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Analysis of the Income Distribution Structure in Iran's Development Plans

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Abstract

This study analyzes income distribution in Iran across six national development plans (1989–2022), focusing not only on inequality measures—such as the q_5/q_1 1 ratio, Palma ratio, Hoover index, and Lorenz curves—but also on the underlying structure of income inequality. A key contribution of this research is the combined assessment of both the level and the structure of inequality over time. Logarithmic differentiation is applied to determine whether changes stem from the top or bottom of the income distribution. Additionally, inspired by Sitthiyot and Holasut (2020), a composite index is developed by combining the Gini coefficient with decile-based ratios, allowing for structural differentiation even when Gini values are constant. The findings indicate that despite some fluctuations in standard indices, the overall structure of income distribution remained largely stable. Modest improvements occurred during the Third and Sixth Development Plans, while the First, Second, and Fifth Plans showed little to no progress. Over the study period, the Gini coefficient declined by 8.5%, the Hoover index by 9.8%, the Palma ratio by 18.2%, and the q_5/q_1 ratio by 20.7%. These results suggest limited structural change and highlight the need for more targeted and effective redistributive policies—especially under macroeconomic pressures such as inflation and external shocks.

Highlights

- Index is developed to distinguish between identical Gini values with different structures.
- Logarithmic differentiation is applied to identify sources of inequality change.
- Despite index fluctuations, the overall income distribution structure remains largely stable.
- Abstract Income distribution in Iran is examined across six national development plans (1989–2022).
- Both the level and structure of income inequality are assessed simultaneously.

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1. Introduction

Income inequality has long been a central concern in economic policymaking, particularly in post-revolutionary Iran, where promoting social justice and poverty reduction became key priorities. A range of redistributive measures—such as interest-free loan schemes (Qarz-al-Hasna), targeted subsidies, and support for cooperatives—were implemented to advance these goals. However, many of these initiatives lacked a coherent theoretical foundation rooted in distributive justice (Zahedi Mazandarani & Navaei, 2013), which limited their effectiveness in achieving lasting equity. Consequently, income inequality has persisted as a significant challenge in Iran's economic landscape (Parvin et al., 2019; Rahnavard Ahani, 2022). The limited effectiveness of past policies suggests that numerical indicators alone are insufficient to capture the complexity of income inequality. This paper shifts the focus from measuring inequality levels to examining the structure of income distribution. Specifically, it compares different Lorenz curves that all yield identical Gini coefficients but reflect distinct distribution patterns. This reveals that similar inequality scores may conceal substantial differences in how income is distributed among population groups. To address this, a composite index is introduced, combining the Gini coefficient with the ratio of the top decile's income share to that of the bottom decile. Lorenz curves are drawn using Origin software to ensure identical Gini values across different structures. The composite index allows for ranking these structures based on their inequality levels, even when their Gini coefficients are the same. The paper also analyzes inequality trends in a disaggregated manner. Indices such as the Palma ratio and the decile ratio (D_{10}/D_1) are calculated across different time periods, along with their rates of change. This less common approach offers deeper insights into how different parts of the income distribution have shifted and which groups have contributed most to changes in inequality.

The article is organized into five sections. Section 2 reviews the theoretical and empirical literature on income inequality. Section 3 presents two analytical approaches: the first calculates various inequality indices over time, and the second models income distribution structures based on the composite index. Section 4 provides the empirical analysis across six national development plans. Lorenz curves and composite indices are used to track changes in income distribution. Section 5 concludes with key findings and policy implications. An appendix summarizes trends in inequality indices and major redistributive policies across development plans, including stated goals for poverty alleviation.

2. Literature Review

Research on income inequality typically falls into two broad categories: (1) measurement-oriented studies, which focus on constructing and interpreting indices such as the Gini coefficient, Palma ratio, and entropy-based metrics; and (2) policy-oriented studies, which analyze the institutional and macroeconomic factors—such as fiscal policies, labor markets, and redistribution mechanisms—that shape income distribution. While overlapping in practice, this distinction

helps clarify whether studies aim to describe inequality patterns or to explain their drivers and policy implications. This study is mainly measurement-focused but also takes a very brief look at policy contexts in development plans.

The study of income inequality owes much to early pioneers like Vilfredo Pareto and Max Lorenz. Pareto's observations on the concentration of wealth led to what is now known as the "80/20 rule," highlighting how a small share of the population tends to control a large portion of total income (Bruni & Montesano, 2024). Lorenz, meanwhile, introduced the Lorenz curve—a graphical representation that illustrates cumulative income shares across population percentiles—providing a clear and intuitive way to visualize inequality (Lorenz, 1905). His contribution paved the way for turning abstract ideas about fairness and distribution into measurable tools. One of the most enduring outcomes of this development is the Gini coefficient, introduced by Corrado Gini in 1912. It remains the most widely used inequality index, valued for its simplicity and comparability. Yet its limitations—such as low sensitivity to changes in the tails of the distribution—have spurred the creation of alternative measures. Bonferroni (1930) called for more attention to the lower tail; Atkinson (1970) introduced a family of indices grounded in welfare economics; and Wolfson (1994) proposed a polarization index to capture the decline of the middle class. More recent work has continued to refine how inequality is assessed. Palma (2011) proposed comparing the income share of the richest 10% to that of the poorest 40%, arguing that middle-income shares tend to be stable across countries. Ravallion (2014), drawing on a variety of indices, documented a general decline in inequality across developing countries over the past three decades. Jenkins (2017) reviewed both graphical methods and entropy-based indices, underscoring the diversity of tools available for inequality analysis. According to Sitthiyot & Holasut (2020), more than 50 inequality indices have been developed, though the Gini coefficient remains the benchmark in most empirical studies. These contributions have shifted the field from simple measurement to more nuanced analysis. They also underscore a key insight: similar values of a single index may mask very different income distribution patterns. This paper builds on that idea by comparing Lorenz curves that share the same Gini coefficient but reflect different distributional structures. While much of the theoretical work on inequality measurement has been developed internationally, empirical studies in Iran have provided detailed insights into income disparities at both national and provincial levels. These studies often rely on summary indicators—such as the Gini coefficient and decile ratios—to track inequality trends over time. For instance, Arslanbod (2004) documented changes in the Gini coefficient for Iran between 1969 and 1994, noting an increase before the 1979 revolution, a decline during the 1980s, and a renewed rise in the early 1990s. Similarly, Abounouri & Iraji (2004) found comparable trends in Khorasan Province, using parametric models to assess inequality in both urban and rural areas. Kazemi & Zamanian (2005), focusing on Sistan and Baluchestan, observed a steady increase in inequality from 1997 to 2001. Other studies have examined broader historical periods. Shahiki Tash et al.

(2008) analyzed inequality during the pre-revolution era, the immediate post-revolution years, and the first three Five-Year Development Plans. Using indices like the Gini coefficient, Theil index, and D10/D1 ratio, they found a gradual decline in inequality between 1983 and 2004. More recent studies, including Nejad-Abdollahi et al. (2013), reported a relative improvement in income equality during the late 1990s and early 2000s, particularly in urban regions. Beyond inequality trends, some researchers have critically assessed the design and goals of Iran's development policies. Arabmazar & Noormohammadi (2016), for example, argued that while these plans often reference equity and redistribution, they suffer from vague objectives and weak theoretical foundations. Loravand & Laali (2023) extended this critique using parametric techniques on household data in Isfahan. Their findings suggest that standard indices may overlook important distributional shifts, reinforcing the need for more detailed structural analysis. Despite the breadth of existing research, few studies have investigated how the structure of income distribution has changed over time—especially within the context of national development plans. Most analyses remain limited to single-number measures like the Gini or Palma ratios, which, while useful, may obscure deeper changes in distribution patterns. This paper seeks to fill that gap by examining six national development plans from 1989 to 2022 using both summary and structural approaches. Specifically, it offers three contributions:

1. Calculating and interpreting key inequality indices, including the Gini, Palma, Hoover, and rich-to-poor ratios;
2. Plotting Lorenz curves at the start and end of each plan to visualize structural changes;
3. Applying a composite index—based on Sitthiyot and Holasut (2020)—to compare distributional structures in years with identical Gini coefficients.

By combining quantitative measurement with structural visualization, the study provides a more nuanced understanding of how inequality in Iran has evolved—not only in magnitude but also in form.

3. Theoretical Foundations and Methodology

This study examines income distribution by integrating both theoretical and empirical approaches. It begins with conventional inequality measures such as the Gini coefficient and Lorenz curve, supplemented by additional indices including the Palma ratio, rich-to-poor income share ratio, and Hoover index. Combining these measures helps overcome the limitations of relying on a single indicator and offers a clearer picture of income distribution dynamics. This approach is especially relevant for countries with persistent inequality challenges (Atkinson, 2016; Milanovic, 2016). The analysis is then deepened by applying logarithmic transformations and partial differentiation to inequality indices, allowing for a detailed breakdown of how changes in income shares affect overall inequality. It highlights the internal dynamics driving inequality trends. Additionally, the study compares three hypothetical income distributions with identical Gini coefficients but differing composite index values, illustrating that conventional measures may

overlook structural differences. The empirical analysis uses household-level gross per capita expenditure data from Iran (1989–2022) provided by the Statistical Center of Iran.

3.1 Analysis and Calculation of Income Inequality Indices and their Changes

While the Gini coefficient remains a standard tool in inequality analysis, its limited sensitivity to distributional differences across income groups (Hasell,2023) has prompted the use of complementary indices in this study, including the quintile share ratio, Palma index, and Hoover index for a more detailed assessment.

3.1.1 Quintile Share Ratio

The Quintile Share Ratio (QSR) measures the relative income shares between distinct population segments, typically calculated as the ratio of the income share of the top quintile (Q_5) to that of the bottom quintile (Q_1), expressed as Formula 1.

$$R = Q_5/Q_1 \quad (1)$$

This index captures income disparity between the richest and poorest groups by focusing on distribution tails. Unlike overall measures, it is sensitive to shifts in income shares at both extremes. The analysis goes beyond calculation by decomposing changes over time into contributions from increases or decreases in the shares of the richest and poorest quintiles, providing insight into the main drivers of inequality trends. These calculations are performed using Formulas 2 through 4.

$$logR = \log(Q_5) - \log(Q_1) \quad (2)$$

$$\Delta logR = \Delta\log(Q_5) - \Delta\log(Q_1) \quad (3)$$

$$\frac{\Delta R}{R} = \frac{\Delta(Q_5)}{Q_5} - \frac{\Delta(Q_1)}{Q_1} \quad (4)$$

3.1.2 Palma ratio

The Palma ratio is a relative measure of income inequality, defined as the ratio of the income received by the top 10% of the population (decile D_{10}) to that received by the bottom 40% (the sum of the first two quintiles, $Q_1 + Q_2$). Unlike indicators that consider only the bottom 20%, the Palma ratio captures a broader segment of low-income groups and thus provides a sharper lens on redistribution between the richest and the relatively poor. Assuming the income distribution of the middle 50% remains relatively stable, this ratio is particularly sensitive to policy-induced shifts at the extremes; It is computed as Formula 5 (Palma, 2011).

$$p = \frac{D_{10}}{Q_1 + Q_2} \quad (5)$$

The relative change in this ratio is also calculated using Equations 6 through 8.

$$logp = logD_{10} - \log(Q_1 + Q_2) \tag{6}$$

$$\frac{\Delta P}{P} = \frac{\Delta D_{10}}{D_{10}} - \frac{\Delta(Q_1 + Q_2)}{Q_1 + Q_2} = \frac{\Delta D_{10}}{D_{10}} - [\frac{\Delta Q_1 + \Delta Q_2}{Q_1 + Q_2}] \tag{7}$$

$$\frac{\Delta p}{p} = \frac{\Delta D_{10}}{D_{10}} - (\frac{Q_1}{Q_1 + Q_2}\frac{\Delta Q_1}{Q_1} + \frac{Q_2}{Q_1 + Q_2}\frac{\Delta Q_2}{Q_2}) \tag{8}$$

3.1.3 Hoover index

The Hoover index—also known as the Robin Hood or Imbalance Index—measures the share of total income that must be redistributed to reach equality. It ranges from 0 (perfect equality) to 1 (maximum inequality), with higher values indicating greater deviation from an equal income distribution (Pavlov & Pavlova, 2021). It Calculated as Formula 9.

$$\sum_{i=1}^{n} \frac{1}{2} |p_i - I_i| \tag{9}$$

Where p_i denotes the population share and I_i represents the income share of group i, the index captures absolute differences across the distribution. While the Gini coefficient reflects average relative differences, Hoover offers a more direct interpretation of redistributive effort. As Rogerson (2013) notes, Gini often underestimates inequality intensity compared to Hoover, which explains why the two are frequently used together as complementary indicators.

3.2 Modeling Income Distribution Structures Using a Composite Index

Due to the widespread use yet inherent limitations of the Gini coefficient in capturing disparities between the richest and poorest groups, Sitthiyot & Holasut (2020) proposed a composite index combining the Gini coefficient with the income share ratio of the top to bottom deciles. This allows differentiation of income distributions with identical Gini values by reflecting structural inequality more accurately. The composite index I is defined as Formula 10.

$$I = F(gini, h) = \frac{\sqrt{gini^2 + h^2}}{\sqrt{2}} \quad , 0 \le I \le 1 \tag{10}$$

Where h is a decreasing function of the ratio of the income share of the bottom decile to the top decile, and it is calculated using Equation 11.

$$h = 1 - \left(\frac{D_1}{D_{10}}\right)^{\alpha} \quad , \quad \alpha = \frac{\ln(1 - avggini)}{\ln(avg\,\frac{D_1}{D_{10}})} \qquad 0 < \alpha < 1 \tag{11}$$

Here, D_1 and D_{10} denote the income shares of the first (poorest) and tenth (richest) deciles, respectively. Avg gini is the average Gini coefficient across the

observed data. The exponent α adjusts the sensitivity of the function based on the observed average inequality.

Inspired by the I-index, which reveals differences in inequality among Lorenz curves with identical Gini coefficients, this study designs three theoretical Lorenz curves that share the same Gini coefficient (0.32) but differ in their income distribution structures. These structures were constructed theoretically using Origin software and are differentiated based on how income is distributed among income groups in society, particularly the income shares of the top and bottom deciles. The three structures are illustrated in Figure 1. Line E represents the line of equality. The structures are named according to the value of the D_{10}/D_1 ratio as follows:

H: Structure with the highest D_{10}/D_1 ratio

L: Structure with the lowest D_{10}/D_1 ratio

M: Structure with a medium D_{10}/D_1 ratio (between the two)

In Figure 1, the Gini coefficient for all three curves—L, M, and H—indicates the same level of inequality. Therefore, the area between each curve and the line of equality (E) is identical. However, the shapes of the curves reflect differences in how income is distributed among income groups, which are analyzed through the D_{10}/D_1 ratio and the I-index. We will analyze the index I under the assumption that the Gini coefficient remains constant in the subsequent formulas, from 12 to 14.

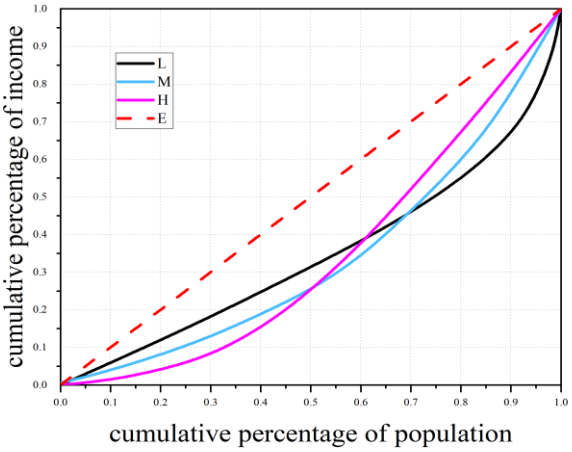

Figure 1. Three theoretical income distribution structures with an identical Gini coefficient (0.32), illustrating differences in income share allocations among deciles.
***Source**: Research findings using Origin software*

Let the Gini coefficient be considered a fixed value, denoted by c, ($gini \approx c$) regardless of its magnitude.

$$I = \frac{\sqrt{c^2 + h^2}}{\sqrt{2}} \ , 0 \le I \le 1 \tag{12}$$

Then, we differentiate with respect to h.

$$\frac{\partial I}{\partial h} = \frac{\sqrt{2}\, h}{2\sqrt{c^2 + h^2}} = \frac{h}{\sqrt{c^2 + h^2}.\sqrt{2}} \tag{13}$$

Since, $h = 1 - \left(\frac{D_1}{D_{10}}\right)^{\alpha}$, the value of h is typically between 0 and 1. So, I increase with an increase in h ($\frac{\partial I}{\partial h} > 0$). In order to study the behavior of I in terms of $\frac{D_1}{D_{10}}$, we define $x = \frac{D_1}{D_{10}}$, and differentiate I with respect to x. The formula for this derivative is given in Equation 14.

$$\frac{dI}{dx} = \frac{dI}{dh}.\frac{dh}{dx} = \frac{h}{\sqrt{c^2 + h^2}.\sqrt{2}}.(-\alpha x^{\alpha-1}) \tag{14}$$

when the Gini index remains constant, the composite inequality index decreases with respect to the ratio $\frac{D_1}{D_{10}}$ .This means that as the ratio $\frac{D_1}{D_{10}}$ increases (indicating a reduction in inequality between the lower and upper percentiles), the value of I decreases because h decreases, and its effect on I leads to a reduction in the inequality index. Therefore, different income distribution structures with the same Gini coefficient can be ranked more effectively based on the composite index (I), as it better reflects the underlying differences in inequality. For each of the income distribution structures illustrated in Figure 1, the income share of each decile is specified. The ratio of the income share of the richest decile to the poorest decile (D_{10}/D_1), as well as the ratio of the highest income quintile to the lowest income quintile (Q_5/Q_1), are presented in Table 1.

Table 1. Ranking of Distribution Structures Based on I.

Structure Type	$\frac{\mathbf{D_{10}}}{\mathbf{D_1}}$	$\frac{\mathbf{Q_5}}{\mathbf{Q_1}}$	Inequality Rank
Type H	17.00	8.25	1 (Highest)
Type M	7.33	5.17	2 (Medium
Type L	5.33	3.75	3 (Lowest)

***Source**: Points on the curves in Figure 1 in Origin software*

As shown in Table 1, despite having the same Gini coefficient, the income distribution structures differ significantly in terms of inequality when assessed using the ratios of top to bottom deciles ($\frac{D_{10}}{D_1}$) and quintiles ($\frac{Q_5}{Q_1}$). Based on these alternative indicators, Structure H exhibits the highest level of inequality, followed by Structure M and then Structure L. This ranking aligns with the

composite index (I), confirming its ability to differentiate between structural forms of income distribution even when traditional metrics remain constant.

To enhance the comprehension of the distinctions and attributes of each index utilized in this study for analyzing inequality, Table 2 provides a concise overview of their main focus and features. Consequently, this current analysis can offer a more nuanced and multidimensional depiction of income distribution structure by taking into account the complementary features of these indices.

Table 2. Summary of some income inequality indices and their key characteristics.

Index	Focus	Features
Lorenz Curve	Graphical representation of income distribution	• A visual representation of how total income is distributed. • Useful and practical for comparing distribution patterns. • Requires a numerical index for quantification.
Gini Coefficient	Overall income inequality index	• Ranges from 0 (perfect equality) to 1 (complete inequality). • Simple, most common inequality index. • Less sensitive to changes at the top and bottom classes.
Quintile and Decile Share Ratio	Examining differences between distribution segments	• Compares quintiles and deciles. • Reflects changes in various parts of the distribution, easy to understand. • Lacks detail about the entire distribution curve.
Palma	Focus on two income extremes	• Ratio of income of the top 10% to the bottom 40%. • High transparency, focuses on both ends of the income distribution. • Ignores the middle class.
Hoover Index	Amount of redistribution needed for equality	• Ranges from 0 to 1 (or as a percentage). • Easy to interpret, directly shows the intensity of inequality. • More sensitive to absolute changes.
Composite Index (I)	Overall inequality and concentration at both end of the distribution	• Ranges from 0 to 1. • Considers overall inequality and the tail of the distribution simultaneously. • A combination of the Gini coefficient and the share ratio of deciles. • Ability to distinguish between different structures with the same Gini.

***Source**: Authors' compilation*

4. Empirical Results

This section presents an empirical analysis of income inequality in Iran from 1989 to 2022, with a focus on the six national development plans. The analysis draws on Lorenz curves and widely used inequality indicators, including the income share ratio of the top 20% to the bottom 20%, the Palma ratio, and the Hoover index. These indicators offer a clearer view of income concentration and distributional shifts across population groups. To capture long-term changes, the growth rates of the rich-to-poor ratio and the Palma ratio are calculated, comparing 2022 with 1989. This provides a numerical basis for tracking trends in inequality beyond static measurements.

In the second part of the analysis, a composite index (I) is employed. While this index has typically been used for cross-country comparisons with identical Gini coefficients, here it is applied across different years in Iran with similar Gini values. This approach challenges the assumption that a stable Gini coefficient implies unchanged inequality. Variations in the income shares of the richest and poorest deciles may signal structural changes not captured by the Gini index alone. By integrating this composite measure with the theoretical framework presented in Section 3.2, the analysis offers a deeper understanding of how the structure of income distribution in Iran has evolved over time.

4.1 Data

The data used in this study are drawn from the Iranian Statistical Center and include the annual per capita gross expenditure shares of each decile at the national level from 1989 to 2022. These data, categorized by income deciles, enable a detailed analysis of inequality trends within the framework of Iran's development plans. The dataset serves as the basis for drawing Lorenz curves and calculating some inequality measures. The selected time frame allows for a long-term evaluation of inequality trends and the effectiveness of national development policies.

4.2 Structural Comparison of Income Distribution Using Lorenz Curves across Successive Development Plans

Following the Islamic Revolution, Iran's economic and social policies evolved along two key lines: limiting the state's direct economic role and strengthening social protection through a constitutionally grounded social security system. Designed to address poverty and inequality, this system has provided services such as insurance coverage and welfare assistance (Shahbazi et al., 2023). Additionally, successive governments have used tax policies as redistributive tools within the framework of national development plans (Abdollah Milani et al., 2017; Karimi & Dorbash, 2018; Yarahmadi et al., 2022). However, a critical question remains: to what extent have these efforts succeeded in reducing income inequality and improving the living conditions of lower-income groups? Anchored in the Revolution's emphasis on social justice and support for the disadvantaged, a redistribution-oriented policy approach took shape. Beginning

with land reforms, this trajectory has continued for over four decades through the implementation of equity-oriented strategies aimed at narrowing income disparities and fostering structural justice (Dara & Ali Avargani, 2023).

Since 1989, six national development plans have been implemented, each prioritizing fair resource allocation and the reduction of socioeconomic gaps. A selection of key distributive and redistributive measures from these plans is summarized in Table 3, reflecting the state's commitment to income equality. These plans serve as the foundation for evaluating changes in the structure of income distribution over time. To support this analysis, Lorenz curves have been constructed for the initial and final years of each plan (Figure 2), enabling comparison of inequality trends both within and across different planning periods.

As depicted in Figure 2, the Lorenz curves for the beginning (1989) and end (1994) of the First Development Plan remained largely unchanged, indicating that income distribution did not significantly improve during the First Development Plan. Although there was a slight overall decline in inequality, it was not sufficient to benefit lower-income deciles. In the aftermath of the war, the plan focused primarily on reconstruction and economic growth, while reducing poverty and inequality was not a policy priority. Policymakers assumed that economic expansion would naturally lead to greater equity. However, studies suggest that any potential benefits were offset by rising foreign debt, increased government spending, monetary expansion, and high inflation—all of which eroded the purchasing power of low-income groups (Ghasemi Dehghi et al., 2023).

Table 3. ***Some Distributional and Redistributive Approaches in the Development Plans***

Economic Development Plans	Approach of Iran's Economic Development Plans Toward Income Distribution and Redistribution
1st	• Distribution of ration coupons and expansion of insurance coverage • Very limited and weak income taxation
2nd	• Expansion of insurance and social security • Introduction of Value-Added Tax (VAT)
3rd	• Implementation of rural insurance and financial system reform • Increase in taxes, especially on corporations
4th	• Implementation of the Mehr Housing Project and expansion of insurance • Expansion of VAT and income taxes
5th	• Elimination of subsidies for high-income groups and targeted support measures • Increase in income and corporate taxes, though indirect tax enforcement remained weak
6th	• Elimination of subsidies for high-income groups with targeted support.

	Increased income and corporate taxes, with weak indirect tax enforcement.

***Source**: Compiled by the authors based on academic articles and reports from the Iranian Parliament Research Center.*

In the Second Development Plan, although a slight improvement in income distribution is observed, the Lorenz curve at the end of the period (1999) lies slightly below that of the beginning (1995). This indicates that the policies implemented or the prevailing economic conditions during this period did not lead to a reduction in inequality. A similar outcome is evident in the Fifth Development Plan. In contrast, the Third Development Plan, formulated with insights from the two preceding plans, adopted a more pragmatic approach. One of its key objectives was to promote social justice through the expansion of the social security system and the targeting of subsidies. The reformist government experienced both achievements and setbacks in implementing this plan (Mosallanejad & Mohammadzadeh, 2016). However, an analysis of the Lorenz curves suggests that the plan led to only a modest reduction in inequality. In contrast, the Fourth Development Plan—being the first plan based on the national long-term vision document—placed greater emphasis on social justice and social security compared to the three preceding plans (Shahbazi et al., 2023). A comparison of the Lorenz curves at the beginning and end of this period, along with the calculated inequality indices (Table 4), indicates a more notable improvement in income distribution during this phase.

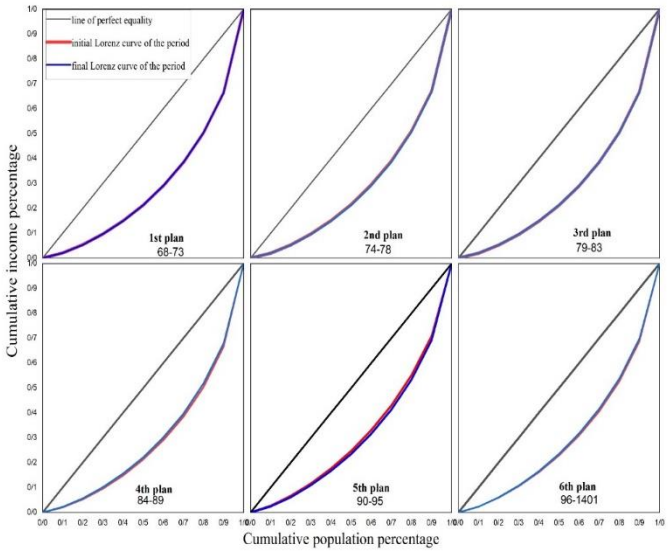

Figure 2. Comparison of Lorenz Curves at the Beginning and End of Iran's Six Economic Development Plans.

***Source**: Authors' calculations using Origin2019 software*

Continuing along this path, the Targeted Subsidies Law was passed by the Islamic Consultative Assembly in 2009 to support low-income groups. This law became one of the government's most significant income redistribution policies. Although it significantly reduced inequality during the 2005–2010 (1384–1389 SH) period, its effects were not sustained over time. In the Fifth Development Plan, the targeted subsidy reform, originally proposed in earlier plans, was implemented. This policy influenced income distribution through various mechanisms, including changes in household purchasing power and poverty levels (Yashar'el & Habibian Naqibi, 2016). The Lorenz curve indicates that by the end of this period (2016), inequality had increased compared to its beginning. Zahedi & Lavasani (2016) argue that despite some alignment between this plan and theories of social justice, the lack of a comprehensive and goal-oriented vision at the macro level prevented the achievement of desirable outcomes. The Sixth Development Plan, with its emphasis on empowerment and the eradication of absolute poverty, continued the policy of cash subsidies—albeit with gradual reforms and the exclusion of high-income deciles. According to the Lorenz curve data, income distribution improved by the end of this period relative to its start. Overall, data analysis suggests that although Iran's development plans have consistently aimed to reduce inequality and promote economic justice, their actual success has varied. In some cases—such as the implementation of the targeted subsidies policy—inequality even increased during certain periods. To further clarify these trends, the evolution of income shares across deciles over the past 35 years is illustrated in Figure 3.

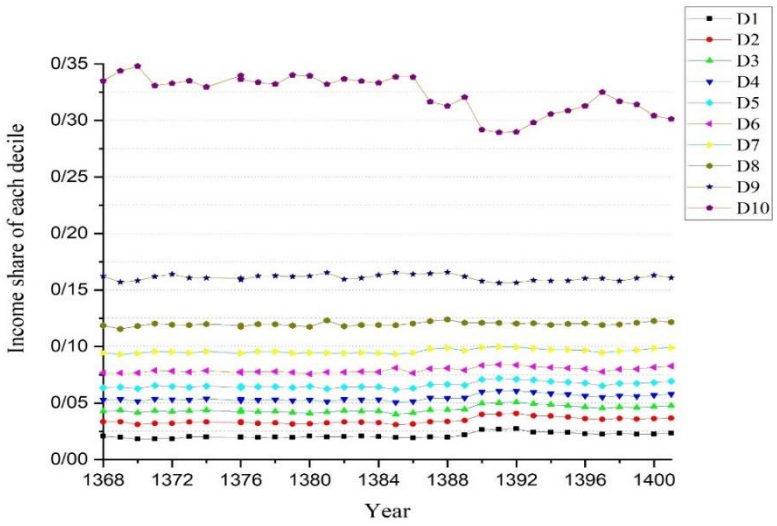

Figure 3. Changes in the share of income deciles over time.
***Source**: Authors' calculations using Origin2019 software*

In Figure 3, the income share of $\boldsymbol{D_1}$ to $\boldsymbol{D_{10}}$ and the range of their changes are depicted to allow for a more detailed examination of changes in the structure of inequality. As seen in the chart, the income share of the first decile has fluctuated slightly over time. The average share of 0.0213 and the very small variance of this decile's share indicate that throughout this period, the first decile's share of gross per capita expenditure has remained relatively low and stable, with minimal changes and no sharp fluctuations. A notable increase in this decile's share occurred during the Fourth Development Plan. A similar pattern is observed for deciles two through seven. In contrast, the tenth decile, with an average of 0.3234, has consistently held a higher share of the total gross per capita expenditure compared to the other deciles. The higher variance (0.0003) of this decile, compared to the others, suggests more fluctuations in its share, though its trend remains relatively stable. In Table 4, inequality indices have been calculated to quantitatively assess the level of inequality. The gradual decline in the share of the tenth decile since the 2000s reflects a relative decrease in the concentration of expenditure within the highest decile, although it still accounts for over thirty percent of total expenditure.

Table 4. ***Inequality Indices in the First and Last Years of Each Development Program Implementation***

Development Plan	year	Wealth-to-Poverty Ratio Index (Quintile 5 and Quintile 1)	Richest-to-Poorest Ratio Index (Deciles 1 and 10)	Palma Index	Hoover index	Gini Coefficient
First	1989	9.2098	16.2400	2.2413	0.6206	0.4249
	1994	9.2626	16.4700	2.2450	0.6185	0.4244
second	1995	9.2083	16.4700	2.2413	0.6115	0.4198
	1999	9.4596	16.6800	2.2467	0.6197	0.4248
third	2000	9.8615	17.5000	2.3515	0.6290	0.4322
	2004	9.2396	16.2100	2.2450	0.6175	0.4240
Fourth	2005	9.4015	16.5000	2.2408	0.6192	0.4248
	2010	8.5387	14.7100	2.2450	0.5993	0.4099
Fifth	2011	6.7806	11.0900	1.6571	0.5396	0.3700
	2016	6.6143	12.9900	1.8508	0.5679	0.3900
Sixth	2017	8.0020	13.6500	1.9323	0.5805	0.3981
	2022	7.7017	12.8800	۱۶1.82	0.5652	0.3878

Source*: Research Findings*

The trend of changes in these indices is presented in the appendix (Figures A1-A3). The overall decrease in the richest-to-poorest ratio in the long term indicates a reduction in the gap between the wealthiest and the poorest deciles, although there are significant fluctuations. The peak of this index in 1991 may be related to the economic conditions after the Iran-Iraq war, while the lowest value in 2011 is likely a result of subsidy policies (such as cash subsidies). The Gini coefficient also reaches its highest value in 1991, which is probably due to severe

inequality following the war, and its lowest value in 2011 and 2012 is related to redistributive policies. The decrease in the Palma index reflects a relative improvement in the distribution of costs, particularly in the 2010s. However, the value above 1 indicates that significant inequality still exists.

On the other hand, based on the Lorenz curves of six periods and the share of income deciles in all years, it can be observed that the income distribution structure in Iran, as shown in Figure 1, is of an M-shape. Despite the fact that distribution and redistributive policies in Iran have always been implemented with the aim of reducing economic inequality and improving living conditions, after the Islamic Revolution, governments have tried to make income distribution more equitable by using various strategies and establishing related institutions (Dara & Alaei Aurgani, 2023). However, this structure has not changed. The results of these programs and policies, which began in 1989 and continued until the completion of the Sixth Development Plan, are shown together in Figure 4.

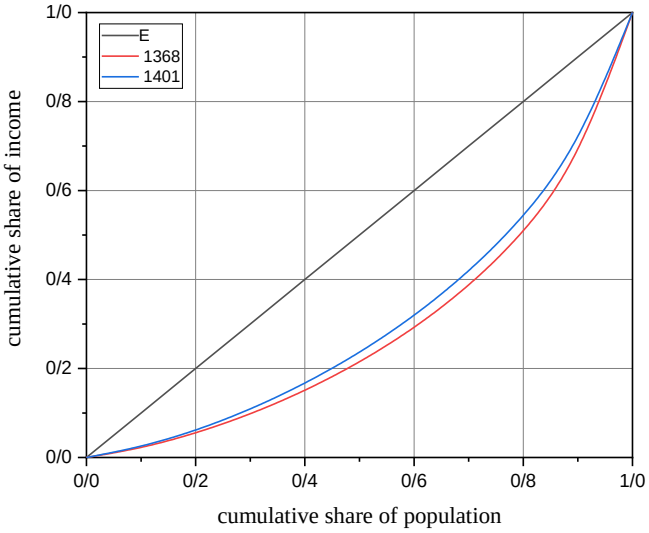

Figure 4. Comparison of the Lorenz Curves for 1989 and 2022.
***Source**: Authors' calculations using Origin2019 software*

Figure 4 displays the Lorenz curves for the years 1989 and 2022 in comparison with the equality line. It can be observed that the curve for 2022 (blue line) is closer to the equality line compared to 1989 (red line), indicating a relative improvement in income distribution and a reduction in overall inequality during this period. However, both curves still maintain a significant distance from the equality line, with more than 55% of total income in both years being held by the top 20% of income earners, while the share of the bottom 20% remains limited to

less than 5%. This persistent inequality highlights the need for a deeper analysis using supplementary measures, which are presented in Table 5. As shown in this table, the overall trend of inequality has been decreasing throughout the study period. However, this research goes beyond numerical values and examines the structure of this reduction.

Table 5. Inequality Indicators – 1989 and 2022.

year	Gini coefficient	Hoover index	Q5/Q1 Ratio	D10/D1 Ratio	Palma index
1989	0.4249	0.6206	9.2098	16.2400	**2.2413**
2022	0.3878	0.5652	7.7017	12.8800	**1.8216**

Source: *Research Findings*

An examination of indicators such as the Palma ratio and the rich-to-poor income shares ratio sheds light on the underlying dynamics of the observed improvement in income distribution. If this decline in inequality is driven by a rising income share among lower-income groups, it can be interpreted as evidence of progress toward a more equitable distribution. Conversely, if the decline is largely attributable to falling incomes among the top deciles, it may reflect economic stagnation or contraction among high-income earners rather than meaningful gains for lower-income groups. To further explore these distributional patterns, the income shares of each quintile are reported in Table 6.

Table 6. Income Distribution Across quintiles – 1989 and 2022.

year	Q_1 income Share (Lowest20%)	Q_2 income Share	Q_3 income Share	Q_4 income Share	Q_5 income Share (Highestt20%)
1989	0.0540	0.0955	0.1403	0.2130	0.4973
2022	0.0600	0.1054	0.1520	0.2205	0.4621

Source: *Research Findings*

Now, using Equations (4) and (8), we analyze the growth rates of the Rich-to-Poor Ratio and the Palma Index.

$$\frac{\Delta R}{R} = \frac{\Delta(Q_5)}{Q_5} - \frac{\Delta(Q_1)}{Q_1} = -0.0708 - 0.1111 = -0.1819$$

$$\frac{\Delta(Q_5)}{Q_5} = -0.0708 \quad and \quad \frac{\Delta(Q_1)}{Q_1} = 0.1111$$

The results of these calculations indicate that the decline in the Rich-to-Poor Ratio is driven by two simultaneous trends: a 7% decrease in the income share of the richest group and an 11% increase in the share of the poorest group. Since the increase in the income share of the poorest group exceeds the decrease in that of the richest group (11% vs. 7%), this shift suggests a meaningful reduction in inequality and a relative improvement in the economic condition of low-income groups. Therefore, it can be concluded that during this period, income distribution moved toward greater equity.

The Palma Index, encompassing a wider range of income groups, also decreased by approximately 20% during this period. This reduction is similarly driven by the increase in the share of low-income groups and the decrease in the income share of the wealthiest 10% of the population.

$$\frac{\Delta D_1}{D_1} = -0.100 \ and \ \frac{\Delta(Q_1+Q_2)}{Q_1+Q_2} = 0.107$$

$$\frac{Q_1}{Q_1+Q_2}.\frac{\Delta(Q_1)}{Q_1+Q_2} = 0.040 \ \text{and} \ \frac{Q_2}{Q_1+Q_2}.\frac{\Delta(Q_2)}{Q_1+Q_2} = 0.066$$

Thus, the decline in the Palma Index can be interpreted as a relative improvement in the economic position of lower-income groups within the context of a broadly stable income distribution structure. Moreover, the 10% reduction in the Hoover Index during this period indicates that the gap between the actual income distribution and perfect equality has slightly decreased. However, the overall structure of income distribution in Iran, as seen in the Lorenz curves, remains relatively stable with an M-shaped pattern. Therefore, although the inequality indices show a relative improvement over the past three decades, these improvements have occurred within a stable and less-variable income structure, with no fundamental changes in the way income is distributed among different groups.

These findings highlight the effectiveness of redistributive policies implemented during this period, as they contributed to a more equitable income distribution by enhancing the economic position of lower-income groups. Nevertheless, it is worth noting that the extent of the reduction in inequality over 35 years, despite considerable policy focus, may not be as significant as expected given the efforts and time frame. Furthermore, it should be emphasized that these relative improvements (the reduction in inequality in 2022 compared to 1989) are the result of more than three decades of continuous efforts under six national development plans. In fact, the reduction in inequality has been achieved not through sudden transformation but rather through the gradual implementation of redistributive policies since 1989.

4.3 The Analysis of Income Inequality Structural: Application of Index I

In this study, income inequality has been analyzed not only through numerical indices but also by examining the structure of income distribution. To this end, Lorenz curves were plotted at the beginning and end of each development period to reveal changes in income distribution patterns. However, the analyses indicated that in certain years, the Gini coefficient remained nearly constant, approximately at 0.425. To take a deeper step in examining inequality, we compare these years to determine whether the stability of the Gini coefficient necessarily implies no change in the structure of income distribution, or if there may have been significant shifts in the income shares of different groups. For this purpose, the composite index introduced in Equation 10 is employed. The selected

years, along with the required and calculated variables, are presented in Table 6. To compute this index, it is first necessary to calculate α for Iran during this period. The average values of the Gini coefficient and the income share ratio between the highest and lowest deciles are also reported in Table 7.

Table 7. Average Gini Coefficient and the Average Income Share Ratio of the Top and Bottom deciles for the Entire Period, and Calculation of α

The average Gini coefficient	The average share ratio	$\boldsymbol{\alpha}$
0.412	15.400	$\approx \frac{1}{5}$

***Source**: Research findings*

The average Gini coefficient for Iran from 1989 to 2022 was 0.412, and the average income share ratio of the tenth decile to the first decile was 15.4. Therefore, the values of α and h were calculated based on formula 11 and the I index, using formula 10. These values, along with the $\frac{D_1}{D_{10}}$ ratio for each of these years, are presented in Table 8.

Table 8. I Index and its associated variables.

year	1989	1992	1994	1999	2003	2005
$\frac{D_1}{D_{10}}$ Ratio	0.062	0.056	0.061	0.059	0.060	0.061
h	0.427	0.438	0.430	0.430	0.427	0.429
I index	0.426	0.432	0.427	0.428	0.428	0.427

***Source**: Research findings*

What is observed in the calculations is that the values of h, I, and the Gini coefficient are approximately close to each other. For better comparison, in Figure 5, the graph of both indices, I and the Gini coefficient, is plotted.

A comparison of the Gini coefficient and the composite index *I* across the study years reveals that the values of these two measures are remarkably close. This convergence is primarily attributed to the relative stability of the income ratio between the lowest and highest deciles throughout the examined period. Since the composite index *I* is defined based on the product of the Gini coefficient and a function of the rich-to-poor income ratio, when this ratio remains relatively constant, the value of index *I* tends to closely align with that of the Gini coefficient. This finding suggests that, during the years under study, the structure of income distribution—despite minor fluctuations—did not undergo any profound structural changes.

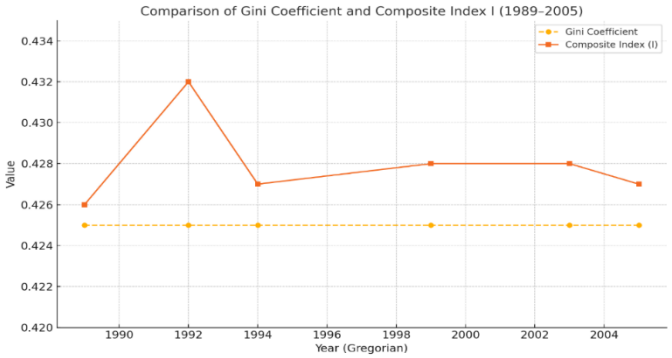

Figure 1. Structural Sensitivity of the Composite Index I Compared to the Gini Coefficient.
***Source**: Authors' calculations using Microsoft Excel.*

Case 1: When the value of ***h*** is very small (approaching zero), index ***I*** can be approximated as expressed in Equation (15).

$$I = F(gini, h) = \frac{\sqrt{gini^2}}{\sqrt{2}} = \frac{gini}{\sqrt{2}} \quad (15)$$

Economically, this condition represents a highly egalitarian income distribution, where the income of the lowest decile is nearly equal to that of the highest decile. In such a scenario, income inequality is minimal, and both the Gini coefficient and index *I* approach very low values, reflecting a nearly uniform distribution of income across the population.

Case 2: When the value of ***h*** closely approximates the Gini coefficient—which is the case observed in this study—index ***I*** can be simplified as follows (Equation 16).

$$I = F(gini, h) \approx \frac{\sqrt{gini^2 + gini^2}}{\sqrt{2}} = \frac{\sqrt{2gini^2}}{\sqrt{2}} = gini \quad (16)$$

As a result, the composite index *I* does not show any significant difference from the Gini coefficient. This suggests that during this period, overall income inequality (as measured by the Gini coefficient) and the inequality between the top and bottom deciles (represented by the parameter *h*) were in alignment. From an economic perspective, *h* and the Gini coefficient are equal when overall income inequality in society is consistent with the income gap between the top and bottom deciles. This situation implies that in the economic structure of the society, inequality is more driven by the income gap between the poorest and wealthiest groups, rather than by scattered inequalities across other parts of the income distribution. The Lorenz curves for these six years, shown in Figure 6, confirm this relative stability.

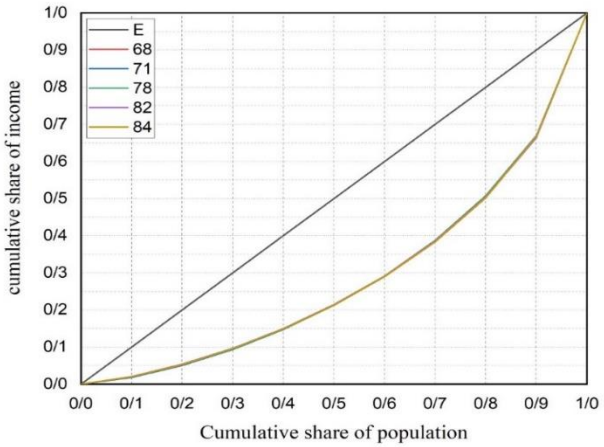

Figure 2. The Lorenz curves for the six years, all with the same Gini coefficient, are plotted in a single space.
Source: *Author's calculations using Microsoft Excel.*

This finding, and its comparison with Figure 1, indicates that over the six years, not only were there no significant changes in the overall income distribution that would have caused a shift in the overall inequality index (the Gini coefficient), but the structure of income distribution in Iran has remained relatively stable. In other words, although there may have been changes at a more granular level (such as shifts in the shares of specific deciles), this suggests that the economic and social policies implemented during this period have not been able to bring about fundamental changes in the income distribution pattern. In other words, the changes that occurred were not significant enough to alter indices such as the Gini coefficient, or even cause noticeable changes in the introduced composite index. Overall, this finding suggests that during the study period, inequality reached a structural stability, although minor changes may have occurred, which did not have a significant impact on the overall inequality indices at the macro level. Despite the fact that the changes are minimal, as depicted in Figure 5, the composite index *I* captures these variations. Specifically, the lowest level of inequality, with a Gini coefficient of 0.425, occurred in 1989, while the highest level of inequality was observed in 1992.

5. Concluding Remarks

Understanding and addressing income inequality through economic, social, and political lenses is essential for designing effective and inclusive public policies. Following the Islamic Revolution, the Islamic Republic of Iran embraced a justice-oriented approach, positioning itself as an active agent of redistribution in support of the disadvantaged. As highlighted by Dara & Aali-Avorgani (2023),

reducing income inequality was explicitly adopted as a central objective in the country's national development plans, signaling a long-term strategic commitment to social equity. Against this backdrop, one of the keys aims of this study is to assess the extent to which these development programs have succeeded in achieving that goal, drawing on decile-level data on per capita gross household expenditure published by the Iranian Statistical Center. Independent of the specific policy instruments or contextual factors at play, the central concern of this research lies in evaluating the actual outcomes of development efforts in reducing inequality and fostering distributive justice. Unlike previous research that has mostly focused on general measures such as the Gini coefficient, this study analyzes the structure of income distribution in greater detail.. To capture different aspects of the distribution, a set of complementary indicators has been used, each highlighting specific segments of the income scale.

By analyzing long-term trends over a 35-year period (1989–2022), the study reveals both consistent patterns and notable changes in inequality. This broader analytical perspective offers a more nuanced understanding of income disparities than conventional approaches. Lorenz curves were constructed to visualize the structure and nature of income distribution over time, followed by the calculation of several inequality measures. While the Gini coefficient remains the most widely used metric, due to its limited sensitivity to changes in specific parts of the distribution, additional indices—including the Palma ratio, the rich-to-poor income share ratio, and the Hoover index—were also computed for each period (the trends of these indices are presented in the Appendix). These calculations help capture a wider range of inequality dynamics. The findings indicate that by the end of the Sixth Development Plan (2022), income inequality had improved compared to the beginning of the First Plan (1989). Specifically, the Gini coefficient declined by 8.5 percent, and the Hoover index by 9.8 percent, reflecting a relative improvement in the overall distribution of income.

Furthermore, the Palma index and the ratio of the top to bottom quintile shares fell by 18.2 percent and 20.7 percent, respectively—signaling a narrowing of the income gap between the highest and lowest social groups. However, the analysis reveals that the First, Second, and Fifth Development Plans were largely ineffective in reducing inequality and, in some cases, even contributed to widening class disparities. In contrast, the Third and Sixth Plans were associated with improvements in equity and a more balanced distribution of income.

In addition to the standard inequality measures, this study employed a composite index known as Index I, which incorporates both the Gini coefficient (overall inequality) and class-based disparities. This index provided the foundation for constructing hypothetical income distribution structures with identical Gini coefficients but differing patterns of dispersion. Based on this idea, three Lorenz curves with the same Gini value but distinct income distribution patterns were generated using Origin software and labeled as structures H, M, and

L. Index I was able to differentiate between these structures and rank them according to their level of inequality: structure H represents the highest inequality, structure L the lowest, and structure M falls in between. The construction of these stylized distributions and the application of Index I to rank them constitutes one of the methodological innovations of this study. Based on the empirical Lorenz curves observed over the analyzed periods, Iran's income distribution structure most closely resembles type M. One of the key contributions of this study is its focus on the structure and stability of the Gini coefficient in selected years—1989, 1992, 1994, 1999, 2003, and 2005—when the index remained approximately constant at 0.425. Given the Gini coefficient's widespread use and acceptance as a comparative tool, this raises an important question: does an identical Gini value necessarily imply the same level and structure of inequality? To address this question, the study applied the composite Index I to compare inequality in different years with similar Gini values. This application of the composite index to Iran's case—across different time points with equal Gini coefficients—represents another methodological innovation of the research.

The results of the composite Index I for years with identical Gini coefficients reveal a relative stability in income inequality over time, with only minor differences observed in two of the years. Notably, the income shares of the bottom and top deciles showed no substantial changes during this period. This persistence, along with the analysis of Lorenz curves, indicates that the structure of income distribution in Iran remained largely unchanged. Although some redistributive policies implemented during these years may have modestly improved general inequality indicators, they failed to produce meaningful shifts in the distributional structure. These minor variations were nonetheless captured by Index I.

Moreover, the close alignment between the composite index and the Gini coefficient suggests that overall inequality in Iran is primarily driven by the income gap between the richest and poorest deciles. If redistributive measures had been successful, one would have expected an increase in the income share of the lowest decile and a decrease in that of the highest. The Lorenz curves across the different development plan periods further confirm that the structure of income distribution in Iran has remained consistently stable. This persistence highlights the limited effectiveness of redistributive efforts in improving distributive justice. From an economic standpoint, the evidence suggests that the redistributive policies applied during this period were insufficient in significantly altering the structure of income distribution.

The findings of this study suggest that policies aimed at narrowing the gap between the poorest and richest income groups—such as progressive taxation and targeted social support—can be effective in reducing overall inequality, provided they are properly designed and implemented. The results underscore the

importance of examining the structure of income distribution in depth and tailoring redistribution strategies accordingly. They also point to the critical role of addressing disparities at both ends of the income spectrum in advancing economic justice.

This study recommends that future policymaking in Iran give greater attention to the underlying structure of inequality, not merely its aggregate indicators, and that redistribution policies be formulated with this structural awareness in mind. Moreover, the analysis presented here can serve as a foundation for further research exploring the effectiveness of such policies.

Future studies could investigate the extent to which external and macroeconomic factors—such as inflation, sanctions, or oil price shocks—have influenced both the implementation and the outcomes of redistribution policies, as well as their impact on the structure of income distribution. Using micro-level data, advanced econometric methods, or machine learning techniques, researchers can further uncover hidden dynamics and provide deeper insights into the persistence or change in inequality over time.

Author Contributions

All authors contributed to the study design, data collection and analysis, and the writing and revision of the manuscript. The final version of the manuscript was reviewed and approved by all authors.

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Conflicts of Interest:

The authors declare no conflict of interest.

Data Availability Statement:

The data used in the study were taken from https://amar.org.ir.

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Appendices

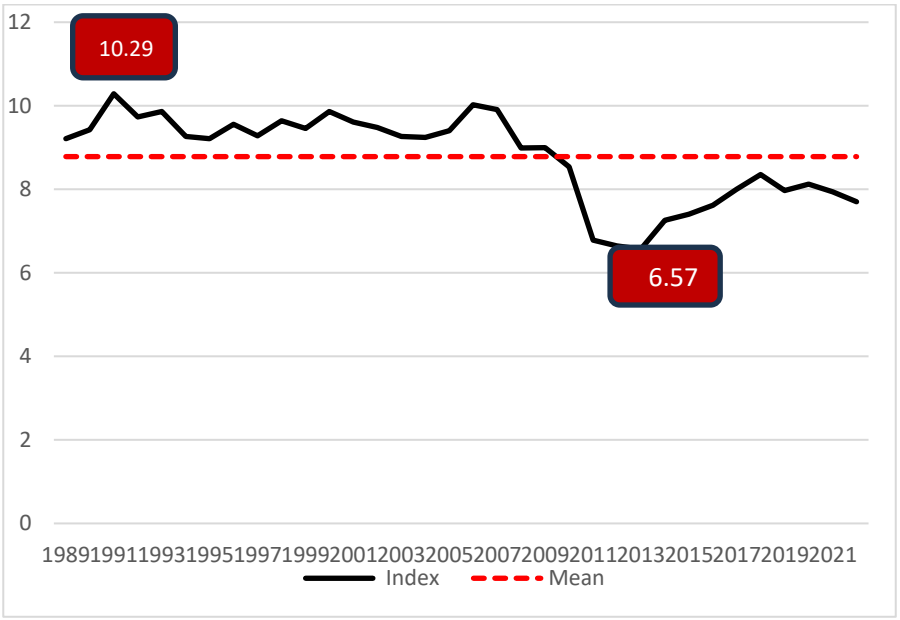

Figure A1. Changes in the Ratio of the Tenth decile to the First decile around Its mean (1989–2022).

Source: *Author's calculations using Microsoft Excel*.

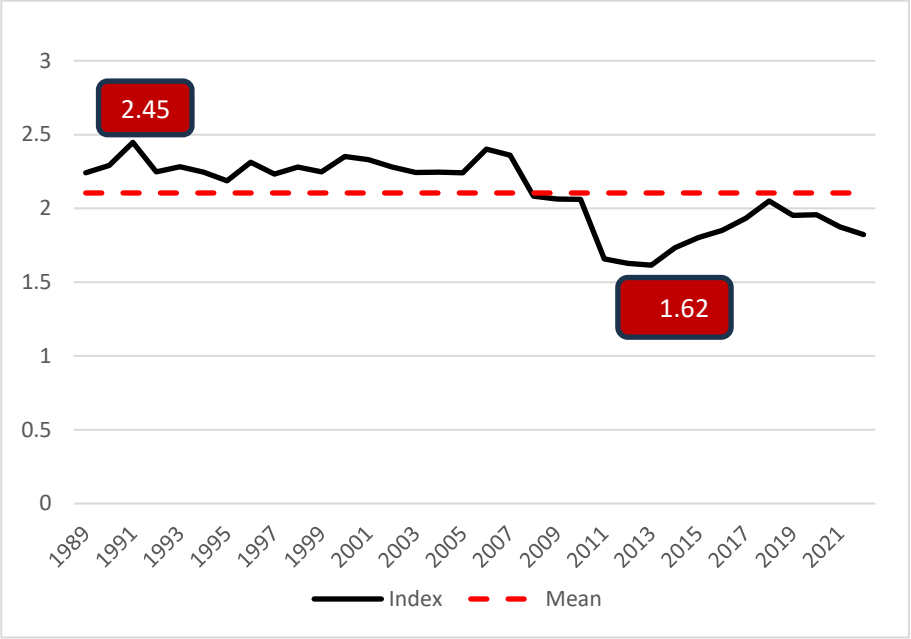

Figure A2. Changes in the Palma Ratio Around Its mean (1989–2022).
Source: *Author's calculations using Microsoft Excel*

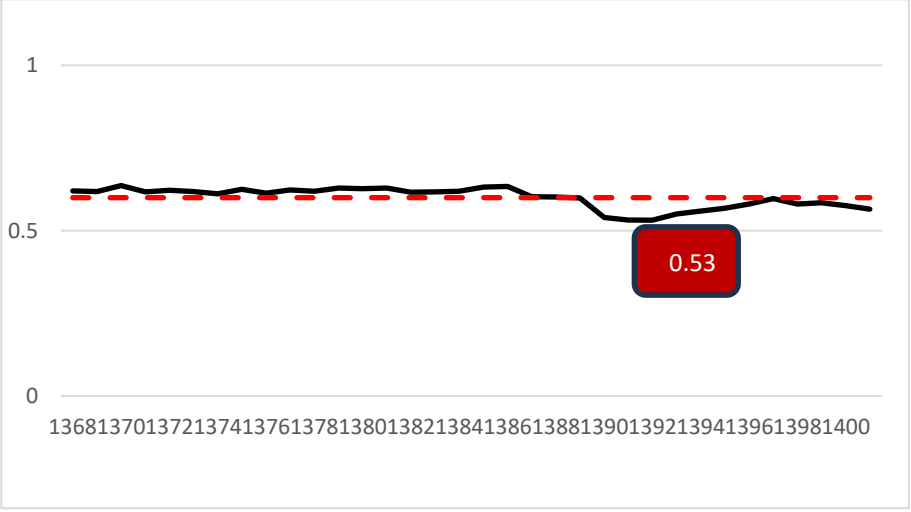

Figure A3. Changes in the Hoover Index around Its mean (1989–2022)
Source: Author's calculations using Microsoft Excel