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Economic Development's Influence on Financial Structure of Iran: New Structural Financial Economics View

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Abstract

This study investigates the asymmetric influence of economic development on the financial structure of Iran through the framework of New Structural Financial Economics (NSFE). Using the nonlinear autoregressive distributed lag (NARDL) model and data for 1991–2023, economic development is measured by real GDP per capita and decomposed into positive and negative variations to capture short-run and long-run dynamics. The findings reveal indicator-specific and horizon-dependent asymmetries. When financial structure is measured by the relative size of capital markets to the banking sector, strong long-run asymmetry is observed: negative income shocks exert substantially larger adverse effects than positive shocks, underscoring the vulnerability of market size to downturns. Conversely, when financial structure is measured by market activity, the asymmetry emerges in the short run: positive shocks stimulate trading and participation, while negative shocks trigger disproportionately larger declines in activity, reflecting the volatility of equity markets. Control variables such as inflation, industrial value added, and trade openness, as well as dummy variables derived from Bai–Perron structural break tests further enrich the analysis. Overall, the results highlight that financial structure in Iran is highly sensitive to contractions in economic development, but the timing and channel of asymmetry differ across measures. This evidence underscores the fragility of market development and suggests that sustainable financial deepening requires policies that stabilize equity markets and reduce the dominance of banks, particularly during adverse economic conditions.

Highlights

- Studying the relationship between financial structure and economic development based on new structural financial economics view.
- Employing Non-Linear ARDL approach to examine the effect of positive and negative fluctuations of economic development on financial structure of Iran.
- Financial structure in Iran is highly sensitive to contractions in economic development, but the timing and channel of asymmetry differ across measures.

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1. Introduction

The structure of the financial system is widely recognized as a key determinant of economic development, as it shapes the mobilization of savings, the allocation of resources, and the management of risk (Levine, 2002; Allen & Gale, 2000). A longstanding debate has revolved around whether bank-based or market-based systems are more conducive to growth, generating extensive theoretical and empirical research (Beck et al., 2001; Demirgüç-Kunt & Maksimovic, 2001). In response to this debate, the New Structural Financial Economics (NSFE) framework emphasizes that financial structure evolves endogenously in line with the stage of economic development and the structural characteristics of production (Lin et al., 2013; Lin et al., 2022). Despite the importance of this issue, the Iranian case remains underexplored. The financial system in Iran has historically been dominated by banks, while capital markets have played only a limited role. This imbalance raises an important research question: to what extent has economic development influenced the evolution of Iran's financial structure, and has the system been capable of adjusting to the demands of the real economy?

The significance of this question is heightened by the macroeconomic realities of Iran. Over the past three decades, the financial system has faced recurrent structural challenges and episodes of instability, which have tested its adaptability. These circumstances highlight the need for a framework that accounts for both the asymmetric impact of positive and negative fluctuations in development and the long-run stage-dependent nature of financial evolution. Hence, this study makes three contributions. First, it applies the NSFE perspective to Iran, focusing explicitly on the reverse causality from economic development to financial structure. Second, it employs the nonlinear autoregressive distributed lag (NARDL) model, which allows for the examination of asymmetric short-run and long-run adjustments. This methodology is particularly suitable because it can accommodate variables with mixed integration orders while distinguishing between positive and negative deviations (Demir & Hall, 2017). Third, the analysis covers a comprehensive period (1991–2023), capturing episodes of reform and structural change, thereby offering a long-term perspective on Iran's financial evolution. Although threshold models could also be used to capture regime-dependent dynamics, NARDL provides the necessary flexibility for our research objective.

The remainder of the paper is structured as follows. Section 2 reviews the related literature. Section 3 describes the theoretical foundations of NSFE. Section 4 presents the data, variables, and methodological approach. Section 5 discusses the empirical findings, and Section 6 concludes with key implications, limitations, and suggestions for future research.

2. Literature Review

The investigation into the correlation between financial sector architecture and economic expansion has long been a central theme in financial economics.

Existing scholarship on this subject can be broadly categorized into two distinct strands of thought: one that treats financial structure as an exogenous variable and another, more recent, that conceptualizes it as an endogenous outcome of economic development.

2.1. The Exogenous View: Bank-Based vs. Market-Based Systems

The predominant strand in the literature, to which most early studies belong, considers the financial structure of an economy to be as an exogenous given. The primary research question within this framework revolves around identifying which configuration of financial institutions—banks or capital markets—is more effective at fostering economic growth. This debate has yielded three competing perspectives:

The Bank-Based View: Proponents of this view argue that banks play a vital and superior role in facilitating economic growth. They emphasize the banking system's capacity to support settlements for new businesses, provide funding to established firms, mitigate information asymmetries, and ensure an efficient allocation of capital, particularly in the early stages of development or in economies with weak institutional frameworks (Stiglitz, 1985; Singh, 1997; Ayadi et al., 2015).

The Market-Based View: Conversely, several researchers highlight the unique contributions of stock markets. They posit that markets are better suited for promoting growth due to their inherent abilities to offer superior risk diversification through liquid investments, facilitate corporate control, and foster innovation by financing new, risky ventures (Greenwood & Jovanovic, 1990; Greenwood & Smith, 1997; Allen & Gale, 2000).

The Financial Services View: A third group of scholars contends that the overarching development level of the financial system is more critical for growth than its specific structural form. This synthesis view argues that banks and stock markets are complementary, not substitutes, each providing essential but different financial services. Therefore, a well-functioning overall financial system is the key determinant of economic growth (Boyd and Prescott, 1986; Beck & Levine, 2002; Osoro & Osano, 2014; Arize et al., 2018).

2.2. The Endogenous View: New Structural Economics and Financial Structure

A second, less developed category of studies challenges the exogenous view by considering financial structure as an endogenous variable, shaped by the underlying structure of the real economy. Early work in this vein, such as that by Demirgüç-Kunt & Levine (2001), observed that financial markets tend to become more dynamic and larger relative to banks as economies develop, though it fell short of providing a robust theoretical explanation for this relationship or defining an optimal financial structure.

A fundamental theoretical advancement was made with the introduction of New Structural Economics (NSE) by Lin (2003). NSE posits that a country's economic structure is endogenously determined by its factor endowments (e.g., labor, capital, natural resources). Consequently, the optimal industrial structure at any given development stage is one that is aligned with its comparative advantage, derived from this endowment structure. As development occurs and factor endowments evolve, the optimal industrial structure also changes (Lin, 2003; Ju et al., 2015).

Building upon NSE, the theory of New Structural Financial Economics (NSFE), developed by Lin and his colleagues, provides a precise demand-side framework for understanding financial structure. Unlike the supply-led models of the exogenous view, which focus on the characteristics of financial institutions themselves, NSFE argues that the optimal financial structure evolves to meet the changing financing needs of the real economy's industrial structure. In the early stages of development, the industrial base consists primarily of small firms in traditional, labor-intensive sectors whose needs for standard debt financing are best met by banks. As the economy develops and its industrial structure shifts towards more capital-intensive, technologically advanced, and risky sectors, the demand for financing shifts towards equity and long-term capital, which capital markets are better equipped to provide (Lin et al., 2013; Lin et al., 2022; Lin et al., 2024).

2.3. Empirical Evidence Supporting the Endogenous View

A growing body of empirical research aligns with the endogenous perspective of NSFE, providing evidence that alignment between financial and real economic structures is crucial for growth. Demir & Hall (2017) conducted a rigorous empirical investigation using the Nonlinear Autoregressive Distributed Lag (NARDL) model for Germany, the United States, France, and Turkey (1989-2012). Their analysis provided empirical validation for the core assertions of the NSFE paradigm across all four countries. Ye et al. (2021) constructed a structural matching indicator to measure the coherence between financial systems and the structure of technological advancement. Their findings showed that this matching indicator exerted a statistically significant and positive influence on economic growth, an effect more pronounced in developed economies. Allen et al. (2018) explored how a country's real economic structure shapes its financial structure. Their analysis of 108 countries, supplemented by case studies from India, Finland, Sweden, and South Korea, demonstrated that shifts in economic structure drive corresponding changes in financial markets and institutions. Sethi & Kumar (2014), in a study of India and OECD countries (1988-2009), used quantile regression to show that deviations from the estimated optimal financial structure harm the economy and slow growth. Ye et al. (2023) utilized Chinese provincial panel data to show that congruence between regional financial structures and technological levels had a positive effect on growth, while structural misalignment exerted a detrimental impact.

Despite the theoretical advancements and international empirical support for the endogenous view, a significant research gap exists regarding its application to the Iranian economy. A review of domestic studies reveals that nearly all empirical investigations examining the finance-growth nexus in Iran (e.g., Ebrahimi, 2014; Mozaffari et al., 2018; Aboutorabi et al., 2021; Alimoradi Afshar, 2022; Negintaji et al., 2022) belong to the first category, treating financial structure as exogenous. A notable exception is Ahmadi (2022), who, based on new structuralist theory, found an absence of a causal linkage between the real sector structure and financial structure in Iran (1991-2023) using ARDL Bounds testing.

Therefore, a compelling need remains for a comprehensive analysis of the relationship between financial structure and economic development in Iran from the NSFE perspective. This study aims to fill this gap by employing the NARDL methodology to empirically examine this relationship, specifically testing for asymmetric responses of financial structure to positive and negative changes in economic development, thus providing a novel and nuanced investigation into the dynamics of Iran's financial system.

3. New Structural Financial Economics (NSFE)

New Structural Financial Economics (NSFE) is a sub-discipline of New Structural Economics (NSE) that provides an alternative framework for understanding how financial systems can best serve the real economy. Developed by Justin Yifu Lin and colleagues, NSFE challenges two prevailing views in development economics. While the benchmark view asserts that developing economies are encouraged to align their financial frameworks with those established in advanced nations as optimal models, the NSFE argues this neglects crucial differences in production structures between economies at different development stages. Also, whereas the irrelevance view claims that only the overall level of financial development matters, not its structure, the NSFE denies it and counters that various financial arrangements possess unique comparative advantages, making them more suitable for addressing specific financing requirements (Lin et al, 2024).

The New Structural Financial Economics (NSFE) framework contends that the principal role of the financial system is to serve the needs of the real economy. Accordingly, a prerequisite for designing an appropriate financial architecture is a thorough examination of the real economy’s distinct financing needs at different stages of development. Given that these needs evolve over time, it becomes essential to evaluate the comparative efficacy of various financial systems in meeting such requirements. Ultimately, the financial structure can only be considered optimally configured when it is tailored to and harmonized with the specific financing demands of the underlying production structure (Figure 1) (Gong et al, 2019).

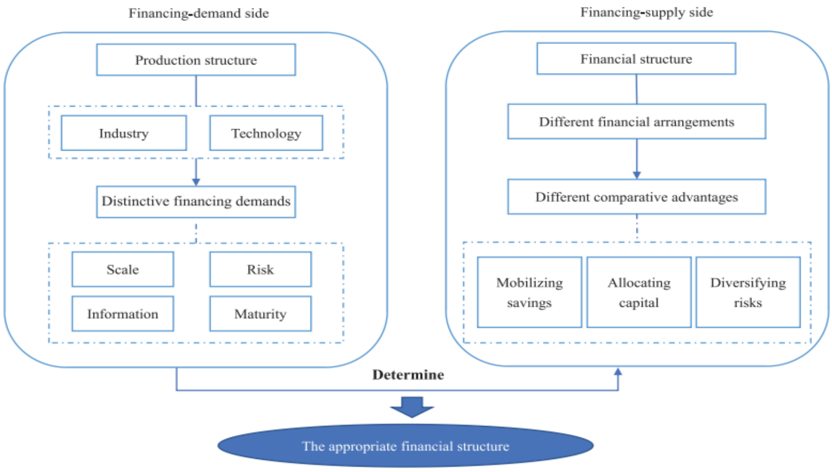

Figure 1. Analytical framework of the appropriate financial structure based on NSFE
***Source**: Lin et al, 2024*

As an economy transitions from its nascent phase to a more advanced stage in contemporary society, the share of agriculture within the industrial framework progressively diminishes, conversely, the segments of manufacturing and services exhibit a propensity for expansion. Throughout this transformation, the production framework undergoes a transformation from a primarily labor-dependent model to one characterized by heightened reliance on capital investment and advanced technologies. Varied technologies and industries are characterized by distinct technical attributes, including prerequisites for specialized capital, skills, and infrastructure, alongside considerations of economies of scale and inherent risks; consequently, they possess unique financial requirements to fulfill the necessary investment and operational scales while addressing the intrinsic uncertainties. Hence, the progression of financial architecture grounded in the NSFE view can be categorized into three sections (Lin et al, 2024):

1. As the economy is at the outset of its development and dominated by small and medium enterprises (SMEs) in labor-intensive production structures, the financial needs of the firms are generally small-scale with limited collateral. In this circumstance, a bank-dominated financial system with many small banks is better suited to serve the economy. This situation is typical in low-income economies.

2. When an economy develops and involves more capital-intensive and technology-intensive industries, a mix of small and large banks along with a developing capital market is an appropriate financial structure. So, the share of banks in providing financial needs of industries decline in comparison to the first stage. This is usual for middle-income economies.

3. Finally, in advanced economies dominated by innovation-driven production structures, the financial needs of the firms are characterized by large-scale, high innovation risks, and long-term horizons. Hence, developed capital markets grow more to meet their needs. It is expected that the proportionate role of the capital market within the overall financial system will increase relative to the previous stage.

Therefore, from the NSFE perspective, the optimal financial structure of an economy is endogenously shaped by its underlying production configuration, which encompasses the interconnection of industries and the technological heterogeneity within them. This production structure, in turn, is fundamentally influenced by the economy's specific composition of factor endowments (the mix of labor, capital, land, and other production factors) (Lin et al, 2024).

The theory warns that if the financial sector of the economy becomes detached from the productive segment of the economy and acts exogenously (independently), then the phenomenon of financialization will occur; a phenomenon that will have serious consequences on the economy, including an increase in rentier activities, speculative activities, diversion of resources from productive investments to short-term arbitrage, and increasing systemic risk and financial instability (Lin et al, 2024).

4. Methodology

4.1 The Model

The objective of this research is to examine the impact of economic development on the financial structure of Iran. As mentioned in the literature section, the New Structural Financial Economics (NSFE) framework posits that an economy's financial architecture is endogenous and evolves in response to shifts within the industrial composition and, consequently, the requirements of the real economic sector. From this perspective, it follows that economic development fundamentally shapes the configuration of the financial system. Moreover, the relationship between economic development and financial structure is characterized by nonlinearity. Specifically, as the real sector of the economy becomes more robust, firms increasingly demand financial services predominantly provided by capital markets. Conversely, during the initial phases of economic development or when the real sector remains underdeveloped, firms rely primarily on banking institutions to satisfy their financial needs.

Therefore, to test this theory, models that allow for the examination of nonlinear relationships between variables should be used. Among the existing models such as Markov-Switching Cointegration, Smooth Transition Cointegration, etc. this research utilized a nonlinear autoregressive distributed lag (NARDL) framework because of its two advantages in comparison to other methods. Firstly, it facilitates the examination of asymmetries over both short-term and long-term horizons in a single-equation framework; Secondly, it allows for using variables whose orders of integration are less than two (Obeng et al, 2022).

If we consider a usual ARDL model that is stated as follows by assuming only two variables i.e. Y and X:

$$\Delta Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \alpha_2 X_{t-1} + \sum_{j=1}^{p} \gamma_j \Delta Y_{t-j} + \sum_{i=0}^{q} \omega_i \Delta X_{t-i} + \varepsilon_t \qquad (1)$$

The NARDL framework, originally introduced by Shin et al. (2014) based on the ARDL model, can be obtained by conducting two steps:

Initially, the exogenous variable X_t is decomposed into its constituent positive and negative partial sums X_t^+, X_t^- - as follows:

$$X_t^+ = \sum_{j=1}^{t} \Delta X_j^+ = \sum_{j=1}^{t} max(\Delta X_j, 0), \quad X_t^- = \sum_{j=1}^{t} \Delta X_j^- = \sum_{j=1}^{t} max\ (\Delta X_j, 0) \qquad (2)$$

Second, the positive and negative partial sums are substituted into equation (1) to obtain the NARDL model:

$$\Delta Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \alpha_2^+ X_{t-1}^+ + \alpha_2^- X_{t-1}^- + \sum_{j=1}^{p} \gamma_j \Delta Y_{t-j} + \sum_{i=1}^{q} (\omega_i^+ \Delta X_{t-i}^+ + \omega_i^- \Delta X_{t-i}^-) + \varepsilon_t \qquad (3)$$

The superscripts (+) and (−) represent the positive and negative components of the partial sum's decomposition, the parameters p and q represent the lag lengths associated with the dependent and independent variables, respectively.

4.2 Data and Model Specification

Building upon the research of Arestis et al. (2001) and Lee (2012), Demir & Hall (2017) employed the following model to empirically investigate the association between financial structure and economic development:

$$FSR = F(ED^+,\ ED^-) \qquad (4)$$

FSR stands for the financial structure ratio, and ED^+ and ED^-- denote the partial cumulative sums of negative and positive variations, respectively, in the logarithm of real GDP per capita as outlined by Lee (2012) and Demirgüç-Kunt et al. (2011). According to these two variables, the NARDL model can be represented as:

$$\Delta FSR_t = \alpha_0 + \alpha_1 FSR_{t-1} + \alpha_2^+ ED_{t-1}^+ + \alpha_2^- ED_{t-1}^- + \sum_{j=1}^{p} \gamma_j \Delta FSR_{t-j} + \sum_{i=1}^{q} (\omega_i^+ \Delta ED_{t-i}^+ + \omega_i^- \Delta ED_{t-i}^-) + \varepsilon_t \qquad (5)$$

The Financial Structure Ratio (FSR) is typically characterized by the comparative significance (in terms of magnitude, operational functions, and efficacy) of financial markets (notably equity markets) relative to financial intermediaries (specifically banking institutions) within the financial framework of a nation (Beck et al. 2001; Levine 2002). Although a collection of four indicators namely structure-size, structure-activity, structure-efficiency, and structure-aggregate may serve as an indicator or substitute measure for financial structure, only the first two indicators have been used for the financial structure ratio variable due to the level of access to data. The first indicator, structure-size (FSS), gauges the degree of advancement of equity markets in comparison to banks by measuring their relative size. It is defined as the ratio of stock market capitalization to GDP divided by the ratio of bank credit to the private sector to

GDP. The second indicator, structure-activity (FSA), also assesses stock market activity compared to banking activity. The measure employs the total value traded ratio, defined as the volume of domestic equity transactions on local stock exchanges relative to GDP, which is then normalized by the ratio of bank credit—specifically, loans extended by the depository banking sector to the private industry expressed as a percentage of GDP (Xu et al, 2024). It should be noted that stock market capitalization, bank credit to the private sector, and GDP were first converted into real terms by deflating with the GDP deflator. Accordingly, the financial structure ratios (FSS and FSA) are based on real values, ensuring that the measures are not distorted by inflationary effects or nominal scale changes. From the perspective of new structural financial economics, it is assumed that in the upper regime, developments in the real economy are expected to positively influence the financial structure ratio, whereas in the lower regime, their effects may be adverse or destabilizing.

In addition to ED as a main independent variable, the model integrates a set of control and structural variables to improve specification robustness and mitigate potential bias:

-Inflation rate (Inf). High inflation typically erodes the real value of financial assets and increases uncertainty, which may discourage long-term investment in capital markets. Therefore, a negative relationship is expected between inflation and the financial structure ratio.

-Share of industry sector value added in GDP (Ind). A higher share of industrial output in GDP may indicate greater demand for long-term financing, which could stimulate capital market development. Thus, a positive effect on the financial structure ratio is anticipated.

-Trade openness (Open). Greater openness to international trade often increases access to external capital. This may support the expansion of capital markets relative to traditional banking, implying a positive expected impact on the financial structure ratio.

-Deposit insurance dummy (DumIns), set to 1 for years following the establishment of the Deposit Guarantee Fund in Iran in 2013 and 0 otherwise. The introduction of deposit insurance is expected to enhance public confidence in the banking system, potentially reinforcing the dominance of banks in financial intermediation. Therefore, its effect on the financial structure ratio may be negative, reflecting a relative decline in capital market reliance.

- In addition, to account for potential structural breaks in the Iranian economy over the sample period, we employed the Bai–Perron multiple structural break test. The results indicated the presence of three significant breakpoints in 1996, 2002 and 2015. Accordingly, three dummy variables were introduced into the model, each taking the value of 1 in the corresponding sub-period after a detected break and 0 otherwise. Incorporating these dummies ensures that structural shifts in the economy are adequately captured and prevents biased estimates in the NARDL framework.

Table 1. Bai & Perron Structural Break Test Results

	Statistic	Critical value 1%	Critical value 5%	Critical value 10%	Result
supF	6.32	3.25	2.69	2.48	Significant at 1%

Source: *Author calculations*

It is worth mentioning that the results of the research model estimation were obtained using the Eviews.13 software. The variables used in this study and their sources are presented in Table 2. After describing the variables and their sources, the statistical characteristics of the variables are presented in Table 3.

Table 2.Variable Definitions and Sources

Variable	Definition	Sources
FSS	Log of the ratio of stock market capitalization to GDP divided by the ratio of bank credit to the private sector to GDP	World Development Indicators (WDI)
FSA	Log of the ratio of total stock market value traded to GDP, normalized by bank credit	World Development Indicators (WDI)
ED	Log of real GDP per capita	World Development Indicators (WDI)
Ind	Log of the ratio of industry sector value added to GDP	World Development Indicators (WDI)
Inf	Log of the inflation rate	World Development Indicators (WDI)
Open	Log of the ratio of total exports and imports to GDP	World Development Indicators (WDI)
DumIns	Dummy variable for deposit insurance (1 = after 2013, 0 = before)	Deposits Guarantee Fund Web
Dum2	Dummy variable (1 = after 1996, 0 = before)	Author's calculation based on Bai-Perron structural break test
Dum3	Dummy variable (1 = after 2002, 0 = before)	Author's calculation based on Bai-Perron structural break test
Dum4	Dummy variable (1 = after 2015, 0 = before)	Author's calculation based on Bai-Perron structural break test

Source: *Author calculations*

Table 3. Summary of Descriptive Statistics

Variable	Mean	Std. Dev.	Min	Max
FSS	0.55	0.46	0.10	2.20
FSA	0.12	0.18	0.02	1.02
ED	9.45	0.16	9.18	9.67
Ind	3.69	0.13	3.47	3.90
Inf	2.99	0.51	1.98	3.91
Open	3.78	0.16	3.37	4.07
DumIns	0.33	0.48	0	1
Dum2	0.18	0.39	0	1
Dum3	0.39	0.49	0	1
Dum4	0.24	0.43	0	1

Source: *Author calculations*

5. Model Estimation and Results

To apply the NARDL model in this study, we follow the steps below (Wadström et al, 2023):

1. Given that the model under study includes time series variables and NARDL cannot handle I (2) variables, assessing the stationarity of the variables is essential for ensuring the validity of the analysis before estimating the model, because otherwise, the probability of obtaining spurious results will be high. In this study, the Augmented Dickey–Fuller (ADF) test and the Phillips–Perron (PP) test has been used to investigate the degree of stationarity. In addition, the Zivot–Andrews (ZA) test is employed to account for possible structural breaks, since the Iranian economy has experienced numerous disruptions and regime shifts over time. The unit root test outcomes presented in Table 4 demonstrate that all variables attain stationarity following first differencing.

Table 4. Unit root tests

Variable	ADF		PP		ZA	
	Level	First Difference	Level	First Difference	Level	First Difference
FSS	-1.54	-5.06**	-1.60	-5.64**	-4.94**	-4.74
FSA	-2.01	-6.52**	-1.53	-8.67**	-4.72	-6.27**
ED	-0.71	-4.68**	-0.71	-4.62**	-3.80	-5.42**
Inf	-2.04	-5.50**	-2.09	-5.99**	-3.85	-5.48**
Open	-1.77	-4.86**	-1.77	-6.29**	-3.31	-5.68**
Ind	-1.71	-5.80**	-1.79	-5.83**	-3.79	-6.27**

*Note: ** denotes the significance level of 5 percent.*

Source: *Author calculations*

2. After ensuring that the stationarity degree of all variables is less than 2 (step 1), the NARDL model is estimated. Optimal lags for dependent variable (p) and independent variable (q) are determined by using AIC. The results of this step are presented after reporting and confirming the diagnostic tests.

3. After estimating the NARDL model, an asymmetry test is essential to be done. This test becomes the typical Wald-type hypothesis concerning the balance of positive and negative asymmetry coefficients. The results of the asymmetry Wald test (Table 5) indicate that the null hypothesis of symmetry is rejected in the long run for the FSS model at the 5% significance level, while no evidence of long-run asymmetry is found for the FSA model. Conversely, in the short run, the null hypothesis of symmetry is rejected for the FSA model but not for the FSS model.

Table 5. Long-run and Short-run Asymmetry test

Variable	Statistic	FSS as Dep.Var Value (Prob)	Result	FSA as Dep.Var Value (Prob)	Result
			Long Run		
ED	F-statistic	7.54 (0.01)	Significant at 1% level	0.48 (0.50)	Not Significant
	Chi-square	7.54 (0.00)		0.48 (0.49)	
			Short Run		
ED	F-statistic	0.22 (0.64)	Not Significant	6.75 (0.02)	Significant at 1% level
	Chi-square	0.22(0.64)		6.75 (0.00)	

Source: *Author calculations*

4. To test if a cointegration exists between FSR and (ED_t^+, ED_t^-), the Bounds test is employed after estimating the NARDL model. If the computed F-bounds test statistic substantially exceeds the upper critical value, the null hypothesis asserting the absence of cointegration can be decisively rejected. According to the framework proposed by Pesaran et al. (2001), to avoid the issue of spurious or degenerate cointegration, it is imperative to further assess the joint significance of coefficients related to the lagged explanatory variables. This is typically carried out using a Wald test, contingent upon the prior satisfaction of the F-bounds criteria. Rejecting the null hypothesis that all coefficients in question are simultaneously zero affirms the existence of a valid, non-degenerate cointegrating relationship. As shown in Table 6, the empirical results indicate that the F-bounds statistic lies well above the upper bound of the I(1) critical values, thereby providing robust evidence against the null hypothesis of no cointegration. Furthermore, the Wald test, based on its associated p-values, confirms the rejection of the joint null hypothesis, reinforcing the conclusion that the identified cointegrating relationship is both statistically significant and theoretically meaningful. Moreover, this validates that the emerging cointegrating relationship is reasonable and not vague.

Table 6. Bounds and Wald tests

Test	Statistic	FSS as Dep.Var Value (Prob)	FSA as Dep.Var Value (Prob)
Bounds Test	F-statistic	9.46	3.93
Wald Test	F-statistic	9.37 (0.00)	4.90 (0.01)
	Chi-square	46.85 (0.00)	19.60 (0.00)

Note: The upper and lower bounds of the F statistic at the 1 percent level is (2.39, 3.38).

Source: *Author calculations*

5. To verify the model, the Breusch-Godfrey test was employed to assess the presence of autocorrelation within the regression residuals, whereas the Breusch-Pagan-Godfrey test was utilized to examine the homoscedasticity of the error terms following model estimation. Following Brown et al. (1975), the study utilized the cumulative sum (CUSUM) and cumulative sum of squares (CUSUM-SQ) diagnostic tests to evaluate stability. Additionally, the Ramsey RESET test assessed the model's functional form.

Table 7. Diagnostic Tests

Test	FSS as Dep.Var Value (Prob)	FSA as Dep.Var Value (Prob)
Serial Correlation (Breusch-Godfrey LM test)	1.78 (0.21)	1.63 (0.24)
Normality test (Jarque-Bera)	0.41 (0.81)	1.43 (0.49)
Heteroskedasticity test (Breusch-Pagan-Godfrey)	2.37 (0.07)	1.46 (0.25)
Ramsey RESET test	F = 0.51 (0.49) t = 0.71 (0.50)	F = 0.25 (0.62) t = 0.50 (0.62)

Source: *Author calculations*

Based on the diagnostic test outcomes presented in Table 7, the p-values from the Jarque-Bera test confirm that the residuals follow a normal distribution. Likewise, the results of the Breusch-Godfrey test reveal no evidence of serial correlation, indicating that the residuals are independently distributed over time. The Breusch-Pagan-Godfrey test p-value confirms no evidence of heteroscedasticity when FSS and FSA are employed as a dependent variable. Additionally, the Ramsey RESET test p-values point to no issues with omitted variable bias. Furthermore, the CUSUM and CUSUM-SQ test graphs (Figure 2), employed to assess the structural stability of parameters over both short and long durations, indicate that they consistently fall within the acceptable critical thresholds at the 5% level of significance, demonstrating stable coefficients over time.

Figure 2. CUSUM and CUSUM-SQ tests (Top: FSS as Dep. Var; Bottom: FSA as Dep. Var)
Source: *Author calculations*

6. Bypassing all diagnostic tests, the findings derived from both the long-term and short-term analytical frameworks are reported in Table 8a, Table 8b and Table 10. The empirical analysis uncovers a nuanced, indicator-specific pattern in the relationship between economic development and the financial structure of Iran. Considering the long-run estimates first, the FSA (financial structure-activity) specification shows a positive and statistically significant coefficient for inflation, while the decomposed income terms do not attain significance. This indicates that, over the multi-year horizon, financial structure activity (as captured by FSA) does not display a persistent asymmetric response to positive versus negative deviations of per-capita income in the preferred specification. By contrast, the long-run behavior of the size-based indicator (FSS) is clearly asymmetric. In the FSS long-run equation both lagged positive and lagged negative deviations of economic development enter significantly and with negative signs, but the magnitude of the coefficient on negative deviations is much larger (ED^{+} (-1) = −2.23; ED^{-} (-1) = −12.72) confirming that prolonged contractions affect the bank–market size balance far more strongly than expansions strengthen it. Inflation and trade openness retain positive roles in the FSS long-run specification (Inf positive at weak/significant levels; Open positive

and significant), but the dominant feature is the asymmetric long-run sensitivity of the size ratio to income contractions. To statistically confirm the presence of asymmetric effects in the long run, a Wald test was conducted on the null hypothesis that the long-run coefficients of positive and negative deviations of economic development are equal. The results, presented in Table 9, unequivocally reject the null hypothesis of symmetry at the 5% significance level.

Short-run dynamics reveal an almost complementary pattern. The error-correction terms are negative and statistically significant in both specifications, confirming the presence of adjustment toward a long-run equilibrium; however, the speed and pattern differ across indicators. In the FSA model the ECT is relatively small in absolute value (ECT= −0.37), indicating gradual correction, while in the FSS model the ECT is larger in absolute magnitude (ECT= −1.33), signaling an over-adjustment tendency and hence short-run volatility in the size measure. This phenomenon is common in economic systems characterized by high volatility, institutional rigidities, and rapid responses to macroeconomic shocks. In the context of Iran's financial system, this overshooting can be interpreted as a sign of structural instability and heightened sensitivity. The banking sector and capital markets appear to react strongly and rapidly—perhaps excessively—to disequilibria, which could be driven by factors such as: Speculative behavior and herd mentality in the Tehran Stock Exchange, Sudden shifts in liquidity between the banking system and capital markets in response to changes in perceived risk and return, Policy interventions and regulatory changes that are implemented abruptly and can have amplified short-term effects on financial structure. So, while the system is ultimately stable (as the negative ECT ensures convergence), the overshooting implies pronounced short-run volatility in the relative size of capital markets to the banking sector. This finding underscores the immature and reactive nature of Iran's financial structure, where adjustments are not gradual but are instead characterized by periods of overreaction and correction.

Short-run coefficients highlight that financial structure-activity (FSA) reacts asymmetrically and sharply to income shocks. Contemporaneous and lagged positive changes in income raise FSA ($\Delta ED^{+} = 5.26$; $\Delta ED^{+}(-1) = 10.31$), whereas lagged negative shocks produce a very large adverse impact ($\Delta ED^{-}(-1) = -35.08$). Industrialization exerts a sizable negative short-run effect on FSA ($\Delta Ind = -6.38$), while trade openness and contemporaneous inflation support market activity ($\Delta Open = 5.76$; ΔInf positive). For FSS, short-run asymmetry is not supported, instead, FSS dynamics are dominated by persistence through significant lagged-dependent terms and by a volatile correction process consistent with the larger ECT coefficient. The dummy for deposit insurance (DumIns) has a negative and significant coefficient in both specifications (DumIns = −1.72 for FSA; = −0.80 for FSS), consistent with the notion that the formal introduction of deposit insurance strengthened the attractiveness or stability of bank deposits and thereby reduced relative market activity and the bank–market size ratio in the short run. The Bai–Perron dummies reveal that each identified structural break coincided with a shift away from market activity and toward a relatively larger banking sector, underscoring that structural regime changes have been an important determinant of Iran's financial structure and must be accounted for when assessing asymmetric responses to economic development.

Table 8a. Long-run Asymmetric NARDL Estimates (FSA as Dep. Var)

Variable	Coef	Std. Error	t-Statistic	CI 95%
Ind(-1)	-20.27	13.35	-1.52	(-46.45, 5.90)
Inf	1.53**	0.66	2.32	(0.23, 2.83)
Open(-1)	11.88	7.29	1.62	(-2.41, 26.17)
ED	6.31	7.92	0.80	(-9.22, 21.85)
C	-34.10	58.96	-1.58	(-149.67, 81.47)

Note: **p<0.05.
Source: *Author calculations*

Table 8b. Long-run Asymmetric NARDL Estimates (FSS as Dep.Var)

Variable	Coef	Std. Error	t-Statistic	CI 95%
Ind(-1)	-1.09	1.09	-0.99	(-3.23, 1.05)
Inf	0.21*	0.12	1.83	(-0.02, 0.44)
Open	1.10**	0.48	2.28	(0.16, 2.04)
$ED^{+}(-1)$	-2.23**	0.83	-2.68	(-3.85, -0.60)
$ED^{-}(-1)$	-12.72***	3.34	-3.81	(-19.27, -6.18)
C	-2.16	2.59	-0.83	(-7.23, 2.91)

Note: ***p<0.01, **p<0.05, *p<0.10.
Source: *Author calculations*

Table 9. Wald Test for Long-Run Asymmetry

Dependent Variable	Test Statistic	Value (Prob)	Result
FSS	F-statistic	8.79** (0.01)	Reject H_0
	Chi-square	8.79** (0.00)	Reject H_0

Note: **p<0.05.
Source: *Author calculations*

Table 10. Short-run Error Correction Representation of the NARDL Model

Variable	FSA as Dep.Var	FSS as Dep.Var
ECT(-1)	-0.37***(-5.72)	-1.33***(-9.84)
D(FSS(-1))	-	0.46***(4.88)
D(FSS(-2))	-	0.28**(2.68)
D(FSS(-3))	-	0.27**(2.45)

D(ED)	-	-1.31(-1.21)
D(Ind)	-6.38***(-4.46)	-0.25(-0.60)
D(Ind(-1))	-1.96** (-2.74)	-
D(Open)	5.76***(5.34)	-
D(ED^+)	5.26*(1.88)	-
D(ED^-)	6.29(0.93)	-
D(ED^+(-1))	10.31***(3.13)	-
D(ED^-(-1))	-35.08***(-4.94)	-
DumIns	-1.72***(-5.70)	-0.80***(-5.98)
Dum2	-0.62***(-3.63)	0.28***(3.96)
Dum3	-0.82***(-4.52)	1.04***(9.19)
Dum4	-1.28***(-3.22)	0.36**(2.89)
Adjusted R^2	0.74	0.83
F statistic (Prob)	8.64 (0.00)	16.13 (0.00)
DW stat	2.68	2.59

Note: ***p<0.01, **p<0.05, *p<0.1
Source: *Author calculations*

7. Finally, to track how temporary shocks in ED_t^+ and ED_t^- affect financial structure ratio over time, dynamic multipliers are estimated and plotted to visualize asymmetry. Figure 3 presents the cumulative multiplier associated with economic development, illustrating the dynamic adjustment of the financial structure in response to both positive and negative shocks, as the system progresses toward a new long-term equilibrium. Positive changes in economic development (ED) are depicted using a bold blue solid line, while negative shocks are represented by a bold yellow line. The bold red line denotes the asymmetry trajectory, capturing the differential impact of positive versus negative shocks on the financial structure ratio over 15-year horizon. Surrounding this red line is a shaded region corresponding to the 95% confidence interval, which confirms the statistical significance of the asymmetrical response.

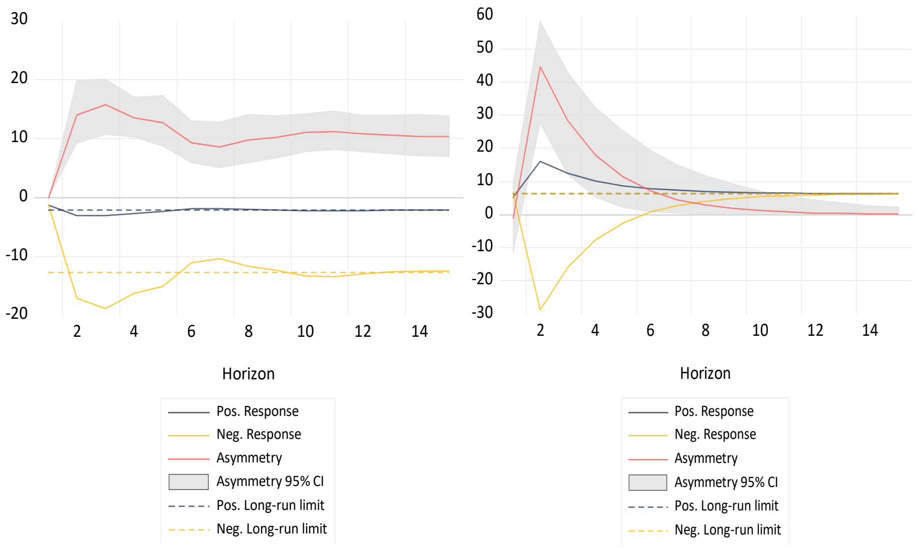

Figure 3. The Cumulative Dynamic Multipliers
(Right: FSA as Dep. Var; Left: FSS as Dep. Var)
Source: *Authors' calculations*

6. Conclusion

This study applies the framework of New Structural Financial Economics (NSFE) to examine the dynamic relationship between financial structure and economic development in Iran. The NSFE perspective, which views financial structure as endogenously determined by a country's developmental stage, provides the theoretical foundation for our investigation. To empirically test these propositions, we employ the Nonlinear Autoregressive Distributed Lag (NARDL) approach, which allows for asymmetric responses to positive and negative shocks in Iran during 1991-2023. The central question we address is how Iran's financial structure, measured by the relative size or activity of capital markets to banking sectors, evolves in response to economic development fluctuations.

Our analysis confirms the presence of a stable long-run relationship but reveals a strikingly indicator-specific and horizon-dependent asymmetry. For the FSA model, no long-run asymmetry is detected; however, the short-run dynamics exhibit sharp asymmetric reactions. Positive shocks to income stimulate market activity, but negative shocks lead to disproportionately larger declines, underscoring the volatility and sensitivity of equity markets to adverse macroeconomic conditions. In contrast, the FSS model shows the opposite pattern: long-run asymmetry is strongly confirmed, with negative income shocks exerting much stronger adverse effects than positive shocks. This implies that over time, contractions in economic development weaken the relative position of markets vis-à-vis banks far more severely than expansions strengthen them. Short-run dynamics in the FSS model remain broadly symmetric but are characterized by over-adjustment, reflecting instability and heightened sensitivity to shocks. These findings challenge a linear interpretation of NSFE for Iran, suggesting that financial structure evolution in Iran cannot be explained solely by the gradual developmental path envisioned in the NSFE framework. Instead, it is heavily influenced by cyclical downturns, regime shifts, and institutional shocks, with asymmetries manifesting differently depending on whether financial structure is measured by activity or size. This underscores the reactive rather than proactive nature of Iran's financial system: capital market development often retreats in the aftermath of downturns, while temporary surges during crises are rarely sustained. For policymakers, the implication is clear. Strategies to deepen capital markets and rebalance the financial structure cannot rely on cyclical or crisis-driven dynamics. Instead, reforms must aim to consolidate stability, address institutional fragilities, and ensure that market development becomes a permanent and resilient feature of the financial system, rather than a temporary response to shocks.

Finally, while this study employs the NARDL framework to investigate the asymmetric effects of economic development on financial structure, consistent with the causal direction emphasized by the NSFE framework, we acknowledge certain limitations and promising avenues for future research. A key practical limitation was the constraint on the number of lags and variables that could be included without rendering the model over-parameterized and statistically infeasible to estimate. Consequently, several key macroeconomic variables—such as the real interest rate, exchange rate shocks, degree of financial openness, capital market regulations, and global business cycles—were omitted to preserve model parsimony and ensure the model remains empirically identifiable and numerically tractable. This necessary simplification, however, introduces the potential for omitted variable bias, and thus the results should be interpreted with this caveat in mind. To deepen this analysis, future studies with access to longer time series or alternative methodologies could incorporate these variables to enhance robustness. Furthermore, threshold or smooth transition models could provide a complementary perspective by explicitly identifying regime-dependent dynamics. More fundamentally, constructing a direct measure of 'structural matching' between Iran's financial system and its real production structure would provide the most robust test of the NSFE core thesis. Investigating how economic development influences the matching index would powerfully complement the findings of this study.

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Conceptualization, methodology, validation, formal analysis, all authors; All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest

The authors declare no conflict of interest.

Data Availability Statement

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