Public Choice (2006) 130:163–177
DOI 10.1007/s11127-006-9078-0

ORIGINAL ARTICLE

An empirical note on economic freedom and income inequality*

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Received: 19 December 2005 / Accepted: 18 May 2006

Abstract I report estimates for a fixed-effects model of country-level Gini coefficients as a function of economic freedom along with relevant control variables. Gini coefficients are drawn from the UNU/WIDER World Income Inequality Database Version 2.0a, while economic freedom is measured by the Fraser Institute's Economic Freedom of the World index. Controls are included for per capita income, political structure, education, demographics, and industrial composition. Over a broad range of freedom, the estimated relation between economic freedom and income inequality is positive, statistically significant, but relatively inelastic.

Keywords Economic freedom · Income inequality · Gini coefficient · Equality · Tradeoff · Country panel

1. Introduction

In empirical studies in this journal, both Berggren (1999) and Scully (2002) present evidence that the relationship between economic freedom and income equality is complementary, not competitive. Scully (2002: 90) concludes that "economic freedom reduces income inequality." More nuanced, Berggren (1999: 217) claims that "sustained and gradual increases in economic freedom influence equality measures positively." These two studies are valuable contributions, but the question of the relationship between economic freedom and income equality warrants further investigation. Here I report the results of a cross-country panel study of the possible tradeoff between economic freedom and income equality. It would be reassuring if the regressions supported the conclusions quoted above, but they do not. The results

*Able assistance was provided by Elisa Gjoka (College of the Holy Cross, '06) and funded by the May and Stanley Smith Charitable Trust Summer Research Assistant Program. I am also indebted to Charles Anderton, Robert Baumann, Miles Cahill, and an anonymous referee for their helpful comments.

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below indicate that the estimated relation between economic freedom and country-level Gini coefficients is positive, statistically significant, but relatively inelastic.

2. Need for further study

The tradeoff question deserves more study for at least two reasons. First, while the conclusions of Berggren (1999) and Scully (2002) are in basic agreement, it is not clear that the conclusions follow from the evidence presented. Second, data on both economic freedom and income inequality have been improved and now permit the application of panel-study methods with their attendant advantages.

2.1. Prior studies

Putting aside questions of data and methodology, problems arise in Berggren's (1999) interpretation of his regression results. In his central equation, Berggren (1999) regresses income inequality in 1985 on economic freedom in 1985, the change in economic freedom between 1975 and 1985, real per capita income, and illiteracy, based on a cross-section of 66 countries. Ignoring the control variables, the population regression model can be written

$$Y = \beta_1 + \beta_2 X + \beta_3 (X - X_{-1}) + e, \tag{1}$$

where Y and X are measures of income inequality and economic freedom. Using the Gini coefficient to measure inequality, the estimated coefficients on freedom and change in freedom are statistically significant and equal $+1.5$ and -3.4 respectively. Noting the opposite signs of the two coefficients, Berggren (1999: 213) states that "the latter result emanates from gradual increases and from a period of ten years, while the former result is based on a much shorter time period during which many of the effects of policy changes which are interrelated with [economic freedom] do not have time to burgeon and where only one-shot increases of [economic freedom] are involved." Berggren maintains that the change in economic freedom is "more valid as an explanatory factor," thus leading to the conclusion quoted in the introduction above.

Regrettably, Berggren errs in his interpretation of the regression results. To see this, rewrite (1) as

$$\begin{aligned} Y &= \beta_1 + (\beta_2 + \beta_3) X - \beta_3 X_{-1} + e \\ &= \beta_1 + \alpha_2 X + \alpha_3 X_{-1} + e, \end{aligned} \tag{2}$$

which is recognized as a simple distributed-lag model. The estimated short-run effect of economic freedom on inequality is $\hat{\alpha}_2 = 1.5 - 3.4 = -1.9$, while the long-run effect is $\hat{\alpha}_2 + \hat{\alpha}_3 = +1.5$. Hence, the short-run effect may be toward more equality, but the estimated long-run effect of economic freedom is to increase inequality. Without more information it is not possible to determine whether the estimated effects are statistically significant.

Scully's (2002) article is an ambitious analysis based on a three-equation model of economic freedom, growth, and inequality. The model is estimated for a pooled sample of 26 countries with a total of 86 observations taken as available for 1975, 1980, 1985, and 1990. Pertaining to the tradeoff question, Scully (2002: 85–86) summarizes his results as follows: "The income inequality regression, which has the log-odds of the Gini coefficient as the dependent variable, performs well statistically. The coefficient of [economic freedom] on

the Gini coefficient is negative and statistically significant. This means that nations that have more economic freedom have a more equal income distribution." Upon inspection, however, the estimated coefficient and standard error reported in the regression table are −0.053 and 0.19, yielding a *t* statistic of only −0.28. Curiously, the coefficient is reported in scientific notation while the standard error is not, thus raising the possibility that one or the other number is misreported. If both numbers are taken to be correct, however, little confidence can be placed in Scully's conclusion that a complementary relationship exists between freedom and equality.

2.2. New data

To measure economic freedom, Berggren (1999) and Scully (2002) used the Economic Freedom of the World (EFW) index, which at the time was available for approximately 100 countries on a quinquennial basis from 1975 through 1990 (Gwartney, Lawson, & Block, 1996). In brief, the index was intended as a measure of "personal choice, protection of private property, and freedom of exchange" (Gwartney et al., 1996: xv). In 2002 a substantial revision was completed to improve the measure's accuracy and comprehensiveness. A chain-linked version of the EFW index is now available for 53 nations in 1970, 70 in 1975, 102 in 1980, 109 in 1985, 113 in 1990, 123 in 1995, and 123 in each year 2000 through 2003. The summary index ranges from 0 (least free) to 10 (most free) and is based on ratings in five major areas: size of government; legal structure and security of property rights; access to sound money; freedom to trade internationally; and regulation of credit, labor, and business. For complete details, see Gwartney and Lawson (2005). For a critique of alternative measures, including the EFW index, see de Hann and Sturm (2000).[1]

To measure income inequality, Berggren (1999) and Scully (2002) used Gini coefficients drawn from the secondary database assembled by Deininger and Squire (1996). The database represented a major advancement not only for the coverage and quality of its coefficients, but also for its emphasis on the variations in underlying definitions of income and population. The United Nations University/World Institute for Development Economics Research (UNU/WIDER) subsequently compiled an expanded database known as the World Income Inequality Database, with Version 1.0 (WIID1) released in 2000 followed by Version 2.0a (WIID2a) in 2005. According to the UNU/WIDER website, the newer version "consists of a checked and corrected WIID1, a new update of the Deininger & Squire database from the World Bank, new estimates from the Luxembourg Income Study and Transmonee, and other new sources as they have become available." For a critical review of both the construction and use of secondary databases, see Atkinson and Brandolini (2001).

3. Methodology

3.1. Model

Economic freedom potentially impacts income inequality in competing ways. As argued by De Soto (1989, 2000), economic freedom removes legal barriers that protect politically

[1] At the risk of oversimplification, it is reasonable to say that the EFW index reflects a conception of freedom grounded in Lockean rights to person and property. It should be acknowledged that there exist competing conceptions, some of which imply that restraints on the right to contract constitute no loss of freedom if they are democratically chosen. For further discussion, see de Hann and Sturm (2000) and the references therein.

favored groups and provides access to formal property rights necessary for the generation of capital and wealth. Hence, economic freedom opens economic opportunities to less privileged and lower income individuals, thereby decreasing inequality. On the other side, economic freedom means less redistribution via taxes, transfers, and regulations. To the extent that the redistribution favors persons with lower incomes, economic freedom increases income inequality. Also, economic freedom entails product markets open to international trade and labor markets open to equilibrating wages. Standard Heckscher-Ohlin theory suggests that trade can raise inequality in developed countries and lower it in developing countries as wages of unskilled workers converge. Because increased inequality has accompanied trade liberalization in many developing countries, alternative explanations have been offered, often centering on skill-biased technological change that might itself be endogenous to trade. For a sampling of this still evolving literature, see Richardson (1995), Wood (1995), Acemoglu (2002), and Thoenig and Verdier (2003).

It would be convenient if there was a standard empirical model of inequality from which control variables could be drawn. Unfortunately, no such model exists, as documented by Atkinson and Brandolini's (undated) review of 27 cross-country time-series studies of income distribution. What commonality does exist seems to follow from Kuznet's (1955) conjecture of an inverted-U relationship between inequality and per capita income. In its simplest form, the conjecture can be derived by assuming two sectors (e. g., agriculture and industry, rural and urban, less educated and more educated, etc.), with population concentrated in the first sector and per capita income higher in the second sector. As the population shifts into the second sector, economy-wide per capita income increases. Assuming no offsetting shifts in the intra-sector distributions, income inequality first increases but eventually decreases as the population becomes concentrated in the second sector.

In the next section I report estimates for a fixed-effects model of the country-level Gini coefficient as a function of economic freedom along with relevant control variables. The potentially opposing effects of economic freedom can generate a nonlinear relationship, the specific form of which will depend on how the initial impacts and any diminishing returns combine. The Kuznets conjecture likewise suggests nonlinearities. Hence, I initially use a quadratic specification, with all explanatory variables entered as both linear and squared terms. Controls are included for per capita income, political structure, education, demographics, and industrial composition. More specifically, in addition to fixed effects and economic freedom, the right-hand variables include real per capita income, separate indexes of political rights and civil liberties, average years of education, percent of population under age 15, percent of population over age 64, percent of population in urban areas, percent of employment in industry, and percent of employment in services. Notice that some variables included in other studies are excluded here because they are subsumed in the measure of economic freedom. Examples of such variables include government size, trade openness, trade distortion, and inflation. Table 1 provides definitions, sources, and summary statistics for all variables.

3.2. Sample

The initial sample was constructed as an unbalanced panel consisting of 123 countries and 6 time periods. As will be seen, the effective sample turned out to be much smaller due to missing data. The 123 countries consisted of those for which the chain-linked EFW index was available for the year 2000. The periods were 1975–79, 1980–84, 1985–89, 1990–94, 1995–99, and 2000–04. With two exceptions, observations were drawn for the first year of a period, that is, in 1975, 1980, continuing out to 2000. The variable for average years of education was

Table 1 Variable definitions, sample statistics, and sources

Variable	Definition	Mean (Std. Dev.)	Minimum	Maximum	Source
Gini coefficient	Gini coefficient (0 = minimum, 100 = maximum)	36.464 (10.570)	20.000	63.300	UNU/WIDER (2005)
Economic freedom	Economic freedom of the world index (0 = least free, 10 = most free)	6.435 (1.138)	3.258	8.563	Gwartney et al. (2005)
Per capita income	Real GDP per capita (chain, 1000 s of 1996 PPP dollars)	12.970 (7.988)	1.165	33.293	Heston et al. (2002)
Political rights	Gastil political rights index (0 = least free, 10 = most free)	8.269 (2.616)	0.000	10.000	Freedom House (2005)
Civil liberties	Gastil civil liberties index (0 = least free, 10 = most free)	7.580 (2.489)	0.000	10.000	Freedom House (2005)
Years of education	Average years of schooling in total population ages 25 and over	7.754 (2.484)	1.950	12.250	Barro and Lee (2001)
Percent under 15	Percent of population ages 14 and under	26.142 (8.580)	14.254	46.153	World Bank (2005)
Percent over 64	Percent of population ages 65 and over	9.991 (4.852)	2.913	18.172	World Bank (2005)
Percent urban	Urban population as percent of total population	66.377 (19.075)	17.041	91.641	World Bank (2005)
Percent industry	Industry employment as percent of total employment	26.326 (6.818)	10.300	43.100	World Bank (2005)
Percent services	Services employment as percent of total employment	55.702 (15.577)	12.300	74.500	World Bank (2005)

Notes: For any given country, Gini coefficients have a quality rating of 1 or 2 and come from a single source. Summary statistics are for the pooled sample of 39 countries with 104 observations. Gastil indexes have been rescaled.

not available for 2000, so observations on education in 1999 were substituted. As discussed more below, the frequency of available Gini coefficients was irregular, so observations on inequality were drawn for the first available year within each period.

3.3. Gini coefficients

Fixed-effects estimation has the well-known advantage of controlling for omitted variables that are correlated with included variables and are country-specific and time-invariant. The associated disadvantage is that the estimation relies entirely on within-country variation across time. Precise estimates therefore require substantial within-country variation of the explanatory variables and small within-country variation of any dependent-variable measurement error. The first requirement causes no obvious problem because many countries have experienced sizeable changes in economic freedom. The second requirement, however, is a serious concern due to the ease with which measurement errors can be introduced into Gini-coefficient time series.

Some background information is helpful regarding country-level Gini coefficients and particularly those found in the UNU/WIDER database. The Gini coefficient can be defined in terms of the Lorenz curve, which plots cumulative income share (on the vertical axis) versus cumulative population share, where population is ranked by ascending income. A summary measure of inequality is provided by the ratio of two areas: the area between the 45-degree line and the Lorenz curve, and the area under the 45-degree line. The Gini coefficient can be defined as either the ratio or the ratio times 100. Using the latter definition throughout this paper, the coefficient ranges from 0 for perfect equality to 100 for perfect inequality.

The good news for social scientists is that more than 4600 country-year Gini coefficients are available in the current version of the UNU/WIDER World Income Inequality Database. The bad news is that the coefficients were originally computed by different organizations for different country-years using different surveys, methods, and definitions. Variations arise because population coverage can be rural, urban, or national; the distribution can be in terms of income, consumption, or expenditures; and income can be total income, disposable income, monetary income, or earnings. Other sources of variation exist and are documented in the user's guide for WIID2a (UNU/WIDER, 2005).

The practical import is that considerable care is necessary when selecting Gini coefficients from WIID for the purpose of conducting cross-country time-series research. Trading off number of observations in favor of within-country consistency, I adopted a conservative approach for selecting Gini coefficients from WIID2a. First, observations were used only if they earned a quality rating in WIID2a of 1 or 2. Briefly, an observation earned a rating of 1 by UNU/WIDER if both the underlying income concept and the survey methodology were judged appropriate, and it earned a 2 if either the income concept or the methodology (but not both) was somehow problematic. Second, observations were used only if the area, population, and age coverage were comprehensive (coded as "all" in WIID2a), the income sharing unit was the household, and the unit of analysis was the person. Third, for any given country I selected Gini coefficients based on a uniform income concept and when possible drawn from a single source (or survey). When observations were available for more than one concept, I showed preference for disposable income over monetary disposable income, monetary disposable income over consumption (one country in my sample, Egypt), and consumption over expenditure (one country, Thailand). At the same time, I showed a preference for the concept that permitted the longest series from a single source.

Table 2 Gini coefficients

Country	1980	1985	1990	1995	2000
Australia*				30.2 (1995)	31.0 (2000)
Austria*				27.0 (1995)	23.7 (2000)
Bangladesh		26.9 (1986)	28.2 (1992)		
Bolivia				60.2 (1999)	63.3 (2000)
Bulgaria				38.4 (1995)	33.2 (2000)
Canada*		31.5 (1987)	30.9 (1991)	31.7 (1997)	
Chile		54.0 (1987)	53.3 (1992)	54.4 (1998)	59.5 (2000)
China				29.0 (1995)	39.0 (2000)
Denmark*				20.0 (1995)	22.0 (2001)
Ecuador			54.6 (1994)	56.1 (1998)	
Egypt				34.5 (1996)	37.8 (2000)
El Salvador				52.1 (1997)	53.8 (2000)
Finland*	23.3 (1981)	22.4 (1985)	22.8 (1990)		
France*				30.2 (1995)	28.2 (2000)
Germany*				27.8 (1995)	24.6 (2000)
Greece*				35.1 (1995)	32.3 (2000)
Indonesia		32.0 (1987)	32.0 (1990)	36.0 (1996)	
Ireland*				34.3 (1995)	30.1 (2000)
Israel		34.8 (1986)	35.3 (1992)	35.7 (1997)	37.2 (2001)
Italy*		32.5 (1987)	28.9 (1991)	33.7 (1995)	33.4 (2000)
Mexico*	46.9 (1984)		52.9 (1992)	52.0 (1996)	53.5 (2000)
Netherlands*	24.5 (1981)	24.2 (1985)			
New Zealand*	28.3 (1982)	27.8 (1986)	33.4 (1991)	34.1 (1996)	
Norway*		24.6 (1986)	25.1 (1991)	25.7 (1995)	27.4 (2000)
Panama				56.8 (1995)	57.8 (2000)
Peru			46.4 (1991)	50.6 (1997)	49.3 (2000)
Philippines		41.0 (1985)	43.8 (1991)	46.1 (1997)	
Poland*			31.7 (1993)	32.1 (1995)	34.5 (2000)
Portugal*				37.4 (1995)	34.7 (2000)
Slovak Republic*				23.7 (1996)	26.4 (2000)
Slovenia				25.2 (1996)	24.6 (2000)
South Korea*			34.7 (1992)	33.4 (1995)	
Spain*	34.4 (1980)		32.4 (1990)	37.1 (1995)	34.5 (2000)
Sweden*			23.0 (1991)	23.7 (1996)	29.2 (2000)
Thailand	42.6 (1981)	44.8 (1986)	47.4 (1990)	46.3 (1996)	
Turkey*		46.5 (1987)	46.7 (1994)		
United Kingdom*	25.2 (1980)	27.7 (1985)	33.5 (1990)		
United States*		37.2 (1986)	37.4 (1991)	40.5 (1997)	39.4 (2000)
Venezuela				47.4 (1995)	45.8 (2000)

Notes: For any given country, Gini coefficients have a quality rating of 1 or 2 and come from a single source. Within each five-year period, they are taken in the first available year (in parentheses). Asterisks indicate OECD countries.

For some countries, the series was extended by drawing observations from a second source but with the same concept. Finally, in my dataset I included dummy variables that indicated for any given country which uniform income concept was used, whether the Gini coefficients had a quality rating of 1 or 2, and whether the Gini coefficients were from a single source. See Table 2 for a listing of Gini coefficients used in the regression analysis that follows.

Table 3 Regression results for quadratic specification of income inequality model

Variable	Coefficient	Std. Error	*t*-Statistic	Probability
Constant	−39.426	20.416	−1.931	0.060
Economic Freedom	−2.892	1.107	−2.613	0.012
Economic Freedom^2	0.359	0.093	3.851	0.000
Per Capita Income	−0.214	0.434	−0.493	0.625
Per Capita Income^2	0.002	0.008	0.225	0.823
Political Rights	−2.119	0.586	−3.616	0.001
Political Rights^2	0.155	0.046	3.323	0.002
Civil Liberties	3.399	0.790	4.301	0.000
Civil Liberties^2	−0.279	0.057	−4.915	0.000
Years of Education	9.442	1.914	4.934	0.000
Years of Education^2	−0.488	0.101	−4.815	0.000
Percent Under 15	0.056	0.586	0.096	0.924
Percent Under 15^2	0.015	0.009	1.657	0.105
Percent Over 64	4.273	1.668	2.562	0.014
Percent Over 64^2	−0.186	0.054	−3.420	0.001
Percent Urban	0.283	0.500	0.567	0.574
Percent Urban^2	−0.004	0.005	−0.862	0.393
Percent Industry	0.204	0.504	0.405	0.688
Percent Industry^2	−0.002	0.009	−0.268	0.790
Percent Services	−0.270	0.202	−1.336	0.188
Percent Services^2	0.005	0.002	2.273	0.028
R^2	0.990			
Countries	39			
N	104			

Notes: Income inequality is measured by Gini coefficients. For any given country, Gini coefficients have a quality rating of 1 or 2 and come from a single source. Estimation is by least squares with country fixed effects and White's panel-robust standard errors.

4. Regression results

4.1. Basic results

Table 3 reports fixed-effects estimates for the initial quadratic model based on a panel of 39 countries and 104 observations, with Gini coefficients of quality 1 or 2 and drawn from a single source. The model is estimated by least squares with White's panel-robust standard errors (Cameron & Trivedi, 2005: 707). When both country and period effects are included, the null hypothesis of no effects is rejected at $\alpha = 0.05$ significance for country effects (chi-square $= 297.05$, $p = 0.000$) but not for period effects (chi-square $= 7.42$, $p = 0.115$). Thus, period effects are omitted but will be reconsidered in later specifications. Using a Hausman test, the null hypothesis that the country effects are uncorrelated with the explanatory variables is easily rejected (chi-square $= 45.31$, $p = 0.001$). Thus, random-effects estimation is not appropriate.[2]

The estimated relationship in Table 3 between economic freedom and income inequality is U-shaped and highly significant. Most countries in the sample, however, fall well to the right of the downward-sloping portion of the curve. The estimated marginal effect on inequality

[2] The estimation and statistical inference here and below was conducted using EViews 5.1.

turns from negative to positive when the EFW index equals 4.028 = 2.892/(2*0.359), which is more than two standard deviations below the sample mean. More pointedly, for all but three observations the EFW index is high enough that an increase in freedom is estimated to raise inequality. To gauge freedom's impact, note that sample range for the EFW index runs from 3.26 to 8.56, while the same for the Gini coefficient runs from 20.00 to 63.30. Imagine a country with an EFW index equal to 5.30, one standard deviation below the sample mean. With all other variables fixed at their mean values, the estimated Gini coefficient would be 34.96. Suppose that the country's freedom index is increased by one standard deviation to 6.43 and then by another standard deviation to 7.57. The estimated Gini-coefficient elasticity with respect to the EFW index would increase in turn from 0.14 to 0.31 and from 0.31 to 0.50. The estimated Gini coefficient itself would increase by 0.14 standard deviations to 36.46 and then again by 0.22 standard deviations to 38.79. Putting the changes together, an increase in economic freedom by two standard deviations would lead to an estimated increase in the Gini coefficient by about one-third standard deviation.[3]

Turning briefly to the control variables, the coefficients on per capita income, percent urban population, and percent industry employment are statistically insignificant. The effects of average years of education and percent of population over age 64 are significant and positive across broad ranges of values before turning negative. Most surprising perhaps are the statistically significant but opposite effects of the two Gastil indexes of political rights and civil liberties. To facilitate their interpretation, here the indexes are scaled to between 0 (least free) and 10 (most free). The usual supposition seems to be that democracy favors equality. For example, Barro (2000: 6) writes, "If the mean income in an economy exceeds the median income, then a system of majority rule voting tends to favor redistribution of resources from rich to poor." However, a multidimensional model of democratic politics may be more appropriate to issues of income distribution. A classic result in public choice theory due to Ward (1961) holds that any distribution of an income pie can be the outcome of majority rule except all-to-one and none-to-all. In Ward's (1961: 385) words, majority rule holds "no egalitarian bias-nor inegalitarian one either." In any case, over a broad range beginning below the sample mean, the effect of political rights on inequality is estimated to be positive for the panel of countries here.

Table 4 shows regression results for several alternative specifications of the inequality model. In column (1) I drop per capita income, percent urban, and percent industry from the full quadratic model (redundancy test chi-square = 8.66, $p = 0.193$). In column (2) I drop the same variables plus the squared terms for percent under age 15 and percent services (chi-square = 12.83, $p = 0.118$). All coefficients in the latter regression are statistically significant with p-values well under 0.05, with the exception of the coefficient on percent services ($p = 0.053$). Notice that the inequality-freedom relationship remains reasonably stable. In column (3) I include both country and period fixed effects. As in the earlier quadratic model, the country effects are easily significant at $\alpha = 0.05$ (chi-square = 350.19, $p = 0.000$); in this case, however, the period effects also come close to being significant (chi-square = 8.31,

[3] The interested reader can place the estimated Gini coefficients above in historical context by relating them to the coefficients of specific countries found in Table 2. The Gini coefficients are estimated in the following manner. Using the earlier notation of Equation (1) in the text, the model can be written $Y = \beta_1 + \beta_2 X + \beta_3 X^2 + \cdots + e$. At the sample mean point, $\hat{Y} = \bar{Y} = 36.46$. For any given change in economic freedom $\Delta X = X_2 - X_1$, the corresponding change in inequality is $\Delta\hat{Y} = \hat{\beta}_2 \Delta X + \hat{\beta}_3 (X_2^2 - X_1^2)$, from which the new estimated Gini coefficient is easily computed. Elasticities are computed as the estimated marginal effect (evaluated at X) times the $X/\hat{Y}$ ratio.

Table 4 Regression results for alternative specifications of income inequality model

Variable	(1)	(2)	(3)	(4)	(5)
Constant	−34.935	−34.876	−43.741	−50.275	−53.496
	(19.504)	(20.134)	(21.661)	(20.631)	(21.064)
Economic Freedom	−2.723	−2.864	−1.766		1.091
	(1.327)	(1.220)	(1.431)		(0.467)
Economic Freedom^2	0.329	0.356	0.265	0.111	
	(0.112)	(0.101)	(0.124)	(0.039)	
Political Rights	−2.127	−2.083	−2.153	−2.006	−1.872
	(0.424)	(0.420)	(0.411)	(0.408)	(0.413)
Political Rights^2	0.152	0.151	0.160	0.145	0.134
	(0.039)	(0.037)	(0.041)	(0.040)	(0.042)
Civil Liberties	3.204	3.126	3.332	3.325	3.328
	(0.822)	(0.863)	(0.829)	(0.801)	(0.794)
Civil Liberties^2	−0.265	−0.256	−0.275	−0.271	−0.271
	(0.062)	(0.064)	(0.064)	(0.062)	(0.062)
Years of Education	8.182	6.034	5.985	5.957	5.842
	(2.320)	(1.624)	(1.593)	(1.622)	(1.642)
Years of Education^2	−0.431	−0.311	−0.307	−0.309	−0.307
	(0.120)	(0.083)	(0.085)	(0.085)	(0.087)
Percent Under 15	0.376	0.797	0.982	1.047	1.078
	(0.649)	(0.231)	(0.264)	(0.259)	(0.269)
Percent Under 15^2	0.008				
	(0.011)				
Percent Over 64	3.999	3.619	3.904	3.856	3.905
	(1.552)	(1.586)	(1.758)	(1.735)	(1.739)
Percent Over 64^2	−0.166	−0.139	−0.146	−0.143	−0.143
	(0.049)	(0.048)	(0.053)	(0.053)	(0.053)
Percent Services	−0.110	0.124	0.099	0.103	0.104
	(0.201)	(0.063)	(0.062)	(0.062)	(0.063)
Percent Services^2	0.003				
	(0.002)				
R^2	0.989	0.989	0.989	0.989	0.989
Countries	39	39	39	39	39
N	104	104	104	104	104

Notes: Income inequality is measured by Gini coefficients. For any given country, Gini coefficients have a quality rating of 1 or 2 and come from a single source. Estimation is by least squares with White's panel-robust standard errors (in parentheses). Columns (1) and (2) include country fixed effects. Columns (3)–(5) include both country and period fixed effects.

$p = 0.081$). Note that the coefficient on the linear EFW term becomes insignificant, while that on the squared term remains significant. In columns (4) and (5) I retain the period effects but include either the squared or linear EFW term alone. A slight nod goes to column (4)'s nonlinear specification due to its superior statistical significance of the coefficient ($p = 0.007$ versus $p = 0.024$) and standard error of the regression (1.566 versus 1.587). Evaluated at sample means, the estimated Gini-coefficient elasticity with respect to economic freedom is 0.25 and 0.19 in the nonlinear and linear specifications respectively. These are down slightly from the elasticity of 0.31 estimated above for the quadratic model without period effects.

Table 5 Sensitivity analysis

Variation	Coefficient on Economic Freedom	Coefficient on Economic Freedom^2	R^2	Countries	N
(1) Default equation	−2.864 (1.220)	0.356 (0.101)	0.989	39	104
(2) Exclude 3 countries with extreme Gini coefficients	−2.861 (1.245)	0.369 (0.099)	0.984	36	96
(3) Exclude 3 countries with extreme EFW indexes	−3.879 (2.369)	0.430 (0.171)	0.989	36	96
(4) Exclude 1 country with extreme residual	−2.634 (1.216)	0.333 (0.101)	0.990	38	101
(5) Include lagged EFW index	−3.008 (1.254)	0.374 (0.111)	0.989	39	101
(6) Exclude Gini coefficients with Quality = 2	−4.356 (2.250)	0.444 (0.150)	0.983	27	74
(7) Include Gini coefficients from second source	0.351 (1.477)	0.026 (0.162)	0.981	39	119
(8) Exclude 5 East Asian countries	−3.561 (1.352)	0.404 (0.120)	0.990	34	90
(9) Exclude 8 Latin American and Caribbean countries	−1.048 (1.918)	0.246 (0.125)	0.970	31	83
(10) Exclude 16 non-OECD countries	−5.548 (1.652)	0.532 (0.114)	0.980	23	63
(11) Exclude 23 OECD countries	−0.135 (3.474)	0.054 (0.362)	0.993	16	41

Notes: The default regression comes from column (2) of Table 4. Estimation is by least squares with country fixed effects and White's panel-robust standard errors (in parentheses).

4.2. Robustness

To explore the robustness of the results above, I take the comparatively parsimonious model from column (2) of Table 4 as the default and subject it to various changes. The summary results are shown in Table 5, with the default regression in row (1).

Rows (2) through (4) of Table 5 deal with the effects of possible outliers. Row (2) shows little change in the economic freedom coefficients after dropping three countries with at least one inequality observation further than two standard deviations from the mean. When the same criterion is used in row (3) to drop three countries with extreme values of economic freedom, the coefficient on the linear term loses significance ($p = 0.108$). If the regression is re-estimated to include either the squared or linear EFW term alone (not shown), the respective coefficients are highly significant, with a slight nod again going to the nonlinear specification. In the default regression, one country has an absolute residual in excess of 1.5 times the standard error of the regression. When that country is dropped in row (4), the economic freedom coefficients remain essentially unchanged.

Recall that Berggren (1999) estimated economic freedom to have opposite effects on inequality in the short run versus the long run. To allow for this possibility, the default

regression is re-estimated in row (5) to include the lagged value of economic freedom. The coefficient on the lagged index (not shown) equals −0.497 but is insignificant ($p = 0.184$), and the coefficients on contemporaneous economic freedom are essentially unchanged.

Rows (6) and (7) investigate whether the regression results are sensitive to the criteria by which Gini coefficients are selected from the UNU/WIDER database. Recall that to this point the Gini coefficients for any given country have a quality rating of 1 or 2 and come from a single source. The selection criteria can be tightened to require a quality rating of 1, or they can be loosened to permit a second source. When the higher rating is required in row (6), the coefficient on the linear freedom term loses a small degree of significance ($p = 0.061$). When mixed sources are permitted in row (7), however, the inequality-freedom relationship completely disappears, with both freedom coefficients becoming much smaller and insignificant ($p = 0.813$ and $p = 0.873$). This finding is particularly important because it cautions against the often used practice of drawing Gini coefficients from multiple sources.[4]

Rows (8) through (11) consider whether the regression results are sensitive to the sample coverage of particular groups of countries. The exclusion of five East Asian countries in row (8) leaves the coefficients on economic freedom roughly unchanged. When the sample is restricted in row (9) to exclude eight Latin American and Caribbean countries, the linear freedom term becomes insignificant, and the squared term is reduced in significance to $p = 0.057$. If the regression is re-estimated with either the linear or squared term alone, the coefficients are highly significant (not shown). In rows (10) and (11) the model is estimated for subsamples of OECD and non-OECD countries respectively. A simple F-test using the two subsamples yields a statistic of 0.885 with a corresponding p-value of 0.568; hence, a null hypothesis of structural stability cannot be rejected. At the same time, the estimated coefficients on the economic freedom terms are noticeably smaller and statistically insignificant for the non-OECD countries. If period effects are added, the coefficients become larger but remain insignificant; the results are also insignificant when the model includes real per capita income or either the linear or squared freedom term alone (not shown).

Consistent with the F-test, weaknesses might exist in the data that make it impossible to pick up parameter differences between OECD and non-OECD countries, if any differences in fact exist. The within-country variation of economic freedom for non-OECD countries is comparatively large, which should make it easier to detect any systematic effect on inequality if one exists. The non-OECD sample, however, is relatively small and might suffer more variation in inequality measurement error. In a source cited by UNU/WIDER (2005), Deaton and Zaidi (2002) maintain that consumption is superior to income as a basis for measuring living standards in developing countries, where self-employment and rural agriculture are so important. This is because consumption data in such economies are subject to less short-term variation and can be acquired with more accuracy. If Deaton and Zaidi are correct, then the income-based Gini coefficients used above for all but two of the non-OECD countries could weaken the precision of the estimates.[5]

[4] By permitting mixed sources, the sample can be increased to 42 countries (picking up India, Sri Lanka, and Switzerland) and 126 observations. The results are similar to those shown in row (7).

[5] In his empirical study, Scully (2002: 92) went a step farther than Deaton and Zaidi (2002), arguing that it "would seem unreasonable to use Gini coefficients which are based on money income or expenditure for countries where a good deal of economic exchange is by barter and where own-household production and consumption is high relative to market production and consumption." Consistent with this view, Scully included in his sample only OECD countries together with a handful of more industrialized Asian nations. He also conjectured that the parameters would differ between developed and undeveloped countries, a conjecture that

5. Conclusion

Increased economic freedom can raise income equality by widening income-earning opportunities, and it can lower equality by reducing income redistribution toward the poor. The empirical evidence presented above suggests that the latter effect is dominant except at comparatively low levels of freedom. Thus, a tradeoff between economic freedom and income equality is indicated, with the rate of tradeoff probably increasing at higher levels of freedom. Using the results in Table 3, the magnitude of the tradeoff can be gauged in several ways. Over a broad range of economic freedom, the estimated elasticity of inequality as gauged by the Gini coefficient is less than 0.50. Hence, a one percent increase in economic freedom is predicted to generate something under a one-half percent increase in the Gini coefficient. Across the center of the sample distribution, an increase in economic freedom by two standard deviations is estimated to raise the Gini coefficient by less than two-fifths of a standard deviation, holding other variables fixed at their sample means. Equivalently, policy changes that shift a country's economic freedom index from the 18th to the 88th percentile are predicted to raise its Gini coefficient from the 59th to the 69th percentile. Given this assortment of estimates, observers who value income equality highly might conclude that the tradeoff is considerable. Others for whom economic freedom is paramount might instead judge the tradeoff to be small. Thus, any assessment of the substantive significance of the tradeoff is subjective.

The results presented here contrast sharply with those reported by Berggren (1999) and Scully (2002), who found no evidence of a tradeoff. This could be due to any number of methodological differences, but prime suspects include this study's use of fixed effects, extensive control variables, and more consistent Gini coefficients. In supplementary regressions not shown here, if either the control variables or the fixed effects are (inappropriately) deleted, then the estimated coefficients on the linear and squared freedom terms are reasonably stable, but they remain statistically significant only if the fixed effects are included. If both the control variables and the fixed effects are omitted, then the estimated tradeoff disappears. Concerning the consistency of the Gini coefficients, Scully (2002: 91) correctly criticized Berggren's (1999) failure to control for the use of Gini coefficients based on different income or consumption concepts. Scully attempted to rectify the problem by using a series of dummy variables, an approach that is common but also subject to criticism (Atkinson & Brandolini, 2001). In the present study, the Gini-coefficient basis is uniform within any given country, thus obviating the need for dummy variables in the context of a fixed-effects specification. Moreover, this study is careful to draw coefficients from a single source for any given country, an issue on which both Berggren and Scully were silent. As shown in Table 5 above, if Gini coefficients from different sources are mixed, the estimated tradeoff between economic freedom and equality again disappears.

Future research might proceed along several lines. First, the sample used above is small by panel-method standards but can be expanded as data for more countries become available. Second, a question remains whether a tradeoff between economic freedom and equality holds for non-OECD countries. Further study of these countries might benefit from the use of consumption-based Gini coefficients, which are thought to be subject to smaller measurement error in less developed countries (Deaton & Zaidi, 2002). Third, it might be useful to extend the analysis here by disaggregating the Economic Freedom of the World

is not supported by the F-test reported in the text above. For evidence of parameter instability between OECD and non-OECD countries in a study of economic growth, see Grier and Tullock (1989).

index (Gwartney & Lawson, 2005). If the various elements of freedom have different effects, then the estimates could give valuable guidance for the development of theoretical models of political economy and inequality. Considerable care would be required in such an undertaking, however. The EFW index is constructed from thirty-eight components and sub-components which compose five major areas. Complete disaggregation would be limited by available degrees of freedom and hence would be restricted to some subset of components. More feasible would be disaggregation into the five major areas. Because chain-linked indexes are not provided for the five areas, attention would need to be given to the fact that for any individual country the available underlying components change over time, particularly for years prior to 2000.

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