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A Dynamic Analysis of Economic Freedom and Income Inequality in the 50 U.S. States: Empirical Evidence of a Parabolic Relationship

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Abstract. This paper examines the dynamic relationship between economic freedom and income inequality in the fifty U.S. states over the 1979-2004 period. Using fixed effects regression analysis, we find evidence that increases in economic freedom are associated with lower income inequality, but the dynamic relationship between the two variables depends on the initial level of economic freedom. This suggests that there may be an inverted U-shaped relationship between economic freedom and income inequality. The inflection point at which additional increases to economic freedom in a state result in less income inequality is estimated. The results are robust to various time periods and several alternative measures of income inequality.

1. Introduction

Economic inequality is one of the most divisive contemporary political issues in the United States. In a 2011 speech, President Obama invoked the age-old dogma that the rich are getting richer while the poor are getting poorer in claiming that "over the past three decades, the middle class has lost ground while the wealthiest few have become even wealthier."[1] In doing so, President Obama was making the case for a second government stimulus since taking office, with the implicit message that government redistribution is a corrective mechanism necessary to reduce the inequalities created under a market system.

President Obama is correct in suggesting that income inequality has increased over the past 30 years in the United States, according to most aggregate measures. The household income Gini coefficient, a measure of relative inequality in the distribution of income among households that ranges from zero (perfect equality) to one (perfect inequality), increased from 0.403 to 0.469 over the 1980-2010 period, a 16.5% increase in inequality.[2] Figure 1 displays the trend in the income Gini household measure in the U.S. from 1980-2010. Across the fifty U.S. states, a similar pattern of increased income inequality emerged, with the average state-level household income Gini measure increasing by 13.2% over the 1980-2010 period.[3] Among the states, inequality grew by the least (6.4%) in Mississippi and the most (24.6%) in Connecticut.

[1] Remarks of President Barack Obama from his weekly radio address on October 29, 2011, entitled ``We Can't Wait to Strengthen the Economy and Create Jobs." Transcript reviewed March 26, 2012 at *www.whitehouse.gov/blog/2011/10/29/weekly-address-we-can-t-wait-create-jobs*.

[2] The 80/20 income ratio, or the ratio of the upper income limits of the 80th to 20th percentile of households, is an alternative measure of inequality. Similar to the household income Gini measure, the 80/20 income ratio grew from 4.2 to 5.0 between 1980-2010, an increase in inequality of 18.9%.

[3] Average here refers to the simple, non-population weighted mean percentage change in household income Gini. State data are from the U.S. Census Bureau's decennial Censuses.

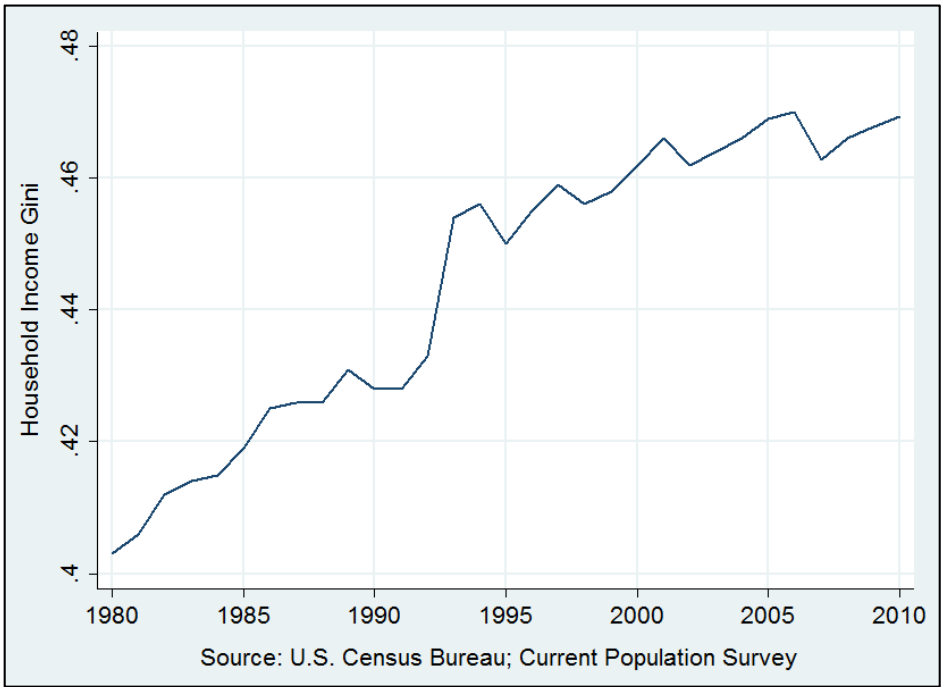

Figure 1: U.S. household income Gini coefficient, 1980-2010.

To the extent that reducing inequality is a policy objective, gaining a better understanding of the relationship between economic freedom and inequality is needed. In this paper, we empirically examine the relationship between state-level economic freedom, as measured by the Fraser Institute's Economic Freedom of North America Index, and relative income inequality for the fifty U.S. states over the 1979-2004 period. We use the family income Gini coefficients of Galbraith and Hale (2006), hereafter GH, as our primary measure of income inequality.[4]

In empirically examining the effect that economic freedom exerts on income inequality, there are generally two channels to examine. The first is to analyze the relationship between levels of economic freedom and inequality through panel analysis. Using a variety of methods, we fail to find a statistically significant relationship between the level of economic freedom and income inequality in the U.S. While the static relationship between the two variables is unclear, fixed effects models exploring the dynamic relationship between economic freedom and income inequality are more revealing. Our findings suggest that increases in economic freedom are associated with lower income inequality, but this effect depends on the initial level of economic freedom, implying that there is an inverted U-shape relationship between economic freedom and income inequality. The results are robust to various time spans and several alternative measures of income inequality.

The remainder of the paper is organized as follows. Section two provides a brief literature review and is followed by a discussion of the Economic Freedom of North American Index. In section four, our methodology and empirical results are presented. Section five discusses the theoretical possibility of an inverted U-shaped economic freedom-income inequality curve, along with evidence of its existence from our analysis. The last section offers concluding remarks.

2. Literature review

Economic theory does not yet offer clear guidance on the anticipated relationship between economic freedom and income inequality. Berggren (1999) attempted to provide a theoretical foundation in showing that economic freedom influences income inequality through various channels, but concluded that the net effect of economic freedom — both in levels and changes — on income inequality is theoretically ambiguous. The ambiguity in Berggren's theory is due to the anticipated differential

[4] GH (2006) calculated annual state Theil statistics from the BEA industry- and sector-level data from 1969-2004 and used them to fit family income Gini coefficients using the U.S. Census Bureau's Current Population Survey data.

effect on inequality of the various components comprising a measure of economic freedom.[5]

Both Berggren (1999) and Carter (2006) suggest that government redistribution, which reduces economic freedom, leads to an increase in equality. As Barro (2000) notes however, the anticipated negative relationship between redistribution and inequality rests on the assumption that the "distribution of political power is more egalitarian than the distribution of economic power," implying that redistribution must be vertical rather than horizontal to induce improvements in equality. In addition to Barro's point that relates to rent-seeking and corruption, it is also conceivable that redistribution leads to increased inequality through other channels. The revenues used to finance redistribution are largely raised through distortionary taxation that provides a disincentive to work. If the disincentives are large enough, then some -- particularly those at or near the eligibility level for transfer programs -- may become dependent on the government for transfers and likely experience stagnation in their income over time. Meanwhile, those remaining in the labor force continue to acquire human capital and likely experience income gains, resulting in an increase in income inequality over time.[6] Vedder, Gallaway, and Sollars (1988) provide an overview of some of the other arguments that have been advanced as to why government redistribution might not reduce inequality, including the crowding out of private sector charity and the capitalization of public transfer payments.[7] Thus, it is not clear *a priori* that governmental redistribution serves as an inequality-reducing policy mechanism.

Redistribution is not the only policy related to economic freedom that potentially exerts an impact on inequality. Several authors have empirically examined the relationship between individual components of economic freedom and inequality. Clark and Lawson (2008) found that high marginal tax rates are negatively related to income inequality, suggesting that progressive tax and redistribution policies increase equality, but that other aspects of economic freedom such as property rights, sound money, trade openness and limited government act to reduce income inequality. Berggren (1999) found that trade openness and financial deregulation exert a significant negative impact on income inequality. Scully (2002) indicated that the size of government, as measured by the government consumption and transfers and subsidies as a share of GDP ratios, is associated with greater income equality, but that government intervention in the form of state-owned enterprises is associated with greater income inequality. Ashby and Sobel (2008) suggested that minimum wage reductions and lower tax burdens would be the best policies to reduce income inequality in the United States.

A number of authors have conducted holistic analyses of the relationship between economic freedom and inequality using a variety of methodologies, but the results have thus far been inconclusive. Berggren (1999) concluded that across countries the level of economic freedom is positively associated with inequality, but changes that enhance economic freedom over time lead to lower inequality; however, as Carter (2006) points out, Berggren's model can be rewritten as a distributed-lag model, and as such, the regression results imply the opposite of what Berggren indicates, namely that the short-run effect of the level of economic freedom on inequality is negative and the long-run effect is positive.

Using a multiple stage approach, Scully (2002) found that economic freedom and income inequality are negatively related across countries and that increases in economic freedom enhance income equality through the growth of the share of market income earned by the two lowest income quintiles and a reduction in the share of the highest quintile. Ashby and Sobel (2008), in an analysis of the fifty U.S. states, found that policy changes that enhance economic freedom lead to higher levels of income and income growth for all income groups, acting to reduce relative income inequality. Concerning the results of Ashby and Sobel, the Carter critique is applicable, as their regression models can also be rewritten as distributed lag models, and as such, the results are subject to a different interpretation.

Carter (2006) employed a fixed effects approach in exploring whether there is a parabolic relationship between economic freedom and income inequality across countries, finding that beginning at a low initial level of economic freedom, increases in

[5] Berggren's analysis as well as ours adopts the Gwartney, Lawson, and Hall (2012) definition of economic freedom, which includes policies and institutions that promote personal choice, voluntary exchange, freedom to compete, and security of privately owned property.

[6] See Cox and Alm (1995) for empirical evidence of income mobility in the U.S.; Barro (2000) also discusses the disincentive to invest and save created by redistribution, implying that these disincentives may act to increase inequality through slowing of economic growth.

[7] See Gruber and Hungerman (2007) and Hungerman (2005) for empirical evidence of public sector crowd out; see Gwartney and Stroup (1986) and Tullock (1986) for discussion of market adjustments to transfers.

economic freedom can exert a negative effect on income inequality, but that beyond a relatively low level of freedom, additional increases generate increased inequality. Carter's results contradict those of Berggren (1999) and Scully (2002) and, as Carter notes, imply that there is a tradeoff between economic freedom and income inequality. Thus, there remains ambiguity in the relationship between economic freedom and inequality.

The contribution of the current research is twofold. First, our analysis of the relationship between income inequality and economic freedom in the U.S. differs in two significant ways from that of Ashby and Sobel (2008). Their analysis uses the ratio of the highest-to-lowest income quintiles as the measure of relative income inequality, while our paper utilizes income Gini coefficients, alternative measures of relative income inequality that account for the entire income distribution. We also use several alternative income Gini measures as a robustness check. In addition, our analysis incorporates lagged dynamic effects, whereas that of Ashby and Sobel does not. Next, while Carter (2006) examined the parabolic relationship between economic freedom and income inequality across countries, our analysis explores this relationship across states. Given that some institutions and policies are established at the national level, the results from international and subnational analyses might differ.

3. Economic freedom in the U.S.

The independent variable of interest for this study is economic freedom. We use data from the Fraser Institute's annual *Economic Freedom of North America* (EFNA) report to measure economic freedom for several reasons. First, the economic institutions and policies measured by the index are consistent with the definition of economic freedom advanced by James Gwartney, Bob Lawson, and their various co-authors over the years. As noted by its authors, the EFNA index attempts "to gauge the extent of the restrictions on economic freedom imposed by governments in North America," including the United States (Ashby, Bueno, and McMahon (2011)). Thus, it attempts to measure the extent to which states enact policies consistent with free market principles.

Second, it provides annual state-level data for the period spanning 1981-2009, making it the only comprehensive dataset available for a long enough period of time to evaluate the dynamic effects that changes in market-oriented policy exert on income inequality.[8] Next, the index is comprised of reliable, data-driven measures that are consistent across states, with the data for the underlying variables easily accessible. Finally, the data are provided at two levels: all government, which includes all federal, state, and local government economic activity within a state, and subnational, which includes only state and local government economic activity; this provides an opportunity to examine whether economic policy by level of government exerts a differential impact. The analysis and results reported here make use of the subnational data only, since state governments have little control over federal economic policy.

The EFNA index is comprised of three main areas, each with several components. The three areas are: size of government; takings and discriminatory taxation; and labor market freedom. Each component is transformed to a 0-10 scale and is assigned an equal weight for the area to which it belongs, and each area is given an equal weighting in the composite index score. Table 1 provides a breakdown of the three areas and subcomponents of each.

Table 1. Economic Freedom of North America Index components.

Area 1: Size of Government
1A: General Consumption Expenditures by Government as a % of GDP
1B: Transfers and Subsidies as a % of GDP
1C: Social Security Payments as a% of GDP
Area 2: Takings and Discriminatory Taxation
2A: Total Tax Revenue as a % of GDP
2B: Top Marginal Income Tax Rate & Threshold at Which it Applies
2C: Indirect Tax Revenue as a % of GDP
2D: Sales Taxes Collected as a % of GDP
Area 3: Labor Market Freedom
3A: Minimum Wage Legislation
3B: Government Share of Total Employment
3C: Union Density

[8] Economic freedom data from 1981 are assigned to 1979 in order to match the availability of data for other variables in the analysis.

Despite the advantages mentioned above, there are several limitations to the EFNA data. First, economic institutions and policy have a tendency to change slowly over time. We attempt to overcome this issue by using quintennial rather than annual data.[9] Next, economic institutions that may exert an impact on inequality, such as the protection of property rights, monetary policy, and trade openness are relatively homogenous across states. For instance, the Commerce Clause of the U.S. Constitution prevents individual states of the union from imposing trade restrictions, and the Federal Reserve controls the money supply for the entire country. Berggren (1999) found trade liberalization to be one of the most important determinants of economic freedom in reducing inequality, and Scully (2002) indicated that inflation and inequality are positively related. Thus, to the extent that economic institutions are constant across states, the estimated effects of economic freedom on income inequality may not have external validity beyond the United States. Finally, the EFNA index does not measure any of the nuanced regulatory differences across states that may exert an influence on income inequality. The Mercatus Center's *Freedom in the 50 States* report contains more comprehensive information on such regulations, but unfortunately it only began to measure economic freedom over the last few years, which is not a sufficient duration for a dynamic analysis.

4. Methodology and empirical results

First, the level of income inequality is regressed on the 10-year change in economic freedom, $\Delta_{10}EF_{st}$, using fixed state, c_s, and time, dj_t, effects, and a number of contemporaneous control variables, X_{st}, such as per capita income, the unemployment and college attainment rates, the share of the population over the age 65, and the Hispanic share of the population[10]:

$$Gini_{st} = \beta_0 + \beta_1\Delta_{10}EF_{st} + \gamma X_{st} + c_s + \sum_{j=1}^{J}\delta_j\, dj_t + u_{st} \quad (1)$$

The results of estimating equation 1, reported in Table 2, suggest that increases in economic freedom over the preceding 10 years are associated with lower levels of income inequality in the current period. Columns (2) and (3) provide a robustness check of this result using decennial Census measures of household and family income Gini coefficients as the dependent variable, respectively.[11]

The results suggest that a state which increased economic freedom by a single point, or 1.6 standard deviations, over the course of the preceding decade has a family income Gini measure 0.005 lower than a state with the same initial level of economic freedom but whose rating remained unchanged over the period, all else equal. In other words, a 1 standard deviation increase in economic freedom over the preceding decade is associated with a 0.104 standard deviation lower family income Gini coefficient in the current period, ceteris paribus. Although the point estimates differ, the two alternative measures of income inequality reflect the same qualitative and statistically significant results, suggesting that the findings are robust.[12]

Next, we employ two dynamic fixed effects distributed lag panel models to test whether changes in economic freedom are associated with changes in income inequality. Equation 2 provides the general structure for these models, which regresses the 5- and 10-year changes in income inequality, ΔG, on the initial level of inequality, $G_{s,0}$, 5-year intervallic changes in economic freedom, including a lagged change, ΔEF, where γ is a $k \times 1$ vector of coefficients:[13]

$$\Delta G_{st} = \beta_0 + \beta_1 G_{s,0} + \gamma\Delta EF_{st} + c_s + \sum_{j=1}^{J}\delta_j\, dj_t + u_{st} \quad (2)$$

The results from estimations of the two dynamic variations of equation 2 augment the evidence reported in Table 2. Lagged increases in economic freedom are associated with reductions in income inequality. Column 1 of Table 3 reports the

[9] 1981 is the first observation year, followed by 1984. Quintennial data after 1984 (years ending in 4 or 9) are used in order to align with the income inequality data, which is only available until 2004.

[10] Summary statistics for the variables used in the estimations are reported in the appendix.

[11] The Census measures are available decennially from 1979-1999. Household income Gini measures are available annually from the American Community Survey beginning in 2006. An average of the 2006-2010 household income measures is assigned to 2009, providing an additional observation for it.

[12] Estimates given are for the GH (2006) family income Gini measures. For the Census family and household income Gini measures, the partial effects are -0.007 and -0.003, suggesting that a 1 standard deviation increase in economic freedom over the preceding decade is associated with a 0.163 and 0.08 standard deviation decline of income inequality, respectively, for the observations included in the sample used to estimate equation 1 with the respective measures as the dependent variable.

[13] k is the number of intervallic 5-year changes in economic freedom. k=2 for $\Delta_5 G$, and k=3 for $\Delta_{10} G$.

estimates of equation 2 when 5-year changes in inequality, $\Delta_5 G$, are regressed on the initial level of inequality, the corresponding 5-year change in economic freedom, $\Delta_5 EF$, and the lagged quintennial change in economic freedom, $\Delta_{5-10} EF$. The sign on both dynamic variables is negative, but only the lagged change in economic freedom is statistically significant.

Table 2. Fixed effects regression estimates of equation 1.

	(1) Family (GH)	(2) Household	(3) Family (Census)
Δ_{10}EF	-0.005*	-0.003**	-0.007***
	(0.002)	(0.001)	(0.002)
Mean Income	0.138	0.164***	0.022
	(0.134)	(0.055)	(0.137)
Unemployment	-0.065	0.159**	0.049
	(0.120)	(0.066)	(0.123)
College	0.562**	0.284***	0.389**
	(0.234)	(0.074)	(0.173)
Senior	0.335	0.399***	0.146
	(0.201)	(0.102)	(0.251)
Hispanic	0.323***	0.054	0.267***
	(0.071)	(0.038)	(0.057)
d2009		-0.026***	
		(0.006)	
d2004	-0.025*		
	(0.013)		
d1999	-0.016*	-0.002	-0.005
	(0.008)	(0.003)	(0.008)
d1994	-0.012***		
	(0.004)		
Intercept	0.185***	0.261***	0.280***
	(0.057)	(0.023)	(0.052)
R-squared	0.792	0.873	0.869
N	200	150	100

***Statistically significant at 99% level; **95% level; *90% level.
Fully robust standard errors are in parentheses. Mean income per capita data from the Bureau of Economic Analysis and in constant 2011 $10,000's of dollars. Unemployment rate data are from the Statistical Abstract of the United States. College is the share of the adult (25+ years) population with 4 or more years of college, Senior is the 65+ share of the population, and Hispanic is the share of the population of Hispanic descent. Data for the latter three variables are from the decennial Censuses of the Population, with missing years interpolated using the annual compound growth rate between Censuses.

Table 3: Dynamic regression estimates of Equation 2.

	(1) 5Year ΔGini	(2) 10Year ΔGini	(3) ΔGini 1984-2004	(4) ΔGini 1979-1999	(5) ΔGini 1979-2004
$Gini_{t-5}$	-0.190				
	(0.154)				
$Gini_{t-10}$		-0.399*			
		(0.202)			
$Gini_{t-20}$			0.454*	0.307*	
			(0.189)	(0.137)	
$Gini_{t-25}$					0.399*
					(0.189)
Δ_5EF	-0.002	0.007	0.004	0.030**	-0.006
	(0.002)	(0.005)	(0.013)	(0.009)	(0.013)
Δ_{5-10}EF	-0.008***	-0.005*	0.031**	-0.008	0.034**
	(0.002)	(0.002)	(0.011)	(0.009)	(0.012)
Δ_{10-15}EF		-0.008***			
		(0.002)			
Δ_{10-20}EF			-0.004	0.003	
			(0.007)	(0.004)	
Δ_{10-25}EF					0.004
					(0.005)
d2004	0.010***	0.018***			
	(0.004)	(0.003)			
d1999	0.010***	0.009***			
	(0.002)	(0.002)			
d1994	-0.001				
	(0.001)				
mw			-0.008	0.006	-0.007
			(0.014)	(0.012)	(0.014)
ne			0.021	0.019	0.019
			(0.015)	(0.011)	(0.015)
west			0.008	0.019	0.007
			(0.014)	(0.012)	(0.014)
south			-0.010	0.007	-0.004
			(0.014)	(0.011)	(0.014)
Intercept	0.081	0.168**	-0.141	-0.099	-0.112
	(0.059)	(0.077)	(0.072)	(0.053)	(0.072)
R-squared	0.433	0.609	0.487	0.529	0.477
N	200	150	50	50	50
Model	FE	FE	OLS	OLS	OLS

***Statistically significant at 99% level; **95% level; *90% level. Fully robust standard errors are in parentheses for the first 2 columns, with normal standard errors for the latter 3 columns.

When the 10-year changes in inequality, $\Delta_{10}G$, are regressed on the initial level of inequality and the previous three quintennial changes in economic freedom, we find similar results. Lagged increases in economic freedom, $\Delta_{10-15}EF$, as well as increases during the first 5 years following the start of the contemporaneous period of measure, $\Delta_{5-10}EF$, are statistically significant and negatively associated with income inequality over a 10-year period. The magnitude of the marginal effect of the latter variable is greater than that of the former. Recent changes in economic freedom, $\Delta_5 EF$, do not exert a statistically significant effect, although the sign is positive, on the 10-year change in inequality. These results are reported in column 2 of Table 3. Together, these two dynamic models suggest that increases in economic freedom lead to lower income inequality, but the effect takes time to be realized.

We also examined the dynamics between changes in economic freedom and changes in income inequality over a longer time period using ordinary least squares regression. The 20-year changes in income inequality, $\Delta_{20}G$, are regressed on initial income inequality and changes in economic freedom in the two most recent 5-year intervals, $\Delta_5 EF$ and $\Delta_{5-10}EF$, change in economic freedom during the first decade following the initial period, $\Delta_{10-20}EF$, and regional dummy variables, as defined by the Census Bureau, to control for potential region-specific effects. Columns 3 and 4 of Table 3 report the results using 1984 and 1979, respectively, as the initial period. The results indicate that increases in economic freedom over the 1994-1999 period are associated with the long-run increase in income inequality, but that changes during the other intervals are not statistically significant. A single unit increase in economic freedom during the 1994-1999 period is associated with 0.03 and 0.031 point increases in the income Gini over the twenty year periods ending in 1999 and 2004, respectively. In other words, a 1 standard deviation rise in economic freedom from 1994-1999 is associated with 0.691 and 0.714 standard deviation rises in income inequality over the 1979-1999 and 1984-2004 periods, respectively.[14]

Column 5 of Table 3 reports the estimates when the 25-year change in inequality, $\Delta_{25}G$, is regressed on the initial level of inequality, the two most recent 5-year changes in economic freedom, and changes in economic freedom for the first 15 years after the initial period, $\Delta_{10-25}EF$. The results again suggest that increases in economic freedom over the 1994-1999 period are associated with the long-run growth in income inequality. The results from the last three regressions suggest that changes in the economy in the latter part of the 1990s are driving the long-run results. This period marked the rapid expansion of the technology sector and an above average 4% real annual growth rate of the U.S. economy. Economic freedom and income inequality both increased during this period, with 39 of 50 states experiencing an increase in the former and all 50 states an increase in the latter. Unfortunately, data on economic freedom prior to the 1980s is not available. As such, we cannot examine whether changes in economic freedom prior to this time exerted an effect on the long-run change in inequality.

5. Towards an alternative explanation

Our results are suggestive that increases in economic freedom are associated with reductions in inequality, but that the changes in the former take time to exert an effect on the latter. In other words, there is a lag between when economic freedom is enhanced and income inequality declines. The long-run dynamic regressions muddy this relationship somewhat, driven by changes to the economy in the 1990s coinciding with the technology boom. Reflecting on this evidence, perhaps the relationship between economic freedom and income inequality is not a linear one. Economies are, after all, in different stages of development, and they have different economic institutions and polices in place at any given point in time.

Simon Kuznets (1955) famously theorized that as economies grow inequality rises until a certain level of income is reached and inequality begins to fall, suggesting that the benefits of growth initially accrue to the upper end of the income distribution before trickling down to the lower part of the distribution. Assuming that the Kuznets relationship holds, one might expect that the same inverted U-shape relationship exists between economic freedom and income inequality, since the former has been empirically shown to be a positive determinant of economic growth (cf. Knack and Keefer, 1995; Berggren, 2003; Dawson, 2003; De Haan, Lundström, and Sturm, 2006; Gwartney, Holcombe, and Lawson, 2006; Hall, Sobel, and Crowley, 2010; Rode and Coll, 2011).

[14] The analysis uses the standard deviation of economic freedom for observations from 1994 and 1999 only and the standard deviation of family income Gini for observations from 1979-2004.

Thus it is plausible that starting from low levels of economic freedom, enhancements would induce growth and provide new economic opportunities that initially benefit the upper part of the income distribution more so than the lower part since investments would likely originate from those with the physical and human capital necessary to launch an enterprise or engage in trade. This would result in an increase in income inequality.[15] As economic freedom continues to expand, growth continues, providing new economic opportunities to those previously lacking the capital to take advantage of emerging economic opportunities. Eventually, greater economic freedom should result in greater benefits accruing to the lower part of the distribution relative to the upper part, resulting in an increase in equality. Berggren (1999) and Ashby and Sobel (2008) both found evidence that the income-enhancing effects of positive changes in economic freedom benefit the bottom of the income distribution more so than the top over time. Proposition 1 describes this possibility.

> **Proposition 1**: An inverted U-shaped relationship exists between economic freedom and income inequality. That is, beginning from low levels of economic freedom, increases initially lead to more income inequality, but as enhancements to economic freedom continue, an inflection point is reached such that additional increases lead to more income equality.

To test proposition 1, we use the static fixed effects model given by equation 3:

$$Gini_{st} = \beta_0 + \beta_1 EF_{st} + \beta_2 EF^2{}_{st} + c_s + \sum_{j=1}^{J} \delta_j \, dj_t + u_{st} \quad (3)$$

The results, reported in Table 4, provide evidence of the existence of an inverted U-shaped relationship between economic freedom and income inequality as the coefficients on the linear and quadratic economic freedom terms are positively and negatively, respectively, associated with income inequality. To check the sensitivity of the results to the measure of inequality and the time period of data availability, three different measures of income inequality are used as the dependent variable in equation 3. All generate similar statistically significant results, suggesting that the parabolic relationship is robust. The inverted U-shaped relationship depicted by these estimates is opposite the finding of Carter (2006), adding complexity to our already limited understanding of the relationship between economic freedom and income inequality.

The inflection point at which additional increases in economic freedom are associated with less income inequality are reported in the last row of Table 4 for each alternative measure of inequality. Figure 2 plots the average predicted income Gini measure against the average economic freedom score for the states using the Galbraith and Hale (2006) family income Gini measures, depicting an inverted U-shaped parabolic relationship between the two variables. The inflection point is 7.319, suggesting that states with an economic freedom score below this level will experience an increase in inequality when economic freedom expands, whereas states with economic freedom above this level will experience reductions in inequality for additional increases in economic freedom.[16] We computed the average economic freedom rating by state over the 1979-2004 period and found that 21 of the 50 states have an average rating above the inflection point. Proposition 1 suggests that additional increases in economic freedom in these states would generate more income equality.[17]

In order to further test proposition 1, we separately estimate equation 1 for states with economic freedom above and below the inflection point in 1979. The results, reported in Table 5, indicate that increases in economic freedom over the preceding decade are significantly associated with lower income inequality for states with economic freedom above the inflection point in the initial period. Meanwhile, the sign on the 10-year change in economic freedom variable is negative for the states with an initial level of economic freedom below the inflection point, but the coefficient is highly insignificant. Compared to the results obtained for the entire sample, reported in column 1 of Table 2, the partial effect of $\Delta_{10}EF$ on income inequality is much stronger for the subsample of states with initial economic freedom above the inflection point. These results lend empirical support to the validity of proposition 1.

[15]Although income inequality is likely to increase during the initial stages of economic liberalization and growth, other measures of inequality such as consumption and standard of living may decline. Data on such measures are limited and beyond the scope of the present study.

[16]The mean economic freedom over states and time included in the sample is 7.092, with a standard deviation of 0.695.

[17]For the interested reader, the states with an average economic freedom rating to the right of the inflection point are AL, AZ, CO, DE, FL, GA, IN, IA, LA, MS, MO, NE, NV, NH, NC, SC, SD, TN, TX, VA, and WY.

Table 4. Parabolic FE regression estimates of equation 3.

	(1) Family (GH)	(2) Household	(3) Family (Census)
EF	0.067**	0.051**	0.086***
	(0.030)	(0.021)	(0.028)
EF^2	-0.005**	-0.003**	-0.006***
	(0.002)	(0.001)	(0.002)
d2009		0.049***	
		(0.002)	
d2004	0.045***		
	(0.003)		
d1999	0.034***	0.044***	0.051***
	(0.002)	(0.002)	(0.002)
d1994	0.017***		
	(0.001)		
d1989	0.011***	0.026***	0.032***
	(0.002)	(0.002)	(0.002)
d1984	0.007***		
	(0.001)		
Intercept	0.137	0.211**	0.057
	(0.107)	(0.077)	(0.101)
R-squared	0.778	0.901	0.900
N	300	200	150
EF Inflection Point	7.319	7.484	7.138

***Statistically significant at 99% level; **95% level; *90% level. Fully robust standard errors are in parentheses.

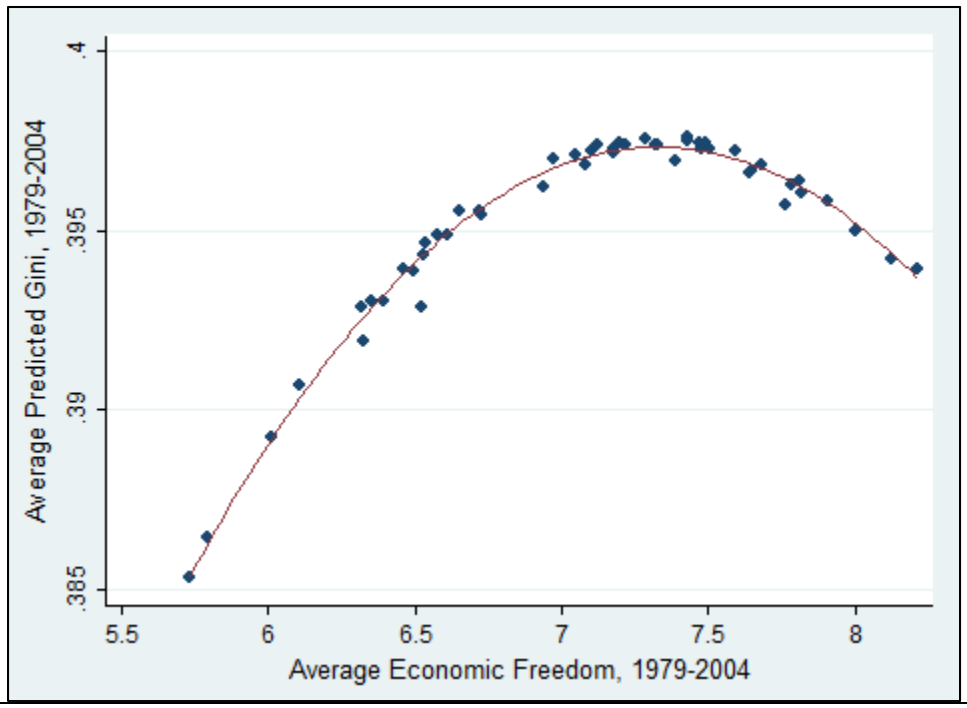

Figure 2. Income inequality vs. economic freedom.

Table 5. Estimates of equation 1, controlling for initial EF.

	(1) Above Inflection, 1979	(2) Below Inflection, 1979
Δ_{10}EF	-0.007**	-0.001
	(0.003)	(0.003)
Unemployment	-0.151	-0.018
	(0.148)	(0.166)
Mean Income	0.140	0.119
	(0.163)	(0.224)
College	-0.045	0.973**
	(0.276)	(0.314)
Senior	-0.057	0.528**
	(0.350)	(0.207)
Hispanic	0.159	0.423***
	(0.102)	(0.082)
d6	0.013	-0.052***
	(0.016)	(0.010)
d5	0.008	-0.032***
	(0.011)	(0.007)
d4	0.003	-0.021***
	(0.005)	(0.004)
Intercept	0.369***	0.072
	(0.074)	(0.060)
R-squared	0.840	0.821
Number of States	17	33
Observations	68	132

***Statistically significant at 99% level; **95% level; *90% level. Fully robust standard errors are in parentheses. The sample in column (1) is limited to states with an economic freedom score above 7.319 in 1979, whereas the sample in column (2) includes states with economic freedom below this level in 1979. Note that economic freedom in 1981 is assigned to 1979.

6. Summary

In this study, the dynamic relationship between economic freedom and income inequality for the fifty U.S. states over the 1979-2004 period is analyzed. Previous literature examining the relationship between income inequality and economic freedom has been inconclusive. Most authors have examined the relationship between the two variables using a linear framework, with these studies (Berggren, 1999; Scully, 2002; and Ashby and Sobel, 2008) suggesting that increases in economic freedom are associated with enhancements of income equality. Our results tend to support this finding and are robust to alternative measures of income inequality and various time periods. Carter (2006) offered a critique of the interpretation of the previous results in suggesting that there is a policy trade-off between economic freedom and income inequality, finding evidence of the existence of a U-shaped curve between the two variables in an international analysis.

The current analysis of the U.S. states adds further complexity to the discussion, as we find evidence of an inverted U-shaped curve between income inequality and economic freedom. This suggests that beginning from a low level of economic freedom, increases initially generate more inequality as the upper part of the income distribution benefits

relatively more than the lower part; however, as enhancements of economic freedom continue, this reverses and the lower part of the distribution experiences larger relative income gains. This finding is also robust to alternative measures of income inequality. The preponderance of evidence tends to support this proposition, which is economically intuitive given that enhancements of economic freedom lead to greater growth and development, which in turn may initially act to increase income inequality before the benefits trickle down the income distribution and result in more income equality.

It should be noted that our results pertain to the United States and may not extend to an international analysis. The measure of economic freedom used can be roughly thought of as only accounting for differences across states in fiscal and labor market policies, holding constant other aspects of economic freedom such as property rights and legal structure, and monetary and trade policies, which may be important determinants of the distribution of income. This is a relatively good depiction of reality in the U.S., as the aforementioned institutional arrangements are maintained at a national level, and as such are relatively homogenous across states. The lack of variation across states in macro-level economic institutions could explain why our findings are opposite those reported by Carter.

Our results add to the discussion concerning the relationship between economic freedom and income inequality but are far from the final word on the matter. We suspect that this line of research will grow in the coming years, as the two variables are of significant concern among policymakers not only in the U.S., but also around the world. As such, additional research is needed to better understand the relationship between the two variables in order to better guide public policy.

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References

Ashby, N., and R. Sobel. 2008. Income inequality and economic freedom in the U.S. states. *Public Choice* 134: 329-346.

Ashby, N., A. Bueno, and F. McMahon. 2011. *Economic Freedom of North America 2011*. Vancouver, BC: The Fraser Institute.

Berggren, N. 1999. Economic freedom and equality: Friends or foes? *Public Choice* 100: 203-223.

Berggren, N. 2003. The benefits of economic freedom: A survey. *The Independent Review* 8(2): 193-211.

Carter, J. 2006. An empirical note on economic freedom and income inequality. *Public Choice* 130: 163-177.

Clark, J., and R. Lawson. 2008. The impact of economic growth, tax policy and economic freedom on income inequality. *The Journal of Private Enterprise* 24(1): 23-31.

Cox, M., and R. Alm. 1995. *By Our Own Boostraps: Economic Opportunity & the Dynamics of Income Distribution*. Federal Reserve Bank of Dallas, Annual Report.

Dawson, J. 2003. Causality in the freedom-growth relationship. *European Journal of Political Economy* 19: 479-495.

De Haan, J., S. Lundström, and J.E. Sturm. 2006. Market-oriented institutions and policies and economic growth: A critical survey. *Journal of Economic Surveys* 20(2): 157-191.

Galbraith, J., and T. Hale. 2006. State income inequality and presidential election turnout and outcomes. Working Paper, The University of Texas at Austin.

Gruber, J. and D. Hungerman. 2007. Faith-based charity and crowd-out during the Great Depression. *Journal of Public Economics* 91(5-6): 1043-1069.

Gwartney, J., R. Holcombe, and R. Lawson. 2006. Institutions and the impact of investment on growth. *Kyklos* 59(2): 255-273.

Gwartney, J., R. Lawson, and J. Hall. 2012. *Economic Freedom of the World: 2012 Annual Report*. Vancouver, BC: The Fraser Institute.

Gwartney, J., and R. Stroup. 1986. Transfers, equality and the limits of public policy. *Cato Journal* 6: 111-137.

Hall, J., R. Sobel, and G. Crowley. 2010. Institutions, capital and growth. *Southern Economic Journal* 77(2): 385-405.

Hungerman, D. 2005. Are church and state substitutes? Evidence from the 1996 welfare reform. *Journal of Public Economics* 89(11-12): 2245-2267.

Knack, S., and P. Keefer. 1995. Institutions and economic performance: Cross-country tests using alternative Institutional Measures. *Economics and Politics* 7(3): 207-227.

Kuznets, S. 1955. Economic growth and income inequality. *The American Economic Review* 45(1): 1-28.

Rode, M., and S. Coll. 2011. Economic freedom and growth. Which policies matter the most? *Constitutional Political Economy* 23(2): 95-133.

Scully, G. 2002. Economic freedom, government policy and the trade-off between equity and economic growth. *Public Choice* 113(1-2): 77-96.

Tullock, G. 1986. Transitional gains and transfers. *Cato Journal* 6: 143-154.

Vedder, R., L. Gallaway, and D. Sollars. 1988. The Tullock-Bastiat hypothesis, inequality-transfer curve and the natural distribution of income. *Public Choice* 56: 285-294.

Appendix

Table A1. Summary statistics.

Variable	Mean	Std. Dev.	Min.	Max.	N
Family Income Gini (GH)	0.398	0.028	0.338	0.502	300
Δ_5 GH	0.009	0.009	-0.018	0.052	250
Δ_{10} GH	0.019	0.014	-0.004	0.094	200
Δ_{20} GH	0.038	0.019	0.007	0.115	100
Δ_{25} GH	0.047	0.022	0.011	0.12	50
Family Income Gini (Census)	0.39	0.031	0.33	0.472	150
HH Income Gini (Census)	0.431	0.028	0.371	0.5	200
Economic Freedom (EF)	7.08	0.682	5.101	8.673	350
Δ_5EF	0.014	0.324	-1.078	0.935	300
Δ_{10} EF	0.034	0.424	-1.384	1.3	250
Δ_{5-10} EF	0.047	0.33	-1.078	0.935	250
Δ_{10-15} EF	0.065	0.351	-1.078	0.935	200
Δ_{10-20} EF	0.066	0.47	-1.384	1.3	150
Δ_{10-25} EF	0.098	0.498	-1.23	1.352	100
Unemployment Rate	0.06	0.022	0.025	0.15	350
Mean Income	0.336	0.067	0.194	0.562	350
College Attainment Rate	0.215	0.054	0.106	0.382	350
Senior Share Population	0.123	0.021	0.03	0.185	350
Hispanic Share Population	0.066	0.084	0.005	0.456	350

Economic Freedom data are from the Fraser Institute's annual Economic Freedom of North America report. Note that EFNA data from 1981 are assigned to 1979 in order to match up with the availability of data for other variables. Unemployment rate is the average monthly unemployment rate for a given state and data are from the Statistical Abstract of the United States. Mean income is personal income per capita, and data are from the Bureau of Economic Analysis. The college attainment rate is the share of adults (25+ years of age) with 4+ years of college. Senior share of population is the percentage of a state's population age 65 and over. College attainment, senior, and Hispanic data are from the U.S. Census Bureau.
$\Delta_j X = X_t - X_{t-j}; \Delta_{j-k} X = X_{t-j} - X_{t-k}$.