

ON THE RELATION BETWEEN INCOME INEQUALITY AND ECONOMIC GROWTH:

AN ASYMMETRIC ANALYSIS

by

Amid Motavallizadeh Ardakani

A Dissertation Submitted in
Partial Fulfilment of the
Requirements for the Degree of

Doctor of Philosophy

in Economics

at

The University of Wisconsin-Milwaukee

May 2018

ABSTRACT

ON THE RELATION BETWEEN INCOME INEQUALITY AND ECONOMIC GROWTH: AN ASYMMETRIC ANALYSIS

by

Amid Motavallizadeh Ardakani

The University of Wisconsin-Milwaukee, 2018
Under the Supervision of Professor Mohsen Bahmani-Oskooee

Economic growth and income inequality are two prominent topics in development economics due to their close relation to social stability. The main objective of this thesis is to investigate the short-run and long-run dynamics between income inequality and income growth. Additionally, it is important to consider the dynamic between income inequality and income volatility. This investigation fills a gap in the literature by examining whether changes in income, as well as changes in income volatility, have asymmetric effects on income distribution. The study of asymmetric impacts is critical because it might not be always true that economic booms and busts have similar effects in terms of magnitudes and signs on income disparity.

To conduct the analysis, country-level data was obtained for forty countries from two sources for the time periods ranging from 1963-2008: (1) University of Texas Inequality Project and (2) the International Financial Statistics of the International Monetary Fund. State-level data were obtained for all fifty US states for 1945-2013 from a construction of the Internal Revenue Service data set by Frank (2009).

To determine the short-run and long-run dynamics between income inequality and income growth, the Linear Autoregressive Distributive Lag (ARDL) approach to cointegration and the Non-linear Autoregressive Distributive Lag (NARDL) approach are employed.

Results from both country and state level data suggest an asymmetric relationship between income inequality and its determinants. In the other words, income growth and income volatility have long-run asymmetric impacts on the distribution of income. In almost all the cases that the long-run relationships are established, increased and decreased per capita income, also increased and decreased income volatility hurt income distribution.

To
my wife
and my parents

TABLE OF CONTENTS

Chapter 1. Introduction	1
Chapter 2. Literature Review.....	4
2.1. Cross-sectional Studies.....	4
2.2. Panel Data Studies	6
2.3. Time Series Studies	8
2.4. Income Volatility and Income Inequality.....	11
Chapter 3. The Models and the Methodology.....	13
3.1. The Linear Model.....	13
3.2. The Non-linear Model	16
Chapter 4. Empirical Results.....	18
4.1. Inequality and Growth in 40 countries.....	18
4.1.1. Short-run Analysis of Linear and Non-linear Models:.....	20
4.1.2. Long-run Analysis of Linear and Non-linear Models:.....	21
4.2. Inequality and Growth in the United States	22
4.2.1 Short-run Analysis of Linear and Non-linear Models.....	26
4.2.2. Long-run Analysis of Linear and Non-linear Models.....	27
4.3. Inequality and Growth Volatility in 40 Countries.....	29
4.3.1. Short-run Analysis of Linear and Non-linear Models.....	30
4.3.2. Long-run Analysis of Linear and Non-linear Models.....	31
4.4. Inequality and Growth Volatility in the United States	32
4.4.1. Short-run Analysis of Linear and Non-linear Models.....	32
4.4.2. Long-run Analysis of Linear and Non-linear Models.....	33
4.4.3. Multivariate Linear and Non-linear Models	34
Chapter 5. Conclusion.....	36
References.....	107
Appendix A. Definition of the Variables	111
Appendix B. Data Source	112
Appendix C. Gini Trends in 40 Countries	114
Appendix D. State-Level Trends in Real Income and Income Inequality	117
Curriculum Vitae.....	121

LIST OF FIGURES

Figure 1. Gini Trends in 40 Countries	114
Figure 2. State-Level Trends in Real Income and Income Inequality, 1945-2013	117

LIST OF TABLES

Table 1. Literature Review Summary	41
Table 2. Estimates of Linear and Non-linear Gini-Growth Model (40 Countries)	45
Table 3. Estimates of Linear and Non-linear Gini-Growth Model (U.S. State Level)	55
Table 4. Estimates of Linear and Non-linear Gini-Volatility Model (40 Countries)	68
Table 5. Estimates of Linear and Non-linear Gini-Volatility Model (U.S. State Level)	78
Table 6. Estimates of Linear and Non-linear Theil-Volatility Model (U.S. State Level)	91
Table 7. The ADF Test Results for 40 Countries	104
Table 8. The ADF Test Results for U.S. States	105
Table 9. Data period for 40 countries	112

Chapter 1. Introduction

Economic growth and inequality are two prominent topics in development economics due to their relationship with social stability. Kuznets (1955) pioneered the work in discussing the role of inequality in the process of economic development. In a developing country, Kuznets argues that, in the process of economic growth, initially inequality rises then drops as an economy grows; this is due to the intersectoral shift that happens through the process of the reallocation of economic resources that takes place from low-productivity (traditional) sectors toward high-productivity (modern) ones. This pattern is known as Kuznets inverted-U hypothesis. The empirical information presented by Kuznets is limited since he had data for only five countries over a very short time period. However, what makes his work a classic is the way he expresses the impact of economic growth on inequality and more importantly, the policy consequences of his hypothesis, which implicitly declares if developing economies focus on economic growth and do not worry about the social consequences of income disparity in the short-run, they should reach a point on a longer time horizon where income inequality falls.

Although the Kuznets inverted-U hypothesis is verified by numerous earlier cross-section studies, recent works employing panel data and time series methodologies mostly fail to confirm it. Since there is no unanimity to support or reject this hypothesis, some economists are now doubtful about Kuznets' suggested pattern, especially after the sharp rise of income inequality in the United States since the 1970s. They believe that the inverted-U hypothesis, driven by rural/urban transition process, is no longer of interest. On the other hand, Piketty (2006) claims that the same logic of the two-sector model still could justify the rise in income disparity in the countries like the United States. The model could consist of a traditional economy with old business sectors and a new economy with IT-intensive sectors. What we observe since 1970's is only a recreation of the left side of the inverse-U curve. Thus,

Piketty argues that a consideration of the dynamic technical change view of inequality in which any technological innovation could lead to a new inverted-U pattern.

The existing Kuznets curve literature mostly applied cross-sectional and panel data methodology, but Kuznets focuses on understanding how inequality changes over time within a country. As Durlauf (2001, p68) states: “Empirical growth studies virtually always assume that one theory is equally valid for all countries, whereas it is far more natural to think that a given theory will explain the growth experience of each country more or less well depending on the country’s individual characteristics.” The heterogeneity and data comparability problems would be avoided by concentrating on individual country time series data. Accordingly, a time series approach seems to be a superior method for this concept. Since recently more time series data has become available, a shift to time series models is observable in the literature.

There are a few studies that have applied Autoregressive Distributed Lags (ARDL) model to investigate the Kuznets pattern, but all of them are focused on the symmetric impacts of output on income inequality. This assumes that output jumps and output drops have symmetric effects on income disparity. In other words, if economic growth has un-equalizing effects on income distribution, then a recession can improve income inequality. However, this might not be always true, as economic booms and busts would not have similar impacts in terms of magnitudes and signs on income disparity. Asymmetry may arise from the fact that top income earners benefit when the economy grows but do not significantly suffer during declines in growth. Therefore, I assume that income distribution might react differently during different phases of income changes.

Another strand in the literature of economic growth and income inequality, however, discusses that economic uncertainty measured by income or output volatility can hurt income distribution due to the fact that the labor force and lower income members of society are not well equipped to absorb

the output shocks relative to entrepreneurs and higher income members. As a result, some scholars argue that economic volatility might be a more crucial factor than economic growth in the determination of income distribution. Thus, income volatility is expected to make income distribution worse. The studies that investigated the link between income volatility and income inequality assume that this relationship is symmetric. The policy implication of this assumption suggests that if volatility makes the distribution of income worse, then a decline in volatility could decrease inequality. Therefore, in addition to investigating the effect of income volatility on income inequality, I explore whether the link between these two variables is symmetric or not.

To date, current scholars have not assumed that the relationship between income inequality and its determinants (income growth and income volatility) is asymmetric. This thesis fills this gap in the literature by decomposing these determinants of income inequality into partial sum processes of positive and negative changes to investigate whether the impacts of recessionary shocks and cyclical upturns on income inequality are different using time series data for 40 countries and nearly 70 years of reliable state-level data of the United States. The analysis utilizes the Non-linear Autoregressive Distributive Lag (NARDL) approach (Shin et al., 2014) and Linear Autoregressive Distributive Lag (ARDL) approach to cointegration (Pesaran et al., 2001).

This dissertation is structured as follows. the literature review is provided in chapter 2. The model specification and methodology are described in chapter 3. Chapter 4 reports the empirical findings. Chapter 5 concludes the thesis.

Chapter 2. Literature Review

The seminal work of Simon Kuznets (Kuznets, 1955) is considered as the original study on the relationship of economic inequality and growth. Kuznets claims that, at the initial levels of the development process, inequality rises with the expansion of the economy; at later stages, inequality begins to fall with further growth, i.e., Inverted U hypothesis. The fact that he clarifies that his paper is 5 percent empirical and 95 percent speculation mixed with “wishful thinking” did not stop researchers from working on this profound concept and thinking about the effect of economic development on income disparity. Over last 60 years, this idea has been grabbing the attention of economists and other social scientists. With respect to econometric methodology, three different approaches are detectable. The methodologies of the earlier studies perhaps due to the lack of sufficient data are mostly cross-countries. Most of these studies are successful in supporting Kuznets’ hypothesis. However, to empirically test the Kuznets curve, time-series or panel data analysis are more suitable since it is a hypothesis about the dynamics of an economy over its development process. Therefore, there is a shift from cross-section analysis to panel data and time series analysis. Focusing on time series scholars, this literature review is divided into three subsections of cross-sectional, panel data and time series studies.

2.1. Cross-sectional Studies

The earlier scholars used cross-section data to overcome the lack of reliable and sufficient time series data set in investigating the Kuznets hypothesis considering the change in the income dispersion across countries at the same point in time.

Perhaps Paukert (1973) is the pioneering work in adopting cross-section data. The paper compares averages of the Gini coefficient and income per capita of 56 countries including 43 developing and 13

developed. His tabular evidence shows a clear inverted-U pattern. Adelman and Morris (1973) considers cross-sectional data of 11 countries and conclude that neither the level of income nor the rate of growth is determinants of the pattern of inequality. However, the works of Ahluwalia (1974,1976) became a baseline for future work. He uses cross-sectional data from 62 countries and a multivariate regression and measures inequality in terms of the income share of top 20% and bottom 40 and 60%. The results show strong support for the inverted-U hypothesis for both top 20% and bottom 40%. He also finds some other factors that significantly affect income inequality like literacy rate, population, and urbanization.

Saith (1983) was one of the first studies that focused on the limitation of using cross-sectional methodology. He questions the cross-section U-curve by emphasizing on Ahluwalia (1976) and states that cross-country inverted-U hypothesis is a barrier to understanding growth and income equality relationship and it can be replaced by an inverted-L shape curve. He claims that Ahluwalia (1976) and Paukert (1973) ignore the fundamental difference between a cross-section and a time series analysis considering this fact that the process of changing inequality with income growth should be investigated in a historical context of a particular country. In addition, Papanek and Kyn (1986) find that there is no systematic linkage between the rate of income per capita growth and inequality using data for 83 countries over the period of 1967-86. Their result later is challenged by Zang (1998) who shows that Kuznets curve is stable over this period. Campano and Salvatore (1988) verify Kuznets pattern for data set of 95 countries for various deciles of income share except for bottom 20%.

Ram (1988) finds some support for an inverted-U pattern using a quadratic form equation but the pattern gets limited support when in the sample of only developing countries. In another study Ram (1991), besides conducting a time-series analysis, uses four cross-sections of U.S. states in 1949, 1959, 1969 and 1979 but the results cannot support Kuznets pattern in this country and show that an

ordinary (un-inverted) U-curve is a better pattern to explain the relationship. Anand and Kanbur (1993) by using Ahluwalia's data set, shows that growth-inequality relationship is very sensitive to the functional form of inequality and income relationship and misspecification of it can lead to incorrect results. Accordingly, they provide six different functional forms and do not find the Kuznets relationship.

In summary, due to the lack of reliable and sufficient data, the first studies on the effects of growth on income disparity were cross-sectional. However, none of these studies examine Kuznets curve directly. They only investigate whether income inequality is lower in higher income countries than lower income ones regardless of comparability of data across countries and they are not able to test whether inequality rises and then declines as income grows within countries which is the main object of Kuznets hypothesis. Therefore, cross-sectional is not a suitable methodology for this topic. By looking at individual countries we can better investigate the impacts of growth on income distribution.

2.2. Panel Data Studies

Cross-country panel data became available in 1990's and Deininger and Squire (1996) is one of the pioneers in employing panel data methodology. They provide a large-scale data set of 108 countries from different studies and come up with this conclusion that in most of the countries' inequality paths are not following the Kuznets pattern. Their data set become a cornerstone for several scholars to test the Kuznets curve. Deininger and Squire (1998), Higgins and Williamson (1999), Savvides and Stengos (2000), and Barro (2000) find that Kuznets effect disappears upon adding country fixed-effect. On the other hand, List and Gallet (1999) and Thornton (2001) using the same dataset, find an inverted-U pattern between 96 countries in the postwar period. Tam (2008) using panel data from 84 countries in the period of 1970-90 finds that Kuznets curve could be inverted-U, U-shaped, monotonically increasing or decreasing depending on the functional and control specifications.

Employing three different dynamic panel error correction estimators including Dynamic Fixed Effect(FE), Mean Group(MG), and Pooled Mean Group (PMG) and using a U.S. state-level database, Frank (2009) shows a positive long-run relationship between growth and income inequality for the period of 1945-2004 for all those three estimators. The short-run coefficient for the growth-inequality relationship is positive for dynamic FE and negative for Pooled MG and MG indicating a decreasing and un-inverted-U pattern for the relationship between inequality and economic growth. Kim et al. (2011) use the same data set and time period to test the Kuznets curve by a quadratic equation. Their pooled MG result indicates that a U-shape pattern exists between inequality and economic development.

Chambers (2010) investigates the impacts of past economic growth on the inequality by using a semi-parametric method, finds that economic growth affects inequality in developed and developing countries in the same way in the short-run and mid-run and differently in the long-run. The long-run growth raises inequality in developed and decreases inequality in developing countries.

Using non-parametric and semi-parametric methods, Zhou and Li (2011) confirm the existence of inverted-U pattern for 75 countries. They use income per capita of \$1380 as a proxy for development and show that Kuznets pattern holds for the countries with per capita income above that. Recently, Oyvatt (2015) using World Income Inequality Database for inequality and Penn World Table for income per capita data over the period of 1960-2010 shows that an inverted-U relationship exists only for developing countries. Three structural change channels that could create Kuznets pattern are defined including urbanization (gap between the value added and employment share of the agricultural and nonagricultural), change in the level of formality (informal and self-employment in the nonagricultural sector), and changes in the educational inequality. All the channels are proved to be

increasing by economic growth for low-income countries while they are declining in higher income countries.

Bayajargal (2016) examines the asymmetric response of top income share to upturn and downturn of economic growth. She employs a panel database of 26 countries over the period of 1870 to 2011 and finds a strong un-inverted-U relationship between inequality and per capita income. Also, she confirms an asymmetric response between economic growth and top income share indicating that income share of top earners rises during the economic upturn but does not decline during the economic downturn.

In summary, compared to cross-sectional analyses, panel data studies find less evidence for Kuznets inverted-U curve showing the fact that what is happening over time within countries can be different than what is happening among them. The Kuznets' idea is basically understanding how inequality changes over time within a country and regarding this point, time series analyses would be the most suitable methodology to examine this hypothesis.

2.3. Time Series Studies

Ram (1991) is one of the first empirical studies to employ continuous annual time series observation for an individual country to estimate a quadratic model of Kuznets hypothesis. The data covers the period 1947-88 for the U.S. The main inequality measurement is Gini index reported by U.S. Bureau of Census as well as other measurements such as income share of specific quantile of families. The real GNP per capita is used to measure the level of development. The estimates of the quadratic equation reveal the absence of inverted-U structure in this 42-year period and show that a U-curve can be a better fit for the link between income inequality and level of development in this period.

Also, using UTIP database, Khasru and Jalil (2004) investigate Kuznets pattern in 24 countries by autoregressive time series analysis of two Kuznets models, one including quadratic level and the other

including a quadratic log of real per capita income. The study captures an un-inverted-U structure for most of the countries where inequality declines as the economy grows and then after a turning point inequality rises with economic growth in both models.

A recent trend in the literature is using the autoregressive distributed lags (ARDL) modeling to research the linkage between income inequality and economic development and examine the Kuznets curve. These models have the advantage of identifying long-run and short-run effects. Bahmani-Oskooee and Gelan (2008) applying ARDL and Error Correction model (ECM) for the time series data of U.S. in the period of 1957 to 2002. Using the Gini data is from Deininger and Squire (1996) they find that economic growth in short-run disturbs the income distribution but in long-run has equalizing effects. They also consider other explanatory variables and show that population in both short-run and long-run worsens income inequality, but currency depreciation raises the Gini index only in short-run and in long-run a negligible equalizing effect.

Bahmani-Oskooee et al. (2008) employed the ARDL technique of Pesaran et al. (2001) for 16 countries to revisit Kuznets inverted-U hypothesis, and also to see the effect of openness on inequality. Among these 16 countries, only 11 are identified to have a long-run relationship between income inequality, GDP per capita, and openness. The results clarify that only one country seems to demonstrate a Kuznets structure and one country follows an un-inverted-U pattern.

Shahbaz (2010) uses annual data over the period of 1971 to 2005 to investigate the association between income inequality and growth in Pakistan. To capture non-linearity of this relationship, quadratic and cubic forms of per capita income are employed in the ARDL model. The results strongly support inverted-U also an inverted-S pattern. The impacts of other explanatory variables are examined as well, and it is shown that in long-run, Human Development and unemployment seem to worsen the

income inequality, but urbanization improves income distribution. Literacy rate, FDI, and life expectancy have un-equalizing effects.

Focusing on China, Jalil (2012) employs Autoregressive distributed lag (ARDL) to estimate the long-run relationship between openness and income inequality. Following Dobson and Ramlogan (2009), the growth rate of per capita income, trade openness, trade openness square, financial development, and inflation are considered as the determinants of income inequality. An inverted-U pattern is detected between inequality and openness in the period of 1952 to 2009 implying an increase in inequality with increasing in openness in the short-run and a fall in the long-run. In addition, financial development and income are found to have equalizing effects on income distribution.

Cheng and Wu (2016) apply ARDL technique for the post-reform period (1978-2011) in China. They use both Gini and Theil indices as the measures of inequality and urbanization, dualism, inflation, and education as the determinates of income inequality instead of income per capita. The study shows that urbanization is the primary determinant of inequality in China. By inserting a square form of this variable, they capture an inverted-U pattern between urbanization and income distribution. The second main contributor to the income inequality is determined to be dualism defined as the ratio of agriculture productivity to the whole economy productivity. This factor, as well as expanding higher education and inflation have un-equalizing impacts on income inequality.

Finally, Yang and Greaney (2017) apply the Engle-Granger two-step ECM approach to estimate the long-run and short-run relationships between income inequality and growth for four economies - China, Japan, South Korea, and the United States. Income inequality is modeled in long-run as a function of average income level and its square and cubic as well as trade openness. The results for country-specific model support an S-curve pattern for all four economies in long-run and find no significant impact of GDP per capita on inequality indicator for the short-run. In both cases of the

United States and China, the S-curves start from the back portion of inverted-U and Kuznets structure cannot be verified for the period of 1960 to 2014. On the other hand, the inverted-U pattern is detected for Japan and South Korea.

None of these studies considered the asymmetric impacts of income per capita on the income inequality. The main purpose of this thesis is to fill this gap in the existing literature and thus this paper considers the effect of positive and negative changes in income per capita on income distribution.

2.4. Income Volatility and Income Inequality

One of the first studies that focuses on the adverse effects of income volatility on income distribution is perhaps Hausmann and Gavin (1997). They use cross-section analysis of 56 countries in Latin America and industrial economies, they found that while neither GDP growth nor inflation had any significant effects on income inequality, the volatility of real GDP had significant adverse effects on income inequality. They argue that poor members of society are less prepared to absorb economic shocks and uncertainties compared to wealthier members. Caroli and Garcia-Penalosa (2001), consider the effects of volatility of wages on wage differentials between low skilled and high skilled workers. They argue that in an economy which experiencing shocks, risk-averse workers initially avoiding random wage and choose a lower constant wage but when the economy grows the high skilled workers become less risk-averse and therefore, economy experience a between-group wage inequality. Breen and Garcia-Penalosa (2005) also use a cross-section of developed and developing countries and find that higher output volatility results in higher income inequality. In another cross-sectional regression framework, Laursen and Mahajan (2005) find that output volatility has a negative impact on income share of the bottom quintile.

Using a panel data model Calderon and Yeyati (2009) look at the effects of output volatility on income inequality measured by Gini coefficient and find output volatility has adverse effects on income distribution. They also assess asymmetric effects of output fluctuations by assigning dummy variables to output drops and output jumps to show that output volatility has asymmetric effects on income distribution.

Finally, Huang et al. (2015) using recent advances in error-correction modeling techniques and employ a panel error-correction approach instead of the conventional method of using cross-sectional data. Their findings are similar to the previous studies, in that they also find that volatility of income has an adverse effect on income distribution in the U.S.

The main features of this literature review are also provided in *Table 1*.

Chapter 3. The Models and the Methodology

In our time-series analysis, we model log of income inequality (GINI) in the long-run as a function of the log of income per capita (Y) as follows¹:

$$\ln Gini_t = \alpha + \beta \ln Y_t + \epsilon_t \quad (1)$$

As argued by Bahmani-Oskooee and Gelan (2008), comparing long-run and short-run effects of income per capita on income inequality enables us to verify the Kuznets hypothesis. An estimate of equation (1) only yields the long-run effects of the exogenous variable. In order to derive the short-run effects, we follow Pesaran et al.'s (2001) bounds testing approach and rewrite equation (1) as an error-correction model. Then following Shin et al. (2014) the log of income per capita is decomposed into a partial sum of positive changes (POS) and negative changes (NEG), this decomposition introduces non-linearity in the model.

3.1. The Linear Model

As mentioned above, to introduce the short-run dynamics we rewrite equation (1) in an error-correction format. The Engle-Granger method of cointegration involves a two-step analysis which is based on unit root test for the residuals from a single regression equation. Therefore, equation (1) can be represented by an error-correction model:

$$\Delta \ln Gini_t = \alpha + \sum_{j=1}^{n_1} \phi_j \Delta \ln Gini_{t-j} + \sum_{j=0}^{n_2} \pi_j \Delta \ln Y_{t-j} + \lambda \epsilon_{t-1} + U_t \quad (2)$$

¹ Some studies consider the effect of other variables on income inequality as well as income. Here our bivariate model lets us to engage asymmetric Granger causality detection following Granger (1969).

In the above equation (2), λ measures the speed of adjustment and the sign of λ determines if the adjustment is towards the long-run equilibrium and a negative and significant value of λ implies that there is cointegration between the measure of inequality and income per capita. This method of cointegration has this limitation that it requires all the variables to be cointegrated in the same order and therefore needs unit root test for the variables in levels but Pesaran et al. (2001) by introducing ARDL (Autoregressive Distributive Lag) model claim that there is no need of any pre-testing and ARDL approach can include I(1) variables or I(0) variables or a combination of both I(1) and I(0). Accordingly, the error correction model in equation (2) can be rewritten by replacing the lagged value of the error term ϵ_{t-1} with the linear combination of lagged-level variables in the in the equation (1) to arrive at:

$$\Delta \ln Gini_t = \alpha + \sum_{j=1}^{n_1} \phi_j \Delta \ln Gini_{t-j} + \sum_{j=0}^{n_2} \pi_j \Delta \ln Y_{t-j} + \lambda_1 \ln Gini_{t-1} + \lambda_2 \ln Y_{t-1} + u_t \quad (3)$$

By applying OLS to the above error correction model, short-run and long-run effects of exogenous variables on the dependent variable could be estimated in one step and the estimates of coefficients attached to first-differenced variables π_j present short-run effects. The long-run effect is inferred by the estimate of λ_2 normalized on λ_1 . This arises from setting the lagged-linear combination equal to zero as in equation (4):

$$\hat{\lambda}_1 \ln Gini_{t-1} + \hat{\lambda}_2 \ln Y_{t-1} = 0 \quad (4)$$

and solving equation (4) for $\ln Gini_{t-1}$ as in equation (5):

$$\ln Gini_{t-1} = -\frac{\hat{\lambda}_2}{\hat{\lambda}_1} \ln Y_{t-1} \quad (5)$$

However, to avoid spurious estimates and to get valid long-run estimates, cointegration between GINI and Y must be established and for this purpose, two tests are recommended by Pesaran et al. (2001).

The first test is the standard F-test to establish the joint significance of lagged-level variables in above equation. They provided two sets of critical values including upper bound critical value which is obtained by assuming that all variables are I(1) and the lower bound critical value is obtained by assuming all variables to be I(0). In the case that the computed F-statistic is smaller than the lower critical bound the null hypothesis of no cointegration between variable cannot be rejected and if F-statistics is larger than upper bound then all the variables are cointegrated and the test result is inconclusive if the F-statistics falls between lower and upper bound.

The second test is to discover whether the adjustment of variables is toward their long-run equilibrium or not, the error correction term is to be considered. I use equation (5) to arrive at:

$$ECM_{t-1} = \ln Gini_{t-1} + \frac{\hat{\lambda}_2}{\hat{\lambda}_1} \ln Y_{t-1} \quad (6)$$

Then lagged level variables in Equation (3) is replaced by ECM_{t-1} as in equation (7):

$$\Delta \ln Gini_t = \alpha + \sum_{j=1}^{n_1} \phi_j \Delta \ln Gini_{t-j} + \sum_{j=0}^{n_2} \pi_j \Delta \ln Y_{t-j} + \gamma ECM_{t-1} + \mu_t \quad (7)$$

Then, we estimate equation (7) using the same optimum-lag structure. According to Bahmani-Oskooee and Ardalani (2006), a negative and significant estimated coefficient for γ supports adjustment toward the long-run equilibrium, which in turn implies a cointegration between the variables.

Once cointegration is proven to hold, following Bahmani-Oskooee and Oyolola (2007), within this approach, short-run Granger causality can be shown by applying Wald test for $\sum \pi_j \neq 0$.

3.2. The Non-linear Model

An implicit assumption in income inequality-output relationship is that changes in income have symmetric effects on income inequality. In other words, if an income growth has equalizing or un-equalizing effects on income inequality then a recession has un-equalizing or equalizing effects on income distribution.

By introducing a non-linear ARDL model we examine this conjecture. We draw on the Shin et al.'s (2014) non-linear autoregressive distributed lag model (NARDL). The strength of this approach is the flexibility of the model to comprise all possible combinations of short-run and long-run (a)symmetry in an inequality-output relationship while maintaining all the advantages of a linear ARDL model explained earlier.

Following Shin et al. (2014), to separate income per capita increases and decreases, $\ln Y_t$ (natural logarithm of income per capita) is decomposed to the partial sum of positive and negative changes denoted POS and NEG respectively.

$$POS = \sum_{j=1}^t \Delta \ln Y_j^+ = \sum_{j=1}^t \max(\Delta \ln Y_j, 0)$$
$$NEG = \sum_{j=1}^t \Delta \ln Y_j^- = \sum_{j=1}^t \min(\Delta \ln Y_j, 0)$$

The non-linear long-run and Error Correction specifications can be represented by replacing $\ln Y_t$ variable by these two new time-series variables in equation (1) and (3) as follows:

$$\ln Gini_t = \alpha + \beta_1 POS_t + \beta_2 NEG_t + \epsilon_t \quad (8)$$

$$\Delta \ln Gini_t = \alpha + \sum_{j=1}^{n_1} \phi_j \Delta \ln Gini_{t-j} + \sum_{j=0}^{n_2} \pi_j^+ \Delta POS_{t-j} + \sum_{j=0}^{n_3} \pi_j^- \Delta NEG_{t-j} + \rho_0 \ln Gini_{t-1} + \rho^+ POS_{t-1} + \rho^- NEG_{t-1} + v_t \quad (9)$$

Shin et al. (2014) demonstrate that (9) could be estimated by OLS and Pesaran et al.'s (2001) approach of testing cointegration using upper bound critical values of F-test¹.

Equation (9) includes both short-run and long-run asymmetric effects. The estimates of the coefficients of the first-differenced variables (π_j^+ and π_j^-) observe the short-run effects of economic upbeat and downbeat on the distribution of income respectively and therefore, the short-run “asymmetric adjustment” can be detected if the number of lags on ΔPOS and ΔNEG were different. Also, if either size or sign of the estimates of π_j^+ and π_j^- were different, it could be judged as “asymmetric effects”. The Wald test can be applied to determine the short-run impact asymmetry ($\sum \pi_j^+ \neq \sum \pi_j^-$). Furthermore, the Wald tests can be utilized to establish short-run asymmetric Granger causality ($\sum \pi_j^+ \neq 0$ or $\sum \pi_j^- \neq 0$). For this reason, If the first condition holds but the second condition does not, then it could be concluded that an economic upturn causes income disparity but a decrease in income does not. Similarly, if the second condition is proven to hold but not the first one, we will conclude that a decline in income causes income inequality but not an increase.

On the other hand, the long-run effects are given by the estimates of the coefficients of the lagged level variables. The asymmetric long-run impacts of changes in income per capita on income inequality are judged by applying the Wald test on normalized coefficients of POS and NEG variables to determine if $\rho^+ / \rho_0 \neq \rho^- / \rho_0$.

¹ Note that Pesaran et al.'s (2001) critical values are provided for large samples. Critical values tabulated by Narayan (2005) can be used for small sample sizes.

Chapter 4. Empirical Results

In this chapter, the empirical results of two different specifications adopted in this thesis are discussed. In the first part, the linear and non-linear ARDL model are estimated to investigate short-run and long-run effects of income growth on income inequality in 40 developed and developing countries listed in *Table 9*. Also, these effects are studied for state-level data in the United States for the period of 1945-2013. In the second part of the chapter, short-run and long-run effects of income volatility on income distribution are investigated for the same countries and U.S. state-level data.

4.1. Inequality and Growth in 40 countries

In this section, I discuss the estimation results of both linear model (3) and non-linear model (9) for each of the 40 countries listed in *Table 9* in the Appendix. Depending on the availability of the GINI coefficient, the study period differs from one country to another. In both models, a maximum of six lags imposed and using the Akaike's Information Criterion (AIC), the optimum number of lags is chosen. The results for both models and for all countries are reported in *Table 2* in three panels. Panel A reports short-run estimates and Panel B shows long-run estimates. Then all diagnostics are reported in Panel C. In what follows I discuss the results for one country, Canada and then summarize them for all countries.

Linear Model (Canada): From the estimates of the linear model denoted by L-ARDL, the real GDP carries negative and significant coefficient in the short-run, implying that economic growth improves income distribution in the short-run. The long-run normalized estimate reported in Panel B is positive and significant. However, since the F statistic in Panel C is insignificant, the long-run estimate is spurious. Pesaran et al. (2001) recommend using the long-run normalized estimate and equation (1) to generate the error term, denoted by ECM. They then propose replacing the linear combination of

lagged level variables by ECM_{t-1} and estimating this new specification at the same optimum lags reported in Panel A of *Table 2*. A significantly negative coefficient of ECM_{t-1} is an alternative method of supporting cointegration. From Panel C it is clear that even this test does not support cointegration in this case. Therefore, in the results for Canada, the linear model reveals that while economic growth has short-run effects on income inequality, it has no long-run effects.

Panel C reports a few additional statistics. The Lagrange Multiplier statistic (LM) is reported to test for serial correlation. Since we are testing for the first-order autocorrelation, it has a χ^2 distribution with one degree of freedom. This statistic is insignificant, supporting autocorrelation free residuals of the linear model. Ramsey's RESET statistic which is also distributed as has χ^2 with one degree of freedom is reported to check for misspecification. This statistic is significant, so, the hypothesis of a misspecified linear model cannot be rejected. I have also applied the well-known CUSUM and CUSUMSQ tests to establish the stability of all coefficient estimates. Stable estimated are indicated by "S" and unstable one by "US". The coefficient estimates of Canada linear model are stable. Finally, size of adjusted R^2 is reported to judge the goodness of fit.

Non-linear Model (Canada): The short-run results of the NL-ARDL model of Canada show that the decrease in real GDP (i.e., ΔNEG) carries one significant coefficient, implying that economic downturn has short-run effects on Gini. On the other hand, there is no significant coefficient for the short-run effect of an economic upturn on income supporting short-run asymmetric effects. Indeed, this is supported by the Wald-Short statistic reported in Panel C which is significant. However, in this non-linear model short-run symmetric effects translate into long-run asymmetric effects since NEG variable carries significant coefficient that is supported by significant cointegration tests (F as well as ECM_{t-1}). Also, the Wald-Long test, reported in Panel C supports these asymmetric long-run effects which show that decrease in real GDP in Canada worsens income inequality in the long-run. Thus,

introducing non-linear adjustment of real GDP not only results in cointegration but also in long-run asymmetric effects of changes in real GDP on income distribution in Canada. Additionally, the non-linear model enjoys a much better fit since the size of adjusted R^2 is much higher.

4.1.1. Short-run Analysis of Linear and Non-linear Models:

- I. In the linear model, I observe that only in 27 countries the real GDP variable ($\Delta \ln \text{RGDP}$) carries at least one significant coefficient in the short-run. However, in the non-linear model either ΔPOS or ΔNEG variable carries at least one significant short-run coefficient in all 40 countries except in the cases of three countries, i.e., Netherlands, Sweden, and the U.K. Thus, distinguishing economic upturns and downturns and introducing non-linear adjustment process to the model yields more support for the short-run effects of real GDP on income distribution.
- II. In most countries the numbers of lag attached to both ΔPOS and ΔNEG variables are different, supporting short-run adjustment asymmetry. Furthermore, the size or the sign of these short-run estimates are also different, again supporting short-run asymmetric adjustment.
- III. The short-run cumulative or impact asymmetry, however, is supported in 25 countries since the Wald-Short statistic is significant in these cases. The list includes Austria, Belgium, Canada, Cyprus, Ecuador, Finland, France, Greece, Hong Kong, Hungary, India, Iran, Italy, Kenya, Luxembourg, Malaysia, Malta, Mauritius, Mexico, Morocco, the Philippines, Singapore, Spain, Uruguay, and Venezuela.

4.1.2. Long-run Analysis of Linear and Non-linear Models:

In the linear model, the real GDP has a significant long-run coefficient that is supported by cointegration (i.e., by a significant F or ECM_{t-1}) in 12 countries of Belgium, Cyprus, Finland, Hong Kong, Indonesia, India, Israel, Jordan, Luxembourg, Malaysia, Norway, and Uruguay. However, between these countries, only the results for Cyprus, Indonesia, Jordan, and Malaysia show that real GDP has an equalizing effect on distribution in long-run, and only Jordan supporting Kuznets hypothesis due to the significantly negative long-run coefficient of real GDP and short-run positive coefficients. The non-linear model, on the other hand, shows either a significant coefficient for POS or NEG variables supported by a significant F or ECM_{t-1} test in 23 countries. The list includes Austria, Belgium, Bolivia, Canada, France, Hong Kong, Indonesia, Iran, Israel, Italy, Kenya, Luxembourg, Malaysia, Mauritius, Mexico, Netherlands, Norway, Panama, the Philippines, Singapore, Spain, Uruguay, and Venezuela. Proving the fact that, introducing non-linear adjustment of real GDP yields more support for the long-run effects of income changes on GINI. These long-run effects seem to be asymmetric since the Wald-Long statistic is highly significant in these countries. Among these 23 countries I can recognize that:

- I. In three countries of Austria, Israel, and Luxembourg economic boom worsens income distribution since the POS variable carries a positive coefficient.
- II. In four countries of Canada, Mexico, Panama, and Venezuela recession disturbs income distribution since the NEG variable carries a negative coefficient.
- III. In four countries of Iran, Italy, Malaysia, and Spain an economic downturn decreases income inequality since the NEG variable carries a positive coefficient.

- IV. In five countries of Belgium, France, Hong Kong, Mauritius, and Uruguay economic downturn improves and economic upturn worsens income distribution since both POS and NEG variable carries positive coefficients.
- V. In four countries of Indonesia, Kenya, the Philippines, and Singapore since both POS and NEG variable carry negative coefficients, income growth improves, and recession worsens distribution of income.
- VI. In three countries of Bolivia, the Netherlands, and Norway economic upturns and downturns both decrease income inequality since POS variables carry negative and NEG variables carry positives coefficients.
- VII. In the linear model Kuznets hypothesis that economic growth lowers income inequality, in the long-run, was supported in only three countries (Indonesia, Jordan, and Malaysia) but in the non-linear model it was supported in four countries (Iran, Italy, Malaysia, and Spain).

4.2. Inequality and Growth in the United States

The ARDL and NARDL models are estimated for the U.S. using aggregate level data as well as for 50 states and Washington D.C. by imposing a maximum of six lags and Akaike's Information Criterion (AIC) to select the optimum lag. The results are reported in *Table 3* which contains four panels. I used * (**) to indicate if an estimate or a diagnostic statistic is significant at the 10% (5%) level.

Panel A reports the short-run estimates with the t-statistics in the parenthesis. Under Panel B the long-run estimates are reported. Panel C shows the diagnostic statistics including the results of F-test, the coefficient of ECM_{t-1} , the Lagrange Multiplier (LM) test, Regression Specification Error (RESET) test and the information about the CUSUM and CUSUM square tests.

Wald tests are reported in panel D respectively tests short-run Granger causality in the linear model, short-run Granger causality in the non-linear model, asymmetric short-run impacts, and asymmetric long-run effects.

According to the results for aggregate U.S. data, the linear model carries only one significant short-run coefficient estimate in panel A indicating that economic growth increases income disparity in the short-run. This result is consistent with the first section of Kuznets inverted-U curve but on the other hand, even though there is a significant coefficient in long-run, this long-run relationship is not verified by either ECM_{t-1} nor F-test. Therefore, the second portion of Kuznets inverted-U curve cannot be confirmed. The non-linear model clarifies that only increases in income per capita affect income inequality. So, it can be concluded that economic growth has an asymmetric effect on income inequality in short-run and no long-run effect is found between these two variables due to lack of cointegration, as indicated by insignificant F or ECM_{t-1} .

In the case of aggregate data of U.S., in the both of linear and non-linear models, the F statistics values are below lower bound critical values as suggested by Narayan (2005) which implies that there is no cointegration among the variables in both the linear and the non-linear model. The cointegrations are not supported by ECM_{t-1} either.

To test autocorrelation in the error terms the Lagrange Multiple (LM) is applied. The null hypothesis of the test is that there is no serial correlation in the residuals up to the specified order. The LM statistic follows a chi-square χ^2 distribution with one degree of freedom. Its critical value at 10% (5%) significance level is 2.70 (3.84). For both the linear and non-linear models the values of LM statistics are below the critical level and therefore the null hypothesis of no autocorrelation is not rejected.

The Ramsey's Regression Specification Error Test (RESET) is applied to check that the model is correctly specified. The RESET statistic follows a chi-square χ^2 distribution with one degree of freedom. The estimated RESET statistic for the USA in the linear model is 0.04 and in the non-linear model is 0.27 and both are smaller than 3.84 which is the critical value of χ^2 at 5% significant level and therefore, it can be concluded that model is specified correctly.

The ECM_{t-1} coefficient relates short-run dynamic adjustment to the long-run equilibrium. A significantly negative estimate of the ECM_{t-1} term has two implications. First, according to Bahmani-Oskooee and Tankui (2008), it is an alternative way of establishing cointegration between the variables. Second, it measures the speed of adjustment of variables toward their long-run equilibrium values. Base on the result of U.S. aggregate data both ECM_{t-1} coefficient in the linear and non-linear model are negative but insignificant implying that there is no cointegration between variables.

To test for the structural stability in the estimated short-run and long-run coefficients, the method of the cumulative sum of recursive residuals (CUSUM) and the cumulative sum of recursive residuals of square (CUSUMQ) tests proposed by Brown et al. (1975) are adopted. The CUSUM test is based on a plot of the sum of the recursive residuals. If this sum goes outside 5% critical bound, one concludes that there is a structural break. The CUSUMQ test is like the CUSUM test but plots the cumulative sum of squared recursive residuals. The parameters are said to be unstable if the plots lie outside the 5% critical bounds. The last row in Panel C reports adjusted R^2 and it is relatively small in the U.S. aggregate data indicating that variation in the measure of income inequality cannot be explained well by a single variable of income per capita.

The first three Wald tests in Panel D investigate the short-run asymmetric Granger causality. In the case of U.S. aggregate data, as it can be seen, the income changes in short-run Granger causes the measure of inequality due to significant value of the first Wald test, i.e., $\sum \pi \neq 0$. However, this is

proven to be asymmetric given that second Wald test indicates that only economic upturns cause inequality in the distribution of income and the fourth Wald test statistics is significant showing that the sum of the short-run coefficient estimates attached to ΔPOS are significantly different than the sum of coefficients attached to ΔNEG , i.e., $\sum \pi_j^+ \neq \sum \pi_j^-$, indicating asymmetric impacts of the change in income per capita on income inequality. Hence, one can conclude that only increases in income per capita cause the measure of income inequality. In the three states of Connecticut, Illinois, and Kansas the results are explained below.

In the states of Connecticut and Illinois, panel A shows only one short-run significant coefficient for each state in the linear models and as the non-linear model indicates only the coefficients for increases in income per capita (POS) are significant. On the other hand, second Wald test in Panel D reveals that for both states only economic upturns cause the income disparity. Panel B for both states suggest a positive relationship between income inequality and income per capita in long-run. The linear model in panel A for Kansas exhibits that in short-run income per capita carries two significant and negative coefficients indicating that income inequality drops with economic growth. Also, the long-run coefficient for income per capita is positive and significant in panel B. Panel C reveals that in both linear and non-linear models in Connecticut the evidence for cointegration is established by F-test or ECM_{t-1} or both. Also, in Illinois, we only see the long-run relationship in the non-linear model while in Kansas the long-run relationship only for linear model is verified.

Therefore, Kuznets hypothesis cannot be verified in these states. In Connecticut in both linear and non-linear models, income inequality increases in short-run and long-run. In Illinois, the long-run relationship is found only in the non-linear model and it is increasing in both long-run and short-run. In Kansas, the linear model shows an un-inverted-U pattern. Finally, in panel D, short-run and long-

run asymmetries are proven to exist in Illinois but the results do not show asymmetric impacts in short-run and long-run for Connecticut and Kansas.

As mention before, one of the requirements of ARDL approach is that variables must be $I(0)$ or $I(1)$ or combination of them. Both variables are plotted in *Figure 2* for each state as well as for the United States as a whole. It is clear from *Figure 2* that most are nonstationary. However, to ensure that they are $I(1)$ and not $I(2)$, we apply the ADF test to level and first-differenced. The results are reported in *Table 8* and as can be seen, only six variables seem to be $I(0)$ and they are the level of real income in California, Delaware, Florida, Missouri, Nevada, and New Mexico. The ADF statistic is significant, rejecting the null of the unit root in these cases. In the remaining cases, the ADF statistic is significant when it is applied to first-differenced variables therefore, they are all $I(1)$.

4.2.1 Short-run Analysis of Linear and Non-linear Models

- I. From the results of the linear model associated with each state, I observe that real income per capita ($\Delta \ln \text{RPCIN}$) carries at least one significant short-run coefficient in all cases except five states of Iowa, Main, Minnesota, Nevada, and Oklahoma. However, the sum of these estimates, as a reflection of short-run causality is significant in 36 cases. In addition, in six cases of California, Colorado, Massachusetts, Mississippi, Washington, and District of Colombia, positive coefficients are followed by negative ones verifying the short-run Kuznets' effect. Focusing on short-run results of the non-linear model, I gather that either ΔPOS or ΔNEG carry at least one significant coefficient in all states except five states of Arkansas, Maryland, Montana, Ohio, and Wisconsin. Thus, distinguishing economic upturn and downturn by introducing non-linear adjustment process does not yield more support for the short-run effects of real per capita income on income inequality.

- II. In the following 28 cases, the numbers of lag attached to both ΔPOS and ΔNEG variables are different supporting short-run adjustment asymmetry. These states including California, Colorado, Delaware, Georgia, Hawaii, Idaho, Iowa, Kansas, Kentucky, Louisiana, Massachusetts, Michigan, Mississippi, Nebraska, Nevada, New Jersey, Oklahoma, Oregon, Rhode Island, South Carolina, South Carolina, South Dakota, Texas, Utah, Vermont, Virginia, Wyoming, and Washington D.C.
- III. The short-run cumulative or impact asymmetry, however, is supported by the Wald test, i.e., $\sum \pi_j^+ \neq \sum \pi_j^-$ in only following 20 states of Illinois, Indiana, Minnesota, Mississippi, Nevada, New Jersey, New Mexico, New York, North Carolina, Oregon, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Vermont, Washington, West Virginia, and Wyoming.
- IV. From the Wald test of $(\sum \pi \neq 0)$ I gather that in 35 states the income growth Granger causes the income inequality. The next Wald tests show that in 19 states economic upturn Granger causes the index of income inequality but only in ten states economic downturn Granger causes income inequality and in seven states both economic upturn and downturn Granger cause income distribution.

4.2.2. Long-run Analysis of Linear and Non-linear Models

As for the long-run effects, while the linear model indicates that in 12 states of Connecticut, Georgia, Hawaii, Idaho, Kansas, Main, Nebraska, New Hampshire, Ohio, Rhode Island, Utah, and Vermont, the long-run relationships are supported by cointegration (either by the F or ECM_{t-1}), the non-linear model reveals that in 16 states of Connecticut, Hawaii, Idaho, Illinois, Iowa, Maine, Mississippi, Nebraska, Nevada, New Jersey, North Dakota, Oregon, Rhode Island, South Dakota, Utah, and Wyoming. This improvement for the support of asymmetric cointegration must be credited to non-

linear adjustment of the real income per capita in these states. In all these 16 states, I witness that both economic upturns and downturns have un-equalizing effects on income inequality in long-run. An interesting observation is that in any state that there is evidence of significant long-run asymmetric effects, while POS carries positive coefficient, the NEG variable carries negative coefficient, indicating that income jumps and drops worsen income distribution in these states. These long-run asymmetric effects verified by Wald test in only nine states of Iowa, Nevada, North Dakota, Oregon, Rhode Island, South Dakota, Utah, Vermont, and Wyoming. In summary:

- I. In six states of Connecticut, Hawaii, Idaho, Illinois, Maine, and New Jersey, economic upturn worsens income distribution since the POS variable carries a positive coefficient.
- II. In six states of Iowa, Nevada, North Dakota, South Dakota, Utah, and Wyoming economic downturn worsens income inequality since the NEG variable carries a negative coefficient.
- III. In two states of Oregon and Rhode Island, both the economic upturn and economic downturn worsens income distribution since the POS variable carries a positive coefficient and the NEG variable carries a negative coefficient.

4.3. Inequality and Growth Volatility in 40 Countries

As mentioned before, another strand of literature argues that higher income volatility is associated with higher Gini coefficient implying that a reduction in volatility would improve equality of income distribution. In this section I show the result of linear and non-linear ARDL models applied, to investigate whether this link is asymmetric or not.

Following literature and the same line of thought from previous sections, the linear models take the following forms long-run specification:

$$\ln\text{Gini}_t = \alpha + \beta \ln\text{VOL}_t + \epsilon_t \quad (10)$$

Also, the linear error-correction models:

$$\Delta \ln\text{Gini}_t = \alpha + \sum_{j=1}^{n_1} \phi_j \Delta \ln\text{Gini}_{t-j} + \sum_{j=0}^{n_2} \pi_j \Delta \ln\text{VOL}_{t-j} + \lambda_1 \ln\text{Gini}_{t-1} + \lambda_2 \ln\text{VOL}_{t-1} + u_t \quad (11)$$

In these equations, VOL is Measure of income volatility which defined as a four-year moving standard deviation of the change in the growth rate of real total output. For the non-linear model, the VOL variable is substituted with the partial sum of positive and negative changes. The results of both linear and non-linear models are reported in *Table 4*. I estimate both the linear and the non-linear model for each of the 40 countries that are listed in *Table 9*. A maximum of four lags are imposed on each first-differenced variable in both models and Akaike's Information Criterion (AIC) is used to select an optimum specification in each case.

4.3.1. Short-run Analysis of Linear and Non-linear Models

- I. Panel A of *Table 4* shows the estimates of short-run coefficients for 40 countries. In the linear model, I observe that the volatility measure carries at least one significant coefficient in 25 countries. The number of countries that have short-run estimates of either ΔPOS or ΔNEG variable carries at least one significant coefficient increases to 32 countries when shifting to non-linear model.
- II. In half of the countries, the numbers of lag attached to ΔPOS and ΔNEG variables are different supporting short-run adjustment asymmetry. This list includes Australia, Chile, Colombia, Cyprus, Finland, Greece, Indonesia, Ireland, Iran, Israel, Italy, Luxembourg, Malaysia, Malta, Mauritius, Mexico, South Africa, the United Kingdom, Uruguay, and Venezuela.
- III. The short-run cumulative or impact asymmetry, however, is supported by the Wald test, i.e., $\sum \pi_j^+ \neq \sum \pi_j^-$ in only following 24 countries of Australia, Bolivia, Canada, Chile, Colombia, Cyprus, Ecuador, Finland, Greece, Indonesia, Iran, Italy, Jordan, Korea, Luxembourg, Morocco, the Netherlands, Panama, Singapore, South Africa, Spain, Sweden, Uruguay, Venezuela.
- IV. In the linear model, the sum of short-run estimates, as a reflection of short-run Granger causality is significant in 16 countries including Canada, Cyprus, Hungary, Iran, Kenya, Korea, Luxembourg, Malta, Morocco, the Netherlands, the Philippines, Singapore, South Africa, Spain, Uruguay, and Venezuela. In these countries, the Wald test reported in Panel C is significant, rejecting the null of $\sum \pi_j = 0$. The next two Wald tests reveal that in ten countries of Colombia, Cyprus, Hong Kong, Kenya, Korea, Luxembourg, Malta, Netherlands, the Philippines, and Singapore increased in volatilities Granger cause Gini measure. Also, in nine

countries of Ecuador, Indonesia, Iran, Jordan, Mauritius, Panama, South Africa, Spain, Uruguay decreased in volatility Granger causes the income inequality. In seven countries of Australia, Canada, Chile, Greece, Italy, Morocco, and Venezuela both increased and decreased in income volatility Granger cause the income distribution. Thus, in total, in 26 countries the short-run Granger causalities are confirmed revealing more support for short-run Granger causality in the non-linear model.

4.3.2. Long-run Analysis of Linear and Non-linear Models

While the long-run relationship between income volatility and distribution is established by cointegration (either by the F or ECM_{t-1}) only in three countries of Cyprus, Morocco, and the Philippines, switching to non-linear model is rewarding by establishing this long-run relationship for 12 countries, i.e., Austria, Canada, Chile, Colombia, Hungary, Israel, Italy, Jordan, Luxembourg, Mexico, Morocco, and South Africa. In these countries, either the POS or the NEG variables carry at least a significant coefficient. This increase in the number of countries must be due to introducing non-linear adjustment of the volatility measure. Furthermore, 11 countries from above list, long-run effects are asymmetric since the long-run Wald test is significant rejecting the null of $\rho^+/\rho_0 \neq \rho^-/\rho_0$. Following is a summary of what I observed from these 12 countries:

- I. In Canada, Chile, and Hungary while the long-run relationship is not verified by cointegration, this relationship is established in non-linear models. The non-linear model exhibits that although increased volatility worsens inequality and declined in volatility reduces inequality (both POS and NEG coefficient are significant and positive), but the unit effects measured by the size of coefficients are significantly different displaying an asymmetric relationship.
- II. In Colombia, Jordan, and Morocco increased volatility improves income distribution and declined volatility worsens inequality (both POS and NEG coefficient are significant and

negative), but unit effects measured by the size of coefficients are significantly different showing an asymmetric long-run relationship.

- III. In the case of Austria, both increased and decreased volatility have equalizing effects on the distribution of income.
- IV. The non-linear model in the case of Israel reveals that only increased volatility worsens inequality and declined volatility has no long-run effect on Gini.
- V. In Luxembourg, Mexico, and South Africa only decreased volatility worsens inequality and increased volatility has no long-run effect on income inequality.

4.4. Inequality and Growth Volatility in the United States

In this section, I discuss the estimation results of both the linear and the non-linear models introduced in Section 4.3 which are applied to the United States and its 50 states plus the District of Columbia. The data are annual and a maximum of four lags are imposed on each first-differenced variable and Akaike's Information Criterion (AIC) is used to select an optimum model. *Table 5* exhibits these results.

4.4.1. Short-run Analysis of Linear and Non-linear Models

- I. Panel A in *Table 5* shows the short-run coefficients for both linear and non-linear models. The linear model reveals that income volatility carries at least one significant coefficient in 15 cases, i.e., Alaska, Arizona, Georgia, Maryland, Mississippi, Missouri, New Hampshire, North Dakota, Oklahoma, Pennsylvania, South Carolina, South Dakota, Texas, Washington, and West Virginia. From the results that belong to the non-linear models, in 36 cases either ΔPOS or ΔNEG carries at least one significant coefficient. Thus, exposing the non-linear adjustment

of income volatility provides more support for the short-run effects of volatility on income inequality.

- II. In the aggregate U.S. data and following 25 cases, since the numbers of lag attached to ΔPOS and ΔNEG variables are different short-run adjustment asymmetry is supported. These cases are Arizona, Colorado, Delaware, Florida, Georgia, Hawaii, Illinois, Indiana, Louisiana, Massachusetts, Michigan, Mississippi, Montana, Nebraska, North Dakota, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Dakota, Texas, Utah, Washington, Wisconsin, and District of Columbia.
- III. A significant value in the first Wald test in panel D of *Table 5*, can be interpreted as a short-run Granger causality. Therefore, in nine states of Alaska, Arizona, Georgia, Maryland, Massachusetts, Missouri, New Hampshire, Pennsylvania, and South Dakota volatility of income Granger causes the income inequality. On the other hand, from the non-linear model, I witness that in the U.S. and nine states increased volatility Granger causes income inequality, in nine states, declined in volatility Granger causes the measure of income inequality, and in 14 both increased and decreased volatility Granger cause Gini.
- IV. The short-run cumulative or impact asymmetry can be interpreted from the significance of Wald-SR reported in panel D. In the U.S. and 38 states the null of $\sum \pi_j^+ \neq \sum \pi_j^-$ is rejected indicating that the short-run effects are mostly asymmetric.

4.4.2. Long-run Analysis of Linear and Non-linear Models

The long-run linear estimates reported in panel B of *Table 5* show that VOL carries a significantly negative coefficient that is supported by a significant F or t-test for cointegration in none of the cases implying that income volatility has no long-run impact on income distribution. However, when we consider the estimates from non-linear models, in 16 states either the POS or the NEG variable carry

a significant coefficient that is supported by one of the cointegration tests. The list includes Florida, Idaho, Indiana, Kansas, Louisiana, Michigan, Mississippi, Missouri, Montana, Nebraska, Nevada, Oklahoma, Rhode Island, South Dakota, West Virginia, and Wyoming. This increase in the number of states in which income volatility has long-run effects on income inequality can be credited to non-linear adjustment of income volatility. The summary of long-run impacts of volatility in income on income inequality is as follow:

- I. In Florida, Kansas, Louisiana, Montana, Nebraska, and Oklahoma only increased volatility worsens inequality and decreased volatility has no long-run effect on Gini.
- II. In Idaho, Mississippi, Missouri, Nevada, Rhode Island, and West Virginia, decreased volatility worsens inequality and increased volatility has no long-run effect on income inequality.
- III. In Indiana, Michigan, South Dakota, and Wyoming both increased and decreased volatility worsen income distribution in long-run.

4.4.3. Multivariate Linear and Non-linear Models

In order to determine whether these findings are sensitive to a different measure of income inequality and omitted variables, considering following long-run specification:

$$\ln Theil_t = c_1 + c_2 \ln Y_t + c_3 \ln Population + c_4 \ln VOL + \epsilon_t \quad (12)$$

I used the Thiel measure of income inequality and added the Kuznets' effect measured by real income in each state as well as the population in each state as other determinants of income inequality in addition to income volatility. For the non-linear model, the VOL variable is substituted with the partial sum of positive and negative changes. The results are reported in *Table 6*.

The linear model reveals that in six states long-run relationship between income volatility and Theil index is established. These states include Alaska, Florida, Massachusetts, Rhode Island, West Virginia, and Wisconsin. In all of these states except in Massachusetts income volatility has an un-equalizing effect on the distribution of income. The non-linear model the number of established long-run relationship raises to 13 that includes following states: Alaska, Florida, Hawaii, Idaho, Indiana, Louisiana, Michigan, Nebraska, Oklahoma, Washington, West Virginia, Wisconsin, and Wyoming. However, these new results were somewhat different from the previous specification as follows:

- I. In three states of Alaska, Hawaii, and Idaho, increased volatility worsens income distribution in the long-run and decreased volatility improved it.
- II. In seven states of Florida, Indiana, Louisiana, Michigan, Nebraska, West Virginia, and Wisconsin increased volatility worsens income distribution but decreased volatility has no long-run impact.
- III. In the state of Washington decreased volatility improves inequality but an increase in volatility has no long-run effects.
- IV. In two states of Oklahoma and Wyoming, both an increase and a decrease in volatility make income distribution worse.

Chapter 5. Conclusion

This dissertation investigates the response of income distribution on different phases of output growth and growth volatility. Kuznets (1955) pioneers the work discussing the role of inequality in the process of economic development. The well-known Kuznets curve claims that income growth worsens income inequality in the short-run but has an equalizing effect on the distribution of income in the long-run. This pattern is known as Kuznets inverted-U hypothesis. The current literature, regardless of the models, i.e., cross-sectional, panel data, or time-series, has mostly assumed that the effects of changes in economic activity measured by changes in real income or real Gross Domestic Product (GDP) on income distribution are symmetric, implying that if economic growth improves income inequality, a recession or a decline in real income should worsen it. This linear relationship among variables implies that the output changes have symmetric effects on income inequality, but income distribution can be affected by economic booms and busts and also by growth volatility.

In this dissertation, the most recent data on forty developed and less developed countries, as well as state-level data in the United States, is considered. By employing the non-linear ARDL approach it is found that in many cases the income growth and income volatility have asymmetric effects on income distribution. Estimating both linear and non-linear ARDL models enables me to test my main hypothesis to explore whether a more flexible non-linear model can capture the long-run relationship between income inequality and income growth (or income volatility) more than a linear model.

For the first bivariate specification, where the real per capita income is the determinant of income inequality, annual data from forty countries are used to test for the symmetric and asymmetric effects of income per capita changes on income distribution. Results could be summarized by stating that, first, the linear model detects that in 27 countries there are short-run significant effects of economic growth on income inequality. However, the short-run effects last into long-run meaningful estimates

in only 12 countries, i.e., Belgium, Cyprus, Finland, Hong Kong, Indonesia, India, Israel, Jordan, Luxembourg, Malaysia, Norway, and Uruguay. The non-linear model, on the other hand, provides significant short-run effects in all 40 countries and these short-run relationships translate to long-run in 23 countries, i.e., Austria, Belgium, Bolivia, Canada, France, Hong Kong, Indonesia, Iran, Israel, Italy, Kenya, Luxembourg, Malaysia, Mauritius, Mexico, Netherlands, Norway, Panama, the Philippines, Singapore, Spain, Uruguay, and Venezuela. This supports the fact that introducing non-linear adjustment of real GDP yields more support for the long-run effects of income changes on income inequality.

The second key finding suggests that long-run effects seem to be asymmetric because the long-run Wald tests are highly significant in these countries. This implies that if an economic upturn increases the Gini coefficient it would not be expected that an economic downturn decreases this index. Finally, in the linear model, Kuznets hypothesis that economic growth lowers income inequality in the long-run is supported in only three countries of Indonesia, Jordan, and Malaysia. In the non-linear model, it is supported in four countries, i.e., Iran, Italy, Malaysia, and Spain. These findings suggest support for a non-linear model and utilization of non-linear adjustment of the real GDP to test Kuznets' hypothesis.

The same models were applied to the United States and its states using state-level data for the period of 1945-2013. While a panel data study (Frank, 2009) using the same data set for 1945-2004 finds that income growth worsens income distribution, my findings for the U.S. aggregate data show that neither the linear model nor the non-linear model reveals a meaningful long-run relationship between income changes and income inequality. By using state-level data, I noticed that this result does not hold for each state and may suffer from aggregation bias. The results for individual states reveal that the linear model finds significant long-run relationships in 12 states including Connecticut, Georgia, Hawaii,

Idaho, Kansas, Main, Nebraska, New Hampshire, Ohio, Rhode Island, Utah, and Vermont. Introducing non-linear adjustment to the model increases the number of states that exhibit long-run relationships to 16, i.e., Connecticut, Hawaii, Idaho, Illinois, Iowa, Maine, Mississippi, Nebraska, Nevada, New Jersey, North Dakota, Oregon, Rhode Island, South Dakota, Utah, and Wyoming. Since non-linear model provides the evidence of asymmetry cointegration in 16 states compared to symmetry cointegration from the linear model in only 12 states, this favors non-linear dynamic adjustment of real per capita income and application of the non-linear ARDL model. In addition, while the non-linear model reveals that in five states a short-run Kuznets pattern can be observed (positive coefficients are followed by negative ones), neither the linear nor the non-linear model can verify that income growth improves income distribution in the long-run. Finally, I find that the long-run relationship is asymmetric in nine states, i.e., Iowa, Nevada, North Dakota, Oregon, Rhode Island, South Dakota, Utah, Vermont, and Wyoming. In these states, both an increase in real per capita income and a decrease in real per capita income have un-equalizing effects on income inequality.

Findings in the United States suggest that if jumps in income worsen income inequality, we cannot expect any equalizing effect from drops in income. One explanation could be that top income earners benefit from economic upturns but they do not suffer during economic downturns. Therefore, in order to address income inequality and unfair income distribution, these findings should be taken into consideration when designing and implementing welfare policies.

For the second bivariate specification where the income volatility is the determinant of income inequality, I use the same data for 40 countries and the United States and employ the linear model to investigate the growth-volatility nexus. Since an economic shock hurts the poor more than the rich, this could worsen income distribution. The previous studies have assumed a linear link between two variables. I extend this research and employ the non-linear ARDL model to investigate whether the

effects of income volatility on income inequality are asymmetric. i.e., whether increased uncertainty has different effects on income disparity than decreased uncertainty.

The results of both linear and non-linear models using data from the 40 countries can be summarized as follows: while the linear model reveals that income volatility affects income inequality in 25 countries, the non-linear model shows that in 32 countries there are short-run significant effects of income volatility on income distribution. The short-run cumulative or impact asymmetry is supported by the Wald test in only 24 countries. The estimates of the linear model reveal that income volatility has short-run causal effects on income inequality in 16 countries, and the estimates of the non-linear model produce evidence of short-run causal effects in 26 countries. On the other hand, while the long-run relationship between income volatility and income distribution is established by cointegration only in three countries of Cyprus, Morocco, and the Philippines in the linear model, switching to the non-linear model is able to establish this long-run relationship for 12 countries (mostly developing countries). This rise in the number of countries is likely due to the introduction of the non-linear adjustment of the volatility measure. Interestingly, the long-run Wald tests are significant for 11 countries, i.e., Austria, Canada, Chile, Colombia, Hungary, Israel, Jordan, Luxembourg, Mexico, Morocco, and South Africa, proving the long-run effects are asymmetric.

The estimations of the same linear and non-linear models for the U.S. state-level data can be summarized as follows: first, exposing the non-linear adjustment of income volatility provides more support for the short-run effects of volatility on income inequality since the linear model finds a significant short-run link for 15 states but this number rises to 36 for the non-linear model. Also, the estimates of the linear model reveal that income volatility has short-run causal effects on income inequality in only nine states, while estimates of the non-linear model produce evidence of asymmetric short-run causal effects in 32 states. Although the linear model finds no long-run link between income

inequality and Gini, the non-linear short-run effects translate to the long-run significant, meaningful, and asymmetric effects in 16 states, i.e., Connecticut, Hawaii, Idaho, Illinois, Iowa, Maine, Mississippi, Nebraska, Nevada, New Jersey, North Dakota, Oregon, Rhode Island, South Dakota, Utah, and Wyoming. Both increased volatility and decreased volatility worsen income distribution in these states. Interestingly, using only aggregate data from the U.S. demonstrates no significant impact of income volatility on GINI. It is only after we disaggregate the data that we are able to determine asymmetric effects in 16 states.

In summary, the main finding of this dissertation that has not been discussed in previous studies is the observation of an asymmetric relationship between income inequality and its determinants i.e., income growth and income volatility. In other words, income growth and income volatility have long-run asymmetric impacts on the distribution of income. In almost all the U.S. states that the long-run relationships are established, increased and decreased per capita income, also increased and decreased income volatility, worsen income distribution. The implication of these results is that in the United States if economic growth worsens income inequality we cannot expect that any decline in growth will reduce it. Moreover, although many studies show the un-equalizing effects of income volatility on income distribution, a policy that targets a decrease in income volatility would not necessarily reduce income inequality. However, this policy could be effective in some countries. Therefore, other policy options may need to be explored, for instance, a progressive tax plan that raises taxes on the rich while reducing them on the poor.

Table 1. Literature Review Summary

References	Methodology	Measure of Inequality	Independent Variable(s)	Number of Countries	Data period	Results/Remarks
Kuznets (1955)	Cross-sectional	Ratio of the income share of the 20% richest to that of the 60% poorest	Per capita income	6	First half of 20 th century	developing countries exhibit a higher degree of inequality than developed ones
Kuznets (1963)	Cross-sectional	Summary of income differences among distinguishable groups	Per capita Income	18	Late 1940's and Early 1950's	inverted-U Pattern
Kravis (1960)	Cross-sectional	Share of lowest and highest quantiles	Per capita Income	11	Early 1950's	Support inverted-U Pattern
Adelman and Morris (1973)	Cross-sectional	Relative income shares of different quantiles	Per capita Income and growth rate of GDP	43	1950-63	Neither the level of income nor the rate of growth is determinant of the pattern of inequality
Paukert (1973)	Cross-sectional	Gini	Per capita GDP	56	Around 1965	Support inverted-U Pattern
Ahluwalia (1974)	Cross-sectional	Top 20%, middle 40%, lowest 40%, and lowest 60%	Per capita GDP, rate of growth, education, rate of growth of population	62	1960	Support inverted-U Pattern for top 20% and lowest 40%
Ahluwalia (1976)	Cross-sectional	Percentage Income Shares (top 20%, middle 40%, and lowest 40 and 60%)	Per capita GDP, growth, education, growth of population, share of agriculture in GDP, share of urban population	62	1960's	Support inverted-U for lowest income groups

Table 1(continued): Literature Review Summary

References	Methodology	Measure of Inequality	Independent Variable(s)	Number of Countries	Data period	Results/Remarks
Papanek and Kyn (1986)	Cross-sectional	Gini and share of bottom 40%	GDP per capita and its square	83	1952-78	Support inverted-U hypothesis
Saith (1983)	Cross-sectional	Income share of bottom 20%	Growth rate, GDP per capita	41	1960's	Cross-country inverted U hypothesis is a barrier to understanding growth and income equality relationship and an inverted-L is a better fit
Ram (1991)	Time-series	Gini	Linear and quadratic GDP per capita	US	1947-88	Does not support Kuznets hypothesis
Anand and Kanbur (1993)	Cross-sectional	Income share of bottom 40%	GDP per capita	60		The growth-inequality relationship is very sensitive to functional form
Matyas et al. (1998)	Panel data	Gini	Per capita income, it's squared and cubed	62	1970-93	Does not support inverted-U and claims specific characteristic of a country explain the change in income inequality better than GDP per capita
Deiningger and Squire (1998)	Panel data	Gini	Real per capita income and the inverse of real per capita income	49	1970-90	Supports inverted-U in the pooled case for only five countries and finds U-shaped curved for four countries and no significance of Kuznets curve in 40 countries Also does not support Kuznets process in fixed effect case

Table 1(continued): Literature Review Summary

References	Methodology	Measure of Inequality	Independent Variable(s)	Number of Countries	Data period	Results/Remarks
List and Gallet (1999)	Panel data	Gini	Per capita income, it's squared and cubed	71	1961-92	Growth path of each country is different, and a universal path of development does not exist. However, the inverted-U curve is verified and shows that the developed countries the relationship is positive again which can be interpreted as S-shape curve
Thornton (2001)	Panel data	Gini	GDP per capita	96	Postwar period	Supports inverted-U and claims that income inequality tends to decline at higher income levels
Tam (2007)	Panel data	Gini	GDP per capita, GDP per capita-square, Trade openness, primary, secondary, and higher educational attainment, population, urbanization	84	1970-1990	Kuznets curve could be inverted-U, U-shaped, monotonically increasing or decreasing depending on the functional specifications
Desbordes and Verardi (2012)	Semiparametric panel data	Gini	Income per capita and its squared	113	1960-2000	Non-causal inverted-U relationship
Ramzi and Ashrafzadeh (2012)	Time series	Gini	Growth in GDP	Iran	1971-2007	No inverted-U pattern and the positive long-run relationship between growth and distribution
Gallup (2012)	Time series	Gini	Income per capita and its square	78	1960-2011	Anti- Kuznets curve
Alawin et al. (2013)	Time series	Gini	GDP	Jordon	1987-2010	Support inverted-U, Income distribution causes growth

Table 1(continued): Literature Review Summary

References	Methodology	Measure of Inequality	Independent Variable(s)	Number of Countries	Data period	Results/Remarks
Das et al. (2014)	Panel data	Gini	Logarithm of per capita consumption and its square	14 states in India	1958-2005	Support inverted-U
Melikhova and Cizek (2014)	Panel data	Gini	GDP per capita and its square	145	1979-2009	Support inverted-U for countries with low social contribution
Jauch and Wadtzka (2015)	Panel data	Gini	Credit to GDP	138	1960-2008	The positive effect of financial development on inequality
Oyvat (2015)	Panel data	Gini	Income per capita, educational Gini, Trade openness, Government expenditure	106	1985-2010	Inverted-U only exists in the developing countries
4 Kang (2015)	Time series	Gini	GDP per capita	18	1960-2013	Positive relation of growth and inequality in the majority of Asian countries
Bayarjargal (2016)	Panel data	Income share of top 0.1, 1, and 10 percent	Growth rate, GDP per capita, GDP per capita-square	26	1870-2011	U-curve relationship between top income share and per capita income
Yang and Greaney (2017)	Time series	Gini	GDP per capita and its squared and cubic forms	4	1960-2013	The S-shaped curve for all countries

Table 2. Estimates of Linear and Non-linear Gini-Growth Model (40 Countries)

	Austria		Belgium		Bolivia		Chile	
	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL
Panel A: Short-Run Estimates								
ΔLnGini								
$\Delta \text{LnGini}_{t-1}$		.14(1.06)	.37(2.8)**	.33(2.61)**	.24(1.58)	1.62(7.49)**		
$\Delta \text{LnGini}_{t-2}$		.05(.40)			.20(1.25)	1.62(9.98)**		
$\Delta \text{LnGini}_{t-3}$		.41(2.83)**			-.12(.85)	1.08(5.99)**		
$\Delta \text{LnGini}_{t-4}$					-.39(2.74)**	.30(2.33)**		
$\Delta \text{LnGini}_{t-5}$						.23(2.85)**		
$\Delta \text{LnGini}_{t-6}$								
ΔLnRGDP	-.21(2.15)**		-.23(3.4)**		.88(3.29)**		-.02(0.24)	
$\Delta \text{LnRGDP}_{t-1}$	-.08(.96)		-.08(.94)		-1.01(4.00)**		-.17(2.63)**	
$\Delta \text{LnRGDP}_{t-2}$			-.17(2.17)**					
$\Delta \text{LnRGDP}_{t-3}$			-.07(.91)					
$\Delta \text{LnRGDP}_{t-4}$			-.18(2.27)**					
$\Delta \text{LnRGDP}_{t-5}$			-.11(1.63)					
$\Delta \text{LnRGDP}_{t-6}$								
ΔPOS_t		.17(1.28)		-.35(4.26)**		.37(3.14)**		-.04(.32)
ΔPOS_{t-1}		.01(.03)		-.19(1.95)*		-.05(.38)		
ΔPOS_{t-2}		.30(2.90)**		-.22(2.31)**		-.10(.88)		
ΔPOS_{t-3}				-.09(1.03)		-.76(3.72)**		
ΔPOS_{t-4}				-.21(2.38)**		-.05(.30)		
ΔPOS_{t-5}						.26(1.56)		
ΔPOS_{t-6}								
ΔNEG_t		-1.51(-2.63)**		1.18(2.55)**		.85(3.83)**		-.06(.56)
ΔNEG_{t-1}		.77(1.33)				.32(1.01)		-.20(1.78)*
ΔNEG_{t-2}		.91(1.43)				.47(1.39)		
ΔNEG_{t-3}		2.10(3.67)**				-.22(.65)		
ΔNEG_{t-4}		.91(1.68)*				-.15(.49)		
ΔNEG_{t-5}						-1.19(4.27)**		
ΔNEG_{t-6}								
Panel B: Long-Run Estimates								
Constant	3.12(41.10)**	3.42(145.68)**	2.93(12.38)**	3.53(181.65)**	3.29(6.99)**	3.74(272.21)**	3.55(9.32)**	3.72(102.16)**
LnRGDP_t	.10(5.97)**		.17(45.64)**		.16(1.36)		.11(0.93)	
POS_t		.09(5.73)**		.23(7.40)**		.07(6.08)**		-.01(.19)
NEG_t		-1.49(1.27)		2.13(2.00)**		-54(8.51)**		-.41(2.52)**
Panel C: Diagnostic Statistics								
F	1.53	10.95**	9.88**	8.60**	4.04	21.29**	.79	2.52
ECM_{t-1}	-.05(.81)	-.55(5.98)**	-.41(4.52)**	.81(4.58)**	-.36(2.85)	-2.91(9.79)**	-.09(1.27)	-.26(2.82)
LM	.05	2.43	2.20	28.34	.35	16.73**	0.03	.25
RESET	.22	1.53	0	.07	.94	4.29**	0.43	.38
CUSUMM	S	S	S	US	S	S	S	S
CUSUMSQ	S	S	S	S	S	S	S	US
Wald-Short		4.17**		2.70*		.02		.47
Wald-Long		1.23		1.27		141.45**		13.02**
Adjusted R ²	.18	.27	.48	.30	.50	.97	.14	.27

Notes: See end of the table.

Table 2 continued.								
	Canada		Colombia		Cyprus		Ecuador	
	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL
Panel A: Short-Run Estimates								
ΔLnGini								
$\Delta \text{LnGini}_{t-1}$	.34(2.75)**	.28(2.74)**	.02(.09)	-.06(.27)				
$\Delta \text{LnGini}_{t-2}$			.30(1.72)*	.64(3.09)**				
$\Delta \text{LnGini}_{t-3}$				.45(2.30)**				
$\Delta \text{LnGini}_{t-4}$								
$\Delta \text{LnGini}_{t-5}$								
$\Delta \text{LnGini}_{t-6}$								
ΔLnRGDP	-.21(2.95)**		.01(.11)		-.14(3.83)**		.01(.05)	
$\Delta \text{LnRGDP}_{t-1}$			-.06(1.42)					
$\Delta \text{LnRGDP}_{t-2}$								
$\Delta \text{LnRGDP}_{t-3}$								
$\Delta \text{LnRGDP}_{t-4}$								
$\Delta \text{LnRGDP}_{t-5}$								
$\Delta \text{LnRGDP}_{t-6}$								
ΔPOS_t		-.01(.18)		-.32(2.81)**		.01(.01)		-.10(.73)
ΔPOS_{t-1}				-.25(1.98)**				-.25(1.71)*
ΔPOS_{t-2}				.01(.08)				-.25(1.66)*
ΔPOS_{t-3}				.34(2.97)**				-.04(.29)
ΔPOS_{t-4}								-.19(1.30)
ΔPOS_{t-5}								-.34(2.72)**
ΔPOS_{t-6}								
ΔNEG_t		-1.01(4.43)**		.12(2.63)**		-.28(4.26)**		.24(.71)
ΔNEG_{t-1}								.75(2.06)**
ΔNEG_{t-2}								1.02(2.79)**
ΔNEG_{t-3}								1.02(2.72)**
ΔNEG_{t-4}								.79(1.97)**
ΔNEG_{t-5}								
ΔNEG_{t-6}								
Panel B: Long-Run Estimates								
Constant	3.26(23.52)**	3.54(386.85)**	3.59(43.36)**	3.80(56.51)**	3.93(60.98)**	3.73(114.77)**	3.34(14.14)**	3.96(31.21)**
LnRGDP_t	.10(3.45)**		.06(2.85)**		-.06(3.75)**		.12(2.12)**	
POS_t		-.01(.99)		.05(1.96)**		-.04(1.98)**		-.01(.08)
NEG_t		-1.63(6.85)**		-.12(1.13)		.01(.18)		-.27(.40)
Panel C: Diagnostic Statistics								
F	2.37	6.20**	3.32	.68	4.56	3.60	3.43	5.11*
ECM_{t-1}	-.15(2.06)	-.60(4.43)**	-.27(2.45)	-.24(1.49)	-.26(3.02)*	-.28(3.10)	-.16(2.52)	-.51(4.10)**
LM	.02	.06	0	1.44	.78	.57	.01	.16
RESET	4.19**	.25	.12	1.23	5.25**	.80	3.38*	3.60*
CUSUMM	S	S	S	S	S	S	S	S
CUSUMSQ	S	S	S	S	US	US	US	S
Wald-Short		10.65**		2.09		3.64*		8.87**
Wald-Long		70.04**		2.67		2.75*		.21
Adjusted R ²	.40	.60	.14	.58	.33	.41	.10	.39

Table 2 continued.								
	Finland		France		Greece		Hong Kong	
	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL
Panel A: Short-Run Estimates								
ΔLnGini								
$\Delta \text{LnGini}_{t-1}$	-.15(.99)	-.32(2.05)		-1.55(8.96)**		.12(.64)		-.37(2.76)**
$\Delta \text{LnGini}_{t-2}$				-1.89(7.74)**		-.16(.82)		
$\Delta \text{LnGini}_{t-3}$				-2.19(5.81)**		-.30(1.33)		
$\Delta \text{LnGini}_{t-4}$				-2.13(7.80)**		.67(2.42)**		
$\Delta \text{LnGini}_{t-5}$				-1.30(4.08)**				
$\Delta \text{LnGini}_{t-6}$								
ΔLnRGDP	-.01(.19)		-.05(.18)		.02(.35)		-.38(2.52)	
$\Delta \text{LnRGDP}_{t-1}$	-.21(2.62)**							
$\Delta \text{LnRGDP}_{t-2}$	-.08(.85)							
$\Delta \text{LnRGDP}_{t-3}$	.16(2.39)**							
$\Delta \text{LnRGDP}_{t-4}$								
$\Delta \text{LnRGDP}_{t-5}$								
$\Delta \text{LnRGDP}_{t-6}$								
ΔPOS_t		-.10(1.18)		-.13(.79)		-.24(1.30)		-.59(3.93)**
ΔPOS_{t-1}		-.29(1.38)		-.74(3.60)**		.25(1.44)		
ΔPOS_{t-2}		-.14(1.46)		.25(1.60)		.30(2.05)**		
ΔPOS_{t-3}				.46(2.46)**		.22(1.88)*		
ΔPOS_{t-4}				.18(1.04)		-.22(1.78)*		
ΔPOS_{t-5}				-.64(3.21)**		.24(2.52)**		
ΔPOS_{t-6}								
ΔNEG_t		.24(1.57)		-3.78(2.45)**		.57(1.98)**		1.15(2.35)**
ΔNEG_{t-1}		-.25(1.37)		-23.97 (8.88)**		.36(1.31)		
ΔNEG_{t-2}		.04(.23)		-20.30(5.38)**		.17(.69)		
ΔNEG_{t-3}		.36(2.28)		-6.88 (4.20)**		.32(1.78)*		
ΔNEG_{t-4}				-3.18(2.65)**		.46(2.53)**		
ΔNEG_{t-5}								
ΔNEG_{t-6}								
Panel B: Long-Run Estimates								
Constant	2.75(13.89)**	3.41(42.97)**	2.92(10.55)**	3.51(109.50)**	3.28(11.37)**	3.67(59.90)**	1.61(5.70)**	3.07(10.48)**
LnRGDP_t	.19(3.65)**		.15(2.45)**		.11(1.61)		.53(8.11)**	
POS_t		.24(1.32)		.95(2.17)**		-.02(.25)		.93(1.99)**
NEG_t		.38(.50)		39.88(1.76)*		-.87(1.47)		9.79(.94)
Panel C: Diagnostic Statistics								
F	5.24*	3.88	2.62	13.73**	.90	4.46	7.33**	13.69**
ECM_{t-1}	-.88(3.24)*	-.08(3.44)*	-.27(2.22)	-.49(7.86)**	-.06(1.23)	-.48(4.01)**	-.14(3.64)**	-.11(6.50)**
LM	1.14	.56	.49	.98	.84	.11	1.22	.18
RESET	.49	.25	.11	.13	3.07*	4.16**	2.33	4.75**
CUSUMM	S	S	S	S	S	S	S	S
CUSUMSQ	S	S	S	S	S	S	S	US
Wald-Short		7.29**		13.44**		4.00**		6.27**
Wald-Long		.039		3.08*		2.15		1.68
Adjusted R ²	.45	.52	.09	.90	.01	.04	.36	.62

Table 2 continued.								
	Hungary		Indonesia		India		Ireland	
	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL
Panel A: Short-Run Estimates								
ΔLnGini								
$\Delta \text{LnGini}_{t-1}$			.40(1.78)*		.10(.75)	-.11(.82)		-.03(.23)
$\Delta \text{LnGini}_{t-2}$			.72(3.35)**		-.01(.09)	-.15(1.30)		-.15(1.18)
$\Delta \text{LnGini}_{t-3}$			.41(1.94)*		.30(2.26)	.14(1.38)		.20(1.20)
$\Delta \text{LnGini}_{t-4}$			.16(.86)			-.49(4.93)**		.33(2.02)**
$\Delta \text{LnGini}_{t-5}$			-.33(1.76)*					
$\Delta \text{LnGini}_{t-6}$								
ΔLnRGDP	-.01(.09)		-.35(3.68)**		-.07(1.59)		-.21(2.73)**	
$\Delta \text{LnRGDP}_{t-1}$	-.38(2.90)**		-.08(.73)	.20(1.06)	-.10(2.37)**			
$\Delta \text{LnRGDP}_{t-2}$	-.02(.13)		.01(.06)	.63(3.28)**	-.15(3.54)**			
$\Delta \text{LnRGDP}_{t-3}$	-.19(1.68)**		.03(.24)	.35(1.79)*				
$\Delta \text{LnRGDP}_{t-4}$			-.19(1.93)**					
$\Delta \text{LnRGDP}_{t-5}$			-.38(3.72)**					
$\Delta \text{LnRGDP}_{t-6}$								
ΔPOS_t		.35(1.71)*		-.24(1.13)		-.14(3.20)**		-.2(.27)
ΔPOS_{t-1}						-.04(.93)		-.34(3.79)**
ΔPOS_{t-2}						-.10(1.91)*		-.20(2.02)**
ΔPOS_{t-3}						-.09(1.76)*		-.18(1.79)*
ΔPOS_{t-4}								-.13(1.36)
ΔPOS_{t-5}								-.18(1.79)
ΔPOS_{t-6}								
ΔNEG_t		-.11(.73)		-.33(2.03)**		.48(4.07)**		-5.59(1.19)
ΔNEG_{t-1}		-.74(4.69)**		-.02(.15)		-.54(4.32)**		
ΔNEG_{t-2}		-.29(1.68)*		.35(2.48)**		-.24(1.89)**		
ΔNEG_{t-3}		-.33(2.10)**		.02(.12)		.34(2.60)**		
ΔNEG_{t-4}		-.23(1.50)		-.20(1.33)		.25(2.25)**		
ΔNEG_{t-5}		-.38(2.30)**		-.55(3.91)**				
ΔNEG_{t-6}								
Panel B: Long-Run Estimates								
Constant	.18(10)	2.58(2.25)**	4.26(93.07)**	3.98(215.09)**	3.85(137.19)**	4.35 (6.95)**	3.61(153.45)**	3.67(234.55)**
LnRGDP_t	.89(2.04)**		-.09(9.02)**		.05(3.70)**		.03(3.55)**	
POS_t		1.51(.64)		-.07(4.63)**		.20 (.83)		.01(.85)
NEG_t		2.84(.36)		-.02(.10)		4.34 (0.71)		-7.98(1.42)
Panel C: Diagnostic Statistics								
F	1.88	3.90	10.46**	4.59	6.77**	4.31	1.90	9.30**
ECM_{t-1}	-.04(1.88)	-.06(3.59)**	-1.13(4.70)**	-.78(3.92)**	-.22(3.71)**	-.07(3.75)**	-.10(1.95)	-.54(5.50)**
LM	.19	1.38	.07	1.60	.30	.14	.02	.02
RESET	2.01	2.33	.05	.63	1.31	2.02	.01	.36
CUSUMM	S	S	S	S	S	S	S	S
CUSUMSQ	S	S	S	S	S	S	US	S
Wald-Short		17.33**		.52		3.56*		.71
Wald-Long		.06		.092		.40		1.15
Adjusted R ²	.47	.59	.56	.60	.38	.72	.14	.56

Table 2 continued.								
	Iran		Israel		Italy		Jordan	
	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL
Panel A: Short-Run Estimates								
ΔLnGini_t								
$\Delta \text{LnGini}_{t-1}$	.23(1.67)*	.31(2.69)*	.15(1.11)	-.21(1.31)		-.18(1.04)	-.07(.43)	.53(1.42)
$\Delta \text{LnGini}_{t-2}$	-.14(.96)	-.18(1.67)*	-.16(1.27)	-.01(.05)		-.13(.76)	.49(2.97)**	.98(2.50)**
$\Delta \text{LnGini}_{t-3}$	.34(2.59)**	.34(3.05)**	-.18(1.23)	-.33(2.55)**			.52(3.04)**	.72(2.01)**
$\Delta \text{LnGini}_{t-4}$							.42(2.73)**	.58(1.92)*
$\Delta \text{LnGini}_{t-5}$							.35(2.74)**	.40(1.91)*
$\Delta \text{LnGini}_{t-6}$								
ΔLnRGDP_t	.18(2.78)**		-.05(1.51)		-.37(2.83)**		.05(.73)	
$\Delta \text{LnRGDP}_{t-1}$	.01(.11)		-.07(2.55)**		-.39(2.92)**		.34(4.84)**	
$\Delta \text{LnRGDP}_{t-2}$	.17(2.42)**		-.15(4.51)**				.18(1.96)**	
$\Delta \text{LnRGDP}_{t-3}$			-.11(3.76)**					
$\Delta \text{LnRGDP}_{t-4}$			-.12(3.27)**					
$\Delta \text{LnRGDP}_{t-5}$								
$\Delta \text{LnRGDP}_{t-6}$								
ΔPOS_t		.17(2.04)**		.05(.52)**		-.22(.98)		.43(1.52)
ΔPOS_{t-1}		-.01(.09)		-.99(1.14)		-.71(2.79)**		-.01(.03)
ΔPOS_{t-2}		.93(1.18)		-.26(4.55)**		-.21(.76)		.43(1.82)*
ΔPOS_{t-3}		.09(1.21)		-.11(1.91)*		-.43(1.90)*		-.01(.56)
ΔPOS_{t-4}		-.27(3.29)**		-.06(1.06)				-.12(.80)
ΔPOS_{t-5}		-.12(1.48)		.10(1.80)*				-.26(1.92)*
ΔPOS_{t-6}								
ΔNEG_t		.11(.77)		.07(.47)		1.61(1.72)*		-.09(.48)
ΔNEG_{t-1}		.06(.38)		.15(1.28)		.31(.32)		-.35(.89)
ΔNEG_{t-2}		.65(4.14)**		-.17(1.99)**		-.06(.06)		-.41(1.12)
ΔNEG_{t-3}		-.20(1.15)		-.18 (2.07)**		1.24(1.50)		-.05(.17)
ΔNEG_{t-4}		.22(1.50)		-.17(2.42)**				-.33(.94)
ΔNEG_{t-5}		.65(4.62)**						.45(2.18)**
ΔNEG_{t-6}								
Panel B: Long-Run Estimates								
Constant	3.36(10.73)**	3.81(33.88)**	3.44(81.21)**	3.79(20.94)**	4.43(4.34)**	4.10(12.87)**	4.41(21.82)**	3.91(70.34)**
LnRGDP_t	.09(1.12)		.08(8.87)**		-.16(.78)		-.15(2.63)**	
POS_t		.06(1.16)		.09(4.47)**		-.01(.05)		.01(.22)
NEG_t		.22(1.81)*		.60(.93)		13.42(1.98)**		.48(3.02)**
Panel C: Diagnostic Statistics								
F	8.61**	11.81**	11.99**	4.29	2.46	13.58**	13.73**	2.35
ECM_{t-1}	-.18(4.21)**	-.39(6.29)**	-.79(5.00)**	-.41(3.83)**	-.12(2.18)	-.19(3.80)**	-.38(4.20)**	-1.32(3.14)
LM	.47	1.45	.55	.37	.16	2.51	7.05**	12.17**
RESET	.41	.31	2.18	2.16	.01	2.30	1.93	.45
CUSUMM	S	S	S	S	S	S	S	S
CUSUMSQ	S	S	S	S	S	S	S	US
Wald-Short		6.52**		.13		5.15**		.13
Wald-Long		2.90*		.64		1.10		.98
Adjusted R ²	.43	.75	.57	.73	.27	.35	.50	.58

Table 2 continued.								
	Kenya		Korea		Luxembourg		Malaysia	
	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL
Panel A: Short-Run Estimates								
ΔLnGini_t								
$\Delta \text{LnGini}_{t-1}$		.23(1.20)					.20(1.34)	
$\Delta \text{LnGini}_{t-2}$		-.55(2.87)**					.24(1.37)	
$\Delta \text{LnGini}_{t-3}$		-.21(1.17)						
$\Delta \text{LnGini}_{t-4}$		-.46(2.59)**						
$\Delta \text{LnGini}_{t-5}$		-.35(1.98)**						
$\Delta \text{LnGini}_{t-6}$								
ΔLnRGDP_t	-.01(.60)		-.27(4.16)**		.08(.76)		-.18(2.35)**	
$\Delta \text{LnRGDP}_{t-1}$							-.07(.91)	
$\Delta \text{LnRGDP}_{t-2}$							.01(.07)	
$\Delta \text{LnRGDP}_{t-3}$							-.21(2.90)**	
$\Delta \text{LnRGDP}_{t-4}$								
$\Delta \text{LnRGDP}_{t-5}$								
$\Delta \text{LnRGDP}_{t-6}$								
ΔPOS_t		-.005(1.73)*		-.30(3.75)**		-.11(1.08)		-.52(6.89)**
ΔPOS_{t-1}		.30(4.10)**						-.28(3.08)**
ΔPOS_{t-2}		-.03(1.23)						-.34(4.32)**
ΔPOS_{t-3}								-.19(2.53)**
ΔPOS_{t-4}								
ΔPOS_{t-5}								
ΔPOS_{t-6}								
ΔNEG_t		.24(2.65)**		-.33(1.15)		.76(2.61)**		.56(3.37)**
ΔNEG_{t-1}		.18(2.40)**				.62(2.10)**		.07(.42)
ΔNEG_{t-2}		.61(5.25)**				.53(1.75)*		.42(2.69)**
ΔNEG_{t-3}		.08(1.52)						
ΔNEG_{t-4}		.18(3.77)**						
ΔNEG_{t-5}		.10(2.76)**						
ΔNEG_{t-6}								
Panel B: Long-Run Estimates								
Constant	4.05(4.93)**	4.03(202.39)**	4.05(18.73)**	3.94(49.13)**	3.08(40.73)**	3.42(119.87)**	3.98(72.28)**	3.91(190.29)**
LnRGDP_t	-.05(4.93)**		-.05(1.70)*		.12(5.74)**		-.06(5.09)**	
POS_t		-.12(6.55)**		-.09(4.03)**		.10(5.00)**		.01(.10)
NEG_t		-.42(4.68)**		-1.42(1.97)**		-.22(.57)		.95(3.16)**
Panel C: Diagnostic Statistics								
F	3.96	11.64**	1.03	2.45	6.05*	3.46	7.85**	13.20**
ECM_{t-1}	-.28(2.14)	-1.16(6.70)**	-.11(1.23)	-.26(2.73)	-.40(3.43)**	-.39(3.29)*	-.38(4.03)**	-.47(6.33)**
LM	.28	4.83**	2.22	1.12	1.37	.34	.93	1.25
RESET	.37	4.74**	.76	4.20**	4.00**	.26	.37	4.15**
CUSUMM	S	S	S	S	S	S	S	S
CUSUMSQ	S	S	S	S	S	S	S	S
Wald-Short		29.34**		.02		10.94**		29.47**
Wald-Long		16.96**		.10		1.35		7.61**
Adjusted R ²	.08	.73	.31	.38	.19	.29	.48	.72

Table 2 continued.								
	Malta		Mauritius		Mexico		Morocco	
	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL
Panel A: Short-Run Estimates								
ΔLnGini								
$\Delta \text{LnGini}_{t-1}$	-.41(2.82)**	-.75(6.11)**	.48(3.20)**	.18(1.49)	-.73(3.68)**	.02(.11)	.28(1.60)	.26(1.69)*
$\Delta \text{LnGini}_{t-2}$		-.19(1.16)		.10(.74)	-.69(3.15)**	.02(.09)		
$\Delta \text{LnGini}_{t-3}$		-.31(2.13)**		-.39(3.16)**	-.69(2.96)**	-.44(2.28)**		
$\Delta \text{LnGini}_{t-4}$				-.08(.66)	-.64(3.28)**	-.97(4.04)**		
$\Delta \text{LnGini}_{t-5}$				-.61(5.87)**		-.69(2.30)**		
$\Delta \text{LnGini}_{t-6}$								
ΔLnRGDP	-.04(2.82)**		-.08(.69)		-.03(.30)		-.01(.15)	
$\Delta \text{LnRGDP}_{t-1}$	-.22(1.33)				-.08(.74)			
$\Delta \text{LnRGDP}_{t-2}$	-.14(.84)				-.07(.68)			
$\Delta \text{LnRGDP}_{t-3}$	-.10(.63)				.10(1.05)			
$\Delta \text{LnRGDP}_{t-4}$	.36(2.10)**				-.21(2.05)**			
$\Delta \text{LnRGDP}_{t-5}$	-.31(2.13)**				-.13(1.29)			
$\Delta \text{LnRGDP}_{t-6}$								
ΔPOS_t		-.25(2.07)**		.35(2.27)**		-.18(1.35)		-.19(2.20)**
ΔPOS_{t-1}		-.27(1.95)*		.01(.05)		.31(2.33)**		
ΔPOS_{t-2}		-.28(2.01)**		-.35(3.45)**				
ΔPOS_{t-3}				-.39(3.16)**				
ΔPOS_{t-4}				-.08(.66)				
ΔPOS_{t-5}				-.61(5.87)**				
ΔPOS_{t-6}								
ΔNEG_t		2.28(1.71)*		.59(2.53)**		-.77(2.33)**		.60(2.77)**
ΔNEG_{t-1}		5.47(3.57)**		-2.02(5.79)**		.39(1.27)		
ΔNEG_{t-2}		6.27(4.19)**		-1.23(4.87)**		.76(2.67)**		
ΔNEG_{t-3}		5.71(3.84)**		-1.44(5.52)**		1.54(4.50)**		
ΔNEG_{t-4}		8.23(5.69)**		-1.02(4.10)**		.81(2.11)**		
ΔNEG_{t-5}				-.59(2.83)**				
ΔNEG_{t-6}								
Panel B: Long-Run Estimates								
Constant	3.26(2.70)**	4.39(4.11)**	3.75(4.74)**	4.06(42.91)**	2.75(3.59)**	3.73(198.76)**	3.50(21.29)**	3.86(259.64)**
LnRGDP_t	.26(.49)		-.02(.12)		.30(1.29)		.10(2.43)**	
POS_t		-.17(.89)		.10(2.53)**		-.02(.47)		.14(4.09)**
NEG_t		-76.16(.94)		4.24(8.52)**		-1.21(5.77)**		.37(2.20)**
Panel C: Diagnostic Statistics								
F	.95	9.64**	3.02	14.96**	.95	5.19*	2.34	3.58
ECM_{t-1}	-.04(1.40)	-.06(5.55)**	-.08(1.68)	-.59(7.24)**		-1.29(4.27)**	-.17(2.13)	-.25(2.99)
LM	.14	.04	0	1.19		1.67	.41	.81
RESET	3.30*	.01	0	.10		.08	1.96	2.48
CUSUMM	S	S	S	S	S	S	S	S
CUSUMSQ	US	S	S	S	S	S	US	US
Wald-Short		35.29**		5.08**		5.73**		8.05**
Wald-Long		1.56		5.24**		52.24**		.05
Adjusted R ²	.39	.69	.19	.75		.69	.11	.28

Table 2 continued.								
	Netherlands		Norway		Panama		Philippines	
	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL
Panel A: Short-Run Estimates								
ΔLnGini								
$\Delta \text{LnGini}_{t-1}$			.02(.13)	.36(2.76)	-.02(.10)	.20(1.09)		.51(2.90)**
$\Delta \text{LnGini}_{t-2}$			-.30(1.66)*		.47(1.91)**	.54(2.93)**		.38(2.52)**
$\Delta \text{LnGini}_{t-3}$			-.25(1.45)		.78(3.07)**	.84(4.49)**		.34(2.52)**
$\Delta \text{LnGini}_{t-4}$			-.10(.61)		.95(3.65)**	1.16(6.95)**		.10(.84)
$\Delta \text{LnGini}_{t-5}$			-.43(2.98)**		.37(1.57)	.54(3.34)**		-.26(1.83)*
$\Delta \text{LnGini}_{t-6}$								
ΔLnRGDP	.02(.27)		-.01(.09)		-.10(1.13)		-.01(.11)	
$\Delta \text{LnRGDP}_{t-1}$			-.27(2.08)**		.21(1.90)*			
$\Delta \text{LnRGDP}_{t-2}$			-.29(2.20)**		.05(.44)			
$\Delta \text{LnRGDP}_{t-3}$			-.34(2.63)**		.21(1.80)*			
$\Delta \text{LnRGDP}_{t-4}$			-.20(1.45)		-.16(1.62)			
$\Delta \text{LnRGDP}_{t-5}$			-.27(2.00)**					
$\Delta \text{LnRGDP}_{t-6}$								
ΔPOS_t		.05(.53)		-.02(.20)		.11(.79)		-.25(1.83)*
ΔPOS_{t-1}				-.24(2.25)**		.37(2.59)**		
ΔPOS_{t-2}				-.30(2.68)**				
ΔPOS_{t-3}				-.26(2.31)**				
ΔPOS_{t-4}				-.17(1.48)				
ΔPOS_{t-5}				-.35(3.11)**				
ΔPOS_{t-6}								
ΔNEG_t		-.62(.83)		-5.83(1.11)		-.41(3.54)**		.47(2.51)**
ΔNEG_{t-1}				4.84(.91)		.21(1.48)		
ΔNEG_{t-2}				13.43(2.51)**		.30(2.12)**		
ΔNEG_{t-3}				-14.17(2.47)**		.61(4.62)**		
ΔNEG_{t-4}								
ΔNEG_{t-5}								
ΔNEG_{t-6}								
Panel B: Long-Run Estimates								
Constant	3.06(28.80)**	3.46(214.36)**	3.17(51.84)**	3.48(312.78)**	3.63(21.06)**	3.74(109.81)**	3.82(37.55)**	3.88(242.23)**
LnRGDP_t	.12(4.68)**		.11(11.10)**		.04(.88)		.01(.39)	
POS_t		.07(2.94)**		.08(7.55)**		.02(.88)		-.04(2.28)**
NEG_t		-1.55(2.99)**		-13.04(2.99)**		-.31(2.06)**		-.27(2.89)**
Panel C: Diagnostic Statistics								
F	3.91	4.43	4.34	10.18**	5.78*	9.06**	4.97	5.98*
ECM_{t-1}	-.33(2.75)	-.51(3.62)**	-.57(3.02)*	-1.01(5.81)**	-.38(3.48)**	-.89(5.47)**	-.40(3.18)*	-.83(4.39)**
LM	.08	0	.04	.33	.11	.60	0	.83
RESET	1.89	0	2.69	.26	.25	2.78*	1.28	.58
CUSUMM	S	S	S	S	S	S	S	S
CUSUMSQ	S	S	US	S	US	US	US	S
Wald-Short		.85		.01		.21		4.39**
Wald-Long		9.92**		9.10**		10.20**		8.87**
Adjusted R ²	.12	.25	.50	.68	.41	.70	.16	.41

Table 2 continued.								
	Singapore		South Africa		Spain		Sweden	
	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL
Panel A: Short-Run Estimates								
ΔLnGini								
$\Delta \text{LnGini}_{t-1}$	.56(4.29)**	.54(4.25)**	-.34(1.14)	.27(1.10)				.16(1.10)
$\Delta \text{LnGini}_{t-2}$			-.25(1.06)	.15(.59)				
$\Delta \text{LnGini}_{t-3}$			-.03(.13)	.37(1.62)				
$\Delta \text{LnGini}_{t-4}$			-.66(3.35)**	-.30(1.43)				
$\Delta \text{LnGini}_{t-5}$			-.30(1.45)					
$\Delta \text{LnGini}_{t-6}$								
ΔLnRGDP	-.20(2.94)**				.07(1.05)			-.14(1.34)
$\Delta \text{LnRGDP}_{t-1}$	.08(1.06)		.18(1.66)**					-.17(1.64)
$\Delta \text{LnRGDP}_{t-2}$	.09(1.56)		-.23(2.17)**					
$\Delta \text{LnRGDP}_{t-3}$								
$\Delta \text{LnRGDP}_{t-4}$								
$\Delta \text{LnRGDP}_{t-5}$								
$\Delta \text{LnRGDP}_{t-6}$								
ΔPOS_t		-.08(.88)		-.08(.59)		.54(3.04)**		-.11(.84)
ΔPOS_{t-1}		.07(.78)		.19(1.54)		.25(1.46)		
ΔPOS_{t-2}		.18(2.19)**		-.26(1.94)*		.08(.46)		
ΔPOS_{t-3}		.07(.81)				.39(2.60)**		
ΔPOS_{t-4}		.05(.66)						
ΔPOS_{t-5}								
ΔPOS_{t-6}								
ΔNEG_t		-1.84(2.55)**		-.09(.20)		-4.15(2.53)*		-.63(1.24)
ΔNEG_{t-1}						-6.86(3.12)*		
ΔNEG_{t-2}						-4.04(1.94)*		
ΔNEG_{t-3}						-4.86(2.58)**		
ΔNEG_{t-4}						-3.41(2.09)**		
ΔNEG_{t-5}						-3.14(1.89)*		
ΔNEG_{t-6}								
Panel B: Long-Run Estimates								
Constant	3.49(12.74)**	3.45(57.68)**	2.81(4.16)**	3.77(29.44)**	3.79(21.17)**	4.33(12.82)**	2.72(13.67)**	3.30(67.31)**
LnRGDP_t	.03(.47)		.22(1.64)		-.03(.68)		.16(3.31)**	
POS_t		-.10(4.52)**		.05(.31)		.04(1.26)		.05(.40)
NEG_t		-5.58(6.20)**		-.55(.55)		4.61(2.06)**		-.96(.73)
Panel C: Diagnostic Statistics								
F	1.51	3.99	.29	.65	2.60	5.51*	1.12	1.39
ECM_{t-1}	-.03(1.72)	-.24(3.58)**	.16(.77)	-.45(1.36)	-.20(2.29)	-.69(4.23)**	-.09(1.42)	-.17(2.01)
LM	.44	.10	.02	.36	.41	0	.13	.27
RESET	1.40	9.79**	6.21**	9.91**	.36	22.02**	1.94	.01
CUSUMM	S	S	S	S	S	S	S	S
CUSUMSQ	S	S	US	US	US	S	S	S
Wald-Short		5.88**		.08		10.80**		.87
Wald-Long		29.06**		1.89		4.31**		1.85
Adjusted R ²	.51	.62	.34	.31	.08	.25	.23	.21

Table 2 continued.								
	Turkey		United Kingdom		Uruguay		Venezuela	
	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL
Panel A: Short-Run Estimates								
ΔLnGini								
$\Delta \text{LnGini}_{t-1}$					.24(1.45)		-.43(2.13)**	-.37(2.39)**
$\Delta \text{LnGini}_{t-2}$					.28(2.73)**		-.45(2.07)**	-.54(3.19)**
$\Delta \text{LnGini}_{t-3}$					.42(.12)		-.38(1.77)*	-.61(3.31)**
$\Delta \text{LnGini}_{t-4}$					.35(2.80)**		-.37(1.65)*	-.68(3.26)**
$\Delta \text{LnGini}_{t-5}$								-.36(1.73)*
$\Delta \text{LnGini}_{t-6}$								
ΔLnRGDP	-.14(1.83)*		-.06(.52)		-.05(.83)		.05(.45)	
$\Delta \text{LnRGDP}_{t-1}$	-.15(1.75)*		-.23(2.01)**		-.17(1.87)*		-.25(2.81)**	
$\Delta \text{LnRGDP}_{t-2}$	.06(.73)				-.27(3.46)**		-.29(2.81)**	
$\Delta \text{LnRGDP}_{t-3}$	.22(2.83)**				-.32(3.94)**		.04(.32)	
$\Delta \text{LnRGDP}_{t-4}$					-.12(1.50)		-.27(2.20)**	
$\Delta \text{LnRGDP}_{t-5}$					-.11(1.50)			
$\Delta \text{LnRGDP}_{t-6}$								
ΔPOS_t		-.18(1.62)		-.11(.51)		.30(3.37)**		-.05(.33)
ΔPOS_{t-1}		-.22(2.24)**				.21(2.43)**		.07(.40)
ΔPOS_{t-2}		.01(.04)				.01(.13)		-.51(3.00)**
ΔPOS_{t-3}		.19(1.84)*				-.14(1.70)*		.21(1.40)
ΔPOS_{t-4}						.10(1.17)		-.42(2.95)**
ΔPOS_{t-5}								
ΔPOS_{t-6}								
ΔNEG_t		.15(.64)		-.29(.52)		-.10(1.17)		-.2(.12)
ΔNEG_{t-1}						-.78(4.31)**		
ΔNEG_{t-2}						-.83(5.06)**		
ΔNEG_{t-3}						-.59(3.70)**		
ΔNEG_{t-4}						-.37(2.91)**		
ΔNEG_{t-5}								
ΔNEG_{t-6}								
Panel B: Long-Run Estimates								
Constant	3.41(38.96)**	3.72(84.27)**	2.83(2.29)**	3.22(128.50)**	2.39(50.95)**	3.63(269.03)**	-36.23(.07)	3.72(60.46)**
LnRGDP_t	.12(5.40)**		.23(1.01)		.34(29.84)**		10.64(.07)	
POS_t		.24(3.31)*		.11(3.21)**		.41(20.81)**		-.04(.38)
NEG_t		1.10(.56)		-3.40(6.25)**		.60(8.94)**		-1.29(3.14)**
Panel C: Diagnostic Statistics								
F	1.79	2.79	.46	2.33	13.10**	18.49**	4.71	19.05**
ECM_{t-1}	-.22(1.76)	-.25(2.89)	-.05(.97)	-.8(1.41)	-1.07(5.31)**	-1.07(5.81)**	-.01(3.09)*	-.59(5.85)**
LM	.10	2.89*	.60	.46	.02	3.46*	.01	.25
RESET	.90	1.16	.31	7.80**	3.78*	10.18**	1.14	.82
CUSUMM	S	S	S	S	S	S	S	S
CUSUMSQ	S	S	S	S	S	US	S	S
Wald-Short		.45		.04		12.38**		3.98**
Wald-Long		2.37		8.65**		1.70		21.54**
Adjusted R ²	.31	.40	.10	.04	.67	.77	.36	.62

a. Numbers inside parentheses are t-ratios. **, * denote significance at the 5, 10% levels, respectively. **b.** At the 10% (5%) significance level when there is one exogenous variable ($k=1$), the upper bound critical value of the F test is 5.05 (6.16). These come from Narayan(2005, p. 1988) for our small sample size. **c.** The number inside the parenthesis next to ECM_{t-1} is the absolute value of the t-ratio. Its upper bound critical value at the 10% (5%) significance level is -2.93 (-3.28) when $k=1$ and these come from Banerjee et al. (1989, p. 276). In the non-linear model where $k=2$, these critical values change to -3.20 (-3.57). **d.** LM is Lagrange Multiplier test of residual serial correlation. It is distributed as χ^2 with one degree of freedom (first order). Its critical value at 10% (5%) significance level is 2.70 (3.84). These critical values are also used for Wald tests since they also have a χ^2 distribution with one degree of freedom. **e.** RESET is Ramsey's test for misspecification. It is distributed as χ^2 with one degree of freedom.

Table 3. Estimates of Linear and Non-linear Gini-Growth Model (U.S. State Level)

	USA		Alabama		Alaska		Arizona	
	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL
Panel A: Short-Run Estimates								
ΔLnGini								
$\Delta \text{LnGini}_{t-1}$	.19(1.49)	.20(1.58)			.29(1.99)**	.26(2.08)**	.09(.81)	
$\Delta \text{LnGini}_{t-2}$							-.19(1.76)*	
$\Delta \text{LnGini}_{t-3}$								
$\Delta \text{LnGini}_{t-4}$								
$\Delta \text{LnGini}_{t-5}$								
$\Delta \text{LnGini}_{t-6}$								
$\Delta \text{LnRPCIN}$	.17(2.06)**		.04(2.52)**		.33(4.08)**		.04(1.84)*	
$\Delta \text{LnRPCIN}_{t-1}$					-.14(1.54)			
$\Delta \text{LnRPCIN}_{t-2}$					.13(1.80)*			
$\Delta \text{LnRPCIN}_{t-3}$								
$\Delta \text{LnRPCIN}_{t-4}$								
$\Delta \text{LnRPCIN}_{t-5}$								
$\Delta \text{LnRPCIN}_{t-6}$								
ΔPOS_t		.25(2.30)**		.05(2.31)**		.06(2.22)**		.04(1.67)*
ΔPOS_{t-1}								
ΔPOS_{t-2}								
ΔPOS_{t-3}								
ΔPOS_{t-4}								
ΔPOS_{t-5}								
ΔPOS_{t-6}								
ΔNEG_t		-.07(.51)		.34(1.18)		1.13(3.75)**		-.05(.31)
ΔNEG_{t-1}								
ΔNEG_{t-2}								
ΔNEG_{t-3}								
ΔNEG_{t-4}								
ΔNEG_{t-5}								
ΔNEG_{t-6}								
Panel B: Long-Run Estimates								
Constant	-4.80(7.47)**	-1.11(4.10)**	-3.42(8.89)**	-.29(.45)	-6.13(2.64)**	-.99(6.51)**	-3.13(7.54)**	-1.00(3.96)**
LnRPCIN_t	.41(6.45)**		.28(7.18)**		.34(2.41)**		.25(6.06)**	
POS_t		.31(2.34)**		.36(2.99)**		.41(2.41)**		.20(2.05)**
NEG_t		-.80(.52)		2.55(.99)		1.26(1.52)		-.29(.31)
Panel C: Diagnostic Statistics								
F	2.18	1.13	3.71	1.94	2.02	1.43	2.54	4.07
ECM_{t-1}	-.08(2.07)	-.09(1.99)	-.16(2.68)	-.13(2.14)	-.10(1.57)	-.15(2.61)	-.14(1.92)	-.18(2.58)
LM	1.35	.55	.08	.03	2.26	5.91**	.01	.68
RESET	.04	.27	3.09*	3.95**	1.46	4.81**	2.61	3.61*
QS(QS ²)	S(US)	S(US)	S(S)	S(S)	S(US)	S(US)	S(US)	S(US)
Adjusted R ²	.99	.99	.97	.97	.94	.94	.97	.96
Panel D: Wald Tests								
$\sum \pi_j = 0$	4.23**		6.36**		5.70**		3.38**	
$\sum \pi_j^+ = 0$		5.30**		5.34**		10.41**		2.79*
$\sum \pi_j^- = 0$		.26		1.39		4.62**		.10
Wald-SR		2.81*		1.10		1.24		.33
Wald-LR		.62		.78		.98		.35

Table 3 continued.								
	Arkansas		California		Colorado		Connecticut	
	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL
Panel A: Short-Run Estimates								
ΔLnGini								
$\Delta \text{LnGini}_{t-1}$			.21(1.71)*	.27(2.19)**				
$\Delta \text{LnGini}_{t-2}$								
$\Delta \text{LnGini}_{t-3}$								
$\Delta \text{LnGini}_{t-4}$								
$\Delta \text{LnGini}_{t-5}$								
$\Delta \text{LnGini}_{t-6}$								
$\Delta \text{LnRPCIN}$	.04(2.12)**		.29(2.94)**		.42(3.32)**		.12(3.88)**	
$\Delta \text{LnRPCIN}_{t-1}$			-.27(2.77)**		-.37(2.73)**			
$\Delta \text{LnRPCIN}_{t-2}$					-.07(.48)			
$\Delta \text{LnRPCIN}_{t-3}$					-.33(2.34)**			
$\Delta \text{LnRPCIN}_{t-4}$					.46(3.33)**			
$\Delta \text{LnRPCIN}_{t-5}$					-.36(3.08)**			
$\Delta \text{LnRPCIN}_{t-6}$								
ΔPOS_t		.03(1.22)		.25(1.81)		.54(2.88)**		.10(2.86)**
ΔPOS_{t-1}						-.25(1.50)		
ΔPOS_{t-2}						-.14(.79)		
ΔPOS_{t-3}						-.37(2.17)**		
ΔPOS_{t-4}						.36(2.12)**		
ΔPOS_{t-5}						-.52(3.40)**		
ΔPOS_{t-6}								
ΔNEG_t		.72(1.45)		.32(1.00)		.22(.73)		.05(.39)
ΔNEG_{t-1}				-.88(2.40)**		-.49(1.42)		
ΔNEG_{t-2}				.67(1.83)*		-.69(1.97)**		
ΔNEG_{t-3}				-.48(1.36)				
ΔNEG_{t-4}				.57(1.70)*				
ΔNEG_{t-5}								
ΔNEG_{t-6}								
Panel B: Long-Run Estimates								
Constant	-2.80(5.99)**	-.80(2.07)**	-6.01(8.60)**	-1.09(3.6)**	-3.63(9.61)**	-.71(6.20)**	-4.77(19.2)**	-.93(7.78)**
LnRPCIN_t	.22(4.66)**		.52(7.75)**		.29(8.17)**		.39(16.61)**	
POS_t		.21(1.37)		.38(1.72)*		.32(6.34)**		.36(5.23)**
NEG_t		.14(.09)		-.70(.36)		.96(1.52)		.18(.39)
Panel C: Diagnostic Statistics								
F	3.67	2.23	2.59	1.44	3.67	3.74	5.71*	4.66*
ECM_{t-1}	-.17(2.47)	-.16(2.34)	-.11(2.35)	-.10(2.01)	-.21(2.71)	-.23(2.91)	-.31(3.77)**	-.28(3.16)
LM	.46	.40	.34	1.79	.28	.97	.10	.16
RESET	3.36**	6.18**	.03	.64	.13	1.48	1.85	2.12
QS(QS ²)	S(S)	US(S)	US(S)	S(US)	S(S)	S(S)	US(S)	S(S)
Adjusted R ²	.94	.94	.99	.99	.97	.97	.98	.98
Panel D: Wald Tests								
$\sum \pi_i = 0$	4.49**		.03		.88		15.03**	
$\sum \pi_i^+ = 0$		.31		3.29*		1.01		8.16**
$\sum \pi_i^- = 0$		2.64		.04		4.01**		.15
Wald-SR		2.03		.01		1.04		.18
Wald-LR		.01		.39		1.17		.18

Table 3 continued.								
	Delaware		Florida		Georgia		Hawaii	
	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL
Panel A: Short-Run Estimates								
ΔLnGini								
$\Delta \text{LnGini}_{t-1}$	-.30(2.30)**	-.32(2.51)**				.21(1.61)		.10(.60)
$\Delta \text{LnGini}_{t-2}$	-.21(1.73)*	-.26(2.06)**						-.07(.42)
$\Delta \text{LnGini}_{t-3}$								-.24(1.58)
$\Delta \text{LnGini}_{t-4}$								.12(.83)
$\Delta \text{LnGini}_{t-5}$								-.31(2.07)**
$\Delta \text{LnGini}_{t-6}$								
$\Delta \text{LnRPCIN}$	.20(1.52)		.19(2.14)**		.15(1.98)**		.02(.17)	
$\Delta \text{LnRPCIN}_{t-1}$	-.12(1.06)						-.05(.36)	
$\Delta \text{LnRPCIN}_{t-2}$	-.10(.86)						-.16(1.27)	
$\Delta \text{LnRPCIN}_{t-3}$	-.37(3.29)**						-.21(1.66)*	
$\Delta \text{LnRPCIN}_{t-4}$	.29(2.65)**						.07(.55)	
$\Delta \text{LnRPCIN}_{t-5}$							-.22(2.00)**	
$\Delta \text{LnRPCIN}_{t-6}$								
ΔPOS_t		.48(2.43)**		.26(1.94)*		.23(2.31)**		.42(2.24)**
ΔPOS_{t-1}		-.13(.76)				-.17(1.63)		-.10(.62)
ΔPOS_{t-2}		.17(1.11)						-.08(.54)
ΔPOS_{t-3}		-.46(3.11)**						-.35(2.25)**
ΔPOS_{t-4}		.51(3.41)**						-.06(.40)
ΔPOS_{t-5}								
ΔPOS_{t-6}								
ΔNEG_t		-.16(1.13)		-.01(.10)		.04(.42)		-.65(1.67)*
ΔNEG_{t-1}								
ΔNEG_{t-2}								
ΔNEG_{t-3}								
ΔNEG_{t-4}								
ΔNEG_{t-5}								
ΔNEG_{t-6}								
Panel B: Long-Run Estimates								
Constant	-3.11(2.53)**	-1.27(2.76)**	-5.73(2.51)**	-1.04(2.3)**	-4.06(3.79)**	-.82(2.57)**	-2.64(8.36)**	-.77(14.58)**
LnRPCIN_t	.24(2.53)**		.51(2.24)**		.34(3.19)**		.20(6.48)**	
POS_t		.02(.12)		.38(1.26)		.33(2.13)**		.30(1.93)*
NEG_t		-1.27(2.76)**		-.17(.10)		.51(.37)		.75(.70)
Panel C: Diagnostic Statistics								
F	1.81	2.13	3.09	2.38	5.49*	2.48	7.27**	6.08**
ECM_{t-1}	-.13(1.64)	-.13(1.65)	-.26(1.64)	-.06(1.10)	-.05(1.29)	-.08(1.56)	-.34(3.81)**	.32(1.94)
LM	.18	.63	.57	.52	1.83	.04	1.18	.02
RESET	.71	3.98**	1.61	1.12	3.70*	4.57**	.01	1.36
QS(QS ²)	S(S)	S(S)	S(S)	US(S)	S(S)	S(S)	S(S)	S(US)
Adjusted R ²	.81	.83	.98	.98	.99	.99	.93	.94
Panel D: Wald Tests								
$\sum \pi_i = 0$	.18		4.57**		3.93**		8.09**	
$\sum \pi_i^+ = 0$		2.23		3.75*		.21		4.65**
$\sum \pi_i^- = 0$		1.27		.01		.01		2.78*
Wald-SR		2.27		2.01		.17		.04
Wald-LR		1.16		.14		.02		.24

Table 3 continued.								
	Idaho		Illinois		Indiana		Iowa	
	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL
Panel A: Short-Run Estimates								
ΔLnGini								
$\Delta \text{LnGini}_{t-1}$	-.21(1.80)	-.19(1.74)*				.04(.32)	-.19(1.38)	-.01(.06)
$\Delta \text{LnGini}_{t-2}$						.14(1.19)	.06(.43)	.21(1.42)
$\Delta \text{LnGini}_{t-3}$						.06(.49)	-.26(2.05)**	-.26(1.93)*
$\Delta \text{LnGini}_{t-4}$						-.05(.38)		.16(1.32)
$\Delta \text{LnGini}_{t-5}$						-.37(2.87)**		
$\Delta \text{LnGini}_{t-6}$								
$\Delta \text{LnRPCIN}$	.20(1.53)		.18(2.25)**		.12(1.88)*		.03(1.22)	
$\Delta \text{LnRPCIN}_{t-1}$	.18(1.36)				-.09(1.48)			
$\Delta \text{LnRPCIN}_{t-2}$	-.53(4.19)**							
$\Delta \text{LnRPCIN}_{t-3}$								
$\Delta \text{LnRPCIN}_{t-4}$								
$\Delta \text{LnRPCIN}_{t-5}$								
$\Delta \text{LnRPCIN}_{t-6}$								
ΔPOS_t		.25(1.28)		.33(3.15)**		.23(2.46)**		-.02(.61)
ΔPOS_{t-1}		-.01(.04)						
ΔPOS_{t-2}		-.47(2.37)**						
ΔPOS_{t-3}								
ΔPOS_{t-4}								
ΔPOS_{t-5}								
ΔPOS_{t-6}								
ΔNEG_t		-.01(.01)		-.13(1.24)		-.13(1.52)		-.54(2.50)**
ΔNEG_{t-1}		.80(2.36)**						.48(2.07)**
ΔNEG_{t-2}		-.54(1.75)						-.06(.27)
ΔNEG_{t-3}								.11(.88)
ΔNEG_{t-4}								.26(2.15)**
ΔNEG_{t-5}								
ΔNEG_{t-6}								
Panel B: Long-Run Estimates								
Constant	-4.42(10.3)**	-.91(5.31)**	-5.62(7.62)**	-1.24(6.1)**	-4.40(8.80)**	-1.28(6.2)**	-2.87(4.19)**	-1.14(19.6)**
LnRPCIN_t	.38(8.92)**		.48(6.70)**		.37(7.55)**		.22(3.31)**	
POS_t		.23(1.91)*		.25(1.74)*		.13(.80)		-.04(.59)
NEG_t		-.27(.39)		-1.26(1.16)		-.96(1.21)		-.86(3.75)**
Panel C: Diagnostic Statistics								
F	6.97**	4.43*	3.26	5.16*	3.79	2.73	1.94	4.42*
ECM_{t-1}	-.28(2.90)	-.31(2.47)	-.09(1.90)	-.10(2.03)	-.12(2.14)	-.14(2.15)	-.15(1.59)	-.49(3.32)
LM	.19	.38	.99	.50	.84	1.90	.58	.04
RESET	.59	1.81	.17	.49	.01	1.31	.14	1.42
QS(QS ²)	US(US)	S(S)	S(S)	S(S)	S(US)	S(S)	S(US)	S(S)
Adjusted R ²	.95	.95	.99	.99	.99	.99	.94	.95
Panel D: Wald Tests								
$\sum \pi_i = 0$	.39		5.07**		.12		1.49	
$\sum \pi_i^+ = 0$		.31		9.93**		6.06**		.37
$\sum \pi_i^- = 0$		.06		1.54		2.34		.25
Wald-SR		.19		8.66**		7.02**		.29
Wald-LR		.75		2.49		2.95**		23.49**

Table 3 continued.								
	Kansas		Kentucky		Louisiana		Maine	
	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL
Panel A: Short-Run Estimates								
ΔLnGini								
$\Delta \text{LnGini}_{t-1}$	-.21(1.68)*	-.20(1.51)						
$\Delta \text{LnGini}_{t-2}$								
$\Delta \text{LnGini}_{t-3}$								
$\Delta \text{LnGini}_{t-4}$								
$\Delta \text{LnGini}_{t-5}$								
$\Delta \text{LnGini}_{t-6}$								
$\Delta \text{LnRPCIN}$	-.01(.10)		.03(1.89)*		.15(1.09)		-.15(.79)	
$\Delta \text{LnRPCIN}_{t-1}$	-.18(1.96)**				-.26(1.85)*			
$\Delta \text{LnRPCIN}_{t-2}$	-.17(1.80)*				-.01(.03)			
$\Delta \text{LnRPCIN}_{t-3}$					-.29(1.96)**			
$\Delta \text{LnRPCIN}_{t-4}$					-.08(.61)			
$\Delta \text{LnRPCIN}_{t-5}$					-.17(1.53)			
$\Delta \text{LnRPCIN}_{t-6}$								
ΔPOS_t		.05(.35)		.01(.72)		-.11(.60)		.09(2.16)**
ΔPOS_{t-1}		-.31(2.01)**				-.22(1.22)		
ΔPOS_{t-2}		.05(.32)				-.23(1.24)		
ΔPOS_{t-3}		.16(.93)				.01(.01)		
ΔPOS_{t-4}		-.43(2.63)**				-.45(2.44)**		
ΔPOS_{t-5}						-.31(1.92)*		
ΔPOS_{t-6}								
ΔNEG_t		-.34(.82)		-.47(.76)		.66(1.16)		-.44(1.03)
ΔNEG_{t-1}		-.06(.15)		1.40(2.11)**		-.17(.32)		
ΔNEG_{t-2}		.47(1.27)				.05(.10)		
ΔNEG_{t-3}		-.80(2.32)**				-1.02(1.85)*		
ΔNEG_{t-4}		.58(2.03)**				1.21(2.03)**		
ΔNEG_{t-5}		.60(1.98)**						
ΔNEG_{t-6}								
Panel B: Long-Run Estimates								
Constant	-3.37(10.5)**	-.79(3.2)**	-2.99(5.66)**	-1.39(4.9)**	-3.38(7.85)**	-.07(.07)	-3.26(14.2)**	-1.06(7.91)**
LnRPCIN_t	.27(8.72)**		.23(4.46)**		.28(6.19)**		.25(11.27)**	
POS_t		.21(1.79)*		.08(.78)		.31(1.49)		.16(2.25)**
NEG_t		-.02(.02)		-2.65(1.73)*		1.83(.55)		-.84(1.11)
Panel C: Diagnostic Statistics								
F	5.48*	2.11	3.69	2.57	4.12	2.53	12.71**	7.88**
ECM_{t-1}	-.25(2.92)	-.21(2.22)	-.15(2.26)	-.21(2.84)	-.18(2.80)	-.12(1.62)	-.48(4.59)**	-.53(4.45)**
LM	.05	1.65	.01	.03	.25	.46	1.04	1.01
RESET	2.90*	.36	.98	1.97	1.04	9.91**	6.41	6.70**
QS(QS ²)	S(S)	S(S)	S(S)	S(S)	S(US)	S(US)	S(S)	US(US)
Adjusted R ²	.96	.97	.95	.95	.97	.98	.91	.91
Panel D: Wald Tests								
$\sum \pi_j = 0$	4.46**		3.56*		5.31**		.63	
$\sum \pi_j^+ = 0$		2.21		.52		11.12**		4.69**
$\sum \pi_j^- = 0$		.41		.99		.30		1.06
Wald-SR		.01		.96		1.72		1.73
Wald-LR		.05		3.56*		.23		2.12

Table 3 continued.								
	Maryland		Massachusetts		Michigan		Minnesota	
	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL
Panel A: Short-Run Estimates								
ΔLnGini								
$\Delta \text{LnGini}_{t-1}$			.18(1.39)		-.17(1.31)		-.25(2.10)**	-.19(1.44)
$\Delta \text{LnGini}_{t-2}$					.21(1.67)*			
$\Delta \text{LnGini}_{t-3}$								
$\Delta \text{LnGini}_{t-4}$								
$\Delta \text{LnGini}_{t-5}$								
$\Delta \text{LnGini}_{t-6}$								
$\Delta \text{LnRPCIN}$	.04(2.21)**		.27(2.43)**		.05(2.07)**		.03(1.51)	
$\Delta \text{LnRPCIN}_{t-1}$			-.29(2.66)**					
$\Delta \text{LnRPCIN}_{t-2}$			.17(1.66)*					
$\Delta \text{LnRPCIN}_{t-3}$								
$\Delta \text{LnRPCIN}_{t-4}$								
$\Delta \text{LnRPCIN}_{t-5}$								
$\Delta \text{LnRPCIN}_{t-6}$								
ΔPOS_t		.03(1.24)		.36(2.62)**		-.08(.76)		.20(1.92)*
ΔPOS_{t-1}				-.23(1.39)		.18(1.67)*		
ΔPOS_{t-2}						-.10(1.01)		
ΔPOS_{t-3}						.24(2.41)**		
ΔPOS_{t-4}								
ΔPOS_{t-5}								
ΔPOS_{t-6}								
ΔNEG_t		-.21(1.28)		.01(.04)		.12(1.25)		-.19(1.61)
ΔNEG_{t-1}								
ΔNEG_{t-2}								
ΔNEG_{t-3}								
ΔNEG_{t-4}								
ΔNEG_{t-5}								
ΔNEG_{t-6}								
Panel B: Long-Run Estimates								
Constant	-3.48(8.1)**	-1.20(5.1)**	-4.16(11.3)**	-.93(2.4)**	-5.35(7.3)**	-1.20(5.8)**	-2.92(6.8)**	-1.02(9.9)**
LnRPCIN_t	.27(6.66)**		.34(9.61)**		.46(6.32)**		.22(5.48)**	
POS_t		.16(1.78)*		.32(1.81)*		.06(.24)		.10(1.27)
NEG_t		-1.19(1.14)		.08(.04)		-1.00(1.11)		-1.15(1.44)
Panel C: Diagnostic Statistics								
F	3.26	2.08	3.33	2.73	1.02	1.77	4.13	3.00
ECM_{t-1}	-.16(2.23)	-.18(2.45)	-.17(2.43)	-.15(2.12)	-.11(2.03)	-.12(2.00)	-.12(1.70)	-.17(2.13)
LM	.92	.53	.02	1.88	.01	.52	.70	.77
RESET	.29	1.05	2.69	1.88	1.18	3.03**	.66	.01
QS(QS ²)	S(S)	S(S)	S(S)	S(S)	S(S)	S(S)	S(S)	S(S)
Adjusted R ²	.97	.97	.98	.98	.98	.98	.98	.98
Panel D: Wald Tests								
$\sum \pi_i = 0$	4.88**		.92		4.27**		2.27	
$\sum \pi_i^+ = 0$		1.54		.44		1.12		3.68*
$\sum \pi_i^- = 0$		1.63		.01		1.57		2.59
Wald-SR		2.41		.07		1.53		5.05**
Wald-LR		1.96		.02		2.51		3.06**

Table 3 continued.								
	Mississippi		Missouri		Montana		Nebraska	
	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL
Panel A: Short-Run Estimates								
ΔLnGini								
$\Delta \text{LnGini}_{t-1}$	.13(1.04)	.29(2.60)**						
$\Delta \text{LnGini}_{t-2}$	.34(2.77)**	.30(2.69)**						
$\Delta \text{LnGini}_{t-3}$	.14(1.10)							
$\Delta \text{LnGini}_{t-4}$	-.04(.35)							
$\Delta \text{LnGini}_{t-5}$	-.34(2.68)**							
$\Delta \text{LnGini}_{t-6}$								
$\Delta \text{LnRPCIN}$	.30(2.30)**		.04(2.25)**		.09(2.56)**		-.16(1.39)	
$\Delta \text{LnRPCIN}_{t-1}$	.12(.92)						-.18(1.74)*	
$\Delta \text{LnRPCIN}_{t-2}$	-.24(2.08)**							
$\Delta \text{LnRPCIN}_{t-3}$	-.21(1.80)*							
$\Delta \text{LnRPCIN}_{t-4}$								
$\Delta \text{LnRPCIN}_{t-5}$								
$\Delta \text{LnRPCIN}_{t-6}$								
ΔPOS_t		.31(2.03)**		.05(1.69)*		.04(1.01)		-.27(1.78)*
ΔPOS_{t-1}		.06(.37)						-.19(1.12)
ΔPOS_{t-2}		-.48(3.13)**						.22(1.36)
ΔPOS_{t-3}		-.31(1.98)*						-.32(2.27)**
ΔPOS_{t-4}		-.07(.42)						
ΔPOS_{t-5}		-.53(3.62)**						
ΔPOS_{t-6}								
ΔNEG_t		.50(1.77)*		.06(.32)		.57(1.19)		.09(.29)
ΔNEG_{t-1}								-.11(.40)
ΔNEG_{t-2}								-.70(2.55)**
ΔNEG_{t-3}								.62(3.04)**
ΔNEG_{t-4}								
ΔNEG_{t-5}								
ΔNEG_{t-6}								
Panel B: Long-Run Estimates								
Constant	-3.18(5.9)**	-.09(.2)	-3.81(7.3)**	-.83(4.1)**	-4.75(7.5)**	-1.01(10.0)**	-3.00(9.6)**	-.91(7.0)**
LnRPCIN_t	.26(4.89)**		.31(6.10)**		.41(6.56)**		.23(7.73)**	
POS_t		.31(3.28)**		.33(1.95)*		.14(1.05)		.10(1.57)
NEG_t		-2.07(1.69)*		.42(.31)		-.82(1.38)		-.37(1.08)
Panel C: Diagnostic Statistics								
F	3.89	6.25**	3.80	2.01	3.96	3.41	6.83**	7.21**
ECM_{t-1}	-.18(2.50)	-.24(4.14)**	-.13(2.34)	-.14(2.33)	-.23(2.96)	-.32(3.39)	-.33(3.52)*	-.42(3.78)*
LM	.13	4.78**	.34	.42	.43	.01	1.25	.39
RESET	4.34**	3.76**	1.07	.96	.01	3.35**	.01	1.10
QS(QS ²)	S(S)	S(S)	S(S)	S(S)	S(S)	S(S)	S(US)	S(S)
Adjusted R ²	.96	.96	.97	.97	.94	.94	.92	.94
Panel D: Wald Tests								
$\sum \pi_i = 0$	.01		5.05**		6.54**		3.80*	
$\sum \pi_i^+ = 0$		4.76**		2.84*		1.01		1.81
$\sum \pi_i^- = 0$		3.12*		.10		1.42		.04
Wald-SR		5.07**		.01		1.23		.52
Wald-LR		2.39		.01		4.23**		2.75*

Table 3 continued.								
	Nevada		New Hampshire		New Jersey		New Mexico	
	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL
Panel A: Short-Run Estimates								
ΔLnGini								
$\Delta \text{LnGini}_{t-1}$	-.70(4.17)**	.46(2.86)**	-.38(3.28)**	-.43(3.44)**	.17(1.35)	.04(.32)	-.20(1.59)	-.20(1.58)
$\Delta \text{LnGini}_{t-2}$	-.60(3.56)**	.37(2.48)**			.21(1.68)	.05(.35)		
$\Delta \text{LnGini}_{t-3}$	.55(3.48)**	-.40(2.88)**				-.02(.14)		
$\Delta \text{LnGini}_{t-4}$	-.48(3.32)**	-.25(1.92)*				-.12(.82)		
$\Delta \text{LnGini}_{t-5}$	-.28(2.32)**	-.26(2.39)**				-.35(2.79)**		
$\Delta \text{LnGini}_{t-6}$								
$\Delta \text{LnRPCIN}$	-.03(.45)		.31(2.19)**		.08(3.21)**		.10(2.46)**	
$\Delta \text{LnRPCIN}_{t-1}$								
$\Delta \text{LnRPCIN}_{t-2}$								
$\Delta \text{LnRPCIN}_{t-3}$								
$\Delta \text{LnRPCIN}_{t-4}$								
$\Delta \text{LnRPCIN}_{t-5}$								
$\Delta \text{LnRPCIN}_{t-6}$								
ΔPOS_t		.35(1.47)		.35(1.87)*		.61(4.23)**		-.40(1.11)
ΔPOS_{t-1}						.26(1.70)*		
ΔPOS_{t-2}						-.02(.14)		
ΔPOS_{t-3}						.08(.60)		
ΔPOS_{t-4}						.41(2.96)**		
ΔPOS_{t-5}								
ΔPOS_{t-6}								
ΔNEG_t		-.11(.32)		.28(1.02)		-.88(3.03)**		.95(1.69)*
ΔNEG_{t-1}		.56(1.38)				-.31(1.23)		
ΔNEG_{t-2}		.82(2.23)**				.17(.72)		
ΔNEG_{t-3}		.06(.16)				-.76(3.17)**		
ΔNEG_{t-4}		.84(2.16)**						
ΔNEG_{t-5}		.39(1.52)						
ΔNEG_{t-6}								
Panel B: Long-Run Estimates								
Constant	-4.81(1.57)	-1.36(8.5)**	-3.76(9.3)**	-.78(3.0)*	-4.54(17.7)**	-1.93(2.3)**	-3.61(9.0)**	-.43(1.5)
LnRPCIN_t	.37(1.11)		.30(7.64)**		.37(14.99)**		.30(4.46)**	
POS_t		-.17(.71)		.44(1.80)*		.29(2.14)**		.42(4.23)**
NEG_t		-2.64(2.40)**		1.54(.77)		-2.7(.95)		2.65(1.55)
Panel C: Diagnostic Statistics								
F	.59	6.76**	4.40*	3.45	2.68	5.96**	2.80	3.23
ECM_{t-1}	.07(.66)	-.33(2.33)	-.22(2.33)	-.18(1.67)	-.22(3.22)	-.13(1.67)	-.35(2.84)	-.36(2.92)
LM	.76	.06	.50	.48	.01	.80	.07	.07
RESET	.82	3.88**	.44	.73	1.70	2.33	2.11	1.94
QS(QS ²)	S(S)	S(US)	S(S)	S(S)	S(S)	S(S)	S(S)	S(S)
Adjusted R ²	.84	.96	.95	.95	.99	.99	.90	.90
Panel D: Wald Tests								
$\sum \pi_i = 0$	.20		4.82**		10.33**		6.07**	
$\sum \pi_i^+ = 0$		2.17		3.51*		12.34**		1.22
$\sum \pi_i^- = 0$		9.32**		1.05		9.99**		2.85*
Wald-SR		6.47**		.04		13.70**		3.15*
Wald-LR		8.24**		.39		1.30		1.90

Table 3 continued.								
	New York		North Carolina		North Dakota		Ohio	
	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL
Panel A: Short-Run Estimates								
ΔLnGini								
$\Delta \text{LnGini}_{t-1}$			.06(.48)	.06(.48)	-.20(1.58)			
$\Delta \text{LnGini}_{t-2}$			.21(1.75)**	.22(1.72)*				
$\Delta \text{LnGini}_{t-3}$			-.22(1.78)*	-.22(1.70)*				
$\Delta \text{LnGini}_{t-4}$								
$\Delta \text{LnGini}_{t-5}$								
$\Delta \text{LnGini}_{t-6}$								
$\Delta \text{LnRPCIN}$	.41(4.78)**		.18(1.89)*		-.09(1.94)*		.06(2.44)**	
$\Delta \text{LnRPCIN}_{t-1}$					-.10(2.07)**			
$\Delta \text{LnRPCIN}_{t-2}$								
$\Delta \text{LnRPCIN}_{t-3}$								
$\Delta \text{LnRPCIN}_{t-4}$								
$\Delta \text{LnRPCIN}_{t-5}$								
$\Delta \text{LnRPCIN}_{t-6}$								
ΔPOS_t		.56(4.92)**		.02(1.20)		-.08(1.42)		.04(1.22)
ΔPOS_{t-1}								
ΔPOS_{t-2}								
ΔPOS_{t-3}								
ΔPOS_{t-4}								
ΔPOS_{t-5}								
ΔPOS_{t-6}								
ΔNEG_t		-.14(1.18)		.46(1.90)*		-.10(1.81)*		-.07(.53)
ΔNEG_{t-1}								
ΔNEG_{t-2}								
ΔNEG_{t-3}								
ΔNEG_{t-4}								
ΔNEG_{t-5}								
ΔNEG_{t-6}								
Panel B: Long-Run Estimates								
Constant	-6.59(5.9)**	-1.27(6.2)**	-3.40(4.5)**	-.93(4.6)**	-2.83(7.6)**	-.88(26.2)**	-4.80(10.4)**	-1.10(5.39)**
LnRPCIN_t	.57(5.34)**		.27(3.58)**		.22(6.00)**		.40(8.86)**	
POS_t		.32(2.75)**		.19(1.39)		.01(.28)		.25(1.64)
NEG_t		-1.19(1.30)		-.41(.31)		-.20(1.96)**		-.45(.51)
Panel C: Diagnostic Statistics								
F	2.66	3.83	2.13	1.07	3.60	7.22**	5.24**	3.25
ECM_{t-1}	-.07(1.97)	-.12(2.50)	-.08(1.50)	-.09(1.40)	-.25(2.88)	-.50(4.70)**	-.15(2.49)	-.15(2.38)
LM	.28	.05	.42	.01	.45	.41	.01	.01
RESET	.24	.04	1.62	2.08	.05	2.15	.26	.57
QS(QS ²)	S(S)	S(S)	S(S)	S(S)	US(US)	S(S)	S(S)	S(S)
Adjusted R ²	.99	.99	.97	.97	.91	.91	.98	.98
Panel D: Wald Tests								
$\sum \pi_j = 0$	22.85**		3.59*		6.59**		5.98**	
$\sum \pi_j^+ = 0$		24.22**		1.44		2.02		1.49
$\sum \pi_j^- = 0$		1.38		3.61*		3.27*		.28
Wald-SR		13.83**		3.27*		.05		.94
Wald-LR		3.42*		.26		15.82**		.91

Table 3 continued.								
	Oklahoma		Oregon		Pennsylvania		Rhode Island	
	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL
Panel A: Short-Run Estimates								
ΔLnGini								
$\Delta \text{LnGini}_{t-1}$			-.18(1.50)					
$\Delta \text{LnGini}_{t-2}$								
$\Delta \text{LnGini}_{t-3}$								
$\Delta \text{LnGini}_{t-4}$								
$\Delta \text{LnGini}_{t-5}$								
$\Delta \text{LnGini}_{t-6}$								
$\Delta \text{LnRPCIN}$	.04(2.28)		.08(2.57)**		.05(2.30)**		.13(4.22)**	
$\Delta \text{LnRPCIN}_{t-1}$								
$\Delta \text{LnRPCIN}_{t-2}$								
$\Delta \text{LnRPCIN}_{t-3}$								
$\Delta \text{LnRPCIN}_{t-4}$								
$\Delta \text{LnRPCIN}_{t-5}$								
$\Delta \text{LnRPCIN}_{t-6}$								
ΔPOS_t		-.02(.10)		.43(2.78)**		.41(2.48)**		.18(1.10)
ΔPOS_{t-1}		-.10(.59)		-.02(.12)				.19(1.02)
ΔPOS_{t-2}		-.14(.83)		.48(2.96)**				.21(1.47)
ΔPOS_{t-3}		-.03(.20)						.13(.92)
ΔPOS_{t-4}		.15(.92)						.28(2.05)**
ΔPOS_{t-5}		-.47(2.85)**						.37(2.64)**
ΔPOS_{t-6}								
ΔNEG_t		.01(.04)		-.25(2.09)**		-.64(1.75)*		-.68(2.55)**
ΔNEG_{t-1}								
ΔNEG_{t-2}								
ΔNEG_{t-3}								
ΔNEG_{t-4}								
ΔNEG_{t-5}								
ΔNEG_{t-6}								
Panel B: Long-Run Estimates								
Constant	-3.40(7.0)**	-.76(6.2)**	-4.37(11.0)**	-1.07(16.9)**	-4.58(10.3)**	-1.03(2.9)**	-4.07(19.1)**	-1.21(15.5)**
LnRPCIN_t	.28(5.71)**		.36(9.32)**		.38(8.80)**		.33(15.84)**	
POS_t		.22(2.95)**		.21(3.91)**		.41(4.74)**		.18(4.53)**
NEG_t		.02(.03)		-.73(2.25)**		.22(.16)		-1.06(2.98)**
Panel C: Diagnostic Statistics								
F	3.31	2.20	3.62	4.54*	4.72	3.89	10.37**	9.66**
ECM_{t-1}	-.16(2.52)	-.21(2.45)	-.21(2.71)	-.34(3.59)*	-.14(2.34)	-.13(2.22)	-.39(4.29)**	-.64(5.37)**
LM	.14	.44	.01	1.08	.80	.01	.91	3.35*
RESET	.17	3.09*	1.24	2.65	.04	.19	7.62**	1.65
QS(QS ²)	S(S)	S(S)	S(US)	S(S)	S(S)	S(S)	S(S)	S(S)
Adjusted R ²	.96	.96	.97	.97	.99	.99	.96	.97
Panel D: Wald Tests								
$\sum \pi_i = 0$	5.22**		6.59**		5.30**		17.80**	
$\sum \pi_i^+ = 0$		2.78*		9.14**		6.15**		11.20**
$\sum \pi_i^- = 0$		.01		4.37**		3.07*		6.49**
Wald-SR		2.64		10.39**		5.08**		11.16**
Wald-LR		.18		11.65**		.02		15.42**

Table 3 continued.								
	South Carolina		South Dakota		Tennessee		Texas	
	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL
Panel A: Short-Run Estimates								
ΔLnGini								
$\Delta \text{LnGini}_{t-1}$								
$\Delta \text{LnGini}_{t-2}$								
$\Delta \text{LnGini}_{t-3}$								
$\Delta \text{LnGini}_{t-4}$								
$\Delta \text{LnGini}_{t-5}$								
$\Delta \text{LnGini}_{t-6}$								
$\Delta \text{LnRPCIN}$	.03(1.93)*		-.04(.51)		.03(2.17)**		.08(.82)	
$\Delta \text{LnRPCIN}_{t-1}$			-.24(2.72)**				-.16(1.67)*	
$\Delta \text{LnRPCIN}_{t-2}$			-.08(1.01)				-.23(2.60)**	
$\Delta \text{LnRPCIN}_{t-3}$			-.20(2.96)**				-.22(2.47)**	
$\Delta \text{LnRPCIN}_{t-4}$								
$\Delta \text{LnRPCIN}_{t-5}$								
$\Delta \text{LnRPCIN}_{t-6}$								
ΔPOS_t		.34(2.01)**		-.01(.08)		.02(.99)		.15(1.14)
ΔPOS_{t-1}		-.12(.77)						-.26(1.95)*
ΔPOS_{t-2}		-.44(2.96)**						-.25(1.90)*
ΔPOS_{t-3}								-.29(2.30)**
ΔPOS_{t-4}								
ΔPOS_{t-5}								
ΔPOS_{t-6}								
ΔNEG_t		.21(.56)		-.25(1.65)*		1.33(2.31)**		-.02(.16)
ΔNEG_{t-1}		.79(2.26)**		-.17(1.22)				
ΔNEG_{t-2}				.12(.86)				
ΔNEG_{t-3}				-.28(2.85)**				
ΔNEG_{t-4}								
ΔNEG_{t-5}								
ΔNEG_{t-6}								
Panel B: Long-Run Estimates								
Constant	-3.41(5.9)**	.67(.3)	-2.99(8.5)**	-1.17(15.3)**	-3.17(6.7)**	-1.19(2.9)**	-3.21(7.8)**	-.72(5.9)**
LnRPCIN_t	.28(4.75)**		.24(7.00)**		.25(5.40)**		.27(6.85)**	
POS_t		.47(1.30)		-.01(.08)		.14(1.16)		.24(3.58)**
NEG_t		5.28(.77)		-.60(3.75)**		-1.48(.81)		-.10(.17)
Panel C: Diagnostic Statistics								
F	3.24	1.28	4.80	8.23**	2.86	1.90	3.57	3.35
ECM_{t-1}	-.11(2.08)	-.06(1.12)	-.29(3.56)*	-.48(4.71)**	-.13(2.32)	-.14(2.43)	-.15(3.07)	-.16(2.83)
LM	.84	1.27	.03	1.36	.38	.03	.79	.69
RESET	.33	5.12	.74	6.03**	.91	2.56	.11	.30
QS(QS ²)	S(S)	S(US)	US(US)	S(S)	S(S)	S(S)	S(S)	US(S)
Adjusted R ²	.97	.97	.93	.94	.97	.97	.98	.98
Panel D: Wald Tests								
$\sum \pi_i = 0$	3.73*		6.16**		4.72**		8.85**	
$\sum \pi_i^+ = 0$		.86		.01		.99		8.45**
$\sum \pi_i^- = 0$		3.61*		3.48*		5.37**		.03
Wald-SR		3.25*		3.41*		5.27**		6.59**
Wald-LR		.55		29.30**		.90		.39

Table 3 continued.								
	Utah		Vermont		Virginia		Washington	
	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL
Panel A: Short-Run Estimates								
ΔLnGini								
$\Delta \text{LnGini}_{t-1}$				-.28(1.89)*				
$\Delta \text{LnGini}_{t-2}$				-.16(1.16)				
$\Delta \text{LnGini}_{t-3}$				-.01(.05)				
$\Delta \text{LnGini}_{t-4}$				-.32(2.36)**				
$\Delta \text{LnGini}_{t-5}$				-.33(2.44)**				
$\Delta \text{LnGini}_{t-6}$								
$\Delta \text{LnRPCIN}$	.06(1.80)*		.08(3.04)**		.02(1.56)*		.42(4.16)**	
$\Delta \text{LnRPCIN}_{t-1}$							-.21(2.17)**	
$\Delta \text{LnRPCIN}_{t-2}$							.18(1.85)*	
$\Delta \text{LnRPCIN}_{t-3}$							-.15(1.53)	
$\Delta \text{LnRPCIN}_{t-4}$								
$\Delta \text{LnRPCIN}_{t-5}$								
$\Delta \text{LnRPCIN}_{t-6}$								
ΔPOS_t		.04(1.20)		.47(2.57)**		.01(.68)		.49(3.81)**
ΔPOS_{t-1}				.04(.21)				
ΔPOS_{t-2}				.10(.55)				
ΔPOS_{t-3}				.21(1.17)				
ΔPOS_{t-4}				.51(2.85)**				
ΔPOS_{t-5}								
ΔPOS_{t-6}								
ΔNEG_t		-.03(.12)		-.69(2.13)**		.73(2.13)**		-.07(.54)
ΔNEG_{t-1}		.71(2.21)**				-.92(2.17)**		
ΔNEG_{t-2}		.78(2.50)**				.70(1.50)		
ΔNEG_{t-3}		.50(1.62)						
ΔNEG_{t-4}		1.17(3.71)**						
ΔNEG_{t-5}								
ΔNEG_{t-6}								
Panel B: Long-Run Estimates								
Constant	-4.56(8.3)**	-1.35(11.4)**	-3.19(12.4)**	-1.52(4.9)**	-2.82(5.2)**	-1.09(2.9)**	-4.19(11.3)**	-1.06(8.7)**
LnRPCIN_t	.39(7.15)**		.25(9.80)**		.21(4.08)**		.40(9.78)**	
POS_t		.12(1.48)		.01(.06)		.12(.74)		.31(3.71)**
NEG_t		-2.30(3.24)**		-2.65(1.92)*		-1.61(.61)		-.38(.50)
Panel C: Diagnostic Statistics								
F	5.16*	4.02	7.05**	2.60	3.57	.86	3.47	3.08
ECM_{t-1}	-.15(2.01)	-.33(3.82)**	-.30(3.27)*	-.26(2.13)	-.09(1.75)	-.08(1.35)	-.16(2.18)	-.18(2.34)
LM	.01	.34	1.01	.80	.07	.47	.67	.02
RESET	.01	4.67**	7.40	2.64	.72	.67	.01	.10
QS(QS ²)	S(S)	S(S)	US(S)	S(S)	S(S)	S(S)	S(US)	S(US)
Adjusted R ²	.98	.98	.95	.95	.98	.98	.98	.98
Panel D: Wald Tests								
$\sum \pi_i = 0$	3.24*		9.25**		2.45		1.71	
$\sum \pi_i^+ = 0$		1.45		8.19**		.46		14.54**
$\sum \pi_i^- = 0$		12.70**		4.55**		.56		.29
Wald-SR		12.32**		8.02**		.52		8.75**
Wald-LR		14.67**		4.45**		.49		1.05

Table 3 continued.								
	West Virginia		Wisconsin		Wyoming		District of Colombia	
	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL
Panel A: Short-Run Estimates								
ΔLnGini								
$\Delta \text{LnGini}_{t-1}$	.22(1.74)*	.27(2.16)**						
$\Delta \text{LnGini}_{t-2}$								
$\Delta \text{LnGini}_{t-3}$								
$\Delta \text{LnGini}_{t-4}$								
$\Delta \text{LnGini}_{t-5}$								
$\Delta \text{LnGini}_{t-6}$								
$\Delta \text{LnRPCIN}$	.04(1.82)*		.02(.31)		.02(.58)		.38(2.50)**	
$\Delta \text{LnRPCIN}_{t-1}$								
$\Delta \text{LnRPCIN}_{t-2}$								
$\Delta \text{LnRPCIN}_{t-3}$								
$\Delta \text{LnRPCIN}_{t-4}$								
$\Delta \text{LnRPCIN}_{t-5}$								
$\Delta \text{LnRPCIN}_{t-6}$								
ΔPOS_t		.42(1.98)**		.02(1.24)		.04(1.53)		.54(2.73)**
ΔPOS_{t-1}								
ΔPOS_{t-2}								
ΔPOS_{t-3}								
ΔPOS_{t-4}								
ΔPOS_{t-5}								
ΔPOS_{t-6}								
ΔNEG_t		-1.48(2.74)**		-1.13(.78)		-.38(1.76)*		-.10(.24)
ΔNEG_{t-1}						.33(1.40)		.63(1.79)*
ΔNEG_{t-2}						.68(3.03)**		.42(1.14)
ΔNEG_{t-3}						.40(1.76)*		.79(2.18)**
ΔNEG_{t-4}						.39(1.69)*		
ΔNEG_{t-5}						.66(2.15)**		
ΔNEG_{t-6}								
Panel B: Long-Run Estimates								
Constant	-3.43(5.1)**	-1.44(3.5)**	-3.71(8.7)**	-1.07(5.7)**	-3.93(1.73)	-.98(60.9)**	-3.81(7.9)**	-1.08(8.2)**
LnRPCIN_t	.27(4.09)**		.30(7.36)**		.34(1.64)		.30(6.70)**	
POS_t		.22(1.35)		.19(1.71)*		.06(1.72)*		.12(1.15)
NEG_t		-1.74(.84)		-.92(.83)		-1.39(7.23)**		-1.09(1.55)
Panel C: Diagnostic Statistics								
F	3.00	2.69	4.14	2.99	.30	11.74**	2.01	2.83
ECM_{t-1}	-.14(2.24)	-.14(2.37)	-.13(2.11)	-.14(2.00)	-.06(.67)	-.63(5.75)**	-.24(2.13)	-.30(2.68)
LM	.05	.74	.26	.13	1.02	.49	.24	.10
RESET	.24	1.34	.06	.92	.19	6.16**	.31	.83
QS(QS ²)	S(S)	S(S)	S(S)	S(S)	S(US)	S(S)	S(S)	S(S)
Adjusted R ²	.95	.96	.99	.99	.95	.97	.94	.95
Panel D: Wald Tests								
$\sum \pi_j = 0$	3.71*		1.33		.33		.36	
$\sum \pi_j^+ = 0$		3.90**		1.55		2.36		7.50**
$\sum \pi_j^- = 0$		7.51**		.61		10.10**		.45
Wald-SR		8.20**		.95		9.63**		.01
Wald-LR		1.04		1.23		85.44**		4.01**

a. Numbers inside parentheses are t-ratios. **, * denote significance at the 5, 10% levels, respectively. b. At the 10% (5%) significance level when there is one exogenous variable (k=1), the upper bound critical value of the F test is 4.93 (6.04). These come from Narayan(2005, p. 1988) for our small sample size. c. The number inside the parenthesis next to ECM_{t-1} is the absolute value of the t-ratio. Its upper bound critical value at the 10% (5%) significance level is -2.93 (-3.28) when k=1 and these come from Banerjee et al. (1989, p. 276). In the non-linear model where k=2, these critical values change to -3.20 (-3.57). d. LM is Lagrange Multiplier test of residual serial correlation. It is distributed as χ^2 with one degree of freedom (first order). Its critical value at 10% (5%) significance level is 2.70 (3.84). These critical values are also used for Wald tests since they also have a χ^2 distribution with one degree of freedom. e. RESET is Ramsey's test for misspecification. It is distributed as χ^2 with one degree of freedom.

Table 4. Estimates of Linear and Non-linear Gini-Volatility Model (40 Countries)

	Austria		Belgium		Bolivia		Canada	
	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL
Panel A: Short-Run Estimates								
ΔLnGINI								
$\Delta \text{LnGINI}_{t-1}$	-.08(.64)	.23(1.53)				.41(2.42)**		.34(2.49)**
$\Delta \text{LnGINI}_{t-2}$	-.07(.50)	.16(1.10)				.30(1.64)		
$\Delta \text{LnGINI}_{t-3}$	.33(2.22)**	.42(3.03)**						
$\Delta \text{LnGINI}_{t-4}$								
ΔLnVOL_t	.01(2.61)**		.01(.60)		.01(.38)		.01(2.73)**	
$\Delta \text{LnVOL}_{t-1}$	-.01(.58)						.01(2.04)**	
$\Delta \text{LnVOL}_{t-2}$	-.01(2.16)**							
$\Delta \text{LnVOL}_{t-3}$	-.02(3.60)**							
$\Delta \text{LnVOL}_{t-4}$								
ΔPOS_t		.93(2.82)**		.21(.99)		.98(1.14)		1.15(5.10)**
ΔPOS_{t-1}		.84(2.12)**						
ΔPOS_{t-2}								
ΔPOS_{t-3}								
ΔPOS_{t-4}								
ΔNEG_t		-1.68(4.54)		-.07(.30)		-.02(.02)		.33(1.90)*
ΔNEG_{t-1}								
ΔNEG_{t-2}								
ΔNEG_{t-3}								
ΔNEG_{t-4}								
Panel B: Long-Run Estimates								
Constant	5.40(.39)	3.48(751)**	3.85(12.4)**	3.55(71.8)**	4.00(14.05)**	3.83(125)**	3.75(1.62)	3.54(9.01)**
LnVOL_t	.40(.90)		.03(.53)		.02(.35)		-.06(.09)	
POS_t		-.44(1.75)*		1.36(.98)		1.91(1.16)		1.84(5.89)**
NEG_t		1.72(9.05)**		-.45(.33)		-.03(.02)		.53(1.79)*
Panel C: Diagnostic Statistics								
F	1.65	8.94**	.97	2.03	2.03	4.51*	.07	5.75**
ECM_{t-1}	-.01(.15)	-.98(5.16)**	-.05(2.32)	-.15(2.06)	-.16(1.23)	-.51(3.22)	-.01(.19)	-.63(5.99)**
LM	1.28	.46	.04	.01	3.17*	4.08**	.69	.84
RESET	3.22*	.09	.01	.04	1.65	8.76**	.73	3.12*
QS(QS ²)	S(S)	S(S)	S(S)	S(S)	S(US)	S(US)	S(S)	S(S)
Adjusted R ²	.92	.94	.98	.98	.64	.78	.94	.97
Panel D: Wald Tests								
$\sum \pi_j = 0$	2.57		.36		.15		11.86**	
$\sum \pi_j^+ = 0$		11.33**		.99		1.30		26.06**
$\sum \pi_j^- = 0$		20.61**		.09		.01		3.60*
Wald-SR		21.03**		1.61		3.80*		34.24**
Wald-LR		158.10**		7.29**		7.34**		408.24**

Table 4 continued.								
	Chile		Colombia		Cyprus		Ecuador	
	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL
Panel A: Short-Run Estimates								
ΔLnGINI								
$\Delta \text{LnGINI}_{t-1}$	.29(1.67)*	.48(3.17)**	.02(.09)	.32(1.95)*				
$\Delta \text{LnGINI}_{t-2}$			.39(2.04)**	.70(4.24)**				
$\Delta \text{LnGINI}_{t-3}$								
$\Delta \text{LnGINI}_{t-4}$								
ΔLnVOL_t	.01(.62)		.01(.24)		.01(2.81)**		.01(.50)	
$\Delta \text{LnVOL}_{t-1}$							-.01(.86)	
$\Delta \text{LnVOL}_{t-2}$							-.02(2.29)**	
$\Delta \text{LnVOL}_{t-3}$								
$\Delta \text{LnVOL}_{t-4}$								
ΔPOS_t		.73(3.37)**		.04(.30)		.55(2.47)**		.90(1.20)
ΔPOS_{t-1}				1.41(2.65)**		.59(2.34)**		
ΔPOS_{t-2}				1.59(2.84)**				
ΔPOS_{t-3}				1.85(2.76)**				
ΔPOS_{t-4}								
ΔNEG_t		-.15(.82)		-1.20(2.4)**		.02(.15)		-.52(2.16)**
ΔNEG_{t-1}		-.55(2.68)**		1.29(4.57)**				
ΔNEG_{t-2}		-.73(3.22)**		1.12(1.58)				
ΔNEG_{t-3}								
ΔNEG_{t-4}								
Panel B: Long-Run Estimates								
Constant	3.98(14.09)*	3.68(296)**	3.84(46.7)**	3.77(819)**	3.81(124)**	3.70(73.4)**	3.63(13.87)**	3.77(60.5)**
LnVOL_t	.04(.48)		.01(.25)		.04(4.72)**		-.01(.83)	
POS_t		1.49(7.05)**		-1.48(3.3)**		-20(.54)		-1.25(.90)
NEG_t		.67(3.87)**		-2.76(5.8)**		.05(.15)		-1.93(1.61)
Panel C: Diagnostic Statistics								
F	1.23	12.98**	.96	9.01**	4.00	6.15**	.99	4.31
ECM_{t-1}	-.08(1.19)	-.75(5.29)**	-.13(1.44)	-.87(5.03)**	-.40(3.28)*	-.40(2.85)	-.13(1.37)	.27(2.33)
LM	7.78**	.68	4.91**	0.27	.04	.01	.06	.04
RESET	.19	.01	1.46	.01	.63	.99	3.45*	.43
QS(QS ²)	US(US)	S(S)	S(S)	S(S)	US(S)	S(US)	S(US)	S(US)
Adjusted R ²	.87	.93	.82	.91	.81	.83	.76	.73
Panel D: Wald Tests								
$\sum \pi_i = 0$	.38		.06		7.87**		2.20	
$\sum \pi_i^+ = 0$		11.37**		7.47**		10.31**		1.43
$\sum \pi_i^- = 0$		13.32**		2.31		.02		4.69**
Wald-SR		15.84**		3.04*		6.38**		3.57*
Wald-LR		185.49**		90.13**		2.73*		1.92

Table 4 continued.								
	Finland		France		Greece		Hong Kong	
	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL
Panel A: Short-Run Estimates								
ΔLnGINI								
$\Delta \text{LnGINI}_{t-1}$		-.01(.11)						-.39(1.63)
$\Delta \text{LnGINI}_{t-2}$		.01(.05)						
$\Delta \text{LnGINI}_{t-3}$		.33(2.58)**						
$\Delta \text{LnGINI}_{t-4}$								
ΔLnVOL_t	-.01(2.30)**		.01(.66)		.01(.14)		-.0(1.05)	
$\Delta \text{LnVOL}_{t-1}$	.01(1.63)							
$\Delta \text{LnVOL}_{t-2}$	.01(.87)							
$\Delta \text{LnVOL}_{t-3}$	.01(2.21)**							
$\Delta \text{LnVOL}_{t-4}$								
ΔPOS_t		.076(.50)		.83(.80)		.12(.70)		-1.15(1.25)
ΔPOS_{t-1}						-.70(2.01)**		-1.71(1.78)*
ΔPOS_{t-2}						-.80(2.56)**		1.85(1.99)**
ΔPOS_{t-3}						-.47(1.64)		
ΔPOS_{t-4}								
ΔNEG_t		-.73(2.24)**		.27(.30)		.60(1.81)*		
ΔNEG_{t-1}		.57(1.83)*						.10(.08)
ΔNEG_{t-2}		.27(.87)						-.11(.10)
ΔNEG_{t-3}		1.39(4.36)**						-1.70(1.58)
ΔNEG_{t-4}								
Panel B: Long-Run Estimates								
Constant	1.23(.20)	3.43(260)**	3.68(37.5)**	3.57(181)**	3.77(21.13)**	3.72(123)**	3.16(3.20)**	2.58(19.38)**
LnVOL_t	-.57(.35)		.01(.73)		.01(.12)		-.28(.88)	
POS_t		.24(.55)		1.94(.97)		3.26(1.47)		1.90(1.04)
NEG_t		-.71(1.57)		.62(.31)		2.73(1.29)		-6.48(3.44)**
Panel C: Diagnostic Statistics								
F	3.79	4.09	1.29	1.14	.56	2.68	.68	1.44
ECM_{t-1}	-.02(.35)	-.31(3.06)	-.30(2.39)	-.43(2.16)	-.09(.78)	-.22(1.92)	-.03(1.33)	.30(2.24)
LM	.28	.54	.79	.35	.99	.01	.27	1.29
RESET	.08	.03	.52	.67	.21	.11	4.25**	6.77**
QS(QS ²)	S(S)	S(S)	S(US)	US(US)	S(S)	S(S)	S(S)	S(S)
Adjusted R ²	.90	.95	.67	.60	.73	.79	.98	.98
Panel D: Wald Tests								
$\sum \pi_i = 0$	1.08		.43		.02		1.09	
$\sum \pi_i^+ = 0$		.24		.64		4.10**		4.81**
$\sum \pi_i^- = 0$		6.64**		.09		3.28*		.60
Wald-SR		6.21**		1.36		4.06**		.61
Wald-LR		40.82**		2.49		2.62		100.36**

Table 4 continued.								
	Hungary		Indonesia		India		Ireland	
	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL
Panel A: Short-Run Estimates								
$\Delta \ln \text{GINI}$								
$\Delta \ln \text{GINI}_{t-1}$	.33(1.85)*	.31(1.68)*					.29(1.83)*	.40(2.22)**
$\Delta \ln \text{GINI}_{t-2}$								-.06(.34)
$\Delta \ln \text{GINI}_{t-3}$								.39(1.85)*
$\Delta \ln \text{GINI}_{t-4}$								
$\Delta \ln \text{VOL}_t$	.01(1.99)**		.01(.69)		.01(.15)			-.01(1.19)
$\Delta \ln \text{VOL}_{t-1}$								
$\Delta \ln \text{VOL}_{t-2}$								
$\Delta \ln \text{VOL}_{t-3}$								
$\Delta \ln \text{VOL}_{t-4}$								
ΔPOS_t		.66(1.34)		.55(2.37)**		-.30(1.10)		-.21(.53)
ΔPOS_{t-1}				.15(.48)		.59(2.28)**		
ΔPOS_{t-2}				-.37(1.18)				
ΔPOS_{t-3}								
ΔPOS_{t-4}								
ΔNEG_t		.38(1.04)		.10(.24)		.22(.93)		.11(.21)
ΔNEG_{t-1}				-1.20(3.6)**				-.94(1.70)*
ΔNEG_{t-2}				-.03(.09)				
ΔNEG_{t-3}				.87(2.47)**				
ΔNEG_{t-4}								
Panel B: Long-Run Estimates								
Constant	9.23(.62)	3.22(153)**	3.94(48.6)**	3.91(177)**	3.94(74.19)**	3.94(78.6)**	3.43(21.55)**	3.58(104)**
$\ln \text{VOL}_t$	1.13(.38)		.01(.76)		.01(.15)		-.04(1.06)	
POS_t		5.05(4.11)**		-.22(.28)		-1.78(.65)		-1.23(.54)
NEG_t		1.06(.84)		.97(1.14)		-1.29(.65)		-1.09(.49)
Panel C: Diagnostic Statistics								
F	3.29	7.91**	1.52	2.92	3.17	3.15	2.90	1.52
ECM_{t-1}	-.01(.41)	-.36(2.93)	-.27(1.90)	-.32(2.41)	-.20(2.42)	.13(1.18)	-.14(1.93)	-.17(2.12)
LM	.09	.01	.01	.06	.99	.01	.01	.51
RESET	8.07**	5.00**	4.19**	2.18	.03	.18	.32	.04
QS(QS ²)	S(S)	S(S)	S(US)	S(S)	S(S)	S(S)	S(S)	S(S)
Adjusted R ²	.97	.99	.54	.72	.73	.73	.83	.84
Panel D: Wald Tests								
$\sum \pi_i = 0$	3.96**		.48		.02		1.41	
$\sum \pi_i^+ = 0$		1.81		.31		.54		.28
$\sum \pi_i^- = 0$		1.08		6.35**		.86		1.20
Wald-SR		.13		4.03**		.02		.45
Wald-LR		331.52**		6.97**		.32		.08

Table 4 continued.								
	Iran		Israel		Italy		Jordan	
	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL
Panel A: Short-Run Estimates								
ΔLnGINI								
$\Delta \text{LnGINI}_{t-1}$	.34(2.18)**	.19(1.11)	-.19(.97)	.31(2.00)**				
$\Delta \text{LnGINI}_{t-2}$	.04(.23)	-.07(.44)	-.46(2.89)**					
$\Delta \text{LnGINI}_{t-3}$	.35(1.98)**	.36(2.23)**	-.42(2.24)**					
$\Delta \text{LnGINI}_{t-4}$								
ΔLnVOL_t	.01(.63)		.01(1.05)		-.01(1.10)		-.01(1.42)	
$\Delta \text{LnVOL}_{t-1}$	.03(1.89)*							
$\Delta \text{LnVOL}_{t-2}$								
$\Delta \text{LnVOL}_{t-3}$								
$\Delta \text{LnVOL}_{t-4}$								
ΔPOS_t		-.24(.98)		.71(1.40)		.91(.75)		-.18(.60)
ΔPOS_{t-1}						4.43(2.91)**		
ΔPOS_{t-2}						2.73(2.00)**		
ΔPOS_{t-3}						2.32(1.68)*		
ΔPOS_{t-4}								
ΔNEG_t		.75(2.06)**		.08(.65)		-2.76(3.4)**		-.75(3.79)**
ΔNEG_{t-1}		.98(2.78)**		.24(2.52)**				
ΔNEG_{t-2}		.44(1.23)		-.02(.20)				
ΔNEG_{t-3}				-.31(2.93)**				
ΔNEG_{t-4}								
Panel B: Long-Run Estimates								
Constant	3.50(30.4)**	3.85(78.7)**	4.09(7.57)**	3.65(334)**	3.50(38.2)**	3.39(49.1)**	3.76(35.4)**	3.93(185)**
LnVOL_t	-.08(2.28)**		.06(.55)		-.02(1.14)		-.3(1.03)	
POS_t		-.84(1.12)		1.59(7.05)**		-8.07(3.0)**		-2.43(4.31)**
NEG_t		-.87(1.38)		.02(.25)		-7.21(3.1)**		-1.56(3.79)**
Panel C: Diagnostic Statistics								
F	4.07	4.88**	1.50	10.48**	2.56	4.68*	2.39	7.35**
ECM_{t-1}	-.23(3.11)*	-.28(3.29)*	-.07(.94)	-.85(4.72)**	-.25(2.14)	-.38(3.27)**	-.18(1.65)	-.48(3.69)**
LM	.35	.37	.63	1.22	.80	.04	.38	.33
RESET	1.33	.99	4.22**	1.73	.01	1.10	.01	2.88*
QS(QS ²)	S(S)	S(S)	S(S)	S(S)	S(S)	S(S)	S(S)	S(S)
Adjusted R ²	.90	.91	.87	.93	.62	.69	.69	.78
Panel D: Wald Tests								
$\sum \pi_i = 0$	3.15*		1.11		1.20		2.02	
$\sum \pi_i^+ = 0$		.95		1.96		8.14**		.36
$\sum \pi_i^- = 0$		7.79**		.01		11.42**		14.37**
Wald-SR		9.83**		1.46		9.72**		2.77*
Wald-LR		.01		88.06**		2.09		15.60**

Table 4 continued.								
	Kenya		Korea		Luxembourg		Malaysia	
	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL
Panel A: Short-Run Estimates								
ΔLnGINI								
$\Delta \text{LnGINI}_{t-1}$		-.25(.87)			-.32(1.84)*		.31(1.64)	.49(3.04)**
$\Delta \text{LnGINI}_{t-2}$		.45(1.59)			-.30(2.02)**		.32(1.58)	
$\Delta \text{LnGINI}_{t-3}$		-.38(1.28)			-.21(1.29)			
$\Delta \text{LnGINI}_{t-4}$								
ΔLnVOL_t	.01(.58)		.02(2.86)**		-.02(2.91)**		-.01(.73)	
$\Delta \text{LnVOL}_{t-1}$	-.01(2.87)**						.01(2.03)**	
$\Delta \text{LnVOL}_{t-2}$	-.01(2.15)**						-.01(1.92)*	
$\Delta \text{LnVOL}_{t-3}$	-.01(2.68)**						.01(1.51)	
$\Delta \text{LnVOL}_{t-4}$								
ΔPOS_t		.35(1.71)*		.72(2.99)**		-.70(2.34)**		.07(.33)
ΔPOS_{t-1}		.34(1.91)*						.10(.26)
ΔPOS_{t-2}		.22(1.44)						.46(1.22)
ΔPOS_{t-3}		.21(1.12)						.74(1.80)*
ΔPOS_{t-4}								
ΔNEG_t		.30(1.60)		.13(.74)		-.55(1.64)		.77(1.24)
ΔNEG_{t-1}		-.05(.68)				.67(1.96)**		
ΔNEG_{t-2}		-.13(1.69)*				.84(2.43)**		
ΔNEG_{t-3}		-.21(2.43)**						
ΔNEG_{t-4}								
Panel B: Long-Run Estimates								
Constant	3.95(174)**	4.17(14.1)**	3.75(20.1)**	3.59(51.1)**	4.46(2.09)**	3.39(256)**	3.59(21.4)**	3.74(37.2)**
LnVOL_t	.03(3.37)**		.03(.61)		.35(.48)		-.02(.60)	
POS_t		-.01(.01)		1.22(.93)		-.48(1.25)		-.5(.02)
NEG_t		.50(.91)		.94(.78)		-1.80(4.8)**		.44(.18)
Panel C: Diagnostic Statistics								
F	3.10	2.54	2.41	1.64	.84	9.04**	2.60	1.15
ECM_{t-1}	-.41(2.24)	-.33(1.16)	-.11(2.19)	-.14(2.04)	.03(.53)	-.52(4.32)**	-.17(1.89)	-.16(1.75)
LM	.06	1.71	.41	3.11*	.49	.21	1.17	.44
RESET	.01	.45	.03	.31	2.36	.62	.93	.78
QS(QS ²)	S(S)	S(US)	US(US)	S(S)	S(S)	S(S)	S(S)	S(S)
Adjusted R ²	.73	.71	.90	.89	.92	.95	.82	.86
Panel D: Wald Tests								
$\sum \pi_i = 0$	8.39**		8.16**		8.50**		.46	
$\sum \pi_i^+ = 0$		5.00**		8.97**		5.51**		.18
$\sum \pi_i^- = 0$		.12		.55		2.43		1.54
Wald-SR		2.07		4.02**		5.60**		.04
Wald-LR		1.09		.16		160.16**		1.29

Table 4 continued.								
	Malta		Mauritius		Mexico		Morocco	
	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL
Panel A: Short-Run Estimates								
$\Delta \ln \text{GINI}$								
$\Delta \ln \text{GINI}_{t-1}$	-.52(2.95)**	-.44(2.38)**	.47(2.85)**	.32(1.87)*	-.42(2.00)**		.72(3.59)**	.43(2.67)**
$\Delta \ln \text{GINI}_{t-2}$							.32(1.59)	
$\Delta \ln \text{GINI}_{t-3}$							.32(1.71)*	
$\Delta \ln \text{GINI}_{t-4}$								
$\Delta \ln \text{VOL}_t$	-.03(3.03)**		.02(1.56)		-.01(.01)		-.04(3.68)**	
$\Delta \ln \text{VOL}_{t-1}$								
$\Delta \ln \text{VOL}_{t-2}$								
$\Delta \ln \text{VOL}_{t-3}$								
$\Delta \ln \text{VOL}_{t-4}$								
ΔPOS_t		-1.68(2.13)**		.63(1.11)		.07(29)		-.35(1.76)
ΔPOS_{t-1}								
ΔPOS_{t-2}								
ΔPOS_{t-3}								
ΔPOS_{t-4}								
ΔNEG_t		-1.13(1.14)		1.02(2.26)**		-.24(.58)		-.61(2.66)**
ΔNEG_{t-1}		2.61(2.54)**		.23(.44)		.91(2.09)**		
ΔNEG_{t-2}		-.61(.59)		1.09(2.40)**		.95(1.49)		
ΔNEG_{t-3}		1.65(1.62)						
ΔNEG_{t-4}								
Panel B: Long-Run Estimates								
Constant	5.84(1.73)*	6.83(.08)	4.03(29.5)**	3.79(39.3)**	3.87(9.98)**	3.72(332)**	3.76(197)**	3.89(302)**
$\ln \text{VOL}_t$	.63(.69)		.09(2.70)**		-.01(.01)		-.04(7.48)**	
POS_t		473.5(.04)		3.10(1.30)		.07(.29)		-.61(2.25)**
NEG_t		528.3(.04)		3.34(2.75)**		-.98(3.59)**		-1.06(5.50)**
Panel C: Diagnostic Statistics								
F	3.78	5.44**	2.08	1.19	.34	4.88*	7.56**	3.35
ECM_{t-1}	.05(.67)	.01(.04)	-.18(2.39)	-.20(1.78)	-.07(.57)	-.92(3.81)**	-.92(4.14)**	-.58(3.26)*
LM	.13	.81	.63	.55	1.93	.17	.05	.02
RESET	1.23	5.87**	2.72*	.20	1.63	3.72*	1.75	.34
QS(QS ²)	S(S)	S(US)	S(S)	S(S)	S(S)	S(S)	S(S)	S(S)
Adjusted R ²	.83	.87	.94	.95	.74	.80	.85	.89
Panel D: Wald Tests								
$\sum \pi_i = 0$	9.21**		2.43		.01		13.51**	
$\sum \pi_i^+ = 0$		4.57**		1.24		.08		3.10*
$\sum \pi_i^- = 0$		.99		6.52**		2.54		7.05**
Wald-SR		2.45		2.10		2.04		4.30**
Wald-LR		.01		.03		83.71**		6.94**

Table 4 continued.								
	Netherlands		Norway		Panama		Philippines	
	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL
Panel A: Short-Run Estimates								
ΔLnGINI								
$\Delta \text{LnGINI}_{t-1}$	-.33(1.76)*							
$\Delta \text{LnGINI}_{t-2}$	-.28(1.49)							
$\Delta \text{LnGINI}_{t-3}$								
$\Delta \text{LnGINI}_{t-4}$								
ΔLnVOL_t	.01(2.32)**		.01(.20)		.01(.82)		.01(2.78)**	
$\Delta \text{LnVOL}_{t-1}$								
$\Delta \text{LnVOL}_{t-2}$								
$\Delta \text{LnVOL}_{t-3}$								
$\Delta \text{LnVOL}_{t-4}$								
ΔPOS_t		1.43(3.27)**		-.06(.15)		.59(1.64)		.35(1.89)*
ΔPOS_{t-1}								
ΔPOS_{t-2}								
ΔPOS_{t-3}								
ΔPOS_{t-4}								
ΔNEG_t		.38(1.08)		.31(.47)		-.95(2.45)**		.28(1.61)
ΔNEG_{t-1}								
ΔNEG_{t-2}								
ΔNEG_{t-3}								
ΔNEG_{t-4}								
Panel B: Long-Run Estimates								
Constant	2.89(6.66)**	3.39(123)**	3.70(7.24)**	3.46(228)**	4.00(18.18)**	3.77(150)**	3.96(90.5)**	3.83(246)**
LnVOL_t	-.14(1.52)		.02(.20)		.04(.75)		.03(2.56)**	
POS_t		3.84(2.53)**		-.17(.15)		.10(.15)		.93(1.96)**
NEG_t		1.03(.90)		-1.72(1.57)		-.45(.69)		.72(1.58)
Panel C: Diagnostic Statistics								
F	2.26	2.88	.16	2.46	1.82	1.42	6.95**	3.12
ECM_{t-1}	.10(1.14)	-.37(2.83)	-.05(.86)	-.37(2.72)	-.14(1.59)	-.33(1.44)	-.38(3.37)**	-.38(2.89)
LM	.72	.30	.06	1.37	1.59	.14	.22	.12
RESET	1.69	4.96**	.07	.11	.01	2.44	.01	.33
QS(QS ²)	S(S)	S(S)	US(S)	S(S)	S(S)	S(S)	S(S)	S(S)
Adjusted R ²	.87	.89	.90	.90	.78	.81	.58	.55
Panel D: Wald Tests								
$\sum \pi_i = 0$	5.40**		.04		.67		7.75**	
$\sum \pi_i^+ = 0$		10.71**		.02		2.69		3.56*
$\sum \pi_i^- = 0$		1.17		.22		5.99**		2.59
Wald-SR		11.15**		.31		7.11**		1.30
Wald-LR		28.70**		40.03**		3.63*		1.60

Table 4 continued.								
	Singapore		South Africa		Spain		Sweden	
	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL
Panel A: Short-Run Estimates								
ΔLnGINI								
$\Delta \text{LnGINI}_{t-1}$	.59(4.03)**	.51(3.56)**		.76(3.61)**	-.28(1.55)	-.26(1.79)*	.29(1.57)	.44(2.36)**
$\Delta \text{LnGINI}_{t-2}$	-.28(1.82)*	-.26(1.73)*		.64(3.30)**				
$\Delta \text{LnGINI}_{t-3}$				.78(4.59)**				
$\Delta \text{LnGINI}_{t-4}$								
ΔLnVOL_t	.01(1.79)*		.01(.04)		.01(.42)		-.01(1.59)	
$\Delta \text{LnVOL}_{t-1}$			-.01(2.70)**		.01(2.15)**		.01(1.45)	
$\Delta \text{LnVOL}_{t-2}$					.02(2.69)**		.01(1.77)*	
$\Delta \text{LnVOL}_{t-3}$								
$\Delta \text{LnVOL}_{t-4}$								
ΔPOS_t		.76(2.70)**		-.24(.82)		-.88(1.35)		-.02(.05)
ΔPOS_{t-1}						.37(.46)		
ΔPOS_{t-2}						.33(.45)		
ΔPOS_{t-3}						-2.98(4.3)**		
ΔPOS_{t-4}								
ΔNEG_t		-.03(.16)		.63(1.20)		.84(.97)		-.42(1.36)
ΔNEG_{t-1}				.88(1.48)		.80(1.05)		
ΔNEG_{t-2}				1.86(3.31)**		1.63(2.21)**		
ΔNEG_{t-3}				.79(1.44)		1.59(2.16)**		
ΔNEG_{t-4}								
Panel B: Long-Run Estimates								
Constant	3.65(28.5)**	3.48(28.9)**	4.41(3.97)**	3.57(805)**	3.22(6.35)**	3.11(1.99)*	3.00(10.59)**	3.30(214)**
LnVOL_t	.02(.52)		.14(.55)		-.10(.89)		-.09(1.29)	-.05(.05)
POS_t		.44(.30)		-.21(.89)		-.87(.41)		1.23(1.33)
NEG_t		-.25(.16)		-1.15(5.6)**		-8.78(.42)		
Panel C: Diagnostic Statistics								
F	2.78	2.62	2.69	9.51**	3.80	.50	1.93	2.59
ECM_{t-1}	-.13(3.51)**	-.12(2.71)	-.05(.75)	-1.15(4.9)**	-.15(1.26)	-.06(.54)	-.10(1.51)	-.34(2.67)
LM	.20	.05	.39	3.20*	.21	1.92	1.81	.26
RESET	.02	.19	.64	2.32	.49	.19	.62	.97
QS(QS ²)	S(S)	S(S)	S(US)	S(S)	S(S)	S(S)	S(S)	S(S)
Adjusted R ²	.94	.92	.87	.92	.73	.85	.89	.89
Panel D: Wald Tests								
$\sum \pi_i = 0$	3.20*		3.38*		8.82**		.98	
$\sum \pi_i^+ = 0$		7.29**		.67		2.30		.01
$\sum \pi_i^- = 0$		.03		7.49**		7.82**		1.84
Wald-SR		6.77**		8.20**		6.52**		4.71**
Wald-LR		1.05		294**		.01		18.54**

Table 4 continued.								
	Turkey		United Kingdom		Uruguay		Venezuela	
	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL
Panel A: Short-Run Estimates								
ΔLnGINI								
$\Delta \text{LnGINI}_{t-1}$					4.63(1.93)**	-3.05(.74)		
$\Delta \text{LnGINI}_{t-2}$					-17.58(1.93)*	-13.45(3.22)**		
$\Delta \text{LnGINI}_{t-3}$					25.52(3.00)**			
$\Delta \text{LnGINI}_{t-4}$								
ΔLnVOL_t	.01(1.56)		-.01(.13)		1.66(3.31)**		.01(.07)	
$\Delta \text{LnVOL}_{t-1}$							-.03(2.30)**	
$\Delta \text{LnVOL}_{t-2}$							-.03(2.49)**	
$\Delta \text{LnVOL}_{t-3}$							-.04(3.32)**	
$\Delta \text{LnVOL}_{t-4}$								
ΔPOS_t		.48(1.40)		-.37(.54)		-9.89(.96)		.06(.16)
ΔPOS_{t-1}				1.75(2.17)**		39.87(2.35)**		1.12(1.97)**
ΔPOS_{t-2}								1.07(2.18)**
ΔPOS_{t-3}								
ΔPOS_{t-4}								
ΔNEG_t		.40(1.38)		.28(.41)		84.43(7.18)**		-1.01(2.67)**
ΔNEG_{t-1}				-.66(1.07)		50.08(2.53)**		
ΔNEG_{t-2}				1.10(1.98)*		61.67(3.40)**		
ΔNEG_{t-3}						17.11(1.00)		
ΔNEG_{t-4}								
Panel B: Long-Run Estimates								
Constant	4.08(35.1)**	3.79(107)**	3.62(8.89)**	3.43(42.6)**	3.61(11.49)**	1.07(.13)	4.33(24.5)**	3.60(79.5)**
LnVOL_t	.07(2.00)**		-.01(.14)		-.04(.43)		.16(3.31)**	
POS_t		1.91(2.23)**		-.50(.17)			37.03(.35)	-1.22(.90)
NEG_t		1.60(1.57)		-2.50(1.25)			17.23(.35)	2.91(1.77)*
Panel C: Diagnostic Statistics								
F	1.92	1.55	.46	1.78	4.03	9.21**	4.59	3.21
ECM_{t-1}	-.19(2.35)	-.25(1.70)	-.06(1.24)	-.25(1.90)	-5.89(2.40)	1.32(.32)	-.26(2.40)	-.35(2.73)
LM	.43	1.93	.31	.01	.22	.01	.03	.25
RESET	.63	3.17*	3.75*	4.20**	23.04**	22.90**	1.89	.01
QS(QS ²)	S(S)	S(US)	S(S)	S(S)	S(S)	S(S)	S(S)	S(US)
Adjusted R ²	.86	.84	.96	.97	.47	.92	.86	.89
Panel D: Wald Tests								
$\sum \pi_i = 0$	2.42		.02		10.93**		10.84**	
$\sum \pi_i^+ = 0$		1.97		2.13		2.54		4.08**
$\sum \pi_i^- = 0$		1.92		.16		15.50**		7.15**
Wald-SR		.30		1.23		10.32**		5.64**
Wald-LR		.50		3.81*		.12		17.38**

1. Numbers inside parentheses are t-ratios. **, * denote significance at the 5, 10% levels, respectively.
2. At the 10% (5%) significance level when there is one exogenous variable (k=1), the upper bound critical value of the F test is 4.88 (5.91) and 4.23(5.02) for (k=2) when we have two exogenous variables. These come from Narayan (2005, p. 1988) for our small sample size
3. The number inside the parenthesis next to ECM_{t-1} is the absolute value of the t-ratio. Its upper bound critical value at the 10% (5%) significance level is -2.93 (-3.28) when k=1 and these come from Banerjee et al. (1989, p. 276). In the non-linear model where k=2, these critical values change to -3.20 (-3.57).
4. LM is Lagrange Multiplier test of residual serial correlation. It is distributed as χ^2 with one degree of freedom (first order). Its critical value at 10% (5%) significance level is 2.70 (3.84). These critical values are also used for Wald tests since they also have a χ^2 distribution with one degree of freedom.
5. RESET is Ramsey's test for misspecification. It is distributed as χ^2 with one degree of freedom.

Table 5. Estimates of Linear and Non-linear Gini-Volatility Model (U.S. State Level)

	USA		Alabama		Alaska		Arizona	
	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL
Panel A: Short-Run Estimates								
ΔLnGINI_t								
$\Delta \text{LnGINI}_{t-1}$	.25(1.78)*	.24(1.73)*		.16(1.12)			-.07(.52)	
$\Delta \text{LnGINI}_{t-2}$				.27(1.87)*			-.34(2.62)**	
$\Delta \text{LnGINI}_{t-3}$								
$\Delta \text{LnGINI}_{t-4}$								
ΔLnVOL_t	-.01(.77)		.01(.38)		.01(1.68)*		.02(2.44)**	
$\Delta \text{LnVOL}_{t-1}$	-.01(1.08)							
$\Delta \text{LnVOL}_{t-2}$	.01(1.34)							
$\Delta \text{LnVOL}_{t-3}$								
$\Delta \text{LnVOL}_{t-4}$								
ΔPOS_t		-.32(1.75)*		.68(1.91)*		.29(1.68)*		-.08(.35)
ΔPOS_{t-1}		-.28(1.43)						-.61(2.29)**
ΔPOS_{t-2}								-.49(2.00)**
ΔPOS_{t-3}								
ΔPOS_{t-4}								
ΔNEG_t		.43(1.56)		-.39(1.64)		.25(1.51)		.53(1.59)
ΔNEG_{t-1}								.87(2.66)**
ΔNEG_{t-2}								
ΔNEG_{t-3}								
ΔNEG_{t-4}								
Panel B: Long-Run Estimates								
Constant	.60(.22)	-.75(4.77)**	-.12(.11)	-.94(21.4)**	.65(.33)	-.54(1.56)	-21.10(.17)	-.71(10.20)**
LnVOL_t	.16(.30)		.10(.35)		.32(.63)		-3.89(.17)	
POS_t		1.39(.68)		.17(.22)		4.45(.89)		2.22(1.58)
NEG_t		-.61(.29)		-1.64(2.1)**		3.92(.73)		.96(.67)
Panel C: Diagnostic Statistics								
F	.06	1.08	.46	2.37	3.30	.87	3.42	3.62
ECM_{t-1}	-.01(.55)	-.07(1.31)	-.02(1.01)	-.24(2.18)	-.03(.77)	-.06(1.00)	.01(.16)	-.19(2.40)
LM	.38	.24	.01	.78	.87	1.05	.14	.11
RESET	6.32**	3.19*	1.22	.06	.15	.01	.36	.81
QS(QS ²)	S(US)	S(US)	S(S)	S(US)	US(US)	S(US)	S(S)	S(S)
Adjusted R ²	.99	.99	.97	.97	.91	.91	.97	.97
Panel D: Wald Tests								
$\sum \pi_j = 0$	.08		.15		2.82*		5.93**	
$\sum \pi_j^+ = 0$		5.08**		3.66*		2.82*		6.05**
$\sum \pi_j^- = 0$		2.45		2.70*		2.28		7.77**
Wald-SR		5.24**		5.83**		.14		10.26**
Wald-LR		23.93**		68.15**		.23		56.91**

Table 5 continued.								
	Arkansas		California		Colorado		Connecticut	
	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL
Panel A: Short-Run Estimates								
ΔLnGINI_t								
$\Delta \text{LnGINI}_{t-1}$						-.25(1.89)*		
$\Delta \text{LnGINI}_{t-2}$						-.28(2.13)**		
$\Delta \text{LnGINI}_{t-3}$						-.27(2.05)**		
$\Delta \text{LnGINI}_{t-4}$								
ΔLnVOL_t	.01(.59)		-.01(1.15)			-.01(.26)		-.01(1.21)
$\Delta \text{LnVOL}_{t-1}$								
$\Delta \text{LnVOL}_{t-2}$								
$\Delta \text{LnVOL}_{t-3}$								
$\Delta \text{LnVOL}_{t-4}$								
ΔPOS_t		.19(.92)		-.61(2.90)**		-.59(1.80)*		-.01(.04)
ΔPOS_{t-1}						-.51(1.50)		
ΔPOS_{t-2}								
ΔPOS_{t-3}								
ΔPOS_{t-4}								
ΔNEG_t		-.11(.54)		.35(1.17)		1.09(2.25)**		-.21(1.32)
ΔNEG_{t-1}								
ΔNEG_{t-2}								
ΔNEG_{t-3}								
ΔNEG_{t-4}								
Panel B: Long-Run Estimates								
Constant	-.25(.49)	-.81(12.92)**	1.09(.40)	-.86(4.70)**	.03(.01)	-.76(19.4)**	5.44(.09)	-.91(10.21)**
LnVOL_t	.08(.59)		.25(.51)		-.16(.18)		2.81(.01)	
POS_t		.72(.95)		-.70(.34)		1.36(1.22)		-.05(.04)
NEG_t		-.43(.57)		3.10(1.31)		-.03(.03)		-1.83(1.42)
Panel C: Diagnostic Statistics								
F	1.24	2.60	.04	1.58	.01	3.20	1.41	3.41
ECM_{t-1}	-.05(1.35)	-.27(2.77)	-.01(.65)	-.07(1.42)	-.01(.27)	-.21(2.76)	.01(.10)	-.12(1.93)
LM	1.30	.01	.33	.59	.07	2.51	.02	.76
RESET	.01	1.25	2.58	.66	.01	.35	.01	.21
QS(QS ²)	US(S)	S(US)	S(US)	S(US)	S(S)	US(US)	US(US)	US(S)
Adjusted R ²	.93	.93	.99	.99	.95	.95	.98	.98
Panel D: Wald Tests								
$\sum \pi_i = 0$	.34		1.32		.07		1.47	
$\sum \pi_i^+ = 0$		.84		8.43**		5.82**		.01
$\sum \pi_i^- = 0$		.29		1.36		5.05**		1.75
Wald-SR		5.70**		5.84**		7.85**		3.29
Wald-LR		47.32**		18.30**		47.63**		32.52**

Table 5 continued.								
	Delaware		Florida		Georgia		Hawaii	
	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL
Panel A: Short-Run Estimates								
ΔLnGINI_t								
$\Delta \text{LnGINI}_{t-1}$	-.30(2.32)**	-.26(2.07)**	.99(53.50)**			.21(1.60)		.31(1.91)*
$\Delta \text{LnGINI}_{t-2}$								
$\Delta \text{LnGINI}_{t-3}$								
$\Delta \text{LnGINI}_{t-4}$								
ΔLnVOL_t	.01(.05)		.01(.66)		.01(.26)		-.01(.75)	
$\Delta \text{LnVOL}_{t-1}$					-.01(2.70)**			
$\Delta \text{LnVOL}_{t-2}$								
$\Delta \text{LnVOL}_{t-3}$								
$\Delta \text{LnVOL}_{t-4}$								
ΔPOS_t		.15(.74)		-.18(.77)		-.06(.37)		.21(.91)
ΔPOS_{t-1}				-.63(2.15)**		-.39(2.20)**		
ΔPOS_{t-2}				-.67(2.46)**		.27(1.58)		
ΔPOS_{t-3}				-.44(1.60)				
ΔPOS_{t-4}								
ΔNEG_t		-1.43(3.00)**		.66(1.88)**		.29(1.01)		-.99(1.84)*
ΔNEG_{t-1}		.55(1.15)						1.29(2.37)**
ΔNEG_{t-2}		.16(.35)						-.99(1.71)*
ΔNEG_{t-3}		-1.35(3.13)**						
ΔNEG_{t-4}								
Panel B: Long-Run Estimates								
Constant	-.60(1.61)	-.84(8.61)**	1.70(.30)	-.67(6.90)**	6.04(.16)	-.84(21.5)**	-.20(.77)	-.72(21.19)**
LnVOL_t	.01(.05)		.39(.38)		1.32(.18)		.11(1.62)	
POS_t		.91(.78)		2.67(2.43)**		.69(1.24)		1.15(.84)
NEG_t		-.04(.04)		.74(.67)		-.80(1.44)		.46(.28)
Panel C: Diagnostic Statistics								
F	.92	1.70	.28	4.29*	.71	3.99	2.63	1.70
ECM_{t-1}	-.06(.99)	-.17(2.06)	-.01(.41)	-.19(3.06)	-.01(.18)	-.24(3.10)	-.09(2.04)	.18(2.00)
LM	6.99**	.11	.11	.50	.48	.01	2.37	.01
RESET	1.38	.17	.36	.14	2.54	.06	.47	4.71**
QS(QS ²)	S(US)	S(US)	S(S)	S(S)	S(S)	S(S)	US(S)	S(S)
Adjusted R ²	.77	.82	.98	.98	.99	.99	.92	.93
Panel D: Wald Tests								
$\sum \pi_i = 0$	.01		.43		3.56*		.57	
$\sum \pi_i^+ = 0$		.55		7.31**		4.82**		.83
$\sum \pi_i^- = 0$		6.67**		3.56*		1.01		.46
Wald-SR		7.11**		8.06**		3.98**		.69
Wald-LR		7.14**		102.32**		274.32**		2.93*

Table 5 continued.								
	Idaho		Illinois		Indiana		Iowa	
	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL
Panel A: Short-Run Estimates								
ΔLnGINI_t								
$\Delta \text{LnGINI}_{t-1}$	-.46(3.59)**						-.29(2.35)**	-.20(1.41)
$\Delta \text{LnGINI}_{t-2}$	-.29(2.29)**						-.04(.33)	.04(.31)
$\Delta \text{LnGINI}_{t-3}$							-.35(2.85)**	-.27(2.11)**
$\Delta \text{LnGINI}_{t-4}$								
ΔLnVOL_t	.01(.07)		.01(.63)		.01(1.17)		.01(1.45)	
$\Delta \text{LnVOL}_{t-1}$								
$\Delta \text{LnVOL}_{t-2}$								
$\Delta \text{LnVOL}_{t-3}$								
$\Delta \text{LnVOL}_{t-4}$								
ΔPOS_t		.21(.92)		-.30(1.39)		-.70(2.38)**		.28(1.61)
ΔPOS_{t-1}				-.35(1.63)		-1.44(3.6)**		
ΔPOS_{t-2}						-1.05(3.0)**		
ΔPOS_{t-3}						-.75(2.30)**		
ΔPOS_{t-4}								
ΔNEG_t		-.52(1.93)*		.69(2.24)**		.25(.82)		.11(.55)
ΔNEG_{t-1}						.47(1.58)		
ΔNEG_{t-2}								
ΔNEG_{t-3}								
ΔNEG_{t-4}								
Panel B: Long-Run Estimates								
Constant	-.27(.23)	-.88(47.03)**	1.25(.33)	-.72(4.12)**	12.67(.08)	-.90(83.3)**	.17(.21)	-.69(3.77)**
LnVOL_t	-.02(.08)		.28(.43)		2.77(.08)		.22(.99)	
POS_t		.39(.93)		2.69(1.09)		1.55(5.85)**		1.19(1.27)
NEG_t		-.95(2.27)**		.60(.24)		-.46(1.97)**		.47(.47)
Panel C: Diagnostic Statistics								
F	.22	7.47**	.22	1.52	1.01	9.73**	.83	2.17
ECM_{t-1}	-.02(.73)	-.54(4.28)**	-.01(.54)	-.08(1.52)	-.01(.09)	-.56(5.09)**	-.05(1.49)	-.24(2.12)
LM	.32	3.83*	.38	.29	1.93	.46	.35	.44
RESET	.03	.02	2.72*	2.36	.53	5.45**	.13	.23
QS(QS ²)	S(US)	S(S)	S(S)	S(S)	US(S)	S(US)	S(US)	S(US)
Adjusted R ²	.93	.93	.99	.99	.98	.99	.93	.93
Panel D: Wald Tests								
$\sum \pi_i = 0$	.01		.40		1.37		2.11	
$\sum \pi_i^+ = 0$		.85		4.72**		16.62**		2.58
$\sum \pi_i^- = 0$		3.74*		5.03**		3.32*		.30
Wald-SR		15.88**		7.02**		15.40**		2.74*
Wald-LR		226.19**		26.75**		1011.3**		23.83**

Table 5 continued.								
	Kansas		Kentucky		Louisiana		Maine	
	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL
Panel A: Short-Run Estimates								
$\Delta \ln \text{GINI}_t$								
$\Delta \ln \text{GINI}_{t-1}$	.29(2.29)**					.23(1.68)*	-.33(2.63)**	
$\Delta \ln \text{GINI}_{t-2}$						.30(1.91)*		
$\Delta \ln \text{GINI}_{t-3}$						.30(1.84)*		
$\Delta \ln \text{GINI}_{t-4}$								
$\Delta \ln \text{VOL}_t$	.01(1.52)		.01(1.26)		.01(1.24)		-.01(.10)	
$\Delta \ln \text{VOL}_{t-1}$								
$\Delta \ln \text{VOL}_{t-2}$								
$\Delta \ln \text{VOL}_{t-3}$								
$\Delta \ln \text{VOL}_{t-4}$								
ΔPOS_t		-.01(.04)		.13(.64)		-.12(.49)		.27(.98)
ΔPOS_{t-1}		-.74(1.93)*				-.72(2.26)**		
ΔPOS_{t-2}		-.55(1.39)				-.73(2.48)**		
ΔPOS_{t-3}						-.68(2.17)**		
ΔPOS_{t-4}								
ΔNEG_t		1.44(3.68)**		-.18(.69)		1.37(3.17)**		-.29(1.11)
ΔNEG_{t-1}		-.54(1.28)						
ΔNEG_{t-2}		1.08(2.56)**						
ΔNEG_{t-3}								
ΔNEG_{t-4}								
Panel B: Long-Run Estimates								
Constant	.95(.39)	-.71(11.91)**	-.09(.19)	-.83(15.1)**	.25(.29)	-.79(25.0)**	-.64(1.28)	-.87(44.86)**
$\ln \text{VOL}_t$	.36(.65)		.14(1.09)		20(.96)		-.01(.10)	
POS_t		3.27(2.66)**		.50(.61)		1.92(3.82)**		.54(1.06)
NEG_t		1.62(1.37)		-.70(.78)		.46(.91)		-.57(1.10)
Panel C: Diagnostic Statistics								
F	.91	4.28*	1.38	2.59	1.07	5.22**	.49	5.26**
ECM_{t-1}	-.20(.71)	-.24(2.74)	-.01(.18)	-.25(2.59)	-.03(1.22)	-.50(3.98)**	-.06(1.36)	-.51(4.24)**
LM	2.65	5.37**	.19	.26	.09	.01	3.10*	.71
RESET	.01	.83	.01	.24	2.46	.01	.80	3.84**
QS(QS ²)	S(US)	S(S)	US(S)	S(S)	S(US)	S(US)	US(S)	S(S)
Adjusted R ²	.96	.96	.95	.95	.97	.97	.89	.90
Panel D: Wald Tests								
$\sum \pi_i = 0$	2.31		1.59		1.54		.01	
$\sum \pi_i^+ = 0$		3.95**		.41		9.22**		.97
$\sum \pi_i^- = 0$		10.84**		.47		10.08**		1.24
Wald-SR		10.16**		4.67**		12.19**		14.10**
Wald-LR		78.31**		43.40**		493.60**		120.07**

Table 5 continued.								
	Maryland		Massachusetts		Michigan		Minnesota	
	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL
Panel A: Short-Run Estimates								
$\Delta \ln \text{GINI}_t$								
$\Delta \ln \text{GINI}_{t-1}$					-.21(1.59)	.11(.87)	-.27(2.09)**	
$\Delta \ln \text{GINI}_{t-2}$					.18(1.37)	.43(3.46)**		
$\Delta \ln \text{GINI}_{t-3}$						.19(1.50)		
$\Delta \ln \text{GINI}_{t-4}$								
$\Delta \ln \text{VOL}_t$	-.01(1.78)*		-.01(1.44)		.01(.03)		.01(1.00)	
$\Delta \ln \text{VOL}_{t-1}$			-.01(1.55)					
$\Delta \ln \text{VOL}_{t-2}$								
$\Delta \ln \text{VOL}_{t-3}$								
$\Delta \ln \text{VOL}_{t-4}$								
ΔPOS_t		-.01(.08)		-.57(2.47)**		-.42(1.87)*		.40(1.70)*
ΔPOS_{t-1}				-.38(1.66)*		-.58(2.22)**		
ΔPOS_{t-2}						-.49(1.92)*		
ΔPOS_{t-3}						-.41(1.76)*		
ΔPOS_{t-4}								
ΔNEG_t		-.35(1.55)		.38(1.19)		.52(2.02)**		.71(2.43)**
ΔNEG_{t-1}								
ΔNEG_{t-2}								
ΔNEG_{t-3}								
ΔNEG_{t-4}								
Panel B: Long-Run Estimates								
Constant	.71(.25)	-.91(19.29)**	3.51(.18)	-.86(11.3)**	.36(.09)	-.90(99.1)**	.05(.09)	-.81(13.58)**
$\ln \text{VOL}_t$	.27(.47)		.69(.20)		.02(.03)		.14(1.02)	
POS_t		-.6(.09)		-.04(.03)		.78(3.29)**		.43(.61)
NEG_t		1.57(2.01)**		1.80(1.45)		-.66(3.02)**		-.83(1.04)
Panel C: Diagnostic Statistics								
F	.27	2.75	.11	2.66	.01	9.39**	.06	3.42
ECM_{t-1}	-.01(.55)	.22(2.78)	-.01(.21)	-.14(2.35)	-.01(.38)	-.63(5.27)**	-.03(1.31)	-.19(2.83)
LM	.01	1.07	.01	.28	.06	.01	.09	1.12
RESET	.26	.01	.65	.01	.55	.14	.01	.13
QS(QS ²)	S(S)	S(S)	S(S)	S(S)	S(S)	S(S)	S(S)	S(S)
Adjusted R ²	.96	.96	.98	.98	.98	.99	.97	.97
Panel D: Wald Tests								
$\sum \pi_i = 0$	3.18*		5.14**		.01		1.01	
$\sum \pi_i^+ = 0$		.01		9.10**		8.11**		2.90*
$\sum \pi_i^- = 0$		2.39		1.42		4.08**		5.92**
Wald-SR		6.83**		6.63**		9.09**		7.11**
Wald-LR		73.07**		56.15**		1210.9**		64.25**

Table 5 continued.								
	Mississippi		Missouri		Montana		Nebraska	
	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL
Panel A: Short-Run Estimates								
$\Delta \ln \text{GINI}_t$								
$\Delta \ln \text{GINI}_{t-1}$		.29(2.27)**			-.20(1.54)	.14(90)	-.18(1.43)	
$\Delta \ln \text{GINI}_{t-2}$		.42(3.04)**				.26(1.74)*		
$\Delta \ln \text{GINI}_{t-3}$		.25(1.84)*				.31(2.27)**		
$\Delta \ln \text{GINI}_{t-4}$								
$\Delta \ln \text{VOL}_t$	.01(.13)		-.01(.30)		.01(.99)			
$\Delta \ln \text{VOL}_{t-1}$	-.02(1.92)*		-.01(2.38)**					
$\Delta \ln \text{VOL}_{t-2}$								
$\Delta \ln \text{VOL}_{t-3}$								
$\Delta \ln \text{VOL}_{t-4}$								
ΔPOS_t		.27(1.23)		-.06(.34)		.37(1.85)*	.01(1.31)	-.39(.73)
ΔPOS_{t-1}								
ΔPOS_{t-2}								
ΔPOS_{t-3}								
ΔPOS_{t-4}								
ΔNEG_t		-.26(.47)		-.31(1.55)		.28(.85)		.69(1.58)
ΔNEG_{t-1}		-.94(2.18)**				-.41(1.39)		-.77(1.79)*
ΔNEG_{t-2}						-.58(1.95)*		
ΔNEG_{t-3}						.58(1.84)*		
ΔNEG_{t-4}								
Panel B: Long-Run Estimates								
Constant	-.41(.53)	-.92(25.92)**	.78(.26)	-.88(17.6)**	.04(.05)	-.91(21.0)**	-.06(.11)	-.75(13.75)**
$\ln \text{VOL}_t$	.03(.16)		.30(.44)		.16(.79)		.15(.98)	
POS_t		.62(1.33)		-.32(.33)		.71(1.87)*		1.25(2.23)**
NEG_t		-.76(1.75)*		-1.68(1.71)*		-.41(1.08)		.08(.15)
Panel C: Diagnostic Statistics								
F	.58	5.44**	.23	1.96	.75	4.16	.78	5.08**
ECM_{t-1}	-.04(1.15)	-.44(4.15)**	-.01(.59)	.19(2.29)**	-.05(1.41)	-.52(3.32)*	-.07(1.73)	-.44(4.07)**
LM	1.66	.83	.01	.48	.74	.16	1.31	.01
RESET	0.9	4.27**	1.04	.22	.01	.02	2.00	.24
QS(QS ²)	S(S)	S(S)	US(S)	S(S)	S(S)	S(S)	S(US)	US(US)
Adjusted R ²	.93	.94	.97	.97	.93	.95	.90	.91
Panel D: Wald Tests								
$\sum \pi_i = 0$	1.70		4.11**		1.00		1.71	
$\sum \pi_i^+ = 0$		1.52		.12		3.43*		.54
$\sum \pi_i^- = 0$		3.38*		2.40		.03		.02
Wald-SR		4.40**		4.71**		.45		.13
Wald-LR		162.22**		57.83**		204.29**		108.52**

Table 5 continued.								
	Nevada		New Hampshire		New Jersey		New Mexico	
	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL
Panel A: Short-Run Estimates								
ΔLnGINI_t								
$\Delta \text{LnGINI}_{t-1}$	-.47(3.84)**	-.21(1.66)*	-.53(4.44)**	-.33(2.74)**			-.34(2.74)**	
$\Delta \text{LnGINI}_{t-2}$	-.31(2.45)**							
$\Delta \text{LnGINI}_{t-3}$	-.32(2.67)**							
$\Delta \text{LnGINI}_{t-4}$								
ΔLnVOL_t	.01(.61)		.01(.15)		-.01(.54)		.01(.28)	
$\Delta \text{LnVOL}_{t-1}$			-.02(2.47)**					
$\Delta \text{LnVOL}_{t-2}$			-.02(2.07)**					
$\Delta \text{LnVOL}_{t-3}$								
$\Delta \text{LnVOL}_{t-4}$								
ΔPOS_t		.11(.54)		-.27(1.38)		-.01(.02)		.27(.92)
ΔPOS_{t-1}								
ΔPOS_{t-2}								
ΔPOS_{t-3}								
ΔPOS_{t-4}								
ΔNEG_t		-.63(2.20)**		-.61(2.66)**		-.16(1.08)		-.45(1.27)
ΔNEG_{t-1}								
ΔNEG_{t-2}								
ΔNEG_{t-3}								
ΔNEG_{t-4}								
Panel B: Long-Run Estimates								
Constant	-4.54(.29)	-.92(25.0)**	.75(.42)	-.87(31.6)**	-.48(.27)	-.87(9.16)**	-.40(.82)	-.84(24.03)**
LnVOL_t	-.55(.23)		.32(.76)		-.27(.29)		.04(.28)	
POS_t		.23(.54)		-.98(1.16)		-.02(.02)		.59(.94)
NEG_t		-1.34(2.93)**		-2.25(2.5)**		-1.77(1.21)		-.93(1.38)
Panel C: Diagnostic Statistics								
F	.12	5.72**	.64	3.24	.24	1.75	.74	5.39**
ECM_{t-1}	.01(.25)	-.47(3.60)**	-.02(.81)	-.27(2.60)	-.01(.40)	-.09(1.70)	-.07(1.52)	-.49(3.97)**
LM	5.54**	.01	.04	.02	.42	1.40	2.63	.73
RESET	.08	.31	1.37	1.05	.22	.01	.05	.89
QS(QS ²)	S(US)	S(S)	S(S)	S(S)	US(S)	S(S)	S(S)	S(S)
Adjusted R ²	.94	.95	.95	.95	.98	.98	.88	.88
Panel D: Wald Tests								
$\sum \pi_i = 0$	.38		6.58**		.29		.08	
$\sum \pi_i^+ = 0$		.30		1.90		.01		.85
$\sum \pi_i^- = 0$		4.85**		7.05**		1.17		1.60
Wald-SR		11.87**		6.79**		2.37		11.17**
Wald-LR		212.10**		74.86**		23.96**		79.16**

Table 5 continued.								
	New York		North Carolina		North Dakota		Ohio	
	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL
Panel A: Short-Run Estimates								
ΔLnGINI_t								
$\Delta \text{LnGINI}_{t-1}$		.21(1.52)	.04(.27)	.09(.71)	-.33(2.58)**			
$\Delta \text{LnGINI}_{t-2}$			.18(1.38)	.29(2.20)**				
$\Delta \text{LnGINI}_{t-3}$			-.26(1.97)**					
$\Delta \text{LnGINI}_{t-4}$								
ΔLnVOL_t	-.01(.16)		.01(.17)		-.02(1.64)		-.01(.12)	
$\Delta \text{LnVOL}_{t-1}$					.01(.45)			
$\Delta \text{LnVOL}_{t-2}$					.03(2.79)**			
$\Delta \text{LnVOL}_{t-3}$					.02(1.54)			
$\Delta \text{LnVOL}_{t-4}$								
ΔPOS_t		.05(.42)		.01(.54)		-.27(1.32)		.01(.11)
ΔPOS_{t-1}						-.14(.57)		
ΔPOS_{t-2}						.39(1.49)		
ΔPOS_{t-3}								
ΔPOS_{t-4}								
ΔNEG_t		-.08(.51)		-.30(1.66)**		-.10(.80)		-.15(.91)
ΔNEG_{t-1}								
ΔNEG_{t-2}								
ΔNEG_{t-3}								
ΔNEG_{t-4}								
Panel B: Long-Run Estimates								
Constant	-1.84(.35)	-.78(7.15)**	-.21(.20)	-.94(19.9)**	-.84(2.75)**	-.82(25.9)**	-.42(.29)	-.89(12.85)**
LnVOL_t	.11(.17)		.04(.17)		-.11(.94)		-.05(.12)	
POS_t		.78(.43)		.03(.05)		.22(.98)		.13(.11)
NEG_t		-1.13(.55)		-1.20(2.1)**		-.17(.80)		-1.25(1.10)
Panel C: Diagnostic Statistics								
F	.30	1.76	.12	2.67	1.91	7.59**	.23	1.61
ECM_{t-1}	.01(.33)	-.07(1.41)	-.02(.70)	-.25(2.90)	-.09(1.94)	-.56(4.55)*	-.01(.62)	-.12(1.53)
LM	1.80	.16	.01	2.29	1.58	.59	.02	.07
RESET	1.55	2.05	.55	.14	.27	6.03**	1.73	1.66
QS(QS ²)	S(S)	S(S)	S(S)	S(S)	USS(US)	S(US)	US(S)	S(US)
Adjusted R ²	.99	.99	.97	.97	.89	.91	.98	.98
Panel D: Wald Tests								
$\sum \pi_i = 0$	.02		.03		2.40		.02	
$\sum \pi_i^+ = 0$		.18		.01		.01		.01
$\sum \pi_i^- = 0$		.26		2.75*		.64		.82
Wald-SR		2.04		7.35**		.02		1.75
Wald-LR		16.80**		95.76**		149.05**		26.42**

Table 5 continued.								
	Oklahoma		Oregon		Pennsylvania		Rhode Island	
	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL
Panel A: Short-Run Estimates								
ΔLnGINI_t								
$\Delta \text{LnGINI}_{t-1}$		.26(1.77)*		-.27(2.15)**				-.23(1.86)*
$\Delta \text{LnGINI}_{t-2}$		.23(1.58)						
$\Delta \text{LnGINI}_{t-3}$								
$\Delta \text{LnGINI}_{t-4}$								
ΔLnVOL_t	.01(.88)		.01(.76)		-.01(.27)			-.01(1.59)
$\Delta \text{LnVOL}_{t-1}$	-.01(1.68)*				-.01(2.37)**			
$\Delta \text{LnVOL}_{t-2}$	.01(1.42)							
$\Delta \text{LnVOL}_{t-3}$								
$\Delta \text{LnVOL}_{t-4}$								
ΔPOS_t		.36(2.53)**		-.18(.66)		-.19(.71)		.36(1.11)
ΔPOS_{t-1}				-.53(1.84)*		-.64(2.30)**		-.54(1.54)
ΔPOS_{t-2}								
ΔPOS_{t-3}								
ΔPOS_{t-4}								
ΔNEG_t		.31(1.02)		.95(2.41)**		.07(.39)		-.40(1.83)*
ΔNEG_{t-1}		-1.18(2.52)**						
ΔNEG_{t-2}								
ΔNEG_{t-3}								
ΔNEG_{t-4}								
Panel B: Long-Run Estimates								
Constant	-.10(.21)	-.80(48.88)**	.32(.20)	-.84(23.0)**	1.52(.49)	-.77(5.95)**	-1.75(.89)	-.92(23.70)**
LnVOL_t	.12(.98)		.18(.53)		.48(.68)		-.42(.57)	
POS_t		.81(3.17)**		.59(.85)		2.55(1.21)		.32(.59)
NEG_t		-.34(1.15)		-.81(1.17)		.76(.35)		-1.11(2.02)**
Panel C: Diagnostic Statistics								
F	1.04	3.60	.55	2.89	.66	1.34	1.45	4.72*
ECM_{t-1}	-.05(1.46)	-.44(3.42)*	-.02(.77)	-.25(2.70)	-.01(.79)	-.09(1.59)	-.02(.65)	-.35(3.24)*
LM	.01	.01	.16	.45	.17	.21	1.26	.15
RESET	.02	.32	.47	1.12	2.45	1.06	.42	.19
QS(QS ²)	S(S)	S(S)	US(S)	S(S)	S(S)	S(S)	US(US)	S(S)
Adjusted R ²	.95	.96	.97	.97	.98	.98	.96	.96
Panel D: Wald Tests								
$\sum \pi_i = 0$	.08		.58		3.66*		2.53	
$\sum \pi_i^+ = 0$		6.43**		3.09*		4.77**		.12
$\sum \pi_i^- = 0$		2.50		5.84**		.16		3.34*
Wald-SR		4.24**		6.20**		4.47**		.14
Wald-LR		147.47**		111.40**		24.78**		169.53**

Table 5 continued.								
	South Carolina		South Dakota		Tennessee		Texas	
	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL
Panel A: Short-Run Estimates								
ΔLnGINI_t								
$\Delta \text{LnGINI}_{t-1}$								
$\Delta \text{LnGINI}_{t-2}$								
$\Delta \text{LnGINI}_{t-3}$								
$\Delta \text{LnGINI}_{t-4}$								
ΔLnVOL_t	.01(.18)		.20(1.74)*		.01(.13)		.01(1.25)	
$\Delta \text{LnVOL}_{t-1}$	-.01(1.99)**						-.01(2.13)**	
$\Delta \text{LnVOL}_{t-2}$							.01(1.74)*	
$\Delta \text{LnVOL}_{t-3}$								
$\Delta \text{LnVOL}_{t-4}$								
ΔPOS_t		-.01(.08)		.72(1.63)		-.05(.26)		-.05(.18)
ΔPOS_{t-1}				-1.51(3.0)**				-.67(2.15)**
ΔPOS_{t-2}				-.95(1.84)*				
ΔPOS_{t-3}								
ΔPOS_{t-4}								
ΔNEG_t		-.16(.78)		.05(.11)		-.33(1.40)		.45(2.64)**
ΔNEG_{t-1}				.97(2.61)**				
ΔNEG_{t-2}								
ΔNEG_{t-3}								
ΔNEG_{t-4}								
Panel B: Long-Run Estimates								
Constant	.62(.22)	-.87(7.60)**	2.14(.33)	-.62(7.03)**	-.36(.46)	-.86(15.5)**	.73(.96)	-.46(1.58)
LnVOL_t	.27(.42)		.83(.41)		.03(.13)		.33(1.69)*	
POS_t		-.12(.08)		2.01(3.48)**		-.27(.26)		7.96(1.26)
NEG_t		-1.39(1.00)		.99(1.87)*		-1.76(1.62)		7.10(1.01)
Panel C: Diagnostic Statistics								
F	.36	1.33	1.31	6.30**	.84	2.33	1.92	1.81
ECM_{t-1}	-.01(.63)	-.11(1.42)	-.02(.48)	-.47(4.33)**	-.03(1.08)	-.19(2.33)	-.03(1.68)	-.06(1.22)
LM	.53	2.46	.53	.58	.02	.38	.57	.68
RESET	2.20	.23	.65	.02	.05	.16	.73	.16
QS(QS ²)	S(S)	S(S)	S(US)	S(US)	US(S)	S(S)	US(S)	S(US)
Adjusted R ²	.97	.97	.90	.92	.96	.96	.98	.98
Panel D: Wald Tests								
$\sum \pi_j = 0$	1.67		3.04*		.02		.24	
$\sum \pi_j^+ = 0$		.01		3.80*		.07		3.49*
$\sum \pi_j^- = 0$		.62		2.39		1.97		6.99**
Wald-SR		1.21		3.73*		4.29**		7.07**
Wald-LR		10.35**		90.30**		42.15**		.09

Table 5 continued.								
	Utah		Vermont		Virginia		Washington	
	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL
Panel A: Short-Run Estimates								
ΔLnGINI_t								
$\Delta \text{LnGINI}_{t-1}$								
$\Delta \text{LnGINI}_{t-2}$								
$\Delta \text{LnGINI}_{t-3}$								
$\Delta \text{LnGINI}_{t-4}$								
ΔLnVOL_t	.01(.59)							
$\Delta \text{LnVOL}_{t-1}$								
$\Delta \text{LnVOL}_{t-2}$								
$\Delta \text{LnVOL}_{t-3}$								
$\Delta \text{LnVOL}_{t-4}$								
ΔPOS_t								
ΔPOS_{t-1}								
ΔPOS_{t-2}								
ΔPOS_{t-3}								
ΔPOS_{t-4}								
ΔNEG_t								
ΔNEG_{t-1}								
ΔNEG_{t-2}								
ΔNEG_{t-3}								
ΔNEG_{t-4}								
Panel B: Long-Run Estimates								
Constant	.12(.10)							
LnVOL_t	.13(.50)							
POS_t								
NEG_t								
Panel C: Diagnostic Statistics								
F	1.22	1.73	.54	3.92	.68	1.81	.25	3.52
ECM_{t-1}	-.02(.86)	-.13(1.61)	-.03(.94)	-.33(3.02)	-.01(.59)	-.16(2.37)	-.01(.70)	-.19(2.82)
LM	.49	.01	.13	1.10	.01	.12	.01	1.88
RESET	.60	1.38	.22	3.04*	.54	.16	1.46	.12
QS(QS ²)	US(S)	S(S)	S(S)	S(S)	US(S)	S(S)	S(S)	S(S)
Adjusted R ²	.97	.98	.94	.94	.97	.97	.98	.98
Panel D: Wald Tests								
$\sum \pi_j = 0$	.35		.06		1.97		.01	
$\sum \pi_j^+ = 0$		1.83		.01		.07		10.85**
$\sum \pi_j^- = 0$		2.51		2.71*		1.14		8.21**
Wald-SR		3.99**		8.84**		4.90**		15.40**
Wald-LR		32.28**		89.78**		48.92**		95.73**

Table 5 continued.								
	West Virginia		Wisconsin		Wyoming		District of Columbia	
	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL
Panel A: Short-Run Estimates								
$\Delta \ln \text{GINI}_t$								
$\Delta \ln \text{GINI}_{t-1}$		.040(2.81)**			-.36(2.79)**		-.39(3.20)**	-.28(2.30)**
$\Delta \ln \text{GINI}_{t-2}$		.24(1.69)*			-.32(2.60)**			
$\Delta \ln \text{GINI}_{t-3}$		.25(1.70)*			-.25(2.05)**			
$\Delta \ln \text{GINI}_{t-4}$								
$\Delta \ln \text{VOL}_t$	.01(.27)		.01(.29)		.01(.96)		-.01(.30)	
$\Delta \ln \text{VOL}_{t-1}$	-.02(2.18)**							
$\Delta \ln \text{VOL}_{t-2}$								
$\Delta \ln \text{VOL}_{t-3}$								
$\Delta \ln \text{VOL}_{t-4}$								
ΔPOS_t		.24(1.44)		-.44(1.83)*		.22(2.08)**		-.10(.22)
ΔPOS_{t-1}								1.07(2.10)**
ΔPOS_{t-2}								
ΔPOS_{t-3}								
ΔPOS_{t-4}								
ΔNEG_t		-.45(1.86)*		.21(.76)		-.30(2.05)**		-.36(1.34)
ΔNEG_{t-1}				-.52(1.66)*				
ΔNEG_{t-2}								
ΔNEG_{t-3}								
ΔNEG_{t-4}								
Panel B: Long-Run Estimates								
Constant	.87(.48)	.93(51.8)**	-.07(.06)	-.86(28.1)**	2.00(.32)	-.86(46.6)**	-.54(.98)	-.83(13.18)**
$\ln \text{VOL}_t$	.42(.84)		.07(.28)		.44(.40)		-.04(.28)	
POS_t		.48(1.40)		.68(.88)		.50(2.13)**		-.24(.21)
NEG_t		-.91(2.70)**		-.80(1.01)		-.68(2.66)**		-1.44(1.29)
Panel C: Diagnostic Statistics								
F	2.33	4.49*	.31	2.69	.77	5.63**	.76	2.40
ECM_{t-1}	-.03(1.07)	-.50(3.49)*	-.01(.92)	-.20(2.45)	-.01(.42)	-.44(4.19)**	-.04(1.15)	-.25(2.57)
LM	1.02	1.32	.01	.05	4.91**	1.41	2.50	.39
RESET	.39	1.54	.15	3.18*	1.11	4.95**	.33	.23
QS(QS ²)	S(S)	S(S)	S(S)	S(S)	US(US)	S(S)	S(S)	S(S)
Adjusted R ²	.95	.95	.98	.98	.96	.96	.93	.93
Panel D: Wald Tests								
$\sum \pi_i = 0$	1.89		.08		.93		.09	
$\sum \pi_i^+ = 0$		2.08		3.34*		4.31**		2.06
$\sum \pi_i^- = 0$		3.45*		.72		4.21**		1.79
Wald-SR		10.60**		.09		15.37**		2.90*
Wald-LR		245.89**		142.41**		237.68**		35.65**

1. Numbers inside parentheses are t-ratios. **, * denote significance at the 5, 10% levels, respectively.
2. At the 10% (5%) significance level when there is one exogenous variable (k=1), the upper bound critical value of the F test is 4.88 (5.91) and 4.23(5.02) for (k=2) when we have two exogenous variables. These come from Narayan (2005, p. 1988) for our small sample size
3. The number inside the parenthesis next to ECM_{t-1} is the absolute value of the t-ratio. Its upper bound critical value at the 10% (5%) significance level is -2.93 (-3.28) when k=1 and these come from Banerjee et al. (1989, p. 276). In the non-linear model where k=2, these critical values change to -3.20 (-3.57).
4. LM is Lagrange Multiplier test of residual serial correlation. It is distributed as χ^2 with one degree of freedom (first order). Its critical value at 10% (5%) significance level is 2.70 (3.84). These critical values are also used for Wald tests since they also have a χ^2 distribution with one degree of freedom.
5. RESET is Ramsey's test for misspecification. It is distributed as χ^2 with one degree of freedom.

Table 6. Estimates of Linear and Non-linear Theil-Volatility Model (U.S. State Level)

	USA		Alabama		Alaska		Arizona	
	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL
Panel A: Short-Run Estimates								
$\Delta \text{LnTheil}_t$								
$\Delta \text{LnTheil}_{t-1}$						.42(2.09)**		-.38(3.14)**
$\Delta \text{LnTheil}_{t-2}$						.55(3.19)**		-.22(1.93)*
$\Delta \text{LnTheil}_{t-3}$						.54(3.53)**		
$\Delta \text{LnTheil}_{t-4}$								
$\Delta \text{LnRincome}_t$	.94(5.91)**	.96(5.09)**	-.12(.61)	.79(3.98)**	-.57(2.14)**	-.27(.95)	.62(3.13)**	.71(3.71)**
$\Delta \text{LnRincome}_{t-1}$						.12(.44)		
$\Delta \text{LnRincome}_{t-2}$						1.05(4.25)**		
$\Delta \text{LnRincome}_{t-3}$						-.38(1.91)*		
$\Delta \text{LnRincome}_{t-4}$								
ΔLnPOP_t	3.40(1.15)	2.54(.83)	1.01(.75)	-.77(.59)	1.60(2.20)**	1.07(.85)	.92(1.11)	-.01(.02)
$\Delta \text{LnPOP}_{t-1}$						-.24(.17)		
$\Delta \text{LnPOP}_{t-2}$						-1.92(1.82)*		
$\Delta \text{LnPOP}_{t-3}$								
$\Delta \text{LnPOP}_{t-4}$								
ΔLnVOL_t	.01(.91)		.02(.73)		.02(1.20)		.03(1.63)	
$\Delta \text{LnVOL}_{t-1}$								
$\Delta \text{LnVOL}_{t-2}$								
$\Delta \text{LnVOL}_{t-3}$								
$\Delta \text{LnVOL}_{t-4}$								
ΔPOS_t		.51(.65)		1.19(1.25)		2.64(2.98)**		-1.43(1.96)**
ΔPOS_{t-1}						-2.22(2.39)**		-4.11(4.22)**
ΔPOS_{t-2}								-3.48(3.86)**
ΔPOS_{t-3}								-2.11(2.63)**
ΔPOS_{t-4}								
ΔNEG_t		1.01(1.17)		.27(.24)		1.50(1.87)*		3.340(3.39)**
ΔNEG_{t-1}						-1.16(1.39)		
ΔNEG_{t-2}						.16(.20)		
ΔNEG_{t-3}						-3.25(3.65)**		
ΔNEG_{t-4}								
Panel B: Long-Run Estimates								
Constant	-39.5(1.19)	-42.92(.47)	15.90(.26)	44.7(.52)	-11.2(13.3)**	-11.9(2.0)**	-14.2(4.98)**	-86.77(.57)
LnRincome_t	.29(.22)	.40(.22)	1.73(.91)	1.54(1.05)	-.75(3.21)**	-1.09(5.0)**	-1.09(1.75)*	-1.89(.48)
LnPOP_t	1.69(.53)	1.74(.26)	-3.07(.49)	-4.84(.68)	1.76(6.15)**	2.23(4.7)**	2.27(2.45)**	8.46(.57)
LnVOL_t	.11(.74)		.32(.97)		.05(2.00)**		.19(1.62)	
POS_t		6.33(.92)		8.96(1.24)		2.34(2.02)**		62.8(.53)
NEG_t		7.49(.68)		4.03(.39)		2.29(2.67)**		89.9(.52)
Panel C: Diagnostic Statistics								
F	2.48	1.90	.87	2.10	5.77**	3.71*	3.24	5.28**
ECM_{t-1}	-.13(3.15)	-.11(2.88)	-.04(1.49)	-.10(3.30)	-.66(4.86)**	-1.06(4.65)**	-.19(3.58)*	-.04(5.28)**
LM	.14	.08	.46	.01	.21	.86	1.37	.07
RESET	.18	.45	2.31	.77	1.99	.59	.01	3.02*
QS(QS ²)	S(US)	S(US)	S(S)	S(S)	S(S)	S(S)	US(S)	S(S)
Wald-SR		.33		.42		1.12		20.69**
Wald-LR		.11		.89		.01		.01
Adjusted R ²	.98	.98	.98	.97	.92	.93	.96	.97

Table 6 continued.								
	Arkansas		California		Colorado		Connecticut	
	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL
Panel A: Short-Run Estimates								
$\Delta \ln Theil_t$								
$\Delta \ln Theil_{t-1}$	-.43(3.03)**	-.28(2.07)**	-.16(1.21)	-.37(3.12)**	-.40(3.19)**	-.71(5.15)**	-.34(2.72)**	-.28(2.11)**
$\Delta \ln Theil_{t-2}$			-.11(.92)	-.46(3.50)**		-.39(2.71)**		-.17(1.34)
$\Delta \ln Theil_{t-3}$			-.09(.81)			-.13(1.08)		
$\Delta \ln Theil_{t-4}$								
$\Delta \ln Rincome_t$	.41(1.61)	.28(1.12)	1.09(4.64)**	.96(4.34)**	1.24(5.04)**	.47(1.83)*	.88(4.00)**	.92(3.30)**
$\Delta \ln Rincome_{t-1}$			.07(.31)					
$\Delta \ln Rincome_{t-2}$			.06(.29)					
$\Delta \ln Rincome_{t-3}$								
$\Delta \ln Rincome_{t-4}$								
$\Delta \ln POP_t$	-1.42(1.43)	-2.35(2.23)**	1.54(1.26)	3.80(3.33)**	-.96(.82)	-.66(.86)	-.65(.70)	-1.67(1.61)
$\Delta \ln POP_{t-1}$					-.94(.68)			
$\Delta \ln POP_{t-2}$					-2.05(2.17)**			
$\Delta \ln POP_{t-3}$								
$\Delta \ln POP_{t-4}$								
$\Delta \ln VOL_t$	.01(.62)		.01(.19)		.01(.28)		.01(.76)	
$\Delta \ln VOL_{t-1}$	-.05(1.96)**				-.02(1.35)			
$\Delta \ln VOL_{t-2}$	-.08(3.04)**				-.01(.45)			
$\Delta \ln VOL_{t-3}$	-.06(2.14)**				.01(1.18)			
$\Delta \ln VOL_{t-4}$								
ΔPOS_t		-.16(.13)		-2.23(2.96)**		-3.20(3.77)**		.32(.30)
ΔPOS_{t-1}		-1.73(1.49)		-2.86(3.57)**		-6.67(5.10)**		
ΔPOS_{t-2}				-2.89(3.60)**		-4.38(3.76)**		
ΔPOS_{t-3}				-1.38(2.20)**		-1.65(1.62)		
ΔPOS_{t-4}								
ΔNEG_t		3.01(2.29)**		3.10(3.30)**		5.05(4.68)**		.53(.58)
ΔNEG_{t-1}		2.28(1.68)*		2.33(2.08)**				
ΔNEG_{t-2}								
ΔNEG_{t-3}								
ΔNEG_{t-4}								
Panel B: Long-Run Estimates								
Constant	-171.8(.60)	277.3(.59)	-39.9(4.9)**	-29.32(1.32)**	-13.97(.83)	177.5(.17)	-3.53(.14)	27.16(1.79)
$\ln Rincome_t$	-5.97(.52)	4.82(.53)	-.17(.21)	4.07(1.18)	.07(.04)	58.43(.17)	1.93(3.45)**	2.06(3.77)**
$\ln POP_t$	18.24(.57)	-24.81(.57)	2.48(1.83)*	-3.13(.72)	.88(.29)	-80.96(.17)	-2.18(.98)	-4.38(3.18)**
$\ln VOL_t$	-2.10(.48)		-.03(.35)		.14(.83)		-.15(.74)	
POS_t		52.13(.60)		2.14(.24)		391.77(.17)		-1.40(.43)
NEG_t		23.36(.50)		1.91(.15)		465.28(.17)		-3.05(.83)
Panel C: Diagnostic Statistics								
F	2.55	3.00	3.63	5.61**	1.25	5.06**	3.30	2.70
ECM_{t-1}	.04(3.28)	-.51(3.96)*	-.11(3.89)*	-.09(5.53)**	-.11(2.22)	-.01(5.22)**	-.12(3.72)*	-.23(3.15)
LM	.07	.03	6.27**	1.42	1.14	.23	.01	1.62
RESET	2.92*	.57	1.26	4.84**	7.76**	1.77	.22	.62
QS(QS ²)	S(S)	S(S)	S(S)	S(S)	S(S)	S(S)	S(S)	S(S)
Wald-SR		.94		14.67**		24.16**		.01
Wald-LR		.05		.01		.03		1.48
Adjusted R ²	.93	.94	.98	.99	.97	.98	.98	.98

Table 6 continued.								
	Delaware		Florida		Georgia		Hawaii	
	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL
Panel A: Short-Run Estimates								
$\Delta \ln Theil_t$								
$\Delta \ln Theil_{t-1}$			-.36(2.63)**	-.28(2.56)**		-.44(3.18)**		
$\Delta \ln Theil_{t-2}$						-.31(2.26)**		
$\Delta \ln Theil_{t-3}$								
$\Delta \ln Theil_{t-4}$								
$\Delta \ln Rincome_t$	.96(3.61)**	1.44(4.22)**	1.21(7.04)**	1.13(6.70)**	.56(3.96)**	.60(4.61)**	1.23(4.61)**	1.53(5.36)**
$\Delta \ln Rincome_{t-1}$		-.92(2.91)**	.32(1.53)			.24(1.67)*	.55(2.19)**	.46(1.85)*
$\Delta \ln Rincome_{t-2}$		.39(1.34)				.18(1.29)		
$\Delta \ln Rincome_{t-3}$		-.78(2.95)**						
$\Delta \ln Rincome_{t-4}$								
$\Delta \ln POP_t$	3.01(1.91)*	.01(.01)	.12(.18)	.09(.16)	1.08(1.04)	1.09(.90)	-4.29(3.56)**	-5.64(4.46)**
$\Delta \ln POP_{t-1}$								
$\Delta \ln POP_{t-2}$								
$\Delta \ln POP_{t-3}$								
$\Delta \ln POP_{t-4}$								
$\Delta \ln VOL_t$	-.02(.62)		.03(1.45)		-.01(.76)		.01(.67)	
$\Delta \ln VOL_{t-1}$			-.04(1.91)*		-.02(2.12)**			
$\Delta \ln VOL_{t-2}$			-.05(2.63)**					
$\Delta \ln VOL_{t-3}$			-.06(2.85)**					
$\Delta \ln VOL_{t-4}$								
ΔPOS_t		2.38(1.56)		-.41(.61)		-.92(1.97)**		2.33(2.19)**
ΔPOS_{t-1}		-3.05(2.23)**		-2.32(3.06)**		-3.09(4.47)**		
ΔPOS_{t-2}				-2.61(3.60)**		-1.79(2.76)**		
ΔPOS_{t-3}				-1.59(2.27)**		-1.26(2.36)**		
ΔPOS_{t-4}								
ΔNEG_t		-3.35(2.27)**		2.90(3.27)**		1.43(1.84)*		.71(.45)
ΔNEG_{t-1}		3.37(2.26)**		-.16(.17)				
ΔNEG_{t-2}		-1.69(1.25)		-.40(.44)				
ΔNEG_{t-3}		-2.73(2.00)**		-2.87(3.45)**				
ΔNEG_{t-4}								
Panel B: Long-Run Estimates								
Constant	-14.57(1.62)	54.32(.84)	-23.2(2.85)**	-36.4(1.31)**	1.95(.06)	130.8(.71)	-4.42(.69)	-7.33(1.06)
$\ln Rincome_t$	-.46(.50)	4.02(1.13)	-.21(.21)	-.17(.15)	1.80(.71)	3.48(.78)	1.45(1.81)*	2.09(3.26)**
$\ln POP_t$	1.59(.89)	-9.16(1.04)	1.75(1.09)	2.57(.92)	-2.20(.46)	-12.74(.74)	-1.48(1.08)	-2.09(1.99)**
$\ln VOL_t$	-.05(.47)		.53(2.82)**		.48(.74)		.10(1.28)	
POS_t		13.53(1.31)		20.1(1.82)*		46.64(.89)		6.32(2.32)**
NEG_t		4.80(.55)		26.4(1.31)		17.14(.80)		8.43(2.44)**
Panel C: Diagnostic Statistics								
F	3.70	2.00	6.11**	5.70**	3.20	5.66**	4.38*	4.22*
ECM_{t-1}	-.17(3.89)**	-.12(3.24)	-.13(5.10)**	-.14(6.19)**	-.05(3.61)*	-.06(5.54)**	-.26(4.08)**	-.26(4.56)**
LM	.50	2.33	1.19	.57	1.59	1.47	.39	1.72
RESET	3.81**	1.87	.96	1.21	.06	.33	.83	3.58**
QS(QS ²)	US(US)	S(US)	S(S)	S(S)	S(S)	S(S)	S(S)	S(S)
Wald-SR		.80		2.82*		6.41**		.96
Wald-LR		.71		.42		.84		.95
Adjusted R ²	.87	.89	.98	.98	.98	.99	.93	.94

Table 6 continued.								
	Idaho		Illinois		Indiana		Iowa	
	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL
Panel A: Short-Run Estimates								
$\Delta \text{LnTheil}_t$								
$\Delta \text{LnTheil}_{t-1}$					.16(1.38)			
$\Delta \text{LnTheil}_{t-2}$					.21(1.78)*			
$\Delta \text{LnTheil}_{t-3}$								
$\Delta \text{LnTheil}_{t-4}$								
$\Delta \text{LnRincome}_t$	1.08(4.71)**	.88(3.60)**	.90(5.02)**	.71(3.82)**	.67(5.09)**	.56(3.92)**	.66(4.34)**	.66(4.39)**
$\Delta \text{LnRincome}_{t-1}$		.63(2.66)**						
$\Delta \text{LnRincome}_{t-2}$								
$\Delta \text{LnRincome}_{t-3}$								
$\Delta \text{LnRincome}_{t-4}$								
ΔLnPOP_t	-.39(.40)	2.80(1.87)*	-.84(.65)	-2.02(1.90)*	-.25(.25)	-1.37(1.27)	.60(.43)	2.85(1.83)*
$\Delta \text{LnPOP}_{t-1}$		-3.42(2.34)**						
$\Delta \text{LnPOP}_{t-2}$								
$\Delta \text{LnPOP}_{t-3}$								
$\Delta \text{LnPOP}_{t-4}$								
ΔLnVOL_t	.01(.24)		.01(1.14)		.03(2.03)**		.01(.76)	
$\Delta \text{LnVOL}_{t-1}$	-.05(2.16)**		-.02(1.91)*					
$\Delta \text{LnVOL}_{t-2}$								
$\Delta \text{LnVOL}_{t-3}$								
$\Delta \text{LnVOL}_{t-4}$								
ΔPOS_t		-1.16(1.22)		-1.38(1.99)**		-.85(1.09)		-.83(.93)
ΔPOS_{t-1}		-3.12(2.48)**		-1.13(1.73)*		1.42(2.05)**		
ΔPOS_{t-2}		-2.01(1.72)*						
ΔPOS_{t-3}		-2.50(2.37)**						
ΔPOS_{t-4}								
ΔNEG_t		5.17(3.41)**		2.48(2.84)**		2.36(3.00)**		.24(.35)
ΔNEG_{t-1}		-2.87(1.84)*						
ΔNEG_{t-2}		2.17(1.46)						
ΔNEG_{t-3}								
ΔNEG_{t-4}								
Panel B: Long-Run Estimates								
Constant	-16.43(2.34)**	-58.6(2.05)**	29.23(.79)	83.8(2.85)**	-15.04(.31)	112.6(1.93)**	144.6(2.02)**	76.7(2.42)**
LnRincome_t	.15(.20)	.67(.67)	2.59(3.02)**	2.17(3.35)**	1.31(.73)	2.30(2.01)**	2.04(3.20)**	.60(1.49)
LnPOP_t	1.01(.75)	3.56(1.69)*	-4.83(1.48)	-7.81(3.29)**	-.54(.10)	-10.1(2.03)**	-12.19(2.20)**	-5.97(2.44)**
LnVOL_t	.26(1.36)		.41(2.61)**		.55(1.13)		.18(1.15)	
POS_t		19.87(1.69)*		5.79(1.64)		13.0(2.01)**		1.18(.68)
NEG_t		30.81(1.83)*		.25(.05)		2.68(.53)		-1.19(.67)
Panel C: Diagnostic Statistics								
F	3.64	3.72*	2.60	2.19	2.46	3.77*	4.28*	4.80**
ECM_{t-1}	-17(3.91)**	-15(4.51)**	-11(2.97)	-13(2.69)	-06(3.01)	-08(3.77)*	-13(3.90)**	-28(4.97)**
LM	.40	.45	.08	.04	.05	.59	.13	.10
RESET	1.09	2.18	.39	.98	.60	.49	1.55	.06
QS(QS ²)	US(S)	S(S)	US(S)	S(S)	S(US)	S(US)	S(S)	S(S)
Wald-SR		5.23**		8.26**		9.94**		1.07
Wald-LR		1.97		5.67**		8.37**		6.05**
Adjusted R ²	.94	.95	.99	.99	.98	.98	.95	.95

Table 6 continued.								
	Kansas		Kentucky		Louisiana		Maine	
	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL
Panel A: Short-Run Estimates								
$\Delta \text{LnTheil}_t$								
$\Delta \text{LnTheil}_{t-1}$	.13(1.13)		-.16(1.27)	-.17(1.44)	-.20(1.68)*			
$\Delta \text{LnTheil}_{t-2}$				.03(.22)				
$\Delta \text{LnTheil}_{t-3}$				-.24(1.99)**				
$\Delta \text{LnTheil}_{t-4}$								
$\Delta \text{LnRincome}_t$	.47(2.78)**	.17(.96)	.53(2.51)**	.38(1.69)*	.53(2.97)**	.42(2.06)**	.48(1.88)*	.23(.84)
$\Delta \text{LnRincome}_{t-1}$						.29(1.58)		
$\Delta \text{LnRincome}_{t-2}$								
$\Delta \text{LnRincome}_{t-3}$								
$\Delta \text{LnRincome}_{t-4}$								
ΔLnPOP_t	1.84(1.31)	4.09(2.55)**	.89(.52)	2.00(1.00)	-.60(.94)	-.53(.96)	5.01(2.52)**	5.45(2.72)**
$\Delta \text{LnPOP}_{t-1}$	-1.34(1.00)	-4.35(2.80)**	-3.46(2.32)**	-4.90(2.05)**	-1.44(2.36)**	-1.46(2.66)**	-2.10(1.20)	-4.05(2.04)**
$\Delta \text{LnPOP}_{t-2}$				1.97(.91)		.96(1.77)*		
$\Delta \text{LnPOP}_{t-3}$				2.34(1.47)				
$\Delta \text{LnPOP}_{t-4}$								
ΔLnVOL_t	.01(.21)		.02(1.07)		.03(1.58)		-.04(1.73)*	
$\Delta \text{LnVOL}_{t-1}$			-.03(1.99)**		-.02(1.40)			
$\Delta \text{LnVOL}_{t-2}$					-.02(1.15)			
$\Delta \text{LnVOL}_{t-3}$					-.07(3.61)**			
$\Delta \text{LnVOL}_{t-4}$								
ΔPOS_t		-1.31(1.58)		-.54(.59)		1.36(1.69)*		-3.38(2.69)**
ΔPOS_{t-1}		-2.31(2.75)**		-3.03(3.25)**		-1.27(1.88)*		
ΔPOS_{t-2}				-1.47(1.89)*		-2.41(4.35)**		
ΔPOS_{t-3}						-2.92(4.58)**		
ΔPOS_{t-4}								
ΔNEG_t		2.43(3.04)**		3.13(3.06)**		2.77(3.00)**		1.98(1.30)
ΔNEG_{t-1}				-2.11(1.99)**				2.84(1.73)*
ΔNEG_{t-2}				-1.58(1.47)				1.27(.79)
ΔNEG_{t-3}								4.58(3.01)**
ΔNEG_{t-4}								
Panel B: Long-Run Estimates								
Constant	-58.75(3.56)**	-125.2(1.01)**	134.2(.54)	176.7(1.84)*	-10.51(.43)	1.61(.27)	-25.20(.59)	-124.64(1.55)
LnRincome_t	-.30(.72)	-.26(.51)	4.85(.66)	2.52(1.69)*	.59(.83)	-2.6(1.00)	.29(.23)	-2.02(1.32)
LnPOP_t	4.32(2.70)**	8.87(1.90)*	-14.14(.58)	-14.81(1.85)*	.06(.02)	.13(.19)	1.41(.32)	11.36(1.58)
LnVOL_t	.06(.80)		.98(.64)		.39(1.63)		.06(.34)	
POS_t		7.85(1.42)		20.77(1.62)		5.33(2.90)**		-12.73(1.54)
NEG_t		13.72(1.57)		8.07(.88)		.74(.40)		-10.45(1.27)
Panel C: Diagnostic Statistics								
F	3.09	4.01*	2.39	4.42**	3.34	7.02**	1.09	1.60
ECM_{t-1}	-.16(3.40)	-.14(4.57)**	-.04(3.17)	-.17(4.82)**	-.11(3.78)*	-.40(6.19)**	-.12(2.13)	-.15(2.92)
LM	.05	1.24	3.53*	7.00**	.06	.06	.82	1.06
RESET	.11	3.18*	2.80*	1.71	.01	3.13*	1.39	.62
QS(QS ²)	S(S)	S(S)	S(S)	S(S)	S(S)	S(S)	S(S)	S(S)
Wald-SR		2.35		.58		9.82**		6.46**
Wald-LR		.34		8.36**		55.30**		.13
Adjusted R ²	.97	.98	.95	.96	.96	.97	.92	.92

Table 6 continued.								
	Maryland		Massachusetts		Michigan		Minnesota	
	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL
Panel A: Short-Run Estimates								
$\Delta \text{LnTheil}_t$								
$\Delta \text{LnTheil}_{t-1}$				-28(2.45)**	-13(1.03)	-13(1.26)	-.05(.43)	-.22(1.81)*
$\Delta \text{LnTheil}_{t-2}$				-.36(3.01)**	.25(1.93)*	.25(2.26)**	.17(1.46)	
$\Delta \text{LnTheil}_{t-3}$				-.19(1.77)*			.30(2.32)**	
$\Delta \text{LnTheil}_{t-4}$								
$\Delta \text{LnRincome}_t$	.01(.02)	1.03(5.29)**	.87(5.00)**	.79(3.96)**	.63(4.37)**	.60(4.27)**	1.02(5.20)**	.86(4.01)**
$\Delta \text{LnRincome}_{t-1}$			-.33(2.03)**			.29(2.21)**		
$\Delta \text{LnRincome}_{t-2}$			-.18(1.11)			.46(3.34)**		
$\Delta \text{LnRincome}_{t-3}$			-.47(2.70)**			.30(2.26)**		
$\Delta \text{LnRincome}_{t-4}$								
ΔLnPOP_t	2.23(2.28)**	1.94(1.95)*	-2.35(2.12)**	-3.46(2.37)**	3.24(1.59)	5.72(3.25)**	-.98(.53)	-1.68(1.05)
$\Delta \text{LnPOP}_{t-1}$			3.68(3.45)**	3.16(2.45)**	-6.89(2.31)**	-7.44(3.00)**		
$\Delta \text{LnPOP}_{t-2}$					8.30(2.79)**	5.74(3.37)**		
$\Delta \text{LnPOP}_{t-3}$					-4.74(2.53)**			
$\Delta \text{LnPOP}_{t-4}$								
ΔLnVOL_t	-.03(1.95)*		-.03(2.99)**		.06(3.03)**		.04(2.33)**	
$\Delta \text{LnVOL}_{t-1}$	-.03(2.02)**				-.06(2.74)**			
$\Delta \text{LnVOL}_{t-2}$					-.02(.86)			
$\Delta \text{LnVOL}_{t-3}$					-.04(1.92)*			
$\Delta \text{LnVOL}_{t-4}$								
ΔPOS_t		.34(.40)		-2.41(3.63)**		.07(.11)		-1.28(1.51)
ΔPOS_{t-1}				-2.43(3.60)**		-1.81(2.73)**		-2.51(2.69)**
ΔPOS_{t-2}				-2.31(3.20)**				-1.48(1.85)*
ΔPOS_{t-3}				-1.75(2.57)**				-1.48(1.91)**
ΔPOS_{t-4}								
ΔNEG_t		-1.38(1.53)		1.91(2.44)**		3.18(4.72)**		4.61(4.58)**
ΔNEG_{t-1}				1.48(1.77)*		-1.81(2.56)**		
ΔNEG_{t-2}				1.31(1.65)*		-1.69(2.31)**		
ΔNEG_{t-3}						-1.18(1.63)		
ΔNEG_{t-4}								
Panel B: Long-Run Estimates								
Constant	-2.43(.25)	11.39(.89)	79.69(3.69)**	86.57(4.69)**	-173.62(.24)	-11.11(.76)	-14.60(.34)	-1954.8(.16)
LnRincome_t	1.39(2.89)**	1.46(2.76)**	2.67(7.52)**	2.26(5.87)**	6.86(.26)	-.40(1.00)	.34(.25)	-38.92(.17)
LnPOP_t	-1.57(1.30)	-2.60(1.94)*	-8.38(4.64)**	-8.32(5.48)**	4.12(.09)	1.08(.82)	.60(.14)	174.82(.17)
LnVOL_t	.06(1.02)		-.09(1.92)*		7.39(.26)		.52(1.19)	
POS_t		-.08(.04)		.70(.35)		7.91(2.70)**		-285.80(.17)
NEG_t		-2.55(.82)		-2.28(.83)		2.78(1.04)		-174.02(.17)
Panel C: Diagnostic Statistics								
F	5.04**	3.67	5.12**	6.75**	2.23	9.73**	2.13	4.12**
ECM_{t-1}	-.24(4.60)**	-.22(4.30)**	-.22(4.54)**	-.33(6.08)**	-.01(3.08)	-.35(7.32)**	-.07(2.49)	.01(4.72)**
LM	.48	.38	1.61	.18	.24	.14	.90	.30
RESET	1.11	.34	.67	2.97*	.03	.01	2.04	3.01*
QS(QS ²)	S(S)	S(S)	S(S)	S(S)	S(S)	S(S)	S(S)	S(S)
Wald-SR		2.36		15.35**		.01		3.89**
Wald-LR		.92		5.52**		1.88		.01
Adjusted R ²	.98	.98	.99	.99	.97	.98	.97	.98

Table 6 continued.								
	Mississippi		Missouri		Montana		Nebraska	
	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL
Panel A: Short-Run Estimates								
$\Delta \ln Theil_t$								
$\Delta \ln Theil_{t-1}$				-12(.92)			-12(.89)	-19(1.56)
$\Delta \ln Theil_{t-2}$							.24(1.82)*	
$\Delta \ln Theil_{t-3}$								
$\Delta \ln Theil_{t-4}$								
$\Delta \ln Rincome_t$	.74(3.51)**	.74(3.64)**	.67(3.24)**	.52(2.03)**	.47(2.12)**	.44(1.86)*	.61(2.65)**	.52(2.03)**
$\Delta \ln Rincome_{t-1}$				.26(1.06)			.49(2.12)**	.57(2.25)**
$\Delta \ln Rincome_{t-2}$				.46(2.28)**				.52(2.51)**
$\Delta \ln Rincome_{t-3}$								
$\Delta \ln Rincome_{t-4}$								
$\Delta \ln POP_t$	-86(.69)	-1.79(1.32)	-.43(.30)	.80(.53)	-.20(.15)	-.71(.49)	5.95(2.90)**	4.20(2.52)**
$\Delta \ln POP_{t-1}$							-4.21(2.37)**	
$\Delta \ln POP_{t-2}$								
$\Delta \ln POP_{t-3}$								
$\Delta \ln POP_{t-4}$								
$\Delta \ln VOL_t$	.02(.73)		.02(1.29)		-.01(.42)		.03(1.28)	
$\Delta \ln VOL_{t-1}$			-.04(2.92)**					
$\Delta \ln VOL_{t-2}$								
$\Delta \ln VOL_{t-3}$								
$\Delta \ln VOL_{t-4}$								
ΔPOS_t		-1.42(1.39)		-.22(.21)		1.54(1.86)*		-2.22(1.56)
ΔPOS_{t-1}		-.33(.30)		-2.51(2.47)**				2.87(2.09)**
ΔPOS_{t-2}		-.18(.17)						
ΔPOS_{t-3}		-2.40(2.46)**						
ΔPOS_{t-4}								
ΔNEG_t		3.03(1.95)*		2.95(2.80)**		1.10(1.40)		3.57(3.26)**
ΔNEG_{t-1}		-2.48(2.12)**		-.85(.82)		-1.26(1.61)		
ΔNEG_{t-2}						-1.13(1.39)		
ΔNEG_{t-3}								
ΔNEG_{t-4}								
Panel B: Long-Run Estimates								
Constant	22.39(.31)	85.91(.79)	109.94(.42)	296.21(1.02)	-21.61(1.26)	16.4(.35)	-12.24(.18)	159.90(1.56)
$\ln Rincome_t$	1.73(.82)	1.85(.85)	5.44(.59)	3.78(.96)	.48(.57)	.46(.47)	.84(.60)	1.06(.93)
$\ln POP_t$	-3.49(.48)	-8.04(.85)	-13.42(.49)	-23.88(1.02)	.94(.42)	-1.90(.47)	-16(.02)	-12.62(1.60)
$\ln VOL_t$	.54(.87)		1.09(.61)		-.02(.15)		.27(.99)	
POS_t		19.37(1.00)		46.24(1.19)		3.66(.65)		18.18(1.73)*
NEG_t		13.33(.74)		21.92(.96)		.08(.01)		4.25(.52)
Panel C: Diagnostic Statistics								
F	2.43	1.79	2.67	5.07**	1.36	1.33	1.53	4.13**
ECM_{t-1}	-10(3.21)	-.10(3.40)	-.04(3.30)	-.07(4.62)**	-.17(2.36)	-.15(2.67)	.12(2.54)	-.12(4.12)**
LM	1.88	1.29	.09	.70	.10	.71	1.74	.28
RESET	2.34	.01	.90	.01	1.58	3.90**	.01	.18
QS(QS ²)	S(S)	S(S)	S(S)	S(S)	S(S)	S(S)	S(S)	S(S)
Wald-SR		1.81		2.35		.02		6.68**
Wald-LR		.35		5.18**		.69		5.13**
Adjusted R ²	.92	.93	.97	.98	.92	.92	.94	.95

Table 6 continued.								
	Nevada		New Hampshire		New Jersey		New Mexico	
	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL
Panel A: Short-Run Estimates								
$\Delta \text{LnTheil}_t$								
$\Delta \text{LnTheil}_{t-1}$	-.22(.57)	-.31(2.85)**	-.34(3.02)**	-.31(2.78)**			-.33(2.89)**	-.32(2.81)**
$\Delta \text{LnTheil}_{t-2}$		-.18(1.61)		.16(1.57)				
$\Delta \text{LnTheil}_{t-3}$								
$\Delta \text{LnTheil}_{t-4}$								
$\Delta \text{LnRincome}_t$	.87(2.51)**	.53(1.43)	.96(4.43)**	.83(4.05)**	1.05(5.05)**	1.03(4.44)**	.61(1.95)*	.52(1.59)
$\Delta \text{LnRincome}_{t-1}$	.83(2.30)**	1.28(3.28)**						.68(2.05)**
$\Delta \text{LnRincome}_{t-2}$								
$\Delta \text{LnRincome}_{t-3}$								
$\Delta \text{LnRincome}_{t-4}$								
ΔLnPOP_t	1.95(1.50)	1.85(1.56)	-.49(.44)	-.58(.54)	1.24(1.22)	2.17(1.58)	-1.82(1.86)*	-1.68(1.63)
$\Delta \text{LnPOP}_{t-1}$	-4.05(2.55)**	-2.97(2.94)**						
$\Delta \text{LnPOP}_{t-2}$	1.81(1.73)*							
$\Delta \text{LnPOP}_{t-3}$								
$\Delta \text{LnPOP}_{t-4}$								
ΔLnVOL_t	.05(1.51)		-.01(.95)		.01(.99)		.01(.43)	
$\Delta \text{LnVOL}_{t-1}$			-.04(2.25)**				-.04(1.93)*	
$\Delta \text{LnVOL}_{t-2}$								
$\Delta \text{LnVOL}_{t-3}$								
$\Delta \text{LnVOL}_{t-4}$								
ΔPOS_t		.76(.49)		-2.07(2.70)**		.02(.02)		-.19(.13)
ΔPOS_{t-1}				-2.20(2.59)**				
ΔPOS_{t-2}								
ΔPOS_{t-3}								
ΔPOS_{t-4}								
ΔNEG_t		3.71(2.29)**		.27(.26)		.53(.61)		1.11(.69)
ΔNEG_{t-1}								
ΔNEG_{t-2}								
ΔNEG_{t-3}								
ΔNEG_{t-4}								
Panel B: Long-Run Estimates								
Constant	-10.01(10.25)**	-19.13(2.31)**	22.64(.79)	10.39(.65)	3.92(.49)	12.78(1.42)	-10.08(1.08)	-.87(.04)
LnRincome_t	-1.07(1.66)*	-2.58(1.71)*	3.08(1.50)	1.72(1.30)	1.82(8.75)**	1.85(6.71)**	.13(.13)	-.24(.24)
LnPOP_t	2.02(2.64)**	4.65(1.90)*	-5.42(1.91)*	-2.92(1.13)	-2.48(3.35)**	-3.09(3.39)**	.57(.31)	.27(.10)
LnVOL_t	.06(.84)		.21(.89)		.03(.96)		.18(1.25)	
POS_t		1.48(.47)		1.09(.23)		.76(.60)		7.24(1.35)
NEG_t		8.61(1.37)		1.09(.65)		.08(.04)		2.38(.31)
Panel C: Diagnostic Statistics								
F	5.98**	5.17**	2.95	2.39	3.51	3.17	2.40	2.47
ECM_{t-1}	-.03(4.91)**	-.31(5.25)**	-11(3.52)*	-.16(3.59)	-.24(3.79)*	-.38(3.82)*	-.20(3.18)	-.24(3.60)
LM	4.64**	.81	.02	.18	.76	.61	.56	2.10
RESET	.01	3.42**	6.81**	1.09	1.43	.30	.48	.02
QS(QS ²)	S(US)	S(US)	S(S)	S(S)	S(S)	S(S)	S(US)	S(US)
Wald-SR		.91		5.12**		.09		.20
Wald-LR		2.51		.20		.06		1.10
Adjusted R ²	.95	.95	.97	.97	.98	.98	.90	.90

Table 6 continued.								
	New York		North Carolina		North Dakota		Ohio	
	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL
Panel A: Short-Run Estimates								
$\Delta \text{LnTheil}_t$								
$\Delta \text{LnTheil}_{t-1}$		-.31(2.85)**						.03(.22)
$\Delta \text{LnTheil}_{t-2}$		-.19(1.87)*						.30(2.10)**
$\Delta \text{LnTheil}_{t-3}$								
$\Delta \text{LnTheil}_{t-4}$								
$\Delta \text{LnRincome}_t$	1.04(5.51)**	1.19(6.28)**	.63(3.70)**	.60(3.34)**	.14(1.20)	.11(.81)	.57(3.25)**	.73(3.80)**
$\Delta \text{LnRincome}_{t-1}$	-.13(.74)							
$\Delta \text{LnRincome}_{t-2}$	-.18(1.00)							
$\Delta \text{LnRincome}_{t-3}$	-.59(3.21)**							
$\Delta \text{LnRincome}_{t-4}$								
ΔLnPOP_t	-.30(.14)	-3.84(1.95)*	.07(.07)	.44(.36)	.38(.38)	-.93(.74)	.06(.05)	3.62(1.35)
$\Delta \text{LnPOP}_{t-1}$	3.72(1.63)	5.91(2.23)**						
$\Delta \text{LnPOP}_{t-2}$		-3.54(1.80)*						
$\Delta \text{LnPOP}_{t-3}$								
$\Delta \text{LnPOP}_{t-4}$								
ΔLnVOL_t	.01(.47)		-.01(.17)		-.06(1.90)*		.02(1.57)	
$\Delta \text{LnVOL}_{t-1}$	-.01(.20)							
$\Delta \text{LnVOL}_{t-2}$	-.01(.13)							
$\Delta \text{LnVOL}_{t-3}$	-.03(2.41)**							
$\Delta \text{LnVOL}_{t-4}$								
ΔPOS_t		.72(1.05)		.07(.09)		-.54(.70)		1.03(2.48)**
ΔPOS_{t-1}		-1.34(2.24)**		-1.25(1.86)*				
ΔPOS_{t-2}		-1.91(3.21)**						
ΔPOS_{t-3}		-1.09(1.98)**						
ΔPOS_{t-4}								
ΔNEG_t		.84(1.09)		.34(.42)		-.32(.70)		.53(1.01)
ΔNEG_{t-1}		2.44(2.87)**				.80(1.66)*		
ΔNEG_{t-2}		1.65(1.90)*						
ΔNEG_{t-3}								
ΔNEG_{t-4}								
Panel B: Long-Run Estimates								
Constant	90.20(2.68)**	124.56(2.40)**	23.74(.38)	238.85(.30)	13.71(.27)	19.38(.36)	-26.03(.37)	-12.74(.37)
LnRincome_t	3.05(6.72)**	2.22(3.50)**	2.41(.71)	4.65(.33)	.83(2.17)**	.70(1.39)	1.36(1.09)	.69(1.26)
LnPOP_t	-9.06(3.58)**	-10.14(2.76)**	-4.24(.56)	-21.00(.31)	-2.14(.51)	-2.38(.57)	.02(.01)	-1.0(.04)
LnVOL_t	-.04(.38)		.82(.74)		-.29(1.41)		.37(1.21)	
POS_t		1.64(.47)		71.30(.34)		-2.63(1.10)		5.06(1.97)*
NEG_t		-3.34(.74)		36.48(.34)		-2.80(1.42)		2.59(.88)
Panel C: Diagnostic Statistics								
F	4.25*	4.33**	3.31	2.70	1.27	.65	1.61	2.66
ECM_{t-1}	-.21(4.25)**	-.19(4.88)**	.05(3.72)*	-.02(3.70)*	-.12(2.20)	-.12(1.85)	-.08(2.60)	-.20(2.85)
LM	3.01*	.48	.01	.25	.26	.35	.01	.15
RESET	.80	.29	.06	.01	.01	1.58	.91	3.00*
QS(QS ²)	S(S)	S(S)	S(S)	S(S)	S(S)	S(S)	S(S)	S(S)
Wald-SR		7.14**		.49		.87		1.45
Wald-LR		6.28**		.23		.02		6.57**
Adjusted R ²	.99	.99	.97	.96	.91	.91	.97	.97

Table 6 continued.								
	Oklahoma		Oregon		Pennsylvania		Rhode Island	
	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL
Panel A: Short-Run Estimates								
$\Delta \text{LnTheil}_t$								
$\Delta \text{LnTheil}_{t-1}$		.55(3.49)**					-.38(.12)	
$\Delta \text{LnTheil}_{t-2}$		.33(2.20)**					-.38(3.55)**	
$\Delta \text{LnTheil}_{t-3}$		.24(1.75)*					-.15(1.45)	
$\Delta \text{LnTheil}_{t-4}$								
$\Delta \text{LnRincome}_t$	.43(2.31)**	.14(.56)	1.11(6.06)**	.84(4.19)**	.78(4.10)**	.69(.85)	.93(4.33)**	.67(2.88)**
$\Delta \text{LnRincome}_{t-1}$		.81(3.92)**						
$\Delta \text{LnRincome}_{t-2}$		.42(2.18)**						
$\Delta \text{LnRincome}_{t-3}$		.19(1.00)						
$\Delta \text{LnRincome}_{t-4}$								
ΔLnPOP_t	1.67(1.36)	2.04(1.80)*	.20(.24)	-1.13(1.16)	.30(.18)	-.11(.05)	.13(.10)	-1.16(.83)
$\Delta \text{LnPOP}_{t-1}$	-.63(.52)	-.97(.92)				3.29(1.24)	-1.82(1.33)	-2.83(1.88)*
$\Delta \text{LnPOP}_{t-2}$	-.72(.92)	-.12(.17)				1.10(.46)	5.39(4.80)**	6.41(4.43)**
$\Delta \text{LnPOP}_{t-3}$	-1.84(2.24)**	-1.42(1.80)*				1.65(.82)		-2.62(2.15)**
$\Delta \text{LnPOP}_{t-4}$								
ΔLnVOL_t	.04(2.03)**		.02(1.23)		.01(.33)		.01(.90)	
$\Delta \text{LnVOL}_{t-1}$	-.03(1.86)*				-.03(2.51)**		-.08(4.52)**	
$\Delta \text{LnVOL}_{t-2}$	-.02(1.27)						-.05(3.37)**	
$\Delta \text{LnVOL}_{t-3}$							-.02(1.59)	
$\Delta \text{LnVOL}_{t-4}$								
ΔPOS_t		1.23(1.30)		-1.82(2.14)**		-1.65(1.93)*		-.23(.24)
ΔPOS_{t-1}				-1.68(2.06)**		-1.71(2.16)**		-2.10(2.35)**
ΔPOS_{t-2}						-.71(.90)		
ΔPOS_{t-3}								
ΔPOS_{t-4}								
ΔNEG_t		2.80(3.23)**		3.42(3.46)**		2.02(1.79)*		.48(.41)
ΔNEG_{t-1}				-1.19(1.16)				
ΔNEG_{t-2}				-2.14(2.16)**				
ΔNEG_{t-3}								
ΔNEG_{t-4}								
Panel B: Long-Run Estimates								
Constant	-45.30(2.19)**	-6.05(1.52)	-8.45(.45)	39.63(1.00)	89.75(1.21)	109(95(3.87)**	51.02(2.75)**	54.79(1.95)*
LnRincome_t	-.80(.99)	-.57(5.08)**	1.37(.69)	3.51(1.38)	2.22(3.05)**	1.44(5.30)**	2.46(6.00)**	2.20(2.230)**
LnPOP_t	3.98(1.71)*	1.00(2.59)**	-1.07(.30)	-6.99(1.26)	-8.13(1.51)	-8.53(4.58)**	-6.69(3.65)**	-6.69(2.26)**
LnVOL_t	.11(.69)		.34(.97)		.24(1.63)		.26(4.70)**	
POS_t		2.15(5.03)**		18.76(1.40)		2.38(1.63)		4.93(1.98)*
NEG_t		-2.33(6.03)**		12.63(.99)		-1.67(.86)		4.29(1.13)
Panel C: Diagnostic Statistics								
F	3.11	5.00**	2.51	3.19	3.54	3.13	7.74**	2.36
ECM_{t-1}	-.16(3.61)*	-.92(5.10)**	-.08(3.23)	-.09(4.14)**	-.13(3.68)*	-.29(3.97)*	-.32(5.74)**	-.21(3.57)
LM	.71	.01	.05	.08	.74	2.01	1.10	1.69
RESET	.17	3.12*	3.53*	.47	.15	.13	.80	.16
QS(QS ²)	S(S)	S(S)	S(S)	S(S)	S(S)	S(S)	S(S)	S(S)
Wald-SR		.74		2.08		7.26**		3.50*
Wald-LR		180.71**		1.08		6.23**		.03
Adjusted R ²	.96	.97	.96	.97	.98	.98	.97	.96

Table 6 continued.								
	South Carolina		South Dakota		Tennessee		Texas	
	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL
Panel A: Short-Run Estimates								
$\Delta \text{LnTheil}_t$								
$\Delta \text{LnTheil}_{t-1}$	.01(.80)		.06(.43)	.07(.52)			-.20(1.75)*	
$\Delta \text{LnTheil}_{t-2}$	-.07(.60)		.30(2.24)**	.29(2.15)**				
$\Delta \text{LnTheil}_{t-3}$	.44(3.57)**							
$\Delta \text{LnTheil}_{t-4}$								
$\Delta \text{LnRincome}_t$	.87(4.32)**	.85(3.98)**	.32(1.98)**	.26(2.15)**	1.05(4.94)**	1.16(5.24)**	.49(2.72)**	.31(1.64)
$\Delta \text{LnRincome}_{t-1}$	.07(.36)							.31(1.83)*
$\Delta \text{LnRincome}_{t-2}$	-.42(2.30)**							
$\Delta \text{LnRincome}_{t-3}$								
$\Delta \text{LnRincome}_{t-4}$								
ΔLnPOP_t	-1.17(.98)	-2.85(2.04)**	.72(.54)	.96(.51)	.14(.10)	.99(.78)	.53(.51)	.93(.89)
$\Delta \text{LnPOP}_{t-1}$				2.31(.97)			-2.47(2.52)**	-2.23(2.34)**
$\Delta \text{LnPOP}_{t-2}$				-2.94(1.27)				
$\Delta \text{LnPOP}_{t-3}$				3.85(2.09)**				
$\Delta \text{LnPOP}_{t-4}$								
ΔLnVOL_t	.02(1.34)		.01(.34)		.05(2.33)**		-.01(.12)	
$\Delta \text{LnVOL}_{t-1}$					-.03(1.47)			
$\Delta \text{LnVOL}_{t-2}$					.01(.50)			
$\Delta \text{LnVOL}_{t-3}$					-.04(1.89)*			
$\Delta \text{LnVOL}_{t-4}$								
ΔPOS_t		.22(.29)		-1.42(1.14)		1.90(1.82)*		-.72(.77)
ΔPOS_{t-1}		-2.86(3.29)**						
ΔPOS_{t-2}		-.82(1.04)						
ΔPOS_{t-3}		-1.60(2.21)**						
ΔPOS_{t-4}								
ΔNEG_t				.05(.05)		.23(.20)		1.92(2.45)**
ΔNEG_{t-1}								-1.74(1.71)*
ΔNEG_{t-2}								
ΔNEG_{t-3}								
ΔNEG_{t-4}								
Panel B: Long-Run Estimates								
Constant	-16.02(.90)	71.47(.35)	-37.46(1.24)	-20.58(.73)	35.13(.23)	809.79(.36)	-25.41(6.00)**	-38.87(3.84)**
LnRincome_t	.32(.36)	4.49(.53)	.48(.99)	.95(1.45)	3.91(.43)	8.02(.36)	-.62(1.88)*	-1.07(2.56)**
LnPOP_t	.69(.32)	-9.82(.43)	2.13(.77)	.31(.12)	-6.50(.33)	-63.34(.37)	2.24(3.53)**	3.61(3.36)**
LnVOL_t	.26(.93)		-.01(.03)		1.89(.48)		-.03(.53)	
POS_t		90.83(.56)		-4.64(1.87)*		93.97(.37)		-17(.08)
NEG_t		71.47(.35)		-2.90(1.39)		-35.94(.37)		2.58(.89)
Panel C: Diagnostic Statistics								
F	1.95	2.80	1.44	1.34	2.15	3.75*	4.16*	4.72**
ECM_{t-1}	-.10(2.87)	-.03(3.89)*	-.15(2.44)	-.19(2.57)	-.02(2.92)	-.02(4.27)**	-.22(4.13)*	-.25(4.98)**
LM	.36	.77	.74	3.82*	.18	.47	2.77*	1.91
RESET	3.36*	.90	3.24**	2.10	1.19	.01	.07	2.18
QS(QS ²)	S(S)	S(S)	S(S)	S(S)	S(S)	S(S)	S(S)	S(S)
Wald-SR		7.45**		.63		.73		.26
Wald-LR		.18		.27		1.23		1.68
Adjusted R ²	.97	.97	.94	.95	.97	.97	.98	.98

Table 6 continued.								
	Utah		Vermont		Virginia		Washington	
	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL
Panel A: Short-Run Estimates								
$\Delta \text{LnTheil}_t$								
$\Delta \text{LnTheil}_{t-1}$								
$\Delta \text{LnTheil}_{t-2}$								
$\Delta \text{LnTheil}_{t-3}$								
$\Delta \text{LnTheil}_{t-4}$								
$\Delta \text{LnRincome}_t$	.82(3.54)**	.68(2.71)**	1.02(4.44)**	.91(3.54)**	.74(4.29)**	.78(4.02)**	.86(3.94)**	.68(2.73)**
$\Delta \text{LnRincome}_{t-1}$		.47(1.95)*					.40(1.65)*	.37(1.53)
$\Delta \text{LnRincome}_{t-2}$							.55(2.14)**	.51(2.08)**
$\Delta \text{LnRincome}_{t-3}$								
$\Delta \text{LnRincome}_{t-4}$								
ΔLnPOP_t	-1.94(1.41)	-2.09(1.51)	-1.34(1.08)	-1.26(.92)	.35(.33)	.53(.46)	.71(.65)	.63(.60)
$\Delta \text{LnPOP}_{t-1}$	-1.73(1.11)	-1.47(.93)						
$\Delta \text{LnPOP}_{t-2}$	1.20(.81)	.27(.18)						
$\Delta \text{LnPOP}_{t-3}$	-2.48(2.13)**	-2.64(2.21)**						
$\Delta \text{LnPOP}_{t-4}$								
ΔLnVOL_t	.02(1.10)		.01(.68)		-.02(1.19)		-.01(.94)	
$\Delta \text{LnVOL}_{t-1}$							-.01(.45)	
$\Delta \text{LnVOL}_{t-2}$							.03(1.60)	
$\Delta \text{LnVOL}_{t-3}$							.03(1.86)*	
$\Delta \text{LnVOL}_{t-4}$								
ΔPOS_t		-1.45(1.52)		-.50(.34)		.02(.03)		-1.73(1.62)
ΔPOS_{t-1}								-2.66(2.62)**
ΔPOS_{t-2}								
ΔPOS_{t-3}								
ΔPOS_{t-4}								
ΔNEG_t		4.13(3.81)**		.34(.24)		-.91(1.23)		2.64(2.40)**
ΔNEG_{t-1}		-3.24(2.82)**						
ΔNEG_{t-2}								
ΔNEG_{t-3}								
ΔNEG_{t-4}								
Panel B: Long-Run Estimates								
Constant	-14.67(1.54)	-65.50(.80)	-5.81(.19)	5.36(.19)	-26.62(1.17)	-.69(.01)	-41.31(3.39)**	-54.21(2.47)**
LnRincome_t	-.59(.41)	-1.92(.52)	.97(.74)	.85(.65)	-.02(.02)	.34(.28)	-1.76(1.60)	-1.41(1.18)
LnPOP_t	1.80(.76)	7.20(.70)	-.76(.19)	-1.54(.48)	1.67(.61)	-.46(.10)	4.77(2.26)**	5.28(1.97)*
LnVOL_t	.20(1.14)		.20(.74)		-.04(.25)		.05(.34)	
POS_t		20.81(.90)		3.58(.55)		.03(.01)		12.33(1.64)
NEG_t		37.33(.79)		1.10(.14)		-4.61(.54)		16.40(1.73)*
Panel C: Diagnostic Statistics								
F	2.13	3.46	1.91	1.32	1.88	1.70	3.06	3.47*
ECM_{t-1}	-.11(2.97)	-.07(4.33)**	-.10(2.75)	-.11(2.53)	-.09(2.72)	-.12(2.98)	-.17(3.60)*	-.14(4.31)**
LM	.02	.03	.11	.21	.42	.11	.10	.60
RESET	.14	.85	1.62	1.37	.65	.43	.43	.12
QS(QS ²)	S(S)	S(S)	S(S)	US(S)	S(US)	S(US)	S(US)	S(US)
Wald-SR		6.21**		.13		.34		6.67**
Wald-LR		.46		.04		.06		.74
Adjusted R ²	.96	.97	.94	.94	.98	.98	.98	.98

Table 6 continued.								
	West Virginia		Wisconsin		Wyoming		District of Columbia	
	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL	L-ARDL	NL-ARDL
Panel A: Short-Run Estimates								
$\Delta \ln Theil_t$								
$\Delta \ln Theil_{t-1}$							-.43(3.72)**	-.54(4.38)**
$\Delta \ln Theil_{t-2}$								
$\Delta \ln Theil_{t-3}$								
$\Delta \ln Theil_{t-4}$								
$\Delta \ln Rincome_t$	.23(1.28)	.06(.34)	.64(4.03)**	.44(2.93)**	.25(1.10)	.30(1.00)	.96(3.00)**	1.40(3.92)**
$\Delta \ln Rincome_{t-1}$		.34(2.00)**	.26(1.56)				.26(.79)	.59(1.56)
$\Delta \ln Rincome_{t-2}$		.07(.39)	.24(1.48)				.10(.33)	-.58(1.61)
$\Delta \ln Rincome_{t-3}$		.47(2.66)**						
$\Delta \ln Rincome_{t-4}$								
$\Delta \ln POP_t$	-1.77(1.81)*	-.93(1.01)	.89(.69)	2.14(1.42)	-.25(.24)	-.79(1.11)	-.82(.81)	-1.20(1.26)
$\Delta \ln POP_{t-1}$				4.63(2.66)**	-1.19(1.19)			
$\Delta \ln POP_{t-2}$								
$\Delta \ln POP_{t-3}$								
$\Delta \ln POP_{t-4}$								
$\Delta \ln VOL_t$	.01(.52)		.02(1.38)		-.6(2.46)**		.01(.85)	
$\Delta \ln VOL_{t-1}$	-.07(3.12)**		-.04(2.72)**					
$\Delta \ln VOL_{t-2}$	-.07(3.03)**		-.03(2.17)**					
$\Delta \ln VOL_{t-3}$	-.04(1.82)*							
$\Delta \ln VOL_{t-4}$								
ΔPOS_t		-1.50(1.61)		-2.64(3.80)**		-.14(.13)		.96(.58)
ΔPOS_{t-1}		-2.40(2.34)**		-3.62(4.22)**				-5.14(3.48)**
ΔPOS_{t-2}		-2.46(2.38)**		-2.60(3.44)**				-3.51(2.43)**
ΔPOS_{t-3}				-1.31(1.47)				
ΔPOS_{t-4}								
ΔNEG_t		3.01(2.66)**		1.77(2.01)**		-1.64(1.84)*		2.01(1.47)
ΔNEG_{t-1}		-1.87(1.85)*						
ΔNEG_{t-2}		-2.38(3.00)**						
ΔNEG_{t-3}								
ΔNEG_{t-4}								
Panel B: Long-Run Estimates								
Constant	58.70(1.92)*	13.28(1.14)	-43.25(.93)	20.77(1.38)	-27.53(1.60)	6.26(1.06)	30.77(2.07)**	26.27(1.98)*
$\ln Rincome_t$	1.02(4.46)**	-.18(.69)	.40(.27)	.99(3.29)**	.75(.84)	-.18(.56)	.21(.59)	.73(.76)
$\ln POP_t$	-5.23(2.41)**	-.80(.86)	2.47(.51)	-2.62(2.06)**	1.10(.47)	-.39(.52)	-2.59(3.73)**	-2.85(1.95)*
$\ln VOL_t$	.44(2.14)**		.86(2.36)**		-.30(1.68)*		-.01(.18)	
POS_t		5.12(2.42)**		6.27(4.00)**		.03(.03)		3.25(.63)
NEG_t		1.65(.69)		1.29(.75)		-5.98(5.35)**		4.90(.80)
Panel C: Diagnostic Statistics								
F	4.75**	5.97**	6.31**	8.63**	1.07	3.26	2.44	.79
ECM_{t-1}	-.16(4.45)**	-.35(5.69)**	-.10(5.07)**	-.38(6.87)**	-.08(2.01)	-.34(4.09)**	-.28(3.05)	-.22(2.00)
LM	.10	.70	.01	.93	1.41	1.83	.60	.40
RESET	4.95**	.83	.16	.11	.57	.01	3.18*	2.06
QS(QS ²)	S(S)	S(S)	S(S)	S(S)	S(S)	S(US)	S(US)	S(US)
Wald-SR		.69		15.91**		.81		1.50
Wald-LR		14.82**		16.79**		38.01**		.03
Adjusted R ²	.94	.95	.98	.98	.96	.97	.95	.95

1. Numbers inside parentheses are t-ratios. **, * denote significance at the 5, 10% levels, respectively.
2. At the 10% (5%) significance level when there are three exogenous variables (k=3), the upper bound critical value of the F test is 3.92 (4.61) and 3.71 (4.31) for (k=4) when we have four exogenous variables. These come from Narayan (2005, p. 1988) for our small sample size
3. The number inside the parenthesis next to ECM_{t-1} is the absolute value of the t-ratio. Its upper bound critical value at the 10% (5%) significance level is -3.45 (-3.82) when k=3 and these come from Banerjee et al. (1989, p. 276). In the non-linear model where k=4, these critical values change to -3.64 (-4.05).
4. LM is Lagrange Multiplier test of residual serial correlation. It is distributed as χ^2 with one degree of freedom (first order). Its critical value at 10% (5%) significance level is 2.70 (3.84). These critical values are also used for Wald tests since they also have a χ^2 distribution with one degree of freedom.
5. RESET is Ramsey's test for misspecification. It is distributed as χ^2 with one degree of freedom.

Table 7. The ADF Test Results for 40 Countries

Variables	GINI		RGDP	
	Level	First Difference	Level	First Difference
Austria	-1.15[1]	-3.83[3]**	-1.23[5]	-3.37[4]**
Belgium	-1.84[4]	-4.81[2]**	-1.58[1]	-3.90[1]**
Bolivia	-1.14[6]	-3.08[6]**	.25[5]	-3.03[4]**
Chile	-1.80[1]	-3.54[1]**	.71[1]	-3.43[1]**
Canada	-.22[6]	-4.39[4]**	-1.09[1]	-3.96[1]**
Colombia	-1.60[2]	-3.99[3]**	-1.51[1]	-2.83[1]*
Cyprus	-1.70[1]	-5.17[1]**	-.19[2]	-5.14[1]**
Ecuador	-1.68[1]	-4.36[1]**	-3.30[1]**	-3.28[1]**
Finland	-1.21[3]	-3.70[1]**	-.31[2]	-3.70[1]**
France	-2.00[1]	-3.90[1]**	-.36[1]	-2.87[1]*
Greece	-1.30[6]	-3.87[1]**	-2.71[1]*	-3.32[1]**
Hong Kong	-1.56[3]	-2.93[1]*	-1.72[1]	-3.84[1]**
Hungary	-1.26[1]	-2.66[1]*	-1.14[1]	-3.05[1]**
Indonesia	-1.57[1]	-3.85[1]**	-1.36[1]	-3.52[1]**
India	-2.64[1]*	-4.11[1]**	4.57[5]	-3.15[1]**
Ireland	-1.71[1]	-3.80[1]**	1.25[1]	-2.79[1]*
Iran	-1.99[1]	-3.44[1]**	-1.18[1]	-3.59[2]**
Israel	-2.36[5]	-3.12[4]**	-.78[2]	-11.98[3]**
Italy	-2.06[1]	-3.95[1]**	-2.98[4]**	-3.25[1]**
Jordan	-2.14[2]	-3.09[1]**	2.12[1]	-2.58[2]*
Kenia	-.35[1]	-4.51[4]**	-3.46[4]**	-4.15[1]**
Korea	-1.94[1]	-4.17[1]**	-2.50[1]	-3.52[1]**
Luxembourg	-.44[2]	-6.58[1]**	1.11[1]	-3.33[1]**
Malaysia	-2.01[2]	-2.72[1]*	-.73[1]	-3.75[1]**
Mauritius	-1.83[1]	-2.87[1]*	-.21[6]	-4.09[6]**
Malta	-.51[2]	-3.01[1]**	-2.72[4]*	-2.68[3]*
Mexico	1.09[4]	-4.47[3]**	-1.00[1]	-2.86[1]*
Morocco	-1.44[1]	-3.16[1]**	.47[3]	-5.34[1]**
Netherland	-.97[1]	-5.05[1]**	-.13[1]	-3.99[1]**
Norway	.11[4]	-4.24[4]**	-1.09[1]	-3.08[1]**
Panama	-2.14[4]	-2.95[1]**	-.90[2]	-3.98[1]**
Philippines	-2.64[1]*	-4.62[1]**	-.79[2]	-3.65[1]**
Singapore	-3.16[2]**	-3.44[1]**	-2.34[4]	-2.82[2]*
South Africa	-1.19[5]	-3.29[4]**	.87[1]	-3.17[1]**
Spain	-2.39[4]	-4.14[1]**	.16[1]	-2.88[1]*
Sweden	-1.26[1]	-4.05[1]**	-.02[2]	-0.58[6]**
Turkey	-1.73[1]	-3.60[1]**	-.06[1]	-3.57[1]**
United Kingdom	-1.72[1]	-3.41[1]**	.50[2]	-3.37[6]**
Uruguay	-1.44[6]	-3.38[1]**	-1.18[1]	-3.74[2]**
Venezuela	.23[1]	-3.37[1]**	-1.29[1]	-3.05[1]**

Notes:

- a- The ADF test applied to the log of GINI and log of real income of each state.
- b- Maximum number of lags imposed is 6.
- c- Numbers inside the brackets are the optimum lag order in the ADF test selected by AIC.
- d- The critical values for the ADF test statistic 5% and 10% levels are -2.94 and -2.54 respectively.
- e- ** and * indicate that the relevant test statistic is significant at 5% and 10% levels respectively.

Table 8. The ADF Test Results for U.S. States

Variables	GINI		Real Income	
	Level	First Difference	Level	First Difference
U.S.A	-.09[2]	-3.85[4]**	-1.30[1]	-4.70[2]**
Alabama	-1.28[2]	-4.57[1]**	-2.31[1]	-5.09[1]**
Alaska	-1.96[1]	-4.33[1]**	-2.23[1]	-4.41[1]**
Arizona	-.52[2]	-4.70[4]**	-2.75[3]	-4.69[1]**
Arkansas	-1.13[1]	-5.18[1]**	-1.37[1]	-5.49[1]**
California	-.33[1]	-3.70[3]**	-3.14[3]**	-4.70[1]**
Colorado	-.13[3]	-6.90[2]**	-2.26[3]	-5.29[2]**
Connecticut	-.19[1]	-5.98[1]**	-2.12[1]	-4.86[1]**
Delaware	-1.09[1]	-8.10[1]**	-2.65[5]*	-2.60[4]*
Florida	-.22[1]	-5.83[1]**	-4.15[4]**	-4.24[1]**
Georgia	-.35[1]	-5.39[1]**	-1.68[1]	-5.01[1]**
Hawaii	-1.11[1]	-5.01[2]**	-2.41[1]	-3.65[1]**
Idaho	-.94[2]	-8.58[1]**	-.95[1]	-5.46[2]**
Illinois	-.43[1]	-5.07[1]**	-1.98[1]	-4.83[1]**
Indiana	-.06[6]	-3.44[6]**	-1.87[1]	-5.32[1]**
Iowa	-1.45[3]	-6.49[2]**	-1.04[1]	-5.64[1]**
Kansas	-.70[1]	-3.72[6]**	-2.04[3]	-6.71[2]**
Kentucky	-1.17[1]	-5.23[1]**	-1.85[1]	-4.93[2]**
Louisiana	-.93[1]	-5.23[5]**	-2.72[3]	-5.15[2]**
Maine	-1.13[1]	-5.29[4]**	-1.81[1]	-5.42[1]**
Maryland	-.47[1]	-5.98[1]**	-2.36[1]	-4.16[1]**
Massachusetts	-.34[1]	-5.17[1]**	-1.43[1]	-4.83[1]**
Michigan	-3.7[2]	-5.07[1]**	-2.44[1]	-4.67[1]**
Minnesota	-.88[1]	-5.88[1]**	-1.68[1]	-5.14[1]**
Mississippi	.04[6]	-5.20[5]**	-1.88[1]	-5.60[1]**
Missouri	-.65[1]	-4.76[4]**	-2.58[4]*	-5.13[1]**

Table 8. Continued.

Variables	GINI		Real Income	
	Level	First difference	Level	First Difference
Montana	-1.32[1]	-6.66[1]**	-.66[2]	-6.34[1]**
Nebraska	-1.36[5]	-6.00[4]**	-.73[1]	-5.92[1]**
Nevada	-.99[6]	-3.68[5]**	-2.79[4]*	-4.02[1]**
New Hampshire	-.64[1]	-6.53[1]**	-1.82[1]	-4.86[1]**
New Jersey	-.54[1]	-4.60[1]**	-2.19[1]	-4.58[1]**
New Mexico	-1.42[1]	-7.50[1]**	-3.12[3]**	-4.53[1]**
New York	.22[1]	-5.74[1]**	-1.82[1]	-4.68[1]**
North Carolina	-.63[3]	-5.11[2]**	-1.51[1]	-5.20[1]**
North Dakota	-1.27[5]	-5.93[4]**	-.10[1]	-7.01[1]**
Ohio	-.66[1]	-4.72[4]**	-2.36[1]	-4.86[1]**
Oklahoma	-1.19[1]	-5.54[1]**	-1.99[3]	-5.74[2]**
Oregon	-.25[6]	-3.30[6]**	-1.33[1]	-5.26[1]**
Pennsylvania	-.74[1]	-5.52[1]**	-1.63[1]	-5.25[1]**
Rhode Island	-.20[4]	-5.96[3]**	-1.67[1]	-4.96[1]**
South Carolina	-1.07[1]	-4.82[1]**	-1.84[3]	-5.29[2]**
South Dakota	-1.65[1]	-7.16[1]**	.15[2]	-7.75[1]**
Tennessee	-1.04[1]	-5.61[1]**	-1.95[1]	-4.98[1]**
Texas	-.69[1]	-2.71[6]*	-1.75[5]	-5.78[2]**
Utah	-1.07[1]	-6.63[1]**	-1.80[4]	-5.84[2]**
Vermont	-.94[2]	-5.41[4]**	-1.50[1]	-5.14[1]**
Virginia	-.61[1]	-5.08[1]**	-1.93[1]	-4.99[1]**
Washington	-.75[1]	-3.27[6]**	-1.61[4]	-5.50[2]**
West Virginia	-1.46[1]	-4.41[4]**	-1.26[3]	-5.99[2]**
Wisconsin	-.85[1]	-5.23[3]**	-1.59[1]	-5.12[1]**
Wyoming	.02[3]	-2.79[6]*	-.32[3]	-5.69[2]**
District of Colombia	-1.04[1]	-7.47[1]**	.09[1]	-4.59[1]**

Notes:

- a- The ADF test applied to the log of GINI and log of real income of each state.
b- Maximum number of lags imposed is 6.
c- Numbers inside the parentheses are the optimum lag order in the ADF test selected by AIC.
d- The critical values for the ADF test statistic 5% and 10% levels are -2.89 and -2.49 respectively.
e- ** and * indicate that the relevant test statistic is significant at 5% and 10% levels respectively.

References

- Adelman, I., & Morris, C. T. (1973). *Economic growth and social equity in developing countries*. Stanford University Press.
- Ahluwalia, M. S. (1974). Income inequality: some dimensions of the problem. *Finance and Development*, 11 (3), 2.
- Ahluwalia, M. S. (1976). Inequality, poverty, and development. *Journal of development economics*, 3 (4), 307-342.
- Anand, S., & Kanbur, S. R. (1993a). Inequality and development a critique. *Journal of development economics*, 41 (1), 19-43.
- Anand, S., & Kanbur, S. R. (1993b). The Kuznets process and the inequality development relationship. *Journal of development economics*, 40 (1), 25-52.
- Bahmani-Oskooee, M., & Gelan, A. (2008). Kuznets inverted-u hypothesis revisited: a time series approach using us data. *Applied Economics Letters*, 15 (9), 677-681.
- Bahmani-Oskooee, M., & Gelan, A. (2012). On the relation between income distribution and economic growth. *Global Business and Economics Review*, 14 (4), 249-273.
- Bahmani-Oskooee, M., Ghodsi, S. H., et al. (2017). Asymmetric causality and asymmetric cointegration between income and house prices in the United States of America. *International Real Estate Review*, 20 (2), 127-165.
- Bahmani-Oskooee, M., Hegerty, S. W., & Wilmeth, H. (2008). Short-run and long-run determinants of income inequality: evidence from 16 countries. *Journal of Post Keynesian Economics*, 30 (3), 463-484.
- Bahmani-Oskooee, M., & Oyolola, M. (2007). Export growth and output growth: an application of bounds testing approach. *Journal of Economics and Finance*, 31 (1), 1-11.
- Bahmani-Oskooee, M., & Tankui, A. (2008). The black market exchange rate vs. the official rate in testing PPP: Which rate fosters the adjustment process? *Economics Letters*, 99 (1), 40-43.
- Banerjee, A. V., & Duo, E. (2003). Inequality and growth: What can the data say? *Journal of economic growth*, 8 (3), 267-299.
- Barro, R. J. (2000). Inequality and growth in a panel of countries. *Journal of economic growth*, 5 (1), 5-32.
- Bayarjargal, A. E. (2016). *Economic growth and income inequality: asymmetric response of top income shares to growth volatility* (No. 2016-09).
- Breen, R., & Garcia-Penalosa, C. (2005). Income inequality and macroeconomic volatility: an empirical investigation. *Review of Development Economics*, 9 (3), 380-398.
- Brown, R. L., Durbin, J., & Evans, J. M. (1975). Techniques for testing the constancy of regression relationships over time. *Journal of the Royal Statistical Society. Series B (Methodological)*, 149-192.

- Calderón, C., & Levy-Yeyati, E. L. (2009). Zooming in: From aggregate volatility to income distribution.
- Campano, F., & Salvatore, D. (1988). Economic development, income inequality and Kuznets' u-shaped hypothesis. *Journal of Policy Modeling*, 10 (2), 265-280.
- Caroli, E., & Garcia-Penalosa, C. (2002). Risk aversion and rising wage inequality. *Economics Letters*, 77 (1), 21-26.
- Chambers, D. (2010). Does a rising tide raise all ships? the impact of growth on inequality. *Applied Economics Letters*, 17 (6), 581-586.
- Checchi, D., & Garcia-Penalosa, C. (2004). Risk and the distribution of human capital. *Economics Letters*, 82 (1), 53-61.
- Cheng, W., & Wu, Y. (2016). Understanding the Kuznets process an empirical investigation of income inequality in China: 1978-2011. *Social Indicators Research*, 1-20.
- Cline, W. R. (1975). Distribution and development: A survey of the literature. *Journal of Development Economics*, 1 (4), 359-400.
- Dawson, P. (1997). On testing Kuznets' economic growth hypothesis. *Applied Economics Letters*, 4 (7), 409-410.
- Deininger, K., & Squire, L. (1996). A new data set measuring income inequality. *The World Bank Economic Review*, 10 (3), 565-591.
- Deininger, K., & Squire, L. (1998). New ways of looking at old issues: inequality and growth. *Journal of development economics*, 57 (2), 259-287.
- Dollar, D., & Kraay, A. (2002). Growth is good for the poor. *Journal of Economic Growth*, 7 (3), 195-225.
- Durlauf, S. N. (2001). Manifesto for a growth econometrics. *Journal of Econometrics*, 100 (1), 65-69.
- Engle, R. F., & Granger, C. W. (1987). Co-integration and error correction: representation, estimation, and testing. *Econometrica: Journal of the Econometric Society*, 251-276.
- Fang, W., Miller, S. M., Yeh, C. C., et al. (2015). The effect of growth volatility on income inequality. *Economic Modelling*, 45, 212-222.
- Fields, G. S. (2000). Distribution and development: a summary of the evidence for the developing world. *A Background paper prepared for the World Development Report*.
- Fields, G. S. (2001). Distribution and development: a new look at the developing world, Russell sage foundation. *New York, and The MIT Press, Cambridge, Massachusetts, and London*.
- Forbes, K. J. (2000). A reassessment of the relationship between inequality and growth. *American economic review*, 869-887.
- Frank, M. W. (2009). Inequality and growth in the united states: Evidence from a new state-level panel of income inequality measures. *Economic Inquiry*, 47 (1), 55-68.
- Ganaie, A. A., & Kamaiah, B. (2015). Kuznets inverted u hypothesis of income inequality: Looking inside the available economic literature.

- Granger, C. W. (1988). Some recent development in a concept of causality. *Journal of Econometrics*, 39 (1-2), 199-211.
- Higgins, M., & Williamson, J. G. (1999). *Explaining inequality the world round: Cohort Size, Kuznets curves, and openness* (Tech. Rep.). National Bureau of economic research.
- Hsing, Y., & Smyth, D. J. (1994). Kuznets' inverted-u hypothesis revisited. *Applied Economics Letters*, 1 (7), 111-113.
- Jacobsen, P. W., & Giles, D. E. (1998). Income distribution in the united states: Kuznets' inverted-u hypothesis and data non-stationarity. *Journal of International Trade & Economic Development*, 7 (4), 405-423.
- Jalil, A. (2012). Modeling income inequality and openness in the framework of Kuznets curve: New evidence from China. *Economic Modelling*, 29 (2), 309-315.
- Khasru, S. M., & Jalil, M. M. (2004). Revisiting Kuznets hypothesis: A time series and panel data approach.
- Kim, D. H., Huang, H.-C., & Lin, S.-C. (2011). Kuznets hypothesis in a panel of states. *Contemporary Economic Policy*, 29 (2), 250-260.
- Kim, D. H., Lin, S.-C., & Suen, Y.-B. (2016). Trade, growth and growth volatility: New panel evidence. *International Review of Economics & Finance*, 45, 384-399.
- Kravis, I. B. (1960). International differences in the distribution of income. *The Review of Economics and Statistics*, 408-416.
- Kuznets, S. (1955). Economic growth and income inequality. *The American economic review*, 45 (1), 1-28.
- Kuznets, S. (1963). Quantitative aspects of the economic growth of nations: Viii. Distribution of income by size. *Economic development and cultural change*, 11 (2, Part 2), 1-80.
- Laursen, T., & Mahajan, S. (2005). Volatility, income distribution, and poverty. *Managing Economic Volatility and Crises: A Practitioners Guide*, Cambridge University Press New York, 101-136.
- Li, H., Squire, L., & Zou, H.-f. (1998). Explaining international and intertemporal variations in income inequality. *The economic journal*, 108 (446), 26-43.
- Narayan, P. K. (2005). The saving and investment nexus for China: evidence from cointegration tests. *Applied Economics*, 37 (17), 1979-1990.
- Oyvatt, C., et al. (2015). Structural change and the Kuznets hypothesis.
- Papanek, G. F., & Kyn, O. (1986). The effect on income distribution of development, the growth rate and economic strategy. *Journal of Development Economics*, 23 (1), 55-65.
- Paukert, F. (1973). Income distribution at different levels of development: A survey of the evidence. *International Labor Review*, 108, 97.
- Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of applied econometrics*, 16 (3), 289-326.
- Piketty, T. (2006). The Kuznets curve: Yesterday and tomorrow. *Understanding poverty*, 63-72.

- Piketty, T., & Saez, E. (2003). Income inequality in the united states, 1913-1998. *The Quarterly Journal of Economics*, 118 (1), 1-41.
- Ram, R. (1988). Economic development and income inequality: further evidence on the u-curve hypothesis. *World Development*, 16 (11), 1371-1376.
- Ram, R. (1991). Kuznets' inverted-u hypothesis: evidence from a highly developed country. *Southern Economic Journal*, 1112-1123.
- Ravallion, M., & Chen, S. (1997). What can new survey data tell us about recent changes in distribution and poverty? *The World Bank Economic Review*, 11 (2), 357-382.
- Saez, E. (2015). Striking it Richer: The evolution of top incomes in the united states (updated with 2014 preliminary estimates). *Economics Department, UC Berkeley*.
- Saith, A. (1983). Development and distribution: A critique of the cross-country u-hypothesis. *Journal of Development Economics*, 13 (3), 367-382.
- Savvides, A., & Stengos, T. (2000). Income inequality and economic development: evidence from the threshold regression model. *Economics Letters*, 69 (2), 207-212.
- Schorderet, Y. (2001). Revisiting Okun's law: a hysteretic perspective. *Department of Economics, UCSD*.
- Shahbaz, M. (2010). Income inequality-economic growth and non-linearity: a case of Pakistan. *International Journal of Social Economics*, 37 (8), 613-636.
- Shin, Y., Yu, B., & Greenwood-Nimmo, M. (2014). Modeling asymmetric cointegration and dynamic multipliers in a non-linear ARDL framework. *In Festschrift in honor of Peter Schmidt* (pp. 281-314). Springer.
- Tam, H. (2008). An economic or political Kuznets curve? *Public Choice*, 134 (3), 367-389.
- Thornton, J. (2001). The Kuznets inverted-u hypothesis: panel data evidence from 96 countries. *Applied Economics Letters*, 8 (1), 15-16.
- Yang, Y., & Greaney, T. M. (2017). Economic growth and income inequality in the Asia-Pacific region: A comparative study of China, Japan, South Korea, and the United States. *Journal of Asian Economics*, 48, 6-22.
- Zang, H. (1998). The stability of the Kuznets curve: some further evidence. *Applied Economics Letters*, 5 (3), 131-133.
- Zhou, X., & Li, K.-W. (2011). Inequality and development: Evidence from semiparametric estimation with panel data. *Economics Letters*, 113 (3), 203-207.

Appendix A. Definition of the Variables

$Gini_t$ = Level of inequality in year t.

$RGDP_t$ = Real GDP per capita for year t.

$RIncome_t$ = Real total Income per capita for the state at year t.

VOL_t = Measure of income volatility is defined as a four-year moving standard deviation of the change in the growth rate of real total income in each state. Total income including imputed income of non-filers in current thousand dollars divided by CPI (base year = 2014). All data come from the same source as GINI.

$Theil_t$ = Alternative measure of inequality known as the Theil Index. This is basically derived from the concept of information theory. This index is a special case of inequality called Generalized Entropy Measure. Theil index quantifies the level of disorder within a distribution of income.

POP_t = Level of the population in each state.

Appendix B. Data Source

▪ 40 Countries Data Sources and Data Period

Annual data are used for this study. The time period for each country is given in *Table 9*.

Variables:

$Gini_t$ = Level of inequality in year t . The data come from the University of Texas Inequality Project (<http://utip.lbj.utexas.edu/data.html>).

$RGDP_t$ = Real GDP for year t . The data come from the International Financial Statistics of IMF (<http://www.imf.org>)

Table 9. Data period for 40 countries

Country	Time Period	Country	Time Period
Austria	1964-2007	Kenia	1967-1998
Belgium	1963-2007	Korea	1963-2006
Bolivia	1970-2001	Luxembourg	1963-2007
Chile	1963-2006	Malaysia	1970-2007
Canada	1963-2007	Mauritius	1968-2007
Colombia	1968-2005	Malta	1963-2007
Cyprus	1963-2008	Mexico	1970-2000
Ecuador	1965-2007	Morocco	1976-2008
Finland	1963-2007	Netherland	1963-2005
France	1977-2007	Norway	1966-2006
Greece	1963-1998	Panama	1964-2005
Hong Kong	1973-2008	Philippines	1963-2006
Hungary	1970-2007	Singapore	1963-2008
Indonesia	1970-2007	South Africa	1963-2007
India	1963-2007	Spain	1963-2007
Ireland	1963-2007	Sweden	1963-2000
Iran	1963-2005	Turkey	1967-2006
Israel	1968-2006	United Kingdom	1967-2007
Italy	1970-2007	Uruguay	1976-2007
Jordan	1976-2008	Venezuela	1967-1998

- **The U.S. States Data Sources and Data Period**

Annual state-level data is used for this study. The time periods for all the states are 1945-2013 except for Alaska and Hawaii which are included only for their period of statehood (1959-2013)

Variables:

$Gini_t$ = Level of inequality in year t.

$RIncome_t$ = Real total Income for the state at year t. Total income including imputed income of non-filers in current thousand dollars divided by CPI base year 2014.

$Theil_t$ = Alternative measure of inequality known as the Theil Index.

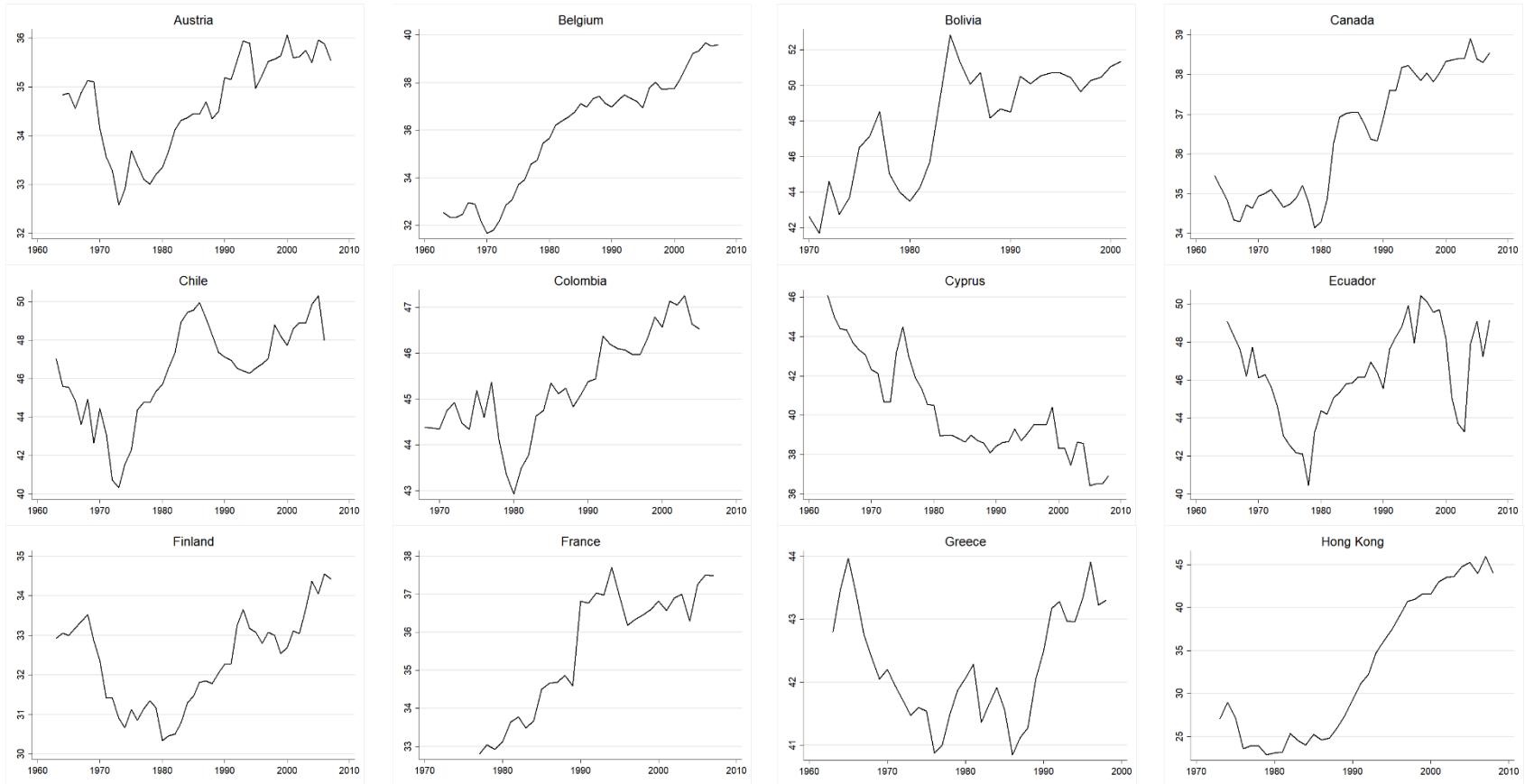
Data is constructed by Mark W. Frank from individual tax filing data available from the Internal Revenue Service. (http://www.shsu.edu/eco_mwf/inequality.html)

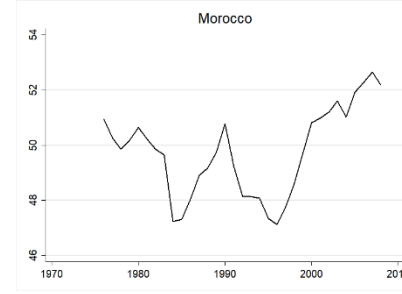
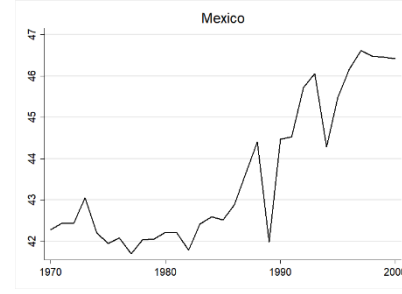
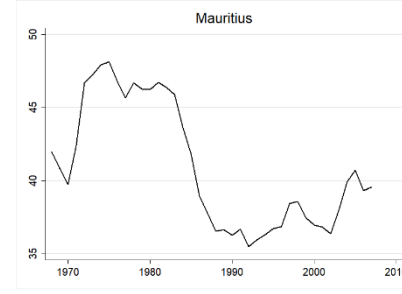
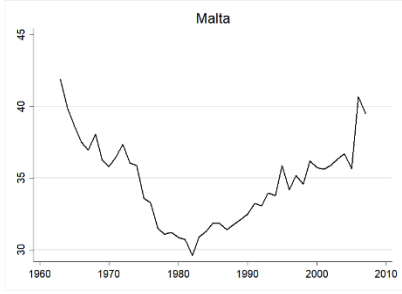
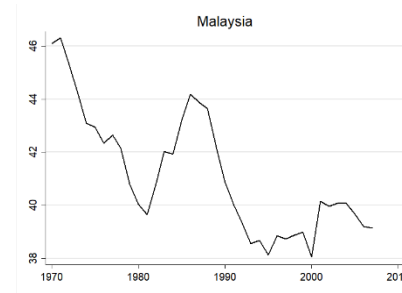
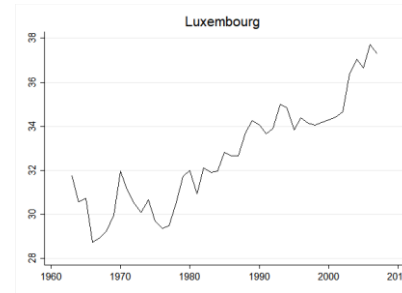
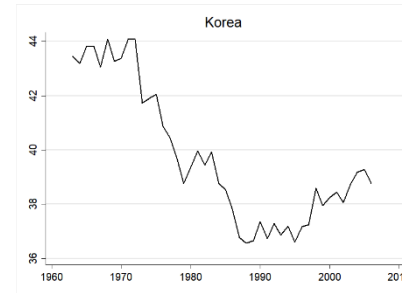
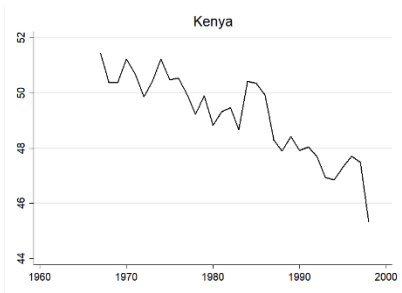
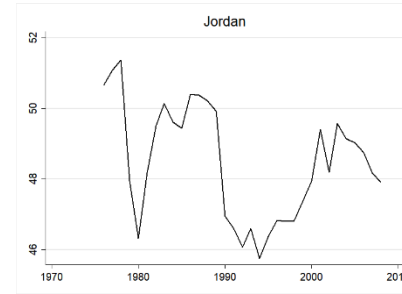
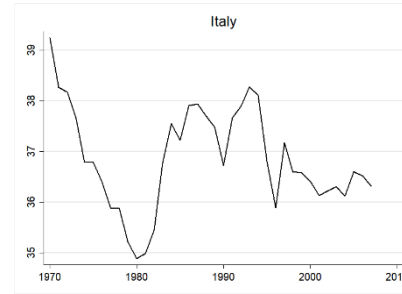
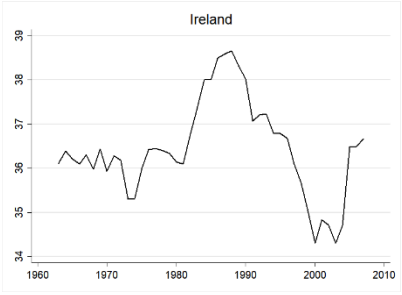
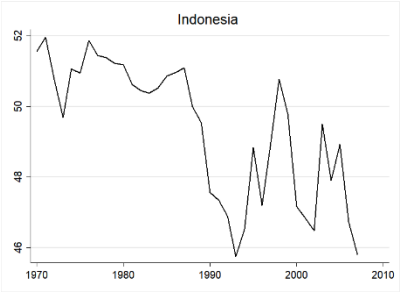
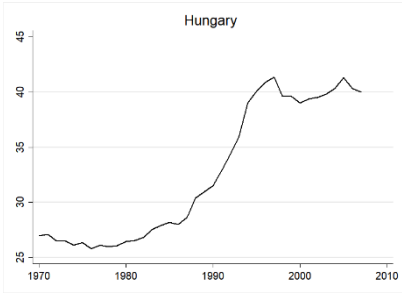
All data for the United States come from the Piketty and Saez available from the web page of Emmanuel Saez: <http://eml.berkeley.edu/~saez/>.

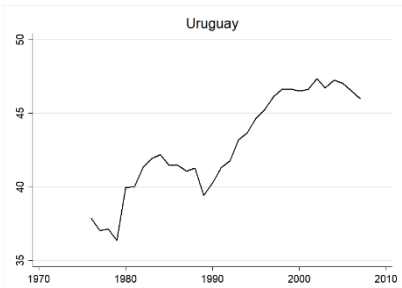
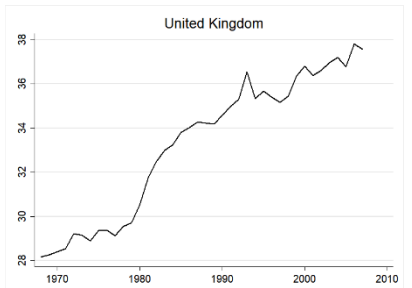
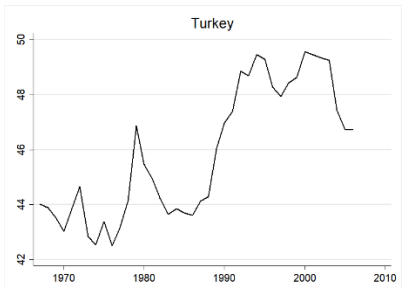
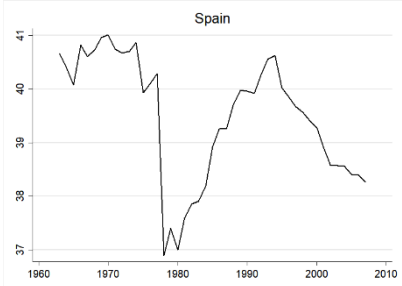
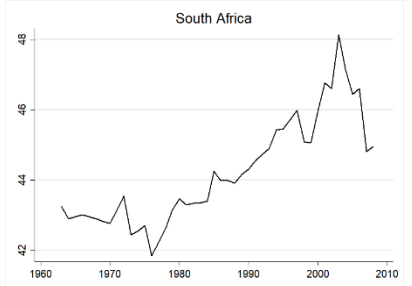
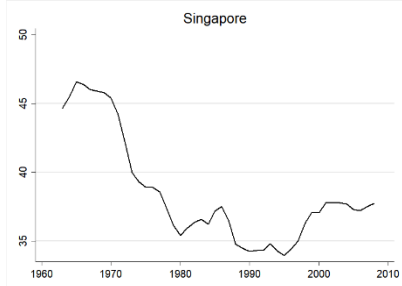
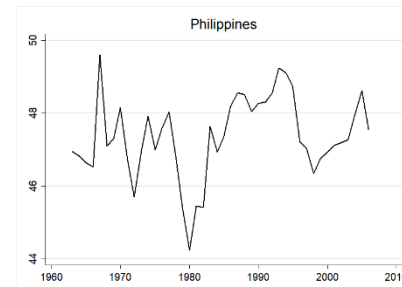
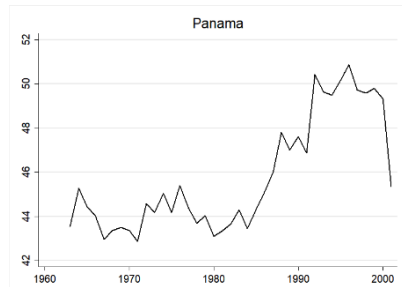
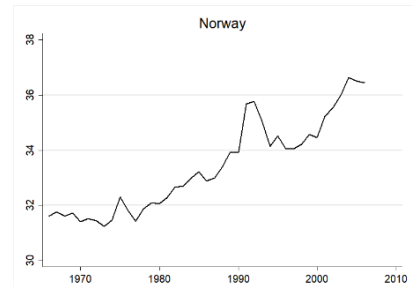
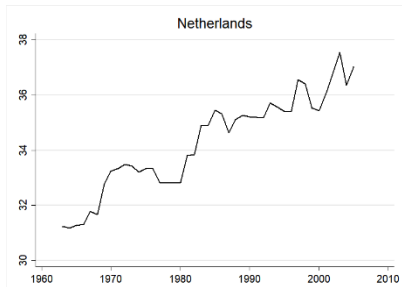
Population = Level of the population in each state. Data come from the Bureau of Economic Analysis – State Personal Income. <https://www.bea.gov/regional/index.htm>

Appendix C. Gini Trends in 40 Countries

Figure 1. Gini Trends in 40 Countries



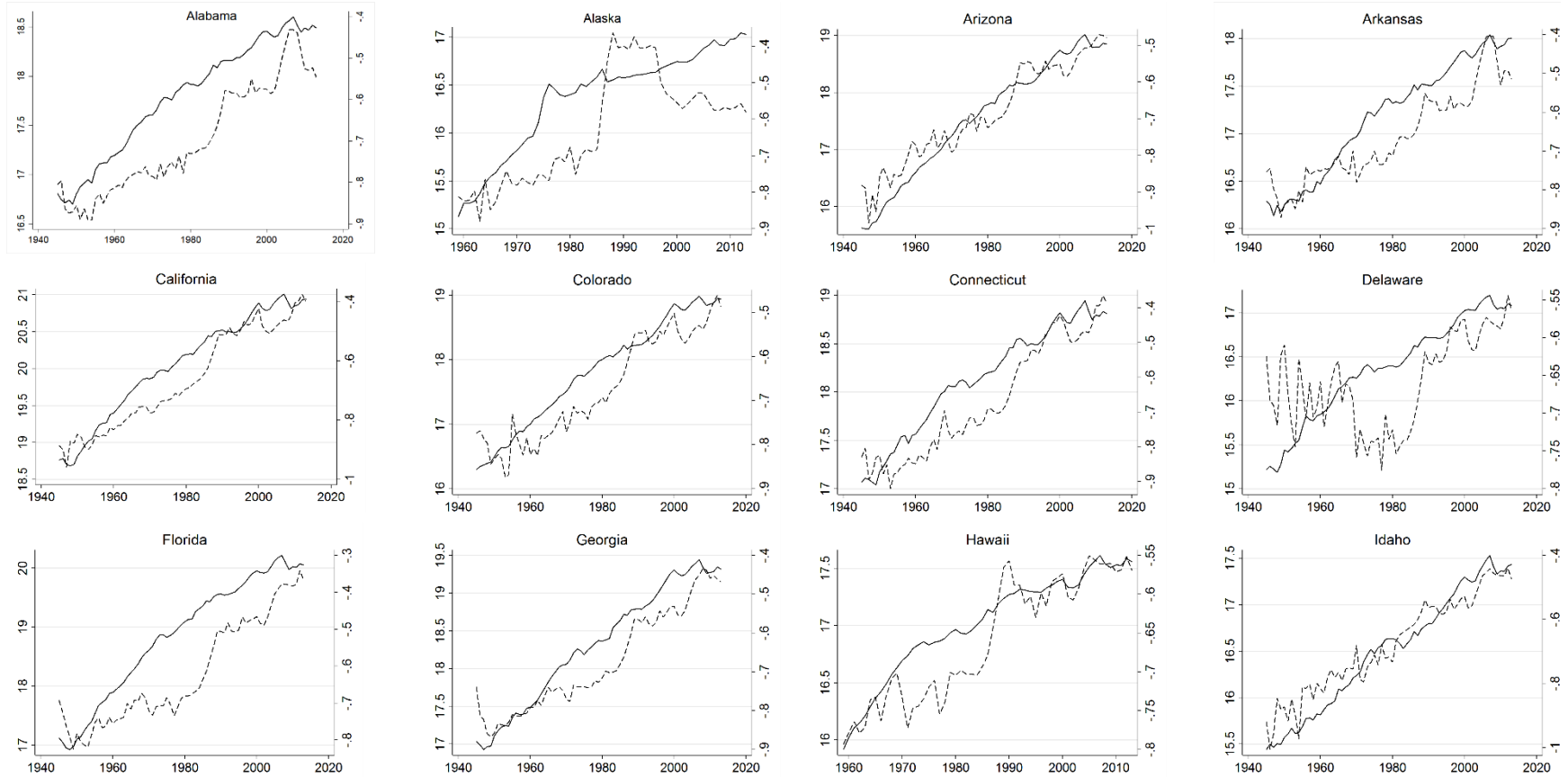


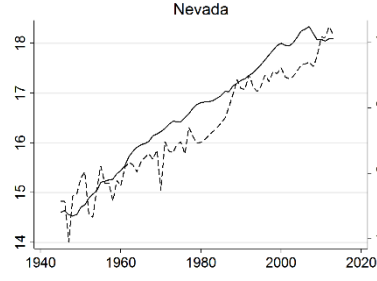
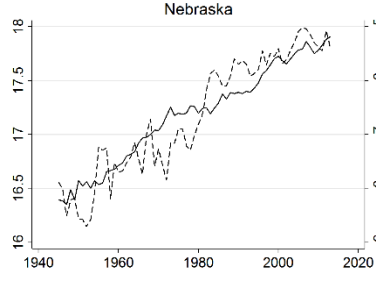
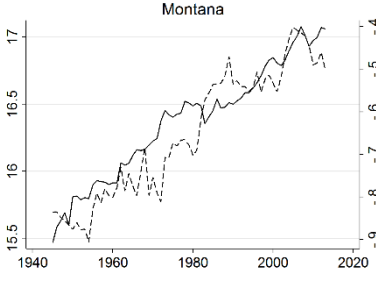
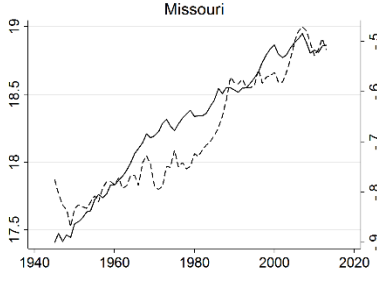
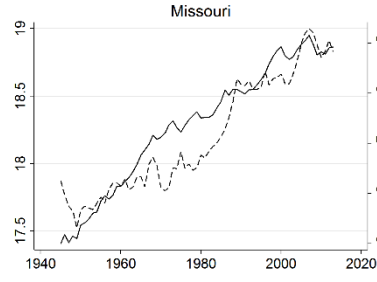
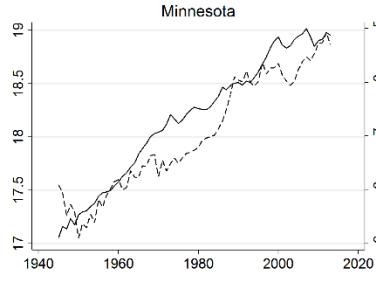
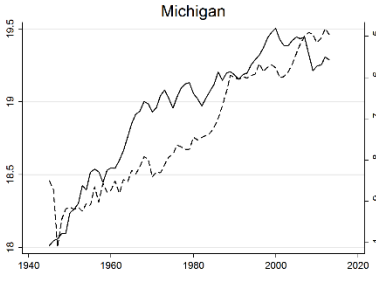
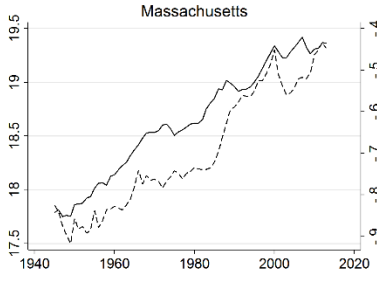
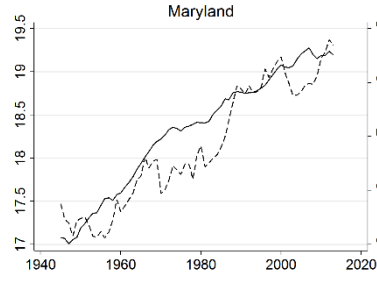
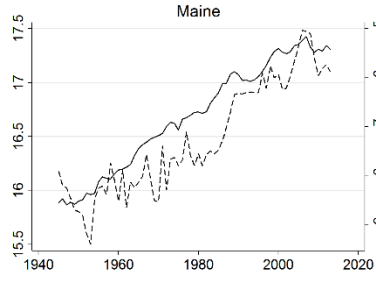
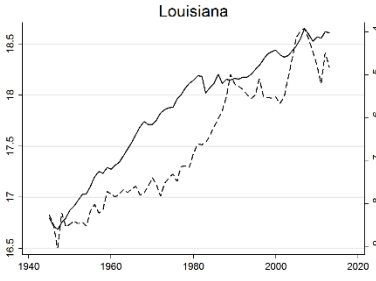
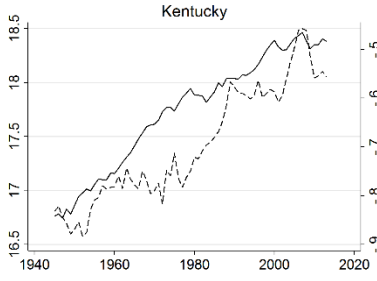
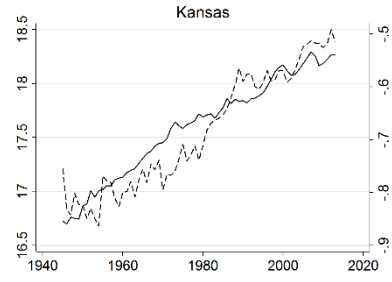
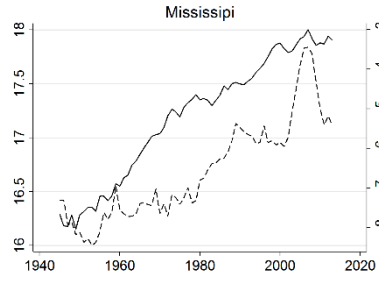
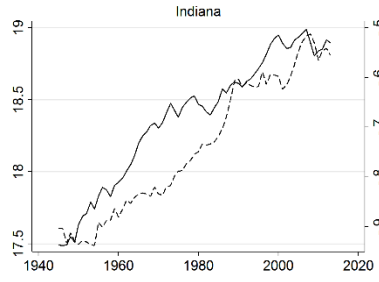
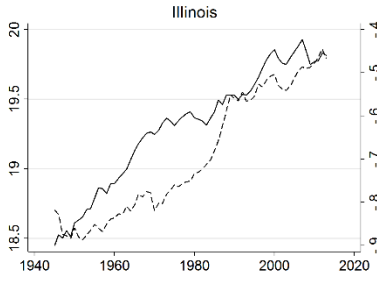


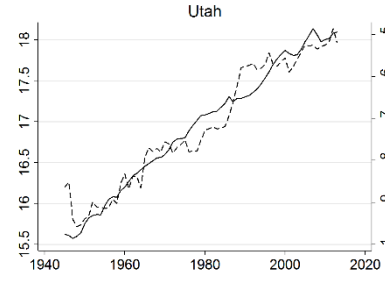
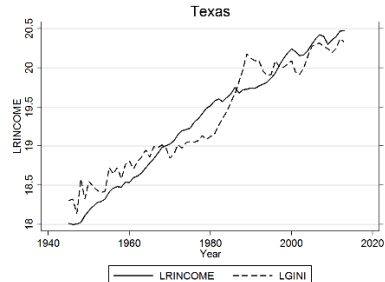
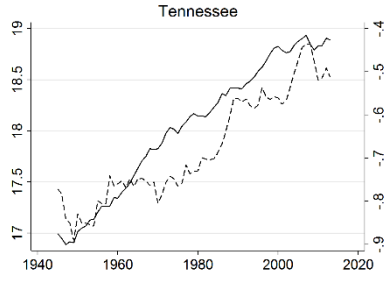
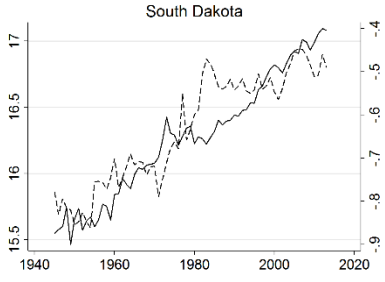
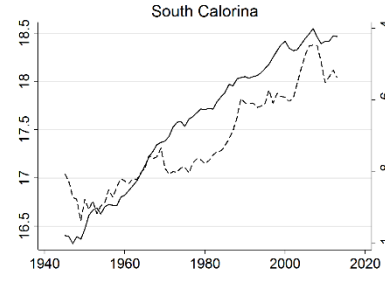
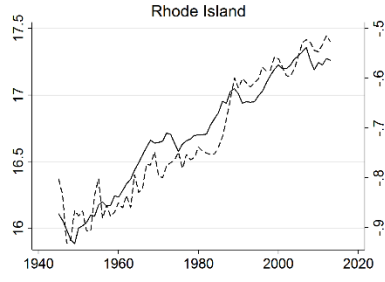
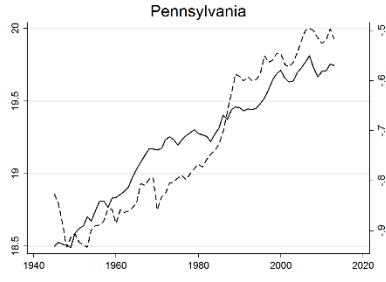
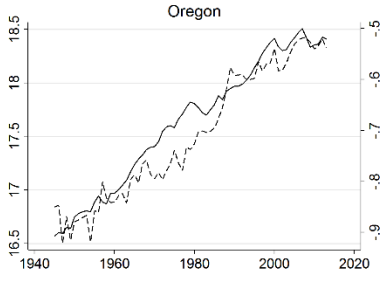
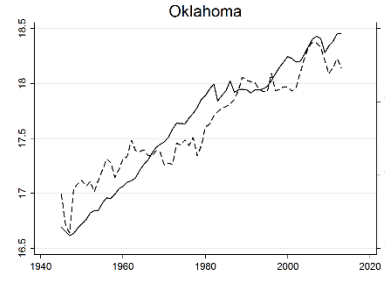
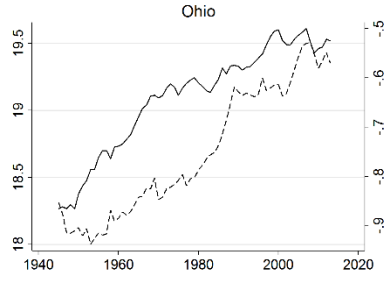
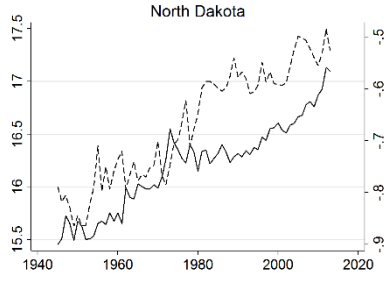
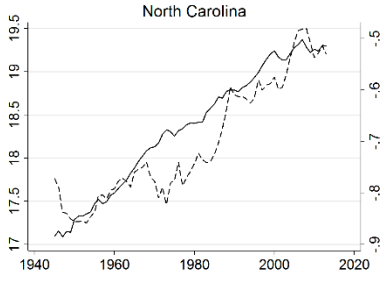
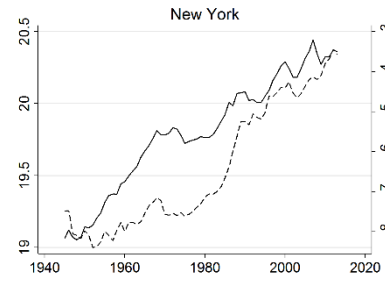
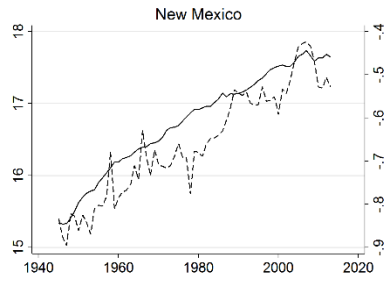
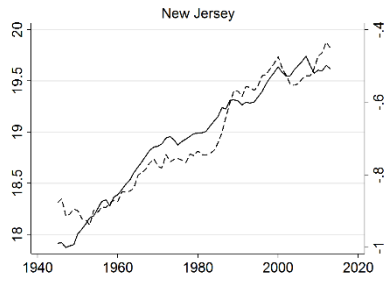
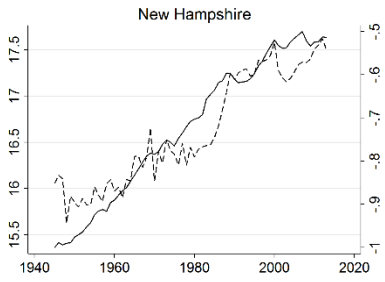
— Gini index

Appendix D. State-Level Trends in Real Income and Income Inequality

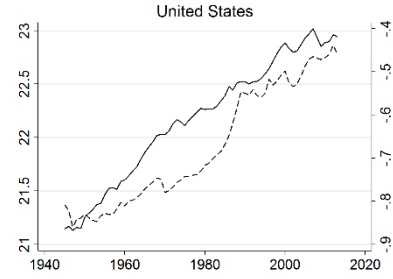
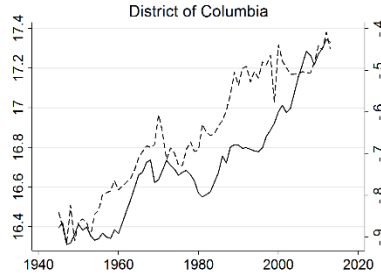
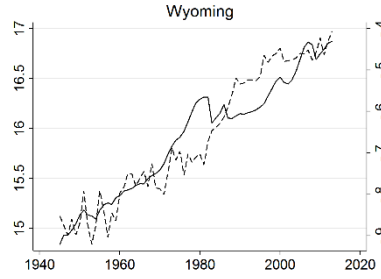
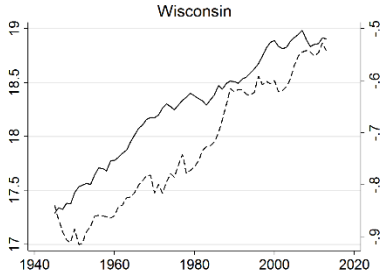
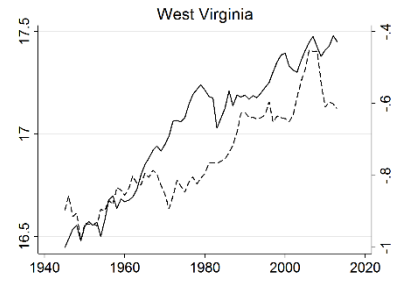
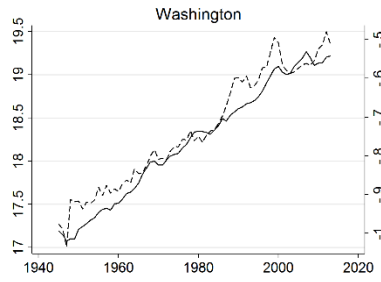
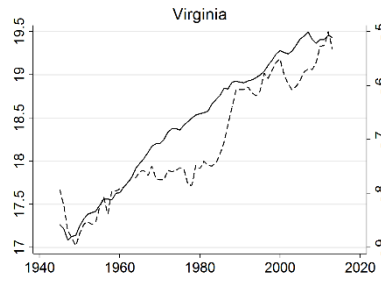
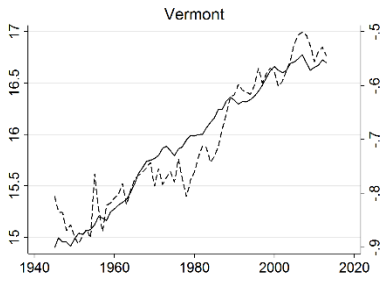
Figure 2. State-Level Trends in Real Income and Income Inequality, 1945-2013







— LRINCOME - - - - LGINI



— Log of Real Income (Left Scale)
 - - - - - Log of Gini Coefficient (Right Scale)

Curriculum Vitae

Amid Motavallizadeh Ardakani

May 2018

EDUCATION

University of Wisconsin-Milwaukee, Milwaukee, USA, Ph.D. Candidate, Economics, 2013-2018

University of Tehran, Tehran, Iran. M.Sc., Economics, 2006-2009

Allameh Tabataba'i University, Tehran, Iran, B.A., Economics, 2001-2005

SELECTED AWARDS AND HONORS

William L. Holahan Prize for Outstanding Teaching, University of Wisconsin-Milwaukee, 2017

Chancellor's Graduate Student Award, University of Wisconsin-Milwaukee, 2013

Lecturer Prize for Excellence in Teaching, Payame Noor University, 2011

PUBLICATIONS

1. "Inequality and Growth in the United States: Is there Asymmetric Response at the State Level?", 2018, *Applied Economics*, Vol 50, No.10, pp. 1074-1092. (with M. Bahmani-Oskooee).
2. "On the Value of the Dollar and Income Inequality: Asymmetric Evidence from State-Level Data in the U.S.", 2017, *Journal of Economic Asymmetries*, Volume 16, pp .64-78. (with M. Bahmani-Oskooee).
3. "Exchange Rate Changes and Income Distribution in 41 Countries: Asymmetry Analysis", 2018, *Quarterly Review of Economics and Finance*, Volume 68, pp. 266-282. (with M. Bahmani-Oskooee).
4. "On the Effects of Income Volatility on Income Distribution: Asymmetric Evidence from State-Level Data in the U.S.", revised and resubmitted to *Research in Economics*. (with M. Bahmani-Oskooee).
5. "Impact of Economic Growth on Income Distribution: Are there Asymmetric Effects?", submitted to *Applied Economics Quarterly*. (with M. Bahmani-Oskooee).
6. "Does GINI Respond to Income Volatility in an Asymmetric Manner? Evidence from 41 Countries", submitted to *Economic Record*. (with M. Bahmani-Oskooee).

TEACHING EXPERIENCE

- **Instructor 2014-2018**

Department of Economics, University of Wisconsin-Milwaukee

Economic Development, International Economics, Intermediate Microeconomics, Principles of Macroeconomics, and Principles of Microeconomics.

- **Graduate Teaching Assistant 2013-2018**

Department of Economics, University of Wisconsin-Milwaukee

- Undertook grading activities for, Economic Statistics, Mathematical Economics, Intermediate Microeconomics, and Intermediate Macroeconomics.
- Conducted discussion sections for Principles of Microeconomics.

- **Lecturer**

Payame Noor University, Karaj, Iran (Sep 2009-May 2012)

Principles of Economics, Principles of Microeconomics, Principles of Macroeconomics, Public Finance, Economic Development, International Trade, and Engineering Economics.

Allameh Ghazvini Institute, Qazvin, Iran (Jan 2007-May 2009)

Money and Banking, Development Economics, Fiscal and Monetary Policies, Economic Systems, and International Finance.

ACADEMIC SERVICE

Speaker at the University of Wisconsin-Milwaukee, Department of Economics TA Training 2017

PROGRAMMING SKILLS

Proficient: Micoft, Eviews.

Working Knowledge: R, MATLAB, STATA.