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The role of financial development in the relationship between income inequality and economic growth in Iran

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ABSTRACT

The aim of this paper is to investigate the effect of financial development on the relationship between income inequality and economic growth in Iran using data from 1984 to 2020. To achieve this goal, real GDP per capita and Gini coefficient are used as indices of economic growth and income inequality, respectively. The results of the cointegration analysis based on the autoregressive distributed lag (ARDL) approach reveal that in the long run, there is an inverted U relationship between economic growth and income inequality, thus confirming the Kuznets curve hypothesis. Additionally, the findings indicate that higher financial development lowers the per capita income level at which income inequality reaches its maximum. In other words, an increase in financial development causes a leftward shift of the Kuznets curve. Also, according to the results government size and trade openness increases income inequality, while the effect of urbanization rate on income inequality is negative.

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1. Introduction

Financial development refers to the expansion and enhancement of financial institutions, markets, and instruments within a country. Its primary objective is to facilitate access to financial resources, improve the efficiency of resource allocation, and increase transparency and safety in financial markets. By improving the performance of the financial system, increasing access to financial services, and reducing costs, financial development can enhance the quality of life and help reduce economic inequalities. In developing countries, where there is a pressing need for diverse goods and services to meet societal demands and improve overall welfare, enhancing the level of financial development is a critical prerequisite for economic progress. The appropriate performance of financial systems can be a potential factor in increasing the accumulation of physical capital, enhancing economic efficiency, and consequently fostering long-term economic growth. The impact of financial development on economic growth directly depends on the role of financial intermediaries in assessing and estimating the capabilities of entrepreneurs and firms that engage in innovation. The factors that contribute to economic growth include mobilizing resources to meet the financial requirements of innovative designs, managing risks, and the role of financial intermediaries in diversifying assets, reducing risks, and predicting expected profits when utilizing new technologies derived from creative activities. According to the neoclassical view, financial development directs saving and capital allocation towards higher production, thereby increasing physical capital and productivity, which in turn fosters greater economic growth. The economic growth driven by financial development subsequently reduces income inequality. Economic growth refers to the development and expansion of an economy's capabilities and resources over a given period and is considered a factor that enables higher levels of production for more consumption and investment. Equitable income distribution, on the other hand, pertains to how these resources are distributed among the population, ensuring that everyone benefits

proportionately from the available resources and opportunities. Together, these two variables, along with the formation of other social, cultural, and political institutions, facilitate and accelerate the process of economic development in countries. Economic planners and policymakers have always faced the question of whether economic growth leads to increased income distribution inequality?. Arthur Lewis (1954) views economic development as a process of shifting factors of production from the agricultural sector with low productivity and traditional technology to the modern sector with high productivity. This allows for the coexistence of the traditional sector alongside the modern sector, facilitating the process of development. Lewis demonstrates that in the initial stages of economic development, this transition leads to an increase in income inequality. This is because, before reaching the Lewis turning point, wages in the labor force remain unchanged while profits in the modern sector increase. Simon Kuznets (1955) proposed a hypothesis in his research titled "Economic Growth and Income Inequality," suggesting that in the course of economic development in any country, income inequality initially increases, then stabilizes at a certain level, and gradually decreases. Kuznets views economic development as a transitional process from traditional to modern economies.

The purpose of this study is to investigate the role of financial development in the relationship between income inequality and economic growth in Iran. This article is structured into five sections. The second section discusses the literature on the topic in terms of theoretical foundations and empirical evidence. The third section introduces the research methodology. The fourth section presents the research findings, and the final section is dedicated to conclusions and research recommendations.

2. Literature Review

Kuznets (1955) views economic development as a process of transition from a traditional (or rural) economy to a modern (urban) one, concluding that at the early stages of development, income distribution worsens because few

people have the capability to to transition to the modern sector. Consequently, the wage gap between the traditional and modern sectors widens. In later stages of development, income distribution improves because a higher number of people will be absorbed into the modern part. Gradually, due to scarcity of labour force in the traditional sector, the income level in the traditional sector will also rise to the modern income levels (Mehrgan et al., 2008). In this regard, Baiardi and Morana (2016) propose a new specification of the Kuznets curve in which the turning point of the curve is taken as an inverse function of the level of financial development. The inverted U relationship between economic growth and income inequality can be shown in the form of Equation (1):

$$y = a + bx + cx^2 \quad (1)$$

Where y is a measure of income inequality, x is real per capita income, and a, b, and c are coefficients, with b>0 and c<0 in order (1) to be consistent with the Inverse-U shaped relationship posited by Kuznets (1955), i.e. the Kuznets curve (KC). The KC turning point (x^*) is obtained by maximizing Equation (1) concerning x,

$$x^* = -\frac{b}{2c} \quad (2)$$

Following Bradford et al. (2005), by differentiating Equation (1) for time and substituting (2), it is obtained:

$$\frac{\partial y}{\partial t} = (b + 2c)\frac{\partial x}{\partial t} \quad (3)$$

$$\frac{\partial y}{\partial t} = \alpha(x - x^*)g$$

where $a \equiv 2c < 0$ and $g \equiv \frac{\partial x}{\partial t}$ is the (per capita) income growth rate. The instantaneous change in economic inequality then depends on the per capita income growth rate g and the distance of x from its turning point x^*; moreover, assuming g>0, inequality increases when $x < x^*$ and decreases when $x>x^*$. Baiardi and Morana (2016) consider the returning point of the

Kuznets curve (x^*) as a function of the level of financial development (f) as follows:

$$x^* = \lambda_0 + \lambda_1 f \quad (4)$$

where λ_0 and λ_1 are parameters, with $\lambda_1 < 0$ implying that a country with more developed financial markets reaches the KC turning point at a relatively lower income level than a country with a less developed financial system. Now, by substituting Equation (4) in Equation (3), we will have:

$$\frac{\partial y}{\partial t} = \beta_1[(x - (\lambda_0 + \lambda_1 f)]g \quad (5)$$

Equation (5) can then be integrated to time, assuming constant the income inequality (y), per capita income growth rate (g), and financial development (f) over time, to yield.

$$y_t = \mu + \beta_1[(x - (\lambda_0 + \lambda_1 f)]gt \quad (6)$$

Where t = 1, ..., T and μ is a constant of integration. By setting variables at their steady-state value (*) we then obtain:

$$y_* = \mu + \beta_1 x_* g_* + \beta_2 g_* + \beta_3 f_* g_* \quad (7)$$

Where μ is the intercept, $\beta_1 \equiv 2\alpha < 0$, as required by the inverse relationship between income inequality and the level of economic development posited by the KC; $\beta_3 \equiv -\beta_1 \lambda_1 < 0$, consistent with the hypothesis of an inverse relationship between financial development and the turning point of the KC; $\beta_2 \equiv -\beta_1 \lambda_0$ can take any value. From the coefficients β_1, β_2 and β_3, the structural parameters of interest λ_0 and λ_1 can then be obtained as $\lambda_0 \equiv \frac{-\beta_2}{\beta_1}$ and $\lambda_1 \equiv \frac{-\beta_3}{\beta_1} < 0$. In short, the Kuznets hypothesis would be supported if the coefficient β_1 is negative. Moreover, the level of financial development has a negative effect on the KC turning point if the coefficients β_1 and β_3 are both negative. There are many empirical studies that have tested the Kuznets' hypothesis. Some of these studies, such as those by Chenery and Syrquin (1975), Ahluwalia (1976a, b),

Saith (1983), Lindert and Williamson (1985), Papanek and Kyn (1986), Adelman and Robinson (1988), Campano and Salvatore (1988), Ram (1988), Bourguignon and Morrisson (1990), Ogwang (1994), Jha (1996), Jalilian and Kirkpatrick (2002), Lin et al. (2006), Barro (2008), Rehman et al. (2008), Shahbaz (2010), Nikoloski (2013), Elmi and Ariani (2014), Utari and Cristina (2015), Rubin and Segal (2015), Abdullah et al. (2015), Maneejuk et al. (2016), Ota (2017), Park and Shin (2017), Afshari and Beykzadeh (2017), Chebli and Saidi (2018), Younsi and Bechtini (2020), Velkovska et al. (2021), Tung and Bentzen (2022), Huynh (2022), Ali et al. (2022), Martínez-Navarro et al. (2022), Castaldo and De Bonis (2023), Ali (2023) and Öndes & Kızılgöl (2024), would confirm this hypothesis.

Also, the Results of studies conducted by Salem and Arab Yarmohammadi (2011), Jaberi Khosroshahi et al. (2012), Zhang and Chen (2015), Aleemran and Shokohi Fard (2017), Akan et al. (2017), Azam and Raza (2018), Mehmet et al. (2020), Khatatbeh et al. (2022), Kamalu & Ibrahim (2023) and Öndes & Kızılgöl (2024) Confirm inverted U-shaped relationship between financial development and income inequality. Another group of studies examines the impact of financial development on the returning point of the Kuznets curve, in the framework of the model suggested by Baiardi and Morana (2016). For example, Baiardi and Morana (2018), Kavya and Shijin (2020) and Farahati and Salimi (2022).

Baiardi and Morana (2018) show for 19 European countries during the period of 1985-2013, the relationship between economic growth and income inequality is inverted U-shaped, and the level of financial development has a negative effect on the KC turning point. Kavya and Shijin (2020) show that from 1984 to 2014 in high-income countries, the relationship between economic development and income inequality and that of between financial development and income inequality is inverted U-shaped, while in middle-income and high-income countries, these relationships are U-shaped. On the other hand, the inverse relationship between the return point of the Kuznets curve and the level of financial development for the countries in question is

not confirmed. Farahati and Salimi (2022) aggregate three indicators of financial development including the ratio of bank loans to the private sector to GDP, the ratio of liquidity liabilities of the banking system or liquidity to GDP and the ratio of the total value of the traded stock to the GDP into an overall (combined) index and then show that there is an inverse relationship between the level of financial development and the turning point of the Kuznets curve for Iran in the long-run. This study investigates the effect of financial development on the turning point of the Kuznets curve for Iran in the framework of the standard KC specification. To this end, a regression model is specified that describes income inequality as a function of economic growth, the square of economic growth, and the product of economic growth and financial development.

3. Model Specification

The purpose of this study is to investigate the role of financial development in the relationship between income inequality and economic growth in Iran, using data for the period 1984-2020, in the framework of the standard KC specification as follows:

$$GINI_t = \alpha + \lambda_1 ED_t + \lambda_2 {ED_t}^2 + \lambda_3 (ED_t \times FD_t) + \delta_1 \mathrm{GS_t} + \delta_2\ \mathrm{URB_t} + \\ + \delta_3 \mathrm{OPEN_t} + \varepsilon_t \quad (8)$$

Where GINI represents the income inequality index, ED shows the real GDP per capita, FD indicates the composite financial development index (explained in the sub-section 3.1), ED × FD is an interaction term between ED and financial development. Moreover, GS illustrates government size (government expenditure-to-GDP), URB indicates urbanization rate (urban population-to-total population), and OPEN shows trade openness (the ratio of exports plus imports to gross domestic product). A KC is said to exist if $\lambda_1 > 0$ and $\lambda_2 < 0$ and both are statistically significant. We expect the coefficient on the interaction term, λ_3, to be negative so that an increase in financial development leads to a decrease in the turning point of the Kuznets curve.

As seen in Equation (8), variables of government size (GS), urbanization rate (URB), and trade openness (OPEN) were used as control variables. Increased government expenditures do not equally affect the purchasing power of all individuals in society. The type, composition, and amount of government spending have different effects on the purchasing power of society deciles. An increase in government expenditures can, on one hand, result in greater benefits for the wealthy compared to the poor, thereby relatively improving the income levels of higher-income deciles over lower-income deciles and worsening income distribution. On the other hand, particularly through increased subsidies and transfer payments to lower-income deciles, it can lead to an improvement in income distribution. Therefore, depending on the nature of government spending, one can expect either a positive or inverse relationship between government spending and income distribution (Afonso et al., 2010). Urbanization can play a significant role in reducing income inequality by creating employment opportunities, providing better public services, fostering positive social and cultural changes, and increasing political participation. Free trade facilitates economic growth for countries by expanding access to scarce resources and promoting growth in sectors where countries have a relative advantage. On the other, According to the Stolper-Samuelson theorem, with the increase in trade liberalization between two countries, one that predominantly uses unskilled labor and the other that predominantly employs skilled labor, income distribution becomes more unequal as these countries specialize in their respective sectors.

3.1 The composite financial development index

The technique of principal component analysis (PCA) was used to create an overall index of financial development from a combination of four index of banking sector development, including Ratio of currency and coins held by the public to the money supply (M1) (FD1), the ratio of liquidity (M2) to gross domestic product to GDP (FD2), the ratio of the banking system's

claims on the private sector to the total credits of the banking system (FD3), the ratio of the private sector's debt to the banking system to GDP (FD4) and an index of non-banking sector development, including the ratio of the total value of shares traded to GDP (FD5). The results of the principal component analysis for financial development indicators are reported in Table (1). As can be seen, the eigenvalues and eigenvectors of the variance-covariance matrix of the main variables of FD1, FD2, FD3, FD4, and FD5 are reported in the upper and lower parts of the table, respectively. Each of the eigenvectors represents the coefficients of the main variables in the linear combination of one of the five principal components, and the corresponding eigenvalue also represents the variance or variability of that component. Furthermore, the sum of the eigenvalues (the variances of the principal components) is equal to the sum of the variances of the main variables; So that each of the principal components represents a percentage of the total variance of the main variables, which is reported in the upper part of the table. As can be seen, the first to fifth principal components contain 64.40, 22.42, 10.01, 3.02, and 0.15% of the total variance of the main variables, respectively. Since the first two principal components represent more than 85% of the total variance or variability of the main variables, the main index can be calculated as the weighted average of these two components, weights of which are based on the corresponding eigenvalues or variances.

The Gini coefficients for the years 1984 to 2020 were estimated using microdata from the household consumer expenditure surveys conducted by the Statistical Center of Iran (SCI) and applying the standard Gini coefficient formula. The data on financial development indicators, per capita GDP, government size, urbanization rate and trade openness during the period 1984-2020 were extracted from the Statistical Center of Iran and the Economic Indicators of the Central Bank of the Islamic Republic of Iran. Some descriptive statistics related to the data are reported in Table (2).

Table 1. The Results of Principal Components Analysis (PCA) for financial development indicators

Number	Eigenvalues (variances)		
	Value	**Proportion (%)**	**Cumulative Proportion (%)**
1	0.0734383	64.40	64.40
2	0.025562	22.42	86.82
3	0.0114164	10.01	96.83
4	0.00344582	3.02	99.85
5	0.000170664	0.15	100

Eigenvectors (loadings)					
Main variables	PC1	PC2	PC3	PC4	PC5
FD1	-0.1321	0.3938	0.3602	0.8058	0.2201
FD2	0.6658	0.5865	0.0516	-0.2961	0.3499
FD3	0.4863	-0.7077	0.2414	0.2080	0.4015
FD4	0.4876	0.0095	0.2401	0.1912	-0.8173
FD5	0.2552	0.0041	-0.8670	0.4280	-0.0023

Source: Research finding

Table 2. Descriptive Statistics

Variable	Observations	Mean	Std. Dev	Minimum	Maximum
GINI	37	0.415714	0.028179	0.352200	0.464200
ED	37	0.065851	0.013134	0.043436	0.085615
FD	37	0.648294	0.205230	0.430640	1.152764
GS	37	0.182807	0.022347	0.143091	0.225730
URB	37	65.14608	7.261353	52.75558	75.43016
OPEN	37	0.147453	0.111836	0.148693	0.668335

Source: Central Bank and Statistical Center of the Islamic Republic of Iran

These statistics summarize the distributional characteristics of each variable, providing measures of central tendency (mean) and variability (standard deviation, minimum, and maximum).

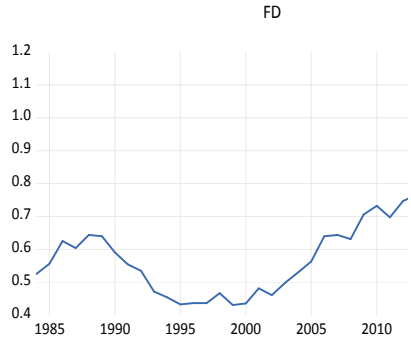

Fig 1. financial development index

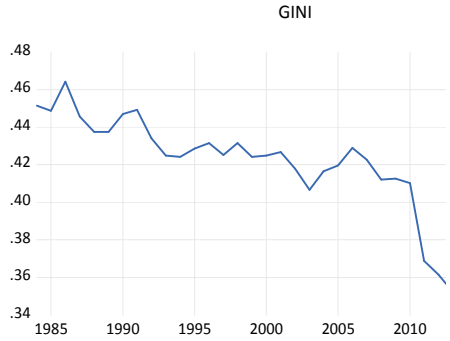

Fig 2. Gini coefficient index

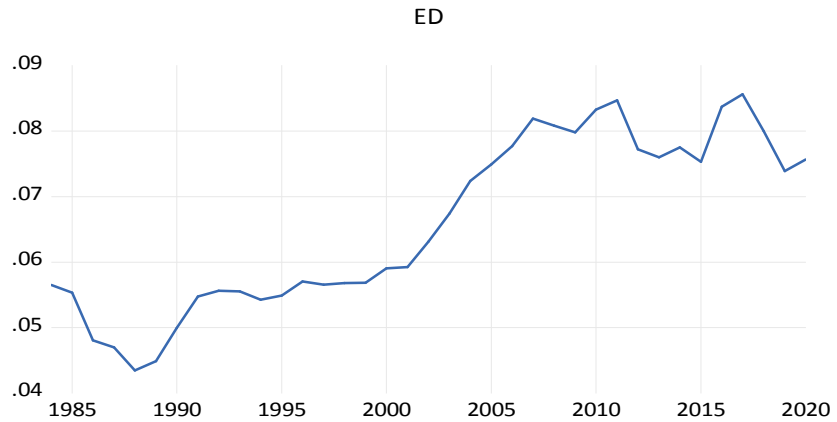

Fig 3. per capita GDP

Source: Research finding

Fig 1 and 2 show the trends in financial development indicators and the Gini coefficient for Iran between 1984 and 2020, respectively. The Financial development index in Iran fluctuated during the Iran-Iraq War (1984-2020) and exhibited an unstable trend. Following the war's conclusion, the index went downward due to government investments to rebuild war-torn infrastructure and the resulting inflation. The index fluctuated between 1997 and 2002. However, it has been on an upward trend since 2003, rising from 0.45 in 2003 to 1.0867 in 2019. Figure (2) shows that the Gini coefficient

has exhibited a relatively downward trend from 1984 to 2007. This index underwent a period of decline from 2007 to 2013, followed by an upward trend continuing until 2016. Afterward, the index fluctuated until the end of the period. The lowest Gini Coefficient during the examined period is 0.365 in 2013. Figure 3 also illustrates the trend of per capita GDP over the period 1984-2020. GDP per capita has experienced a downward trend from the beginning of the period until 1988. After exhibiting a relatively upward trend until 2011, GDP per capita declined until 2015 and then fluctuated for the remainder of the period.

3.2. Autoregressive Distributed Lag Model

Equation (8) is estimated using the autoregressive distributed lag approach (ARDL). In this approach, first, the number of optimal intervals of explanatory variables in an ARDL (p.q) model should be determined in the following form:

$$y_t = \alpha + \sum_{j=1}^{p} \phi_j y_{t-j} + \sum_{j=0}^{q} \boldsymbol{\theta}_j' \boldsymbol{x}_{t-j} + \varepsilon_t \quad (9)$$

Where x_t is a $k \times 1$vector of multiple regressors and θ_j is a $k \times 1$ vector of relevant coefficients. Standard information criteria can be used for this purpose. Also, depending on the diagnosis, the intercept can be removed from the above model, or a time trend or dummy variables can be added. In addition, in this model, it is assumed that the number of regressors' lags (x_t) is the same and equal to q. Nevertheless, these regressors are allowed to have a different number of lags. In the next step, the regression model (9) is rewritten in an error correction form as follows:

$$\Delta y_t = \alpha + \rho y_{t-1} + \boldsymbol{\theta}' \boldsymbol{x}_{t-1} + \sum_{j=1}^{p-1} \gamma_j \Delta y_{t-j} + \sum_{j=0}^{q-1} \boldsymbol{\varphi}_j' \Delta \boldsymbol{x}_{t-j} + \varepsilon_t \quad (10)$$

Where $\rho = \sum_{j=1}^{p} \phi_j - 1$, $\gamma_j = -\sum_{i=j+1}^{p} \phi_i$ for $j = 1. \ldots . p-1$ and $\boldsymbol{\theta} = \sum_{j=0}^{q} \boldsymbol{\theta}_j$, $\boldsymbol{\varphi}_0 = \boldsymbol{\theta}_0$, $\boldsymbol{\varphi}_j = -\sum_{i=j+1}^{q} \boldsymbol{\theta}_j$ for $j = 1. \ldots . q-1$.

Then, the null hypothesis of the non-existence of cointegration between variables (ρ=0 and θ=0) is tested. Wald test is used to test this hypothesis. In this test, the calculated value of the F-statistic is compared with the critical band values reported by Pesaran et al. (2001). If the value of the test statistic is greater than the upper band (critical value), there is a cointegration or long-term relationship between the variables in the following form:

$$y_t = \beta_0 + \boldsymbol{\beta}' \boldsymbol{x}_t + u_t \tag{11}$$

The long-term coefficients of explanatory variables are defined as follows based on regression equations (9) and (10):

$$\boldsymbol{\beta} = \frac{\sum_{j=0}^{q} \boldsymbol{\theta}_j}{1-\sum_{j=1}^{p} \phi_j} = -\frac{\boldsymbol{\theta}}{\rho} \tag{12}$$

The intercept is also defined as follows:

$$\beta_0 = \frac{\alpha}{1-\sum_{j=1}^{p} \phi_j} = -\frac{\alpha}{\rho} \tag{13}$$

The standard error of each of the estimated coefficients can also be calculated using the delta method. In addition, the error correction model (10) can be rewritten as follows:

$$\Delta y_t = \rho ECT_{t-1} + \sum_{j=1}^{p-1} \gamma_j \Delta y_{t-j} + \sum_{j=0}^{q-1} \boldsymbol{\varphi}_j' \Delta \boldsymbol{x}_{t-j} + \varepsilon_t \tag{14}$$

Where ECT_t represents the residual component of the long-term relationship (11), which is known as the error correction term. The coefficient of the first lag of this term (ρ) is also called the speed of adjustment. This coefficient expresses how much of the dependent variable's deviation (positive or negative) from the long-term equilibrium path is corrected in each period.

4. Empirical Results

The results obtained from Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests with different specifications are reported in Tables (3) and (4), respectively.

Table 3. The Results of the ADF Unit Root Test

Level				First difference			
Variable	explicitation	t-Statistic	p-value	Variable	explicitation	t-Statistic	p-value
GINI	C	-0.141718	0.9354	ΔGINI	C	-4.926679	0.0004
	C/T	-1.437878	0.8275		C/T	-4.775426	0.0033
	No	-2.913789	0.0051		No	-7.614225	0.0000
ED	C	-0.771672	0.8150	ΔED	C	-4.424013	0.0012
	C/T	-1.976782	0.5939		C/T	-4.357689	0.0075
	No	0.732663	0.8685		No	-4.388699	0.0001
ED^2	C	-0.869958	0.7862	ΔED^2	C	-4.666953	0.0006
	C/T	-1.941138	0.6125		C/T	-4.862053	0.0022
	No	0.471192	0.8117		No	-4.642841	0.0000
$ED * FD$	C	2.022137	0.9998	$\Delta ED * FD$	C	-5.319466	0.0001
	C/T	-0.984839	0.9330		C/T	-6.689429	0.0000
	No	3.301728	0.9995		No	-2.301299	0.0227
GS	C	-3.119830	0.0339	ΔGS	C	-6.333800	0.0000
	C/T	-3.095018	0.1227		C/T	-6.231108	0.0001
	No	-0.923340	0.3098		No	-6.384023	0.0000
URB	C	-2.807516	0.0672	ΔURB	C	-3.733325	0.0078
	C/T	1.086663	0.9999		C/T	-4.387900	0.0070
	No	2.684336	0.9976		No	-1.061667	0.2547
OPEN	C	-1.592175	0.4762	ΔOPEN	C	-4.830378	0.0004
	C/T	-3.215574	0.0976		C/T	-4.752842	0.0028
	No	0.258376	0.7555		No	-4.818376	0.0000

Source: Research finding

Note: Symbols "C", "C/T" and "No" indicate the model specifications with constant and no trend, with constant and trend and without constant and trend, respectively. The p-values are calculated based on the McKinnon's critical values. The null hypothesis is that there is a unit root in the series.

Table 4. The Results of the PP Unit Root Test

Level				First difference			
Variable	**explicitation**	**t-Statistic**	**p-value**	**Variable**	**explicitation**	**t-Statistic**	**p-value**
GINI	C	-1.663179	0.4409	ΔGINI	C	-7.503744	0.0000
	C/T	-2.610088	0.2784		C/T	-7.456454	0.0000
	No	-0.868958	0.3327		No	-7.570022	0.0000
ED	C	-0.771672	0.8150	ΔED	C	-4.293288	0.0018
	C/T	-2.222576	0.4634		C/T	-4.214274	0.0107
	No	0.732663	0.8685		No	-4.339440	0.0001
ED^2	C	-0.869958	0.77862	ΔED^2	C	-4.572629	0.0008
	C/T	-1.941138	0.6125		C/T	-4.470943	0.0057
	No	0.369548	0.7859		No	-4.582456	0.0000
$ED * FD$	C	1.237600	0.9978	$\Delta ED * FD$	C	-3.257304	0.0249
	C/T	-1.201650	0.8951		C/T	-4.745204	0.0028
	No	2.811561	0.9983		No	-3.286574	0.0017
GS	C	-3.172281	0.0301	ΔGS	C	-6.367668	0.0000
	C/T	-3.162096	0.1081		C/T	-6.258863	0.0000
	No	-0.957925	0.2956		No	-6.421214	0.0000
URB	C	-2.235499	0.1979	ΔURB	C	-3.805672	0.0064
	C/T	0.701808	0.9994		C/T	-4.405716	0.0067
	No	8.224685	1.0000		No	-1.133268	0.2289
OPEN	C	-1.745526	0.4006	ΔOPEN	C	-4.728372	0.0005
	C/T	-2.663368	0.2568		C/T	-4.638827	0.0037
	No	0.201335	0.7389		No	-4.766178	0.0000

Source: Research finding

Note: Symbols "C", "C/T" and "No" indicate the model specifications with constant and no trend, with constant and trend and without constant and trend, respectively. The p-values are calculated based on the McKinnon's critical values. The null hypothesis is that there is a unit root in the series.

According to the results, the variables in Equation (8) are a combination of I(0) and I(1), so the Autoregressive distributed lag (ARDL) approach is used to cointegration analysis between the variables:

$$GINI_t = \alpha + \sum_{i=1}^{p} \beta_{1i}\, GINI_{t-i} + \sum_{i=0}^{q_1} \beta_{2i}\, ED_{t-i} + \sum_{i=0}^{q_2} \beta_{3i}\, {ED^2}_{t-i} + \sum_{j=0}^{q_3} \beta_{4i}\, ED_{t-i} * FD_{t-i} + \sum_{i=0}^{q_4} \beta_{5i}\, GS_{t-i} + \sum_{i=0}^{q_5} \beta_{6i}\, URB_{t-i} + \sum_{i=0}^{q_6} \beta_{7i}\, OPEN_{t-i} + \varepsilon_t \quad (9)$$

The ARDL model with the unrestricted intercept and trend is used in this study. According to the ARCH test, the null hypothesis of homogeneity of variance cannot be rejected at an acceptable confidence level. Based on the results of the F-statistic, the model is statistically significant. Durbin-Watson (DW) statistic also shows that the model has no autocorrelation problem. Also, according to the results of the LM test in the model, the null hypothesis that there is no serial correlation of error terms cannot be rejected at an acceptable confidence level. The results are presented in Table (5).

Table 5. Estimation Results

Diagnostic tests			
F-Statistic (p-value)	LM Test(p-value)		ARCH (p-value)
37.38525 (0.0000)	1.251363 (0.3184)		0.055132 (0.9465)
DW − statistic		R-squared	
1.863778		0.98	
Bounds test			
F-Statistic	Significance Level	Bound Critical Values	
		I(0)	I(1)
17.252066	%10	2.53	3.59
	%5	2.87	4
	%2.5	3.19	4.38
	%1	3.6	4.9
Long-Run coefficients			
	Coefficient	t-Statistic	P-value
ED	18.83751	4.819205	0.0002
ED^2	-121.6461	-1.188453	0.0008

ED ∗ FD	-2.583167	-2.336986	0.0337
GS	1.012050	10.98143	0.0000
URB	-0.041428	-3.618227	0.0025
OPEN	0.053412	1.924779	0.0734
Speed of adjustment			
$\hat{\rho}$	Std. Error	t-Statistic	p-value
-0.685773	0.052741	-13.00270	0.0000

Source: Research finding

The F-test statistic suggested by Pesaran et al. (2001) is used to check the existence of a long-term relationship between the variables. In the F test presented by Pesaran, the null hypothesis indicates the absence of cointegration or a long-term relationship. The calculated value of F is compared with the critical value of the band. If the value of the calculated F statistic is greater than the value of the upper band, the null hypothesis is rejected, and the opposite hypothesis that there is a long-term relationship between the variables in the level values is accepted. According to the results presented in Table (5), the value of the calculated statistic is 17.252066, and because the calculated F-statistic is higher than the upper band (critical value) at the significance level of 1%, the null hypothesis that there is no long-term relationship is rejected, and it can be concluded that there is a long-term relationship between the variables. Another issue related to the ARDL approach is the stability of the estimated model. The basis of statistical inferences, forecasting, and using the results of the regression model is based on the assumption that the coefficients of the variables are stable during the period under review. The common cumulative residual test proposed by Brown et al. (1975) has been used to check the stability of the estimated model. In this test, critical values are drawn as two straight lines along the time. Then, if the test statistic for different periods is placed between the critical lines, the null hypothesis of model stability cannot be rejected at the desired significance level. As seen in Fig 1 and 2, the null

hypothesis of model stability cannot be rejected at the 95% confidence level, and the model parameters are stable.

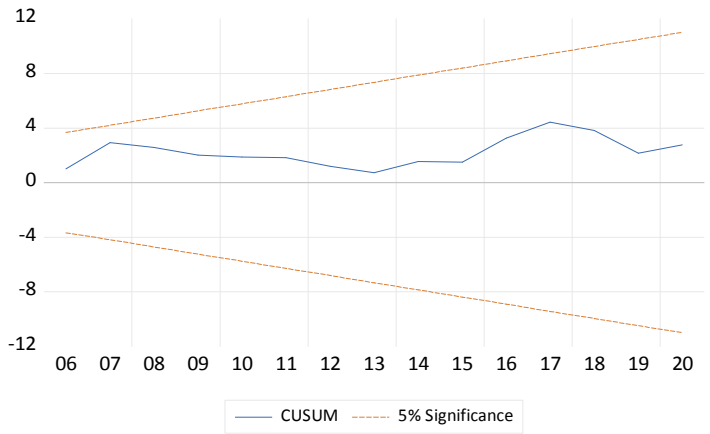

Fig 1. CUSUM for ARDL Model
Source: Research finding

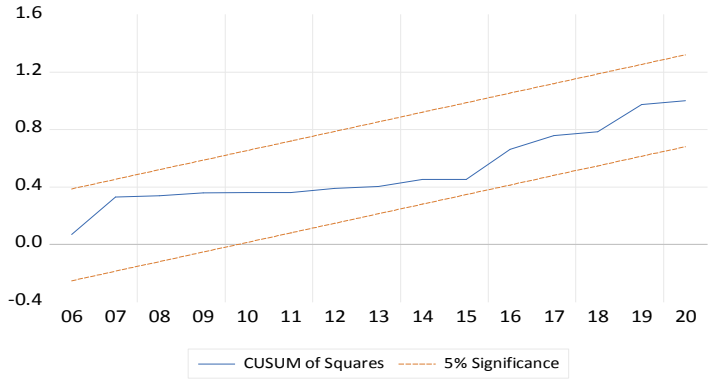

Fig 2. CUSUMQ for ARDL model
Source: Research finding.

The long-run coefficients estimated in Table 5 are reported. According to results coefficients ED and ED^2 are positive and negative, respectively, and both are statistically significant. As a result, the relationship between

economic growth and income inequality is inverted U-shaped that this result confirms Kuznets' hypothesis. Coefficient $ED * FD$ is also negative and significant. So, there is an inverse relationship between the level of financial development and the turning point of the Kuznets curve. Fig (3) depicts the relationship between ED and GINI, influenced by FD, within a 3D space:

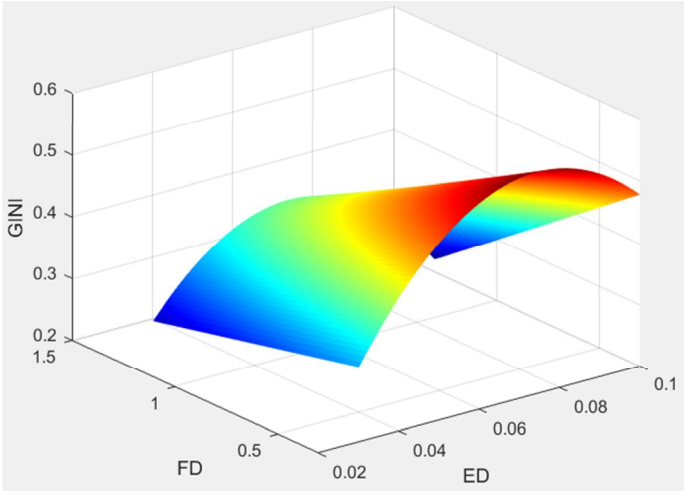

Fig 3. Nonlinear relationship between ED and GINI and the impact of FD

Source: Research finding

As observed, across all levels of FD, the relationship between ED and GINI exhibits an inverse U-shaped pattern. Furthermore, as the level of FD increases, GINI achieves its maximum at lower values of ED. Also, the results show that government size and the trade openness have a positive and significant effect on income inequality, while the impact of urbanization on income inequality is negative and statistically significant. Government can increase income inequality through financial policies such as increasing income taxs, decreasing subsidies and Social Welfare, implementation of inflationary policies, misallocation of government resources and services, such as education and healthcare, and market distortions. Trade openness can lead to increased income inequality because

it tends to concentrate economic benefits and opportunities among those with access to resources, skills, and capital necessary to take advantage of these opportunities. This results in a widening income gap between different groups in society, as the benefits of trade are not distributed equally across all sectors and demographics.

On the other hand, Urbanization can positively impact income inequality by providing increased access to economic opportunities, education, healthcare, social networks, technological advancements, and public infrastructure. These factors enable individuals from diverse backgrounds to improve their economic status, increase their incomes, and contribute to narrowing income inequality. Therefore, promoting urbanization policies that focus on inclusive growth and equitable access to opportunities can be an effective strategy to reduce income inequality in society. The estimation results of the error correction model are reported in the lower part of Table (5). As shown, the coefficient of the first lag of the error correction term is estimated as -0.6858 and is significant at the 1% level. Based on this value, 68.58% of the dependent variable's deviation (positive or negative) from its equilibrium path is corrected in each period.

5. Conclusion and suggestions

The purpose of this study is to investigate the role of financial development in the relationship between income inequality and economic growth in Iran using data for the period 1984-2020. To this end, a regression model is specified that describes income inequality as a function of economic growth, the square of economic growth, and the product of economic growth and financial development. The technique of principal component analysis (PCA) was used to create an overall index of financial development from a combination of five indicators, including Ratio of currency and coins held by the public to the money supply (M1) (FD1), the ratio of liquidity (M2) to gross domestic product to GDP (FD2), the ratio of the banking system's claims on the private sector to the total credits of the banking system (FD3),

the ratio of the private sector's debt to the banking system to GDP (FD4) and an index of non-banking sector development, including the ratio of the total value of shares traded to GDP (FD5). Likewise, the Gini coefficient as an index of income inequality, real GDP per capita as an indicator of economic growth and government size, urbanization rate, and trade openness as control variables and the experimental model using the autoregressive distributed lag (ARDL) are estimated.

The results of the cointegration analysis confirm Kuznets' hypothesis that there is an inverted U-shaped relationship between economic growth (per capita income) and income inequality. According to the obtained results, the mutual effect of economic growth and financial development on income inequality is negative and significant; these results confirm an inverse relationship between the level of financial development and the turning point of the Kuznets curve. Furthermore, based on the results, the Kuznets curve moves to the left as the level of financial development increases. In other words, as financial development improves, income inequality reaches its maximum value at a lower level of per capita income. According to the above results, implementing macroeconomic policies to improve economic growth (increasing per capita income) initially increases income inequality. The upward trend in income inequality continues until a certain level of per capita income is reached (the turning point of the Kuznets curve), but after that, inequality decreases. As the results show, improving the level of financial development can reduce this threshold level of per capita income in the long run. In other words, the expansion and development of financial system's dimensions will lead to an earlier entry into the downward branch of the Kuznets curve, where income inequality decreases simultaneously with economic growth. Therefore, the development of financial institutions and entities and the increase in the quality and efficiency of existing financial institutions in the Iranian economy can be considered by policymakers. In this regard, it is recommended that the government strengthen the banking system to help allocate financial resources optimally .

In addition, the government can improve financial access by strengthening competition between financial intermediaries, which leads to better allocation efficiency. On the other hand, it is recommended that economic policymakers increase the volume of investor transactions by creating incentives and conducting more extensive advertising. Based on the results, it is sugggested that alongside growth policies, financial development in both the banking and non-banking sectors should be targeted by planners and economic policymakers for a fairer income distribution. Increasing the credits granted to the private sector is one way to improve the level of financial development in the banking sector. In this regard, privatizing state-owned banks, increasing the quantity and quality of private banks, and laying the groundwork for the presence of foreign banks will lead to greater efficiency and competition in banking activities. This can increase the credit extended to the private sector, which has higher expected efficiency and profitability. Financial liberalization and the elimination of financial repression will also create balance in the money market, contributing to the development of the banking sector and increased competition among banks, resulting in improved financial development.

Moreover, transparency of information, providing risk management conditions, facilitating transactions, expanding the capital market and making it accessible to all individuals, designing a variety of investment instruments in the stock exchange, and accelerating privatization can improve financial development in the non-banking sector.

Based on the results, government size and economic openness have a positive and significant effect on income inequality, whereas the rate of urbanization has a negative and significant effect on income inequality. It is recommended that government to reduce positive effects of government size on income inequality consider implementing policies for inflation control, tax system reform, and securing financial resources to enhance public and social services such as education, healthcare, and welfare, as well as increasing the minimum wage and ensuring workers' rights. On the other

hand, policymakers can help mitigate the negative effects of trade on income inequality by taking measures such as increasing investment in social and economic infrastructure, expanding education and access to technology, promoting entrepreneurship, and developing skills and capabilities for individuals with lower income levels. It is recommended to implement policies for urban development and increasing opportunities and quality of life in cities with the goal of reducing income inequality. In this regard, policies aimed at providing facilities and encouraging investment in urban businesses can help create employment opportunities and increase incomes for urban residents. Additionally, investment in industries and services can provide greater job opportunities for urban dwellers and boost their incomes. On the other hand, improving urban infrastructure including public transportation, communications, security, water and sanitation, schools, and healthcare facilities can provide better amenities and enhance the quality of life for urban residents.

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All authors had contribution in preparing this paper.

Conflicts of interest

The authors declare no conflict of interest

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