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Potential Determinants of Top Income Inequality*

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Abstract

Using the data series produced from the collective research project on the dynamics of income distribution (Atkinson and Piketty 2007, 2010) we have studied the effect of different economic factors on top income inequality in the Anglo-Saxon countries (Australia, Canada, New Zealand, UK, USA). These effects turn out to be different for individual countries. The bubbles of financial market explain the surge in top income inequality in the United States. Our results reveal that the bubbles of financial market increase top income inequality, although the economic growth rate fails to increase top income shares in the United States. The effect of economic growth rate on top income inequality is also time varying in the Anglo Saxon region. The positive economic growth rate of post 1980 turns out to be pro rich but the economic growth rate of pre 1980 does not promote the top income inequality. The top marginal tax rate and government expenditure may have an equalizing effect by reducing income of the rich, though the impact of financial development on top income inequality is inconclusive.

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1 Introduction

The decline in top income shares until the mid-1970s or even longer can be found almost in every country studied, but as Piketty and Saez (2007) stress there is a sharp contrast between English speaking or Anglo-Saxon countries and other (non-Anglo) countries ever since. The increasing share of the top income earners in total income has been a notable feature of the changes in income inequality in the Anglo-Saxon countries, including USA, UK, Canada (see Atkinson and Piketty (2007); Piketty and Saez, (2003)) while in Europe Netherlands, France and Switzerland display hardly any change in top income shares[1] . In their discussion of United States top income shares, Piketty and Saez (2003) argue that top capital incomes were reduced by several major events, including the great depression, the two World Wars, and periods of high inflation. They also argue that top tax rates played an important role, with high taxes on capital lowering the rate of capital accumulation. Following Piketty (2003), most authors have argued that dramatic increase in tax progressivity that has taken place in the inter war period in many countries studied and which remained in place at least until the recent decades, has been the main factor preventing top income shares from coming back to the very high levels observed at the beginning of the last century[2].

Explaining the surge in top incomes in many advanced countries over the last 20–30 years is more difficult. What explains the growing top income shares in many advanced countries during recent decades? What causal forces could have produced such dramatic changes in top income shares? Economists have formulated several hypotheses about causes of increasing inequality. They are the shift from manufacturing to service

[1]The more recent estimates of Camille Landais (2007) show a rise in recent years in France.

[2]In fact Kuznets (1955) and Lampman (1962) also point out the role of progressive taxation as a central factor explaining the declined income and wealth inequality in the first half of the 20th century.

production, technological changes, increased international trade, less progressive taxation etc. Of these the most frequently cited explanation is that technological advances, particularly in the advent of computerized technologies, have created greater demand for higher skilled and more educated workers and diminished demand for less skilled and less educated workers. By means of a simple application of supply and demand, this theory posits that skill biased technological change has driven up the wages of the higher skilled and driven down those of the lower skilled. However, there is growing group of economists who suggest it is not the sole explanation[3] . For example, Piketty and Saez (2003) challenge the skill-biased technological change thesis on the ground that the timing of the shifts in income differences does not support it in the US. Similarly they contend that widening income differences cannot simply be a response to technical change or changes in the supply of educated workers, because the increase is highly concentrated among the very highest earners. The theory is not able to explain the rise of the working rich. Piketty and Saez (2003) instead argue that changing social norms is an important factor in explaining the recent increase in income inequality, particularly in the rise of mega-incomes for the very top earners[4]. In the US, according to Piketty and Saez (2003), "the coupon-clipping rentiers have been overtaken by the working rich".

According to Kuznets influential hypothesis, income inequality should follow an inverse U-shape along with the development process (see, Kuznets (1955)). The falling top income inequality observed during the first half of the twentieth century, succeeded by a sharp reversal of the trend since the early 1980s in the Anglo Saxon

[3]See e.g. Atkinson, 1999.

[4]In his book "*The New Industrial State*" J. K. Galbraith (1967) made important observations on the role of social norm in management. He writes: "*management does not go out ruthlessly to reward itself - a sound management is expected to exercise restraint .... With the power of decision goes opportunity for making money.... The corporation would be a chaos of competitive avarice. But these are not the sort of thing that a good company man does; a remarkably effective code bans such behaviour*".

countries contradicts the theory of Kuznets. Some economists argue that unequal income distribution is a necessary but regrettable consequence of economic policy, which enhances growth. For these economists, unequal wealth and income distribution is seen as a necessary outcome of an economic environment that provides incentives for work, entrepreneurship, and capital accumulation that in turn are key elements of macroeconomic success. In other words, economic growth favors the elite and exploits the poor . Roine, Vlachos and Waldenström (2009) find some empirical support for this view. Atkinson and Leigh (2008) in turn fail to find evidence for this however.

Many economists in turn have challenged the growth-inequality syllogism on the grounds that in some circumstances, inequality can serve as an obstacle to growth (for a survey, see Aghion, et. al. (1999)). They also blame income and wealth concentration for tilting the political process in favor of the wealthy. In this view, progressive taxation is an appropriate counter-force against wealth concentration. However, as pointed out by Atkinson (2004), there are reasons to expect gross income inequality to increase as a result of increased taxation[5].

Financial development is also a potential determinant of top income inequality. Building on the Kuznets hypothesis, Greenwood and Jovanovic (1990) show how financial development interacts with economic development and derive an inverted U-shaped relationship between income inequality and financial development. There is empirical evidence supporting the hypothesis of Greenwood and Jovanovic (1990) (see Clarke, Xu and Zou (2003), Beck, Kunt and Levine (2007)). Banerjee and Newman (1993) and Galor and Zeira (1993) show however, that due to asymmetric information, poor agents face credit constraints, which prevent them from starting their optimal

[5] Atkinson (2004) also point to taxes having ambiguous effects in "tournament theory" (Lazear and Rosen, (1981)) where an increased tax decreases the return of advancement to the next level but also reduces the risk of attempting such advancement, and in the "winner-take-all" context considered in Frank (2000), where progressive taxation reduces the expected returns of entry. See Atkinson (2004)) pages 135-138.

investment projects. As a result, income inequality remains as long as the economy faces asymmetric information. They also show that in the absence of asymmetric information, income inequality shrinks and a negative linear relationship between income inequality and financial development prevails in the economy.

Some researches support the theory that financial development may not decrease income inequality (see Rajan and Zingales (2003) and Perotti and Volpin (2004)). Claessens and Perotti (2007) show that participation of the economic elite (i.e., the top income earners in political decision making) protect their interests by impeding financial development, which in turn limits the access of finance to all and the lack of financial access is a leading cause of persisting income inequality. Roine, Vlachos and Waldenström (2009) also report that financial development disproportionately benefits the rich in the early stages of a country's development. Although in the absence of skewed political participation of the elite, it could facilitate the access of finance to all and, as a result accelerate the reduction in income inequality.

The literature on the causes of rising inequality also suggests other factors such as globalization or openness as a share of GDP. Trade may reduce the income inequality in those technologically advanced countries where the labor productivity is higher compared to others. Dollar and Kraay (2000) suggest that globalization leads to fastest growth and poverty reduction in poor countries. Tallo (2003) report that there is a positive relationship between degree of openness and income inequality, however Roine, Vlachos and Waldenström (2009) report that globalization has no clear-cut impact on income inequality, if anything, the relationship between openness and inequality is negative.

The standard theory of taxation states that high income people respond to improved incentives to earn income, created by tax cuts. Piketty and Saez (2007) provide important evidence that tax changes may not produce a permanent surge in top income

shares but can fabricate a transitory effect on inequality (see also Atkinson and Leigh (2008), Saez and Veall (2007)). But Atkinson (2007) mentions that the reduction in tax progressivity of post-1978 accelerates the surge in very top income groups in the UK.

Government spending can also play an important role in impeding the surge in income inequality. Government spending through government involvement in an economy could eliminate the problem of unemployment, which in turn reduces the degree of income inequality (see Stack (1978)). Wolff and Zacharias (2007) also report that income inequality in the United States could be reduced by net government expenditures. Roine, Vlachos and Waldenström (2009) however, fail to provide such policy issues of a country and report that the effect of central government spending as a share of GDP on the rich as being inconclusive.

Top income share series constructed for the USA (see Figure 1) by Piketty-Saez (2003, 2007) suggest that bubbles seem to occur during a period of time when top income shares have rapidly increased. Do large bubbles cause increasing top income shares, or do the larger top income shares cause the bubbles? Of course, it is possible that causation could be simultaneously and run in both directions, or it could be that there is no causation at all and both bubbles and inequality are driven by a third factor. A third variable causes both or the relationship is spurious - but that seems unlikely to us. It is interesting to note in Piketty-Saez data that the dot.com bubble in stocks in 2000 - occurred when income inequality (including capital gains) hit a level very similar to that in 1929, particularly for the top 0.01%. The rise in income inequality accelerates from 1995-2000 (see Figure 1)as the dot.com bubble is inflating, and a similar concentration of income is evident as the housing bubble is inflating.

These observations are already a good reason to take into account bubbles as an important factor seeking explanation for top income shares. The rise in income in-

equality in the USA over the past 30 years has to a significant extent been the product of a series of asset-price bubbles. Whenever the market (be it the market in stocks, real estate, whatever) booms, the share of income going to those at the very top increases. When the boom goes bust, that share drops somewhat, but then it comes roaring back even higher with the next asset bubble.

We focus on five Anglo- Saxon countries; Australia, Canada, New Zealand, UK,USA. Of particular interest for us is to include asset bubbles as an important factor in explaining the evolution of top income shares. Our approach extends the previous research and reports that the panel estimates may provide us a long term relationship between top income inequality and its determinants.

Following this, section 2 considers the data whilst the models for explaining the changes in the top income inequality are presented in Section 3. Preliminary statistics and the estimates of different models are reported in Section 4 and in Section 5 respectively. Concluding comments are provided in Section 6.

2 Data

We use the data series produced from the collective research project on the dynamics of income distribution. These studies of the project have been gathered in two edited volumes (Atkinson and Piketty 2007, 2010). The data for top income shares in Australia cover the period from 1941 to 2002, Canada from 1941 to 2000, New Zealand from 1924 to 2005, UK from 1918 to 2005. USA during the period from 1917 to 2007 are collected from Atkinson and Piketty (2007 and 2010). GDP per capita and population size data are collected from Maddison (2006). The rest of the data including financial development, top marginal tax rate, globalization and government expenditure are collected from Roine, Vlachos and Waldenström (2009) and updated

from OECD database, PWT 6.3 and Financial Structure Database (FSD)[6] . There are some missing values in some of the series and those are replaced by linear interpolation technique. The market value of listed stocks and asset returns data are collected from Shiller's web site.

Top income earners are often defined as everyone in the top decile P10(P90–100) of income distribution. The top decile is quite heterogeneous group (see Atkinson and Piketty (2007)). The top income shares are based on personal income tax statistics and income reported as gross total income, including labor, business and capital income (and in a few cases, realized capital gains) before taxes and transfers. Top income shares are computed by dividing the observed top incomes by the total income earned by the entire (tax) population, filed in a personal tax return.

The tax income data which is collected as part of government's administrative process are not free from doubts. First, it is obvious that those paying tax have a financial incentive to present their affairs in such a way that reduces tax liabilities, leading to tax avoidance and tax evasion. The second doubt is associated with the income tax units and with the control totals for income. The tax unit may be an individual (practiced in Australia and Canada) or a combined income of husbands and wives (practiced in the United States). The tax unit may also change over time, for example in New Zealand (since 1953) and UK (since 1990).

Another problem is related to the methodological issues of deriving control totals for income, which is elaborately discussed in Chapter 2, Atkinson and Piketty (2007). The differences in methods are greatest in the area of income totals. The estimates of share-within-shares, inverted Pareto-Lorenz coefficients[7]and other measures of inequal-

[6]We would like to thank them for providing and giving us the permission to use their data.

[7]The inverted Pareto-Lorenz coefficient β =1/[log(Top1%/Top0.1%)/log(10)]. It measures the average income of people above y relative to y. Thus it measures the direct intuitive measure of the fatness of the upper tail of the distribution. A higher β coefficient means larger top income shares and higher income inequality.

ity within the top of the distribution, such as Top1/Top9 and Top0.1/Top0.9 where Top0.9 is defined by (P99-99.9) are not affected by the differences in the income totals, since they measure the shape of the upper part of the distribution (see Atkinson and Piketty (2010)).

The fractiles Top0.1(P99.9-100), Top1(P99-100) and Top9(P90-99) measure the fraction of total income received by the super rich, the rich and by the upper middle class people respectively. The variation of Top0.1 and Top1 is very high, although Top9 is fairly stable . According to Piketty and Saez (2007) the share of total income received by the Top1 is about 18% before the First World War but only 8% from the late 1950s to the 1970s and back to almost 17% by 2000 in the United States, although a significant increase in the top marginal tax rate is documented in 1993 (from 31% to 39.6%). Similar trends are also documented in other Anglo Saxon countries (see Piketty and Saez (2006)).

Like dependent variables, there are many approaches to derive the explanatory variables of top income inequality. Financial development can be measured either by deposits in private commercial and savings banks divided by GDP or by market value of listed stocks divided by GDP. The total market capitalization, which is the sum of first two, can also be used as a measure of financial development. Roine, Vlachos and Waldenström (2009) have preferred to measure financial development by total market capitalization, however we have used bank deposits (deposits at private commercial and savings banks divided by GDP) as our measure, since the asset returns along with the bubbles of financial market are considered as potential determinants of top income inequality in the United States[8]. Moreover, the market value of listed stocks data of New Zealand is not available. The measure of globalization i.e., trade openness is

[8]The changes in total market capitalization and asset returns are highly correlated. Hence the consideration of total market capitalization as a potential determinant of top income inequality may reduce the effect of stock bubbles and vice versa.

defined as the sum of exports and imports as a share of GDP. In order to account for the activity and growth of a government over the period, we include a measure of central government spending, defined as central government expenditure as a share of GDP. Lastly, we use statutory top marginal tax rates to control for the impact of tax progressively, and in a broader sense political intervention, in top income shares.

3 Explaining Changes in Top Income Inequality

Standard multivariate analysis can help us unravel some of the economic factors of top income inequality. This approach has already been applied by Atkinson and Leigh (2008) and Roine, Vlachos and Waldenström (2009). We chose a similar model. The major change from their model is the addition of the stock bubble variables as potential determinants of top income inequality. We also consider inverted Pareto-Lorenz coefficient as a dependent variable. Roine, Vlachos and Waldenström (2009) put together a much larger and more comprehensive cross-country data set on top income inequality. Most importantly, their data set has a panel structure with several potential determinants of top income inequality for each country. This has made it possible to use somewhat more advanced techniques to investigate the relationship between economic factors and top income inequality.

We introduce the asset returns, particularly the bubbles of financial market as the potential determinants of top income inequality in the United States[9].The bubble of the financial market, which is a transitory economic phenomenon, moving the market upward from fundamental value, may create an arbitrage opportunity for stakeholders. Consequently, in a bullish market, the shareholders and option holders exercise that

[9]Piketty and Saez (2007) document that the surge in top executive compensation in the United States is the most important factor that has driven up top wage income shares and is due in large part to the development of stock options. However in Australia, Canada, New Zealand, and in the UK labor income has clearly also surged even though the development of stock options has been slower.

opportunity to produce extra income, which might accelerate the upsurge in top income shares.

Figure 1 states that top income inequality declines during the First World War and in the post war depression (1916-20) although it increases during 1923-1928. Interestingly, the US stock market booms during that period - well known as the First bubble. The First bubble bursts in 1929, instantly reducing the inequality. However, high stock returns may be a reflection of a surge in corporate profits during that period, which is received by tax payers of super rich and rich decile as dividend. Afterwards, the shocks of post First World War depression and the Great Depression and the dynamic effect of progressive taxation on capital accumulation mechanically reduce the increase in dividend payments, which decline inequality until 1970.

Inequality starts to rise again from the 1970s and accelerates during the period of 1995-1999 after which it drops instantly, as shown in Figure 1[10]. During that period, the financial market moves away from the fundamental value through the overvalued Dot-Com companies, generating a bubble in the US stock market. Then tax payers of super rich and rich fractiles exercise their high valued stock options and are able to acquire money in the form of wage incomes, which acquires the favorable tax treatment. Moreover, in a bullish market they also enjoy the capital gain by selling shares. Consequently, the generated income from these strategies widens the gap among high income earners. The bubble bursts in 2000 and the share prices fall dramatically, which instantly reduced top income inequality. Thereafter, speculative bubble of 2007 again elevates the income inequality at its highest level in the United Sates.

[10]We can see temporary shifts in top income inequality unrelated to bubbles in 1986 and 1993. These temporary shifts in income inequality are for the changes of taxation policy in the United States. This supports the findings of Piketty and Saez (2007) where they state that tax changes may not produce a permanent surge in top income shares but can fabricate a transitory effect on income inequality.

The regression equation is as follows:

$$\begin{aligned} y_{i,t}^{m} &= \gamma_0^m + \gamma_1^m g_{it} + \gamma_2^m \Delta \log\left(Findev_{it}\right) + \gamma_3^m \Delta \log\left(Mgtax_{it}\right) \\ &\quad + \gamma_4^m \Delta \log\left(Openness_{it}\right) + \gamma_5^m \Delta \log\left(Govspnd_{it}\right) + \gamma_6^m R_{it} \\ &\quad + R_{it}\left(\gamma_7^m d_1 + \gamma_8^m d_2 + \gamma_9^m d_3\right) + \gamma_{10}^m \Delta \log\left(Pop_{it}\right) + \varepsilon_{it} \\ m &= 1, 2, 3, 4 \end{aligned} \tag{1}$$

where the variable y_{it} measures the changes in top income inequality for country i at time t[11]. The variables $g_{it}, Findev_{it}, Mgtax_{it}, Openness_{it}, Govspnd_{it}$ and Pop_{it} represent the growth rate of gross domestic product per capita, financial development, top marginal tax rate, openness or globalization, government expenditure, and population size for country i at time t respectively. The variable R_{it} stands for stock returns and the term d_1 is a dummy variable, which takes value 1 for the period of 1923-1928 and otherwise 0. The terms d_2 and d_3 are also dummy variables taking value 1 for the period of 1995-1999 and 2004-2007 respectively, otherwise 0. The bubbles are expected to increase the top income inequality more than R_{it}.

So far, we have not highlighted the effect of the growth rate of GDP per capita (here after economic growth rate) on top income inequality, keeping the relationship as simple as Roine, Vlachos and Waldenström (2009). They have tried to find the determinants of top income inequality. Another group of economists also studied the effect of income inequality on economic growth. Most conclude that income inequality generally impedes economic growth (World Bank (2005) and also see Banerjee and Duflo (2003)) although inequality may increase in the short and medium terms during periods of sustained economic growth (Forbes (2000)). So there is a possibility of

[11]The variable $y_{it}^1 = \Delta\beta$, where β is the inverted Pareto-Lorenz coefficient. Another variables $y_{it}^2 = \Delta\left(\text{Top } 1\%/\text{Top}9\%\right)$, $y_{it}^3 = \Delta\left(\text{Top } 0.1\%/\text{Top}0.9\%\right)$, $y_{it}^4 = \Delta \log\left(\text{Top } 1\%\right)$.

reverse causality, which could be a potential topic for further research.

We believe that it is necessary to consider the structural break in top income shares reported in the preliminary analysis section, to examine this relationship. This means that the relationship between the regressand (i.e., change in top income inequality) and the regressor (i.e., growth rate of per capita GDP) is time varying. For example; the relationship between the change in top income inequality and economic growth rate may be different pre- and post 1980. Moreover, to what extent the high income earners are protected from the economic down turn? Are they collecting their income during the economic boom? These interesting questions can be analyzed with the following regression.

$$\begin{aligned} y_{i,t}^{m} &= g_{it}^{+}\left(\alpha_1^m + \alpha_2^m d_4\right) + g_{it}^{-}\left(\alpha_3^m + \alpha_4^m d_4\right) + \alpha_5^m \Delta \log\left(Findev_{it}\right) \\ &\quad + \alpha_6^m \Delta \log\left(Mgtax_{it}\right) + \alpha_7^m \Delta \log\left(Openness_{it}\right) + \lambda_t + \mu_i \\ &\quad + \alpha_8^m \Delta \log\left(Govspnd_{it}\right) + \alpha_9^m \Delta \log\left(Pop_{it}\right) + \varepsilon_{it} \\ m &= 1, 2, 3, 4 \end{aligned} \tag{2}$$

The economic boom is represented by the positive values of g_{it} i.e. g_{it}^{+} and the economic down turn corresponds to the negative values of g_{it} i.e. g_{it}^{-} for i at time t. The term d_4 is also a dummy variable, which takes value 1 for the period of post 1980 otherwise 0. Therefore the contribution of economic boom and the economic down turn in changing top income inequality for the period of post 1980 is measured by $\alpha_1 + \alpha_2$ and $\alpha_3 + \alpha_4$ respectively. During this period there is an asymmetric effect of g_{it} if $\alpha_1 + \alpha_2 \neq \alpha_3 + \alpha_4$. The term λ_t captures the fixed time effect and the country specific trend is represented by μ_i. The country dummies are included to control for time-invariant omitted-variable bias.

Although the above regression reveals the long term relationship between top in-

come inequality and economic growth rate, this formulation does not directly address the issue of how a change in economic growth rate or a change in taxation policy, within a given country affects the top income inequality of that country. Therefore, country specific analysis may address the important policy question of how a change in a country's level of unequal income distribution is related to the per capita GDP and/or government expenditure within that country. Moreover, if the structural break is present in the relationship between inequality and economic growth rate in the Anglo Saxon group then that structural break could be present in all countries within that group. To examine these issues, we have applied the same regression model with a constant intercept term for each country separately, where the fixed time effect and country specific trend are assumed to be zero.

In all these models (equation 1 and equation 2), the assumption of no auto-correlation in the error terms does not necessarily hold. Durbin Watson test statistics suggests that auto-correlation is a problem in some settings. Therefore, we have estimated all these models using the FGLS[12] (feasible generalized least squares) technique, which directly allow serial correlation and heteroskedasticity in the error terms.

4 Preliminary statistics

Table 1 presents the descriptive statistics of our main variables for the entire sample period. Top1% has the highest mean and the highest variation in compare to other measures of top income inequality. The correlation between top income inequality and the level of economic development, which is proxied by GDP per capital, is mostly

[12]Model 1 and Model 2 can also be estimated by using the dynamic first difference specification. The inclusion of a lag dependent variable will correlate with the unobserved fixed effects, and thus we may get biased results. It is also necessary to note that we have large time series data and the number of countries under consideration is small (five countries), so the GMM (generalized method of moments) procedure is not appropriate in our settings. This methodology is developed for "small T, large N" panels, meaning few time periods and many individuals (see Roine, Vlachos and Waldenström (2009), Roodman (2007) for details).

insignificant. But in some cases it is negative[13].But this relationship changes when we split the full sample period into two parts: pre 1980 and post 1980. Figure 2a and Figure 2b show that this relationship is negative pre 1980 but it is positive post 1980 in each country. The relationship between the level of economic development and the inequality however, is not strong post 1980 in New Zealand. Thus we may fail to capture the structural break in the relationship between top income inequality and economic growth rate in that country.

5 Model Estimates

The results of Model 1 are represented in Table 2. In this simple specification, the coefficients of stock bubbles are positive and highly significant. This means the bubbles of the financial market have a positive impact on the changes in top income inequality. Therefore, the bubbles produce the extra income for the people of the upper fractile, which accelerates top income inequality. Assets return increases top income inequality in every case of inequality measure but slower than the bubbles[14].The most plausible explanation for this finding is that the top income group has a larger share of their income associated with the bubbles of the financial market. This explains the recent upsurge in top income shares in the United States. The above evidence is also true when we consider real returns instead of nominal returns in our analysis[15].

The regression coefficient of the per capita growth rate is negative for Top1%, and statistically insignificant in all cases of inequality measures in the United States. This means that the economic growth rate is at least not pro rich and if anything, it

[13]The values are 0.228, -0.1482, 0.229 and -0.014 for inverted Pareto-Lorenz coefficient, Top1%/Top9%, Top0.1/Top0.9% and Top1% respectively for the Anglo Saxon group. The correlation coefficient is positive for all cases of inequality measures in the United States.

[14]The Dot-Com bubble seems to have positive effect in the growth of Top1% but less stronger than other bubbles.

[15]The results of real returns are available upon request.

may decrease the income of the rich. This evidence contradicts the finding of Roine, Vlachos and Waldenström (2009) where they document that the high economic growth disproportionately benefits the rich over the entire twentieth century. The insignificant relationship between the economic growth rate and the changes in inequality is still valid when we re-estimate Model 1 without assets return and bubbles[16]. Until now, we could state that the economic growth rate fails to elevate, while bubbles accelerate income for the rich. This in turn widens the gap among high income earners in the United States.

To further investigate this relationship we allow for a structural break in Model 1. The estimated results of Model 2 are reported in Table 3 to Table 5. The structural break coefficients α_2 and α_4 have their expected sign positive and negative respectively for the Anglo Saxon group as well as, for individual countries except New Zealand. The likelihood ratio (LR) test supports the hypothesis of the structural break in the relationship between economic growth rate and the changes in top income inequality. The LR ratio test fails however, to detect such relationship for Top1/Top9% and Top0.1/Top0.9% in New Zealand and for Top1/Top9% in Australia[17]. The coefficient α_2 is significantly positive and the coefficient α_4 is negative but statistically insignificant for most cases of inequality measures in the Anglo Saxon group (see Table 5)[18].This finding indicates that positive economic growth rate of the post 1980 increases top in-

[16]This result also holds if we use total market capitalization as a proxy for financial development. Newey-West procedure also applied to estimate this restricted model where the total market capitalization is considered as a proxy for financial development. The auto-correlated heteroskedasticity adjusted estimates remain the same with FGLS estimates.

[17]The F-test statistics also provide us the similar result, although it may fail to capture this relationship if either of the structural break coefficients is insignificant. Note that the LM test statistics and the F-test statistics are asymptotically equivalent for a large sample size. It is also worthwhile to mention that the correlation between economic growth rate and stock market return is very high in recent period particularly after 1980. Thus the inclusion of total market capitalization as a proxy for financial development in Model 2 may create an obstacle for the structural break coefficients to be significant.

[18]The coefficient α_4 is marginally significant for Top1% in the Anglo Saxon Group.

come inequality, but negative economic growth rate of the post 1980 has no impact on changing top income inequality. This explains that the rich accumulate their income during good economic conditions and are well hedged during bad economic periods. Contrary to this, neither a positive nor negative economic growth rate of the pre 1980 has any effect in changing top income inequality.

The country specific analysis shows, coefficients α_1 and α_3 are statistically insignificant in most cases of inequality measures, in each country, with some exceptions. In general, economic growth rate of the pre 1980 has no impact on changing top income inequality, if anything it may be negative[19]. The coefficient α_2 is significantly positive in the UK and Canada but it has negative sign in Australia. Another coefficient α_4 is negative as expected, and statistically significant in some cases of inequality measures in Australia. The implication of this finding is that the negative economic growth rate of the post 1980 decreases the top income inequality in Australia, while British and Canadian top income earners are well hedged during bad economic periods[20].This indicates that the relationship between the economic growth rate and the top income inequality changes over time and is different for each country.

In summary, we could state that the economic growth rate of the pre 1980 has no impact on changing top income inequality, if anything this relationship seems to be negative. The effect of economic growth rate of the post 1980 on the changes of top income inequality however, is not the same for each country. Positive economic growth rate of the post 1980 turns out to be pro rich, but the impact of negative growth rate of the post 1980 is mostly insignificant, although in some cases it could reduce the

[19]The coefficient α_3 is negative and significant only in one case, that of the UK, reported in Table 4. The coefficient α_1 is negative and statistically significant in some cases of inequality measure in Canada. As an exception the coefficient α_3 is significantly positive in some cases of Australia and New Zealand.

[20]Exceptionally the coefficient α_4 is significantly negative for Top1% in UK. The Newey-West procedure also provides us the similar findings.

income of the rich. The panel estimates also state that positive economic growth rate of the post 1980 increases top income inequality, whilst the negative economic growth rate of the post 1980 has no impact on changing top income inequality.

The effect of financial development (i.e., bank deposits), turns out to be inconsistent in panel estimates, reported in Table 5. However, the effect of financial development on top income inequality is positive when we consider total market capitalization as a proxy for financial development. This evidence supports the findings of Boot and Thakor (1997) and Levine (2005) and Roine, Vlachos and Waldenström (2009). Country specific analysis reveals that the financial development accelerates income for the rich (Top1%) in all Anglo Saxon countries, except United States and Canada (see Table 2 and Table 3). Interestingly, financial development decreases the income inequality in some cases of UK[21].The impact of financial development on the changes of top income inequality in Anglo Saxon countries however, is inconclusive except in New Zealand (see Table 4) when we consider all the inequality measures. Thus the effect of financial development on top income inequality is mixed and different for each country. This effect also seems to be dependent on proxy variable. The Newey-West estimation procedure also provides us the similar results.

The effect of the top marginal tax rates on the changes in top income inequality[22] is debatable . At a first glance it seems that the top marginal tax rates may have a negative impact on top income inequality although it could be positive from the theoretical point of view (see Atkinson (2004)). According to our estimates, the effect of taxation on changes in top income inequality is negative, but mostly insignificant in panel estimates, as reported in Table 5. Country specific analysis states however

[21]The coefficient of financial development changes sign from negative to positive when we consider total capitalization as a proxy for financial development.

[22]We use different kinds of top income inequality measures. These are inverted Pareto-Lorenz coefficient, ratio of the Top1% and Top9%, ratio of the Top0.1% and Top0.9%, and the growth of Top1%.

that the effect of taxation on income inequality is negative and statistically significant in Australia and Canada, while insignificant in the New Zealand UK and the United States (see, Table 2 to Table 4).

Another important determinant of top income inequality is government expenditure which reduces income inequality by decreasing the income of the rich in panel estimates, as reported in Table 5. This evidence contradicts the finding of Roine, Vlachos and Waldenström (2009). The effect of government expenditure on changes in income inequality is also negative for New Zealand, UK and the United States (see Table 2 to Table 4). This evidence is also holds for Canada, but statistically insignificant in all cases of inequality measures, as reported in Table 3[23].

Finally, openness or globalization is not strongly related to changes in income inequality in panel estimates. This finding supports previous research of Roine, Vlachos and Waldenström (2009) and Dollar and Kraay (2004). Country specific analysis is unable to detect any relationship between top income inequality and globalization, although in some cases of inequality measures in UK and the United States, globalization seems to increase the top income inequality (see Table 2 and Table 4).

[23]The results are mixed for Australia although government expenditure seems to decrease the growth of Top1%. The Newey-West procedure provides us the similar results. These results are also free from choosing the proxy variable of financial development.

6 Conclusions

Using the data series produced from the collective research project on the dynamics of income distribution (Atkinson and Piketty 2007, 2010) we have studied the effect of different economic factors on top income inequality in five Anglo-Saxon countries. These effects turn out to be different for individual countries. The bubbles of financial market explain the surge in top income inequality in the United States. Our results reveals that the bubbles of financial market increase top income inequality, although the economic growth rate fails to increase top income shares in the United States. The effect of economic growth rate on top income inequality is also time varying in the Anglo Saxon region. The positive economic growth rate of post 1980 turns out to be pro rich but the economic growth rate of pre 1980 does not promote the top income inequality. The top marginal tax rate and government expenditure may have an equalizing effect by reducing income of the rich, though the impact of financial development on top income inequality is inconclusive.

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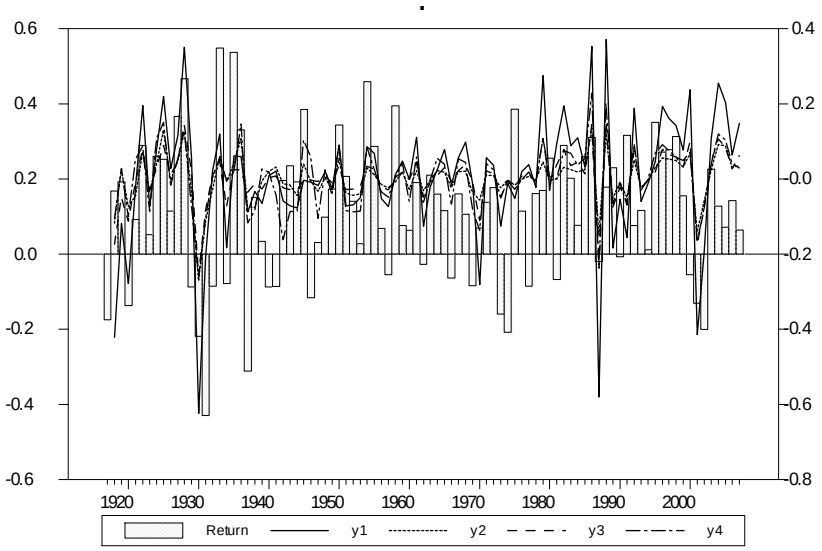

Figure 1: Assets return and Top income inequality in the United States.

Pre1980 Post1980

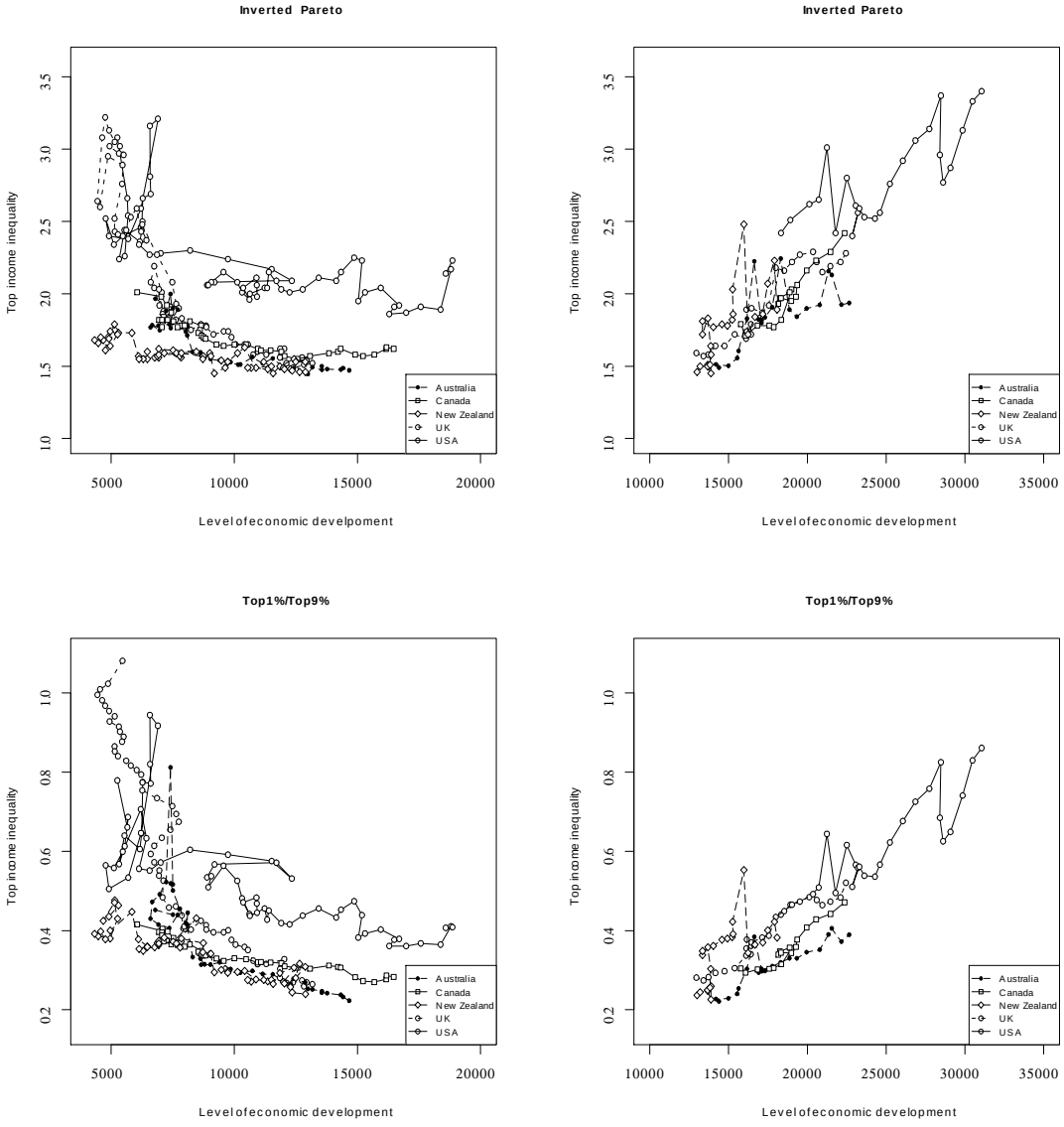

Figure 2a: Relationship between top income inequality and level of economic development.

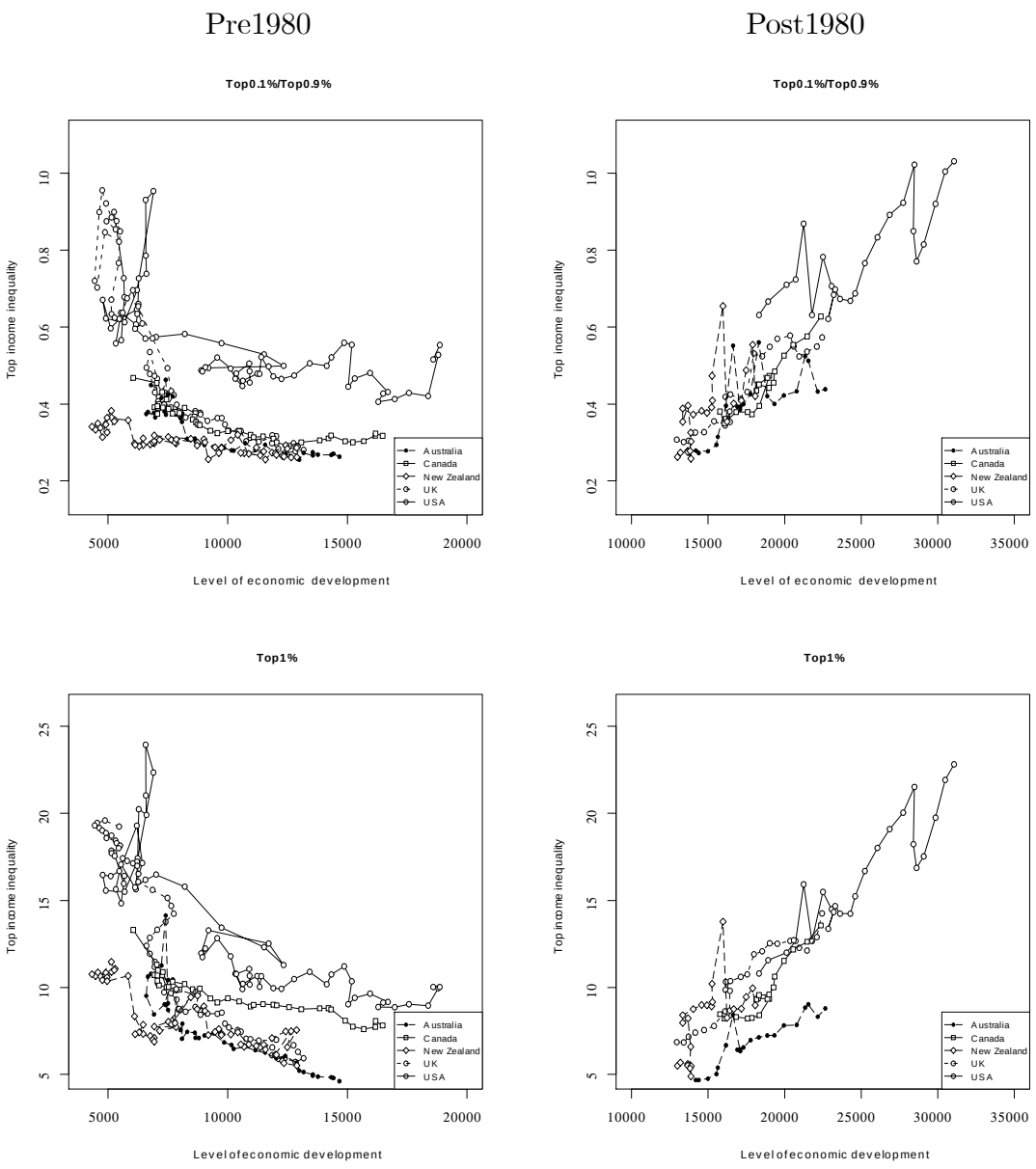

Figure 2b: Relationship between top income inequality and level of economic development.

Table 1:

Summary statistics

Panel A : Descriptive statistics of the United States

Variable	Mean	Std.Dev	Min	Max
Pareto Lorenz	2.406	0.406	1.860	3.540
Top1%	14.16	3.983	8.86	23.94
Top1/Top9%	0.561	0.138	0.360	0.944
Top0.1/Top0.9%	0.625	0.164	0.405	1.093
GDP per capita	14572	7837.307	4777	31352
Assets Return	0.117	0.186	-0.429	0.549
Financial dev.	0.551	0.119	0.338	0.738
Top marginal tax	0.603	0.225	0.240	0.940
Openness	12.082	6.398	5.242	29.074
Givt. expenditure	0.147	0.070	0.030	0.429
Population	189236	59573.29	103817	301280

Panel B : Descriptive statistics of the Anglo Saxon group

Pareto Lorenz	1.954	0.442	1.445	3.545
Top1%	10.500	4.033	4.610	23.940
Top1/Top9%	0.441	0.176	0.220	1.082
Top0.1/Top0.9%	0.448	0.174	0.254	1.093
GDP per capita	12141	5771.64	4327	31352
Financial dev.	0.459	0.195	0.049	1.155
Top marginal tax	0.619	0.195	0.225	0.980
Openness	35.920	16.673	5.242	85.464
Givt. expenditure	0.158	0.051	0.030	0.429
Population	63135	78393.32	1350	301280

Table 2:

Estimates of model one represented by equation 1 : p-values reported in square brackets.

	United States of America (USA)			
Par. Ests.	$\underline{y^1}$	$\underline{y^2}$	$\underline{y^3}$	$\underline{y^4}$
γ_0	0.005	0.018	0.002	0.041
	[0.891]	[0.159]	[0.889]	[0.069]
γ_1	0.226	0.068	0.093	-0.204
	[0.350]	[0.399]	[0.335]	[0.117]
γ_2	0.384	0.014	0.170	-0.383
	[0.497]	[0.925]	[0.443]	[0.188]
γ_3	-0.021	0.003	-0.013	-0.032
	[0.849]	[0.919]	[0.764]	[0.543]
γ_4	0.060	0.200	0.023	0.003
	[0.741]	[0.033]	[0.741]	[0.966]
γ_5	-0.258	-0.064	-0.105	-0.080
	[0.003]	[0.007]	[0.003]	[0.027]
γ_6	0.332	0.132	0.129	0.282
	[0.000]	[0.000]	[0.000]	[0.000]
γ_7	0.367	0.165	0.147	0.164
	[0.015]	[0.000]	[0.016]	[0.092]
γ_8	0.231	0.070	0.100	0.092
	[0.047]	[0.055]	[0.037]	[0.136]
γ_9	1.603	0.477	0.668	0.577
	[0.041]	[0.060]	[0.046]	[0.022]
γ_{10}	-5.096	-3.435	-2.022	-5.894
	[0.099]	[0.000]	[0.097]	[0.001]

Table 3:

Estimates of model two represented by equation 2 : p-values reported in square brackets.

	Australia				Canada			
Par. Ests.	$\underline{y^1}$	$\underline{y^2}$	$\underline{y^3}$	$\underline{y^4}$	$\underline{y^1}$	$\underline{y^2}$	$\underline{y^3}$	$\underline{y^4}$
α_0	-0.004	0.005	-0.002	-0.000	-0.012	0.002	-0.011	0.008
	[0.862]	[0.751]	[0.819]	[0.986]	[0.368]	[0.638]	[0.037]	[0.521]
α_1	-0.321	0.010	-0.087	0.097	-0.033	-0.175	-0.040	-1.149
	[0.255]	[0.941]	[0.436]	[0.714]	[0.916]	[0.012]	[0.659]	[0.000]
α_2	0.957	0.244	0.491	1.112	1.982	0.360	0.780	1.230
	[0.436]	[0.350]	[0.325]	[0.126]	[0.003]	[0.021]	[0.002]	[0.012]
α_3	1.630	0.115	0.648	2.283	0.359	-0.195	0.108	-0.607
	[0.006]	[0.790]	[0.004]	[0.053]	[0.139]	[0.255]	[0.180]	[0.253]
α_4	-3.001	-0.454	-1.242	-3.950	0.665	-0.011	0.173	-0.905
	[0.011]	[0.423]	[0.001]	[0.012]	[0.828]	[0.972]	[0.861]	[0.312]
α_5	-0.023	0.047	0.015	0.937	0.281	-0.054	0.087	-0.228
	[0.943]	[0.812]	[0.896]	[0.017]	[0.222]	[0.271]	[0.210]	[0.140]
α_6	-0.615	-0.035	-0.255	-0.755	-0.133	-0.043	-0.039	-0.074
	[0.018]	[0.818]	[0.009]	[0.006]	[0.033]	[0.000]	[0.040]	[0.067]
α_7	0.034	0.004	-0.020	-0.254	0.023	-0.004	0.047	0.031
	[0.812]	[0.947]	[0.678]	[0.102]	[0.883]	[0.888]	[0.441]	[0.778]
α_8	0.063	-0.070	0.019	-0.224	-0.016	-0.023	-0.010	-0.065
	[0.473]	[0.269]	[0.585]	[0.064]	[0.738]	[0.140]	[0.476]	[0.086]
α_9	-0.077	-0.542	-0.070	-0.957	0.154	-0.009	0.404	0.530
	[0.958]	[0.531]	[0.898]	[0.581]	[0.777]	[0.961]	[0.014]	[0.382]
LR-test	64.611	1.987	66.125	36.562	11.580	11.963	20.066	16.191
Strl.Change	[0.000]	[0.370]	[0.000]	[0.000]	[0.003]	[0.002]	[0.000]	[0.000]

Table 4:

Estimates of model two represented by equation 2 : p-values reported in square brackets..

	New Zealand				United Kingdom (UK)			
Par. Ests.	$\underline{y^1}$	$\underline{y^2}$	$\underline{y^3}$	$\underline{y^4}$	$\underline{y^1}$	$\underline{y^2}$	$\underline{y^3}$	$\underline{y^4}$
α_0	0.036	0.009	0.009	0.025	0.017	-0.008	0.006	-0.026
	[0.019]	[0.102]	[0.083]	[0.170]	[0.280]	[0.002]	[0.266]	[0.000]
α_1	-0.109	0.035	-0.013	-0.203	-1.099	-0.024	-0.447	0.256
	[0.597]	[0.743]	[0.846]	[0.563]	[0.062]	[0.667]	[0.056]	[0.050]
α_2	-1.050	–0.182	-0.321	-0.983	1.534	0.522	0.650	1.377
	[0.014]	[0.232]	[0.073]	[0.030]	[0.034]	[0.000]	[0.025]	[0.011]
α_3	0.059	0.338	0.022	1.174	0.783	0.178	0.316	-0.515
	[0.707]	[0.007]	[0.702]	[0.005]	[0.545]	[0.052]	[0.513]	[0.000]
α_4	-0.382	-0.491	-0.459	-2.963	-2.436	-1.137	-0.939	-3.811
	[0.957]	[0.794]	[0.858]	[0.701]	[0.101]	[0.127]	[0.089]	[0.000]
α_5	0.656	0.213	0.241	0.833	-0.341	0.055	-0.129	0.095
	[0.017]	[0.002]	[0.011]	[0.000]	[0.025]	[0.085]	[0.024]	[0.009]
α_6	0.056	0.031	0.022	0.151	0.015	-0.019	0.006	-0.060
	[0.446]	[0.179]	[0.376]	[0.064]	[0.815]	[0.152]	[0.826]	[0.147]
α_7	0.046	-0.018	0.013	-0.105	0.482	0.014	0.199	-0.008
	[0.311]	[0.294]	[0.400]	[0.121]	[0.051]	[0.221]	[0.037]	[0.821]
α_8	-0.278	-0.121	-0.084	-0.437	-0.257	-0.057	-0.092	-0.082
	[0.001]	[0.001]	[0.009]	[0.001]	[0.114]	[0.012]	[0.128]	[0.095]
α_9	-1.722	-0.508	-0.486	-0.551	-1.787	-0.029	-0.774	-0.307
	[0.013]	[0.049]	[0.057]	[0.505]	[0.091]	[0.723]	[0.046]	[0.373]
LR-test	6.156	5.079	2.123	14.713	10.850	15.593	11.362	14.816
Strl.Change	[0.046]	[0.078]	[0.345]	[0.000]	[0.004]	[0.000]	[0.003]	[0.000]

Table 5:

Estimates of model two represented by equation 2 : p-values reported in square brackets.

	Anglo Saxon Countries			
Par. Ests.	$\underline{y}^1$	$\underline{y}^2$	$\underline{y}^3$	$\underline{y}^4$
α_1	-0.143	0.063	-0.054	-0.067
	[0.286]	[0.133]	[0.260]	[0.591]
α_2	1.282	0.339	0.425	1.222
	[0.010]	[0.002]	[0.023]	[0.000]
α_3	0.043	0.056	-0.019	-0.027
	[0.783]	[0.291]	[0.754]	[0.898]
α_4	-0.994	-0.315	-0.239	-1.821
	[0.409]	[0.304]	[0.694]	[0.022]
α_5	-0.150	0.015	-0.068	0.100
	[0.104]	[0.416]	[0.043]	[0.043]
α_6	-0.064	-0.022	-0.019	-0.034
	[0.059]	[0.021]	[0.159]	[0.265]
α_7	0.024	-0.001	0.031	-0.035
	[0.657]	[0.898]	[0.106]	[0.327]
α_8	-0.115	-0.016	-0.049	-0.072
	[0.001]	[0.069]	[0.000]	[0.009]
α_9	-0.157	-0.021	0.024	0.108
	[0.687]	[0.396]	[0.867]	[0.276]
LR-test	113.178	25.648	57.404	38.971
Strl.Change	[0.000]	[0.000]	[0.000]	[0.000]