Score	5 Year Change in Autocracy Score	5 Year Change in Democracy Score	5 Year Change in Autocracy Score
Initial Democracy Score	-0.435*** (0.042)		-0.434*** (0.042)		-0.433*** (0.042)		-0.432*** (0.042)	
Initial Autocracy Score		-0.495*** (0.047)		-0.499*** (0.047)		-0.499*** (0.046)		-0.502*** (0.046)
Average yrs. Of Education	0.338*** (0.079)	-0.445*** (0.079)	0.260*** (0.091)	-0.319*** (0.090)	0.270** (0.104)	-0.224** (0.087)	0.206* (0.110)	-0.127 (0.101)
Log Gdp	0.163 (0.298)	0.202 (0.277)	0.234 (0.300)	0.086 (0.280)	0.204 (0.304)	0.070 (0.285)	0.266 (0.305)	-0.023 (0.291)
Education Gini			-2.337 (1.430)	3.914*** (1.295)			-2.199 (1.507)	3.410** (1.487)
Education Fractionalization					1.065 (0.952)	-3.589*** (0.918)	0.925 (0.947)	-3.374*** (0.845)
Obs	1020	1020	1020	1020	1020	1020	1020	1020
R ²	0.11	0.13	0.11	0.13	0.11	0.14	0.12	0.13

All Regressions include country fixed effects and a constant term. Standard errors are robust and clustered at the country level. All independent variables are from initial years. Democracy Score and Autocracy Score variables are taken from the Polity IV database. Education Gini and Education Fractionalization data are constructed as discussed in the data section. Average Years of Education data is taken from Barro-Lee. GDP data taken from the Penn World Tables. * indicates statistical significance at the 10% level, ** indicates significance at the 5% level, and *** indicate significance at the 1% level.

Table 5
Time Fixed Effects Model

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent Variable	5 Year Change in Democracy Score	5 Year Change in Autocracy Score	5 Year Change in Democracy Score	5 Year Change in Autocracy Score	5 Year Change in Democracy Score	5 Year Change in Autocracy Score	5 Year Change in Democracy Score	5 Year Change in Autocracy Score
Initial Democracy Score	-0.451*** (0.045)		-0.449*** (0.045)		-0.452*** (0.046)		-0.450*** (0.045)	
Initial Autocracy Score		-0.523*** (0.048)		-0.526*** (0.047)		-0.524*** (0.049)		-0.527*** (0.048)
Average yrs. Of Education	-0.136 (0.141)	0.125 (0.128)	-0.214 (0.136)	0.258** (0.129)	-0.123 (0.152)	0.204 (0.132)	-0.197 (0.145)	0.313** (0.133)
Log Gdp	0.155 (0.341)	0.230 (0.308)	0.206 (0.342)	0.146 (0.314)	0.134 (0.345)	0.098 (0.312)	0.173 (0.345)	0.041 (0.319)
Education Gini			-2.467* (1.398)	4.163*** (1.263)			-2.574* (1.400)	3.809*** (1.279)
Education Fractionalization					-0.357 (0.919)	-2.190** (0.876)	-0.577 (0.949)	-1.860** (0.833)
Time Fixed Effects	0.002	0.000	0.001	0.000	0.004	0.001	0.002	0.000
Obs	1020	1020	1020	1020	1020	1020	1020	1020
R ²	0.06	0.11	0.08	0.13	0.06	0.12	0.07	0.14

All Regressions include country fixed effects and a constant term. Standard errors are robust and clustered at the country level. All independent variables are from initial years. Time Fixed Effects row contains joint significance of all year dummies. Democracy Score and Autocracy Score variables are taken from the Polity IV database. Education Gini and Education Fractionalization data are constructed as discussed in the data section. Average Years of Education data is taken from Barro-Lee. GDP data taken from the Penn World Tables. * indicates statistical significance at the 10% level, ** indicates significance at the 5% level, and *** indicate significance at the 1% level.

Table 6
Long Run Changes

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable	Change in Democracy Score 1960- 2005	Change in Education Average 1960- 2005	Change in Democracy Score 1960- 2005	Change in Education Average 1960- 2005	Change in Education Gini 1960- 2005	Change in Education Gini 1960- 2005
Democracy Score 1960	-0.815*** (0.077)	-0.018 (0.040)	-0.825*** (0.075)	-0.020 (0.041)	0.005** (0.002)	0.003 (0.002)
Education Average	0.805*** (0.134)	-0.012 (0.066)	0.352** (0.177)	-0.104 (0.127)	-0.032*** (0.007)	
Education Gini			-7.208** (2.813)	-1.433 (2.181)	-0.828*** (0.112)	-0.471*** (0.067)
Obs	87	104	87	104	104	104
R ²	0.55	0.00	0.57	0.01	0.58	0.50

All Regressions include a constant term. Standard errors are robust. All independent variables are from initial years. Democracy Score variables are taken from the Polity IV database. Education Gini data are constructed as discussed in the data section. Average Years of Education data is taken from Barro-Lee. GDP data taken from the Penn World Tables. * indicates statistical significance at the 10% level, ** indicates significance at the 5% level, and *** indicate significance at the 1% level.

Table 7
Robustness Checks

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable	5 Year Change in Democracy Score	5 Year Change in Democracy Score	5 Year Change in Democracy Score	5 Year Change in Democracy Score	5 Year Change in Democracy Score	5 Year Change in Democracy Score
Initial Democracy Score	-0.217*** (0.046)	-0.216*** (0.046)	-0.12443 (0.081)	-0.129 (0.085)	-0.222*** (0.045)	-0.220*** (0.045)
Education Average	0.006 (0.084)	0.027 (0.087)	-0.104 (0.235)	-0.113 (0.281)	0.017 (0.081)	0.025 (0.080)
Log Gdp	0.100 (0.136)	0.101 (0.136)	-0.202 (0.290)	-0.295 (0.298)	0.177 (0.124)	0.174 (0.125)
Education Gini	-2.781 (1.966)	-2.833 (1.938)	-7.239 (5.583)	-7.218 (6.032)	-3.334*** (1.595)	-3.206** (1.590)
GDP Gini		-0.003 (0.010)				
Percent Trained Teachers				0.015 (0.013)		
Public Spending On Education (% of GDP)						-0.025 (0.023)
Obs	228	228	29	29	378	378
R ²	0.1689	0.1693	0.1788	0.2149	0.1221	0.1233

All Regressions are pooled OLS. All Regressions include a constant term. Standard errors are robust. All independent variables are from initial years. Democracy Score variables are taken from the Polity IV database. Education Gini and Education Fractionalization data are constructed as discussed in the data section. Average Years of Education data is taken from Barro-Lee. GDP data taken from the Penn World Tables. GDP Gini data from "All the Ginis" database. Percent Trained Teachers and Public Spending on Education taken from the World Development Indicators. * indicates statistical significance at the 10% level, ** indicates significance at the 5% level, and *** indicate significance at the 1% level.

Chart 1

Sample Lorenz Curve: Spain 2000

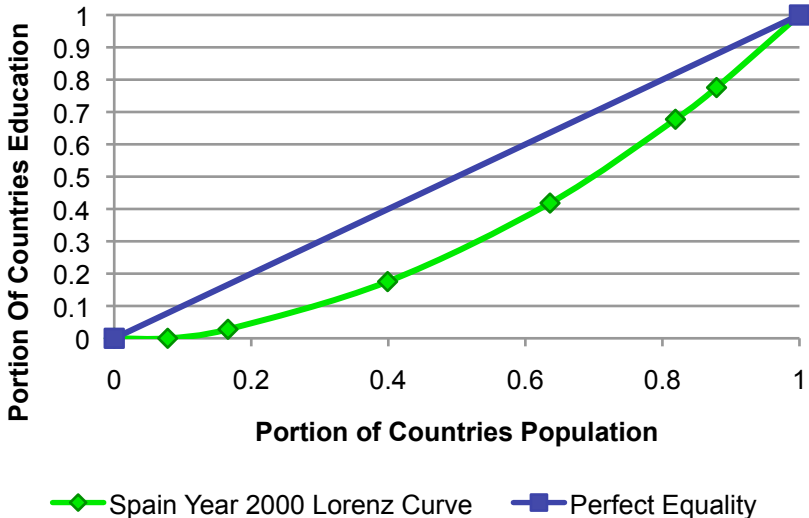


Chart 2

Sample Fractionalization: Spain 2000

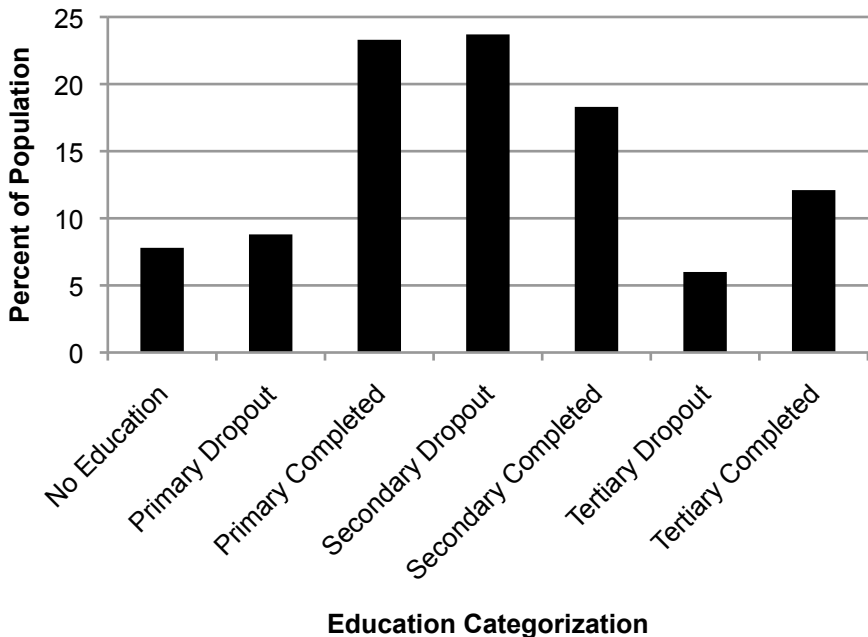
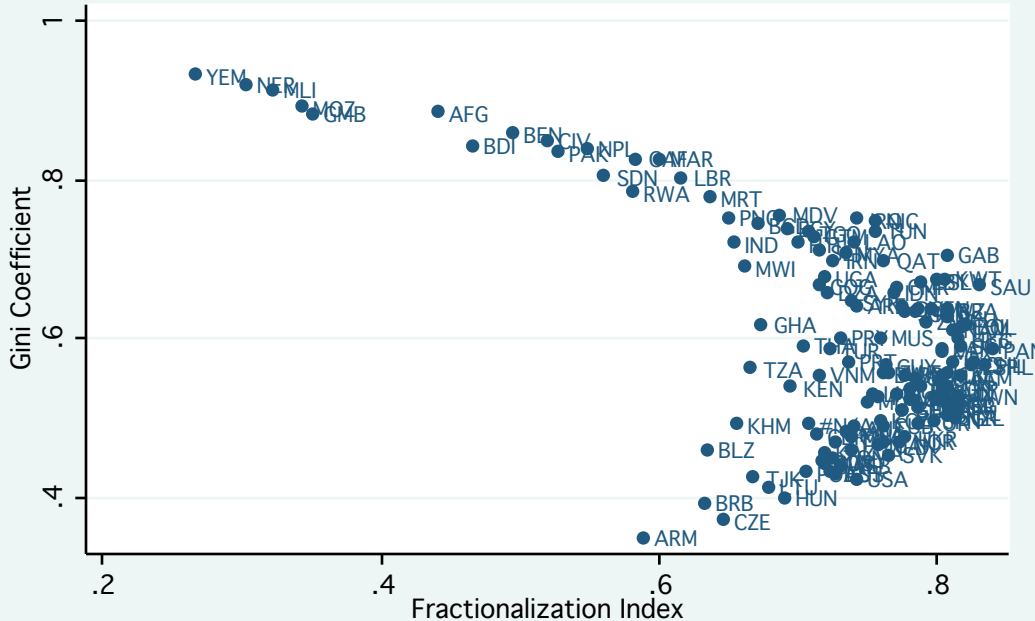
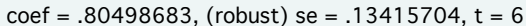


Chart 3

Year 2000 Gini Fractionalization Scatter Plot



Education and Long Run Changes in Democracy: 1960-2005



Democracy and Long Run Changes in Education: 1960-2005

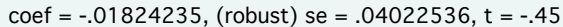
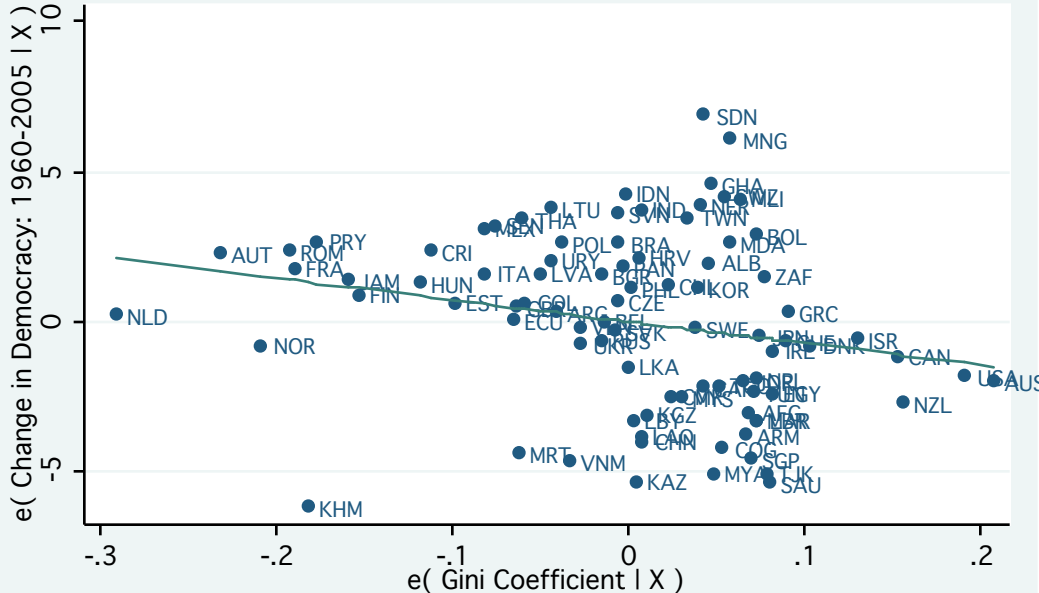


Chart 6

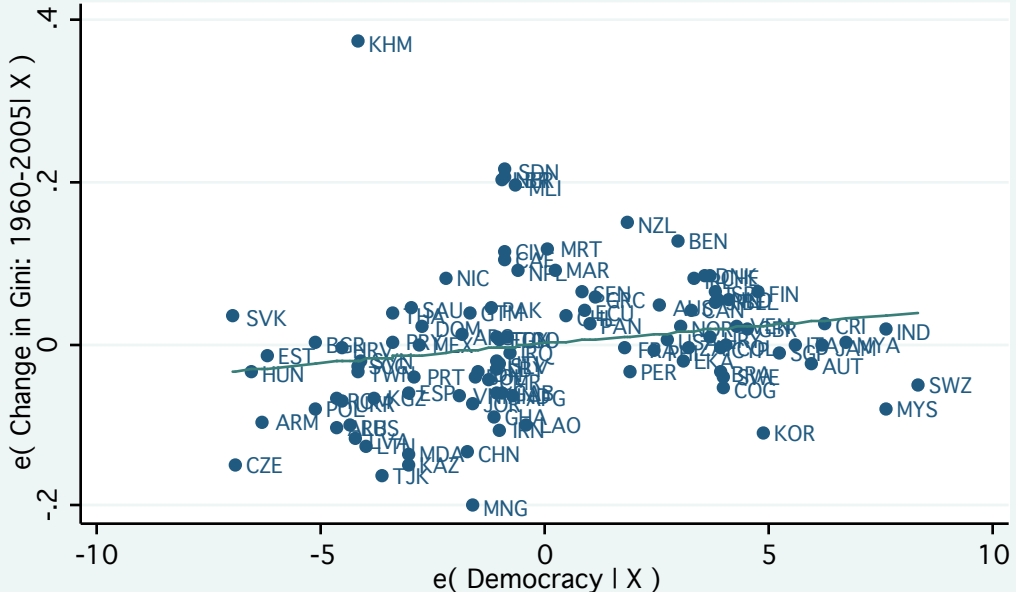
Education Dispersion and Long Run Changes in Democracy: 1960-2005



coef = -7.2081059, (robust) se = 2.8129332, t = -2.56

Chart 7

Democracy and Long Run Changes in Educational Dispersion: 1960-2005



coef = .00472864, (robust) se = .0021178, t = 2.23

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