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Abstract

This paper provides new evidence on the relationship between economic growth and income inequality. The data covers the period between 1870 and 2011 for 26 countries. In contrast to the Kuznets hypothesis, there is evidence of a strong U-curve relationship between the top income shares and per capita income. This finding implies that income inequality measured by a ratio of the income shares of top earners to that of the rest of population increases as economy develops. The results also suggest that top income earners benefit when the economy grows at, or above the preceding year's, 5-year Moving Average, and long-run trend growth rates, but do not significantly suffer during downturns in growth.

Keywords: Top income shares, inequality, kuznets curve, economic growth

JEL codes: D31, H23, N30, O15

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1 Introduction

Increasing income inequality has been observed for many countries in recent few decades. In the US, after a long-term fall over three quarter a century, the income share which goes to the top 10 percent of population has risen again to the level it was in the late 1920s, which is about 50 percent. Even high growth is observed for income shares of the top 1 and 0.01 percent of population. Piketty and Saez (2012) point out that in the US, top income shares fell significantly during the crisis of 2008-2009, there was a rebound to their previous level after just one year of recovery. This is not only happening in the US: in many Western European and some Asian countries as well, inequality evolves along the pronounced U-shape curve overt time (Atkinson & Piketty, 2007, 2010). As Stiglitz (2013)[1] points out that 93 percent of growth in incomes has been taken by the top 1 percent of population in 2010, and inequality is more frequently and severely associated with booms and busts of the economy. Thus, the question arising is whether inequality is a cause of growth divergence, or consequence of it. Indeed, Atkinson and Morelli (2011) analyse the hypotheses whether inequality causes crisis, or the causality is other way around and find no systematic relation either way. Interestingly, inequality worsens during a crisis when inequality is measured by the ratio of income share of top earners to that of the rest of population (Bordo & Meissner, 2012; Morelli, 2012). However, these studies mainly focus on the impact of crisis taken as a dummy variable on inequality.

Since at least the 1970s (Kolm, 1976), it has been realized that various measures of inequality are different constructs and can have varying implications for economic policy. Whereas the subject matter of most inequality analysis was the Gini coefficient (an overall measure of inequality), the recent literature has also paid attention to differences between various strata of society. A century-long data on

[1] An online version of this article can be found at http://opinionator.blogs.nytimes.com/2013/01/19/inequality-is-holding-back-the-recovery/?_php=true&_type=blogs&_r=0.

top income shares so called the World Top Income Database (WTID) developed initially by Thomas Piketty provides an opportunity to better understand the economic mechanisms which contribute to the evolution of it and its interplay with economic growth. Even though the data concentrates only a small percentage of population (mainly 1 percent of population), it indeed captures a significant proportion of total income (it is about 25 percent for the US and 20 percent for continental Europe on average). Thus, this paper intends to examine impact of growth divergence on top income shares.

2 Review of literature

The literature on top income shares mainly consists of historical data analyses. Two volumes on top income distribution edited by Atkinson and Piketty (2007, 2010) include twenty-two country case studies. Few attempts have been made to examine the top income shares using a panel dataset of countries. Atkinson (2005) is a pioneering study which performed a comparative analysis of top income shares across countries[2]. They argue that even though there are differences in the tax system and legislation and definitions of taxes and income, the method of calculating top income shares is basically homogenous across the countries[3]. Based on careful investigation of countries' top income shares taking into account their historical development and background, the author says that the convergence has been observed till the mid-1960s and since then the dispersion has become larger. Other scholars including Atkinson et al. (2011) and Alvaredo et al. (2013) observe a similar finding using even more countrie's data. Continental European countries and Japan show a smaller but continuous increase in top income shares after the 1980s, while top income shares in English-speaking countries have increased drastically during the last three decades. They say that the most prominent explanations for the rapid increase in top income shares are that of Rosen (1981) and Frank and Cook (1996) amongst other macroeconomic and policy factors. The former explains that the communication opportunity which is expanding with globalization increases the rent to those with highest abilities, and the latter argues that there exists a winner-take-all structure. Also, Atkinson et al. draw attention to the fact that the increase in overall

[2] There was an earlier working paper by Atkinson and Leigh in 2004 on top income shares in Anglo-Saxon countries, but that one has been published as a journal article in 2013, hence, I refer Atkinson (2005) as a pioneering study here.
[3] They are France, the UK, the US, Canada, the Netherlands, Australia, and New Zealand.

inequality in recent decades in the US is strongly correlated with the rise in income share of the top 1 percent of earners.

The availability of long time-series data of top income shares for a number of countries makes it possible to do a country panel data analysis and Atkinson and Leigh (2013)[4] and Roine et al. (2009) are pioneering studies. The former examines the income distribution in five Anglo-Saxon countries[5] while the latter is a first comprehensive study which uses a century long top income shares data to examine the long-term determinants of income inequality. Atkinson and Leigh (2013) find that the top income shares in these countries depend on each other and the degree of association remains high even if the distribution of top income shares has changed over time. They also examine the effect of top marginal tax rate on top 1 percent income shares and find that top income shares are strongly sensitive to the changes in top income tax rates, which is consistent to the Alvaredo et al. (2013) findings. Moreover, existing comparative analyses and the data clearly indicate that income and wealth shares of top earners are highly associated each other (Atkinson & Piketty, 2007, 2010; Piketty, 2014). Roine et al. (2009) find that financial sector development promotes the increase of top income shares is consistent with the view that financial development benefits the rich, particularly in the initial stages of development, but later the effect is spread throughout the distribution. This conclusion is robust when financial development is replaced by a banking crisis, as the crisis causes a drastic contraction to the financial sector, and consequently shrinks top income shares. Roine et al. find a strong and positive effect of GDP per capita growth on the changes in top income shares, but negative on the bottom of the income distribution. This implies that growth is not inclusive; rather is pro-rich. Another significant conclusion drawn is that the authors find no significant difference in the effect of financial development on inequality between Anglo-Saxon and other countries.

By summarizing, inequality measured by the tail of income distribution (i.e. top income shares) is increasing and getting persistent over time. Though theoretical models of inequality argue that differences in the initial distribution of wealth (or occupations/human capital/land and so on) matter for

[4] The paper is published in 2013 but referenced in many studies as a working paper in 2007 and IZDA discussion paper in 2010.
[5] Analyzing only Anglo-Saxon countries has an advantage of holding social and institutional factors constant.

persistence of inequality[6], macroeconomic performance could also be as important as other factors do. Atkinson and Morelli (2011) study the impact of economic crisis on inequality and its causality. While the former effect shows how far economic crisis lead to rising inequality; the latter indicates how far inequality increases the probability of crisis occurrence. Their analysis includes 72 cases of banking crises using a data combined from three sources: Laeven and Valencia (2010) (in which the data starts from the1970s), Bordo and Landon-Lane (2010), and Reinhart and Rogoff (2008, 2009). Consumption and GDP collapses are defined as in Barro and Ursúa (2008)[7] whereby 100 consumption and 101 GDP disasters are identified. By examining the trend of, and changes in inequality preceding and following the crisis years, they conclude that there is no causal relationship between crisis and inequality and however, say that financial crises occur after rising inequality. Similarly, Bordo and Meissner (2012) present no conclusive result on the relationship between inequality and crisis, they report an interesting finding. Authors find that top income shares increase during a crisis period (proxied by a dummy variable), and thus inequality worsens. This is because of that top income shares grow when economy booms and drop in downturns at higher rate than those of lower percentiles in the income distribution do.

Many economic researchers consider the asymmetric effects of shocks/volatility on economic variables. From the microeconomic point of view, an inflation and price adjustment theory propounds an explanation for the asymmetric price response to a general level of inflation. In macroeconomics, an asymmetry is usually examined in the macroeconomic/monetary policy shocks literature. There are a few studies that examine the asymmetric effects of economic growth volatility on inequality and poverty. Inequality (income distribution) indeed is highly affected by macroeconomic booms and busts. Hence, along with the literature on asymmetric effects of shocks on macroeconomic variables, I assume that top income shares may change differently with different phases of economic growth. Our specification of asymmetric responses of inequality to different phases of economic growth is mainly based on the

[6] The theoretical literature mainly concerns initial heterogeneity in wealth (income, land, occupations, human capital and so on) among individuals and few of them display the Kuznets inverted-U curve in the later stage of development.
[7] Disasters are defined as cumulative declines from peak to trough of at least 10 per cent in real per capita consumption or GDP per capita.

specifications of asymmetric impacts defined in Buckle and Carlson (2000), Grier et al. (2004), and Kolluri and Wahab (2007).

Since top income shares is one of the important measures of economic inequality, it would be a significant contribution to the literature to examine the existence of Kuznets inverted-U curve hypothesis for top income shares. A topic pursued in the literature for long time is an international convergence of per capita incomes. A profound idea first developed by Kuznets (1955) concerns the inverted-U shape relationship between inequality and economic development. He argues that inequality increases in the initial stages of development and then gradually declines as a country develops. Thus the aim of the paper is twofold. First, I investigate whether there is an asymmetric movement of the income share of the top 1 percent of population across high and low growth phases[8]. Secondly, I enquire a consistency of the Kuznets inverted-U curve with a measure of income inequality using a tail of income distribution.

3 Data and model specification

A seminal work by Piketty (2003) on top income shares for France has facilitated efforts aimed at collecting and calculating the data on top income shares over the twentieth century using a common methodology[9]. Consequently, the data on top income shares is expanding[10]. This long-term dataset of top income shares makes it possible to conduct a panel-data analysis. A panel data approach allows us to take into account all unobservable time-invariant factors, as well as country-specific trends. Existing studies consider the impact of growth regardless of whether it is actually positive or negative. The purpose of this chapter is to examine whether top income shares respond differently to economic volatility. Therefore, in order to see this asymmetry in the impacts of economic growth, I characterize growth volatility by comparing to the benchmarks defined in three ways explained below. In other words, instead of distinguishing growth rates in a particular year in a way whether it is positive or negative, I

[8] The idea of an asymmetric effect is from the literature on price asymmetry by Buckle and Carlson (2000) and that on the asymmetric response of government spending to economic growth by Kolluri and Wahab (2007). The former analyses the asymmetric response of price to inflation using a micro dataset. The latter tests the Wagner Law of expanding state expenditure using 1950-2000 data for the OECD countries.

[9] Although individual country data collections are based on the methodology used in Piketty (2003), there are some biases. Sensitivity analysis, however, has shown that these differences in methodology has unlikely affected on the conclusions drawn for countries.

[10] As of December, 2013, the data on top income shares is available for 27 countries and data collection is in progress for 57 countries.

set three different benchmarks and define upturns and downturns of economic growth in comparison with these benchmarks. The principal advantage of constructing growth rates in different specifications is that in this way I can focus on the long-term effect of economic growth on inequality.

First, I use a difference of actual growth rates in two consecutive years. If the growth rate is accelerated compared to the previous year, it is denoted as gr^{up} (which is an upturn in growth, or positive volatility), otherwise gr^{down} (which is a downturn in growth, or negative volatility).

$$gr_{it,t-1}^{up} = \Delta g_{it}\ if\ g_{it} \geq g_{it-1}\ otherwise\ equals\ to\ 0$$

$$gr_{it,t-1}^{down} = \Delta g_{it}\ if\ g_{it} < g_{it-1}\ otherwise\ equals\ to\ 0$$

Second and third descriptions of upturns or downturns in growth rates are characterized as deviations of the actual growth rate from the long-run trend. In particular, in the second description, the 5-year Moving-Average (MA) growth rate is taken as the benchmark. Then, the upturn and downturn in growth rates are defined as follows:

$$gr_{it,MA}^{up} = (g_{it} - g_{it}^{5-yearMA})\ if\ g_{it} \geq g_{it}^{5-yearMA}\ otherwise\ equals\ to\ 0$$

$$gr_{it,MA}^{down} = (g_{it} - g_{it}^{5-yearMA})\ if\ g_{it} < g_{it}^{5-yearMA}\ otherwise\ equals\ to\ 0$$

In the third definition, the long-run trend growth is calculated using a simple Hodrick-Prescott filter[11] and the upturn and downturn in growth rates are defined as deviations from this trend. In other words, cyclical growth rates are computed and distinguished in positive and negative values.

$$gr_{it,trend}^{up} = (g_{it} - g_{it}^{HP})\ if\ g_{it} \geq g_{it}^{hp}\ otherwise\ equals\ to\ 0$$

$$gr_{it,trend}^{down} = (g_{it} - g_{it}^{HP})\ if\ g_{it} < g_{it}^{hp}\ otherwise\ equals\ to\ 0$$

The second and third definitions capture effects of the volatility of long-run growth on inequality.

Based on the models of endogenous inequality and the literature on asymmetric impacts, the empirical model to be estimated is defined as the following:

[11] The Hotrick-Prescott filter is a standard technique that is used in macroeconomics to extract a trend component from a time-series. In spite of criticisms related to this, the H-P filter is one of the most widely used filters in the literature.

$$TIS_{it} = a_0 + b_1 gr_{it}^{up} + b_2 gr_{it}^{down} + a_1 y_{it} + a_2 y_{it}^2 + \gamma \boldsymbol{X} + \mu_i + \delta_t + \varepsilon_{it} \qquad (1)$$

Where TIS_{it} is the income shares of the top 1, 0.1, and 10 percent of population (henceforth, top 1, 0.1. and 10 percent income shares) of country *i* in year *t*.

gr_{it}^{up} and gr_{it}^{down} are upturns and downturns in economic growth of country *i* in year *t*, respectively. These are defined in three different ways (as mentioned above) in order to see the impact of short- and long-run volatility of economic growth on inequality, and also in order to check the robustness of our result.

y_{it} is logarithm of GDP per capita and y_{it}^2 is logarithm of GDP per capita-squared of country *i* in year *t*, respectively.

Finally, $\boldsymbol{X}$ is a set of control variables derived from theoretical and empirical models. They are explained in the data description section in detail.

μ_i and δ_t are vectors of country and year fixed-effects, respectively and ε_{it} is a standard idiosyncratic error term for each country in each period.

I assume that there are statistically distinguishable differences in the responses of top income shares to different growth environments. These effects are captured in the first and second terms of the model. If there exists a positive asymmetry, top income earners are more likely to increase their earnings during a period of upturn in growth, but are less likely to make a reduction otherwise. In other words, an asymmetry exists in the relationship between top income shares and economic growth. In particular, if positive asymmetry exists, top income earners may benefit more from upturns in growth (when an economy grows at or above the previous year's (or long-run trend) growth), but not suffer as much as when downturns in growth occur. A hypothesis for coefficient test is:

$H_{0.1}: b_1 = b_2$ against $H_{a,1}: b_1 \neq b_2$ (2)

The null hypothesis is a test of 'symmetry' against the alternative hypothesis of 'asymmetry'. Rejection of the null hypothesis is taken as an evidence of asymmetry in the relationship between top income shares and economic growth.

The third and fourth terms of the model are for investigating the presence of Kuznets inverted-U curve relationship between inequality and development. Even though the long-run trend of top income shares present a U-curve over time, I follow the standard Kuznets hypothesis for the relationship between inequality and per capita income. In other words, top income shares increase in the initial stage of development and gradually decline with per capita income, as Kuznets suggests for inequality and development.

Data

Top income shares. I use the WTID, which presents within-country income inequality. Top income shares are estimated using tax report data[12] and the standard definition is gross income excluding capital gains and losses (See Table A.1 in the Appendix). The data is presented in terms of shares i.e. the share of income of the top earners in the total income of the population. I use income shares of the top 0.1, 1 and 10 percent of the population along the income distribution in the analysis and denote them Top01, Top1, and Top10, respectively. The dataset covers the period between 1870 and 2011 for 26 countries. Individual country series starting points range from 1870 to 1974. The potential number of observations are 1605, 1640, and 1141 for top 0.1, 1, and 10 percent income shares, respectively.

GDP per capita and growth rate. A high frequency and comprehensive data of GDP per capita is Barro and Ursúa (2008)[13]. The data includes GDP per capita and consumption estimates indexed at 2006 constant price for 42 countries for the period between 1790 and 2009.

Finally, control variables are derived from the theoretical and empirical literature on income inequality. I control for political regime, human capital accumulation, financial sector development, trade openness, tax rate, interest rate, public sector growth, and population (Data sources and variable definitions can be found in Table A.2 in the Appendix).

Table 1 is about here.

[12] China is excluded because its data is based on HH survey, not tax report.

[13] The Barro-Ursúa data is initially developed on the basis of the so-called Maddison data. In 2013, the Maddison Project launched an updated version of GDP, GDP per capita and population dataset, originally developed by Angus Maddison. The database covers the period between AD1 and 2008 for 197 countries (Bolt & Van Zanden, 2013). GDP per capita is in 1990 constant international Geary-Khamis (G-K) dollars. However, the Maddison data itself was problematic because of flaws in construction (Barro and Ursúa, 2008, pp 2-3). Thus, our analysis is based on the Barro- Ursúa data (henceforth, B-U data)

Table 1 presents the descriptive statistics of top income shares of the full sample (starting as early as 1870 and ending in 2011) by regional distribution. I divide countries into four groups[14]: Western European (WE), Western-offshoots (WO), Asia, and the 'other countries' group. The average income shares of top 0.1, 1, and 10 percent of population are 3.77, 10.81 and 33.13 per cent, respectively. Of these, top 10 percent income shares is the most volatile, with a standard deviation of 6.14, while standard deviations of the top 0.1 and top 1 percent income shares are 2.35 and 4.55, respectively. From the table, it can be seen that the WO countries group has the least estimate of, and volatility in top 0.1 percent income shares. In terms of the top 1 and 10 percent income shares, the WE and 'other countries' groups have the lowest values, but these are highly volatile. More than 50 percent of observations are associated with the WE countries and more than 80 percent of data is from the developed countries.

Figure 1 is about here.

Figure 1 compares growth rates of the top 1 percent income shares of countries for which the data is available for the 1980s and the 2000s when the average values of top income shares in 1980s and 2000s are calculated for each country, and then the growth rate is calculated between these two periods. Out of them, Norway's top 1 percent income shares has more than doubled with the highest growth rate of 127.5 per cent, while Malaysia has the lowest growth rate at 4.4 per cent. Overall, the income share of the richest 1 percent earners increased by 42.1 percent on average. Ten countries witnessed an increase of more than 50 percent in their top 1 per cent's income shares.

The average growth rate of GDP per capita is 2.30 percent for the whole sample, and is highly volatile with a standard deviation of 5.25. The highest growth rate of 67.15 percent is observed in the Netherlands in 1946, whilst Germany witnessed the lowest growth of -66.06 percent in 1945. The average growth rate of WE countries is 2.34, while that is 1.93 for WO countries, 2.87 for Asian countries, and 1.58 for 'other countries' group. The WO countries has the least volatile growth.

[14] The empirical literature mainly considers two groups: Western European and English-speaking countries. The most recent data has additional countries. The 'Other countries' group consists of two Latin American countries – Argentina and Colombia, and two African countries – Mauritius and South Africa. The WE group has 13 countries The WO group consists of those developed countries other than WE, and all are English-speaking. The Asian countries group has five countries: India, Indonesia, Japan, Malaysia and Singapore.

4 Empirical evidence

First, I estimate the model with the pooled-OLS estimation technique as a baseline. The data consists of 26 countries for over a century-long period. Then, to take into account for unobserved country- and/or year effects, I use a fixed-effects estimator. The FE estimator invokes the OLS estimates under the classical assumptions that the error process is independently and identically distributed. If the variance of the error term differs across units, a condition called groupwise heteroskedasticity is presented. In this case, the FE estimator is inefficient and biased. A modified Wald test is used and detects the existence of groupwise heteroskedasticity. It should be noted that the FE estimator doesn't rule out a serial correlation in the error terms. In a panel data of long time-series and a narrow panel of countries, however, the assumptions underlying the standard FE model are more likely to be violated. In particular, a serial correlation in the error terms is expected when T is fairly large. The Wooldridge test for serial correlation is deployed for testing and the result reports the existence of serial correlation. In the existence of serial correlation and heteroskedasticity in the error, the FE estimates will no longer be valid. Therefore, I use the Feasible Generalised Least Squares (FGLS) estimation method in the presence of heteroskedastic and serially correlated errors across year (Baum, 2001; Drukker, 2003; Wooldridge, 2010).

Since I have three different specifications of the upturns and downturns of economic growth, I estimate the model with each of them by using two different samples due to data availability of control variables. This approach has its own advantage to give information of robustness check doing it as splitting the sample. The first sample constitutes the entire period between 1870 and 2011, while the second covers the time span from 1950 to 2011. For the first set of data, population size, political regime, legal origins of countries, an English-speaking dummy, and top marginal tax rates are included as control variables. Since our purpose is to examine the asymmetry in the response of the top income shares to upturns and downturns in growth rates in the presence of inverted-U curve relationship between inequality and development, the main variables of interest are ln(GDP per capita), ln(GDP per capita-squared) and upturns and downturns in growth as defined in the earlier section. The second sample consists of additional control variables that are available for the period between 1950 and 2011.

The period 1870-2011

The time-series for top income shares start in different years for different countries and the model is estimated using the pooled-OLS estimator as a baseline. Both legal origin and English-speaking dummy variables are included based on the AIC and BIC test results[15, 16]). The estimation result shows that English-speaking countries tend to have higher top income shares than non-English-speaking countries. This result is completely consistent with the literature. Of legal origins, the coefficient of a dummy variable for German legal origin is the lowest while that for French legal origin is the highest for all equations. This implies that a country with German legal origin tend to have a lower top income shares than those with French legal origin. Table 2 presents a summary of estimation results of Equation (1). Detailed estimation outcomes can be found in Table 2.a and Table 2.b. In all model specifications, a strong U-curve relationship exists between top income shares and per capita income at the 5 percent or better significance level. Therefore, the findings suggest that the Kuznets inverted-U curve relationship doesn't hold for the top of income distribution. Instead, the relationship is as follows; top income shares decline with per capita income in the initial stage of development, and then increase gradually. This result shows that the Kuznets inverted-U curve hypothesis is sensitive to the choice of the measurement of inequality.

Table 2 is about here.

Coefficients of up and down deviations of growth rates in two consecutive years are statistically significant at the 5 percent level in the estimation results where dependent variables are top 1 and top 0.1 income shares (see Columns 3 and 6 in Table 2.a). Next, I test whether the coefficients of upturns and downturns of economic growth are jointly different from zero and the asymmetry in the response of top income shares to economic growth defined in Equation (2). The test values and significance levels are reported in Table 2. The results indicate that two coefficients of up and downturns of economics growth are jointly different from zero, and are also not equal at the 5 percent significance level for the equations

[15] AIC and BIC take the lowest values in the full model, and also the test result of the dummy variable coefficients shows that the legal origins and the English-speaking dummy variables are jointly significant at the 1 per cent level. Moreover, the Likelihood Ratio test result indicates that both restricted models, which include the legal origin and English-speaking dummy variables separately, are nested in the full model.

[16] Test results of the model estimation with other two specifications of economic volatility produce the same result, and thus I keep both the legal origin and the English-speaking dummy variables in the model.

where the dependent variables are the top 1 and 0.1 per cent's income shares. Moreover, the result indicates that a positive asymmetry exists in the relationship between top income shares and economic growth. The coefficients of long-run upturns in growth rate (which are at or above the 5-year MA and HP trend growth, respectively) are positive and statistically significant at the 1 percent level. The signs of coefficients of downturns in growth (which are below the 5-year MA and HP trend growth, respectively) are negative as expected, but insignificant in these two estimations. However, the joint-test result shows that these two variables are both important in explaining top income shares. Furthermore, the test results confirm that upturns and downturns in growth rates affect top income shares differently. In other words, top income earners gain when the economy grows at/or above the long-run rate, but do not significantly decline when the growth rate falls below the trend (Test results are reported in Columns 1 and 4-8 in Table 2.a).

In contrast, the hypothesis of asymmetric effect is not verified for the model where dependent variable is the top 10 per cent's income shares while the U-curve relationship holds. Indeed, coefficients are statistically insignificant. Thus, divergence of economic growth does not differently affect the top 10 per cent's income shares. This is plausible as the top 10 percent is not a good representative for the income share of people in the tail of the distribution. This means that our findings are robust for the tails of income distribution, but not for average/overall measure of income inequality. As our intent is to focus on the tail of income distribution, henceforth, I use top 1 per cent's income shares as our dependent variable.

The test of a linear form of heteroskedasticity using the White/Koenker nR2 test suggests that heteroskedasticity is detected in the residual variances (the result is presented in columns 1 and 4-5 of Table 2.a). Accordingly, based on the Hausman test result, the FE model is preferred over RE. However, since heteroskedasticity is found, the FE estimates are no longer be consistent. In addition to existence of heteroskedasticity, serial correlation is more likely to exist in panel estimation with a small number of cross-section and large T, time-series. The Wooldridge test result suggests the presence of serial correlation (see columns 12-14 of Table 2.b). To correct these problems, I estimate the model using FGLS estimator which allows AR (1) in disturbances and heteroskedasticity in panels. The estimation results are displayed in the last three columns in Table 2.

All findings demonstrate that the U-curve relationship between top income shares and per capita income is strong and consistent, regardless of estimation method and model specification. Thus, the existence of the Kuznets inverted-U curve is not supported by top income shares data. Indeed, the relationship is in opposite way, and in particular, top income shares decline in the initial stage of development, and then eventually increase with per capita income. This implies that the Kuznets hypothesis doesn't hold for inequality when it is measured by the tail of income distribution. The result is consistent with the findings of Alvaredo et al. (2013) says that "the rich is getting richer globally" and also with the equilibrium of the theory proposed by Matsuyama (2000) to the extent that the rich keeps their high income while the poor is trapped.

The hypothesis of asymmetric response of inequality to economic growth is partially confirmed by the data. All results suggest that a positive relationship exists between top income shares and upturns in economic growth as hypothesised, but not with downturns in growth. In other words, top income earners benefit when the economy grows at, or above the preceding year's, 5-year MA, and/or HP trend growth rates, but do not significantly lose their income shares when economic growth is below the previous year's, 5-year MA, and/or HP-trend growth rates. Moreover, the test result indicates that the effects of up and downturn fluctuations of growth on top income shares are different only at the 10 percent significance level. Indeed, when up and downturns in growth is assessed based on deviations from 5-year MA and/or HP trend growth rates, the coefficients are significantly different from each other. This result is also moderately consistent with Matsuyama (2000) and Mookherjee and Ray (2003) to the extent that inequality is persistent. In particular, top income earners (the rich) receive all the benefits from economic growth but do not share the loss resulting from decline in the long-run.

With regard to control variables, the results are consistent with the findings of existing studies. The top marginal tax rate is significantly, negatively associated with top income shares. Moreover, the magnitude of its coefficient is the highest among the coefficients of other explanatory variables except per capita income. Therefore, the top marginal tax rate is an important determinant of, and strong tool for, income distribution policy.

The coefficient of political regime variable is negative and statistically significant throughout the estimation results. This implies that when a political regime becomes more democratic, top income shares tend to decline. One interesting finding is that top income shares tend to be higher in heavily populated countries. This result may indicate that when a country's population increases, the probability of the existence of top income earners will rise, and at the same time their income share likely to be high.

In accordance with legal origins, the result indicates that countries with the British legal origin tend to have higher top income shares than other countries. The Scandinavian legal origin has the lowest effect on top income shares; indeed, it reduces inequality.

As mentioned earlier, more control variables are available after 1950. Therefore, the next section presents the estimation results of the sample post-1950 period with additional control variables.

Post-1950 period

I estimate the Equation (1) for the post-1950 period with same explanatory variables in order to create a benchmark[17]. The result confirms the findings in the previous section on the relationship between top income shares and per capita income and upturns and downturns in economic growth (see a column 1 of Table 3.a). A summary of the estimation results is presented in Table 3 (Detailed estimation outcomes can be found in Table 3.a and Table 3.b). The same estimation strategy used in the previous section is applied here with additional control variables. The information criteria show that the legal origin dummy variables are not significantly important in explaining the evolution of top income shares in the post-1950 period. This might be related to the fact that countries are becoming more common, particularly in terms of legal origins. Moreover, most countries are well-developed and high-income countries, and therefore not much differences remain related to the legal origins among the countries in our sample. Henceforth, the model is estimated without legal origin dummy variables.

Table 3 is about here.

The estimation results reject the hypothesis of inverted-U curve relationship between top income shares and per capita income at the 1 percent significance level. Indeed, same as in the previous section, a

[17] A similar approach is utilized in Atkinson and Morelli (2011) and Morelli (2012).

strong, significant U-curve relationship between top income shares and per capita income is found. Hence, this finding is consistent irrespective of the time span and model specification.

As expected, the top marginal tax rate is negatively and significantly associated with top income shares, implying that the tax rate could be a strong policy tool that can affect top income shares. This outcome is consistent with the findings of Atkinson and Leigh (2013) who conclude that the increase in top income shares in the fourth quarter of last century is markedly related to tax reduction policy.

In the sample of 1950-2011, the association of political regime with top income shares still holds, but insignificant. The same explanation for legal origins may also apply here. In other words, after 1950, it is more likely that the countries' political regimes remain relatively constant while top income shares diverge. Among other control variables, the government spending to GDP ratio has the highest impact on top income shares. Top income shares decline with government expenditure significantly. As our sample mostly consists of developed countries, the finding is coherent with the literature that proposes government spending reduces inequality. Human capital accumulation and financial development also reduce top income shares. Hence, I can say that the effect of human capital accumulation supports the view of political economists. Human capital accumulation, which is measured by the school enrolment ratio at the secondary level, reduces the power of elites both economically and politically. Even though I expect a positive sign for the coefficient of financial development, which is proxied by bank deposit to GDP ratio, this is negative and statistically significant at the 1 percent level. If I use stock market capitalization ratio as financial development, the effect was the opposite, but insignificant. Thus, our finding implies that the financial development of the banking sector is pro-poor rather than pro-rich (Agnello, Mallick, & Sousa, 2012; Jaumotte, Lall, & Papageorgiou, 2013; Roine et al., 2009).

Trade openness reduces top income shares. This result is contrary to the expectation. It is probably because international trade opens opportunity not only for the rich, but also for the rest of population. In particular, the rest of population benefits from trade openness more than the rich. Moreover, Hecksher-Ohlin model predicts that greater openness increases income inequality in developed countries, but reduces that in developing countries (Barro, 2000; Calderon & Chong, 2001; Dollar & Kraay, 2002; Jaumotte et al., 2013). In this regard, our result is consistent with the literature.

While an expansion of the agricultural sector affects top income shares negatively in the pooled-OLS estimation, its effect disappears in the FGLS estimation which took into account for heteroskedasticity, except in the equation in which 5-year MA growth. Thus, I can say that top income earners have not been affected by the expansion/contraction of the agricultural sector. The pooled-OLS estimation results support the findings in the literature that English speaking countries tend to have higher top income shares. However, the legal origin dummy variables became statistically insignificant. This may imply that after the 1950s, the legal origin of countries has become unimportant.

Our hypothesis of an asymmetric response of top income shares to upturns and downturns in economic growth is partly supported by the post-1950 data. Unlike the whole sample result, autocorrelation was not identified. However, White/Koenker nR2 test result indicates that heteroskedasticity still exists as found in the previous section's estimation. Therefore, I estimate the model using FGLS method allowing heteroskedasticity in panels. The FGLS estimation results are shown in the last three columns of Table 3 . From the table, it can be seen that a strong U-curve relationship still holds between top income shares and per capita income for both the pooled-OLS and the FGLS estimations. However, this doesn't imply that an average level of inequality is increasing. I only can say that U-curve relationship between inequality and per capita income and asymmetry in the effects of upturns and downturns in growth rates on inequality can be found only on the tail of the distribution. Furthermore, in order to check robustness, I estimate the model by using another estimates of GDP per capita, the Maddison data. The estimation outcome with the Maddison data supports the findings with B-U data. This confirms the robustness of our result.

In summary, the estimation results of responses of top income shares to upturns and downturns in growth for the post-1950 period clearly supports our hypothesis of asymmetry in the relationship between top income shares and economic growth. Specifically, I find a positive asymmetry on the response of top income shares to growth deviations. Unlike insignificant results for the effect of downturns in economic growth on top income shares in the whole sample, the magnitude and the significance of coefficients have improved. Test results indicate that the coefficients of upturns and downturns in growth rate are different from each other at the 1 percent significance level. In other words, the empirical findings show that top income earners increase their income shares when the economy grows at, or above preceding

year's, 5-year MA, and HP-trend growth rates. However, their income shares do not substantially (in particular, at the same degree) decline when the economy experiences downturns in economic growth. Overall, income inequality which is measured by the tails of the income distribution is worsening over time. This means the gap between income shares of the top 1 percent and the rest of the population has been increasing at a speedy rate. This result shows, to some extent, persistence of inequality over time as an economy, generally, grows over time.

Moreover, the persistence of inequality is tested by adding the initial level of top income shares at the beginning of each decade into the model. Our particular interest is to see this in post-1950 period when the top income shares is increasing. The estimation result shows a positive and high relation between top income shares and its initial value at the start of the decade[18] (See columns 9-11 in Table A.7 in the Appendix). This means that a country with a high initial level of top income shares tends to have a higher top income share. In other words, inequality which is measured by a ratio of income share of top earners to that of the rest of population remains high if income distribution has initially, at the beginning of a decade, skewed to the top 1 percent of population. This result also confirms the persistence of inequality.

5 Conclusion

This paper investigates the response of top income shares to upturn and downturn deviations of economic growth from the previous year's, the 5-year Moving Average, and the long-term trend growth rates in the presence of the inverted-U curve relationship between inequality and GDP per capita. Because of data availability of control variables, two samples covering different time spans are used in the analysis.

An inverted-U curve relationship between inequality and development is not confirmed by the data. Instead, I find a strong U-shaped relationship between top income shares and per capita income. This implies that top income shares decline in the initial stage of development, and then eventually increase. Therefore, the increase in overall inequality in recent years is partly associated with the rapid growth in top income shares. Moreover, our result suggests that inequality measured by the ratio of income shares

[18] The estimated coefficients for the variable of initial level of top income shares are 0.502, 0.422, and 0.502 in equations with a growth difference of two consecutive years, growth divergence from 5-year MA, and cyclical growth volatility, respectively. It should be noted that adding the initial level of top income shares into the model has not affected the effects of other variables on top income shares significantly, and therefore the all other conclusions remain valid.

of top earners to that of the rest of population worsen further with a rise in per capita income if the income growth of the bottom of the distribution is stagnant or less than that of top income earnings.

The literature suggests several factors that affect inequality (top income shares). I use marginal tax rate, financial development, human capital accumulation, demographic change, government role, political regime type, trade openness, legal origins and the structure of the economy as control variables. Due to data availability, the estimation is done for two samples. The sample of 1870-2011 consists of marginal tax rate, political regime, population and legal origins while the post-1950 estimations include all control variables.

The effect of political regime on top income shares is negative which means that top income shares decline in a democratic regime, but increases when the country becomes more autocratic. This result is consistent with the findings on the effect of democracy on inequality in the political economic literature, particularly for the case of developed countries.

The top marginal tax rate is negatively and significantly associated with top income shares. Therefore, this result is consistent with other studies that indicate the reduction in top marginal tax rates as the main explanation for the rapid increase in top income shares. In other words, this result shows that the top marginal tax rate could be a strong policy tool that can affect the top income shares.

In order to control for the effects of financial development and human capital accumulation, I use the bank deposit to GDP ratio and the school enrolment ratio at secondary level. Both variables negatively and significantly affect top income shares – a result that is consistent with the findings of the inequality literature. However, the school enrolment captures only an average impact of human capital accumulation of a whole country, and is not specific to top income earners. Therefore, if the data allows, this effect should be further examined by using the distribution of human capital accumulation, specific to top income earners.

Finally, the hypothesis of a positive asymmetry between top income shares and economic growth is verified by our analysis, particularly for the long-run effects. The result shows that top income earners increase their income shares during upturns in economic growth, but do not significantly suffer when the

economic growth is below the long-run trend growth. In recent years, top income earners benefit from growth at a higher degree when it is at, or above preceding year's, 5-year MA, and HP trend growth rates compared to what they lose during economic downturns. Specifically, the response of top income shares to upturns in economic growth compared to the 5-year MA and/or HP trend growth rates is higher than that of top income shares to a higher growth rate than in the previous year. In other words, the result shows that inequality (as measured by top income shares) worsens when the economy accelerates, but does not improve when economy decelerates. This finding supports the idea of winners-take-all which is argued in Frank and Cook (1996). Moreover, the outcome that top income earners suffer less from downturn in economic growth may be related to the reason that they can smooth the impact of shock (downturn in growth) through a portfolio re-allocation in the long-run. They may transit their assets from non-liquid to liquid, and use that as a cushion for shocks. Overall, top income earners get all benefits, but do not share losses. Finally, our findings also explain the persistence of inequality from a view of asymmetric impacts of economic growth. Top income shares will increase when economy grows on average. Moreover, this is also confirmed by the estimation which includes the initial value of top income shares at the beginning of each decade. In other words, a country tends to have a higher top income shares (higher inequality) if the income distribution is more skewed to the top tail initially.

This paper examines the asymmetric response of top income shares to different growth phases. However, the finding can be tested using different growth divergence specifications. Also, the long- and short-term effects of growth can be examined separately. These extensions could be subjects of future research.

References

Agnello, L., Mallick, S. K., & Sousa, R. M. (2012). Financial reforms and income inequality. *Economic Letters, 116*(3), 583-587.

Alvaredo, F., Atkinson, A. B., Piketty, T., & Saez, E. (2013). The top 1 percent in international and historical perspective. *Journal of Economic Perspectives, 27*(3), 3-20.

Atkinson, A. B. (2005). Comparing the distribution of top incomes across countries. *Journal of European Economic Associatuion, 3*(2-3), 393-401.

Atkinson, A. B., & Leigh, A. (2013). The distribution of top incomes in five Anglo-Saxon countries over the long run. *Economic Record, 89*(S1), 31-47.

Atkinson, A. B., & Morelli, S. (2011). Economic crisis and inequality. In H. Llavador, J. E. Roemer, & J. Silvestre (Eds.), *Sustainability in the presence of global warming: Theory and evidence* (Vol. 05, pp. 1-70). New York: UNDP.

Atkinson, A. B., & Piketty, T. (2007). *Top Incomes over the Twentieth Century: A Contrast between Continental European and English-Speaking Countries* (Vol. 1). Oxford: Oxford University Press.

Atkinson, A. B., & Piketty, T. (2010). *Top Incomes: A Global Perspective* (Vol. 2). New York: Oxford University Press.

Atkinson, A. B., Piketty, T., & Saez, E. (2011). Top incomes in the long run of history. *Journal of Economic Literature, 49*(1), 3-71.

Barro, R. J. (2000). Inequality and growth in a panel of countries. *Journal of Economic Growth, 5*, 5-32.

Barro, R. J., & Ursúa, J. F. (2008). Macroeconomic crises since 1870. *Brookings Paper on Economic Activity, 1*, 255-350.

Baum, C. F. (2001). Residual disagnostics for cross-section time series regression models. *Stata Journal, 1*(1), 101-104.

Bolt, J., & Van Zanden, J. L. (2013) The first update of the Maddison Project: Re-estimating growth before 1820. *Maddison Project Working Paper 4*. Groningen: GGDC.

Bordo, M. D., & Landon-Lane, J. S. (2010). *The Global Financial Crisis: Is It Unprecedented?* Paper presented at the Global Economic Crisis: Impacts, Transmission, and Recovery, Honolulu.

Bordo, M. D., & Meissner, C. M. (2012) Does inequality lead to a financial crisis? *NBER Working Paper No.17896*. Cambridge: NBER.

Buckle, R. A., & Carlson, J. A. (2000). Inflation and asymmetric price adjustment. *The Review of Economics and Statistics, 82*(1), 157-160.

Calderon, C. A., & Chong, A. (2001). External sector and income inequality in interdependent economies using dynamic panel data approach. *Economic Letters, 71*(2), 225-231.

Dollar, D., & Kraay, A. (2002). Growth is good for the poor. *Journal of Economic Growth, 7*(3), 195-225.

Drukker, D. M. (2003). Testing for serial correlation in linear panel-data models. *Stata Journal, 3*(2), 168-177.

Frank, R., & Cook, P. (1996). *The Winner-Take-All Society: Why the Few at the Top Get So Much More than the Rest of Us*. New York: Penguin Books.

Grier, K. B., Henry, O. T., Olekalns, N., & Shields, K. (2004). The asymmetric effects of uncertainty on inflation and output growth. *Journal of Applied Economics, 19*, 551-565.

Jaumotte, F., Lall, S., & Papageorgiou, C. (2013). Rising income inequality: Technology, or trade and financial globalization? *IMF Economic Review, 61*, 271-309.

Kolluri , B., & Wahab, M. (2007). Asymmetries in the conditional relation of government expenditure and economic growth. *Applied Economics, 39*, 2303-2322.

Kolm, S.-C. (1976). Unequal inequalities. *Journal of Economic Theory, 13*, 82-111.

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

Laeven, L., & Valencia, F. (2010) Resolution of banking crises: The good, the bad, and the ugly. *Working Paper Series WP/10/146*. Washington: IMF.

Matsuyama, K. (2000). Endogenous inequality. *Review of Economic Studies, 67*, 743-759.

Milanovic, B. (2005). *Worlds Apart: Measuring Inequality and Global Inequality*. Princeton: Princeton University Press.

Mookherjee, D., & Ray , D. (2003). Persistent inequality. *Review of Economic Studies, 70*, 369-393.

Morelli, S. (2012). *Banking shocks and top income shares*. Paper presented at the 32nd General Conference of the International Association for Research in Income and Wealth, Boston.

Piketty, T. (2003). Income inequality in France, 1901-1998. *Journal of Political Economy, 123*(3), 1004-1042.

Piketty, T. (2014). *Capital in the Twenty-First Century*. Cambridge: Belknap Press.

Piketty, T., & Saez, E. (2012). *Top incomes and the great recession: Recent evolutions and policy implications*. Paper presented at the 13th Jacques Polak Annual Research Conference, Washington.

Reinhart, C. M., & Rogoff, K. S. (2008) Banking crises: An equal opportunity menace. *NBER Working Paper No.14587*. Cambride: NBER.

Reinhart, C. M., & Rogoff, K. S. (2009) The aftermath of financial crises. *NBER Working Paper No.14656*. Cambride: NBER.

Roine, J., Vlachos, J., & Waldenström, D. (2009). The long-run determinants of inequality: What can we learn from top income data? *Journal of Public Economics, 93*, 974-988.

Rosen , S. (1981). The economics of superstars. *The American Economic Review, 71*(5), 845-858.

Stiglitz, J. (2013, 20 Jan). Inequality is holding back the recovery. *The New York Times*, p. SR1. Retrieved from http://opinionator.blogs.nytimes.com/2013/01/19/inequality-is-holding-back-the-recovery/?_php=true&_type=blogs&_r=0

Wooldridge, J. (2010). *Econometric Analysis of Cross Section and Panel Data* (2 ed.). Massachusetts: MIT Press.

Appendix

Table A.1 Top income shares of countries

Country[19]	Top 1 per cent's income share	Notes
Argentina	1932-2004 (with breaks)	Estimates exclude capital gains
Australia	1921-2010	
Canada	1920-2000	Estimates exclude capital gains. Because of methodological and source breaks, the data since 2000 is not used.
Colombia	1993-2010	
Denmark	1870-2010 (with breaks)	Estimates exclude capital gains. Break in 1970 is because of the change of tax unit.
Finland	1920-1992 1990-2009	Two different data sources are used. Up to 1992, tabulated tax was the base; since 1990, Income Distribution Survey is used as a source.
France	1915-2009 (with breaks)	Excludes capital gains.
Germany	1891-1998 (with breaks)	Breaks are because of coverage of area.
India	1922-1999 (with breaks)	
Indonesia	1921-2004 (with breaks)	
Ireland	1975-2000 (with breaks)	From 1975, estimates are based on income tax returns.
Italy	1974-2009	Estimates exclude capital gains and some types of capital incomes (interest income)
Japan	1886-2010 (with breaks)	Estimates exclude capital gains.
Malaysia	1951-2010 (with breaks)	
Mauritius	1947-2011 (with breaks)	
Netherland	1914-1999 (with breaks)	
Norway	1875-2008 (with breaks)	
New Zealand	1921-2009 (with breaks)	
Portugal	1976-2005 (with breaks)	Estimates exclude most capital gains.
Singapore	1947-2010(with breaks)	
South Africa	1914-2010 (with breaks)	The break in 1990 is related to the change of tax unit from adults aged 15+ minus married women to adults.
Spain	1981-2010	Estimates exclude capital gains.
Sweden	1903-2004 (with breaks)	Estimates exclude capital gains.
Switzerland	1933-2009 (with breaks)	
United Kingdom	1918-2009 (with breaks)	
United States	1913-2012	

Source: WTID: http://topincomes.g-mond.parisschoolofeconomics.eu/

[19] China was excluded as the data is based on household income surveys and not from tax data (individual distribution).

Table A.2 Data sources of variables

Variables	Definition	Source
Top01 Top1 Top10	Income shares of 0.1, 1, and 10 percent of population	Alvaredo, F, A.B. Atkinson, T. Piketty and E. Saez, The World Top Incomes Database, http://topincomes.g-mond.parisschoolofeconomics.eu/
Gini	Gini coefficient which measures income inequality within a country	An updated version of *All the Ginis* by (Milanovic, 2005)
LN(GDPpc)	Natural log of GDP per capita indexed at 2006 constant price for BU data and at 1990 constant Geary-Khamis dollars for Maddison data.	Barro and Ursúa (2008) Bolt and van Zanden (2013)
Ln(Pop)	Natural log of population	Maddison Project data updated by Bolt and van Zanden (2013)
Legal origin	French, Germany and Scandinavian legal origin dummies are included in the estimation	La Porta et al. (2008)
Polity2	Political regime index. Scale from -10 to 10 with higher values indicating a more democratic environment.	Polity IV project by Marshall (2012)
Investment	Share of investment in GDP	Penn World Table, version 8.1 (2013 release)
Openness	A ratio of sum of exports and imports to GDP	WDI, WB (2013 release)
Top marginal tax rate	Top marginal tax rate is a statutory tax rate for Roine et al. data. The top marginal income tax rate includes general income tax supplements in Alvaredo et al. data. The data is same for overlapping years.	Roine et al. (2009), OECD statistics (2013), KPMG survey data (2013), Alvaredo et al. (2013)
Government spending	Share of government consumption spending in GDP	Penn World Table, version 8.1 (2013 release)
Human capital	A combined value of school enrolment from Barro/Lee 2012 and return to education. Secondary school enrolment ratio	Penn World Table, version 8.1 (2013 release) WDI, WB (2013 release)
Financial development	Bank deposit to GDP ratio Stock market capitalization Domestic credit provided by banking sector	Čihák, Demirgüç-Kunt, Feyen, & Levine (2012) WDI, WB (2013 release)
Agriculture share	Share of agricultural sector's value added in GDP	WDI, WB (2013 release)
Industrial share	Share of industrial sector's value added in GDP	WDI, WB (2013 release)
Real interest rate	Real interest rate is the lending interest rate adjusted for inflation as measured by the GDP deflator.	WDI, WB (2013 release)

Table 1. Summary statistics of top income shares, GDP per capita, and growth rate by regions

Variables	Mean	Std. Dev.	Min	Max	Obs.
Top01	3.77	2.35	0.73	13.70	1605
Top1	10.81	4.55	3.49	28.04	1640
Top10	33.13	6.14	13.96	54.30	1141
Ln(GDP per capita)	3.61	0.76	1.36	4.77	2093
Growth rate	2.30	5.25	-66.06	67.15	2091
Western Europe					
Top01	3.54	2.44	0.73	13.70	772
Top1	9.90	4.46	3.49	28.04	778
Top10	32.90	5.75	18.77	54.24	693
Ln(GDP per capita)	3.57	0.75	1.69	4.65	1083
Growth rate	2.34	5.35	-66.06	67.15	1083
Western-Offshoots					
Top01	3.22	1.83	0.96	9.87	331
Top1	10.18	3.51	4.61	19.60	353
Top10	34.05	5.34	23.99	46.63	304
Ln(GDP per capita)	3.77	0.58	2.54	4.64	364
Growth rate	1.93	4.45	-16.77	17.43	364
Asia					
Top01	4.16	2.18	1.21	9.72	317
Top1	11.76	3.91	4.39	21.55	323
Top10	32.89	4.57	22.53	43.87	115
Ln(GDP per capita)	3.30	0.88	1.36	4.77	425
Growth rate	2.87	5.91	-31.09	29.86	423
'Other' countries					
Top01	5.08	2.47	1.02	11.62	185
Top1	14.18	5.70	3.90	25.96	186
Top10	30.13	17.34	13.96	54.30	29
Ln(GDP per capita)	4.15	0.38	3.09	4.73	221
Growth rate	1.58	4.48	-23.90	16.76	221

Source: WTID 2013, http://topincomes.g-mond.parisschoolofeconomics.eu/
Barro and Ursúa (2008)
WDI 2013

Table 2. Estimation results, 1870-2011 period

	Pooled-OLS			FGLS		
Ln(GDP per capita)	-5.825***	-5.060***	-5.440***	-14.10**	-15.12***	-15.03**
	(1.260)	(1.230)	(1.280)	(1.442)	(1.487)	(1.437)
Ln(GDP per capita-squared)	0.480***	0.400**	0.379**	1.875***	1.978***	1.953***
	(0.178)	(0.175)	(0.182)	(0.190)	(0.194)	(0.188)
$g_{it,t-1}^{up}$	0.066**			0.015**		
	(0.028)			(0.008)		
$g_{it,t-1}^{down}$	-0.073**			-0.003		
	(0.031)			(0.008)		
$g_{it,MA}^{up}$		0.144***			0.052***	
		(0.044)			(0.011)	
$g_{it,MA}^{down}$		-0.013			0.008	
		(0.043)			(0.011)	
$g_{it,trend}^{up}$			0.168***			0.033***
			(0.041)			(0.011)
$g_{it,trend}^{down}$			-0.041			0.024**
			(0.039)			(0.010)
Observations	987	956	987	986	956	986
Adjusted R-squared	0.6526	0.6723	0.6553			
Country-effects				Yes	Yes	Yes
$H_0: b_1 = b_2 = 0$	4.95***	6.21***	8.77***	5.18*	29.61***	22.51***
	(0.0073)	(0.0021)	(0.0002)	(0.0750)	(0.0000)	(0.0000)
$H_{0,1}: b_1 = b_2$[a]	0.22	7.18***	7.63***	2.90*	24.64***	22.47***
	(0.6380)	(0.0075)	(0.0058)	(0.0887)	(0.0000)	(0.0000)

Source: Author's estimation

Note: ***, **, *-indicates 1, 5, and 10 percent significance levels, respectively. Standard errors are in parentheses. For test results, p-values are in parentheses.

[a]- For $H_{0,1}$: $b_1 = b_2$ and the alternative hypothesis, $H_{a,1}$: $b_1 \neq b_2$, the F-test and χ^2test results are reported for the pooled-OLS and FGLS estimations, respectively.

Table 2.a Pooled-OLS estimation results, 1870-2011

Dependent variable	Top1					Top01			Top10		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
LNGDP per capita (BU)	-5.825***	-6.273***	-5.060***	-4.677***	-6.028***	-2.874***	-2.314***	-2.967***	-30.00***	-29.54***	-29.99***
	(1.260)	(1.280)	(1.230)	(1.251)	(1.254)	(0.710)	(0.714)	(0.707)	(3.450)	(3.437)	(3.429)
LNGDP per capita^2 (BU)	0.480***	0.523***	0.400**	0.289*	0.506***	0.218**	0.124	0.231**	3.616***	3.546***	3.621***
	(0.178)	(0.180)	(0.175)	(0.177)	(0.177)	(0.100)	(0.101)	(0.100)	(0.465)	(0.465)	(0.463)
Polity score	-0.271***	-0.238***	-0.283***	-0.268***	-0.273***	-0.125***	-0.125***	-0.126***	0.156**	0.118*	0.145**
	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)	(0.015)	(0.015)	(0.015)	(0.063)	(0.063)	(0.064)
Top marginal tax rate	-8.909***	-8.532***	-8.760***	-8.484***	-8.843***	-5.413***	-5.394***	-5.382***	-8.983***	-8.934***	-8.953***
	(0.479)	(0.483)	(0.483)	(0.467)	(0.477)	(0.261)	(0.259)	(0.260)	(0.792)	(0.773)	(0.789)
Ln(Population)	0.671***	0.516***	0.681***	0.686***	0.670***	0.479***	0.487***	0.479***	1.370***	1.301***	1.372***
	(0.074)	(0.070)	(0.063)	(0.074)	(0.074)	(0.042)	(0.043)	(0.042)	(0.114)	(0.113)	(0.113)
Legal origin-French	2.089***	-0.656***		3.039**	2.071**	1.237***	1.568***	1.231**	-9.320***	-7.032***	-9.244***
	(0.511)	(0.229)		(0.543)	(0.508)	(0.288)	(0.307)	(0.287)	(1.338)	(1.908)	(1.336)
Legal origin-Germany	0.683	-2.022***		1.565***	0.646	0.806***	1.104***	0.793***	-11.20***	-9.131***	-11.10***
	(0.533)	(0.288)		(0.561)	(0.531)	(0.300)	(0.317)	(0.299)	(1.362)	(1.924)	(1.359)
Legal origin-Scandinavian	0.767	-2.332***		1.675***	0.707	1.442***	1.753***	1.418***	-11.70***	-9.598***	-11.60***
	(0.583)	(0.273)		(0.614)	(0.580)	(0.332)	(0.351)	(0.330)	(1.364)	(1.920)	(1.359)
English-speaking	3.140***		1.894***	4.019***	3.092***	2.159***	2.447***	2.138***	-7.388***	-5.140***	-7.279***
	(0.525)		(0.190)	(0.554)	(0.522)	(0.295)	(0.312)	(0.294)	(1.363)	(1.930)	(1.359)
Constant	28.11***	28.11***	22.46***	20.49***	23.44***	8.545***	7.430***	8.701***	92.56***	90.63***	92.40***
	(2.314)	(2.314)	(2.162)	(2.436)	(2.405)	(1.375)	(1.398)	(1.366)	(6.462)	(6.545)	(6.402)

Table 2.a continues

	1	2	3	4	5	6	7	8	9	10	11
$g_{it,t-1}^{up}$	0.067**	0.066**	0.092***			0.030**			-0.020		
	(0.027)	(0.028)	(0.028)			(0.015)			(0.048)		
$g_{it,t-1}^{down}$	-0.083***	-0.073**	-0.105***			-0.040**			0.042		
	(0.030)	(0.031)	(0.031)			(0.017)			(0.050)		
$g_{it,MA}^{up}$				0.146***			0.063***			0.036	
				(0.043)			(0.024)			(0.075)	
$g_{it,MA}^{down}$				-0.018			-0.004			0.154**	
				(0.041)			(0.023)			(0.072)	
$g_{it,trend}^{up}$					0.170***			0.082***			0.0642
					(0.041)			(0.022)			(0.069)
$g_{it,trend}^{down}$					-0.047			-0.021			0.110*
					(0.038)			(0.021)			(0.065)
Observations	987	987	987	956	987	964	940	964	817	786	817
Adj R-squared	0.6526	0.6402	0.6385	0.6723	0.6553	0.6451	0.6564	0.6475	0.5508	0.5598	0.5529
AIC/BIC	4690.6/ 4749.3	4724.2/ 4778.1	4726.9/ 4771.0								
$H_0: b_1 = b_2 = 0$	4.95***			6.21***	8.77***	3.53**	3.84**	6.77***	0.36	3.16**	2.26
	(0.0073)			(0.0021)	(0.0002)	(0.0298)	(0.0219)	(0.0012)	(0.6944)	(0.0431)	(0.1047)
$H_{0,1}: b_1 = b_2$	0.22			7.18***	7.63***	0.32	4.91**	6.24***	0.15	5.14**	3.98**
	(0.6380)			(0.0075)	(0.0058)	(0.5742)	(0.0269)	(0.0126)	(0.7009)	(0.0236)	(0.0464)
White/Koenker nR2 test	118.4 (0.0000)			121.6 (0.0000)	91.6 (0.0000)						

Note: ***, **, *- indicate 1, 5, and 10 percent significance levels, respectively. Standard errors are in parentheses. For diagnostic tests, P-values are in parentheses.

[a]- For H_0 and the alternative hypothesis, H_1, the F-test results are reported.

Table 2.b RE, FE and FGLS estimation results, 1870-2011: Dependent variable is Top1

	RE-model			FE-model			FGLS		
	12	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
LGDP per capita (BU-data)	-10.70***	-10.36***	-11.00***	-10.79***	-10.53***	-11.13***	-14.10**	-15.12***	-15.03**
	(1.298)	(1.327)	(1.295)	(1.295)	(1.316)	(1.288)	(1.442)	(1.487)	(1.437)
LGDP per capita-squared (BU-data)	1.166***	1.079***	1.189***	1.237**	1.184**	1.274**	1.875***	1.978***	1.953***
	(0.183)	(0.187)	(0.181)	(0.183)	(0.187)	(0.183)	(0.190)	(0.194)	(0.188)
Polity score	-0.055**	-0.062**	-0.058**	-0.051*	-0.050*	-0.050*	-0.069**	-0.068**	-0.071**
	(0.028)	(0.028)	(0.028)	(0.028)	(0.028)	(0.028)	(0.029)	(0.028)	(0.029)
Top marginal tax rate	-7.217***	-7.171***	-7.179***	-7.139***	-7.023***	-7.074***	-1.898***	-1.733***	-1.828***
	(0.446)	(0.453)	(0.447)	(0.445)	(0.447)	(0.443)	(0.343)	(0.331)	(0.337)
Ln(Population)	0.671***	-0.700**	-0.859***	-2.183***	-2.202***	-2.113***	-3.621***	-3.087***	-3.000***
	(0.074)	(0.283)	(0.312)	(0.466)	(0.473)	(0.465)	(0.700)	(0.750)	(0.703)
Legal origin-French	0.235***	0.045	0.214						
	(1.553)	(1.109)	(1.282)						
Legal origin-Germany	-1.316	-1.510	-1.421						
	(2.037)	(1.422)	(1.676)						
Legal origin-Scandinavian	-6.126***	-5.384***	-5.689***						
	(1.937)	(1.389)	(1.613)						
Constant	28.11***	46.11***	48.51***	22.46***	58.83***	58.91***	80.12***	77.18***	76.46***
	(2.314)	(3.536)	(3.734)	(2.162)	(4.889)	(4.814)	(6.441)	(6.804)	(6.412)

Table 2.b continues

	12	13	14	15	16	17	18	19	20
$g_{it,t-1}^{up}$	0.026			0.026			0.015**		
	(0.022)			(0.022)			(0.008)		
$g_{it,t-1}^{down}$	-0.027			-0.026			-0.003		
	(0.025)			(0.025)			(0.009)		
$g_{it,MA}^{up}$		0.076**			0.073**			0.052***	
		(0.036)			(0.035)			(0.011)	
$g_{it,MA}^{down}$		0.033			0.030			0.008	
		(0.035)			(0.035)			(0.011)	
$g_{it,trend}^{up}$			0.075**			0.067**			0.033***
			(0.034)			(0.033)			(0.011)
$g_{it,trend}^{down}$			0.032			0.032			0.024**
			(0.031)			(0.031)			(0.010)
Observations	987	956	987	987	956	987	986	956	986
Country-effects				Yes	Yes	Yes	Yes	Yes	Yes
R-squared[a]	0.4596	0.5200	0.4743	0.6221	0.6304	0.6245			
$H_0: b_1 = b_2 = 0$							5.18*	29.61***	22.51***
							(0.0750)	(0.0000)	(0.0000)
$H_{0,1}: b_1 = b_2$ [b]							2.90*	24.64***	22.47***
							(0.0887)	(0.0000)	(0.0000)
Modified Wald test				86892.4***	1.1e+05***	1.8e+05***			
				(0.0000)	(0.0000)	(0.0000)			
Hausman test				16.02 ***	48.06***	28.18***			
				(0.0249)	(0.0000)	(0.0002)			
Wooldridge test for auto	18.950***	18.622***	18.696***						
	(0.0003)	(0.0004)	(0.0003)						

Note: ***, **, *-indicate 1, 5, and 10 percent significance levels, respectively. Standard errors are in parentheses. For diagnostic tests, P-values are reported in the parentheses.

[a]- Overall and within R-squared are reported for random and fixed effects models, respectively. [b]- For H_0 and the alternative hypothesis, H_1, the Chi-square test results are reported.

Table 3. Estimation results, post-1950 period

	Pooled-OLS			FGLS		
Ln(GDP per capita)	-42.57**	-33.78***	-40.93**	-46.91***	-48.27***	-46.94***
	(13.65)	(13.07)	(13.43)	(8.146)	(7.495)	(7.889)
Ln(GDP per capita-squared)	5.900***	4.833***	5.718***	5.829***	5.958***	5.825***
	(1.586)	(1.521)	(1.560)	(0.944)	(0.862)	(0.914)
$g_{it,t-1}^{up}$	0.174***			0.064*		
	(0.053)			(0.034)		
$g_{it,t-1}^{down}$	-0.115*			-0.058*		
	(0.063)			(0.034)		
$g_{it,MA}^{up}$		0.274***			0.130***	
		(0.086)			(0.042)	
$g_{it,MA}^{down}$		-0.277***			-0.086*	
		(0.078)			(0.045)	
$g_{it,trend}^{up}$			0.257***			0.164***
			(0.087)			(0.040)
$g_{it,trend}^{down}$			-0.235***			-0.103***
			(0.065)			(0.035)
Observations	343	343	343	343	328	343
Adjusted R-squared	0.7680	0.7630	0.7684			
$H_0: b_1 = b_2 = 0$	5.71***	8.44***	7.84***	4.64*	10.19***	18.86***
	(0.0036	(0.0003)	(0.0005)	(0.0981)	(0.0061)	(0.0001)
$H_{0,1}: b_1 = b_2$ [a]	16.64***	16.64***	14.82***	4.62**	9.03***	18.05***
	(0.0001)	(0.0001)	(0.0010)	(0.0316)	(0.0027)	(0.0000)

Source: Author's estimation

Note: ***, **, *-indicates 1, 5, and 10 percent significance levels, respectively. Standard errors are in parentheses. For test results, p-values are in parentheses.

[a]- For $H_{0,1}$: $b_1 = b_2$ and the alternative hypothesis, $H_{a,1}$: $b_1 \neq b_2$, the F-test and χ^2 test results are reported for the pooled-OLS and FGLS estimations, respectively.

Table 3.a Pooled-OLS estimation results, 1950-2011

	Dependent variable: Top1							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
LNGDP per capita (BU)	-17.96***	-26.51***	-45.01***	-56.72***	-56.33***	-58.05***	-32.97**	-42.57**
	(2.583)	(2.408)	(4.582)	(10.351)	(11.258)	(11.279)	(13.783)	(13.655)
LNGDP per capita-sq. (BU)	2.404***	3.527***	5.965***	7.268***	7.341***	7.552***	4.807***	5.900***
	(0.336)	(0.314)	(0.558)	(1.208)	(1.314)	(1.317)	(1.607)	(1.586)
Polity score	-0.369***	-0.275***	-0.587***	-0.507***	-0.810***	-0.773***	-0.746***	-0.753***
	(0.042)	(0.039)	(0.058)	(0.080)	(0.146)	(0.147)	(0.155)	(0.148)
Top marginal tax rate	-4.603***	-2.291***	-2.290***	-3.425***	-2.175***	-2.134***	-1.251*	-1.222*
	(0.572)	(0.548)	(0.588)	(0.721)	(0.698)	(0.696)	(0.768)	(0.752)
Ln(Population)	0.708***	0.649***	0.792***	0.711***	0.422***	0.338***	0.290**	0.332***
	(0.067)	(0.061)	(0.062)	(0.078)	(0.099)	(0.111)	(0.141)	(0.101)
Legal origin-French	0.898**	-0.014	1.106***	0.313	-0.457	-0.872	-1.169*	
	(0.421)	(0.389)	(0.393)	(0.631)	(0.616)	(0.663)	(0.701)	
Legal origin-Germany	0.892*	-0.821*	1.286**	1.386*	0.465	-0.237	0.764	
	(0.457)	(0.435)	(0.532)	(0.763)	(0.737)	(0.846)	(0.905)	
Legal origin-Scandinavian	0.114	0.192	1.714***	0.305	-0.260	-807	-1.173	
	(0.496)	(0.450)	(0.466)	(0.780)	(0.743)	(0.810)	(0.898)	
English speaking	2.433***	1.141***	2.016***	0.976	0.879	0.336	0.418	1.193***
	(0.436)	(0.408)	(0.429)	(0.682)	(0.658)	(0.732)	(0.777)	(0.245)
Government spending/GDP		-26.74***	-27.65***	-27.62***	-33.30***	-31.73***	-29.85***	-31.57***
		(2.080)	(2.350)	(3.152)	(3.738)	(3.846)	(4.280)	(3.228)

Table 3.a continues

	Dependent variable: Top1							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Financial development			-0.019***	-0.026***	-0.022***	-0.021***	-0.032***	-0.021***
			(0.003)	(0.004)	(0.004)	(0.004)	(0.005)	(0.003)
Agricultural sector/GDP				-0.065**	-0.111**	-0.128***	-0.114**	-0.090***
				(0.028)	(0.032)	(0.033)	(0.036)	(0.025)
Human capital					-0.032***	-0.031***	-0.040***	-0.039***
					(0.006)	(0.006)	(0.007)	(0.007)
Trade openness						-0.008*	-0.006	-0.010**
						(0.005)	(0.005)	(0.004)
Real interest rate							-0.066***	-0.050**
							(0.025)	(0.024)
Constant	38.36***	58.10***	93.99***	122.51***	129.07***	133.54***	78.31***	97.49***
	(5.001)	(4.717)	(9.451)	(22.33)	(24.39)	(24.48)	(29.48)	(29.41)
$g_{it,t-1}^{up}$	0.129***	0.137***	0.149***	0.169***	0.164***	0.168***	0.191***	0.174***
	(0.048)	(0.042)	(0.045)	(0.050)	(0.049)	(0.049)	(0.053)	(0.053)
$g_{it,t-1}^{down}$	-0.098**	-0.112***	-0.060	-0.062	-0.055	-0.055	-0.120*	-0.115*
	(0.045)	(0.039)	(0.046)	(0.052)	(0.054)	(0.053)	(0.062)	(0.063)
Observations	709	716	548	463	408	408	343	343
Adjusted R-squared	0.4789	0.5701	0.6926	0.7158	0.7675	0.7686	0.7939	0.7862
AIC/BIC	2983.5/ 3038.3	2877.6/ 2937.1	2061.5/ 2121.8	1771.8/ 1833.9	1479.5/ 1547.7	1478.6/ 1550.8	1247.9/ 1320.8	1256.6/ 1314.2

Note: ***, **, *- indicate 1, 5, and 10 percent significance levels, respectively. Standard errors are in parentheses.

Table 3.b Estimation results, 1950-2011: Dependent variable is Top1

	Pooled-OLS			RE	FE	FGLS					
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9[c]**	**10[c]**	**11[c]**
LNGDP per capita (BU)	-42.57**	-33.78***	-40.93**	-25.55**	-53.34***	-46.91***	-48.27***	-46.94***	-25.18***	-32.64***	-30.13***
	(13.655)	(13.072)	(13.433)	(111.662)	(10.27)	(8.146)	(7.495)	(7.889)	(6.999)	(6.802)	(6.656)
LNGDP per capita-sq. (BU)	5.900***	4.833***	5.718***	3.957***	6.593**	5.829***	5.958***	5.825***	3.152***	4.039***	3.720***
	(1.586)	(1.521)	(1.560)	(1.358)	(1.184)	(0.944)	(0.862)	(0.914)	(0.813)	(0.785)	(0.773)
Polity score	-0.753***	-0.879***	-0.730***	-0.130	-0.264	-0.665***	-0.614***	-0.645***	-0.393**	-0.411***	-0.464***
	(0.148)	(0.153)	(0.147)	(0.287)	(0.300)	(0.205)	(0.194)	(0.202)	(0.173)	(0.166)	(0.171)
Top marginal tax rate	-1.222*	-0.776*	-0.781	-1.345**	-0.909	-1.543***	-1.405***	-1.285**	-1.687***	-1.579***	-1.554***
	(0.752)	(0.698)	(0.746)	(0.750)	(0.646)	(0.559)	(0.539)	(0.543)	(0.452)	(0.441)	(0.446)
Ln(Population)	0.332***	0.277***	0.323***	1.268***	19.15***	17.01***	17.82***	17.55***	7.610***	10.04***	8.203***
	(0.101)	(0.096)	(0.100)	(0.364)	(1.625)	(1.301)	(1.291)	(1.295)	(1.278)	(1.339)	(1.263)
English speaking	1.193***	1.472***	1.126***	0.966							
	(0.245)	(0.234)	(0.243)	(1.235)							
Government spending/GDP	-31.57***	-3354***	-32.19***	-20.64***	-17.03***	-11.08***	-13.47***	-11.41***	-5.946***	-8.137***	-5.560**
	(3.228)	(3.114)	(3.182)	(4.027)	(3.577)	(2.871)	(2.822)	(2.832)	(2.239)	(2.277)	(2.281)
Financial development	-0.021***	-0.016***	-0.021***	-0.038***	-0.039***	-0.037***	-0.040***	-0.037***	-0.018***	-0.023***	-0.017***
	(0.003)	(0.003)	(0.003)	(0.005)	(0.005)	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)
Agricultural sector/GDP	-0.090***	-0.074***	-0.078***	-0.032	-0.056	-0.063	-0.090**	-0.038	-0.046	-0.043	-0.033
	(0.025)	(0.024)	(0.025)	(0.053)	(0.052)	(0.047)	(0.040)	(0.040)	(0.040)	(0.038)	(0.330)
Human capital	-0.039***	-0.041***	-0.038***	-0.039***	-0.020**	-0.023***	-0.025***	-0.020***	-0.017***	-0.020***	-0.014***
	(0.007)	(0.006)	(0.007)	(0.009)	(0.008)	(0.007)	(0.006)	(0.006)	(0.005)	(0.005)	(0.005)
Trade openness	-0.010**	-0.001	-0.010**	-0.006	-0.029***	-0.029***	-0.032***	-0.030***	-0.005	-0.013**	-0.009
	(0.004)	(0.005)	(0.004)	(0.009)	(0.009)	(0.007)	(0.007)	(0.007)	(0.006)	(0.006)	(0.006)
Real interest rate	-0.050**	-0.043**	-0.063***	-0.080***	-0.086***	-0.066***	-0.064***	-0.067***	-0.022*	-0.023*	-0.018
	(0.024)	(0.023)	(0.024)	(0.022)	(0.019)	(0.016)	(0.014)	(0.015)	(0.013)	(0.013)	(0.013)
Initial level of top income shares									0.502***	0.422***	0.502***
									(0.041)	(0.041)	(0.041)

Table 3.b continues

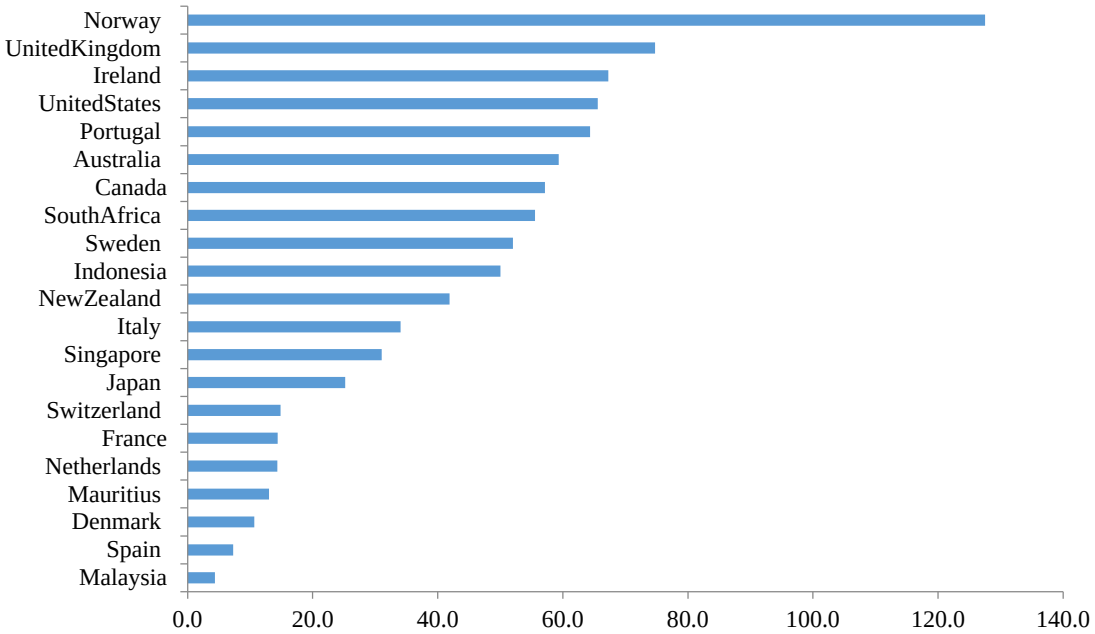
	1	2	3	4	5	6	7	8	9[c]	10[c]	11[c]
Constant	97.49***	80.52***	93.32***	44.16***	-71.03***	-59.86***	-64.53***	-66.18***	-16.23	-24.21	-11.74
	(29.41)	(28.26)	(28.91)	(25.22)	(23.65)	(19.89)	(18.94)	(19.50)	(16.87)	(16.99)	(16.59)
$g_{it,t-1}^{up}$	0.174***			0.145***	0.101***	0.064*			0.037		
	(0.053)			(0.044)	(0.039)	(0.034)			(0.027)		
$g_{it,t-1}^{down}$	-0.115*			-0.111**	-0.101**	-0.058*			-0.044		
	(0.063)			(0.052)	(0.044)	(0.034)			(0.029)		
$g_{it,MA}^{up}$		0.274***					0.130***			0.086**	
		(0.086)					(0.042)			(0.038)	
$g_{it,MA}^{down}$		-0.277***					-0.086*			-0.056	
		(0.078)					(0.045)			(0.040)	
$g_{it,trend}^{up}$			0.257***					0.164***			0.116***
			(0.087)					(0.040)			(0.036)
$g_{it,trend}^{down}$			-0.235***					-0.103***			-0.045
			(0.065)					(0.035)			(0.032)
Observations	343	343	343	343	343	343	328	343	343	328	343
R-squared[a]	0.7862	0.7869	0.7889	0.6901	0.7034						
Country-effects				Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
$H_0: b_1 = b_2 = 0$	5.71***	8.44***	7.84***			4.64*	10.19***	18.86***	2.92	5.24*	10.27***
	(0.0036	(0.0003)	(0.0005)			(0.0981)	(0.0061)	(0.0001)	(0.2321)	(0.0727)	(0.0059)
$H_{0,1}: b_1 = b_2$ [b]	16.64***	16.64***	14.82***			4.62**	9.03***	18.05***	2.90*	4.65**	7.78***
	(0.0001)	(0.0001)	(0.001)			(0.0316)	(0.0027)	(0.0000)	(0.0885)	(0.0310)	(0.0053)
White/Koenker nR2 test	95.92***	31.58***	90.97***								
	(0.0000)	(0.0000)	(0.0000)								
Breusch and Pagan LM test				155.52***							
				(0.0000)							
Modified Wald test					405.73***						
					(0.0000)						
Wooldridge test				0.056							
				(0.8158)							
Hausman test				111.73***							
				(0.0000)							

Note: ***, **, *-indicate 1, 5, and 10 percent significance levels, respectively. Standard errors are in parentheses. For diagnostic tests, P-values are reported in the parentheses.

[a]- Adjusted, overall and within R-squared are reported for the pooled-OLS, random- and fixed-effects models, respectively. [b]- For H_0 and the alternative hypothesis, H_1, the F-test and the Chi-square test results are reported for the pooled-OLS and the FGLS estimations, respectively. [c]- The model includes the initial level of top income shares for testing the persistence of inequality.

Figures

Figure 1 Growth of income share of the richest 1 percent between the 1980s and the 2000s



Note: Average values of top 1 percent income shares over the period of 1980s and 2000s are used to calculate growth rates.

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