The Global Decline in Educational Inequality

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March 30, 2009

PRELIMINARY DRAFT: PLEASE DO NOT QUOTE OR CITE

Abstract

Global trends in inequality are almost always cast in terms of income and wealth. However, the variables that most directly affect human welfare are things such as consumption goods, health, relationships, recreation and education. In this analysis we explore cross-country differences in the trends in educational inequality. We confirm the overwhelming *decline* in educational inequality across almost all countries that occurred between 1960-2000 that has been found elsewhere (Thomas, Wang, and Fan, 2003), and we show a significant decline in inequality for the globe as a whole during that period. Moreover, we explore the significant variation that exists in educational inequality across all stages of economic development. From the very poorest to the very richest, significant variation in what we call the *propensity* for inequality—which is a country's actual level of inequality net of its *capacity* to produce equal outcomes—exists across all countries. We find some evidence that the cultural, religious, and political history of countries matters in explaining this variation, but significant exceptions occur to the patterns we identify. Finally, we demonstrate the propensity for educational inequality is largely unrelated to the propensity for income inequality, suggesting that nations view egalitarianism as a multi-dimensional concept, further stressing the importance of treating it as such in future research.

1. Introduction

In their book, *The Race between Education and Technology*, Goldin and Katz (2008) refer to the twentieth century as the "human capital century." The U.S., the most developed 20th century economy, pursued an aggressive and distinct strategy of investing in education. Between 1910-1940, there was a massive increase in secondary education in the U.S. with the percentage of 17 year olds graduating from high school increasing from 6.4% in 1900 to 78% today. (Goldin and Katz, 2008, *Statistical Abstract*). After World War II with more subsidization of higher education through the G.I. Bill and greater funding of public colleges and universities, more and more individuals were choosing to attend college with over 30% of 25-34 year olds having a bachelors degree by 2007.(*Statistical Abstract* table 227) By the 1950s poorer countries were following the U.S. example investing in education as the presumed path to economic growth. Human capital continues to be at the center of the quest for growth. Political candidates stress the importance of the educational system as a fundamental source of international competitive advantage.

Scholarship followed reality. The models of economic growth developed after World War II (Solow 1956, Swan 1956, Harrod 1939, Domar 1946) emphasized growth in the capital-labor ratio through savings and reduced population growth. Nineteenth century economic growth conformed fairly well to this model with growth in the capital-labor ratio accounting for 41% of the growth in output per worker. However, researchers found that growth in the capital-labor ratio explained less than 20 percent of the growth in output per worker. (Gallman, 1972) This inability of growth models to explain twentieth-century growth set off an extensive search for an explanation of the unexplained "residual" not accounted for by growth in the capital-labor ratio. This search soon emphasized human capital as a primary component of economic growth. (Human capital covers all investments that would make human beings more productive including education, health care, nutrition, and on-the-job training.) These scholarly trends reinforced the apparent lessons of twentieth century experience. Thus, one reason to look at

trends in the level and distribution of educational attainment is the link between economic growth and education.

But education is not only important as an input into economic growth, but also because it is an important direct component of well-being. Education directly affects health, longevity and income. Moreover, it appears that individuals directly desire it to increase the quality of life. People have long pursued education even when it was not linked to income prospects. (Consider adult education and education of women unlikely to enter the labor force.) If we were to consider *ex ante* what the components of well-being might be besides income, it is likely that most individuals would include health, longevity, consumption, leisure and education. If this is true, then the level and distribution of education has relevance for the standard of living and well-being independent of the effect of education on growth in per capita income. (Pope, 2009)

The 20th century saw massive increases in investment in education which in turn should have increased well-being directly and through GDP per capita. Our purpose here is not to verify empirical relationships between growth and education or education and well-being. Nor do we tackle explicitly the problem of disentangling the bi-directional relationship between growth and educational attainment, since effects clearly operate in both directions. Our main purpose is simply to describe the patterns that countries display in allocating educational resources across the population. We document the extremely strong trends toward more equality in education through time in virtually all countries. We will also highlight interesting variations along this near-universal trend toward more education and more equal distribution of education.

2. International Trends in Education

2.1 *Data Sources*

Robert Barro and Jong-Wha Lee have used United Nations data to create a panel of distribution of school attainment for 142 countries. The panel contains observations at five year intervals from 1950 to 1995 with projections for 2000 though not all countries have observations in each year. (Census and survey data for 2000 was not available at the time the data set was completed so 2000 data is projected from enrollment rates.) The basic starting point was existing observations on the distribution of school attainment by sex for the population over age 25. They have since extended the data set to include attainment from age 15 and over arguing that this measure more closely corresponds to the labor force in many countries. Attainment is divided into seven categories—no schooling, some primary, completed primary, some secondary, completed secondary, some higher and completed higher. They then use country- specific data on the number of years of education to estimate average years of schooling for each country for each year of data. The development of the data set over time may be reviewed in Barro-Lee (1993, 1996, 2000). The data set has been used quite widely including Rajan and Zingales (1998), Ramey and Ramey (1995), Easterly and Levine (1998), Hall and Jones (1999) and Sachs and Warner (1995). [check JSTOR] The data may be accessed through Harvard's Center for International Development (www.cid.harvard.edu).

Surveys or census data give the stock of educational attainment for benchmark years. Barro and Lee then use a perpetual inventory method using the flow of educational attainment of young adults and the attainment of those who die to estimate the distribution of attainment for the years without direct observation.[1] They are able to use this method to create a data set of

[1]Barro and Lee do not have data on the correlation between longevity and educational attainment. Consequently, they have to assume that the mortality schedule they apply to the data removes individuals at random relative to their education. Education is positively correlated with longevity so this assumption would slightly understate the educational attainment of older cohorts. If the error this creates is consistent across countries, the problem is small. If the error varies, for example larger link between mortality and education in low-education countries, the problem may be more important.

107 countries with observations or estimates for every five years from 1960 to 2000. To obtain estimates of the educational attainment of young adults, they use gross enrollment rates and data on repeaters at each level of schooling. To obtain average years of schooling, Barro and Lee use year-specific years schooling for each level (primary, secondary and tertiary) for each country. Year-specific rates do change within some countries over the forty year period covered by the data set.

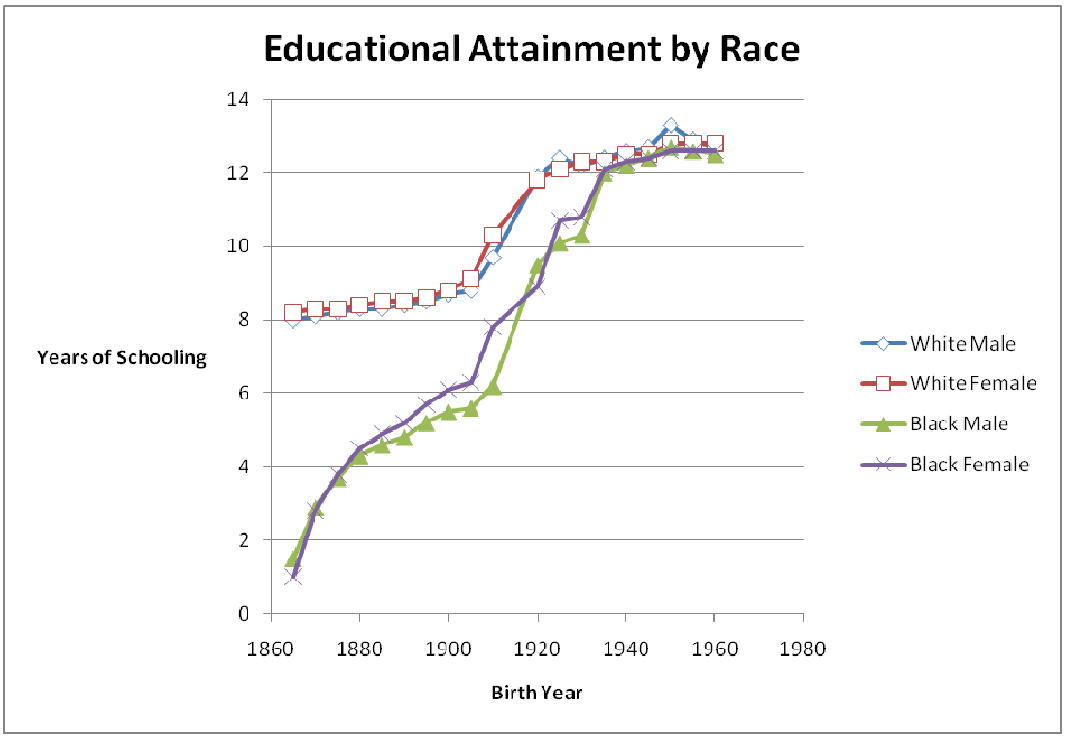
Since the data set gives the stock of educational attainment for all individuals over 15 or 25 while investment in education is concentrated in childhood and young adulthood, it is not a particularly useful measure of changes in the educational policy of the country. Even if a country has significantly improved educational access, the stock of attainment will only be affected marginally. Consequently, one cannot expect average levels of attainment to increase very rapidly even if the levels of education of young adults are increasing rapidly. Moreover, there is an assumption that the quality of schooling whenever attained is the same. It is likely that schooling quality has improved especially in countries with initially low levels of attainment.

2.2. Average Attainment

The best way to measure trends in educational attainment is by cohort as shown in Figure 1 for the United States. Trends for average educational attainment tend to rise for each successive cohort. However, the amount of the increase diminishes with time because of the natural limit to the amount of formal education most individuals will attain. Even in the most educated societies, it is unlikely that educational attainment would move beyond a college degree except for a limited substrata of the population. The rate of return on education falls as the number of working years fall, other things equal. Consequently, education has been concentrated in younger ages in order to maximize the benefits of that education.

International comparisons of educational attainment have been made by Pscharopolous and Ariagada (1986), Lau et al. (1991), and Nehru et al. (1995), but the most comprehensive data

Figure 1: Trends in Average Educational Attainment by Cohort (U.S.)



Note: From 1865 to 1900, the Black group represents Black and Others.
Sources: Current Population Reports: Educational Attainment in the United States: March 1981 and 1980, and Historical Statistics of the United States, Colonial Times to 1970, Part I. The statistics are reported with individuals allocated across an educational year—hence, medians with partial years.

set is that of Robert Barro and Jong-Wha Lee (2000) Their series is more complete in coverage and has been made more comparable by adjustment in the quality of education across countries. They have constructed an international data set doing the difficult work of making years of schooling comparable across countries and trying to adjust for quality differences. Their data set includes school attainment at five year intervals for 138 countries. Unfortunately, the Barro-Lee data set does not allow one to arrange educational attainment by cohort. Rather, they report educational attainment for the whole population by country which will not increase rapidly because most of the improvement is made in the younger cohorts that are added gradually to the complete stock of education for the older population.

Table 1 summarizes increases in educational attainment between 1960 and 2000 dividing the world into regions.

Table 1: Educational Attainment by Region

Region	Average 1960 Attainment	Average 2000 Attainment	Average Gain	% of population age 25 and over Completing Secondary Schooling or more 1960	% of population age 25 and over completing secondary schooling or more 2000
World	4.61	6.72	2.11	13.4	35.8
All Developing Countries	1.79	4.69	3.10	3.2	20.9
Middle East/ N. Africa	1.14	5.08	3.94	3.5	27.1
Sub-Saharan Africa	1.39	3.78	2.39	1.8	12.0
Latin America/ Caribbean	3.13	5.73	2.60	7.1	27.9
East Asia/ Pacific	2.26	6.50	4.24	5.0	35.8
South Asia	1.31	4.19	2.88	1.5	13.8
Advanced Countries	6.97	9.80	2.83	25.2	64.3
Transitional Economies	7.17	9.95	2.78	16.6	49.8

Source: Barro and Lee, 2000. Regions are weighted averages of country data. Cuba and China are included with the East European countries in the transitional group and Japan in the advanced countries rather than in East Asia. Note: The regional breakdowns also come from Barro and Lee.

Table 1 clearly indicates the strong upward trend in educational attainment for the last half of the twentieth century. With worldwide gains of more than 2 years in average attainment and nearly a tripling of the percent of the population attaining a high school education or better, it is obvious that most countries and all regions were investing more in education. Again, remember that the gains by cohort are more dramatic than the gains for the adult population as a whole.

The world wide gain (2.11 years) is less than the average gain in any region (range of 2.39 years to 4.64 years). This seemingly paradoxical result is due to shifting population weights

toward the least educated countries and away from the highest educated countries. That is, the advanced and transitional countries have much lower rates of population growth than Africa, Latin America, the Middle East and South Asia. Therefore, the whole is growing slower than all of the parts.

As shown in Table 2, all countries experienced a gain in mean level of educational attainment over the forty year period—an unsurprising result. South Korea had the most improvement adding more than 7 years to average attainment between 1960 and 2000. The sub-Saharan African countries not only had the lowest levels of attainment in 2000, many of them saw little improvement over the 40 year span of the data set. Developing countries achieved higher absolute gains in attainment than the advanced countries. (3.10 grades compared to 2.83 grades with similar improvements in secondary or better attainment.) Thus, with the possible exception of some African countries, there appears to be a process of convergence between educational attainment in developing and advanced countries. In 1960, average attainment in developing countries was only 29% of the average attainment in the advanced countries, but their attainment was 53% of the average of the advanced countries in 2000. Should Africa follow the patterns in Asia and Latin America, convergence would be assured.

This convergence in average educational attainment is in contrast to the patterns found for income. Lant Pritchett (1997) drew attention to the divergence in per capita income between developing and developed countries over the long term. He estimated that ratio of per capita income of the richest 17 countries to all other countries increased from 2.4 in 1870 to 4.6 in 1990. Moreover, he calculated growth rates were higher for the richest countries than for less developed countries. Per capita income of richer countries grew at a rate of 1.5% per annum while that of less developed countries grew at 1.2%. The growth of GDP per capita in China and India may produce some convergence, but most of the developing countries do not exhibit higher growth rates than the advanced economies.

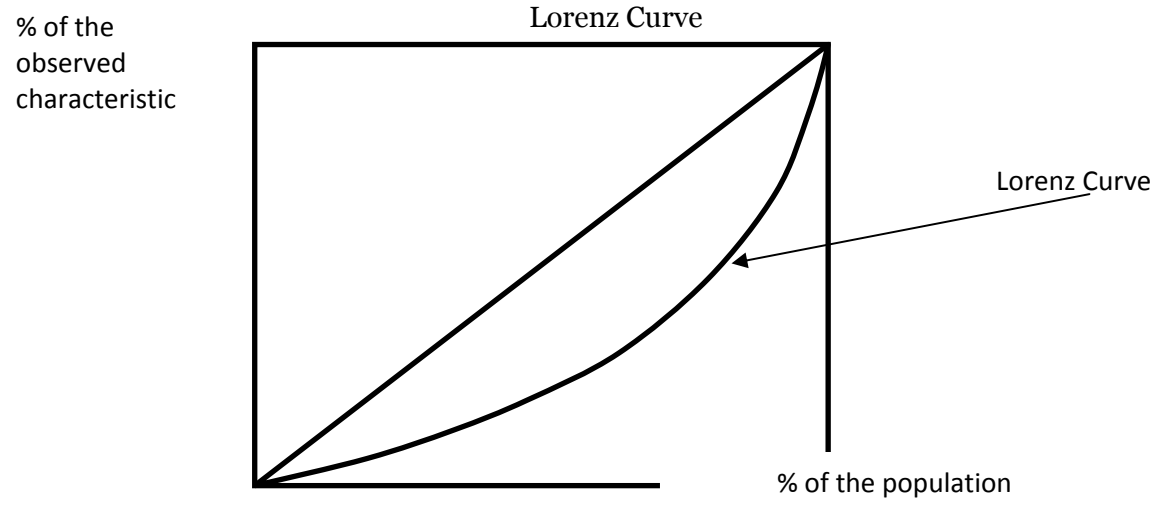
2.3. Educational Inequality

Social scientists have long been interested in the distribution of income and have diligently pursued measurement of that distribution. For the U.S., there are yearly measures of income inequality from 1929 forward. (For example, see Piketty and Saez, 2003.) Most developed countries have been producing measures of income distribution for some time. The World Bank and the U.N. collect measures of income distributions for almost all countries.

2.3.1 Measures of Inequality

There is a wide variety of measures of inequality that may be applied to any distribution of interest. That is, the measures of inequality are not specific to distributions of income. The most common visual portrayal of inequality is the Lorenz curve that shows the proportion of the relevant population that holds a given proportion of the variable of interest. The population is ranked from least to greatest in terms of the characteristic such as income or education and then plotted against shares of the total income or education as shown in Figure 2.

Figure 2



As the Lorenz curve moves closer to the 45 degree line, it unambiguously portrays more equality and portrays more inequality as it bows out further from the diagonal. Unfortunately, two Lorenz curves that intersect represent an ambiguous case where inequality may be viewed as either increasing or decreasing.

The Gini coefficient, the most commonly reported summary measure of inequality, may be related to the Lorenz curve as the area between the Lorenz curve and the 45 degree line divided by the area of the whole triangle. A gini of 0 (Lorenz curve is the 45 degree line) represents absolute equality while a gini of 1 (Lorenz curve has degenerated to a single point where one individual possesses all of the variable in question.) represents total inequality. The most general expression of the gini coefficient is:

$$G = 1 - 2\int_0^1 L(X)dX$$

Where Y=L(X) is the expression of the Lorenz curve—that is Y is the cumulative share of the observed variable and X is the cumulative share of the ordered population. (Anand (1983) and Deaton (1997) have discussions of various formulas to compute the Gini.) With data that is grouped such as is used here, the Gini is most easily computed by a formula linking cumulative proportions. $G = 1 - \sum_{k=1}^{n}(X_k - X_{k-1})(Y_k + Y_{k+1})$ This approach is easily used in a spread-sheet format and is employed here.

There are numerous summary measures of inequality such as the Theil entropy index, variance of the log, the Atkinson index, as well as the Gini index. (Atkinson and Bourguignon, 2000) The Gini has one serious drawback. It is not possible to decompose the inequality due to various components as it is with most of the other measures. However, the Gini continues to be the most commonly reported measure of inequality, which is the primary reason we employ it here.

While gini coefficients and other measures of inequality have been widely applied to income, they are now beginning to be applied to other measures of well-being. Pope (2009)

applies these measures to lifespan and education for the United States finding strong trends toward equality in both the distribution of lifespan and the distribution of educational attainment. Thomas, Wang and Fan (2001) have estimated Gini coefficients for the Barro-Lee data set, finding trends toward equality in educational attainment for virtually all countries. In principle, measures of inequality may be applied to any distribution. Their near universal restriction to description of income inequality simply reflects economists and other social scientists preoccupation with the inequality of the cross-sectional distribution of income. But inequality of income, especially inequality of annual income with its variability and tenuous linkage to consumption, is not necessarily a good measure of the inequality of material well-being. Inequality of lifespan, lifetime consumption, leisure time and educational attainment would all seem to be salient components of the distribution of well-being. Furthermore, the work of Pope and Thomas, Wang and Fan give evidence that the trends of inequality of income, education and lifespan do not move together.

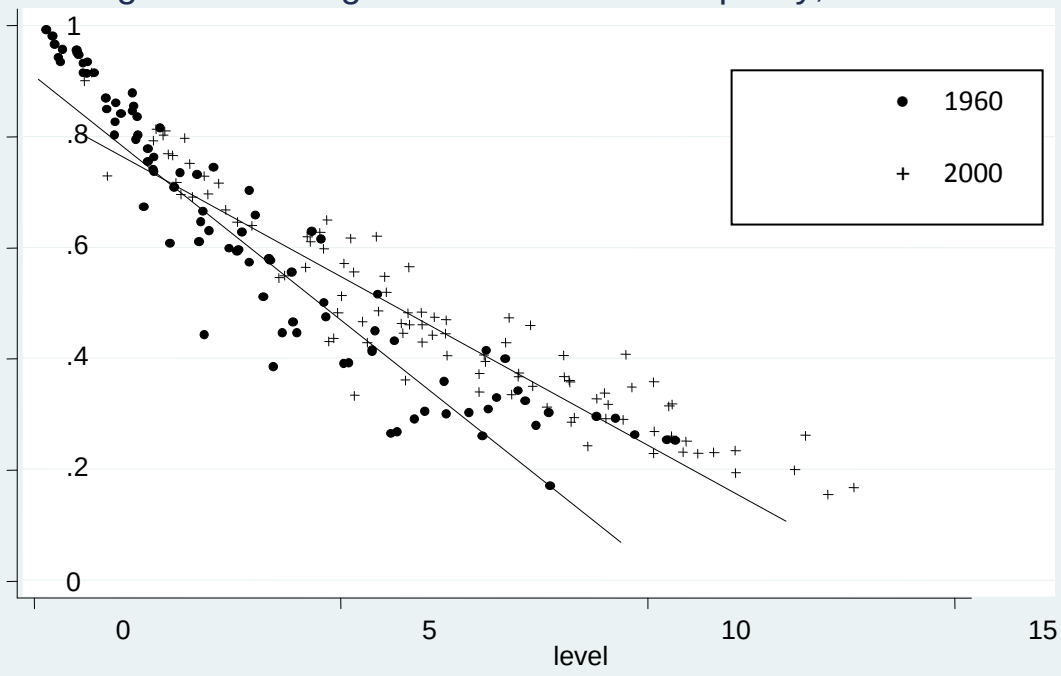
2.3.2. Trends in the Distribution of Educational Attainment

Though not a logical necessity, there is a natural tendency for the distribution of educational attainment to become more equal as the mean of educational attainment increases. It is possible to have an increase in average attainment and an increase in educational inequality. (Imagine a situation where an elite is becoming more educated while the mass receives no education.) In reality, there is a soft natural limit to educational attainment. Most of the population is unlikely to go much beyond sixteen to eighteen years of education given the requirement for employment of much of the population to recoup the costs of the investment in education. Every society has concentrated education in youth and young adulthood with education completed in the early or mid-twenties. This natural upper limit leads to situation where societies with growing average attainment are moving more and more of the young population toward the natural limit creating more equality in each successive cohort. Slowly,

the increasing equality in the young cohorts also increases equality in the population age 25 and over.

Figure 3 illustrates this natural process. As the mean attainment rises there is a very strong downward drift in educational equality as measure by the Gini coefficient. There is a surprising variation in Gini coefficients for both 1960 and 2000. Values in 1960 range from .99 (Nepal) which is nearly total inequality to .17 (United Kingdom), a value significantly lower than income inequality for any country. The mean of the country gini coefficients was .61 (unweighted by population.) By 2000, the mean had fallen to .47 with a range of .92 (Mali) to .15 (Norway).

Figure 3: Average Attainment and Inequality, 1960 and 2000



Source: Calculated from Barro-Lee Set (2000)

The detail behind figure 3 is contained in Table 2. Only eight countries show an increase in inequality as measure by the gini coefficient—United Kingdom, Hungary, Croatia, Belgium, Italy, France, Slovakia and New Zealand. All of these countries began with fairly high income

and education. Not surprisingly, countries with the most inequality made larger gains. South Korea made the most gain in average achievement, over seven grade levels, and made the most progress toward equality reducing its gini by .43—a remarkable achievement in four decades. Yet many countries increase the mean level by several grades and reduced educational inequality significantly. This was true, not only of developing countries with low initial levels of education, but also of many developed countries, such as the Scandinavian countries and the United States , who pushed educational attainment upward with more equality.

Table 2
Educational Inequality 1960 to 2000

	Country	**Last year**	**Level (1960)**	**Level (2000)**	***Change (Level)***	**Gini (1960)**	**Gini (2000)**	***Change (Gini)***
Ist Quartile	Iraq	2000	0.21	4.34	*4.13*	0.98	0.61	*-0.38*
	Syria	2000	0.99	5.74	*4.75*	0.85	0.52	*-0.33*
	Tunisia	2000	0.54	4.20	*3.66*	0.95	0.63	*-0.32*
	Iran, I.R. of	2000	0.63	4.66	*4.03*	0.93	0.62	*-0.32*
	Kenya	2000	1.20	3.99	*2.79*	0.84	0.55	*-0.29*
	Ghana	2000	0.69	4.01	*3.32*	0.91	0.62	*-0.29*
	Egypt	2000	1.32	5.05	*3.73*	0.90	0.62	*-0.28*
	Algeria	2000	0.97	4.72	*3.75*	0.87	0.60	*-0.27*
	Indonesia	2000	1.11	4.71	*3.60*	0.83	0.56	*-0.27*
	Zaire	2000	0.56	3.18	*2.62*	0.90	0.64	*-0.26*
	Togo	2000	0.32	2.83	*2.51*	0.96	0.70	*-0.26*
	Myanmar (Burma)	2000	0.97	2.44	*1.47*	0.87	0.64	*-0.22*
	Haiti	2000	0.70	2.67	*1.97*	0.93	0.72	*-0.22*
	Mozambique	2000	0.26	1.19	*0.93*	0.94	0.73	*-0.21*
	Nepal	2000	0.07	1.94	*1.87*	0.99	0.79	*-0.20*
	Rwanda	2000	0.76	2.03	*1.27*	0.91	0.72	*-0.20*
	Libya	1985	0.63	2.87	*2.24*	0.89	0.70	*-0.19*
	Central Afr. R.	2000	0.39	2.11	*1.72*	0.96	0.78	*-0.19*
	Bangladesh	2000	0.79	2.45	*1.66*	0.91	0.73	*-0.19*
	Liberia	2000	0.56	2.26	*1.70*	0.95	0.77	*-0.18*
	Sudan	2000	0.29	1.91	*1.62*	0.93	0.77	*-0.17*
	Papua New Guin.	2000	1.13	2.39	*1.26*	0.86	0.70	*-0.16*
	Uganda	2000	1.10	2.95	*1.85*	0.80	0.65	*-0.16*
	Gambia	2000	0.50	1.86	*1.36*	0.96	0.81	*-0.15*
	Sierra Leone	2000	0.53	1.99	*1.46*	0.96	0.81	*-0.14*
	Pakistan	2000	0.63	2.45	*1.82*	0.91	0.80	*-0.12*

	Mali	2000	0.17	0.76	*0.59*	0.98	0.92	*-0.07*
	Niger	2000	0.20	0.82	*0.62*	0.97	0.90	*-0.06*
	Afghanistan	2000	1.10	1.14	*0.04*	0.91	0.90	*-0.01*
2nd Quartile	Bahrain	2000	1.37	6.09	*4.72*	0.88	0.48	*-0.40*
	Jordan	2000	1.40	7.37	*5.97*	0.85	0.46	*-0.40*
	Malaysia	2000	2.34	7.88	*5.54*	0.73	0.37	*-0.36*
	Botswana	2000	1.46	5.35	*3.89*	0.80	0.47	*-0.34*
	Swaziland	2000	1.79	5.73	*3.94*	0.82	0.48	*-0.33*
	Zambia	2000	1.60	5.43	*3.83*	0.78	0.46	*-0.31*
	Turkey	2000	2.00	4.80	*2.80*	0.71	0.43	*-0.28*
	Kuwait	2000	2.59	7.05	*4.46*	0.74	0.47	*-0.27*
	Country	**Last year**	**Level (1960)**	**Level (2000)**	***Change (Level)***	**Gini (1960)**	**Gini (2000)**	***Change (Gini)***
	Mexico	2000	2.41	6.73	*4.32*	0.65	0.41	*-0.24*
	Zimbabwe	2000	1.54	4.88	*3.34*	0.67	0.44	*-0.24*
	Cameroon	2000	1.37	3.17	*1.80*	0.85	0.64	*-0.21*
	Mauritius	2000	2.44	5.55	*3.11*	0.66	0.46	*-0.20*
	Honduras	2000	1.69	4.08	*2.39*	0.74	0.55	*-0.19*
	India	2000	1.45	4.77	*3.32*	0.84	0.65	*-0.18*
	Portugal	2000	1.94	4.91	*2.97*	0.61	0.43	*-0.18*
	Benin	2000	0.29	2.10	*1.81*	0.98	0.80	*-0.17*
	Nicaragua	2000	2.09	4.42	*2.33*	0.73	0.57	*-0.17*
	Venezuela	2000	2.53	5.61	*3.08*	0.63	0.49	*-0.14*
	El Salvador	2000	1.70	4.50	*2.80*	0.74	0.61	*-0.13*
	Guatemala	2000	1.43	3.12	*1.69*	0.79	0.67	*-0.13*
	Ecuador	2000	2.95	6.52	*3.57*	0.59	0.48	*-0.12*
	Jamaica	2000	2.46	5.22	*2.76*	0.44	0.33	*-0.11*
	Malawi	2000	1.70	2.58	*0.88*	0.76	0.69	*-0.07*
	Dominican Rep.	2000	2.38	5.17	*2.79*	0.61	0.55	*-0.06*
	Brazil	2000	2.83	4.56	*1.73*	0.60	0.57	*-0.03*
	Senegal	2000	1.60	2.23	*0.63*	0.75	0.75	*0.00*
3rd Quartile	Korea	2000	3.23	10.46	*7.23*	0.66	0.23	*-0.42*
	Singapore	2000	3.14	8.12	*4.98*	0.70	0.35	*-0.35*
	Taiwan	2000	3.32	8.53	*5.21*	0.65	0.33	*-0.32*
	Philippines	2000	3.77	7.62	*3.85*	0.56	0.31	*-0.24*
	Hong Kong	2000	4.74	9.47	*4.73*	0.56	0.32	*-0.24*
	South Africa	2000	4.08	7.87	*3.79*	0.63	0.41	*-0.22*
	Peru	2000	3.02	7.33	*4.31*	0.63	0.41	*-0.22*
	Cyprus	2000	4.29	8.77	*4.48*	0.48	0.29	*-0.19*
	Sri Lanka	2000	3.43	6.09	*2.66*	0.58	0.44	*-0.13*
	Cuba	2000	3.79	7.78	*3.99*	0.47	0.34	*-0.13*

	Panama	2000	4.26	7.90	*3.64*	0.50	0.37	*-0.13*
	Thailand	2000	3.45	6.10	*2.65*	0.58	0.47	*-0.11*
	Spain	2000	3.64	7.25	*3.61*	0.45	0.34	*-0.11*
	Trinidad & Tob.	2000	4.19	7.62	*3.43*	0.42	0.32	*-0.10*
	Greece	2000	4.64	8.51	*3.87*	0.39	0.29	*-0.10*
	Lesotho	2000	3.14	4.47	*1.33*	0.57	0.48	*-0.09*
	Paraguay	2000	3.35	5.74	*2.39*	0.51	0.43	*-0.08*
	Colombia	2000	2.97	5.01	*2.04*	0.60	0.51	*-0.08*
	Argentina	2000	4.99	8.49	*3.50*	0.41	0.34	*-0.07*
	Bolivia	2000	4.22	5.54	*1.32*	0.62	0.56	*-0.05*
	Chile	2000	4.99	7.89	*2.90*	0.41	0.37	*-0.05*
	Guyana	2000	3.50	6.05	*2.55*	0.38	0.36	*-0.02*
	Costa Rica	2000	3.86	6.01	*2.15*	0.45	0.45	*0.00*
	Slovenia	2000	6.94	7.35	*0.41*	0.39	0.40	*0.00*
	Italy	2000	4.56	7.00	*2.44*	0.39	0.43	*0.04*
	Croatia	2000	5.99	6.49	*0.50*	0.32	0.44	*0.12*
4th Quartile	Fiji	2000	5.08	7.96	*2.88*	0.51	0.36	*-0.15*
	Norway	2000	6.11	11.86	*5.75*	0.30	0.15	*-0.15*
	United States	2000	8.66	12.25	*3.59*	0.29	0.17	*-0.12*
	Austria	2000	6.71	8.80	*2.09*	0.41	0.29	*-0.12*
	Romania	2000	5.33	9.51	*4.18*	0.43	0.32	*-0.11*
	Sweden	2000	7.65	11.36	*3.71*	0.30	0.20	*-0.10*
	Canada	2000	8.37	11.43	*3.06*	0.30	0.20	*-0.10*
	Poland	2000	6.74	9.90	*3.16*	0.31	0.23	*-0.08*
	Yugoslavia	1990	5.08	7.48	*2.40*	0.44	0.36	*-0.08*
	Japan	2000	6.87	9.72	*2.85*	0.33	0.25	*-0.08*
	Uruguay	2000	5.03	7.25	*2.22*	0.45	0.37	*-0.08*
	Switzerland	2000	7.30	10.39	*3.09*	0.32	0.26	*-0.06*
	Ireland	2000	6.45	9.02	*2.57*	0.30	0.24	*-0.06*
	Malta	2000	5.64	7.57	*1.93*	0.49	0.43	*-0.06*
	U.S.S.R.	1985	7.59	9.36	*1.77*	0.41	0.37	*-0.05*
	Israel	2000	6.99	9.23	*2.24*	0.40	0.36	*-0.04*
	Finland	2000	5.37	10.14	*4.77*	0.27	0.23	*-0.04*
	Denmark	2000	8.95	10.09	*1.14*	0.26	0.23	*-0.03*
	Barbados	2000	5.22	9.11	*3.89*	0.33	0.30	*-0.03*
	Czechoslovakia	2000	7.19	9.46	*2.27*	0.34	0.31	*-0.03*
	Australia	2000	9.43	10.57	*1.14*	0.25	0.23	*-0.02*
	Bulgaria	2000	6.08	9.74	*3.66*	0.36	0.35	*-0.01*
	Germany, East	1990	8.80	10.17	*1.37*	0.24	0.23	*-0.01*
	Iceland	2000	5.63	8.75	*3.12*	0.29	0.29	*0.00*
	Germany, West	1990	8.28	9.06	*0.78*	0.32	0.32	*0.00*
	Netherlands	2000	5.27	9.24	*3.97*	0.26	0.27	*0.00*

New Zealand	2000	9.56	11.52	*1.96*	0.25	0.26	*0.01*
Slovakia	2000	9.07	9.19	*0.12*	0.36	0.37	*0.01*
France	2000	5.78	8.37	*2.59*	0.30	0.33	*0.02*
Belgium	2000	7.46	8.73	*1.27*	0.28	0.36	*0.08*
Hungary	2000	6.65	8.81	*2.16*	0.26	0.41	*0.15*
United Kingdom	2000	7.67	9.35	*1.68*	0.17	0.32	*0.15*

Source: Computed from the Barro-Lee data set.

Though the strong relationship between the level and inequality of educational attainment is clear, there is also substantial and sometimes surprising variation in the paths that various countries take as they continue to develop. Consider, for example, Asian countries with quite similar levels of educational inequality in 1960—Korea (1960 gini of .66), Taiwan (.65), Hong Kong (.56), Sri Lanka (.58), Thailand(.58) and the Philippines (.56). All increased the level of average educational attainment significantly ranging from over 7 grades for Korea to less than 3 grades for Sri Lanka. All created more equality of education, but the extent of the change in the Gini coefficient varies from -.42 in Korea to -.11 in Thailand. Or, consider all countries with average attainment between and 9.0 and 9.9 years of schooling. Inequality of attainment varies from .23 to .37, a substantial difference on a scale that can only vary between 0 and 1.

The other obvious influence on educational inequality is the level of income. Educational decisions represent a confluence of private and public decision-making. In most countries, the supply of educational opportunities is determined by government while demand for education comes from households with perhaps subsidization from government. As GDP per capita grows households demand more education increasing the equality of education. Also, as the distribution of income becomes more equal holding GDP per capita constant, there may also be an increase in the demand for education.

All the analysis thus far has used countries as the unit of analysis. It is possible, however, to calculate an educational gini coefficient for the world as a whole, or least the subset of the world found in the Barro-Lee dataset. Again, these are not country averages, but are

obtained by adding up the number of people in each educational category, world-wide, and calculating an educational gini as before. Table 3 below shows this trend.

Table 3

Global Trend in Educational Inequality

1960	0.657
1965	0.654
1970	0.644
1975	0.573
1980	0.556
1985	0.539
1990	0.500
1995	0.499
2000	0.485

Thus we see that educational has been declining for the world as a whole. There is almost no decline in educational inequality during the 1960s, but the 1970s saw a remarkable 10 % decline in educational inequality in that one decade. Decline continued through the 1980s and 1990s such that there was an over-all decline of 26% over the forty year period. Since the stock of educational attainment changes slowly, this is a significant and substantial decline. Moreover, because the population of low education countries is growing faster than that of high education countries this decline is all the more remarkable.

In a reduced form context, one would expect GDP per capita (and perhaps its distribution) and the level of educational attainment to be important determinants of educational inequality. But an important question of interest is the extent to which there is variation not explained by the level of education and of GDP per capita. Are there individual differences across countries generated by public policy or culture not associated with income and the level of education? We now turn to this question.

3. Methodological Approach

3.1 Motivation

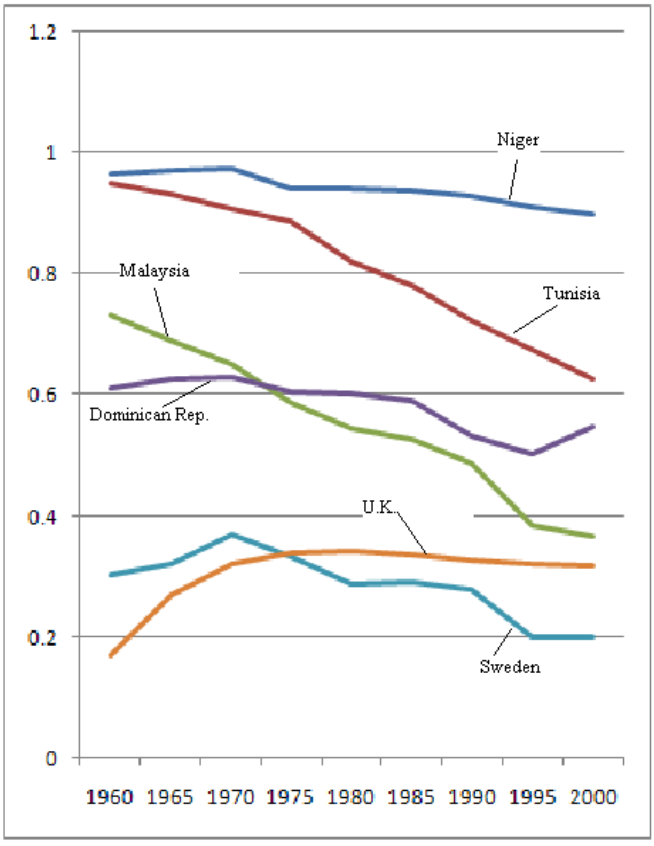
In this analysis, we investigate the determinants of educational inequality over a 40 year period, from 1960 to 2000. Although we hope that future researchers will uncover all the political, economic, and cultural factors that explain a given country's level of educational inequality, our aim is not a complete explanatory model. Our approach specifies a basic dynamic model that can be used to sweep out the structural, demographic forces at play in identifying country differences. We include simple measures of economic and political development, but our emphasis is on searching for patterns in the unexplained part of the variance. For this reason, we don't include regional dummies or other groupings of variables in the model. We hope that the analysis will uncover patterns in the data that can be used in further theoretical development.

With panel data, a large number of empirical specifications are always possible. In choosing an empirical approach, we are particularly attuned to two issues. The first is that educational development, as well as economic development more generally, has followed a variety of different pathways in different countries over the four decades we examine. Even if we were to assume a common developmental trajectory across countries, at a given point in time countries will be at different points along that trajectory. Thus fitting a common growth path for this analysis is not a reasonable assumption.

To illustrate the variety of trajectories that countries have followed, consider the cases in Figure 4 for the educational gini of different countries across time (a similar figure could be produced for mean educational attainment)….It is desirable, therefore to have a specification

that allows each country to follow its own path, meaning that the starting point in 1960 is allowed to vary across time, as is the slope of the trajectory from 1960 to 2000.

Figure 4: Educational Inequality, Selected Countries



Another way to cast this issue of heterogeneity in developmental trajectories is in terms of observational dependence, meaning that the unobserved components of each observation are not independent draws from a common distribution but are, instead, highly correlated. The main source of correlation results from taking repeated observations from the same analytical units, which are countries in this case. Simple OLS regression is clearly inappropriate because it assumes each country-year point as an independent observation, when it is clearly not.

The second major challenged faced in this analysis is that the dependent variable moves only slowly over time. Ideally, we would look at the educational attainment for narrow age cohorts through time, but the data at hand do not allow this. As discussed earlier, because education happens at young ages, innovations in educational investment affect the whole adult population only slowly. Furthermore, the rate at which the educational distribution shifts will be a function, in part, of shifts in the age structure of the population. These features of the dependent variable we are trying to explain shape the analysis in two ways. First, we want to avoid attributing changes in the year to year variation in independent variables; instead we explain long-term changes in the dependent variable to long-term changes in the independent variables. Second, we want to include as many controls as possible to account for demographic change.

3.2. The latent growth curve model

Latent growth curve models fall into the class of models known as hierarchical, multi-level, or mixed models. The canonical example would be a human growth curves. In general humans follow the same growth trajectory over the life-cycle, but there are correlates of growth (diet and genetic endowments) that can shift the curve up or down, as well as accelerate or decelerate it. In our case, we have a further complication due to variation in starting points. Some countries in the data set are highly developed, while others have yet to make significant strides in development. And although 40 years of data is helpful in mapping out this path, the educational development process typically lasts much longer than this. For instance, even though the huge changes that occurred in the United States during the later 19th and early 20th centuries dramatically changed the educational distribution in the population, educational equality continued to improve significantly from 1960 to 2000, as it did in almost all countries. Even if countries follow the same general path (a contestable point), the variation in their stage

of development in 1960 will cause the significant variation in starting points (1960 values) that we see in the Figure 4.

A linear latent growth curve model for educational inequality (*g)* is specified as follows, with *i* indexing countries and *t* indexing time periods:

$$g_{it} = \beta_{0i} + \beta_{1i}t + u_{it} \qquad (1)$$

Each country, therefore, has a unique intercept and unique slope. The residual u_{it} is assumed to be *i.i.d.* normally distributed.

Covariates enter the model through the linear parameters as follows:

$$\beta_{0i} = \gamma_{00} + \gamma_{01}X_{0i} + \delta_{0i} \qquad (2)$$

$$\beta_{1i} = \gamma_{10} + \gamma_{11}X_{1i} + \delta_{1i}. \qquad (3)$$

The covariance matrix of the random effects, δ_{jj} , is given as

$$\Sigma = \begin{matrix} \sigma_{11} & \sigma_{12} \\ \sigma_{21} & \sigma_{22} \end{matrix}. \qquad (4)$$

The vector X_i contains independent variables that do not vary over time within countries. Variables can appear in both the intercept equation and the slope equation or both. In this specification, we designate X_{0i} as the subset of X_i that shift the intercept and X_{1i} as the variables that shift the slope. To interpret the effect of X on g we can substitute the intercept and slope equations into the main equation of interest. This gives:

$$g_{it} = (\gamma_{00} + \delta_{0i}) + \gamma_{01}X_{0i} + (\gamma_{10} + \delta_{1i})t + \gamma_{11}X_{1i}t + u_{it} \qquad (5)$$

which is a simple linear function of X, t and the interaction of X_{1i} and t. Rearranging and regrouping the terms gives another common interpretation:

$$g_{it} = ([\gamma_{00} + \gamma_{01}X_{0i}] + [\delta_{0i}]) + ([\gamma_{10} + \gamma_{11}X_{1i}] + [\delta_{1i}])t + u_{it} \qquad (6)$$

This emphasizes that, for a single country, the model is a simple linear function of t. The intercept and slope of this function consist of a mixture of fixed parameters (the γ_{jj}) and random parameters (the δ_{jj}). The fixed and random effects associated with each term are set off above by square brackets. Thus, the fixed effect for the intercept has a common mean, $\gamma_{00,}$ shared with all

other countries and a part specific to the country. This second term, $\gamma_{01}X_{0i}$, reflects the portion of intercept that can be attributed to a fixed value of X_{0i}. But there is also a country-specific random-effect, δ_{0i} , that shifts the intercept as well. The fixed and random effects for the slope coefficient are interpreted similarly—a fixed effect, which is the sum of a common mean and a portion due to X_{1i}, and a country-specific random effect.[2]

We have not commented yet on the structure of the random effects. It is a common assumption to assume that the random effects for the slope and intercept terms are independent of one another. But as can be readily seen from Figure 4, countries that have not yet developed and have, consequently, a very high educational gini coefficient, can either stay high over time or go down, since the gini is bounded by unity from above. Thus for countries at this level of development, the covariance between the random effects will be negative. Therefore, in estimating the model, it is important to allow for the slope and intercept to be correlated, $\delta_{jj} \neq 0$. The model parameters, including both the γ_{jj} and the σ_{jj}, are estimated by maximum likelihood.

3.3. Explanatory variables

As noted above, the population structure may be important in determining the level of educational inequality. Countries with younger populations, for instance, will change more slowly than countries with relatively aged populations. We, therefore, include four population variables to account for the demographic structure of the country. Each variable is taken from the World Development Indicators dataset produced by the World Bank (cite)

1. ln(total population)
2. percent of population age 15 and younger
3. percent of population age 65 and older
4. percent of population residing in rural areas.

[2] This mixture of fixed and random effects are what motivates the term "mixed model." Unfortunately, when scholars using mixed models use the terms fixed and random effects they often talk past econometricians who use the term "fixed effects" to mean a variable intercept model (or, equivalently, the least squares dummy veriable model) and "random effects" to mean a random intercept model (both of which are special cases of the more general model discussed here).

These variables are included in both the intercept and slope terms. The intercept terms include the values of these variables in 1960; the slope terms (X_{1i}) are included in the model as the average annual change (in absolute terms) over the 40 year period multiplied by the number of years since 1960, as indicated in equation (5). Thus year-to-year changes in these variables are ignored in explaining the trend in the inequality; only the average change over the time period is included.

The main purpose of the demographic variables is to control for demographic shifts that might affect educational inequality in ways that have little to do with a country's decision about how to allocate educational resources. Generally countries with older populations are further along the demographic transition than are younger countries, and the demographic transition is correlated with economic development more generally. Thus we would expect older populations to have more equal distribution of education. However, changes in the educational distribution will be slower to appear in an older population, since our measure of education includes the entire population over age 25.

Economic growth, as measured by real per capita income from the Penn World Tables, is more straight-forward. We anticipate that economic growth has a strong positive effect on average educational attainment and, therefore, on educational inequality, as suggested by the strong link between attainment and equality found in Figure 3. We include the log of real GDP per capital in 1960 to explain the variation in the intercept term and the average change in the logs between 1960 and 2000 (which represents an average annual percentage increase in GDP) multiplied by years since 1960 as the variable affecting the slope coefficient.

We also hypothesize the countries with a greater degree of democracy will, other factors held constant, have a higher degree of both educational attainment and equality. We use the standard Polity score to measure democratization. This ranges from -10 to 10. Those countries with scores less than -10 [indicating they were totally screwed up] were assigned a value of -10. Using this scale, the mean polity score in 1960 for countries matched to the Barro-Lee dataset

was .28 in 1960. The mean oscillated around 0 until 1990, when it began to rise rapidly, reaching 1.98 in 1990, 4.01 in 1995 and 4.19 in 2000.

There are 100 countries used in this analysis, with an average number of observations per country at 8.6. Countries that subdivide (Checkoslovakia) or combine (Germany) are used for the period of the data in which the country definitions are consistent.

4. Regression Estimates

Table 4 contains the results from the estimated models. We estimate three specifications. The first, model (1) is the simple linear model with no covariates; model (2) includes baseline (1960) values; and model (3) is the full model with the variables that contain both the fixed factors affecting the intercept, as well as the fixed factors affecting the slope. We also include simple OLS estimates for comparison purposes. The OLS estimates are obtained using all country-year points for a total of 859 observations.

In the model with no covariates, inequality falls by .004 points per year on average. Adding covariates eliminates this downward trend entirely and actually produces a slightly positive (though statistically insignificant) trend in inequality over time. The fact that the estimated trend disappears when variables are added to the model implies that the variables in the model can completely account for the changes over time in the level of inequality, but not, of course, all the variance in the trend over time.

However, neither GDP nor democracy are vitally important in explaining either variation at a point in time or the trend over time. A country at the 75th percentile of income in 1960 had a gini coefficient of .07 higher than a country at the 25th percentile. A similar comparison for polity gives an advantage of .085. The inner-quartile range for the educational gini in 1960 was .44. Thus economic growth and democracy were important parts of the overall story, but much more was going on. These variables do even worse in explaining the trends from 1960 to 2000.

Table 4: Model Estimates, Educational Inequality

Dep. Var: Gini coeff. For Education	(1)	(2)	(3)	OLS Estimates
Variable	Coef.	Coef.	Coef.	Coef.
Years since 1960 (t)	-0.004 ***	-0.004 ***	0.001	0.000
	(0.000)	*(0.000)*	*(0.001)*	*(0.001)*
Fixed Factors affecting intercept (X_{0i})				
Ln(Real GDP/capita), 1960		-0.055 **	-0.043 *	-0.055 **
		(0.024)	*(0.025)*	*(0.022)*
Polity, 1960		-0.006 ***	-0.005 **	-0.005 ***
		(0.002)	*(0.002)*	*(0.002)*
Ln(total population), 1960		-0.015 *	-0.007	-0.001
		(0.009)	*(0.008)*	*(0.007)*
% of Pop. < 15, 1960		-0.002	0.006	0.007 ***
		(0.004)	*(0.004)*	*(0.003)*
% of Pop.> 65, 1960		-0.019 *	-0.017	-0.003
		(0.011)	*(0.011)*	*(0.005)*
% Rural, 1960		0.227 **	0.170 *	0.142 **
		(0.089)	*(0.090)*	*(0.065)*
Fixed Factors affecting slope (X_{1i})				
Ann. Change in Ln(Real GDP/capita), 1960-2000 * t			-0.046 ***	
			(0.016)	
Ann. Change in Polity, 1960-2000 * t			0.000	
			(0.001)	
Ann. Change in Ln(total population), 1960 -2000 * t			-0.132 ***	
			(0.032)	
Ann. Change in % of Pop. < 15, 1960-2000 * t			0.006 ***	
			(0.002)	
Ann. Change in % of Pop.> 65, 1960-2000 * t			0.008	
			(0.005)	
Annual Change in % Rural, 1960-2000 * t			0.247 ***	
			(0.082)	
Intercept	0.639 ***	1.33206 **	0.834 **	0.722 **
	0.026	(0.403)	(0.412)	(0.323)
Random-Effects Parameters	*Estimate*	*Estimate*	*Estimate*	
std. dev (t)	0.003	0.003	0.002	
	(0.000)	*(0.000)*	*(0.000)*	
std. dev (intercept)	0.256	0.154	0.145	
	(0.018)	*(0.013)*	*(0.011)*	
corr(t, intercept)	-0.716	-0.630	-0.605	
	(0.052)	*(0.074)*	*(0.094)*	
std. dev. (residual)	0.029	0.029	0.029	
	(0.001)	*(0.001)*	*(0.001)*	

Signficance levels are indicated by *: .1, **: .05. ***: .01; standard errors are in parentheses. OLS estimates are given for comparison purposes. They are calculated using time-varying values of the dependent and indepdent variables at each observation (measured at 5-year intervals) and robust standard errors clustered at the country level.

Mean growth in GDP can account for a decline in the gini of only .032, and the effect of democratization over that period was essentially zero.

It may be the case that democratization has little power to explain the trend in equality because the bulk of the changes that occurred did not happen until the 1990s, and this may be too short of a period to significantly affect educational inequality. There is good evidence that the polity scores in 1960 can explain a substantively significant amount of the baseline variation in educational inequality, but the trend after 1960 is unaccounted for. Even if we drop all the other variables from the model so that the polity score does all the work, the estimated impact of polity on inequality change has essentially zero effect on the trend line.

5. Analysis of Country-Level Effects

5.1. The Propensity for Inequality

One advantage of the latent variable model employed here is that country-specific random effects can be drawn from the model for further analysis. In the models just estimated, we determine the country-level random effect associated with the slope coefficient and the intercept. These effects, and the regression residual, tell us how much each country deviates from the overall trend in the model after the structural demographic variables have been controlled for.

The bottom numbers on Tables 4 (which we have not yet discussed) describe the distribution of the random effects. The provide estimates of the standard deviations (the σ_{jj}) for the random parameters in the model. Notice that the standard deviations of the intercept terms, σ_{00} are particularly high. Variation at baseline is the dominant source of variation in the data (this is evident from Figure 4 as well). The standard error, .0022, in the slope parameters are important as well. This may seem to be a small number, but its effects are magnified over time. For instance, a country 2 standard deviations above the mean will have a slope that is .0088 higher than the slope for a country two standard deviations below the mean, which translates,

after 40 years, to a difference in the year 2000 of .352—which is a very large difference, one that dominates the effect of covariates we discussed above.

We hope to draw some general patterns from analyzing how countries differ from the inequalities predicted by the model. In Figure 5, we graph the actual Educational Gini Coefficients against the log of GDP per capita in the year 2000. We bring in GDP here not because it is necessarily the most important determinant of inequality decline, but because it is probably the most salient and characteristic in making comparisons across countries. Furthermore, national income reflects a country's *capacity* for educational development. This figure shows unambiguously that richer countries have significantly less inequality than poor countries. This effect is picked up by the regression estimates in Table 4 (though Table 4 models the whole period from 1960 to 2000). However, for a given level of income, there is a considerable level of variation around the trend line. After we sweep out the effect of GDP, of democracy, and of population changes (recall that these variables explained the entire downward trend in inequality documented earlier) what is left? There are a host of political, economic and cultural explanations that may be explored. We refer to these collectively as the country's *propensity for inequality*. The model represents the economic, political and demographic capacity to pursue greater equality. The deviation from this capacity is the propensity for equality.

In statistical terms, the propensity for inequality is simply the estimated residual from the model in Table 4.[3] In other words, it is the inequality unexplained by the simple model in Table 4. When we graph these values against national income in Figure 6, we can highlight the differences between countries that exist. Although GDP is on the X-axis, we emphasize that the plotted residuals control for all the variables in Table 4, not just GDP.

[3] This residual is due to the slope random effect, the intercept random effect, and the residual, u_{it}. We do not, however, decompose these three sources of variation here.

Figure 5: Educational Inequality (2000)

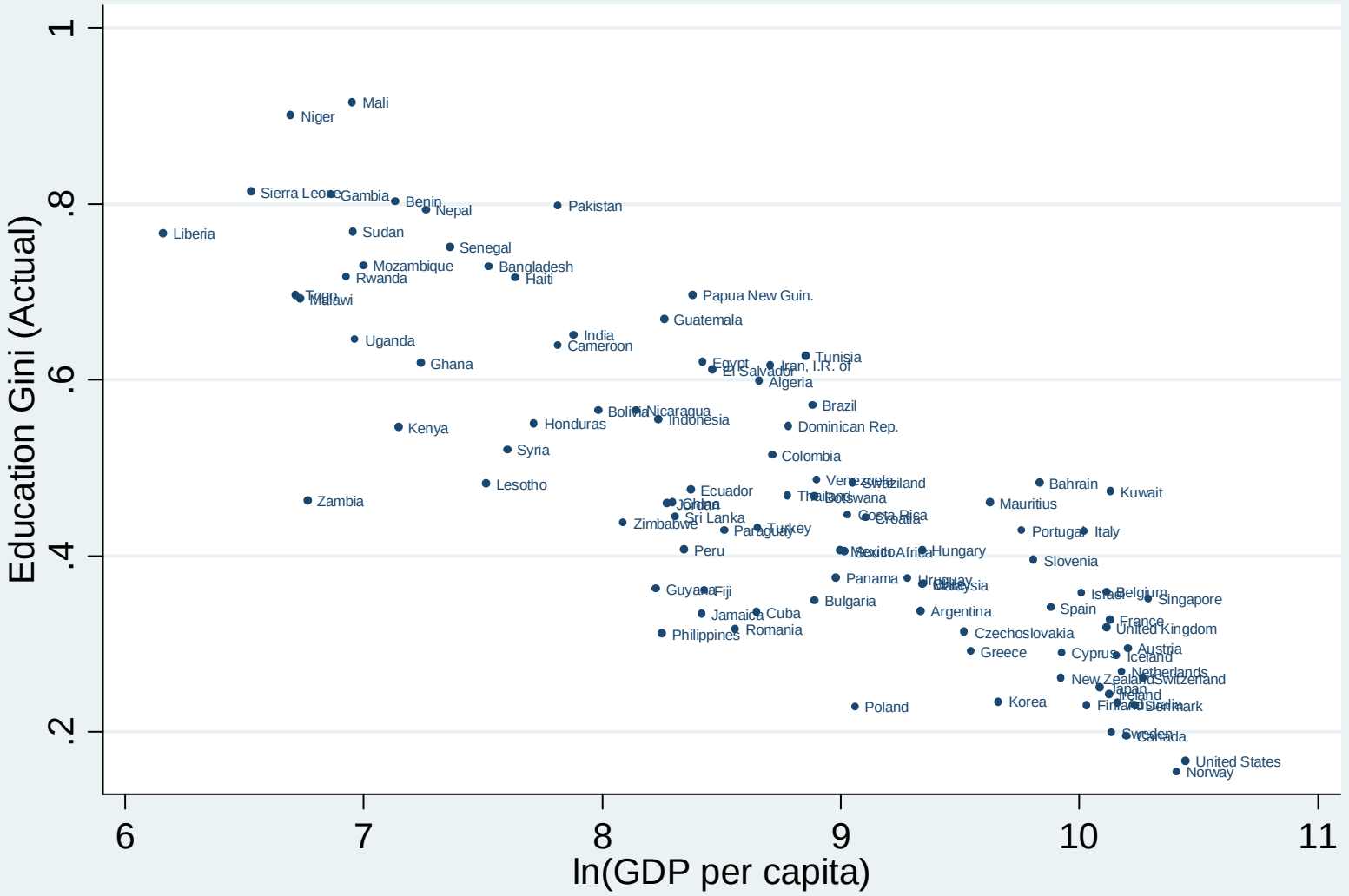
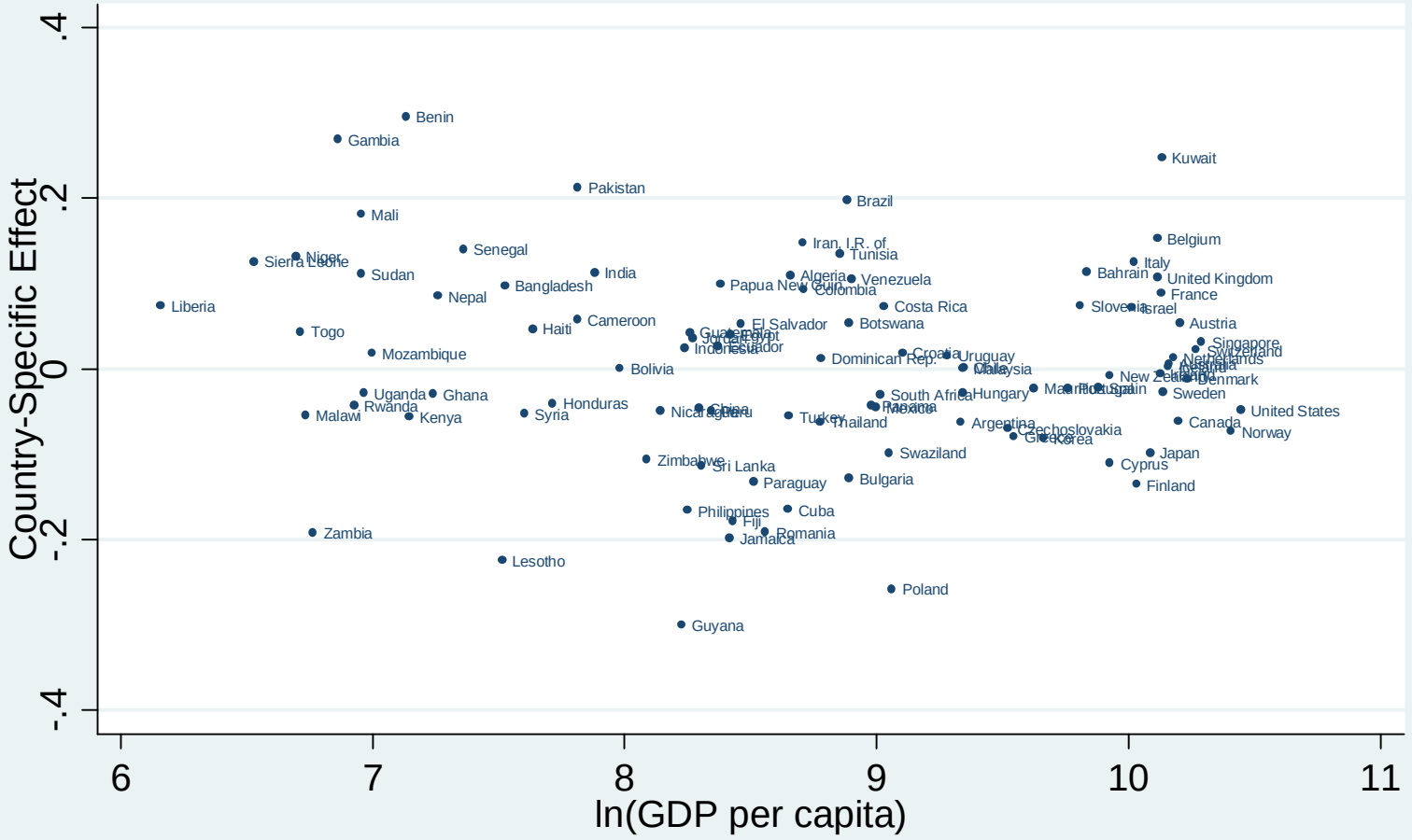


Figure 6: The Proposensity for Educational Inequality (2000)

Deviations from Model Estimates



Estimates based on model (3) in Table 3

Two relatively striking facts are apparent from Figure 6. First, the variance of estimated residuals is high—reflecting the fact that there is a lot more explaining to be done! The residuals range from roughly -.3 to +.3. But we know that inequality was highly variable at the outset. What is more surprising is that the variance of the residuals is high across the income spectrum, even at high levels. We can see a narrowing of the range and variance of these residuals as we move from poor to rich countries, but the range is high across the board.

What, then, might we search for in explaining the propensity for inequality that exists across countries at all income levels? Most of the poorest countries are African. Concentrating on Africa, we find a distinct pattern. Countries in West Africa tend to have the highest propensity for inequality (Benin, Gambia, Mali, Senegal). African countries with a low propensity for inequality tend to be in the south of Africa (Zambia, Lesotho, Zimbabwe). And countries in East/Central Africa (Uganda, Rawanda, Kenya) tend to be in the middle.

We stress that the differences across African sub-regions are not, mostly, due to differences in income. Zambia and Gambia, for instance, have very similar (and very low) levels of income,[4] but the difference in educational inequality is huge. What can explain these sub-regional differences? A first place to look might be colonial heritage. Northern African countries tend to have been French colonies, while the Southern countries were British. These different systems left cultural and political residues that linger to this day. While this is hardly surprising, why these colonial histories would affect educational equality has not been explored, to our knowledge.

Looking at less impoverished countries, however, we do not see the same uniform effect of British colonial Heritage. For instance, India, Pakistan and Bangladesh all have a higher propensity for inequality than predicted by the model, and the previously mentioned countries

[4] Zambia has a polity score of 1, while Gambia is -5, but, as noted earlier, these estimates control for polity. Neither country has a high level of democratic development.

of central Africa are less equal than countries in southern Africa. Of course the most notable exception is Britain itself. The United Kingdom was, in 1960, the least unequal country on the globe, but its gini coefficient increased significantly over the close of the decade. Among developed countries, only Belgium and Italy have higher propensities for inequality than does the United Kingdom. But with those exceptions aside, the English-speaking world, Austraila (which is right at the mean), New Zealand, Canada, and the United States, has a lower than average propensity for inequality than average. Furthermore, countries with a strong U.S. political influence, namely the Phillipenes and Japan, also have notably lower propensities for inequality.

As was the case with Africa, Countries in Central and South America have widely ranging propensity scores. However, there is a strong British effect here as well. The lowest levels of inequality in the region are found in Guyana and Jamaica—former British colonies. Latin countries are mixed and tend to cluster around the mean. Brazil has a noticeably high propensity for inequality and states with a Marxist background (Nicaragua and, especially, Cuba) have lower than average inequality.

Countries in the Muslim world tend to have a high propensity for educational inequality. Notable examples include Sudan, Tunisia, Iran, Pakistan, Algeria, Bahrain and Kuwait. These countries range from poor to very rich and include North Africa as well as the Middle East and Southern Asia. But there are also Muslim countries that have a propensity score somewhat below zero, such as Syria and Turkey. As a group, however, they are above the mean level of propensity. Non-muslim countries in Asia, such as China, tend to be clustered not far from the mean.

Finally, among wealthy countries, there is a relatively high variation in propensity scores. Unsurprisingly, the Scandinavians, particularly Finland, are below the mean, while the rest of Western Europe (with the exception of Greece and Cyprus) are above. The deviations from the mean are not quite as high as they are in poor countries; but they are non-trivial. In contrast,

the former Soviet Bloc countries of Romania, Poland and Bulgaria have low propensities for educational equality. But other countries under Soviet influence, such as Croatia, Slovenia, and Hungary, do not fit this pattern.

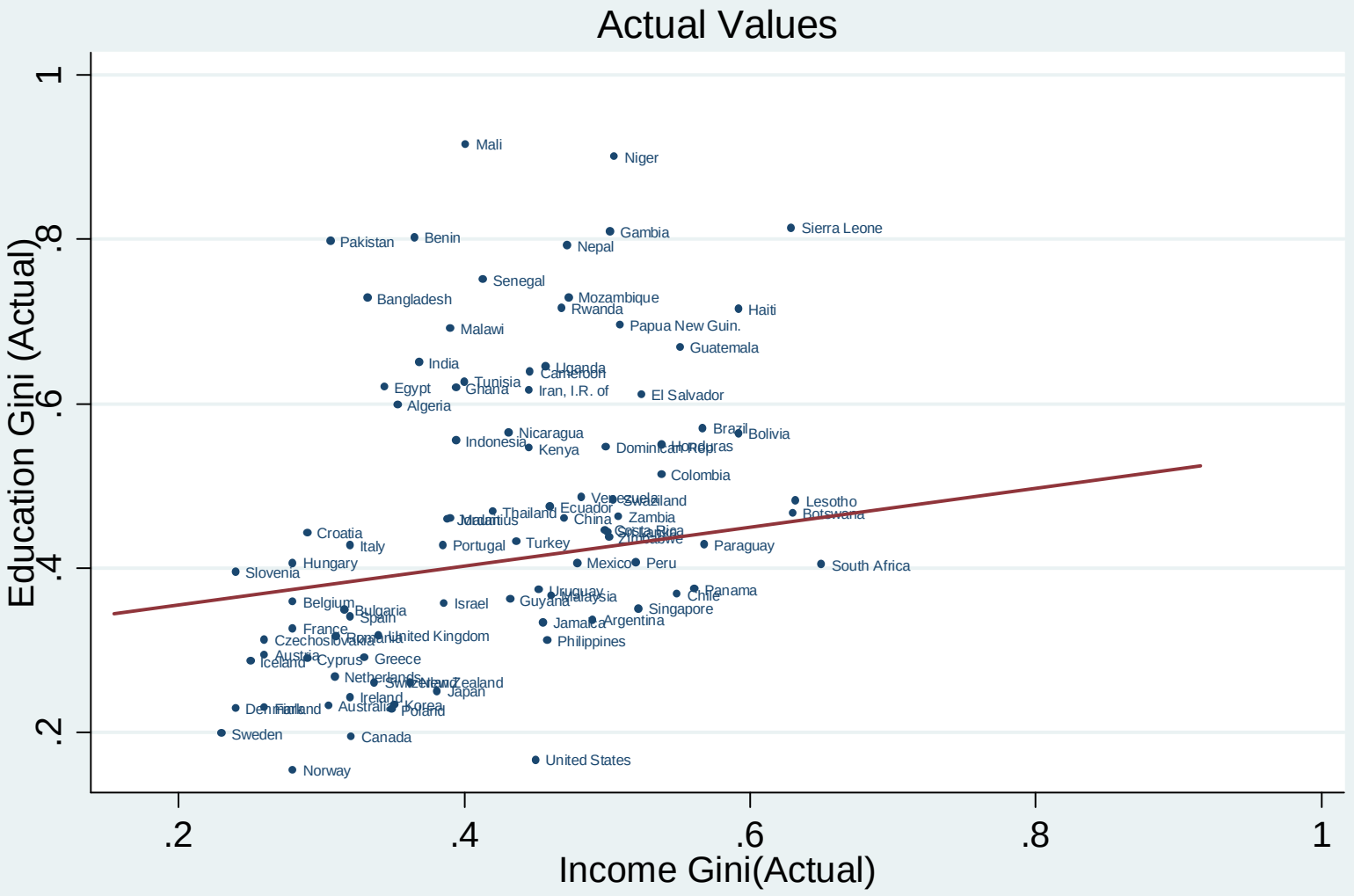
5.2. Education Inequality v. Income Inequality

In the previous subsection we introduced the propensity for inequality in education and explored informally some of the patterns that exist across countries. Here we explore the relationship between educational inequality and income inequality. It is reasonable to assume that the propensity to have an unequal distribution in education would be positively correlated with the propensity to be unequal in income, especially given the strong relationship between education and income discussed previously.

Figure 7, which plots actual Gini coefficients in education and income against each other suggests that this positive relationship exists. Sweden, the country in the dataset with the lowest level of income inequality also has among the lowest levels of educational inequality. Indeed, all the Scandinavian countries are at the extreme end of that equality-loving quadrant. But how much is that observed equality due to a desire for equality, and how much is due to a *capacity* to produce equality? One might say that democracy, prosperity and, in turn, equality are *easy* in Scandinavia. Even with the recent waves of immigration, these are countries are religiously, culturally, and linguistically among the most homogenous places on the planet, especially among the developed world.

To compare inequality propensities, we need an estimate of the propensity for income inequality. We obtain this using the same method we applied to education, except we use data from only 2000. The income Gini is regressed against the all the independent variables employed previously to calculate a predicted level of income inequality. The propensity for income inequality is the estimated residual from that regression equation.

Figure 7: Income inequality and Educational Inequality (2000)



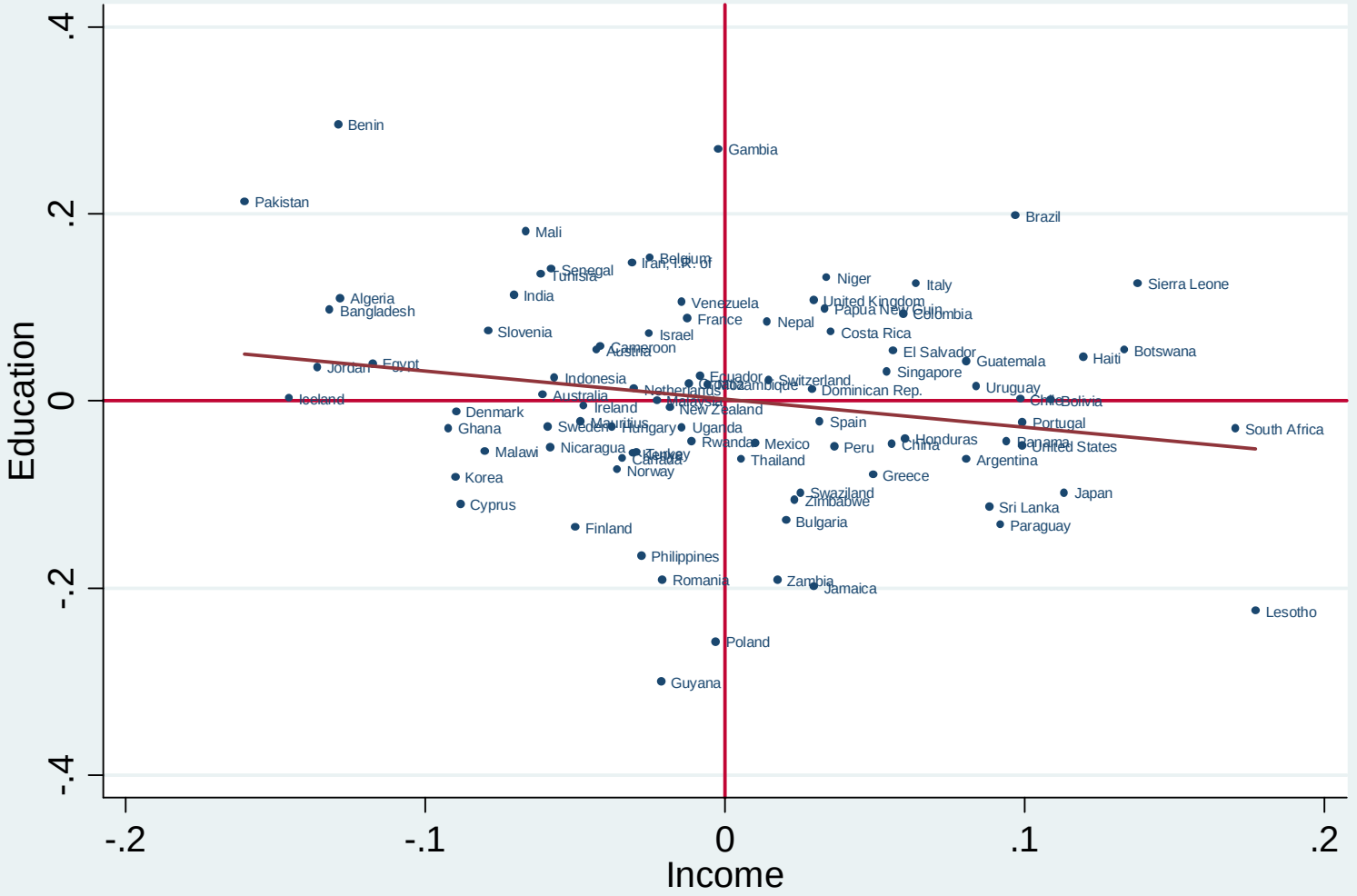
The positive relationship shown in Figure 7 is undone in Figure 8. Controlling for the variables in the regression model shows that the propensity for educational inequality is actually not related to the propensity for income inequality. In fact there is a slight (but statistically insignificant) negative relationship. On balance, countries with a higher than expected income inequality do not have higher than expected educational inequality.

The lower left quadrant shows countries with preferences for both income and educational equality. Not surpisingly, the Scandinavian countries are there, but so are some surprises. South Korea, for instance led the world in absolute gains in educational equality (-.42), but it is also a world leader in the preference for income inequality. In contrast, Korea's East Asian neighbor Japan is far to the right. This suggests that although the actual level of income inequality is similar for these nations, Japan seriously underperforms based on what its capacity for income equality is (as predicted by the regression model). The difference in income equality preferences between Japan and South Korea is .2, which is substantively a very large difference. Indeed, Japan is much closer to the United States than it is to any other developed country.

Overall the countries in the lower-left quadrant are an odd mixture of rich and poor, democratic and non-democratic, Western and non-Western. Nicaragua, is also in this quadrant and is a notable exception to most Latin American countries that are in the opposite quadrant with preferences for inequality. This quadrant on the upper right has several Latin American nations, but it also has some notable European cases, namely Italy and the United Kingdom.

Countries in the upper left and lower right quadrants show preferences that are above the mean for one type of equality, but below the mean for another. The United States has relatively high income inequality preference, but a low educational inequality preference. The upper left quadrant has many Asian countries such as Indian, Iran, Bangladesh, and Muslim nations such as Algeria, Egypt and Jordan. In this quadrant, educational equality preference is below average, but they have a much higher preference for income inequality.

Figure 8: Propensities for Inequality (2000)



The over-riding story from Figure 8, however, is that even though we can make conjectures about preferences for equality based on cultural, religious, or historical factors, the relationship between income inequality and educational inequality is weak, even though the variance in both inequality measures is very large. Brazil and Panama, for instance, have a similar per capita GDP in 2000 and a similar income distribution, but Panama has a markedly lower level of educational inequality (some 20 percentage points), and a much higher level of educational attainment (7.9 years compared to 4.6 years) . Compared to its potential, Brazil is likely the most unequal nation in the dataset.

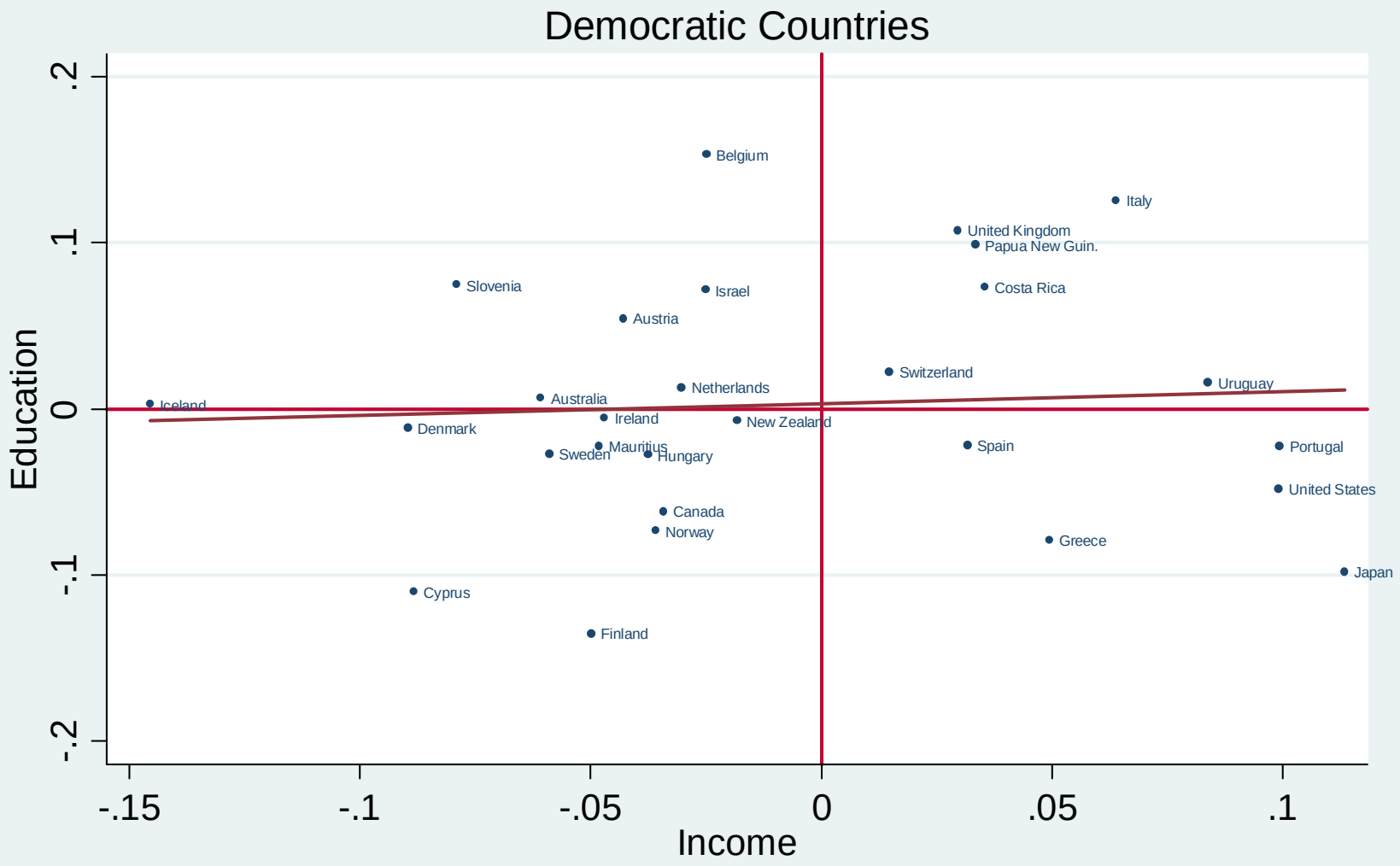
Figure 9 provides the same estimates but for the subset of highly democratic countries (Polity=10). The wide dispersion along both dimensions in this graph is remarkable. Much is made in the popular press about income inequality in the United States, but far less attention is paid to countries with high levels of educational inequality, such as Belgium, Italy or the United Kingdom. The wide differences among wealthy democratic countries deserves additional explanation. Not only is the wide dispersion a puzzle, but the dispersion across different quadrants belies a simple explanation.

6. Conclusions

We are not the first to calculate educational gini coefficients. Thoms, Wang and Fan (2000, 2003) uses the same Barro-Lee data set, and our estimates confirm the trends that they calculated. We go much further than they did, however, in modelling these trends and in exploring the country-level variation in educational inequality that cannot be explained simply be structural changes in the population or by economic growth.

Our view at the outset was the democratic institutions would mediate a nation's desire for increased educational opportunities. However, we found relatively little effect for democracy as captured by polity scores. Variance in polity scores can account for a small part of the variation in 1960 educational inequality, but democratization over the 1960-2000 period had *no*

Figure 9: Propensities for Inequality (2000)



Democratic countries are those with Polity=10

effect on increasing educational equality, perhaps because many of the changes did not occur until after the end of the Cold War.

The trend in educational inequality (and the accompanying increase in educational attainment) is found across the world. Relatively few countries do not follow the general pattern. But aside from the strong downward trend over time, the primary story is one of variation. Whether we divide the data by income level, educational level, or region, we find that within every such category, substantial variation around the downward trends exist. Countries that look a lot alike on observable characteristics follow very different educational paths. This has been true even if highly developed, fully democratic nations.

In our analysis of country-level variation, we find some interesting patterns that merit further scholarly attention. Though the great 19th Century British Empire is usually not thought of as an egalitarian regime, countries with a British colonial heritage tend to have a lower propensity for inequality than do other nations, and certainly lower than other colonial traditions such as the Spanish, French or Portugese. Communist and post-communist states also show markedly lower inequality in education. Muslim nations, on the other hand, have much higher educational inequality (even as they have lower income inequality)

We view our analysis primarily as a means of highlighting these country-level differences in inequality. In the analysis here, we have pushed the research agenda in two directions. First, in the past the scholarly literature has been fixated on the question of income inequality. Just as there is a broad literature on health and mortality disparities across countries, there should be far more attention to inequalities in education. This has import not only for understanding future growth, but education, in itself, profoundly affects human welfare beyond the ability it gives people to increase their income. We confirm Thomas, Wang, and Fan's (2000. 2003) findings that educational inequality around the world has, in contrast to income inequality, declined precipitously from 1960-2000. Inequalities in life expectancy and health have followed similar patterns. Thus to claim something such as "globalization has led to rising inequality

around the globe" is profoundly misleading because people have become fixated on income inequality (which is definitely increasing) as our measure of social equality. From a social policy perspective, we should be concerned with income only to the extent that it can be used to buy components of human welfare—health, life-expectancy, housing, recreation, consumer goods, and education. In all these areas, inequality has been declining, not increasing (Pope 2009). As countries develop economically they not only invest more in education, but the benefits of this investment have become more equally distributed over the late 20th century—both for the world as a whole and in nearly all countries in the world. And, in fact, the more rapid the growth, the greater is the decline in educational inequality.

The second direction we have pushed the research agenda is to think about a country's *propensity* for inequality, which we have defined as a country's actual inequality net of its *capacity* to generate equal outcomes. Viewed in this light, it is not sufficient just to compare inequality measures directly across countries, because countries differ greatly in their capacity to allocate resources more equally. To be sure, this concept needs far more theoretical and empirical work than we have given it here. What our preliminary analysis here suggests is that the propensity for inequality is clearly not a unidimensional concept. It appears that countries have different underlying preferences for inequality that reveal themselves in different ways. Our cross-sectional analysis of income and educational equality certainly suggests a strong variation in propensities.

There are a variety of data quality and reliability issues that pose challenges for this research. Inconsistencies and errors in data reporting over time and across countries likely accounts for a portion of the unobserved variation in education trends. Also, there is a fundamental challenge in comparing years of education across countries because the quality of a year of schooling in one country is difficult to compare to a year in another country. We could use international comparisons in test scores to measure quality of education, but this remains a thorny question.

And even if quality differences exist, how much of the quality differences are due to expenditures and how much to other factors? The United States isrelatively unique among developed countries in that it does not perform extensive early sorting of children into career trajectories (except to a small extent through public and private schools). In the U.S., 18-year-olds headed to elite universities and 18-year-olds headed straight to McDonalds are often going to the same public high schools. Certainly, there are huge variations in school quality across the U.S.: elite Eastern prep schools, for instance, can hardly be compared to the troubled inner-city schools that serve, primarily, poor and minority populations. Still, the relatively high degree of non-sorting is likely to have implications for average educational quality.

Goldin and Katz argue that the high school revolution that took place in the early 20th century set the example for other nations to follow. But our results show that the US also led the way in terms of educational inequality over the last four decades of this century as well. Critics may argue that it did so by offering low-quality education in high school, but it is also true that the US is, when it comes to education at least, a country of the second chance. By making high school graduation widely accessible to all, the US has opened the doors of its colleges to a wide segment of the population. In 2000, the percent of the population 25 and older that had some post-secondary education was 20% in the UK and Germany, 24% in Sweden and Japan, and 43% in the United States. Certainly those raw differences need to be quality-adjusted in some way, but they also suggest that egalitarianism in the US takes a very different form than it does in other democracies. Understanding how inequality is conceived of and valued across countries is vitally important if we are to gauge progress around the globe.

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