RESEARCH PAPER

Testing Piketty's Hypothesis in Analyzing Factors Affecting Income Inequality in Iran: Stock-Flow Consistent (SFC) Approach

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Abstract
Reducing inequality and establishing social justice by balancing the distribution of income and wealth is one of the main concerns of economic policymakers which has been emphasized in the constitution in Iran. Explaining the relationship between inequality and its causes has been one of the most challenging areas of economic debate in the recent decades; despite extensive research in this area, there are still many ambiguous issues in this regard. In recent years, new hypotheses have been proposed by the French economist, Thomas Piketty on the main causes of the spread of inequality. In his analysis, he considers the gap between the rate of return on capital and the rate of economic growth (r-g) to be the main causes of inequality. However, despite providing logical explanations consistent with changes in inequality patterns, he has not conducted any empirical tests for its scientific-theoretical chain. Therefore, these question arise as to how empirically verifiable the Piketty hypothesis is and is it able to explain the increase in inequality of different countries? For this purpose, a Stock-Flow Consistent (SFC) model was used as a first model in the present study to investigate the relationship between inequality and growth in a macroeconomic framework of Iran. This model tests the conclusions and Piketty assumptions for the Iranian economy when changing key parameters. The results of this model showed that under certain circumstances with decreasing growth rate, income inequality increases. However, the analysis proved that there are no inevitable conditions under which a reduction in the growth rate will lead to a sharp increase in the level of inequality.
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Introduction

Understanding the nature of the relationship between inequality and the growth of economic activity has always been of interest to economists, especially the public sector and development economists. This relationship is the source of the emergence of a wide range of schools in the history of economics. The type of attitude towards inequality and the reasons for its existence have been changed and revised many times during the last century, and this change in attitudes has also changed the duties and responsibilities assigned to governments. Although several theories of inequality have emerged in recent years; But the latest theories and the most comprehensive study of inequality are presented by the French economist Thomas Piketty (2014) in Capital in the 21st Century (Krugman, 2014; Summers, 2014).

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On the other hand, reducing inequality has always been one of the main concerns of social reformers and policymakers and is considered as one of the main problems in many developed and developing countries. In Iran, the issue of inequality is doubly important for various reasons; the development and realization of social justice and reduction of inequality have been one of the most important ideals of the Islamic Republic over the past few decades, but despite efforts in this area, governments have not been able to achieve their goals of reducing inequality. Central Bank statistics show that in Iran in 2016, inequality reached its highest level in recent years.

Statistics from the International Monetary Fund (2014) also show that inequality in income distribution has increased over the last three decades in both developing and developed countries. The increase in inequality can be due to the lack of knowledge of the factors affecting it and as a result, the implementation of inappropriate programs by policymakers. Therefore, the question arises that what factors affect inequality. In this regard, economists such as Piketty have tried to re-examine the factors affecting inequality and to this end have proposed new theories.

Piketty (2014) in his analysis has identified the main cause of income divergence as the gap between economic growth and the rate of return on capital. This means that when economic growth is low and capital returns are high, it will concentrate wealth and increase income inequality. On the other hand, Piketty (2014) in most of his analyzes introduced government intervention in the economy as a positive factor to reduce inequality and defended the increase of government intervention in the economy and therefore the progressive tax on capital as a force reducing inequality Recognizes. However, the fundamental questions in this regard are whether the Piketty hypothesis in the Iranian economy is confirmed? Is the gap between the rate of return on capital and economic growth the main cause of inequality in Iran? In addition, can a progressive tax reduce inequality in Iran?

This study tries to answer the above questions in the context of macroeconomics of inequality and using the Stock-Flow Consistent (SFC) model. In the continuation of this research, in the second part, the theoretical foundations and in the third part, the research model are introduced. Section 4 is devoted to the results and their analysis. Finally, in the last part of the study, conclusions and policy proposals are presented.

Theoretical Literature

Piketty's Perspective

Piketty (2014) in his influential book "Capital in the Twenty-first Century" proposes the idea that, whenever the difference between the return on capital (r) and the growth rate of output (g) increases, the share of capital in national income increases. Also, since capital income tends to be more inequitably distributed than labor income, an increase in the share of capital is likely to lead to an increase in inequality in total income (and, over time, wealth), both of these relationships are acceptable. According to Piketty (2014), in general, the dynamics of wealth distribution show strong mechanisms that alternate between convergence and divergence, and there is no dominant spontaneous and natural force in this rotation. On this basis, Piketty in his book Capital in the 21st Century proposes his main theory by proposing two laws called the fundamental laws of capitalism:

The First Fundamental Law of Capitalism

In the first fundamental law of capitalism, capital stock is related to the flow of capital

income. The ratio of capital to income is related by simple equations to the share of capital in national income in the form of Equation (1) (Piketty, 2014).

$$\alpha = r \times \beta \tag{1}$$

where α is the share of capital in national income, r is the rate of return on capital, and β is the ratio of capital to income.

By definition, this relation can be applied to all societies in all eras. Although this relationship is simple to explain, it should be considered as the first fundamental law of capitalism, because it connects three important concepts for analyzing the capitalist system. The concept of rate of return on capital is measured over a year, regardless of its legal form (profits, rents, dividends, interest, copyright, capital gains, etc.), expressed as a percentage of the value of invested capital, and a broader concept of profit rate and much wider than interest rates. This concept links interest rates and Profit rates (Piketty, 2014).

In the first fundamental law of capitalism, ie $\alpha = r \times \beta$, α represents the share of capital income and β represents the ratio of capital to income. This equation states that the share of capital income is equal to the product of the interest rate multiplied by the ratio of capital to income. As Piketty points out, this equation is a mere accounting union. Nevertheless, Piketty claims that an increase in β is likely to lead to a further increase in α because "the effect of capital accumulation will outweigh the decrease in return on capital." This sentence contains one of the main points of the book: due to the Intense accumulation of capital and low growth, the ratio of capital to income has increased, and as a result, the share of capital income will increase. "With this effect, workers, therefore, receive a smaller portion of the total national income cake" (Piketty, 2014).

The Second Fundamental Law of Capitalism

Piketty introduces the second fundamental law of capitalism as a relation (2) in the book Capital in the Twenty-First Century:

$$\beta = \frac{s}{g} \tag{2}$$

where β is the ratio of capital to income, s is the savings rate and g is the economic growth rate.

Piketty believes that this relationship, as the second fundamental law of capitalism, reflects an important fact that a country with more savings and less growth will accumulate large amounts of capital in the long run. Which will ultimately have a significant effect on the social structure and distribution of wealth. Piketty considers the following principles for the implementation of this law:

– Principle One: Accumulating wealth is time-consuming. It takes several decades for the $\beta = s/g$ rule to be established. For example, with a savings rate of 12% and starting from zero capital, it takes 50 years to save the equivalent of 6 years of national income.
– Principle 2: The law $\beta = s/g$ is valid when it focuses on the forms of capital that humans can accumulate.
– Principle 3: The law $\beta = s/g$ is valid when the prices of assets change on average in the same direction as the prices of consumer goods.

Interpretation of Piketty Theory

Piketty (2014) argues based on a standard growth model that patterns of wealth and income concentration are defined by the actual difference in return on capital (r) and growth rate (g). Here is a very simplified concept of the Piketty model and its implications, as proposed by (Góes, 2016); In a closed economy where national income *(Y)* is a function of capital *(K)* and labor *(L)* As $Y_t = K_t^\alpha L_t^{1-\alpha}$, the real return on capital is defined by the final output of capital equal to $r \equiv \frac{\partial Y_t}{\partial K_t}$. Since $r = \frac{\partial Y_t}{\partial K_t} = \alpha \frac{Y_t}{K_t}$, Therefore, the share of capital in national income (α) can be shown as a function of the real rate of return on capital (r). This is the basic definition of what Piketty calls the "first fundamental law of capitalism":

$$\alpha = \frac{rK_t}{Y_t} \tag{3}$$

If the capital stock increase equation is $K_{t+1} = (1 - \delta)K_t + sY_t$ where s is the fixed rate of savings and δ is the rate of constant depreciation, and the rate of population is constant and $Y_{t+1} = (1+g)Y_t$, In which case in the steady-state $\frac{d}{d_t}\left[\frac{K_t}{Y_t}\right] = 0$, which means that:

$$\dot{K} = \dot{Y} \ , \quad \frac{K_{t+1} - K_t}{K_t} = \frac{Y_{t+1} - Y_t}{Yt} \ , \quad \frac{sY - \delta K}{K_t} = \frac{gY}{Yt} \ , \quad \frac{\bar{K}}{\bar{Y}} = \frac{\bar{s}}{\bar{g} + \bar{\delta}} \tag{4}$$

Where the load sign (-) indicates the variables in a steady-state, and the dot sign (.) Indicates the growth of the variables. Piketty defines all its variables in net terms, including that the depreciation rate must be deducted from income, capital, and savings rates. Although both states are equivalent in the steady-state (Krusell and Smith, 2015) and most standard textbooks use these variables in gross terms; but it is better to consider the depreciation clearly. By placing equation (3) in (4) what Piketty calls the "second fundamental law of capitalism"; That is, there is an inverse relationship between the share of capital in national income and economic growth:

$$\bar{\alpha} = \frac{\bar{r}\bar{s}}{\bar{g} + \bar{\delta}} \tag{5}$$

Given that the net savings rate is somewhat constant. Piketty argues that the share of capital in national income, income inequality, and wealth inequality are increasing functions of *r-g*. If this Piketty statement is true, it is expected that changes in the share of capital and inequality can be explained by past and present changes in the gap between *r* and *g* (or, as in the textbook model, between *r* and *g+δ*). Piketty argues that capital income has a more unequal distribution than labor income, so a larger share of capital in national income will also lead to increased income and wealth inequality (Piketty, 2014).

However, the full importance of the increase in *β* becomes apparent only when combined with the first fundamental law of Piketty capitalism and a key relation of inequality. The first fundamental law states that the share of capital income in total national income (*α*) is equal to the real rate of return on capital (*r*) multiplied by *β*. Now if the rate of return on capital remains permanently above the rate of economic growth (*g*) (a case of the key Piketty inequality *r>g*), then *α* increases by definition. This, together with the increase in *β*, arbitrarily brings the share of capital in national income closer to one. This process has a positive feedback loop: as α increases, not only will capitalists become richer, but more investment will be possible for them, unless they consume their entire return on capital. Increasing savings, in turn, causes the rate of capital growth to exceed the rate of growth of national income and increase *β*.

Thus, not only β leads to more α, but higher α also leads to higher β. This, in short, is how Piketty considers dynamic performance. The fact that β is increasing in advanced economies must be taken into account and it must be combined with a definite relation that $r > g$. This process creates a functional distribution of income in favor of capital, and if capital income is more concentrated than income from labor (a relatively undeniable fact), the distribution of personal income will be more unequal, which is what has been seen so well for the last thirty years.

However, these inequality relationships depend on the $r > g$ model. If $r=g$, then capital and national income increase at the same rate, β is stable and the share of capital in total production is constant. Therefore, whether the Piketty approach persists or is rejected, it needs to be clarified whether the available evidence for this idea is strong enough. The second fundamental law concerns the long-term determination of β. The basic theory of growth states that in a steady-state the ratio of capital to production will be equal to the savings rate divided by the growth rate of the economy. Thus, the (long-term) β equilibrium can be determined, which may vary between countries. This is a condition of equilibrium and is not like the first fundamental law of an accounting union.

This argument has attracted the interest of many researchers and policymakers. For example, Krusell and Smith (2015) critique the second fundamental law. This is because it indicates savings behavior that is not supported by empirical evidence. Piketty assumes that the net savings rate remains constant as growth slows. This assumption requires the gross savings rate to tend to one and g to zero, which seems quite impossible.

In this regard, Summers (2014), Milanovic (2014), and Stiglitz (2015) point out as a critique of Piketty views that the amount of savings among the rich affects the increase in inequality. If rich people do not save any amount of their income, their wealth will not increase. In this case, even with the increase of wealth, if the return on capital remains constant, the income from wealth will not increase from one period to another. Therefore, according to Hartley et al. (2020), the relation $r>g$ Piketty should be written as $sr>g$, in which it is ($0 \leq s \leq 1$) and determines the amount of savings of the rich.

Therefore, one strategy to prevent rising inequality in low-growth, zero- and negative-growth economies is to reduce the savings rate (s). If s is low enough, the increase in income inequality will stop. In this case, the fundamental relation will be $s < g / r$. For economies with slow or declining growth, rising inequality can be avoided if the savings rate decreases with the growth rate (Jackson and Victor, 2016).

In the case of zero growth, $g=0$, this means reducing the savings of the rich to zero, so that regardless of the rate r, the wealth of the rich is not increased and their income does not increase. With negative growth, $g<0$, a negative savings rate (while r remains positive) is needed to establish $sr<0$ and prevent further inequality. Negative savings rates also require wealthy people in society who spend their wealth faster than they earn. The global wealth tax can also be in this direction, where the tax rate, t, is greater than the difference between the rate of return on wealth and the rate of growth ($t> r-g$). In this case, the net return on wealth becomes negative, resulting in a decrease in both total wealth and wealth income.

Jones (2015) stated that Piketty's expectation of increasing wealth inequality is based on uncertain assumptions that changes in r do not lead to changes in g, or that net savings rates do not change over time. Mankiw (2015) argues that, in order to increase wealth inequality continuously (what is called the "endless inegalitarian spiral"), r must be about 7% per year greater than g to explain consumer behavior, intergenerational wealth distribution, and wealth taxation.

Economists' Views on Piketty Hypothesis

The most important relationship of the book Capital in the 21st Century is "Inequality grows

if the rate of return on capital is higher than the rate of economic growth" (Piketty, 2014). However, why is the return on capital higher than the growth rate? Piketty explicitly states that this is a historical fact, not a logical necessity. McCloskey (2014) also states that the return on capital is usually higher than the rate of economic growth and the share of capital income in national income is increasing. However, Rognlie (2014) shows that, in theory, endogeneity r and standard estimates of the elasticity of labor and capital generally do not guarantee that rates of return on capital will continue to grow.

Ng (2015) shows that the claim (the effect of a higher rate of return on capital than the rate of growth on inequality) is not valid. In his view, even when the rate of capital growth is higher than total income, another additional necessity must be considered, and that is that savings from non-capital income are not greater than consumption from capital income. In addition, the share of capital income in total income may not increase when the rate of return decreases, and non-capital income may increase with the accumulation of capital. Therefore, according to different societies and times *(r-g)* can have different effects on inequality.

Milanovic (2014) states that Thomas Piketty has provided a very rich and new framework that allows us to analyze rising inequality not as a phenomenon as in the past but on the merits and demerits of individuals to earn more. - can be looked at; rather, rising inequality must be seen as part of the natural changes of modern capitalism. For him, however, Piketty may have acted contrary to one of the fundamental rules of economic theory: and that is the No reduction the Returns of the abundant factor of production.

According to the neoclassical production function, the equilibrium rate of return on capital (r) is derived from the final production of capital, so Van Treeck (2015) poses the question of whether an increase in the ratio of capital to national income (β) leads to a decrease. Return on capital (r) and thus not reduce the share of capital income from total income? to these questions, Piketty argues that the main issue is not the decline in final capital production versus the increase in capital accumulations, but the rate of decline. Therefore, the important point is how much the return on capital (r) decreases as the ratio of capital to income (β) increases.

There are two possible scenarios here: If the rate of decline in return on capital, r, is greater than the rate of increase in the ratio of capital to income β, then the share of capital income in total income (ie $\alpha = r \times \beta$) decreases with increasing β and reduces inequality will be. Conversely, if the rate of decline in return on capital is less than the rate of increase in the ratio of capital to income, then the share of capital in total income increases with increasing β and increases inequality. In this case, reducing the return on capital only acts as a pressure reliever to increase the share of capital, but cannot reduce the share of capital (Piketty, 2014). However, Van Treeck (2015) in the context of a post-Keynesian model and in the context of national accounting states that the gap between r and g depends on specific conditions in the economy.

If the Gross Domestic Product (*GDP*) segment is defined as (6):

$$Y = C_L + C_P + I + G + (X\text{-}M) \tag{6}$$

Where *CL* is wage consumption, *CP* is capital income consumption, *I* is private investment, *G* is government final demand and (X-M) is net exports. National income can also be written as a relation (7):

$$Y = L^{net} + \pi^{net} + T \tag{7}$$

where L^{net}, π^{net} and T are post-tax wages, post-tax profits and government tax revenue, respectively. From the equality of Equation (6) and (7), Equation (8) is obtained:

$$\pi^{net} = C_p + I + (C_L - L^{net}) + (G-T) + (X-M) \tag{8}$$

If productive capital grows by the same amount of income, Equation (8) can also be written as (9):

$$r - g = \frac{C_P}{K} - \frac{S_L}{K} + \frac{G-T}{K} + \frac{X-M}{K} \tag{9}$$

Equation (9) is the starting point for post-Keynesian models of distribution and growth, referring to the macroeconomic conditions that are required to allow profit rates ($r = \pi^{net}/K$) to increase relative to growth rates ($g = I/K$) does.

So increase (r-g) to increase consumption of capital income (C_P) to capital share, or decrease savings from wage income ($S_L = L^{net} - C_L$) to capital share, or increase budget deficit (G-T) to share Capital or increase in net exports (X-M) depends on the share of capital.

Piketty considers economic growth to be the only natural compensatory factor ("natural" means "without government intervention"); if the economic growth rate is high, the relative growth rate of large assets will remain relatively modest and will not be much higher than the average income growth rate. This is a point that Milanovic (2016) also emphasizes. Milanovic shows that inequality has halved when real incomes have quadrupled.

In this regard, Hiraguchi (2019) using the overlapping generations model (OLG) with continuous capital accumulation and the possibility of constant death of agents, shows that the r-g gap and wealth tax are closely related to wealth inequality. In the steady-state if the Cobb-Douglas production function is $f(k) = k^{\alpha}$, where $\alpha \in (0, 1)$ and $r = \alpha k^{\alpha-1}$. In this case, $c_1(k)$ and $c_2(k)$, which refer to the consumption of the first and second generations, respectively, are expressed as relation (10):

$$c_1(k) = n(\rho + d) \frac{k}{\alpha k^{\alpha-1} - g - \tau - \rho - d} \tag{10}$$

$$c_2(k) = k^{\alpha} - (g + \tau + n)k$$

Where d is the probability of death by the Poisson distribution, ρ is the discount factor; τ is the consumption tax rate. In this case, the function $c_1(k)$ is incremental and convex and the value of $c_1(0) = 0$, and similarly the function $c_2(k)$ is concave and the value of $c_2(0) = 0$. Which are equal at one point $c = c_1(k)$ and $c = c2(k)$ and have a common point and unit. To determine $\bar{r}$-g along the balanced growth path (BGP), the quadratic equation (11) must be solved for x:

$$\{x + (1 - \alpha)(g + \tau) - \alpha n\}(x - \rho - d) = \alpha n(\rho + d) \tag{11}$$

where r-g is a strictly decreasing function of g and τ. Prove it as follows: As $f(k)/k = k^{\alpha-1} = r/\alpha$, in equations (9) and (10) if $c_1(k) = c_2(k)$, the result:

$$(r/\alpha - g - \tau - n)(\bar{r} - g - \rho) = nd(\rho + d) \tag{12}$$

Therefore, $\bar{r} - g$ is the solution of Equation (11). In Equation (11), if g and $x(= \bar{r} - g)$ increase together, the left side increases while the right side is constant, which is impossible. The result will be $\frac{d(\bar{r} - g)}{dg} < 0$, which is also true for τ. Thus, it is proved that when the economic growth rate decreases, the r–g gap also widens, which is consistent with Piketty (2014) forecast.

Contrary to Piketty's theories, a recent study by Rubin & Segal (2015) found that in the

United States for the period 1953-2003, the relationship between economic growth and inequality was positive and that high-income groups were more sensitive to economic growth. Jackson and Victor (2016) also show that it is possible to reduce inequality in low economic growth rates. In this regard, Jones (2015) in the framework of a neoclassical growth model claims that r-g gap, tax τ and population growth can affect inequality only in conditions of partial equilibrium and in general equilibrium cannot have the expected Piketty results.

To investigate Pareto inequality in general equilibrium, Jones considers the production function as $Y_t = A_t K_t$. Where $A_t = \bar{A}$ is constant over time and capital is accumulated endogenously ($\dot{K}_t = Y_t - C_t - T_t - \delta K_t$), where C represents total consumption and $T_t = \tau K_t$, total tax revenue. It is also assumed that taxes levied on the economy will not be reused and that interest rates generally create equilibrium. Without referring to the details, the main result is expressed as relation (13):

$$r - g - \tau - \alpha = \bar{n} \tag{13}$$

where α is the share of consumption of wealth and $\bar{n}$ is population growth in general equilibrium. The first result of the Euler standard equation for the standard neoclassical growth model is r-$g = \rho$. Where ρ is the time preference rate and the interest rate moves with a certain growth rate and r-g is constant. Thus, the wealth inequality (η) in the general equilibrium is equal to:

$$\eta = \frac{\bar{n}}{\bar{n}+d} \tag{14}$$

where d is the probability of death with the Poisson distribution. Another feature of Equation (13) is that the tax rate does not affect long-term inequality. The second result is that since r-g-τ-α is the normalized rate of growth of individual wealth, this rate of growth is equal to the rate of population growth $\bar{n}$. For this reason, r-g -τ- α=n is required for general equilibrium.

From this relationship, it can be concluded: if there is no population growth in the model, each child will inherit the amount of capital per capita in the economy, and the accumulation of wealth by individuals over time will be exactly equal to the per capita wealth growth that children inherit. As a result, there will be no inequality in the model. Thus, only in a state of partial equilibrium does an increase in population growth rate ($\bar{n}$) reduce Pareto inequality (due to a reduction in the concentration of wealth by more children).

Piketty and the Role of Government

According to Piketty (2014), one of the important forces to reduce inequality is the progressive tax on capital and increase government activity in the economy, which is criticized by a number of economists.

Facchini and Couvreur (2015) state that Piketty, like many theories of government failure in the economy, accuses the market of being inadequate instead of inefficient, and argues that the market economy is unjust because it does not have a controlling mechanism against inequality. In other words, the market economy has no convergent forces versus divergent forces distributing wealth. On the other hand, the literature shows that government spending, especially social (redistributive) and public spending, has had a negative effect on *GDP* growth. If these results are correct to establish the characteristic that the *GDP* growth rate will eventually decrease and the gap between r and g will increase; It is very important (Facchini and Melki, 2013).

Contrary to Piketty's theory, according to Hiraguchi (2019), consumption tax is better than wealth tax to reduce inequality, because it does not reduce fixed capital consumption as well

as consumption tax. Mankiw (2015) in the form of a simple neoclassical growth model based on equations (15) to (19) shows a better way to reduce the inequality of progressive consumption tax. Because this tax can raise the living standards of workers and capitalists, without weakening the accumulation of capital. Given that in a steady-state economic situation the equations are as follows:

$$c_w = w + \tau k \tag{15}$$

$$c_k = (r - \tau - g)\, nk \tag{16}$$

$$r = f\,'(k) \tag{17}$$

$$w = f(k) - rk \tag{18}$$

$$g = \sigma\, (r - \tau - \rho) \tag{19}$$

where C_W is the consumption of each worker and C_K is the consumption of each capitalist, w is wages, r is the rate of return on capital (before tax), k is the per capita capital of each worker, n is the number of workers (so nk is the capital stock), $f(k)$ is a function Production is for output (net depreciation), g is the rate of incremental technological change in labor, and consequently the rate of economic growth is steady-state, σ is the elasticity of substitution, and ρ is the rate of time preference. Equation (19) is also derived from the Euler equation of capitalism; which relates the growth rate of capitalist consumption (which in a steady-state is g) to the rate of return on taxes.

Since the return on capital in steady-state this economy is $r = \frac{g}{\sigma} + \tau + \rho$, the condition $r > g$ arises naturally. But even in this economy, even if $r > g$, there is no "endless inegalitarian spiral" that Piketty refers to. Instead, there will be a level of inequality in the steady-state (by optimizing sufficient capitalist consumption to prevent a faster increase in wealth from labor income).

If c_w/c_k is used as a proxy for inequality, increasing the number of workers (n) will make capitalists enjoy a higher standard of living. So the more equal the result, the higher the c_w/c_k ratio. In this case, the level of capital tax now depends on the objective function of the government. In this model, if the government wants to maximize the consumption of workers (C_w) according to the limits (15) to (19), it must choose $\tau=0$ (which is also mentioned in the optimal financial literature).

In this economy, because capital taxes reduce capital accumulation, labor productivity, and wages, taxes are not desirable even for workers who have no capital and for whom capital subsidies are provided. Conversely, if the government in this economy is concerned only with the welfare of capitalists, then it chooses τ to maximize c_k. But if maximizing the C_W/C_K ratio is the government's only goal, capital taxes should be raised as much as possible. However, a tax on capital and the constant transfer of income to the workers reduce the steady-state of both the workers and the capitalists, although they impoverish the capitalists more rapidly.

Thus, in a simple neoclassical growth model, a capital tax is less recommended if only the level of consumption is important to the government, while a capital tax can be useful if the government is concerned about the difference in the level of consumption between the capitalist and the workers. Facchini and Couvreur (2015) emphasize that the type of inequality in regulated and unregulated markets cannot be compared because inequality in regulated markets is the result of rent accumulation but in regulated markets inequality is the result of profit accumulation. In this sense, high tax rates are a form of rent-seeking activity that reduces economic freedom.

The question now is whether (ultimately) the cause of inequality is government forces or the market. And what is the role of government in creating and distributing wealth in the 21st century? Piketty (2014) and a number of other pro-government economists cite the liberalization of the economic system around 1980 as one of the reasons for the slowdown in economic growth and the consequent increase in inequality. But if this issue is analyzed according to the Piketty theoretical framework, market forces are not the solution to divergent forces, but government forces may be the most important cause of divergence. For example, Facchini and Couvreur (2015) argue that the dissemination of knowledge and skills (which in Piketty's view is a convergent force) is not necessarily "public goods," so if they are produced by the private sector, then the market forces are convergent forces.

There is also no assurance that the inequality factors mentioned by Piketty are due to the market and capitalist system because there is inequality in all societies but not all societies have a free market and a capitalist system. Thus, inequality seems to be the fault of the real economy in all economies. Institutional planning, on the other hand, determines the nature of inequality. However, in Piketty's work, inequality is considered the same in Libya and Switzerland, as well as in the feudal system with the same capitalist economy.

Although in some of them, inequality arises from the pursuit of rent and in others from the pursuit of profit in productive activities. According to rent theories, people can change the distribution of wealth through taxes, direct and indirect subsidies, or by enacting favorable laws in their favor (Facchini and Couvreur, 2015). In this regard, Acemoglu and Robinson (2015) as a general conclusion claim that since Piketty did not consider the systematic role of institutions and political factors in the formation of inequality, so his general laws had little explanatory power as a result, it is impossible to find a correlation between the gap r and g with inequality. This claim has recently been confirmed in a study by Sarkhosh-Sara et al. (2020).

Methodological Framework

The model used in this study is a new approach to macroeconomics developed by Jackson et al. (2014) and Jackson and Victor (2016) and is called SIGMA (Savings, Inequality, and Growth in a Macroeconomic framework). This approach seeks to integrate ecological, real, and financial variables into a single dynamic system. The intellectual basis of this work comes from post-Keynesian economics and in particular the approach known as Stock-Flow Consistent (SFC) in macroeconomics.

The Stock-Flow Consistent approach was created by Copeland (1949) and extensively developed by Godley and Lavoie (2007) and others. The essence of SFC modeling is consistency in accounting for all cash flows, in which the costs of each sector are the income of the other sector and the financial assets of each sector are the debt of the other sector, and changes in the share of financial assets are consistently related to flows within and between economic sectors. In line with the objectives of the research, an initial version of the general approach of the research model is presented as follows:

The SIGMA demand-driven model assumes that the economy is closed and Stock flow is consistent. Therefore, the behavior of savings, inequality, and growth variables is examined in the context of this macroeconomic model. This model has four financial sectors of households, government, banks, and firms as shown in Figure (1): banks and firms accounts are divided between current and capital accounts to investigate potential inequalities in the distribution of income and wealth. The household sector is divided into "capitalists and workers."

According to the SFC literature, it can be said that this model is generally in the Keynesian framework with a demand-driven perspective. The general approach in this model is to create

a level of aggregate demand through an exogenous growth rate g and to integrate the level of investment through an exogenous savings rate S. Therefore, the effects of changes in these variables over time on the share of labor and capital income are examined through an endogenous rate of return on capital r. To achieve this goal, a production function with constant elasticity of substitution (CES) is used. Production or output is not a standard neoclassical model, but by considering the final productivity of R_K for capital K as well as by creating employment related to the given levels of aggregate demand.

As mentioned, the SIGMA model assumes that the amount of income from the country's exports is equal to the cost of imports, and therefore the economy is considered closed in terms of trade with foreign. Next, it is assumed that the government always maintains the budget balance and has no outstanding debt, so that government spending (G) is equal to tax (T), which applies only to households. Finally, a relatively simple equilibrium is applied according to Table (1) and changes in household wealth are introduced under different patterns of capital ownership.
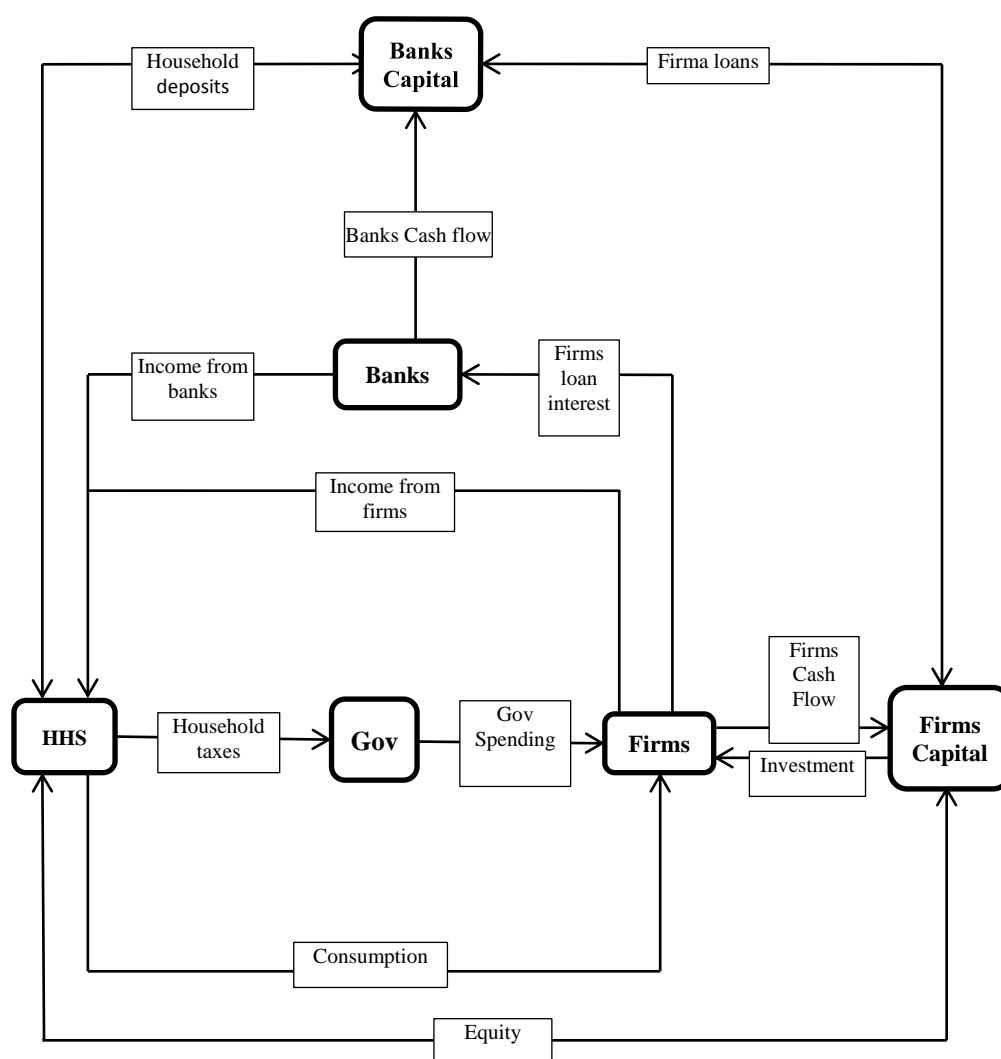
Figure 1. The Basic Structure of the SIGMA Model
Source: Jackson and Victor, 2016.

Household assets are in the form of deposits (D) in banks or as shares (E) in companies. The only other assets/debts category are loans (L) created by banks to non-financial corporations. The banking sector has a relatively direct role as a financial intermediary that provides deposits and facilities for households and loans to firms. Given that these

assumptions are not accurate as a complete description of a modern capitalist economy; more complete versions of the model will be used during the paper.

Table 1. Financial Balance in SIGMA Economic Model

	Households	**Firms**	**Banks**	**Govt**	**Total**
Net financial assets	D + E	-L-E	L-D	-	0
Financial assets	D + E		L	-	D+E+L
Deposits	D			-	D
Loans	-		L	-	L
Equities	E			-	E
Financial liabilities	-	L+E	D	-	L+E+D
Deposits	-		D	-	D
Loans	-	L		-	L
Equities	-	E		-	E

Source: Jackson and Victor (2016).

To examine Piketty theories, the main focus is on national income (*NI*), which can be defined as total income in the economy:

$$NI = W + P + I \tag{20}$$

Where *W* represents wages, *P* represents profits (including rent) and *i* represents net interest received, as well as national income as the total demand of households, companies, and government for goods and services and (net) investment in fixed capital:

$$NI = C + G + I_{net} \tag{21}$$

Where *C* is consumption spending, *G* is government expenditure, and I_{net} is net investment. So the gross domestic product is equal:

$$K = C + G + I \; GDP = NI + \delta_0 \tag{22}$$

Where *K* is the value of accumulated capital, δ_0 is a (fixed) depreciation rate and *I* is gross investment equal to:

$$I = I_{net} + \delta_0 K \tag{23}$$

Since there are two methods for calculating equations (20) and (21), both methods lead to a net national income equal to (24):

$$W + P + i = C + G + I_{net} \tag{24}$$

Profit *P* is generated by non-financial firms and banks. Bank interest P_b simply the difference between interest $i_f = r_l L_{-1}$ if, taken from firms for loans, and interest $i_h = r_d D_{-1}$, paid to households for deposits. Be, is. It is assumed that banks distribute all these profits to households.

Non-financial firms, on the other hand, retain a fixed percentage of r_f their total profits. Retained profits (P_{fr}) are equal to $r_f P_f$ and the rest of the profits, $P_{fd} = P_f - P_{fr}$, are distributed among households. In this case, Equation (24) can be rewritten as Equation (25):

$$W + P_b + P_{fd} + P_{fr} + i_h - i_f = C + G + I_{net} \tag{25}$$

Since $P_b = i_f - i_h$, Equation (24) can also be written as (26):

$$W + P_{fd} + P_{fr} = C + G + I_{net} \tag{26}$$

It should be noted that in this model, banks' profits do not contribute to national income, which only includes firms' wages and profits. In addition, if the household income Y_h^j is defined, with $j \in \{w, c\}$, where w represents workers and c represents capitalists, for each family j there is a relation (27):

$$Y_h^j = W^j + P_b^j + P_{fd}^j + i_h^j \tag{27}$$

Therefore, Equation (25) can be rewritten as Equation (28):

$$Y_h^w + Y_h^c + P_{fr} - i_f = C + G + I_{net} \tag{28}$$

Given that $T = T^w + T^c$ can be substituted for G and $C^w + C^c$ instead of C to the right of Equation (28), by modifying it, Equation 29 is obtained:

$$I_{net} = (Y_h^w - C^w - T^w) + (Y_h^c - C^c - T^c) + (P_{fr} - i_f) \tag{29}$$

The first two expressions in parentheses on the right represent the savings of workers s_h^w and the savings of capitalists' s_h^c, respectively, and the third expression represents the savings of non-financial firms S_f. Accordingly, Equation (29) can be rewritten as (30):

$$I_{net} = S_h^w + S_h^c + S_f \equiv S \tag{30}$$

Where S is the savings of the whole economy. Equation (30) is a special form of the term "fundamental accounting identity" for a closed economy with a balanced budget (Dorman, 2014). In this model, the savings overall evolution is determined by an exogenous savings rate s of national income, so that the net savings in the whole economy are equal to:

$$S = sNI \tag{31}$$

For the purposes of the research, it is assumed that in each scenario s assumes a constant value of s_0. Because the impact of savings on households is significant, the savings rate (S_W) for workers is allowed to change exogenously in different scenarios, so that the savings of working families are equal:

$$S_h^w = s_w(Y_h^w - T^w) \tag{32}$$

In order to establish the total savings expressed in Equation (31), the savings of capitalist families are also determined through the equilibrium relation (33).

$$S_h^c = S - S_h^w - S_f \tag{33}$$

Household savings are distributed between new bank deposits (ΔD) and the purchase of shares from firms (ΔE). For simplicity, it is assumed that the demand for new shares by households is equal to the supply of new shares by firms, which in turn is determined by the optimal ratio of debt to shares in firms. The net savings of each sector divide the distribution

of equity purchases between capitalist and working-class households equally. Therefore, changes in deposits are counted as a residual amount of net savings.

To complete the SIGMA economics model, Piketty theory is defined by defining net national income (*NI*) according to an exogenous growth rate of *g* as in (34):

$$NI = (1+g)*NI_{(-1)} \tag{34}$$

Where *NI* $_{(-1)}$ is the value of the previous period (first lag)) is the variable *NI*. In some scenarios, *g* takes a constant value of g_0 throughout the period (τ) of the scenario, while in other scenarios *g* will decrease uniformly from g_0 to zero over time *t*.

Table 2. Transaction Flow Matrix in SIGMA Economic Model

	Households		**Firms**		**Banks**		**Gov**	**Σ**
	Workers	**Capitalists**	**Current**	**Capital**	**Current**	**Capital**		
Consumption (C)	$-C^w$	$-C^c$	C					0
Gov spending (G			G				$-G$	0
Investment (I)			I	-I				0
Wages (W)	W^w	W^c	-W					0
Profits (P)	$+P^w_{fd}+P^w_b$	$+P^c_{fd}+P^c_b$	$-P_f$	$+P_{fr}$	$-P_b$			0
Taxes (T)	$-T^w$	$-T^c$					T	0
Interest	$+r_d D^w_{-1}$	$+r_d D^c_{-1}$	$-r_1 L_{-1}$		$+ r_1 L_{-1} - r_d D_{-1}$			0
Change in deposits (D)	$-\Delta D^w$	$-\Delta D^c$				$+\Delta D$		0
Change in loans (L)				$+\Delta L$		$-\Delta L$		0
Change in equities (E)	$-\Delta E^w$	$-\Delta E^c$		$+\Delta E$				0
Σ	0		0	0	0	0	0	0

Source: Jackson and Victor (2016) and theoretical foundations of research.

Testing Piketty hypotheses requires that the rate of return on capital be considered *r*. Which in turn helps to bridge the gap between companies' wages and profits from net national income. Like Piketty (2014), the return on capital is first assumed to be determined by the final productivity of capital (r_K).

In the SIGMA model, the final productivity of capital is obtained through the partial differential of the production function with constant elasticity of substitution (CES) as relation (35):

$$Y(K,L,\sigma) = \left(aK^{\frac{(\sigma-1)}{\sigma}} + (1-a) AL^{\frac{(\sigma-1)}{\sigma}} \right)^{\frac{\sigma}{(\sigma-1)}} \tag{35}$$

Where *Y* is the output or production and σ is the elasticity of substitution between labor and capital. *a* is a distribution parameter, and *A* is the coefficient of technology-augmented labour, which is assumed to change over time in the economy due to the growth of labor productivity. Through partial differential Equation (35) with respect to the final productivity of capital r_K is equal to:

$$r_k = \frac{\partial Y}{\partial K} = a\beta^{\frac{-1}{\sigma}} \tag{36}$$

Where β is the ratio of capital to income. This relationship can now be used (37) for return on capital:

$$r_k\, K = a\beta^{\frac{-1}{\sigma}} K \tag{37}$$

Considering the national income (*NI*) instead of *Y* and using the Piketty's first law of capitalism ($\alpha Y = rK$), where the share of capital from national income (α) is determined as relation (38):

$$\alpha = a\beta^{\frac{\sigma-1}{\sigma}} \tag{38}$$

As shown in Equation (38) and pointed out by Piketty (2014), for $\sigma > 1$ (and assuming the capital-to-income ratio is greater than one), the capital-to-income share is an increasing function of the capital-to-income ratio Is. As the ratio of capital to income increases, so does the share of capital in income. Instead, when $0 < \sigma < 1$, the share of capital in income is a decreasing function of the ratio of capital to income. At $\sigma = 1$, a decrease in the rate of return on capital always perfectly offsets the increase in the ratio of capital to income, and the share of income to capital remains constant.

From Equation (38) can be obtained the profit of companies as a relation (39):

$$P_f = r_k K = \alpha NI \tag{39}$$

Equation (3-20) also calculates the income of working-class and capitalist households, and taxes are determined by the rate of external tax on households (and in some scenarios on household wealth). Savings are also determined by equations (31) to (33), so consumption is in relation (40):

$$C^j = Y_h^j - T^j - S^j \tag{40}$$

Equations (25) to (40) help to fully describe the stock-flow consistent in the SIGMA economic model. Table (2) summarizes intra-sectoral flows in a "transaction flow matrix" (Godley and Lavoie, 2007). It should be noted that the sum of the total rows and the sum of the columns in Table (2) is zero and reflects the principles of stock-flow consistency, where the costs of each sector are the revenue of another sector (total rows) and the total revenue and cost (including savings) of each sector. Balance. However, one of these partial equilibria, ie the balance of bank capital accounts, is not specified in Equations (25) to (40), which is in the form of relation (41):

$$\Delta L = \Delta D \tag{41}$$

Although *ΔL* was defined as firms financing demands for *ΔL* and *ΔD* as household savings residual, Equation (41) does not in itself impose itself as a constraint on the model; It emerges as a result of all other transactions in the economy (Godley and Lavoie, 2007). Equation (41) is therefore a useful test for the validity of the whole model.

To reflect the level of inequality in different scenarios, a simple index of income inequality q_y is defined as (42):

$$q_y = \left(\frac{Y_{dh}^c}{Y_{dh}^w} - 1\right) * 100 \tag{42}$$

Where Y_{dh}^c and Y_{dh}^w represent the disposable income of capitalists and workers, respectively. This index is zero when the income of capitalists and workers is the same (ie there is no

inequality) and 100 when the income of capitalists is 100% higher than that of workers. Of course, it can be significantly higher than 100, which will be described in some model scenarios.

This model seeks to open up the dynamics that threaten inequality in the conditions of growth reduction. Therefore, the research model helps to express the systemic dynamics of the relationship between savings, economic growth, investment, and return on capital, and inequality in Iran. Table (3) presents the values used for the model parameters. The study also used Stella software for calibration and simulation.

Table 3. Calibrated Values of Model Parameters

| Variable	Values	Units	Remarks
Initial GDP 2015 At the base price of the year 2011	5946680	Billion Rials	Central Bank of Iran
Initial national income	4166531	Billion Rials	Central Bank of Iran
Initial capital stock (K) in 2015 at a fixed price in 2011	21658999	Billion Rials	Central Bank of Iran
Initial capital to income ratio β	5.19		The capital-to-income ratio is obtained by dividing the initial capital stock by the initial national income.
Initial income share of capital α	42%	%	Tavakolian (2012); Farzinvash et al. (2015)
Initial savings rate s as percentage of national income	21%	%	Average ratio of net private investment to national income in Iran, Central Bank of Iran
Elasticity of substitution σ between labor and capital	It varies between 0.5-5.		In theory, σ can vary between 0 and infinity. Experimental values in the literature typically range from 0.5 (Chirinko, 2008) to about 10 (Pereira, 2003). A value less than 0.5 and a value higher than 5 are suitable to indicate divergent conditions here.
Population	80	Million	The population of Iran in 2016 was about 80 million people.
Workforce as % of population	45%	%	Statistical Center of Iran
Initial workers as % of population	50%	%	Initially there is no distinction between 'workers' and 'capitalists
Initial % of wages going to workers	50%	%	Initially there is no distinction between 'workers' and 'capitalists
Initial % of capital owned by capitalists	50%	%	Initially there is no distinction between 'workers' and 'capitalists
Initial unemployment rate	12%	%	Statistical Center of Iran
Distribution parameter a	Varies		This value is calibrated for each σ according to Eq. $(-T^w) = s_w(Y_h^w S_h^w)$ at time t = 0.
Initial technology augmentation coefficient A0	Varies		This value is calibrated for each σ (and a) using the production function at time t = 0.
Initial growth rate g in reference scenario	3.1%	%	Central Bank of Iran
Initial growth in labor productivity in reference scenario	1.042%	%	Real production growth rate in Iran and Fotros and Dalaei Milan (2017)
Average income tax rate	10%	%	Law of Direct Taxes and Fotros and Dalaei Milan (2017)
Labor share of initial income	53%	%	Abounouri et al. (2014)
firms profit tax rate	25%	%	Law of Direct Taxes and Study of Fotros and Dalaei Milan (2017)

Results and Discussion

Analysis of Results

In the first stage, the realities of the Piketty's 'laws of capitalism' will be examined. For the selected values of the reference scenario, assuming both *s* and *g* are constant, the capital to income ratio (*β*) and the savings-to-growth rate (s/g) ratio are simulated. The results are shown in Figure (2). Figure3 also shows the share of capital in income (*α*) along with the *rs/g* ratio, under the same conditions. According to the obtained results and under the Intended conditions, it is clear that the convergence predicted by Piketty for the Iranian economy occurs, although it is clear that this convergence, in this case, takes about a century.

It is worth noting that in Figure2 the ratio of capital to income *β* clearly converges to the ratio *s/g*. However, Figure3 seems to show that, instead of converging α to the *rs/g* ratio, the *rs/g* ratio converges to *α*. This is due to the special feature of the initial values of the study, i.e. the choice of *σ*= 1. Under these conditions, as mentioned in the previous sections, the rate of return on capital (calculated as the final productivity of capital) moves in a way that exactly offset for the increase in the capital to income ratio as well as keeping the share of capital in the national income constant. Interestingly, this is true even if anything happens to the growth rate.

For example, in Figure4, the growth rate of *g* is allowed to decrease to zero. Therefore, the *s/g* ratio tends to be infinite during the period. As expected, the capital to income ratio *β* increases significantly. For this reason, at the end of the performance period, it more than doubles, i.e. about 8. Nevertheless, this result indicates an important point: despite the establishment of Piketty's second law, *β* does not increase uncontrollably and explosively. More interestingly, according to the result obtained in Figure5, the share of capital in income *α* remains constant once again, because the rate of return *r* decreases rapidly to compensate for the increase in the ratio of capital to income.
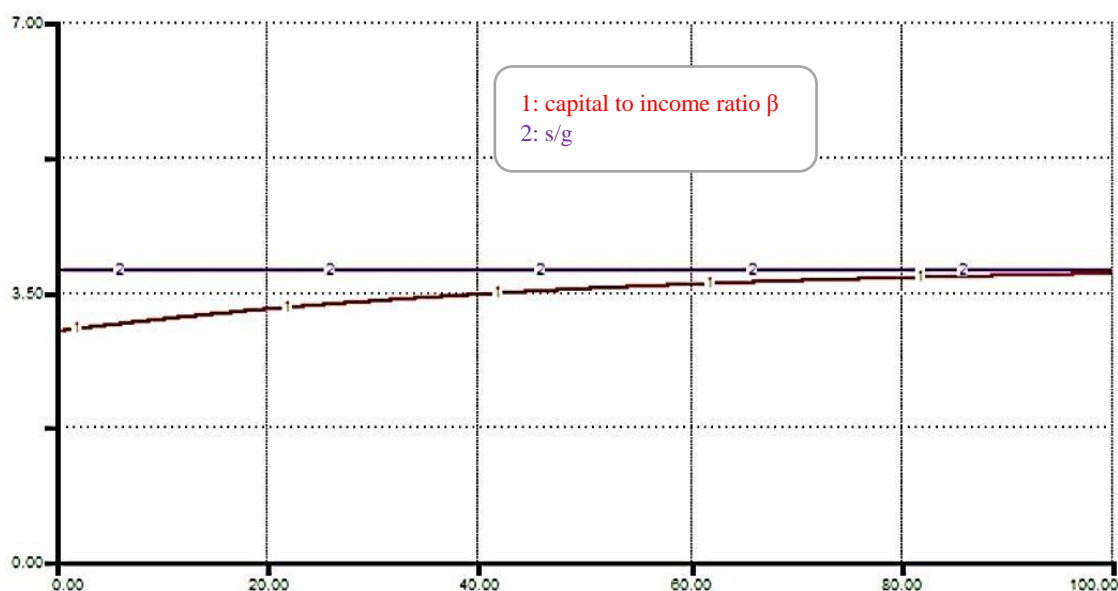
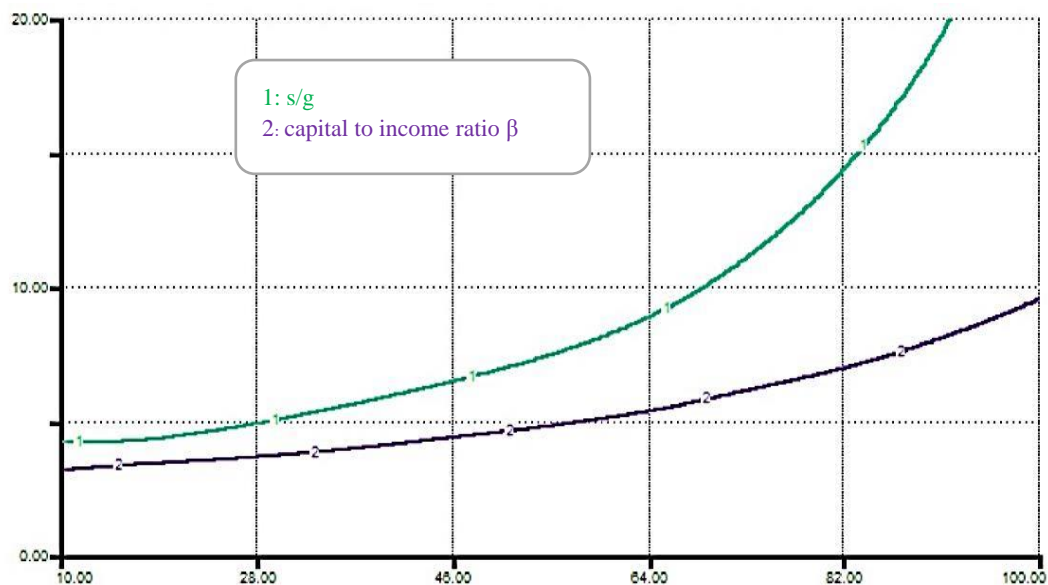**Figure 2.** Long-term Convergence of Capital to Income Ratio with s and g
Source: Research finding.
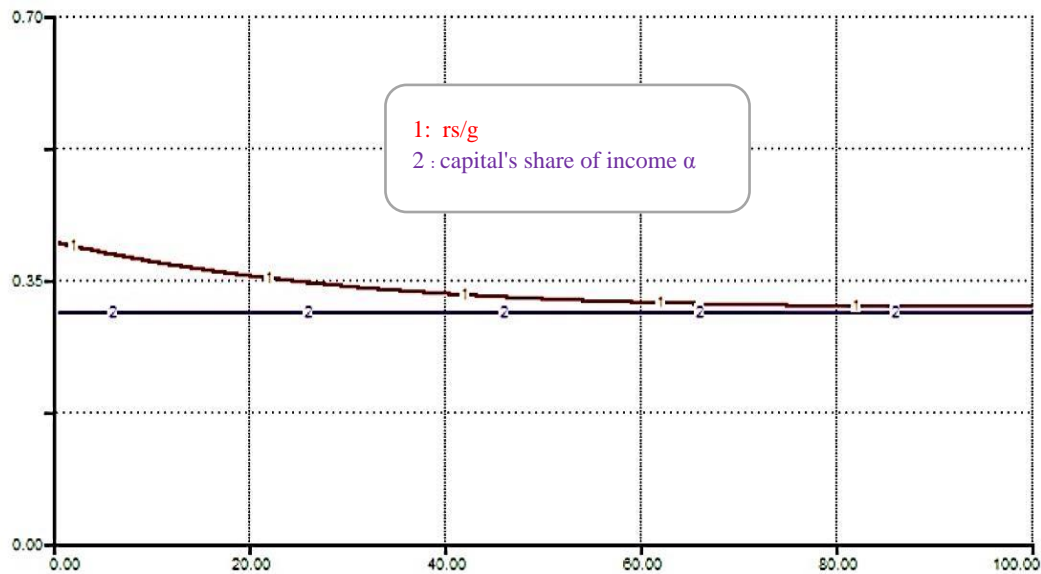
Figure 3. Long-term Convergence of Capital Share of Income with s and g
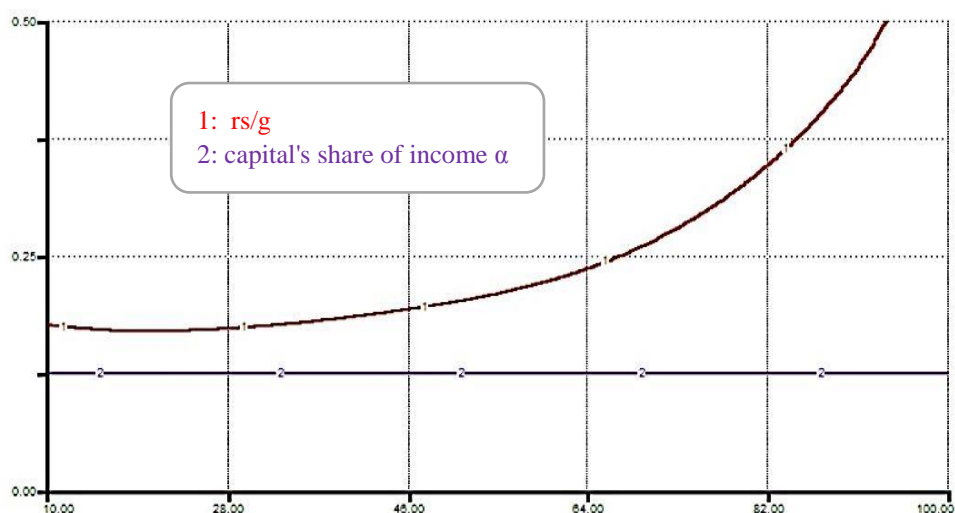**Source**: Research finding.

Figure 4. Long-term Behavior of Capital to Income Ratio When g Goes to Zero (σ= 1)
Source: Research finding.

It should be noted, however, that this non-convergence of α towards *rs/g* is not a refutation of Piketty's law, since g has not been kept constant over time. However, this conclusion is such that it reduces the concern of an explosive increase in inequality as the growth rate decreases.

As shown in Figure5, if the substitution elasticity of σ is exactly one, reducing the growth rate to zero has no effect on the share of capital in national income[1].

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1. This result (fixed share of capital from income) is considered regardless of the hypothetical behavior of the savings rate s. It should be noted that, if the savings rate is allowed to change, there is a wide range of possible changes in the ratio of capital to income. For example, if the savings rate goes to zero with the growth rate, then the s/g ratio to time is fixed. The ratio of capital to income increases very little, but as in the past, the share of capital in income remains constant.
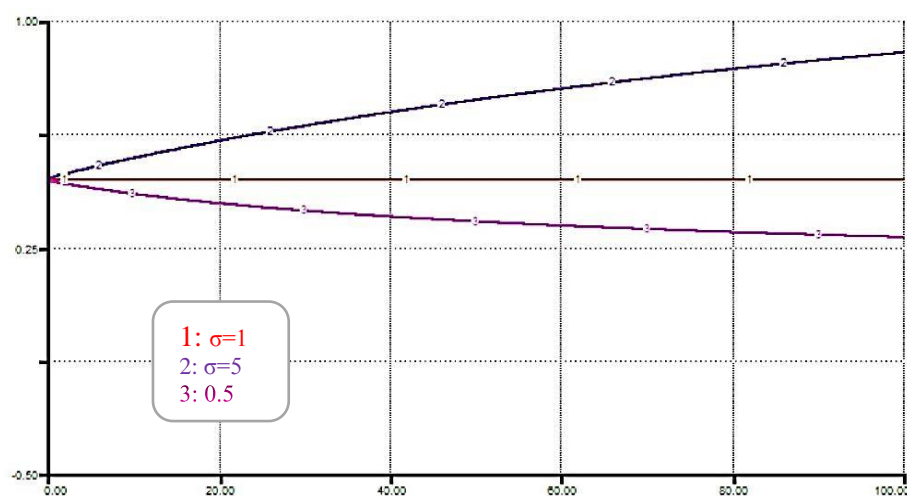
Figure 5. Long-term Behavior of Capital's Share of Income When g Goes to Zero (σ = 1)
Source: Research finding.

However, the stability of the capital share of income is maintained only when the substitution elasticity between labor and capital is exactly one. Figure6 shows the result of the same scenario ($g \rightarrow 0$) for the share of capital from income in three different values of σ: 5, 1, and 0.5. As predicted, according to the results, when the substitution elasticity of σ exceeds one, the share of capital in national income increases. In fact, when σ equals 5, the share of capital approaches 70% of total revenue. Piketty notes that the (less dramatic) increase in the share of capital in the income observed in the data of recent decades is consistent with the substitution elasticity of about 1.3 to 1.6.

In contrast, despite the substitution elasticity of less than 1, the capital share of income decreases over the period, although even *s/g* and *rs/g* tend to be infinite. This is one of the important findings of this study model. Again, there is not necessarily an inverse relationship between declining growth and increasing the share of capital income. Instead, the effect of declining growth on the share of capital in revenue depends primarily on the rate of return on capital, which in turn depends on the technological and institutional structure. In particular, with the elasticity of substitution less than one between labor and capital, and the return on capital according to its final productivity, a decline in economic growth can be accompanied by an increase in the share of labor income.

Figure 6. Long-term Behavior of Capital Share of Income under Variable Succession Elasticity ($g \rightarrow 0$)
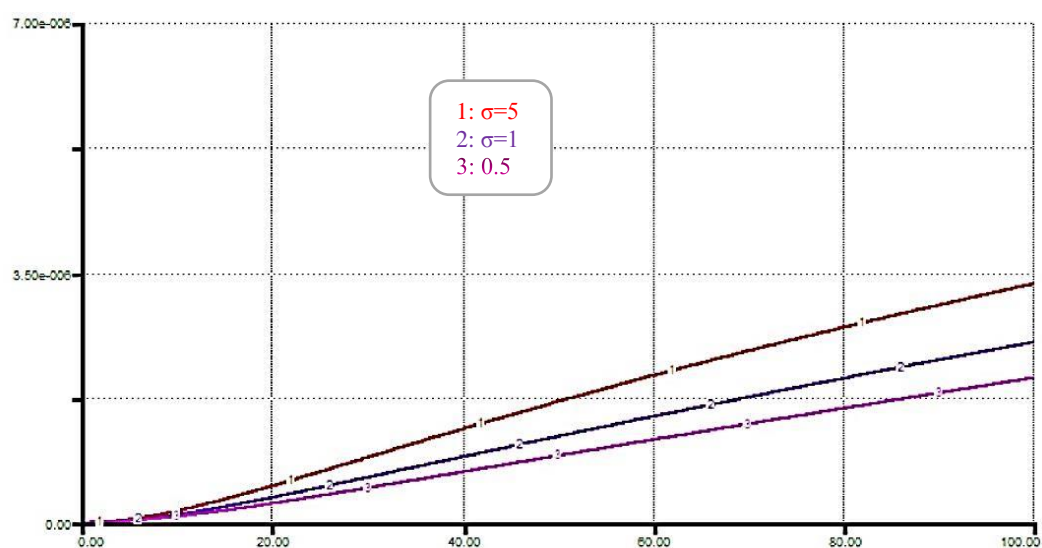**Source**: Research finding.

It should be noted, however, that this theoretical conclusion must be interpreted under the particular conditions of the capital share of income and the distribution of asset ownership. Under the case conditions of this model, both income and wealth are equally distributed among workers and capitalists. For this reason, for all the scenarios identified so far, the inequality index remains unchanged at zero. There is no inequality in such a society, and any change that occurs is for the share of income that will accrue to capital.

Certainly, this is not a very realistic picture of Iran's economy. One thing that is agreed upon is that the distribution of both wealth and wages in today's societies is already skewed and sometimes quite excessively (Jackson and Victor, 2016). One of the dynamic elements of the savings rate is σ. Kalecki (1939) and ONS (2014) have shown that the tendency to save is higher in high-income groups than in low-income groups.

Therefore, it is assumed that for any reason, the savings rate among workers is lower than the national average of Iranian society, and about 5% of disposable income. In this case, the savings rate of the capitalists must be increased (Equation 33) to ensure that the total savings rate in the economy remains at 21%. Figures (7) and (8) show that this seemingly insignificant change has an immediate effect on the trend of income inequality, without reducing the growth rate and with a completely equal distribution of ownership. In Figure 7, income among capitalists by the end of the period is 35% higher than that of workers. This is an interesting confirmation of the structural dynamics of the economy through which capitalism leads to income divergence (Kalecki, 1939; Kaldor, 1956; Wolff and Zacharias, 2007).

At low growth conditions (8), a more interesting result is obtained. In the case of high substitution elasticity σ, inequality between capitalists and workers intensifies. At $\sigma=5$, investors earn 70% more than workers at the end of the scenario. In contrast, this condition improves significantly for low σ. When σ equals 0.5, capitalists' incomes are about 20% higher than workers' incomes at the end of the period, resulting in declining inequality.

Assuming a perfectly equal distribution of income and capital at first, the increase in inequality shown in Figures 7 and 8 is stimulated simply by changing the savings rate. Figure 9 shows the results in the presence of inequality in the initial distribution of assets. In order to achieve the goals, in this scenario it is assumed that the capitalists comprise only 20% of the population but have 80% of the wealth in Iran, this assumption is more in line with the economic realities of Iran.

Figure 7. Income Inequality under Different Savings Rates (g = 2%)
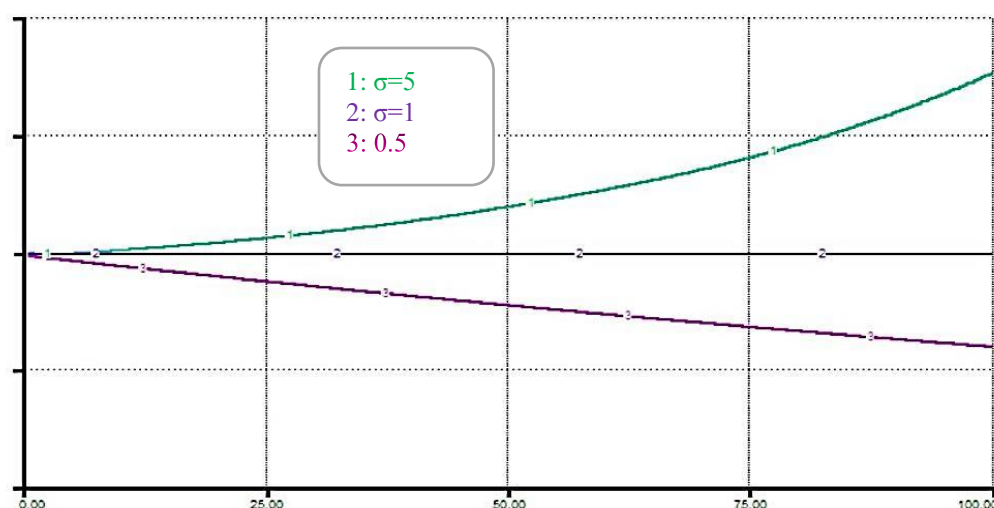**Source**: Research finding.
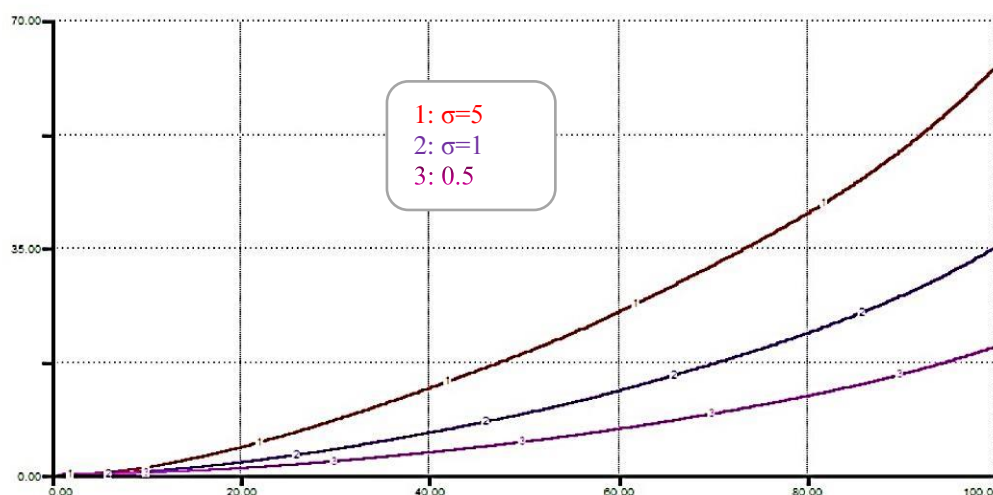
Figure 8. Income Inequality under Different Savings Rates (g → 0)
Source: Research finding.

Also in the case of the scenarios in Figure 9, despite being conservative and despite the skewed distribution in asset ownership, it is assumed that the distribution of wages is equal between the two groups and the capitalists get 20% and the workers 80% of the wages. They bring. However, the income of the owners of the capital is immediately 500% higher than that of the workers due to the additional income from the return on capital. However, this value then depends on the value of σ. With high σ values, inequality increases dramatically because capitalists protect capital returns by substituting cheap labor for expensive labor. For example, when σ equals 5 (Scenario 1 in Figure 9), the income of the capitalists is approximately 800% higher than the income of the workers at the end of the period. At low values of σ, the initial inequality is reversed and the income gap is reduced, so for σ equals 0.5 (Scenario 3), the income of capitalists is about 250% higher than that of workers.

Figure 9. Income Inequality with Skewed Primary Ownership and Differences in Savings
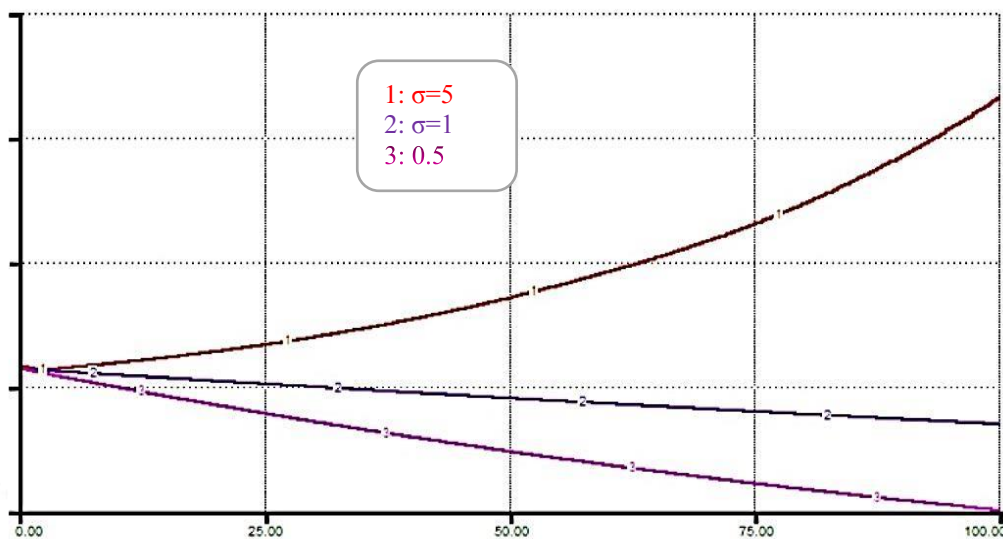**Source**: Research finding.

Finally, in Figure10, the possibility of the effect of progressive taxation on inequality is examined. In this case, it is clear that structural inequality increases at a slower rate than the scenario $\sigma = 5$ in Figure9. In fact, as shown in Figure10, there is an average tax difference (a 40% tax levied on incomes above workers' incomes) and a minimum wealth tax (in this

example only 1.25%) and when $\sigma = 0.5$, can make income relatively equal. However, this tax is not able to fully curb rising inequality when $\sigma = 5$.

Figure11 shows the per capita disposable income in both the workers 'and capitalists' sectors for the low-elasticity of substitution and the progressive tax. It is noteworthy that at the end of the period, capital income and workers' income are on the same level, although the overall growth rate has been reduced to zero. This result is in exactly contrast to concerns about widespread inequality due to declining growth rates. In fact, extending the model beyond 100 years makes worker's incomes surpass those of capitalist's incomes under these assumptions. In other words, the place of workers and capitalists is fundamentally changed in shape. Here is an interesting conclusion in the direction of Keynes, referred to in the last chapter of the book *General* Theory as "the euthanasia of the rentier", in which an excessive increase in savings leads to a progressive decrease in the rate of return on capital (Keynes, 1936).

Figure 10. Reducing Inequality through Progressive Taxes
Source: Research finding.
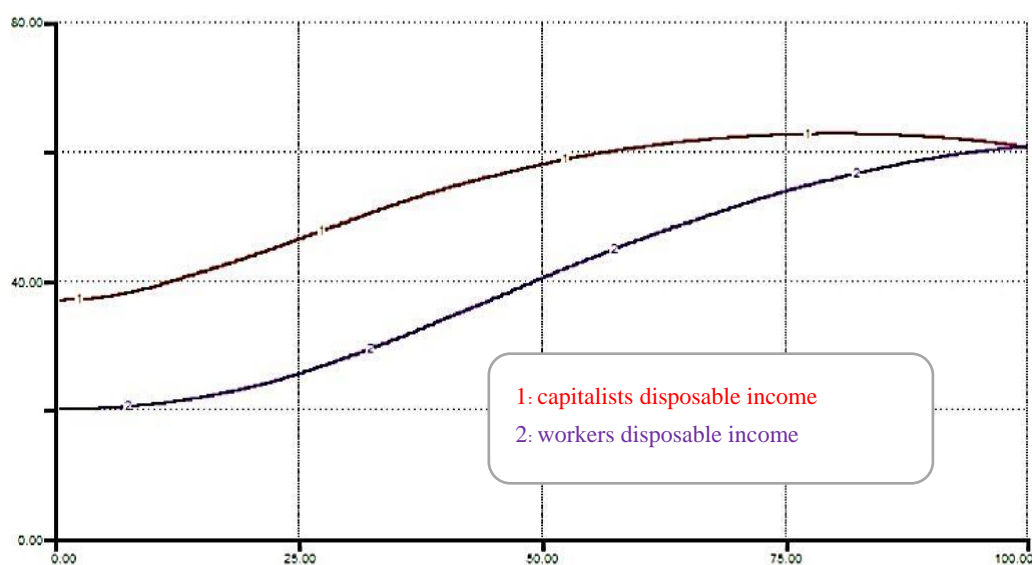
Figure 11. Convergence of Revenues under Progressive Tax Policy (g → 0; σ = 0.5)
Source: Research finding.

Discussion

The main finding of the model is that increasing inequality in Iran is by no means inevitable, even with decreasing growth rates. In other words, slowing economic growth in Iran does not necessarily lead to rising inequality. A key conclusion of the policy is to protect the wages of the labor force in Iran against aggressive strategies of reducing costs in favor of capital gains. This can have the added benefit of maintaining high employment, even in low growth conditions.

The most important factor in these dynamics is the elasticity of substitution σ between labor and capital. This parameter indicates the ease of replacing capital with labor in the economy by changing relative prices. A higher level of substitution elasticity ($\sigma > 1$) actually indicates a rapid increase in the inequality predicted by Piketty, because in this case the growth rate decreases. In an economy with less substitution elasticity ($0 < \sigma < 1$), the risks are somewhat less acute. Thus, the ease with which capital is replaced by labor indicates the tendency of slow-growth environments to increase inequality. On the other hand, a rigid categorization between capital and labor strengthens the ability of policymakers to reduce social inequality in Iran.

From a conventional economic point of view, this seems to be a false hope for reducing inequality. Lower values of σ are often associated with lower levels of development. As Piketty (2014) points out, this indicates a low level of flexibility in traditional agricultural communities. Other economists have argued that modern development is generally associated with an increased substitution elasticity of labor and capital (Karagiannis et al., 2005). Antony (2009) and Palivos (2008) both believe that the typical experimental values of σ are less than one for developing countries and more than one for developed countries. It seems that the general suggestion in the literature is that progress and development is accompanied by a continuous change towards higher levels of σ.

Therefore, it is wrong to conclude from this investigation that the substitution elasticity can be easily changed. Most conventional analyzes (Duffy and Papageorgiou, 2000; Pereira, 2003; Chirinko, 2008) assume that σ values are based on the natural characteristics of an economy or its rate of development. Such analyzes usually provide a better econometric description of a particular economy than the assumption of a substitution elasticity, considering only a wide range of elasticities. Nevertheless, it can be argued that changing the attraction between labor and capital represents another potential path to a sustainable macroeconomic, and in particular a way to reduce the dangerous effects of inequality and unemployment on a low-growth economy like Iran. This requires further investigation and for this purpose, it is necessary to use production functions other than CES for the Iranian economy.

Conclusion

Inequality has been one of the main issues in recent years that has attracted the attention of international organizations and the people of different societies. In recent years, new hypotheses have been proposed by the French economist Thomas Piketty on the main causes of the spread of inequality. For this purpose, this study tried to test the Piketty hypothesis in the Iranian economy using the selected model.

The results of the study showed that although in certain conditions, by reducing the growth rate and increasing its gap with the return on capital, income inequality in Iran increases. However, it has been shown that increasing economic growth in Iran does not necessarily lead to increasing inequality. Even under the very limited initial distribution of ownership of productive assets, it is possible that in some scenarios, revenues will converge in Iran in the

end with relatively moderate intervention from progressive tax policies. The most important factor in these dynamics seems to be the substitution elasticity σ between labor and capital.

According to the results, the following practical suggestions are made to reduce inequality and make optimal use of resources for this purpose in Iran:

It is suggested that policymakers in Iran do not emphasize the return on capital and consequently the gap between economic growth and return on capital as the main factor in increasing inequality, but it is necessary to look at other possible factors such as existing inequality, institutional failure (such as corruption, etc.), lack of efficient tax system and ... be centralized. In addition, according to the results obtained from the study, progressive tax can be a major solution to reduce inequality in Iran.

Orienting the economy to sectors with a low substitution elasticity between labor and capital can be a way to reduce inequality, especially in low-growth and sometimes negative countries such as Iran. This policy can be achieved by investing in sectors such as education, health and culture where it is very difficult to replace the workforce of workers, teachers, nurses and writers. These activities can be supported by investing in infrastructure, such as buildings, schools, hospitals, museums and libraries.

Switching to user industries and more equitable distribution of wealth, along with other measures introduced, can play an important role in reducing inequality. For example, policies to protect the workforce and change the direction of labor-intensive industries can indirectly reduce return on investment. By reducing profits, limiting interest rates, and controlling rents, as well as taxes on rental income, it may be possible to prevent capital flight from productive activities to unproductive investments in the Iranian economy.

State-owned, labor, and nonprofit enterprises may distribute their income more equally and provide more employment despite the lack of profits from their activities, especially in high-utility services such as education and health. Taxes on rent and other income from wealth can be used to fund these sectors. Instead of creating completely new programs, these policies can be an extension of existing programs.

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