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Rethinking the Income Inequality and Financial Development Nexus. A Study of Nine OECD Countries

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Abstract: Sustainable finance seeks to increase the contribution of finance to sustainable and inclusive growth. The global financial crisis of 2008 provoked the return of inequality in advanced countries to levels typical of a century ago. The aim of this paper is to empirically analyze the relationship between finance and income inequality for a group of nine OECD countries over the pre-crisis and post-crisis periods (2000–2015). The model proposed in this study simultaneously considers two explanatory variables for measuring financial depth (credit provision and capital markets) and a new multidimensional variable to measure the financial system's resilience (a composite indicator), and conducts panel data analysis. The empirical results confirm that in terms of financial depth, the "too much finance hypothesis" holds. We also find that financial system's resilience helps alleviate existing income inequality and that income inequality appears higher in liberal market economies than in coordinated economies. These results encourage policymakers to look beyond traditional public redistribution interventions and to pay attention to other financial variables related to the financialization process, the behavior of financial intermediaries, and the specific environment in which they operate.

1. Introduction

Sustainable finance seeks to increase the contribution of finance to sustainable growth. The financial inclusion induced by banks contributes positively to financial stability and to reduce income inequality [1]. Up to date, the literature has widely analyzed the financial and economic growth relationship, where the financial system traditionally has been considered to have a positive impact. However, little attention has been paid to the analysis of whether the economic growth generated is sustainable or inclusive. Since the pioneering studies of Blank and Blinder [2] and Cutler and Katz [3], there has been an academic consensus that recession leads to increases in inequality. The scant empirical evidence available seems to show that the negative impact of economic recessions on the situation of low-income households is considerably higher than the positive impact of the expansive phases of the economy [4].

Financial crises have devastating effects in terms of income inequality because low-income households are the most vulnerable group to any shock that adversely affects the financial system, and provokes a situation of credit rationing or even financial exclusion [5]. Malinen [6] emphasizes the relevance of the channel of credit provision at the origin of crises in developed economies. The financial

crisis that started in 2008 provoked the return of inequality in advanced countries to levels typical of a century ago. Income inequality has increased in recent years, especially in advanced economies [7], and it is expected to get worse as a consequence of the Covid-19 pandemic crisis. Recent studies present arguments linking income inequality to the financial crash. Some authors support the view that the "financialization process" experienced over the last decades decisively contributed to the global financial crisis. Over-funding has exerted a negative influence which questions the Schumpeter's statement that financial deepening generally stimulates economic development [8,9]. Excessive financial intensification entails risks of over-indebtedness and the deflation of assets, which in the past were the dominant factors in the origin of the great economic turbulence [10,11]. Financial capital is understood as a merchandise that its suppliers try to make profitable, and it is no longer seen as a resource that generates productive activity. Therefore, the production of money through money becomes an ordinary channel of wealth generation, and it produces unequal opportunities and risks [12]. The relative importance of income from private properties and capital investments has substantially increased over the last decades, especially in the case of rich families [13]. This wealth disparity is the main reason for the existing income gap and has raised concerns about its economic and social consequences [14].

On these grounds, the debate about the impact of financial systems on economic growth and sustainable development has been reopened to analyze if there is a degree of financial depth beyond which there are no more positive benefits in terms of growth and investment, but still significant costs in terms of inequality, financial fragility, and sustainability. Recent studies find that financial development contributes to lower inequality up to a point [15,16], but as financial development proceeds further, it contributes to higher inequality [17]. Other studies empirically investigate the effects of financial development on incomes within various income groups in the same country and demonstrates a positive but non-linear effect indicating that promoting a balanced financial development would help to ease the income gap between country residents [18]. In economic literature, the more commonly used empirical proxies for financial depth have been the credit extended by commercial banks to the private sector (as percentage of Gross Domestic Product (GDP) [19] and the relative size of capital markets [20]. However, Cihak et al. [21] also highlight the importance of the multidimensional nature of financial systems and show that if we focus on only one characteristic—for example, financial depth or financial stability—this approach would be too narrow and miss important characteristics of the dynamics of modern financial systems. Some theoretical papers have identified structural, behavioral, and institutional factors that ultimately affect the resilience of the financial system as a key issue to be considered [22,23]. In line with EU Commission Action Plan on sustainable finance [24], we try to determine which financial variables contribute more to a resilient system and to long-term sustainable development.

In this article, we consider simultaneously the quantitative importance of the financial system (traditional approaches based on financial depth), and the qualitative assessment of the financial system's resilience. Specifically, this paper tries to answer three questions: i) does financial depth (through credit or market capitalization) affect income inequality? ii) is the resilience of the financial system relevant to inequality? and iii) what is the relationship between these variables and inequality (linear or nonlinear)?

To answer these questions, we carry out a panel data analysis for a group of nine OECD advanced economies during the period 2000–2015. As resilience cannot be directly measured, we identify the variables to measure it and construct a financial system's resilience composite index [25]. We also want to determine if the model of capitalism (liberal markets economies and coordinated market economies) and the financial crisis are affecting the level and the dynamics of income inequality. The empirical results confirm the "Too much finance hypothesis" [26] for the credit provision variable (a U-shaped relationship); a positive relationship between market capitalization and income inequality, and a negative relationship between financial system's resilience and income inequality.

To our knowledge, this is the first study to consider the multidimensional nature of the financial system and to empirically analyze its relationship with income inequality, including quantitative and qualitative assessments. The paper points out the need for policy makers to closely monitor financial intermediaries' behavior and the environment where they operate in order to ensure that the whole financial system exerts a positive role in terms of income inequality and sustainable development. Our paper contributes to sustainable finance research and to the scarce literature about the specific relationship between financial development and income inequality in the specific case of developed countries.

The paper is organized as follows: the second section reviews the literature and presents the contradictory results about the relationship between financial depth, financial resilience and income inequality, which lead us to establish different hypotheses of analysis for each of the variables considered; the third section describes the sample, variables, and methodological issues and we describe the procedure used to construct the composite resilience index and the panel data estimation process. The empirical results are presented in the fourth section. The paper ends with some discussion and concluding remarks, which will be useful for practitioners and policy makers aim at improving the contribution of financial intermediaries to sustainable and inclusive development goals.

2. Theoretical Discussion and Empirical Evidence

2.1. Financial Depth (Credit Provision) and Income Inequality.

Traditionally, there have been identified three types of links between inequality and financial systems: an extensive link (through wider financial access), an intensive link (through improved quality of services for those who are already included in the financial system) and an indirect link (through the labor market) [27].

Credit provision affects inequality because it benefits corporate access to finance, so the extent to which the low-income group can benefit from this source of finance will result in lower levels of income inequality. The provision of credit to households will foster consumption levels based on low-income families' higher marginal propensity to consume. The higher consumption is, the higher the aggregated output of a country and the higher the levels of employment. If the new labor demand is for low-skilled profiles, the poor will enjoy better chances to find a job, contributing to lower levels of inequality [28]. Overall, higher credit availability allows households to make decisions based on the efficient allocation of spending over time, regardless of their inherited wealth.

The advocates of this narrowing effect of financial depth on income inequality argue that more-developed financial systems enhance reductions in income inequality because in the presence of market imperfections, people can borrow only limited amounts [29].

Finance-induced growth may be pro-poor by expanding employment opportunities, but it may also favor entrepreneurs and their profit margin. It usually brings relatively larger benefits to those at the lower end of the income distribution [30–32].

However, in the opposite direction, some studies have found a widening impact of financial depth in terms of income inequality. This effect seems especially clear in advanced economies and in recent years [7,33,34].

One channel through which the widening of income inequality takes place is the easy access to finance that ultimately could lead to a situation of overindebtedness. Some studies [35–37] confirm this statement and find that excessive levels of indebtedness are responsible for the persistent income inequalities in the U.S.

Other authors show that the relationship between the financial system and income inequality is greater in countries with weak collective bargaining, little labor protection, and shareholder corporate governance, commonly referred to as liberal market economies (LMEs) [38].

More recent theoretical models analyze the ways in which the financial system can increase income inequality by allowing larger rent extraction [39], i.e., the booming remuneration of senior executives

and the proportion of salaries to the total income [40]. The financialization process [41], with the rising dominance of financial instruments and financial actors [42], appears to be a factor behind the increase in inequality in OECD countries.

Other authors considering nonlinear patterns find an inverted U-shaped relationship [43] between financial depth and inequality, with a turning point that occurs when the credit to the private sector reaches 114% of GDP [44] or 82% of GDP [45]. This is called a detrimental-to-beneficial pattern [15,16,39]. The inverted U-shaped relationship has also been demonstrated in studies with various income groups inside a country, showing a greater influence in the extremes (low-income and high-income groups) [18].

However, in tune with the "too much finance hypothesis" (U-shaped pattern), some studies have found that although in the early stages of financial development, the role played by the financial system is positive and contributes to narrowing the income-inequality gap, there is a threshold beyond which further financial deepening will lead to a reverse effect, and inequality will start to rise [20,46,47]. Recent studies on OECD and EU countries have shown that the impact of bank credit on inequality could depend on the gap between the real interest rate and the GDP growth rate [17].

According to these contradictory results, we can establish four alternative hypotheses as follows:

Hypothesis 1a: *Credit provision has a negative and significant impact on income inequality (Inequality narrowing hypothesis).*

Hypothesis 1b: *Credit provision has a positive and significant impact on income inequality (Inequality widening hypothesis).*

Hypothesis 1c: *There is an inverted U-shaped relationship between credit provision and income inequality (Detrimental-to-beneficial pattern).*

Hypothesis 1d: *There is a U-shaped relationship between credit provision and income inequality (Too much finance hypothesis).*

2.2. Financial Depth (Capital Markets) and Income Inequality

Regarding the relationship between capital markets and income inequality, the literature reviewed shows that the emergence of a new corporate governance view with an increasing focus on short-term profits gives firms the incentive to cut labor costs while rewarding the top executives who make such decisions, thus fostering income inequality [8]. In addition, as stock prices increase, the gains are disproportionately distributed to the wealthy, thereby further widening the unequal distribution of income [5,48,49]. Income inequality is also likely to deepen when a stock bubble bursts. At the beginning of a boom, the investors entering the stock markets tend to have high income and benefit more from the abnormal returns. Later investors entering the market have low or medium income, so they suffer more severe losses when the bubble bursts [8]. Stock market capitalization has been the driving force of inequality in the EU-27 since 1995 [50] and in Eastern and Central European countries during 2000–2014 [51]. It seems that the effects of capital markets on inequality are only weakly positive and short-lived [52].

Another stream of the literature finds that the relationship between capital markets and income inequality is better captured when nonlinear dynamics that follow a U-shaped [39,53] or inverted U-shaped pattern [54] are considered.

According to these results we can establish two alternative hypotheses as follows:

Hypothesis 2a: *Financial market capitalization has a positive and significant impact on income inequality (Inequality widening hypothesis).*

Hypothesis 2b: *There is a non-linear relationship between financial market capitalization and income inequality.*

2.3. Financial System's Resilience and Income Inequality

Some authors find significant evidence in favor of a positive relationship between financial fragility and income inequality in developed countries during the period 1995–2015 [55]. Financial fragility is the opposite to financial resilience, a term that has entered the debate among academics and policymakers in OECD and EU countries [24,56].

It has been argued that transforming Europe's economy into a more resilient system requires a process of taking due account of environmental and social considerations (basically inequality and inclusiveness) in investment decision-making. This would lead to increase investments in long-term and sustainable activities [24]. The European Banking Authority, within the Action Plan on Sustainable Finance, encourages banking institutions to include these considerations into their business strategy and risk management to build resilient and sustainable business models in the long-term [57].

Some authors utilize the central tenets of resilience thinking as a lens through which to assess investing in disaster risk reduction and climate resilience [58]. Other studies identify resilience with financial health of financial organizations and explore how to include relationships that govern complex systems to the analysis of financial systems exposed to systemic risks [59,60].

Bakir [23] defines financial system's resilience as the capacity of the financial system to adapt in response to both short-term shocks and long-term changes while continuing to fulfil its functions in serving the real economy [61]. Financial resilience refers to the behavior of financial intermediaries [62], the specific environment in which they operate [22,63] and some underlying institutional factors [23].

Research on financial resilience is a relatively a new field in finance and hence, a consensus has not yet been reached about which factors have the most influence on resilience [25].

Ruza et al. [64] review the main studies analyzing and measuring resilience and propose a theoretical and comprehensive framework of financial system's resilience. They define financial resilience as the capacity of a system not to return to an initial point of equilibrium after a shock but to evolve and move to a new state of equilibrium within a stability domain. Inspired by the New Economics Foundation [65], the authors summarize the main determinants of financial resilience: the business model followed by banking institutions (asset and liability composition); the structure of the market in which banks operate and the institutional environment and policies that influence banking behavior. These determinants can help prevent, attenuate, or amplify shock propagation, and also impose limits and influence agents' incentives to engage in risky activities.

For example, the high dependence on the source of wholesale funding increases the risk of systemic collapse when confidence in the system disintegrates [66]. A highly interconnected financial network will serve as a mechanism for shock's propagation rather than a firewall within a highly globalized system [67,68]. Due to the international exposure of globalized financial institutions, any international shock would find no barrier that impedes it to continue expanding elsewhere [69,70]. The degree of concentration seems also relevant in terms of resilience because it leads to larger institutions, some of which deserve the consideration of super-spreaders of contagion effects due to the complex nature of their activities and their market power [22,46,63,69–73].

Finally, prudential regulation (higher bank's capital ratios) and monetary and fiscal policies can influence the resilience of the system as they can impose limits to leverage, to certain risky activities (i.e., securitization of banks' assets) or to agents' incentives to get into debt (low interest rates or QE monetary policies).

In this paper, we assume that financial resilience can contribute to reducing financial fragility and thus reduce income inequality levels [55].

We establish the hypothesis as follows:

Hypothesis 3: *Financial system's resilience has a negative and significant impact on income inequality (Inequality narrowing hypothesis).*

In Table 1, we summarize the contradictory results found in the literature reviewed.

Table 1. Main literature review on relationship between finance and inequality.

Reference	Objective and Sample	Methodology	Results
[34]	They analyzed the impact of financial globalization and technological changes in income inequality. Sample: 51 countries, of which 20 are advanced and 31 are developing and emerging countries, and the period covered is 1981–2003.	Panel demeaned with time dummies.	**(+) effect** Widening inequality.
[74]	Theoretical model of market imperfections and indivisibilities in investment in human capital affect "initial distribution of wealth," which affects "aggregate output" and "investment."	Economic growth equilibrium model (short and long term).	**(-) effect** Narrowing inequality.
[75]	Financial markets revolution opens the access of the poor everywhere. Sample: Wide sample of countries around the world (1960–1995).	Regression (pure cross-sectional analysis; for long-term relationships) and panel data (to test the U-shaped hypothesis) in 5 non overlapping periods.	**(-) effect** Narrowing inequality.
[30]	Analyzes the impact of financial depth in the distribution of income and changes in both relative and absolute poverty. Sample: 72 developed and developing countries.	Ordinary Least Squares (OLS) method; cross-country regressions.	**(-) effect** Narrowing inequality.
[43]	Analyzes the link of savings, economic growth, financial intermediation, and income inequality. They test the Kuznets hypothesis.	Theoretical model of general equilibrium yields a development process consistent.	**(+/-) effect** An inverted U-shaped relationship between financial development and income inequality.
[44]	Explores a potential dynamic and endogenous relationship between financial sector development and inequality. Sample: developed and developing countries (1962–2006).	Dynamic multivariate panel data analysis. Generalized method of moments. Instrumental variable approach (lagged dependent).	**(+/-) effect** An inverted U-curve relationship. The turning point occurs at the point where the credit to the private sector reaches 114% of GDP.
[76]	Analyzes the relationship between financial depth and gross and net income inequality in a cross-country setting. Sample: 1960–2005 for 72 countries.	OLS	**Mixed results.**
[45]	Financial depth increases income inequality (especially in developed countries). Sample: 138 countries for the period 1960–2008.	Panel data analysis. Fixed effects, time dummies. Instrumental variable procedure.	**Mixed results.**
[77]	How financial depth is related to income distribution. Sample: 22 African countries (1990–2004).	Dynamic panel estimation technique (GMM). They used GMM-estimator of Blundell and Bond (1998).	**Mixed results.**
[20]	Financial depth reduces inequality until a point, and then inequality increases (the impact of financial markets). Sample: 35 developing countries (1980–2000).	Dynamic panel models (linear and non-linear) using the two-step GMM estimator provided by Arellano and Bond and a non-linear equation.	**(-/+) effect** U- shaped relationship.

Note: Source: Own elaboration.

3. Data and Estimation Method

3.1. Sample, Source of Information, and Variables

Our sample includes nine OECD countries. Six of the countries correspond to coordinated economies and three to liberalized economies. We want to see if the model of capitalism that characterizes a specific country affects the level and the dynamics of inequality [78,79].

The reason for choosing these relatively homogeneous set of countries is because we intend to focus on a group of advanced economies in terms of financial development. As it has already been argued in the literature, the relationship between income inequality and financial indicators may vary depending on the stage of financial development. We chose the group of G7 countries (Canada, France, Germany, Italy, Japan, the U.K., the U.S.) and two southern Europe economies (Spain and Portugal) as exponents of advanced countries that during the financial crises received financial help from the EU. Indeed, by focusing solely on advanced countries we would be better able to identify specific patterns related to the "financialization process" of these countries, and identify the main drivers of income inequality, which in a mixed sample of countries would be different [17].

The analysis extends over a period of 16 years (2000–2015), so it covers the pre-crisis and post-crisis periods to reveal any significant differences in the patterns. The series goes as far as common data was available at the time of analysis.

Previous studies have often used the Gini coefficient to measure income inequality, either in gross or in net terms. In our study, we decided to include the net Gini as our dependent variable and defined post-tax and post-transfers, so it captures the effect of public redistributive instruments. To do so, we used Solt's [80] Standardized World Income Inequality Database (2009), which seems to be the most comprehensive and comparable database of Gini indices among developed countries over time.

We introduce two exogenous variables to measure financial depth. The first is the credit provided to the private sector as a percentage of GDP (CREDIT), which reflects the ease with which households and corporations may obtain credit [27,45,75].

The second variable, stock market capitalization as a percentage of GDP (MKCAPITAL), accounts for the increasing importance of financial markets for generating capital gains and improving agents' financial wealth [20,78,81].

To measure the resilience of the financial system (RESILINDEX), we follow the methodology proposed by Ruza et al. [64] and construct an updated new composite index. There is no single indicator, or set of indicators, that measures financial resilience. The lack of relevant information to feed the indicators is one of the biggest difficulties faced when we build composite indicators [25].

The variables included in the composite index are those correlated with inequality and according to the sign of this relationship. These variables refer to the way in which banks do business, reflected in their asset and liability composition (bank size, leverage, broad noncore liabilities, credit allocation, inter-financial activity, and international exposure), the structure of the market in which they operate and other characteristics of the financial system influenced by policies and institutional factors (bank concentration, inter-financial activity, securitization exposure, and level of household debt).

The dependent and explanatory variables and their sources of information are summarized in Table 3, together with the expected sign for their relationship according to the previously presented hypotheses.

Drawing on previous studies, we identify various control variables (see Table 2) to account for other important drivers that might influence income inequality:

1. Ln GDP per capita (LnGDP pc). This variable is included to test whether the Kuznets hypothesis holds within the group of advanced economies. This hypothesis suggests that the relationship between economic development and income inequality follows an inverted U-shape.
2. Public expenditure on health (GEXHEALTH). Equality of opportunity refers to the access to basic health services and the public investments in human assets, such as health, that may augment the productivity of a country and enhance the earnings capacity of its population [82].
3. Country classification (COUNCLASS). The model of capitalism that characterizes a specific country might affect the level and the dynamics of inequality [78,79]. From the perspective of the varieties of capitalism proposed by Hall & Soskice [83], capitalist countries can be divided into LMEs and coordinated market economies (CME). LMEs provide stronger shareholder and creditor protection, so they usually promote a market-based model, and the repeated interaction of banks can compensate for reduced creditor protection [39].

4.   Banking crisis time (CRISTIME). This is a dummy variable. Following the definition of the World Bank, a banking crisis occurs if the following two criteria are observed: a) significant signs of financial distress in the banking system and b) significant banking policy intervention. The first year in which both criteria are met is considered the start of the crisis (2008), and the crisis ends when both real GDP growth and real credit growth turn positive for two consecutive years.

Table 2. Control variables.

Variable	Definition	Source
Ln GDP per capita (Ln GDP pc)	Neperian logarithm of GDP per capita, constant 2010 US$	World Development Indicators database, World Bank [84]
Public expenditure on health (GEXHEALTH)	Government's current expenditure on health to GDP (%)	OECD statistics [85].
Country classification (COUNCLASS)	Classification of liberal market economies (LME) and coordinated market economies (CME).	Hall and Soskice [83].
Banking crisis time (CRISTIME)	Dummy variable (0 for years before 2008; 1 for 2008 and the following years)	Global Financial Indicators, World Bank [84].

Note: Source: Own elaboration.

Table 3. Definition of variables and sources of information.

Dependent Variable			
Net Gini (GINI)	**Net Gini Coefficient (Post-Tax, Post-Transfer)** Source: Standardized World Income Inequality Database (SWIID) [80]		
Explanatory Variables			
Variable	Definition	Hypotheses	Expected sign
Financial depth (CREDIT)	Private credit by deposit banks and other financial institutions to GDP (%) Source: Global financial development database, World Bank [64].	H1.a: Credit provision has a negative and significant impact on income inequality.	Negative
		H1.b: Credit provision has a positive and significant impact on income inequality.	Positive
		H1.c: There is an inverted U-shaped relationship between credit provision and income inequality.	Linear term positive and quadratic term negative.
		H1.d: There is a U-shaped relationship between credit provision and income inequality.	Linear term negative and quadratic term positive.
Financial market capitalization (MKCAPITAL)	Stock market capitalization to GDP (%) Source: Global financial development database, [84] and Fed Reserve Bank of St. Louis.	H2a: Financial market capitalization has a positive and significant impact on income inequality.	Positive
		H2b: There is a nonlinear relationship between financial market capitalization and income inequality.	Quadratic term.
Financial system's resilience (RESILINDEX)	Composite Index of Resilience Source: [64] and own elaboration.	H3: Financial system's resilience has a negative and significant impact on income inequality.	Negative

Note: Source: Own elaboration.

Our unbalanced panel of data consists of nine cross-sections and ten time series over 16 years.

3.2. Methodology

The financial system's resilience index used as an explanatory variable is a composite or synthetic index, defined on a scale between 0 and 100 following the methodological procedure proposed by Freudenberg [86] and OECD [87] in terms of: selection of initial indicators or base variables; weighting and aggregation of initial indicators into dimensions or intermediate indicators; and, finally, estimation of the synthetic or composite index by combining the dimensions previously obtained.

The base variables (see Table 2) are normalized by applying the minimum-maximum method and were re-elaborated to adjust them to our objectives [25] considering the sign of the relationship between each variable and resilience.

According to multiple-criteria decision making (MCDM) literature, we follow an objective approach to determine the weights of attributes, which can be grouped into three categories: subjective, objective, and integrated [88].

For the weighting and aggregation of the base variables, we choose the STATIS technique (Structuration des Tableaux à Trois Indices de la Statistique) in its dual version, and we use the ACT program included in the statistical package SPAD [89]. This is a multivariate technique that is used for analyzing multiple matrices or tables of data consisting of continuous variables. There are as many matrices as years, and each matrix is composed of the base variables of the nine countries (end of the year references). The technique is based on a generalization of the method of principal components. The relationships between successive matrices are studied to construct a "compromise matrix" through scalar products that is as close as possible to and representative of the original matrices.

Accounting for the weights assigned to each annual matrix, we organize the pooled data and apply principal component analysis with Varimax rotation, to ease the interpretation of the dimensions (principal components) identified and retained. Considering the scree plot, three dimensions are identified and retained, which accounts for 75% of the explained variance (Table 4).

Table 4. Principal component analysis with Varimax rotation.

Factor Loadings after Varimax Rotation			
Variables*	**D1**	**D2**	**D3**
Market concentration	0.180	−0.446	0.615
Inter-financial linkages	0.374	0.818	0.126
International exposure	0.739	−0.062	0.442
Banking system size	0.908	0.284	0.105
Households' debt	0.051	0.749	−0.256
Credit allocation	0.661	−0.131	0.579
Broad non-core liabilities	0.707	0.046	−0.162
Securitization	0.115	−0.024	−0.925
Leverage	0.863	0.328	−0.020
Variance (%)	35.998	18.237	20.924
Cumulated variance (%)	35.998	54.235	75.159

Note: Source: Own elaboration. * Variable definitions can be found in Ruza et al. [64] Varimax is an orthogonal rotation. Loadings can be interpreted as correlations between the variables and the identified components (dimensions D1, D2, and D3). The shaded cells highlight the variables with the highest weight (correlation) in each dimension. Based on this, D1 can be interpreted as the general profile of the banking system (asset and liability composition). D2 and D3 reflect special characteristics of the banking system influenced by policies and institutional factors; D2 express the dependence of banks on the source of wholesale funding and D3 represent the level of oligopolization in the banking system and its effect on securities markets.

The dimensions in Table 4 are intermediate indicators, each of whom is weighted for constructing the financial system's resilience index. The weights w_i are determined by percentage of variance explained by each component or dimension i as reflected in the following expression (1) [90–92].

$$w_i = \frac{\text{Explained variance of selected component i}}{\text{Explained variance of all selected components}} \tag{1}$$

The index of financial system's resilience for each country and year with linear aggregation is calculated according to the following equation:

$$(\text{RESILINDEX}) = \sum_{i=1}^{3} FS_i * w_i \tag{2}$$

where FS_i is the factor score of each selected component or dimension ($i = 1,2,3$). FS_i is calculated from the base variables for each country and year, weighted by the factor loadings obtained after the Varimax rotation; and w_i is the percentage of variance explained by each component or dimension i according expression (1).

The composite index obtained measures the financial system's resilience. The index is standardized on a scale of 0 to 100, from lower to higher resilience, for the interpretation of subsequent empirical results.

According to H1, H2, and H3, the general empirical model for econometric estimation is set as: where the variables for each country i in year t correspond to the definitions provided in Tables 1 and 3, β are the coefficients or parameters, and ε are random errors.

The econometric estimation of the model has been carried out following the common stages with the help of the Eviews and Stata software. We obtain descriptive statistics and bivariate Pearson correlations with pooled data. Following the Augmented Dickey–Fuller/Phillips–Perron unit-root test (Fisher-type) and cointegration test (Pedroni version) for panel data, most of the series appear to be nonstationary but cointegrated. The Granger test reveals no causal relationships; and none of the explanatory and control variables show problems of endogeneity, except the GDP per capita variable.

The Pesaran test for cross-sectional dependence allows us to accept the null hypothesis of cross-sectional independence. Finally, the Arellano–Bond [93] and Woodridge [94] tests identify serial autocorrelation, and the Pagan-Hall, White/Koenker and Breusch–Pagan/Godfrey/Cook–Weisberg tests detect heteroskedasticity.

The econometric tests suggest we not include the dependent variable with one lag as the explanatory variable because the model specification produces biased estimates. Plausible explanations for the potential bias are the small size of the sample, the strongly autocorrelated residuals, and the nonstationarity of the dependent variable [95].

To address serial autocorrelation, we start with the following specification of the econometric model with all quantitative independent variables lagged one period:

$$\begin{aligned} GINI_{it} = \alpha &+ \beta_1 \text{CREDIT}_{it} + \beta_2 \text{CREDIT}_{it}^2 + \beta_3 \text{MKCAPITAL}_{it} + \beta_4 \text{MKCAPITAL}_{it}^2 + \beta_5 \text{RESILINDEX}_{it} \\ &+ \beta_6 \text{LnGDPpc}_{it} + \beta_7 \text{GEXHEALTH}_{it} + \beta_8 \text{COUNCLASS}_{it} + \beta_9 \text{CRISTIME}_{it} + \varepsilon_{it} \end{aligned} \tag{3}$$

Since the independent variable LnGDPpc_{it-1} is endogenous, it is instrumented in the estimations by its lagged values t-2. The equation is exactly identified.

Model (3) is first estimated with individual random effects applying generalized least squares in two stages (G2SLS random-effects estimator of Balestra and Varadharajan-Krishnakumar). The results are the same for two-stage OLS with pooled data. Accordingly, random effects do not appear to be relevant, and we do not include them in the following estimation.

We then estimate the model by applying the generalized method of moments (two-step efficient GMM estimator) with small sample correction [96]. The empirical results obtained include standard errors that are robust to arbitrary heteroskedasticity and autocorrelation (HAC consistent covariance matrix estimation).

The validity of the instrument is properly tested (underidentification, weak identification and redundant tests), by the Lagrange multiplier (LM) and Wald robust versions of the Kleibergen-Paap rk statistic and an LM test for redundant excluded instruments.

4. Results

Tables 5 and 6 show the descriptive statistics and bivariate correlations among the quantitative variables included in the study. They reflect that the sample is very homogeneous in terms of GDP per capita and inequality (all countries are advanced economies), but not in terms of credit provision, stock market capitalization, and financial resilience.

Table 5. Descriptive statistics (quantitative data).

	CREDIT	MKCAPITAL	RESIL INDEX	LNGDPPC	GEXHEALTH	GINI_COEFFICIENT
CREDIT	**1**	0.494	0.008	0.209	−0.117	0.434
MKCAPITAL	0.494	**1**	0.002	0.516	−0.179	0.297
RESILINDEX	0.008	0.002	**1**	0.059	0.130	−0.520
LnGDPpc	0.209	0.516	0.059	**1**	0.413	−0.241
GEXHEALTH	−0.117	−0.179	0.130	0.413	**1**	−0.429
GINI_COEFFICIENT	**0.434**	**0.297**	**−0.520**	**−0.241**	**−0.429**	**1**

Note: Source: Own elaboration.

Table 6. Bivariate Pearson correlation matrix (quantitative data).

Variable.	Observations	Minimum	Maximum	Mean	Standard Deviation
GINI_COEFFICIENT	137	26.700	37.800	32.285	2.826
CREDIT	137	59.872	202.200	131.376	40.422
MKCAPITAL	137	21.320	171.214	78.225	36.078
RESILINDEX	137	0.000	100.000	50.838	24.901
LnGDPpc	137	9.963	10.854	10.528	0.237
GEXHEALTH	137	4.770	9.420	6.957	1.131

We find a high correlation between credit provision and stock market capitalization but low correlations between the financial resilience index and the rest of the independent and control variables. Credit provision is the only variable that shows a positive relationship with GINI. We find a moderate negative correlation between the financial resilience index and GINI.

Table 7 shows a summary of the model estimation results for the period 2000–2015. We find nonlinear dynamics following a U-shaped pattern in the credit provision-inequality nexus and the stock market capitalization-inequality nexus, confirming H1d and H2b. In both cases, there is a threshold beyond which further financial deepening lead to a reverse effect, which highlights the existence of a trade-off between greater financial depth and greater risk of crisis, confirming the too much finance hypothesis [20,39,53]. The turning point corresponds to credit to the private sector amounting to 114.33% of GDP and stock market capitalization amounting to 66.85% of GDP.

Table 7. Summary of model estimation results.

Dependent variable: GINI_COEFFICIENT	Two-step GMM Estimator
Explanatory Variables (Lagged one Period)	**Coefficient/(Standard Error)**
CREDIT	**−0.087807 *****
	(0.029832)
CREDIT^2	**0.000384 *****
	(0.000113)
MKCAPITAL	**−0.051077 *****
	(0.018442)
MKCAPITAL^2	**0.000382 *****
	(0.000132)
RESILINDEX	**−0.047476 *****
	(0.005298)
LnGDPpc	**−6.554073 *****
	(0.873188)
GEXHEALTH	**−0.310815 ****
	(0.146843)
COUNCLASS	**2.846809 *****
	(0.556353)
CRISTIME (0≤2008; 1>2008)	**1.049639 *****
	(0.288461)
Constant	**110.055158 *****
	(9.609550)
N	**120**
Adjusted R^2	**0.826090**

Notes: Significance: 0.01—***; 0.05—**; 0.1—*; Source: Own elaboration.

With regard to the financial system's resilience index, the negative impact on income inequality confirms our H3. Income inequality is comparatively lower in countries with less household indebtedness, a higher volume of outstanding securitization and banking systems that are less concentrated, more capitalized, and with diversified liabilities, but with lower international exposure and inter-financial dependence. The impact of resilience on reducing inequality would be higher if the credit allocation to the private sector were effectively used to finance more productive and sustainable projects.

We also find, as expected, that income inequality is higher in LMEs, i.e., weak collective bargaining, little labor protection, and few stakeholder-orientated firms.

Finally, when we control for LnGDP per capita, banking crisis, and government expenditure in health, we find that these factors also affect income inequality with the expected signs.

5. Discussion and Conclusions

The last financial crisis has brought into the debate the role played by financial systems in terms of sustainable development and income inequality. Our paper analyzes this relationship in developed countries for the pre- and post-crisis periods. Few of the theoretical and empirical papers reviewed

have paid specific attention to the group of developed countries despite their increasing income inequality over the last decade.

Although previous studies have focused on traditional metrics of financial depth (credit provision or stock market development) for analyzing the link between financial systems and income inequality, we claim that other institutional, behavioral, and environmental components must also be considered.

Our results confirm the "too much finance hypothesis" concerning credit provision and size of capital markets. This suggests that the excess of credit could result in over indebtedness and the deflation of assets in the nine countries analyzed, and that low- or medium-income investors were the ones who suffered the most severe losses when the bubble in the capital market burst in 2008 [5,48,49].

While it is possible to admit that in developing countries the Greenwood–Jovanovic (GJ) hypothesis holds in the relationship between financial development and income inequality (an inverted U-shaped framework), when we focus specifically on the group of developed countries this relationship appears to be U-shaped. After a threshold of financial development, the level of income inequality deteriorates. Therefore, the hypothesis of too much finance does prevail within these advanced economies.

These findings are similar to other studies carried out in Europe [50,51] and the U. S. [35,37,75] and confirm the prediction that, in financially open economies, financial deepening could lead to increasing inequality measured by the Gini index [17]. The same conclusion is reached for few samples of OECD and EU countries [17] where excessive levels of indebtedness and financialization [41,42], a common pattern in advanced countries, appears to be the factors behind the rise in income inequality.

We also find that the impact of the financialization process in terms of income inequality has been higher in countries with liberal market economies, i.e., worse collective bargaining, labor protections, and fewer stakeholder-orientated firms [38,78,79]. The financialization of operations and assets that have occurred over the last decades have generated cash streams that go to common people. The problem is that the distribution of wealth is unequal, and citizens may have unequal claims on the cash stream from financialized assets. Financial deregulation has significantly contributed to this financialization, generating more financial instability since the late 80s.

This conclusion confirms that a financial bubble, within an overheated and rapidly growing economy, highly impacts income inequality. To a certain point, financial capital is no longer seen as a resource that generates productive activity and instead it could generate wealth disparities [13,14,18,19,64].

In this study we also conclude that some structural, behavioral, and institutional factors identified in other theoretical papers [22,23,65] that affect the resilience of the financial system also have an impact on income inequality. The capacity of the financial system to generate inclusive growth is higher in those countries where their financial systems are more resilient, that is, those countries with less banking concentration, with less leveraged medium size banks, with more diversified liabilities, and with less dependence on the source of wholesale funding [46,61,62,67–69,71]. According to our results, credit allocation to private sector during the years analyzed did not contribute to reducing inequality, contrary to what was previously expected [65]. Risky lending during the years before the crisis, or boring lending after the crisis could be the reasons behind this behavior. It seems that institutional factors such as the relaxed monetary policies during these years could have influenced agents' incentives to get into debt, increasing the financialization process, and deviating credit to less productive activities [41]. Our paper has two main methodological contributions. On the one hand, we propose a model that simultaneously considers two explanatory variables measuring financial depth (credit provision and capital markets). On the other hand, we introduce a multidimensional variable (financial system's resilience), which accounts for a deeper assessment of the financial system from a multidimensional perspective.

According to our results, for assessing the contribution of the financial system to sustainable and inclusive growth we should consider not only the depth of the financial system, but also a wide array of other financial variables, especially in liberalized economies. We should avoid thinking that public redistribution interventions would be enough to tackle the problem of increasing income inequality. Regulators and policymakers should pay attention to other financial variables related to the behavior

of financial intermediaries and the specific environment in which they operate. Financial policies aimed at reducing income inequalities should jointly consider the impact of credit provision, capital markets, and the resilience of the overall financial system.

Policymakers should promote regulatory reforms that render the financial system more robust to destabilizing shocks [97] and should also control and supervise the banking business model to ensure that, in the end, credit allocation is effectively used to finance the more productive real economy and to promote sustainable development. These recommendations are especially relevant when public funds or financial facilities are issued by Central Banks, National, or Supranational Governments to face economic and financial crisis.

We must interpret the results cautiously. We are aware that identifying and measuring the different factors that influence financial resilience can be potentially biased by the reach of the authors' knowledge and the reviewed literature [25]. Research on financial resilience is relatively new and we could not contrast our results with other studies.

To enrich our conclusions, future research should introduce more countries into the sample and the reverse relationship of how inequality might affect financial depth and resilience. We would also like to consider new variables: financial inclusion, as there is increasing evidence in the literature supporting that it is particularly effective in lowering income inequality, the value added from the financial sector [98], the share of employment in the financial sector [72], and the wages and wage's premia in the financial industry [99]. These additional measures might be particularly relevant to discuss the allocation or misallocation of factors between the financial sector and the rest of the economy.

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