CESifo WORKING PAPERS

8119
2020

February 2020

Inequality Convergence and Distribution Neutral Fiscal Policy

Sugata Marjit, Amlan Majumder, Sandip Sarkar, Lei Yang

CESifo

Impressum:

CESifo Working Papers
ISSN 2364-1428 (electronic version)
Publisher and distributor: Munich Society for the Promotion of Economic Research - CESifo GmbH
The international platform of Ludwigs-Maximilians University's Center for Economic Studies and the ifo Institute
Poschingerstr. 5, 81679 Munich, Germany
Telephone +49 (0)89 2180-2740, Telefax +49 (0)89 2180-17845, email office@cesifo.de
Editor: Clemens Fuest
https://www.cesifo.org/en/wp
An electronic version of the paper may be downloaded
· from the SSRN website: www.SSRN.com
· from the RePEc website: www.RePEc.org
· from the CESifo website: https://www.cesifo.org/en/wp

CESifo *Working Paper No. 8119*

Inequality Convergence and Distribution Neutral Fiscal Policy

Abstract

We provide an interesting empirical evidence dealing with the cross country data on equality i.e. movements of Gini coefficient over last four decades. This seems to suggest a robust empirical evidence that the growth or change in inequality across nations has a negative relation with initial degree of inequality. This would imply that poorer nations starting with higher degree of inequality experience weaker growth in inequality, exhibiting some sort of convergence in the inequality generating process. With this evidence as the backdrop we then provide an analytical framework where countries make an effort to neutralize the distributional impact with taxes and transfers that might distort incentives. We prove, under fairly general conditions, that ceteris paribus, lower initial inequality makes it tougher for a country to contain further inequality. Thus cross country inequality is likely to exhibit a converging process.

JEL-Codes: H230, D370.

Keywords: inequality, distribution-neutral, fiscal policy.

Sugata Marjit
Indian Institute of Foreign Trade
Kolkata / India
marjit@gmail.com

Amlan Majumder
North Bengal University
India
amlan@amlan.co.in

Sandip Sarkar
Xavier School of Economics
Xavier University / Bhubaneswar / India
sandip.isi.08@gmail.com

Lei Yang
Hong Kong Polytechnic University
Kowloon / Hong Kong
yang@tagsys.org

This Version December 2019
This paper has benefitted from seminars at the universities of Auckland, Tokyo and the IMF at Washington DC. I am indebted to David Cody, Taiji Furusawa, Sanjeev Gupta, Michael Keen, Prasada Rao and B. Ravikumar for useful comments. I am also indebted to the hospitality of departments of economics at the University of Auckland, Konstanz, Kobe, Queensland, Washington University, FAD at the IMF and Federal Reserve , St. Louis which helped in the preparation of this draft. The usual disclaimer applies.

Section 1 Introduction

For a quite some time rising inequality within nations has been a concern among many economists, policy makers, civil society, news media etc. Two recent contributions from the IMF [2017, 2015] provide a detailed analysis of the role of fiscal policy in combating such an outcome. Strong empirical support of a hypothesis that suggests a decline in inequality among nations but a rise within has also been available. Baldwin (2016) extensively discusses the idea that there has been a converging trend among nations with relatively less affluent nations commanding greater share of the world GDP than in the past. One could also demonstrate that between 1950-2017, growth in country specific Gini indices has been negatively correlated with the initial set of Ginis in 1950. That is countries with lower degree of inequality have experienced higher increase. We start with examining this hypothesis in greater detail by considering an extended data set of Deninger and Square (1996) and following the methodology of Barro (2016a, 2016b). We find strong evidence that there is a convergence process at work which suggests that countries having lower inequality are likely to experience greater rise in inequality. This naturally implies that high income countries have found it tougher to control inequality than low income countries. One purpose of this paper is to highlight and concentrate on such a dynamic process. This brings us to the second purpose of this work.

Within country increase in inequality has, at least in spirit, led to political discomfort, agitation, public unrest etc. leading to serious consequences in terms of the BREXIT, attitudes towards immigration policies and electoral outcomes in USA and Europe. Gupta, Marjit and Sarkar (2018) have introduced the concept of Distribution Neutral Fiscal Policy (DNFP) which designs taxes and transfers such that inequality is not allowed to rise in the event of growth, trade or any other shocks. They show with no distortions i.e. with lump sum taxes and transfers once can always design such a policy. This idea is tangentially related to Burman et al (2006). The authors while addressing the case of US argued that if in a particular year, the nation's top earners share of national income rises, and that of the people at the bottom grows at a slower rate (or decline), the following year's tax rates would be automatically rewritten to compensate for the new inequality.[1]

The present paper deals with an extension and more pragmatic concern about the DNFP. It is natural that the ability of the government to tax income or rather incremental income of the high income groups will have distorting consequences. Even at a theoretical and hypothetical level lump sum taxes that take away substantial income gain to implement a DNFP, might kill all the incentives to grow, expand, innovate etc. Not allowing the society to be unequal has underlying incentive costs. From welfare or social justice perspective tackling them or ignoring them would be a completely different issue. From our limited perspective we would like to see whether constrained DNFP may suggest tolerable limits of incentive efforts and how such tolerable limits interact with certain fundamental characteristics such as initial degree of inequality. In other words we try to analyse which group of nations is more likely to be in a position to implement DNFP. Ability to implement such a policy will affect the after tax income distribution. We demonstrate that ceteris paribus, countries having relatively low degree of inequality will find it more difficult to pursue DNFP. Thus between two countries if we focus only taxes and tax financed transfer as strategies to mitigate worsening distribution, the one with higher inequality will be in a better position to follow

Existence and uniqueness of DNFP with lump sum transfers have been elaborated in Marjit et. al. (2019) in the context of Welfare Theorems of General Equilibrium. Earlier works of Dixit and Norman (1986) and Kemp and Wan (1986) are relevant in this context. For works on growth and inequality one may refer to Garcia-Penalosa and Turnovsky (2007) .

such a policy. For example, if we are considering the growth impact, tradeoff between growth and inequality will be sharper where initial degree of inequality is lower.

Note that the countries may not be pursuing specifically a distribution neutralizing policy. But each of them in the face of rising inequality in their own ways tries to contain such a social anomaly. When the growth rate is not so commendable the benchmark which guides such a policy must have initial inequality as a critical component or yardstick. Any fiscal policy must weigh on one hand the additional tax burden that needs to be imposed in order to have a progressive policy and the distorting effects of taxes and transfers on the other. This has to be executed in an environment which also has to care about fiscal balance or fiscal deficit. These three constraints define the ability of a country to pursue anti-inequality policy. Our result shows that under reasonable conditions such actions will mean inequality convergence.

The second section discusses the empirical outcome. The third develops the analytical model in a two class economy. The fourth generalizes the result with many income groups. The last one concludes.

Section 2 Empirical Evidence

In this section, we illustrate the results related to inequality convergence. In order to examine this issue, we focus only on Gini coefficient as measure of inequality. The first reason is the simplicity and wide acceptance of Gini. Secondly, this index is available for a large panel of countries. For the present analysis, we compile two sets of data on Gini. The first source is the World Bank's Povcalnet database. This database is an unbalanced panel on the Gini coefficient for 164 countries over 1977-2017. Note that Povcalnet only compiles data on Gini for a panel of countries. In general, the underlying countries estimate the Gini, from a well-designed sample survey. Another data set on the Gini is made available by

Deninger and Squire (1996) (henceforth DS). DS provides data on Gini coefficient from 1890 to 1996. Recently this data set has also been modified by World Bank that includes data on the Gini coefficient from some more countries.[2] Throughout this paper by DS data set we mean the modified DS version. The authors classify their data-set as high and low-quality types. In the present paper, we consider only the high-quality data set. A particular data is excluded from the high-quality set if it violates five well-accepted conditions. These are: 1) the survey being of less than national coverage 2) the basing of information on estimates derived from national accounts, rather than from a direct survey of incomes; 3) there exist limitations of the sample to the income-earning population, 4) derivation of results from non-representative tax records and 5) no explicit reference to the primary source.

Throughout this paper, we ignore some standard cross- country inequality comparison problems. For example, in some countries, Gini is computed using income (e.g., United States of America, United Kingdom, Luxembourg etc.). On the other hand, for some other countries, it is computed using expenditures (e.g., India). We also ignore any differences amongst countries in terms of survey design.

Convergence of Annual Average Gini

We begin with a simple exercise where we examine the existence of convergence of the annual average growth rate of Gini. In this context, we use only the initial and final time point (T) of all countries, for which data on Gini is available. We denote the initial and time points by T_0 and T_1, respectively. For example, for Albania, Gini coefficient for the years 1996, 2002, 2005, 2008 and 2012 is 27.01, 31.74, 30.6, 29.98, 28.96, respectively. Hence, in

[2] See http://documents.worldbank.org/curated/en/751161468347338016/A-new-data-set-measuring-income-inequality.

this case, $\text{Gini}_{T_0} = 27.01$ and $\text{Gini}_{T_1} = 28.96$. The annual average growth rate for a country i is defined as follows:

$$\text{Growth\_Gini}_{it} = \frac{\log(\text{Gini}_{T_1}) - \log(\text{Gini}_{T_0})}{T_1 - T_0} \quad (1)$$

Convergence holds if growth rate of Gini and initial Gini is negatively correlated. Or, the coefficient β in the following regression negative:

$$\text{Growth\_Gini} = \alpha + \beta\, \text{Gini}_t + u \quad (2)$$

We also check a kind of conditional convergence by repeating the same exercise across income regions. World Bank divides all countries in the following four regions: 1) Low Income 2) Lower Middle Income 3) Upper middle Income 4) High Income. We denote these four regions by q=1, 2, 3 and 4 respectively. In some rare circumstances a country's income group changes. However, for the sake of simplicity we ignore this and consider the latest World Bank Rankings. The last panel in the same diagram is the diagrammatic representation of all the regions combined together.

In Figure 1, we plot growth rate of Gini and initial Gini. We present the same across all income-regions (i.e., by q). The scatterplot indicates a strong evidence of negative relationship between the two variables, across all income groups regions. This is also confirmed by the downward slopping fitted line.

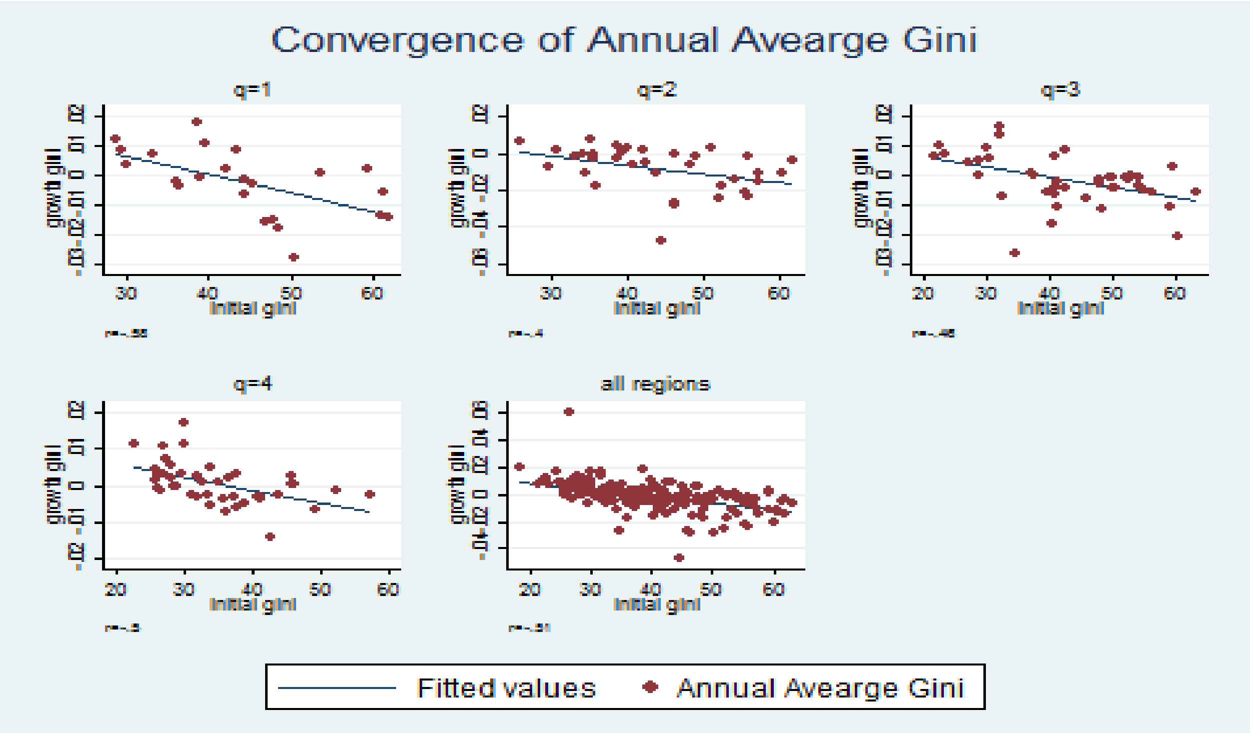

Figure 1

Generalized Inequality Convergence

The previous exercise might be criticized in the sense that the intermediate values of Gini for all countries are ignored, in the inequality convergence analysis. Secondly, some other factors like literacy rates, Gross Domestic Product etc., might nullify the evidence on inequality convergence. We control these factors in the present section. We develop a generalized model of conditional convergence following Barro (2016). Following the authors we divide the entire sample in the following 6 time regimes: 1960-70, 1970-80, 1980-90, 1990-00, 2000-10, 2010-19. For each country we compute the average Gini across the six time spans. Thus we define growth rate of Gini for country i at time span t as follows:

$$\mathrm{DGini}_{it} = \log(\mathrm{Gini}_{it}) - \log(\mathrm{Gini}_{it-1}) \quad (3)$$

where $\mathrm{Gini}_{it}(\mathrm{Gini}_{it-1})$ is the Gini for country i at time $t(t-1)$.

Our main interest in this section is on the sign of θ in the following regression equation:

$$\mathrm{DGini}_{it} = c + \theta\mathrm{Gini}_{it-1} + \gamma X + u \quad (4)$$

where X is a matrix of other controls, and γ is a vector of parameters. If $\theta < 0$ then the evidence of inequality convergence is established. Note that for any country DGini_{it} is non-missing only if the underlying country has information on Gini at both time t and t-1. We follow Barro (2000) to a large extent to choose the controls (i.e., X) in equation 4.[3] The list of all variables is presented below.

1) **LogRGDP: log (GDP per capita (constant 2010 US$))**: The basis of using income per-capita comes from the Kuznets curve hypothesis. We also include the square of GDP as another control.

2) **Education:** Here we control for Primary and Secondary education of different countries. Primary education (denoted by EDUCP), which is the percentage of female pupil having at least primary level of education. The second educational attainment denoted by EDUCS, is the percentage of female population at least completed upper secondary education.

3) **Trade Openness**: Openness of international trade might aggravate inequality, in the sense that increment of foreign capital would widen the skilled-unskilled wage rates. Thus we control for Trade Openness Index which is defined as $\mathrm{TOI} = \frac{\mathrm{Import+Export}}{\mathrm{GDP}} \times 100$. The size of the country may increase TOI. We follow Barro (2000) and filter out the effects of country size, in terms of land area and population size. That is we estimate the following regression equation:

$$\mathrm{TOI}_{it} = \alpha + \beta_1 \log(\text{Area of the country})_{it} + \beta_2 \log(\text{population of the country})_{it} + u_{it} \quad (5)$$

The estimated residual is the proxy of TOI. In the rest of this paper by TOI we only mean this filtered TOI. We also include the interaction of Openness and RGDP in the set of exogenous variables.

4) **Democracy Index**: This variable captures the electoral rights of the citizens of country. The democracy indicator is computed as

[3] See the section "Determinants of Inequality" (pp 21, Barro (2000)).

$$\text{Democracy} = \frac{10+\text{democracy}-\text{autocracy}}{0.2} \quad (6)$$

The variables (democracy and autocracy) are available at the Polity IV (www.systemicpeace.org). Both these variables are available at -10 to +10 scale. The democracy variable defined in equation 4 is in 0-100 scale, where 1 representing highest degree of democracy.

5) **Rule of law (RLE):** RLE captures perceptions of the extent to which agents have confidence on the quality of contract enforcement, property rights, police, courts, as well as the likelihood of crime and violence. RLE is constructed by Worldwide Governance Indicators (http://info.worldbank.org/governance/wgi/Home). The aggregate index is computed using Unobserved Components Model (UCM) from a list of 30 indicators. The index in general lies between -2.5 to 2.5. However, we convert this index in a 0-1 scale. Throughout this paper by RLE we refer the WGI rule of law index that has been transformed to 0-100 scale, where 1 denotes the highest degree of rule of law.

6) **Dummies**: We also incorporate some dummies in the convergence analysis. The first is income dummy. Income dummy is 1 if inequality is estimated on the basis of income or taxation data, and is 0, whenever inequality (i.e., Gini) is estimated from consumer expenditure. In order to control for geographical locations we also include Latin American and Sub-Saharan African dummy.

In Table 1, we present summary statistics of the dependent variable and independent variables used in the inequality convergence equation.

Table1: Summary Statistics

Variables	Mean	Min	Max	SD	Frequency	Source
Gini	39.31	19.49	63.88	9.19	624	Povcalnet & DS
DGini	-0.67	-24.00	15.09	4.22	407	Povcalnet & DS
LagGini	39.31	20.90	63.88	9.31	407	Povcalnet & DS
logRGDP	8.32	5.26	11.56	1.48	509	WDI
logRGDPsq	71.41	27.62	133.64	24.98	509	WDI
ECUP	47.66	29.18	55.51	2.93	455	WDI
ECUS	47.32	22.95	60.35	5.64	399	WDI
ECUH	31.89	0.03	110.18	28.63	367	WDI
Sub-Saharan Africa Dummy	0.20	0.00	1.00	0.40	624	WDI
Latin America Dummy	0.15	0.00	1.00	0.35	624	WDI
Income Dummy	0.51	0.00	1.00	0.50	586	Povcalnet & DS
TOI	76.58	8.76	362.88	46.52	495	WDI
TOI*GDP	653.52	55.39	4123.35	462.76	493	WDI
RLE	45.56	0.00	100.00	24.69	322	WGI
Democracy	69.82	0.00	100.00	31.67	498	Polity IV

Notes: This table presents summary statistics of all variables corresponding to the average of the underlying variable in the time spans 1950-60, 1960-70, 1970-80, 1980-90, 2000-10, 2010-2019. DGini is Growth rate of Gini across different spans. By lag Gini we mean lag of average Gini of a particular country. Frequency refers to the number of non-missing data points of the underlying variable. WDI stands for World Development Indicators. WGI stands for Worldwide Governance Indicators. The primary secondary and territory education variables i.e., ECUP, ECUS and ECUH represent average educational attainments in a particular time regime. Only data points at the starting point of a particular regime is considered as a representative data for RGDP, TOI, RLE, and DI. The entry "mean" for all the dummies refer to the percentages in the total sample. For example, mean of Sub-Sharan Dummy is 0.182. This implies that out of all the data points 18% belongs to Sub-Saharan countries.

In order to control for geographical locations we also include Latin American and Sub-Saharan African dummy. In Table1, we present summary statistics of the dependent variable and independent variables used in the inequality convergence equation.

Notice that in Table 1, there is a discrepancy in terms of the span of data set. The rule of law variable is available only from 2000-2015. This implies that in any regression equation with rule of law implies that we study inequality convergence only for the period of 2000-2015.

We now present the results related to conditional convergence in Table 2. That is we present the results corresponding to equation 6.

Table 2: Conditional Convergence of Inequality

LagGini	-0.16***(0.02)	-0.21***(0.03)	-0.36***(0.04)	-0.40***(0.04)	-0.43***(0.05)	-0.38***(0.05)	-0.43***(0.05)
logRGDP		6.21***(1.73)	8.97***(2.30)	8.99***(2.42)	8.28***(2.87)	7.37***(2.56)	6.81**(3.02)
logRGDPsq		-0.37***(0.10)	-0.51***(0.14)	-0.49***(0.15)	-0.39**(0.19)	-0.39**(0.16)	-0.31(0.19)
ECUP			-0.22(0.17)	-0.22(0.16)	-0.28(0.23)	-0.23(0.17)	-0.29(0.23)
ECUS			0.10(0.09)	0.05(0.10)	0.18(0.14)	0.07(0.10)	0.20(0.14)
ECUH			-0.03**(0.02)	-0.04***(0.02)	-0.07***(0.02)	-0.05***(0.02)	-0.08***(0.02)
TOI				0.03(0.04)	0.07(0.05)	0.06(0.05)	0.10*(0.05)
TOI*GDP				-0.00(0.00)	-0.01(0.01)	-0.01(0.00)	-0.01**(0.01)
RLE					-0.00(0.02)		0.00(0.03)
Democracy						-0.01(0.01)	0.00(0.01)
1.Subsaharan Africa			3.61***(1.00)	3.66***(0.99)	3.66***(1.14)	3.48***(1.04)	3.34***(1.19)
1.Latin America			3.32***(1.11)	4.12***(1.14)	3.63**(1.40)	3.82***(1.16)	3.55**(1.44)
1.Income			1.19(0.97)	1.31(0.96)	1.35(1.16)	1.73*(1.04)	1.60(1.25)
_cons	5.77***(1.50)	-15.77**(7.06)	-20.51**(9.90)	-192.0815	-18.96(13.68)	-13.17(10.60)	-14.01(14.08)
R square	0.15	0.2	0.3	0.33	0.37	0.31	0.36
Adj R square	0.14	0.18	0.26	0.28	0.32	0.25	0.29
Frequency	407	349	229	224	166	212	157

Notes: The dependent variable in all these equations is growth rate of Gini (DGini). DGini is the growth rate of Gini which is the average of Gini at the time regimes 1950-1960, 1960-1970, 1970-1980, 1990-2000, 2000-2010, and 2010-2017. For further details see Table 1.
*****, ** and * denotes significance at 1%, 5% and 10% respectively. Standard Error has been presented in the parenthesis. Time dummies have been incorporated in all the models.**

In Table 2 we present the results associated with the conditional convergence. The first row corresponds to the lag of Gini which is the main variable of interest. This estimate is θ specified in equation 5. It is readily observable that θ is negative and is highly significant across all the models. Thus the evidence of convergence that evolved in the previous section cannot be nullified in the generalized model of conditional convergence. The value of θ changes substantially from -0.16 to -0.43 as we incorporate all the exogeneous variable.

The coefficient for RGDP is positive and is highly significant across all the models. However, the sign of squared RGDP is opposite (insignificant in the last model). This perhaps implies that growth rate of inequality is increasing at a decreasing rate with RGDP.

The effects of primary and secondary levels of female literacy rates are insignificant across all the models. However, effects of tertiary education is significant. The sign of the coefficient is negative which perhaps establishes the negative relationship between higher education and growth rate of Gini. We observe that the coefficient associated with TOI is positive. This might be possible following the arguments of Barro (2000), that increase in TOI also simultaneously increases the gap between skilled-unskilled labors also increases. This eventually leads to an increment of the growth rate of Gina. The interaction effect of TOI and GDP on the other hand is negative. The democracy as well as Rule of Law index both turns out to be insignificant. The Latin American and Sub-Saharan Africa dummy turns out to be positive and significant. This suggests growth rate of inequality is higher in these regions compared to other places. Income dummy is insignificant.

Section 3 Analytical Model

In this section we provide a simple framework where countries try to formulate tax-transfer policies such that the degree of inequality remains the same as noted in Gupta, Marjit and Sarkar, (2018). We try to show why lower initial inequality makes it difficult to pursue inequality neutralizing fiscal policy. Thus countries with low inequality may exhibit higher rates of growth in inequality as suggested in the empirical section.

Let there be two income classes with single entity within each group earning W_{10} and W_{20} with $W_{10} > W_{20}$. Initially at period $'0'$ measured inequality is given by $\frac{W_{10}}{W_{20}} = i_0 > 1$.[4] With passage of time W_{10} goes to W_1 and W_{20} to W_2 such that inequality increases. Now the government decides to tax the first and transfer the proceeds to the second.

$W_1(t)$, with $W_1' < 0$ captures the distortionary effect of tax t. It is obvious that t should be such that $W_1(t)(1-t) \geq W_{10}$. (1)

[4] All major inequality measures are monotonic with respect to relative measure, including Gini.

Proceeds $tW_1(t)$ are transferred to the second group. The resulting relative income is given by $\frac{W_1(t)(1-t)}{W_2+tW_1(t)}$ (2)

(2) implicitly captures the balanced budget condition as the amount of transfer is nothing but $W_1(t)$.

We can broadly interpret t as an extraction from the richer class and it may not be only income tax , but any tax or claim by the government that generates revenue and similarly the transfer can take many forms. We do not need to specify how exactly the claim is collected and redistributed except that the budget has to be balanced.

The usual assumption used in the literature (Marjit, Kollias and Michelacakis, (2019) is that

$$\frac{dtW_1(t)}{dt} \gtreqless 0 \text{ for } t \lesseqgtr \tilde{t}. \text{ We assume that } t < \tilde{t}\text{, so that } \frac{d(tW_1(t))}{dt} > 0 \quad (3)$$[5]

DNFP implies a t^* such that $\frac{W_1(t^*)(1-t^*)}{W_2+t^*W_1(t^*)} = \frac{w_{10}}{w_{20}} = i_0$ (4)

Or, $t^* = \frac{1}{i_0}\frac{W_{10}}{W_1}.\frac{W_1}{W_1(t^*)} - \frac{W_2}{W_1}.\frac{W_1}{W_1(t^*)}$

Or, $t^*w_1(t^*) = \left(\frac{1}{gi_0} - \frac{1}{i_1}\right)w_1$ (5)

where $g = \frac{W_1}{W_{10}}$, $i_1 = \frac{W_1}{W_2}$

For $t^* > 0$, we assume $gi_0 < i_1$, otherwise the high income class has to be subsidized. Hence, $g < \frac{i_1}{i_0}$

Now from (1) let $w_1(\bar{t})(1-\bar{t}) = w_{10}$ (6)

Such a $\bar{t}$ will always exist for $0 < \bar{t} \leq 1$. LHS in (5) is monotonically declining in $\bar{t}$ with $\bar{t} = 1 \Longrightarrow$ LHS(6) = 0 and $\bar{t} = 0 \Longrightarrow$ LHS(6) $> w_{10}$. But t^* that solves (5) can be greater than $\bar{t}$. Hence DNFP is feasible iff $t^* \leq \bar{t}$. For $t \in (t^*, \bar{t})$inequality can be reduced also.

[5] (3) implies that we refrain from the Laffer curve like situation where initial t is so high that a rise in t will reduce tax revenue.

Proposition 1: **<u>If $\exists$ a $t^* \leq \bar{t}$, then t^* must be higher for lower initial inequality i.e. i_0</u>.**

Proof: From (5) $t^*W_1(t^*)$ must rise with a fall in i_0. From (3) this implies t^* must be higher. QED.

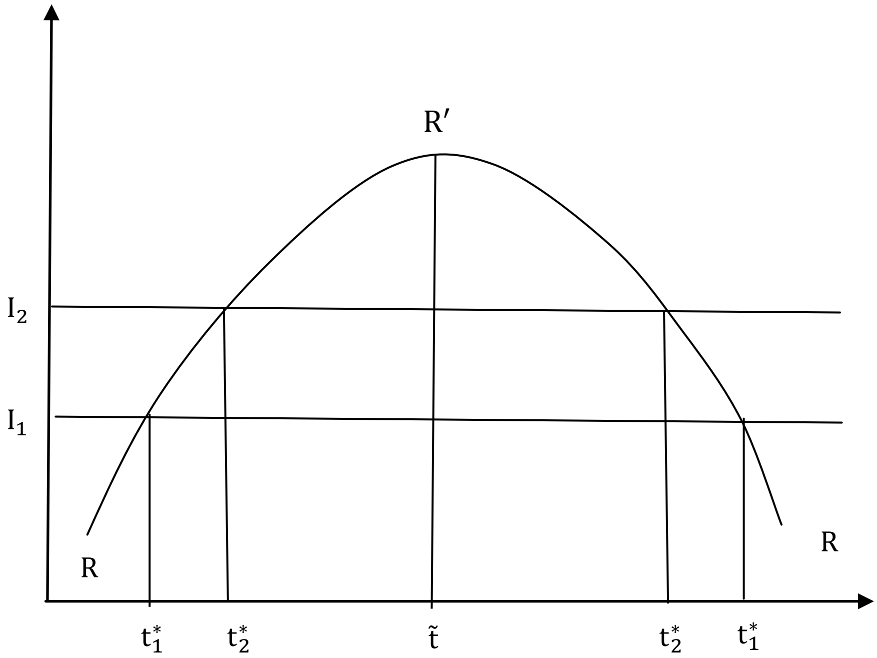

Figure-2

Suppose $tW_1^*(t)$ follows an inverse $'U'$ shape with declining revenue beyond $\tilde{t}$, denoted by $RR'R$. Higher I implies lower inequality. Also for the purpose of demonstration let us suppose that for all possible t^* corresponding to different levels of inequality, $t^* \leq \bar{t}$, i.e. DNFP is feasible. Now depending on level of initial taxes countries belong either to RR' or $R'R$. For countries in RR' we have already shown that it is more difficult for the low-inequality countries to contain inequality. For those in $R'R$ since $\bar{t} > t_1^* > t_2^*$, it is the other way round. However, if a country gets the same tax revenue with much higher taxes or $\bar{t}$ is less than $\tilde{t}$, the relevant range continues to be RR' .

Section 4 Beyond the Two Class Economy

We have shown that lower degree of inequality will mean higher t^* and hence a lower chance of having $t^* \leq \bar{t}$ for our 2 class economy. Now we proceed to extend the result for the n agent case. We use the following notations.

$W_0 = (w_{01}, w_{02}, .., w_{0n})$, be the initial income distribution.

$W_1 = (w_{11}, w_{12}, .., w_{1n})$, be the final income distribution.

Let $\delta = \frac{\sum_{i=1}^{n} w_{1i}}{\sum_{i=1}^{n} w_{0i}}$.

We assume that the society experiences positive growth rate from time 0 to 1. Thus $\delta > 1$. Let W_0 is arranged in ascending order. Furthermore, let $g_{i+1} > g_i$. This condition implies that inequality in W_1 is higher than W_0.

Furthermore, for all i $w_{1i} = g_i w_{0i}$, where g_i denotes the rate of growth, such that $g_i > 0$. Note that if $g_i > 1$, then the income of the individual increases from time 0 to 1.

We define $\hat{\hat{W}} = (\hat{w}_1 - D_1, \hat{w}_2 - D_2, .., \hat{w}_n - D_n)$

where D_i is the distortionary effect, such that $D_i > 0$ if i pays tax, and $D_i \leq 0$ if i receives transfer.

$$\hat{w}_1 - D_1 = \hat{w}_1(t_1)(1 - t_1)$$

$$\text{Or, } D_1 = \hat{w}_1(0) - \hat{w}_1(t_1)(1 - t_1)$$

Net wage will be positive iff

$$\hat{w}_i - D_i \geq w_{0i} \tag{7}$$

$$\text{Or, } D_i \leq \hat{w}_i - w_{0i} \tag{8}$$

Finally we define

$$TC_i(W_0, W_1) = \widehat{w}_i - w_{0i} \tag{9}$$

as the maximum Tolerance Cost of taxation. If $D_i = TC_i$ then the individual is indifferent. If $D_i > TC_i$ then the individual will be better off. Higher tolerance cost implies that the country is in a better position to follow DNFP. It can impose higher tax.

Proposition 2: For any individual i, given w_{0i} and g_i lower initial inequality implies lower tolerance cost of taxation.

Proof: $TC_i(W_0, W_1) = \widehat{w}_i - w_{0i} = (\delta - 1)w_{0i}$. Now consider a low initial inequality profile $W_0^L = (w_{01}^L, w_{02}^L, .., w_{0n}^L)$, where W_0^L is arranged in ascending order, such that $w_{0k}^L = w_{0k} + \epsilon, w_{0m}^L = w_{0m} - \epsilon$ and $w_{0j}^L = w_{0j}$ for all $j \in \left\{1,2,..,\frac{n}{k}, m\right\}$. Further let $W_1^L = (g_1 w_{01}^L, g_2\, w_{02}^L, .., g_n w_{0n}^L)$ be the final income profile. Note that the growth rate for all individuals from W_0 to W_1 and that of from W_0^L to W_1^L is same. Any relative inequality $I: R^n \mapsto R$ measure that satisfies Pigou Dalton Transfer implies: $I(W_0^L) < I(W_0)$. Now $TC_i(W_0^L, W_1^L) = (\delta^L - 1)w_{0i}$, where $\delta^L = \frac{\sum_{i=1}^n w_{1i}^L}{\sum_{i=1}^n w_{0i}^L}$. In order to complete the proof we show that $TC_i(W_0^L, W_1^L) < TC_i(W_0, W_1) \Rightarrow \delta^L < \delta \Rightarrow$

$$\frac{\sum_{i=1}^n w_{1i}^L}{\sum_{i=1}^n w_{0i}^L} < \frac{\sum_{i=1}^n w_{1i}}{\sum_{i=1}^n w_{0i}} \tag{10}$$

Note that by construction $\sum_{i=1}^n w_{0i}^L = \sum_{i=1}^n w_{0i}$. Hence (10) holds only if

$$\sum_{i=1}^n w_{1i}^L < \sum_{i=1}^n w_{1i} \tag{11}$$

An equivalent condition of (11) is $g_m > g_k$, which is true by construction. **Q.E.D.**

We now compare tolerance costs of two sets of income profiles with same degree of initial and final inequality but with different growth rates. We show that the profile with higher growth rate exhibits higher tolerance cost.

Proposition 3: For two sets of initial and final distributions of income profile. Inequality of initial distribution is same for both the profiles. Further, inequality of final distribution is also same for both the profiles. Tolerance cost in this context is higher for the distribution with higher economic growth.

Proof: Let in the first profile $W_0 = (w_{01}, w_{02}, .., w_{0n})$ and $W_1 = (g_1 w_{01}, g_2 w_{02}, .., g_n w_{0n})$ be the initial and final income distributions, respectively. Further $\widetilde{W}_0 = (aw_{01}, aw_{02}, .., aw_{0n})$and $\widetilde{W}_1 = (bg_1 w_{01}, bg_2 w_{02}, .., bg_n w_{0n})$, be the initial and final distribution of the second profile. Here $a > 0$ *and* $b > 0$. Further, W_0, W_1, $\widetilde{W}_0$ and $\widetilde{W}_1$ is arranged in ascending order and $g_{i+1} > g_i$. It is quite straightforward to figure out that for any relative inequality index $I(W_0) = I(\widetilde{W}_0)$ and $I(W_1) = I(\widetilde{W}_1)$. Let the average growth rate from W_0 to W_1 is greater than $\widetilde{W}_0$ to $\widetilde{W}_1$. This implies $\frac{\sum_{i=1}^{n} w_{1i}}{\sum_{i=1}^{n} w_{0i}} > \frac{b\sum_{i=1}^{n} w_{1i}}{a\sum_{i=1}^{n} w_{0i}}$. Following equations 23 and 24 this implies $TC(W_0, W_1) > TC(\widetilde{W}_0, \widetilde{W}_1)$ **Q.E.D.**

Section 5 Conclusion

Rising inequality within nations has impacted the economic policies of major democracies in recent times. The rise of protectionist policies including the so. called trade war between USA and China., BREXIT and rise of bilateralism across the globe, all are examples of disturbing political situations within richer nations. It is a well known empirical fact that inequality across nations has gone down where as inequality within nations is on the rise. With this background we first provide robust empirical evidence that in last six decades, growth in inequality has been faster in nations that started with low levels of inequality. Although the nations have become more unequal worldwide, the more prosperous ones have become even more unequal.

We then develop an analytical framework that asks the following question- whether there always exists a fiscal policy which does not allow inequality to aggravate from a given initial condition. Allowing for tax-transfer policies that accommodate distortions we try to analyze conditions under which such a policy will exist. In case it does, it is more difficult to pursue when initial inequality is lower. Therefore, if all nations in their own ways have been designing suitable fiscal policies which are distribution neutral, countries with lower inequality would find it harder to design such a tax-transfer policy. The maximum tax rates which one can apply to the income of the richer group and consequent redistribution of the resultant tax proceeds may not be sufficient to keep the inequality unchanged. In other words, the range of feasible taxes which makes the distribution less skewed or keep it unchanged would be greater for countries with relatively high degree of inequality.

References

Baldwin, R (2016) –The Great Convergence-**Bleknap and Harvard University Press**

Barro, R. J. (2016a). Economic growth and convergence, applied especially to China (No. wp21872). **National Bureau of Economic Research, USA.**

Barro, R. J. (2016b). Economic Growth and Convergence, Applied to China," **China & World Economy**.

Barro, R. J. (2000). Inequality and Growth in a Panel of Countries. **Journal of economic growth, 5(1), 5-32.**

Burman, L., Shiller, R. J., Leiserson, G., Rohaly, J., & Kennedy, P. J. F. (2007). The rising tide tax system: indexing the tax system for changes in inequality**. Draft manuscript, Tax Policy Center, Yale University**

Clements, M. B. J., de Mooij, R. A., Gupta, M. S., & Keen, M. M. (2015). Inequality and fiscal policy. **International Monetary Fund.**

Deininger, K., & Squire, L. (1996). *Measuring income inequality: a new data-base* (No. 537).

Dixit, A., & Norman, V. (1986). Gains from trade without lump-sum compensation. **Journal of International Economics, 21(1-2), 111-122.**

Gaspar, V., & Garcia-Escribano, M. (2017). Inequality: Fiscal policy can make the difference. **IMF Blog.**

Gbohoui, W., Lam, W. R., & Lledo, V. D. (2019). The great divide: Regional inequality and fiscal policy. **International Monetary Fund.**

Gupta, S., Marjit, S., & Sarkar, S. (2018). An application of distribution-neutral fiscal policy, **IMF working paper No. 18/12.**

Garcia-Penalosa , C. and S. Turnovsky (2007) –Growth, Inequality and Fiscal Policy : What are the relevant Trade Offs? **–Journal of Money, Credit and Banking – 39 (2)- 369-394**

Kemp, M. C., & Wan, H. Y. (1986). Gains from Trade with and without lump-sum compensation- **Journal of International Economics, 21(2) 99-110**

Kollias, I., Marjit, S., & Machelacakis, N. J. (2018). Public Investment, Taxation and Transfer of Technology. **Annals of Public and Cooperative Economics. 90(3) 441-456**

Marjit, S., Mukherji, A., & Sarkar, S. (2019 a). Pareto Efficiency, Inequality and Distribution Neutral Fiscal Policy**—An Overview in New Perspectives and Challenges in Econophysics and Sociophysics edited by Frédéric Abergel, Bikas K. Chakrabarti, Anirban Chakraborti, Nivedita Deo and Kiran Sharma, 191-202, Springer**

Monitor, I. F. (2017). Tackling Inequality. **International Monetary Fund, October.**