AN ATTEMPT FOR A NEW GROWTH MODEL BASED ON INTER-CLASS MOBILITY PROBABILITY*

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ABSTRACT

After Kuznets' pioneering study in 1955, the relationship between growth and income distribution attracted the attention of researchers. Approaches used to explain the relationship between growth and income distribution can be summarized as wealth and redistribution, international trade, technological development, macroeconomic volatility and political economy. In this study, firstly, the theoretical background and literature regarding these approaches are mentioned. Later, based on Akerlof and Yellen's theories on the fair wage-productivity relationship, a new model was tried to be developed that links economic growth with inter class mobility probability. The model is based on the hypothesis that in a hypothetical society of two-class without government, there will be an increase in the productivity of individuals belonging to the lower class as the probability of moving up the class increases. As the probability of individuals belonging to the lower class moving up increases, the probability of individuals belonging to the upper class falling down the class also increases. For this reason, the increase in the transition between classes will lead to an increase in the efforts of individuals belonging to the upper class. An increase in the effort of both classes will result in higher output and therefore higher growth. For this reason, as the income distribution becomes more fair, the growth rate will also increase, but if the income is distributed completely equally, the performance of individuals will decrease because there is no possibility of moving to upper class. Therefore, income inequality up to a certain level motivates individuals, while income inequality above the optimal level demotivates individuals. In other words, the relationship between income inequality and growth is non-linear. Finally, the game theory version of the model is introduced in the study.

Key Words: Income distribution, economic growth, class mobility

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SINIFLAR ARASI HAREKETLİLİK OLASILIĞINA DAYALI YENİ BİR BÜYÜME MODELİ DENEMESİ

ÖZ

Kuznets'in 1955 tarihli öncü çalışmasından sonra büyüme ve gelir dağılımı ilişkisi araştırmacıların dikkatini çekmiştir. Büyüme ile gelir dağılımı arasındaki ilişkiyi açıklamak üzere kullanılan yaklaşımları; servet ve yeniden dağılım, uluslararası ticaret, teknolojik gelişme, makro ekonomik oynaklık ve politik ekonomi şeklinde özetlemek mümkündür. Bu çalışmada öncelikle bu yaklaşımlara ilişkin teorik altyapı ve literatüre değinilmiştir. Daha sonra Akerlof ve Yellen'in adil ücret-verimlilik ilişkisine dair teorilerinden yola çıkarak ekonomik büyüme ile sınıf atlama veya düşme olasılığı arasında bağlantı kuran yeni bir model geliştirilmeye çalışılmıştır. Model iki sınıflı devletin olmadığı hipotetik bir toplumda, sınıf atlama ihtimali arttıkça alt sınıfa mensup bireylerin üretkenliklerinde bir artış olacağı hipotezine dayanmaktadır. Alt sınıfa ait bireylerin sınıf atlama ihtimali arttıkça, üst sınıfa mensup bireylerin sınıf düşme ihtimalleri de artmaktadır. Bu nedenle sınıflar arası geçişkenliğin yükselmesi üst sınıfa ait bireylerin de eforlarında artışa yol açacaktır. Her iki sınıfın da eforlarında artış yaşanması daha yüksek çıktı ve dolayısıyla daha yüksek büyümeyle sonuçlanacaktır. Bu nedenle gelir dağılımı adilleştikçe büyüme oranı da yükselecektir, lakin gelirin tamamen eşit dağılması halinde sınıf atlama ihtimali olmadığı için bireylerin performansı düşecektir. Bu nedenle belirli bir düzeye kadar olan gelir eşitsizliği bireyleri motive etmekte, optimal düzeyin üzerindeki gelir eşitsizlikleri ise bireyleri demotive etmektedir. Başka bir deyişle gelir eşitsizliği ile büyüme arasındaki ilişki doğrusal değildir. Çalışmada son olarak modelin oyun teorisi versiyonu tanıtılmıştır.

Anahtar Kelimeler: Gelir dağılımı, ekonomik büyüme, sınıf hareketliliği

INTRODUCTION

Analyzing the cross-section regression of per capita GNP and income distribution for a large number of countries Kuznets found that high level and low level of incomes are associated with low levels of inequality and middle levels of incomes are associated with high levels of inequality (Kuznets, 1955: pp. 20–22). Thus, he found an inverted U shape graph where there is inequality coefficient on vertical axis and per capita income on horizontal axis. He explained this outcome by a development process argument. According to this argument at the take-off stage the inequality among individuals increases because of the immigration from rural areas to industrialized regions. At this stage the correlation between inequality and growth rate is positive, so inequality is increasing with the increase in per capita income because there is a difference between the incomes of rural area farmers and urban area workers. When this migration and industrialization is complete per capita income is higher and inequality is decreased again to low levels. Thus, the inequality will first increase and then decrease as per capita income increases.

Kuznets` pioneering argument in growth inequality relationship affected many economists, some of whom agreed with his hypothesis and found theoretical and data-based support, and some of whom disagreed and done the same as supporters. There is no consensus on whether inequality is good for economic growth or bad, both in theoretical point of view and in empirical research results. For some countries it is shown by empirical researches that there exists a positive relationship between growth and inequality and for some other a negative one. For instance, Barro and Sala-I Martin have found different signs of correlation for countries at different development level (Barro et al. 1995). Also, there might be a positive correlation for some period of time and for some other period a negative correlation, for the same country. Or even, the relationship might not change over time. For instance, Persson and Tabellini have shown that inequality has a negative effect on growth at all stages of development in developed countries for the period 1830-1985 (Persson and Tabellini, 1994: p.607)

Generally endogenous growth models are used in literature to explain the relationship between growth and inequality, most of which employe a neoclassical AK production function. One of the arguments that favoring the positive correlation between growth and inequality is the wealth effect argument. Marginal propensity to save increases as income increases, and when savings are higher investments are higher and the speed of capital accumulation and output growth accelerates. Therefore, an unequal distribution of income is better for a higher growth rate. Also, the concerns about free riding problem and decision-making difficulties for the investments consisting of large number of investors support this argument. (Investment

indivisibilities) Thus, it's better for growth when investments are managed or held by less number of people.

Another argument relies on the Hecksher-Ohlin model of international trade. The trade argument suggests that for a trade-based growth increase in the demand for exported goods results in an increase for the type of labor intensively used in the export sector which in turn results in an increase in wage differentials. The third argument is based on technological improvements. According to this argument technological development results in an increase in demand for skilled labor and a decrease in demand for unskilled labor, which in turn increases the wage differentials between skilled and unskilled labor income, increasing the inequality. On the other hand, there are also opposite theoretical arguments in favor of the negative impact of inequality on growth. Inequality may be harmful for economic growth since it may create macroeconomic volatility. The second argument is that income redistribution may have positive incentive effect on growth, when credit markets are imperfect and individuals are heterogenic in terms of actions. There are also political economy arguments.

1. WEALTH EFFECT ARGUMENT AND THE EFFECT OF INCOME REDISTRIBUTION

The intuition behind wealth effect argument is very simple and plausible. Marginal propensity to save is higher when individuals earn higher income, and higher savings provide higher financing opportunities for investment, enhancing growth. So, from this very simple reasoning it is very clear that when a large fraction of total income in an economy is held by a small number of people the amount of total savings and therefore total investment is larger, which is in favor of economic growth.

We can analyze the situation in a formal setting. Let's assume an economy consisting of k individuals with different incomes, and therefore different savings. Some individuals can not save at all because their income is only sufficient to survive, and for simplicity, the ones with incomes below this level (who are borrowing in order to survive) will not be considered. So, the first assumption for definition of saving behavior is that individuals have positive savings only if their income is above a certain amount (survival requirement). Second, let's assume that individuals save more if they obtain higher income: the first derivative of saving with respect to income is positive. The sign of the second derivative is crucial, all possible cases will be considered; it might be positive or negative, or zero. Considering this fact, the saving function for individual i at time t could be defined as:

$$S_i(t) = s \times (Y_i(t) - Y^*(t))^m \qquad (1)$$

Where Y*(t) is the minimum amount necessary to survive, is the income of individual i, s and m are positive parameters, and is the saving of individual i. Also there is a logical constraint: the values of s and m will be such that the condition Si(t)≤ - Y*(t) is satisfied, since saving is assumed to be constrained by the amount of income left after deducting the survival requirement.

The first derivative of saving with respect to income at time t is:

$$d\,S_i(t)/d\,Y_i\,(\mathrm{t}) = s \times m \times (Y_i\,(\mathrm{t}) - Y^*\,(\mathrm{t}))^{m-1} \quad (2)$$

which is non-negative for Y_i (t)≥Y^* (t)

The second derivative of saving with respect to income at time t is:

$$d^2\,S_i(t)/d\,Y_i^2\,(\mathrm{t}) = s \times m \times (m-1) \times (Y_i\,(\mathrm{t}) - Y^*\,(\mathrm{t}))^{m-2} \quad (3)$$

Thus, if m=1 saving-income function is linear (d2S/dY2=0), and if m>1 it is convex (d2S/dY2>0), and finally if m<1 the function is concave (d2S/dY2<0) for Y_i (t)>Y^* (t) . The total savings at time t, TS(t), then, is defined with the sum:

$$\mathrm{TS}\,(\mathrm{t}) = \sum_{i=1}^{k} S_i(t) = \sum_{i=1}^{k} s \times (Y_i(t) - Y^*(t))^m \quad (4)$$

In equilibrium this sum is equal to total investment of this economy, and again for simplicity, it is assumed that this simple economy has a single firm to produce output, so all saving is absorbed by this single firm and investment means purchase of additional machines in this simple economy. Besides, output in next period is an increasing function of the current investment amount. This is a plausible assumption, because of the size effect, larger the size of firm lower the average costs, higher the profit.

So the output of the next period is given by:

$$\sum_{i=1}^{k} Y_i(t+1) = \sum_{i=1}^{k} Y_i(t) + \vartheta \times \sum_{i=1}^{k} S_i(t) = \sum_{i=1}^{k} Y_i(t) + \vartheta \times \{ \sum_{i=1}^{k} s \times (Y_i(t) - Y^*(t))^{\mathrm{m}} \}^{\kappa} \quad (5)$$

Where is a positive parameter showing the transformation rate of one unit of investment to output, and κ is a paramater larger than one since it is assumed that next period's output is an increasing function of current investment. And finally, the growth rate of the economy in such a discrete time dynamic modeling will be:

$$G_{t+1} = \{ \sum_{i=1}^{k} Y_i(t+1) - \sum_{i=1}^{k} Y_i(t) \} / \sum_{i=1}^{k} Y_i(t) = \{ \vartheta \times \sum_{i=1}^{k} S_i(t) \} / \sum_{i=1}^{k} Y_i(t) \quad (6)$$

Now let's see the effect of income redistribution in such an economy. Introducing the "growth accelerating tax" again mentioned in the above numerical example will be helpful. This lump sump tax T is collected from all individuals and returned back to some individuals by means of transfers so as to accelerate the growth rate of economy via this saving-investment mechanism, which is defined above. So, we assume that the amount k*T is collected and returned back to n individuals (n<k) in order to obtain a higher amount of saving and investment so as to raise the growth rate of economy. For simplicity of analysis, let's assume that these n individuals get the same transfer amount independent of their income. After the implementation of such a tax, the income of k-n individuals will fall by the amount of transfer T, and the income of transfer receiving individuals will increase by the difference of transfer and lump sum tax; (k*T/n)-T. With this redistribution the total saving and the investment of economy will be defined by:

$$TS^{*}(t) = \sum_{i=1}^{k} S^{*}_{i}(t) = \{\sum_{i=1}^{n} s \times (Y_i(t) + (k \times T/n) - T - Y^{*}(t))^{m}\} + \{\sum_{i=n+1}^{k} s \times (Y_i(t) - T - Y^{*}(t))^{m}\} \quad (7)$$

The total savings of those who get the transfer payments are shown in the first brackets and the total savings of those who don't get any transfer payments are shown in the second brackets.

Also the new growth rate of the economy is given by:

$$G_{t+1} = \vartheta \times \{\sum_{i=1}^{k} S^{*}_{i}(t)\}^{\kappa} / \sum_{i=1}^{k} Y_i(t) \quad (8)$$

The denominator will be the same as the one before redistribution because there is no change in the base year's total income. However, there might be a change in the following year's income because of different investment.

Solution:

The new growth rate is higher than the one before redistribution only if there is an increase in the total savings in this economy. The direction of the movement in total savings depend on the sensitivity of the saving on part of income remaining available to save after deducting the minimum required level to survive. In other words, the value of parameter "m" will determine the outcome of the model.

Case 1: m=1

It is straightforward to see that when m=1 total savings and hence investments will be same and growth rate will not change. In other words, when saving is a linear function of income, then redistribution will not change the total savings and investment

in this economy.

Proof:

$$\sum_{i=1}^{n} s \times (Y_i(t) + (\mathrm{k} \times T/\mathrm{n}) - T - Y^*(t))^1\} + \{\sum_{i=n+1}^{k} s \times (Y_i(t) - T - Y^*(t))^1\}$$

$$= \sum_{i=1}^{n} s \times [Y_i(t) - Y^*(t)] + \sum_{i=n+1}^{k} s \times [Y_i(t) - Y^*(t)] + \{\mathrm{n.s.(kT/n)\text{-}s.n.T}\}\text{-}\{\mathrm{(k\text{-}n).s.T}\}$$

$$= \sum_{i=1}^{n} s \times [Y_i(t) - Y^*(t)] + \sum_{i=n+1}^{k} s \times [Y_i(t) - Y^*(t)] + \mathrm{s.k.T - s.n.T - s.k.T + s.n.T}$$

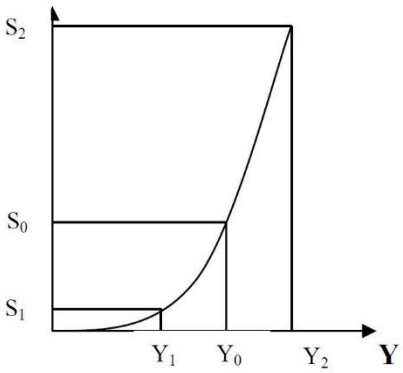
$$= \sum_{i=1}^{n} s \times [Y_i(t) - Y^*(t)] + \sum_{i=n+1}^{k} s \times [Y_i(t) - Y^*(t)]$$

which is equal to before redistribution level of total savings.

Case 2: m>1

A graphical proof will be sufficient. Let's assume the initial income of two individuals are same and equal to Y0, and the associated saving is S0 for both individuals. When the tax is introduced their income will decrease to Y1. However, after the transfer payment the income of individual who gets the transfer will increase to Y2. So after redistribution the income pairs are Y1 and Y2, and the savings are S1 and S2, respectively. It's clear from the figure-1 that S1 + S2 > 2S0.

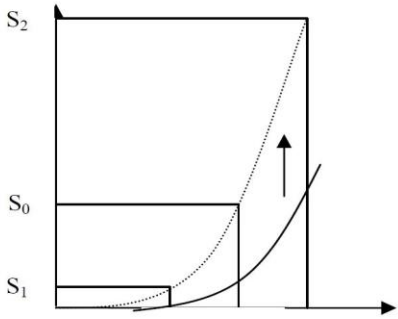
Figure 1: Convex saving function (m>1)



$S_2 - S_0 > S_0 - S_1 \longrightarrow S_2 + S_1 > 2S_0$

Thus, when the marginal saving rate is increasing with higher income then income redistribution accelerates growth.

Figure 2: Steeper saving function (increasing m)



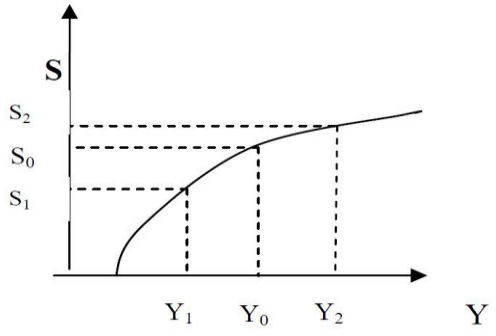
An increase in m (increase in the elasticity of saving with respect to income) accelerates the positive effect of inequality on growth, since the increase in rich's saving (S_2) is more drammatic.

Furthermore, let's assume for some reason, m increases(Figure 2). The saving function will be steeper and the increase in total saving will be higher after income redistribution. This means higher the sensitivity of savings with respect to income, larger the positive effect of inequality on growth rate of economy. The third result can be derived from this graphical reasoning is that smaller the n (the number of individuals receiving transfer payments), larger is the increase in total savings after redistribution.

Case 3: m<1

In this case the total saving will decrease with redistribution. Initial income of both individuals are equal (Y0). After redistribution the income of individual receiving the transfer payment will increase to Y2, and the income of the other individual will decrease to Y1. So the respective saving amounts are S1 and S2. Since the increase in savings of the second individual does not compensate the loss in the savings of first indivitual the total saving, and hence the investment will decrease after redistribution.

Figure 3: Concave saving function (m<1)



$S_2 - S_0 < S_0 - S_1 \rightarrow S_2 + S_1 < 2S_0$

The conclusion derived from this simple model is that higher inequality is not always good for economic growth, the sign of the wealth effect on growth might be either positive or negative, or it may not affect growth rate at all.

Another theoretical possibility is that the saving function might be convex in some interval and concave in some other. In such a case the amount of tax and the taxation policy (i.e. different tax rates for different level of income, introducing exemptions and so on) will determine the outcome of such a redistributive tax. Depending on these factors, the total savings and hence the investment and growth rate could either increase or decrease.

Income redistribution might be good for growth for a couple of reasons. Firstly, it can improve public education that has positive effects on human capital and therefore on growth. Secondly, if the economy is rich enough, redistribution could facilitate investment by poor and will not affect investment by the rich that enhances growth. Thirdly, redistribution could create an important middle class, that has a relevant role as consumers and could favour growth. Finally, redistribution could reduce crime and social strains, creating a positive environment to invest that will facilitate the growth process (Aghion and Williamson, 2000).

2. INTERNATIONAL TRADE ARGUMENT

This argument is used in explaining the wage differentials; particularly the trade effect on inequality between skilled and unskilled labor. The basic intuition stems from the Heckscher-Ohlin theory. This theory states that the countries specialize in the production of the goods which are intensively produced by countries' abundant factors. A country abundant in land for instance will produce and export agricultural goods. If we think in terms of skilled and unskilled labor, the developing countries which are abundant in unskilled labor will devote a great part of their sources to produce the goods requiring unskilled labor intensively. This situation in turn will increase the demand for unskilled labor, and if there is not a significant unemployment problem the decrease in unskilled labor demand will reflect in the wages of unskilled workers. Unskilled workers in developing countries will earn more with the increase in the volume of the international trade and the initial inequality between skilled and unskilled workers' wages will decrease. Thus, with the increase in international trade the economy will grow and the inequality will decrease simultaneously. This result would not change even if initially there was a significant unemployment problem. In this case the wages would not increase significantly but the unemployed unskilled workers would find jobs with the increase in trade volume and again the income distribution would be more "fair".

However, the story in developed countries is different. Developed countries are relatively abundant in skilled labor and therefore tend to export high tech products. In these countries unskilled labor is relatively expensive compared with developing countries. The increase in trade volume will shift the labor demand from unskilled towards skilled. Therefore the wages of skilled workers will increase and the wages of unskilled workers will decrease, under the assumption of flexible wages. On the other hand if wages are rigid, the result will be increase in unemployment rate of unskilled workers. In both cases the inequality will increase with the increase in the trade volume.

Foreign trade and globalization also bring new opportunities (production of new goods, new technologies e.t.c) to societies, and those who are successful in adapting the new environment benefit from such events. On the other hand those who are not able to adapt will lose. Cooper explains this point in simple setting where he takes an example of a villager fishing society consisting of three types of fisherman (ordinary, superior and energetic) who faces new foreign ships that will effect their fishing activity (Cooper, 2001: pp. 2-5)

The fishing village has a closed economy before the arrival of such ships. The earnings of each type of fisherman depends on their knowledge, skills and luck which is a random variable for all. Superior fishermen earn more than others due to their non-transferrable skills, earnings of energetic fishermen on the other hand depends also on their additional efforts. The worst case is of ordinary ones, who earn the least in this society. The arrival of foreign ships disturbs the fishing activity but it also creates new opportunities for villagers (the ships and their crews need local services in the form of food preparation, repairmen, eating establishments, and unskilled labour). With the arrival of ships fishing activity is deteriorated so much (fish are driven away by ships) and, furthermore no villager has the required skills for these new jobs. So most of the villagers will be employed as unskilled workers. But the energetic type fishermen are enthuastic and they easily recognize these new opportunities. Therefore, they suddenly begin to acquire these skills which in turn provide a skill premium.

The effect of such a demand for new labour depends on the demand-supply interaction. If the demand is lower than the supply of labour at initial base wage, then the wage should decrease so as to employ all fishermen. In this case superior fishermen are worse off because their skills, which provided a premium in former economy, are no more functional since these skills are assumed to be non-transferable. On the other hand, energetic fishermen, who are acquiring required skills rapidly, will earn a skill premium in addition to this basic wage. They might be either better off or worse off depending on the amount of skill premium. Ordinary fishermen are worse off since they can only get ordinary jobs.

However, if the demand for new labour is above its' supply at given initial basic wage, then the basic wage will increase to the level that clears labour market. In this case all types of fishermen are better off compared with the insufficient labour demand case. Besides again the energetic men have an opportunity to earn skill premium, which will further improve their earnings. Thus, no matter is the labour market condition, the earnings of energetic fishermen are higher than everyone else in the society.

International trade accelerates growth in this fishing society, however the income distribution may be more or less unequal compared with the before trade situation. The proportions of these three types of fishermen, the difference between fishing income and wage earnings, the amount of skill premium and the labour market conditions will determine together the new income distribution. However, since ordinary and superior fishermen are potentially worse off in the new economy and only energetic men are potentially better off, one can conclude that income distribution will be more unequal.

3. TECHNOLOGICAL IMPROVEMENT

Besides the trade argument, there is another hypothesis to explain the shift in labor demand and the increase in inequality in terms of wage differentials. With technological improvement in production process labor demand shifted towards skilled labor. It is possible to separate this effect into two parts; first, with technical change more skilled labor is used in all industries, so there is a within industry change in production, and second, new sectors which hire skilled labor intensively exist, such as software industry and biotechnology. Also technological improvement causes an increase in labor productivity, which in turn leads to use of less unskilled labor in production.

Empirical evidence shows that the decrease in demand for unskilled labor is largely because of within industry changes, rather than shifts between industries. So, the proportion of unskilled labor in production decreased with the technological improvement and the decrease in unskilled labor demand caused the wage differential become larger. Thus, technological improvement increased the wage inequality between skilled and unskilled workers. The effect of within industry technical development was analyzed by many researchers. Berman, Bound and Griliches show that both computer and research and development expenditures have a positive significant effect on the share of non-production workers (Berman et al. 1994: pp. 367-397).

Although empirical evidence shows that the wage differential enlarged in favor of skilled labor, from the theoretical point of view this result is a bit confusing. The increase in demand for skilled labor pushes the wages upwards but the supply of skilled

labor also increased significantly, which would cause skilled worker wages fall again. Aghion shows that wage premium of skilled workers may increase with the introduction of new technologies even if the relative supply of skilled labor is increasing (Aghion and Williamson, 2000). The explanation is based on general purpose technologies. A general purpose technology is an invention that affects the whole economic system, such as computer, laser technology etc.

General purpose technologies are assumed to diffuse nonlinearly into the entire economy. One reason for this nonlinearity is explained by the term "social learning"; individual firms implement a new technology after they observe that such a technology provides significant benefits to other firms. For a long period, a small number of firms implement this new technology. But after a certain point in time the speed of the spread accelerates and therefore the demand for workers holding such specific skills required in implementation of the new technology raises significantly.

Another reason for nonlinearity is so called lock in effect. Firms do not implement the new technology until it becomes unavoidable because of the deterioration in their competitive position in the market. If most of the other firms obtain a significant cost advantage due to usage of new technology, then the firm is somehow forced to do what everybody does.

However, as the transition process continues all of the skilled labor will be employed only in the sectors using new technologies and all the unskilled workers are working in the old technology sectors. Thus, labor market is segmented when the number of the sectors using new technology is large enough. Wage differential will continuously increase during the transition. After all the sectors use the new technology, all workers will be skilled and they will get the same wages. To sum up, inequality increases with the technological improvement until the economy moves to its new phase in terms of technology.

4. MACROECONOMIC VOLATILITY

If there is a positive correlation between inequality and macroeconomic volatility and a negative correlation between macroeconomic volatility and economic growth one can conclude that there is a negative correlation between inequality and growth. Hausmann and Gavin shows that macroeconomic volatility and growth are negatively correlated and inequality and macroeconomic volatility are positively correlated. They show that the least volatile economies are those industrial economies whose growth rates follow a relatively stable path, i.e. the standard deviation of the growth rate is low in such countries. The growth rate of volatile economies however shows a larger standard deviation (Gavin and Hausmann, 1998).

Aghion, Banerjee and Piketty explain the direct effect of inequality on volatility. Volatility is considered in terms of fluctuations (cycles) and inequality is considered in terms of unequal access to investment opportunities. In a discrete dynamic setting, it's assumed that only a small fraction of the population has access to investment opportunities, since it may require special skills or specific information which is held mostly by the ones already in business (Aghion et al., 1999: pp. 1359–1397).

Indivisibility of investments is considered as another reason behind this limited access. Also credit markets are assumed to be imperfect in this setting. And the last basic assumption of the setting is that economy consists of two production technologies; traditional technology and high-yield technology. Although investments are limited to a small fraction of the population, all individuals are assumed to save a constant fraction of their wealth. So the total supply of the savings in time t depends on the total wealth in time t-1, namely it is independent of the current period variables. The aggregate demand for investment in high-yield sector at time t is a linear function of the wealth of individuals who has access to the high yield investment opportunities. Also, the demand for investment depends on the previous period wealth and the exogenous credit multiplier. Since savings and investments depend on previous period variables, there is no market clearing mechanism, which results in either excess savings or unrealized investments. These excess savings are used in the financing of the traditional sector projects which provides a low return. Thus, there will be a cut in the potential capacity of economy. However, if everyone had the opportunity of investing in the high-yield sector there wouldn't be such a loss in potential output, or if the investors were not credit constrained, they could absorb all savings.

In the boom period of cycles investors' wealth and their borrowings rise, resulting increase in demand for funds. In such periods capital is used more productively, and since the interest rate is determined by marginal product of capital, the economy experiences high interest rates in boom periods. However higher interest rates mean a higher speed of accumulation of dept repayments, which in turn will restrict the borrowing capacity of investors. The squeezing in borrowing capacity led to idle savings which will be used in financing of low return traditional sector projects. The marginal productivity of capital will fall again and interest rates will decrease. Decreased interest rates will courage the borrowings, increasing again the investment opportunities. Thus, booms and slumps will follow each other in such a setting. The aggregate output and the investments will be volatile in such a setting. Volatility in investments is actually nothing but unexploited production possibilities, so the average growth rate of the economy will be lower than it could be in a stable economy with same resources.

Breen and Garcia-Penalosa, regressing income inequality on volatility using cross section of developed and developing countries found that higher volatility deteriorates income distribution. Thus, a relatively more unstable growth path is associated with a higher Gini index. In their empirical work, volatility is defined as the standard deviation of output growth rate (Breen and Garcia-Penalosa, 1999).

Turnovsky, using a model of small stochastic economy, shows that terms of trade volatility, government expenditure volatility, and monetary volatility, all have strong negative impacts on the equilibrium growth rate (Turnovsky, 2003: pp.267-295).

Ismihan, Tansel and Metin-Özcan analyzed the relationship between macroeconomic instability, capital formation and growth in Turkish economy over the period between 1963 and 1999. They used time series analysis, generalized impulse response functions and multivariate cointegration techniques in order to explain the relationship between these variables. They conclude that public investment is badly affected by macroeconomic instability and macroeconomic volatility (instability) caused a significant slow down in both private and public investment, which in turn reflected in low growth rate of GNP in Turkey (Ismihan et al., 2002)

5. POLITICAL ECONOMY

The provision of public goods and the degree and type of taxation required in financing public expenditure are determined in political process. Such taxation will affect the income distribution and saving behavior of individuals, which in turn will determine the growth rate. Thus, political process has an indirect effect on growth.

When the majority of voters have income below the average per capita income then they support the policies for redistribution. Particularly such voters would prefer taxation policies in which individuals are taxed with respect to their income. Furthermore, an increasing tax rate would be the most preferred. Such a taxation policy in turn will reduce the investment incentives, which in turn will result in a lower growth rate (Persson and Tabellini, 1994). However, as mentioned above if the economy is rich enough, redistribution could facilitate investment by poor and will not affect investment by the rich, which in turn will not reduce the growth rate.

Another aspect of the political economy considerations is the social unrest caused partly by inequality. The social unrest will negatively affect both poor and rich in a society. Poor will be involved in unproductive and harmful actions such as revolts and crimes, instead of using their energy in productive activities. Such actions will create a politically and economically unstable environment, which in turn will reduce the investments of rich. Also, in order to cope with such problems, the government will

devote some of public resources that would be used for public investment. Finally, coping with social unrest requires higher taxation for financing military and security expenditures, reducing private investments further.

6. AN ATTEMPT FOR A NEW GROWTH MODEL BASED ON INTER-CLASS MOBILITY PROBABILITY

6.1. Intuition and Theoretical Background

According to the Kuznets curve for some level of inequality, the effect of inequality on economic growth is positive, but if the inequality is above some certain level, the effect becomes negative. Kuznets model defines the relationship between growth and inequality in terms of a development process but in this paper, I will consider the phenomenon in a dynamic probabilistic model setting.

The model's hypothetical economy with no government consists of two types of economic classes, the upper class and the lower class. The first assumption of the model is that the members of each class differ in terms of their income and their attitude towards risk (so the β which stands for the measure of risk aversion, and the δ and θ which stand for the sensitivity of efforts with respect to inequality index are assumed to be randomly distributed), but their perception of economic and sociological conditions are identical when they belong to the same class.

The members of each class are identical in terms of their income and their actions. The second assumption of model is that when the variance of income distribution is high, or when the gini coefficient is too large the inter-class mobility is low and vice versa. This kind of reasoning relies on some economic, sociological and psychological aspects. First, in case of an unequal income distribution the opportunities are not equally distributed, which in turn makes it harder to acquire necessary skills, education, training etc. and also it is harder to accumulate necessary wealth required for improving one's economic rank, and hence makes it harder to jump to upper class.

Second, this highly unequal distribution has pessimistic effects on lower class members (they think that its almost impossible to jump to the upper class) and on the other hand, it causes kind of a comfortable feeling in upper class members (they think that they have a safe position in socio-economic structure or economic hierarchy). In other words, higher the risk of falling to lower class higher the efforts of upper class, and symmetrically higher the chance of jumping to upper class higher the efforts of lower class.

Thus, if the inequality is not so high (if the gini coefficient is small enough) the inter-class mobility is higher. That is, the probability of jumping to upper class (U) is

high, as well as the probability (or risk) of falling to lower class (L). In this case, the members of upper class will have more effort not to fall to lower class and the members of lower class will have more effort to jump to the upper class. Because of these high efforts there will be more competition, productivity will increase and there will be a positive relationship between economic growth and inequality.

On the other hand, if the inequality is so high (i.e. the gini coefficient is sufficiently high) the probability of jumping and falling is small, so will be the efforts of both class members. Because of this comfortable feeling of upper class and hopeless feeling of lower class there will be a significant decrease in their efforts and the growth rate of economy will be negatively affected.

One possible explanation for the relationship between productivity and pessimism due to feeling of inequality and/or non-fairness of economic structure is "the fair wage-effort" hypothesis, introduced by Akerlof and Yellen. Akerlof and Yellen argue that employees have an expectation of the fair wage. In the case that the actual wage is lower than their expectation, the workers decrease their effort in proportion. Thus, depending on the wage-effort elasticity and the costs to the firm of shirking, the fair wage may provide a basis for the wage bargain (Akerlof and Yellen, 1990: pp. 255-283).

Their hypothesis takes its' motivation basically from psychological factors determining human behavior and equity theory of Stacy Adams. When one doesn't get what he deserves (or what he thinks that he deserves), he will try to get even. Adams states that people tend to give something equal to what they get in social exchange (Adams, 1963: pp 422-436). This notion of "equality", of course, is something subjective depending on people's perceptions. Therefore, if a worker thinks that he is not paid fairly he will tend to decrease his productivity on purpose. So, the worker's productivity will increase as his/her wage increases. The same is true even for managers. Some companies offer to pay a certain fraction of profit to the manager, which in turn, makes the income performance dependent. Thus, considering those earn labor income, a more fair distribution causes a higher motivation and hence higher productivity, which in turn makes inter-class moves more frequent, as suggested by the model.

On the other hand, if there is a unfair distribution which causes such pessimism of lower class will result in kind of a comfortable feeling in upper class members (they think that they have a safe position in socio-economic structure or economic hierarchy). Therefore, their efforts also decrease.

Up to here, we tried to clarify how our model relates the distribution of income to efforts and hence the growth of total income in our hypothetical economy of two classes. Now let's go in a bit detail to explain why there might exist a dumped U shape relationship between growth rate and the income distribution and hence the inter class movement probability. If the inequality indicator is very low then a bit inequality doesn't harm growth. The explanation will rely on performance payment criteria considering lower class members and psychology of both classes that affects their efforts. If inequality indicator is already very low, there will be an optimistic economic environment, for those belonging to lower class. Therefore, it will not matter so much for lower class members to deteriorate equality a bit. In a sense, too much equality might be "boring", just like too much inequality might be "dangerous" because of the social unrest arguments explained in the political economy section above. Since they are hopeful about jumping to the upper class, a bonus or performance based payment policy will positively affect their efforts and productivity. Thus, such a performance based payment will increase the total output. But simultaneously such a payment policy increases the wage differentials and hence

increases inequality. Thus, from the lower class members' side their efforts will increase simultaneously with increasing inequality when the inequality level isbelow the threshold, which will be explained.

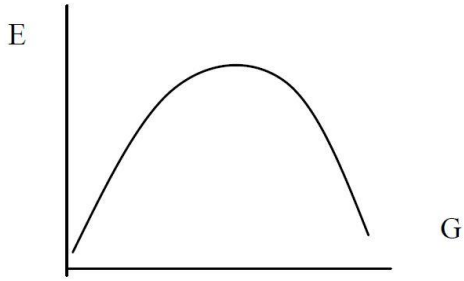
It should be taken into account that the psychology of these upper and lower class members is always asymmetric. When the inequality is low, the upper class members are pessimist since the vertical movement probability is high and vice versa. While lower class members are trying to take the advantage of this fair distribution and equal opportunities and hence improving their efforts, the upper class members will increase their efforts so as not to lose their position due to this credible threat. Thus, although their psychology is asymmetric all the time, the change in efforts is in same direction. Since both class members are increasing their efforts there will be a positive relationship between total output and inequality in case of low inequality levels.

Why should this relation between efforts and inequality be non-linear in the framework of our model? A plausible explanation is that when the inequality is very small the class changing probability is very high, so are the efforts of both upper and lower classes. Therefore, the sensitivity of efforts to inequality increases as the inequality decreases. Equivalently, the sensitivity, and hence the slope of efforts with respect to inequality index will decrease as the index increases, as long as the Gini index is smaller than its' critical level. On the other hand, when the inequality exceeds a certain threshold lower class members begin to be pessimistic; since they think that there is no sense in increasing their efforts further due to very small probability of

jumping to upper class, and, asymmetrically, upper class members begin to be optimistic because of this small probability of losing their position. The result in such a case will be a decrease in the efforts of both classes, resulting in a slowdown in total output. Also as the inequality increases further the hopes will be lost totally and the decrease in efforts of lower class members will sharpen further. This explains why there must be a peak and then a sharpening downward slope in growth-in equality function of our model described intuitively so far.

Thus, if we graph the inequality (measured in terms of Gini coefficient) on x axis and efforts (E) in y axis, we will see a dumped U shape function, as suggested by Kuznets:

Figure 4: Inequality (Gini-G) and Efforts (E)



Before introducing the formal model a table summarizing the causal relationship between the intervals of inequality index, the state of psychological motivation (perception of situation concerning equality), the direction in the change of efforts and the direction of the change in the rate of total output growth will be helpful.

Figure 5: Summary table of the model

Interval of the Gini index	Inter Class Mobility	Upper Class, Psychology and Direction of Efforts	Lower Class, Psychology and Direction of Efforts	Direction of the change in output growth
$0 \leq G_t \leq G^*$ (low Gini)	High	Pessimistic ▲	Optimistic ▲	▲
$G^* \leq G_t \leq 1$ (high Gini)	Low	Optimistic ▼	Pessimistic ▼	▼

▲: increase ▼: decrease G^*: threshold Gini index (peak point)

6.2. Structure of the Model

In hypothetical two-class society consisting of "p" members of lower class and "u" members of upper class, heterogeneity among class members is assumed. Thus, neither the upper class members nor the lower class members are identical. Their attitude towards risk (β) and the sensitivity of their efforts with respect to inequality index (θ and δ for lower and upper class members respectively) will differ among the members of same class.

The growth rate of population (λ) is assumed to be different among classes, since theory suggests that when people have high income, the opportunity cost of raising children is high, so the population growth rate will be lower higher the income level, and hence upper class has a smaller population growth rate. Thus λu< λp So, the time path of population of each class is given by:

$$p(t) = p(0) * e^{t\lambda p} \quad (9)$$

$$u(t) = u(0) * e^{t\lambda u} \quad (10)$$

where u(0) and p(0) denote the initial values for upper class and lower class populations. A realistic assumption is that u(0) < p(0). Furthermore, since the population growth rate upper class is smaller, it is guaranteed that u(t)<p(t) at any point of time. Therefore, even if u(0)=p(0), smaller growth rate implies that there exists a t at which u(t)<p(t). Another point is to note that is: if the difference between population growth rates is sufficiently large, then lower class members would become poorer and poorer even when their share in total income is increasing.

Class changing probability is a function of Gini index as explained above. I think the Beta density function[1] is a suitable distribution function since it is assumed that Gini coefficient is a continuous random variable in the interval [0, 1]. Thus, we define probability density function as:

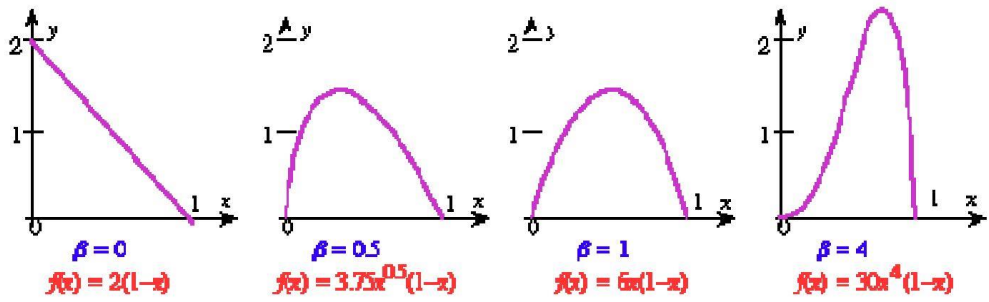
$$f(G) = (\beta + 1)(\beta + 2)G^{\beta}(1 - G) \quad (11)$$

and for β=1, f (G(t)) = 6G(t)(1-G(t))

where 0≤G(t)≤1 and we choose β=1 since it best suits our model to explain the relation suggested by Kuznets. The below is the different distribution functions under different alternative choices of β.

[1] The beta distribution is a continuous probability distribution with the probability density function (pdf) defined on the interval [0, 1]

Figure 6: Alternative Beta Distribution Functions



So, the probability function is defined as:

$$P(x(t)\backslash\, a \le G(t) \le b) = \int_a^b \mathrm{f}\,(\mathrm{G}\,(\mathrm{t}))\,\mathrm{dG} \qquad (12)$$

where $0 \le P(.) \le 1$ and $0 \le a \le b \le 1$

Here a conditional probability is applied because the probability of class changing at time t (class changing at time t is defined as event x (t)) depends on the Gini coefficient. Since by assumption G has a continuous distribution in interval [0, 1], we have to define the probability on an interval such as between "a" and "b", rather than any exact value of G. This probability density function satisfies certain properties:

• Firstly, if G is zero, which means everyone has the same income, then probability of class changing is zero because there is only one class.

• Secondly, the cumulative distribution function will satisfy the condition:

$$F(G) = \int_0^1 \mathrm{f(G)dG}$$

This probability is assumed to be same for the members of same class. Also, the probability of jumping to upper class is just equal to probability of falling to lower class.

This result holds only when the population growth rates of two classes are same, namely when $\lambda u = \lambda p$. So, it is not important who is in upper class and who is in lower class. The classes are defined not according to the average income they earn, but according to their rank in income distribution. For instance, all the people belonging to top 10 percentile in Lorenz curve might be classified in upper class and so on. This means that the income threshold to be considered in upper class will change in time,

but the ratio of upper class population to total population will stay constant. Since the percentile criteria will remain constant over time, "s" guys jump to upper class if and only if another "s" guys from upper class fall to the lower class. Therefore, this probability is same for all members of society. The matter is "to be or not to be in this "s" lucky (unlucky) people". The probability density function has a inverted U shape. Taking the derivative of probability density function with respect to Gini index one finds the peak point of function.

Since f(G) = 6G.(1-G),

df/dG = 6-12G = 0 → G*= 0.5

Since the effort and income will be defined as a linear function of this probability function, G* will correspond to the critical Gini index, the threshold that maximizes the efforts. Thus, when G < G* people have a perception of fair distribution and therefore high probability of inter-class movements. The members of lower class will be optimistic and increase their efforts in order to jump, and the members of upper class will be pessimistic and also increase their efforts in order not to fall.

The society with a Gini index higher than this threshold G*(0.5) will be classified to be unfair. Thus, in the context of this model, the inequality is harmful for growth in countries such as; South Africa (0.63), Namibia (0.59), Surinam (0.58), Zambia (0.57), Sao Tome and Principe (0.56), Central African Republic (0.56), Swaziland (0.55), Mozambique (0.54), Brazil (0.53) and Botswana (0.53) (Gini Coefficient by Country, 2023).

One possible alternative modeling for this probability would be to include a new variable which is inverse of the actual Gini coefficient (i.e $\xi=1/G$) to the probability equation (instead of beta density function). Then the probability could be defined as an increasing function of ξ. In this case the class changing probability would again be a decreasing function of the Gini coefficient, but without a critical value that reflecting the threshold for inequality perceptions of the society.

The effort of member i is defined as an increasing function of the class changing probability as following:

$$E_i(t) = (f_i(G(t)))^{\beta} \tag{13}$$

Where β measures the attitude of member i towards risk, higher the risk aversion lower the β. If β=1 the member is risk neutral; the marginal effect of class changing probability on effort will remain constant over time, if β>1 member is risk lover; the marginal effect of class changing probability on effort will increase as probability increases, and if β<1 member is risk averse; the marginal efforts will decrease as the

probability increases.

Two measures of risk aversion are the absolute and relative risk aversions. The absolute and relative risk aversion equations, over such an effort function are defined as:

• Absolute risk aversion:

ARA (f(t)) = -(d2E/df2)/(dE/df) = - (β-1) f-1(t)

For f(t) ≠ 0, AR(f(t)) =0, when β=1

> 0, when β < 1,

< 0, when β > 1.

Thus, given class changing probability is positive, individuals are absolutely risk averse when β < 1, absolutely risk lover when β > 1, and neutral when β=1. Higher is the β, higher will be the effect of class changing probability on efforts and hence, higher will be the standard deviation of the growth rate of economy. Furthermore, there will be a decreasing absolute risk aversion when β < 1 as f(t) is increasing, a constant absolute risk aversion when β=1, and an increasing risk aversion when β > 1.

• Relative risk aversion:

RRA (f(t)) = - f(t).(d2E/df2) / (dE/df) = -(β -1)

= 0, when β=1,

> 0, when β < 1,

< 0, when β > 1.

Thus, relative risk aversion is independent of f(t).

It is plausible to assume that attitude towards risk is a matter of wealth or income. Usually it is assumed that people have concave utility function which reflects risk aversion. As wealth (income) increases, marginal utility derived from wealth (income) will decrease. However, the risk aversion was defined not on income but on the probability density function. Since income will be defined as a linear function of the effort which is in turn an increasing function of probability density function; the conclusions derived so far will be valid.

The effort of individual "i" in turn will determine his income in the following way:

$$I_i(t) = r\delta_{0,i}(t) + \delta_{1,i}E_i(f(G(t))) \quad (14)$$

where δ1,i measures the marginal effect of efforts on income for individual i, and it is assumed to be positive. r δ0,i denotes the part of income independent of current efforts. One can interpret this variable as the interest earnings or wealth earnings which in a sense are result of cumulated assets due to previous efforts. The term r stands for the exogenous rate of return on previous personal investments. In addition, δ1,i stands for the sensitivity of income of individual "i" (in the upper class) with respect to his efforts. This parameter can be interpreted as a measure of efficiency of efforts. It may depend on the skills and abilities of individuals in transforming efforts to money.

So this part of income can be defined as:

$$\delta_0(t) = s\int_0^{t-\varepsilon} I(G)dG \tag{15}$$

where s is the constant saving rate. The saving rate is assumed to be constant for just simplicity of the analysis. Income is defined as a function of the inequality measure, since by assumption this measure determines the efforts, which in turn determine the income. One should differentiate this component between the members of these two classes. A plausible assumption might be that, this component for a member of upper class is strictly larger than the one for a lower class member. So, there is a need to define a new equation of same type for a member of lower class as:

$$I_i(t) = r\theta_{0,i}(t) + \theta_{1,i}E_i \tag{16}$$

Here, θ0,i (t) represents the part of income which depends on up-to time t wealth accumulation of lower class member. And as it was mentioned above, θ0 is considerably smaller than δ0 . In addition, θ1,i stands for the sensitivity of income of individual "i" (in the lower class) with respect to his efforts.

6.3. Solution of The Model

As it is indicated by the equations this is a self-deterministic model. The Gini coefficient will determine the efforts, efforts in turn will determine the change in income and finally change in income will determine the growth rate of economy. Thus, Gini coefficient will determine everything in this model. The important point is that the distribution function of Gini coefficient and hence the probability function looks like logistic functions for chaotic systems. In this model, the direction of the economic growth will depend on whether the Gini coefficient is larger or smaller than its' critical value. The hypothetical two class economy will grow as long as the Gini coefficient is smaller than its' critical value, because of the fair distribution perception of people.

Thus, considering all the assumptions and equations of the model, the total

income in hypothetical two class economy is defined as:

$$Y(t) = I^T(t) = \sum_{i=1}^{u} \{r\delta_0(t) + \delta_{1,i}(f_i\ (G(t)))^{\beta}\} + \sum_{i=1}^{p} .\{r\theta_0(t) + \theta_{1,i}(f_i\ (G(t)))^{\beta}\} \quad (17)$$

total upper class income total lower class income

$$Y(t) = u(t) * I_u(t) + p(t) * I_p(t) \quad (18)$$

Where Iu(t) and Ip(t) denotes the "average" upper and lower class member incomes respectively. From the above equation the growth rate of whole economy, $\hat{Y}$, can be defined as:

$\hat{Y}$= {(share of upper class in total income)(growth rate of upper class population + growth rate of typical upper class member's income)} +{(share of lower class in total income)*(growth rate of lower class population +growth rate of typical lower class member's income)}*

$$\delta_0(t) = s\int_0^{t-\varepsilon} I(G)dG \quad (15)$$

Where λ denotes the population growth rate for both classes, π denotes the growth rate of income of a typical upper class member and finally ω denotes the growth rate of income of a typical lower class member.

So, the last step in finding the growth rate of total income is finding the growth rates of incomes of typical upper and lower class members, π and ω , respectively. By doing so, the growth rate of total income is defined as a function of the Gini coefficient. Also, the effect of other necessary parameters on this growth rate will be determined; such as population growth rate and the β (reflecting the individual attitude towards risk) and δ (reflecting the sensitivity of efforts to inequality).

Since the income for a typical upper class member is defined with the equation:

Iu(t) = r δ0 + δ1 [6G(t)(1-G(t))]β

And;

dIu/dt = İu = (dI/dG)*(dG/dt) (chain rule)

= β δ1 [6G(t)(1-G(t))]β-1(dG/dt)

so the growth rate of typical upper class member's income, π , will be:

$$\pi = (dI_u/dt)/\, I_u\,(t) = \frac{\beta.\delta_1.\left[6G(t)(1-G(t))\right]^{\beta-1}}{r\delta_0 + \delta_1\left[6G(t)(1-G(t))\right]^{\beta}}.(dG/dt)$$

Symmetrically, the growth rate of typical lower class member's income, ω , will be:

$$\omega = \frac{\beta.\theta_1.\left[6G(t)(1-G(t))\right]^{\beta-1}}{r\theta_0 + \theta_1\left[6G(t)(1-G(t))\right]^{\beta}}.(dG/dt)$$

Since the growth equations have chaotic nature, as mentioned above, the interpretations of these last equations will depend on the interval where the G belongs to. When G is smaller than the critical threshold, one concludes that:

• higher the inequality (G(t)) higher the growth

• higher the risk taking (β) higher the growth

• higher the sensitivity of income with respect to effort (δ1 and θ1) higher the growth

• higher the initial wealth (δ0 and θ0) lower the growth (a kind of "catching up" process; poor grow faster)

On the other hand, when the inequality is above the threshold, namely when there is a perception of high inequality in society, the first three conclusions will be reversed. This point can be explained by the inverted U shape of probability density function, which is the fundamental equation of the model. The last conclusion will not change because it is derived from the denominator of the growth equation.

So, the main conclusion of the model is that, there is a inverted U relationship between growth and inequality; when the inequality is below the critical level, higher inequality results in higher growth, and when the inequality is above this threshold higher inequality results in lower growth. In addition, higher the sensitivity of income with respect to efforts and higher is the risk loving, then higher is the volatility of growth rate.

The model can be analyzed also in a game theoretical approach. This will be discussed in the following section.

7. A GAME THEORY VERSION

In this section, the model will be analyzed in a game theoretical framework. The fundamental assumptions of the model will hold again with only difference of introducing a social planner. The social planner announces the inequality index at the beginning of each period. This announced index reflects the income distribution in the previous period. The individuals strategically react according to the announced inequality index. If they think that the income distribution is "fair", the inequality index is below the threshold then they increase their efforts in the current period and vice versa.

The point is that individuals are only able to recognize whether their own economic conditions are improved or not, so they can not perfectly forecast the Gini index at any period. Therefore they have to, in a sense, trust the social planner. The social planner on the other hand, knows the real inequality index and may manipulate it by announcing a lower level, for instance, in order to accelerate the growth, since he knows that people will increase their efforts only if there is not a deteriorating inequality. At the end of current period individuals will understand,

by backwards induction, whether the announced level was the true value or not. The social planner might be either a "growth focused" one or an "equality focused" one. A "growth focused" social planner will not manipulate the inequality index when it is low, but it will manipulate when it is high in order to accelerate growth. On the other hand, the "equality focused" social planner will manipulate the index when it is low, in order to decrease the degree of competition and provide an equal distribution. However, individuals do not have information about the type of social planner, and they make their evaluations at the end of the period by looking at the results, and they will only consider whether the social planner is an "honest" one or not.

Here there is a need to develop a signaling mechanism. The basic intuition that will be used is that when there is a high inequality is announced people will decrease their efforts, as explained before, due to pessimistic perceptions of lower class and optimistic perceptions of upper class, and vice versa. However the outcome will also depend on the real level of inequality also.

If the inequality is really at low levels and if it is correctly announced then there will be a sharp increase in the growth rate, because of the mechanism inherent in the model. On the other hand, if the inequality is announced low when it is in fact high, then the efforts will again increase but the increase in growth rate will be moderate. The reason is that although lower class members are raising their efforts, due to high inequality in distribution of chances, skills and so on, they will not effectively get the

fruits of their efforts.

By same reasoning, when the inequality index is really high and truly announced, individuals will decrease their efforts and the decrease in the growth rate will be sharp. Finally, when the inequality is high but announced as "low", the decrease in growth rate will be moderate. Thus, individuals will have a perception of "honest" social planner when the changes in growth rate are dramatic and they will have a perception of "dishonest" social planner when the changes are "moderate".

The summary table of these explanations will be:

Type of Social Planner	**Real Inequality Index**	**Announcement**	**Efforts**	**Growth Rate**
Growth Focused	High	Low	↑	↑(Moderate)
Growth Focused	Low	Low	↑	↑(Sharp)
Inequality Focused	Low	High	↓	↓(Moderate)
Inequality Focused	High	High	↓	↓ (Sharp)

However, as seen from the table, in fact both "growth focused" and "equality focused" social planners are behaving "honestly" or "dishonestly" on purpose depending on the real value of the inequality index. Since the individuals make their evaluations at the end of the period, they can not determine the type of the social planner at the beginning of next period by just considering the announcement. At the end of period, they will classify the social planner as an honest one when the change in the income is sharp and a dishonest one when the change is moderate. Even if they classify the social planner by being either honest or dishonest, it will not be the proper classification. Therefore, the outcome explained above is valid for only the initial stage of this game. In repeated games, the outcome will depend on the portion of the individuals trusting the accuracy of the announcement. If they had known the fact that social planner is either growth focused or inequality focused, they could use the announcement as a signal because the growth focused one always announce "low" inequality index, and the inequality focused one always announce "high" inequality index. Nevertheless, this signaling process is of no use for individuals because both types of social planners may manipulate the inequality index. Thus, because of this

asymmetric information and not working signaling mechanism it is not possible to determine a stable solution in this repeated game.

CONCLUSION

The relationship between the inequality and economic growth can not have a clear-cut answer because almost every economic factor that affects inequality also effects economic growth, not necessarily in the same or the opposite direction. Increase in international trade for instance causes expansion in economic value of output if Marshal Lerner condition holds, and it increases the wage inequality if the country has a skill based export sector, such as high tech production, but it decreases inequality if the export goods are not skill based. In either case the

rigidities about prices and wages also matter. Therefore the conditions specific to the country, which is growing due to increased international trade, will determine whether trade-driven growth results in more inequality or not.

Wealth and redistribution arguments also can not provide a clear-cut answer, since the saving behaviors of different classes might differ, and therefore the initial distribution of income and the degree of redistribution will determine the direction of the relationship between growth and inequality.

Thinking in terms of the phases of business cycles, one may argue that total output might be volatile both in recession periods and in boom periods. Therefore, there is no clear conclusion considering macroeconomic volatility aspect of the relationship between inequality and growth. Even if there is a positive correlation between volatility and inequality, volatility might be caused by speedy expansion or speedy recession.

This list can be extended further. Thus, I think researchers found contradicting results in different countries because of the uniqueness of country specific conditions and complexity of the interactions between factors determining both inequality and growth.

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