Investigating the Asymmetric Effects of Banking Sector Development and Stock Market Development on Economic Growth in Iran Using Smooth Transition Regression (STR) Model

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Abstract

The purpose of this paper is to examine the asymmetric effects of banking sector and stock market development on economic growth in Iran. For this purpose, Smooth Transition Regression (STR) model used based on seasonal time series data during 1989-2017. The results indicate that the impact of financial and banking development indices on economic growth is different for economic growth rates above and below 6%. Therefore, if the economic growth rate is higher than 6%, then we have a regression and when economic growth is lower than 6% will have another regression in order to effect of financial development of economic growth. In addition, results show that that the relationship between private sector credit and economic growth is much stronger than the relationship between stock market and economic growth.

Keywords: *Financial development, Stock market, Banking sector, Economic growth, Smooth Transition Regression (STR).*
JEL classification: *B23, O40, P44, N20, D53.*

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1 Introduction

The relationship between financial development (banking sector and capital market) and economic growth has been studied in different ways, including intercountry studies (cross-sectional data), which may result in spurious estimates, and also there are a lot of restrictions on them (Liangi and Teng, 2006).

The relationships among banking sector development, stock market development and economic growth have generated a considerable amount of debate for many years among development economists – but with little consensus. Although a growing body of work reflects the close relationship between financial development and economic growth (Gelb, 1989; King and Levine, 1993a; 1993b; Roubini & Sala-i-Martin, 1992), alternative views nevertheless exist. Studies that support a positive relationship between financial development and economic growth include those of Schumpeter (2012), Goldsmith (1969), McKinnon (1973), Shaw (1973), King and Levine (1993a) and Odedokun (1996), among others. Studies that support a negative relationship include Van Wijnbergen (1983) and Buffie (1984). Apart from these two groups, there are studies that find either no association or a negligible relationship between financial development and economic growth. These include Robinson (1952), Lucas (1988) and Stern (1989).
This paper seeks to highlight the importance of financial development variables in the banking sector and the capital market in Iran's economic growth and development, and examines the relationship between financial and banking and economic development.
For this purpose, we use indices, such as the growth of per capita GDP as an index of economic development and the set of variables of the value of the stock market to GDP ratio, the stock market total value traded to GDP ratio and the ratio of stock market total value traded to stock market value, Ratio of domestic credit provided by banking sector to GDP and Ratio of domestic credit to the private sector to GDP as Indicate of financial development in the banking sector and the stock market (DilekDurusu-Ciftci and et al, 2017; Mohammadi, 2016; Jude, 2010).
Many financial researches (Such as: Chen et al, 2018; DilekDurusu-Ciftci and et al, 2017; Narayan and Narayan, 2013; Yang and Yi, 2008; Samargandi et al., 2015; Shaw, 1973;) have focused on this issue in recent years to enhance linear and nonlinear traditional models to achieve more accurate estimates and predictions, and a variety of combination models have been proposed in this direction. In order to model the return volatility, a nonlinear model (STR) is used, which is based on theoretical and financial theories. The phenomenon of

asymmetry can be seen in other markets, such as the foreign exchange market, and so on. What is considered in this paper is examining the asymmetric effects of banking development and stock market development on economic growth.
The rest of this paper is organized as follows. Section 2 provides the theoretical and experimental background between bank and market based financial development and economic growth. Section 3 presents the empirical analysis of the regression results. Section 4 concludes.

2 Background

2.1 Theoretical background

A more advanced financial system encourages efficiency and growth by reducing costs of information, transactions and monitoring. It can be said that the developed financial market is a market in which there is freedom of choice and transparency of information, and suppliers and demanders of this market can trade their financial services with freedom and awareness. Accordingly, if the financial market can handle these tasks well, which is reducing the cost of information and transactions, it can create the necessary resources to fund investment, which in the long-run will lead to an increase in economic growth.
Greenwood and Jovanovic (1990) and Bencivenga and Smith (1991) emphasized the important role of financial intermediaries in economic growth, and argued that financial intermediaries, through information analysis, helped optimize credit allocation and reduce risk. This view is called a hypothesis of "supply-leading finance". The supply-leading growth hypothesis postulates that financial expansion is a factor for economic growth. In this case, the creation and expansion of new financial institutions will be an important tool for capital accumulation and ultimately economic growth. On the other hand, the development of the financial system has also led to an increase in demand for financial services and expanding the financial sector by transferring scarce resources from small savers to large investors and subsequently generates the growth of the real sector of the economy. This view is called a hypothesis of "demand-following financing" and states that the development of the real sector of the economy induces increased demand for financial services, which in turn, lead to the development and expansion of the financial sector. This view was firstly emphasized by Robinson (1952). The demand-following finance hypothesis states that the growth of the real sector has encouraged domestic financial markets and led to the dynamic process of economic development.
Generally, a financial system is made up of two components: the bank-based component and the market based component. If an economy is driven by financial intermediaries – such as banks and bank-like financial institutions –

more than it is driven by financial markets – such as stock and bond markets – that economy's financial system is generally referred to as a bank based financial system. If securities markets share center stage with banks in driving economic growth via savings mobilization and allocation, corporate control, and risk management, that economy's financial system is generally referred to as a market-based financial system (Nyasha and Odhiambo, 2015).

Most economists still believe that a bank-based financial system is better than a market-based system. In particular, it is argued that economic growth could be encouraged more in a bank-based system because it can induce longer-term investment in the real sector, whereas investment in a market-based system is too sensitive to stock market prices with short-term investment (Hoshi, Kashyap, & Scharfstein, 1990).

Without powerful banks to enforce repayment, external investors would be reluctant to finance industrial expansion in countries with underdeveloped institutions. Thus, if banks are not hampered by regulatory restrictions on their activities, they can exploit economies of scale in information processing, moral hazard amelioration through effective monitoring, and in the formation of long-run relationships with firms to ease asymmetric information distortions – thereby boosting economic growth.

The bank-based system can encourage productive investment because it is less affected by unstable financial markets. Even in recessions, the close relationship between banks and businesses can allow firms to continue investment without pushing them into bankruptcy (Odhiambo, 2011). Moreover, it is argued that expensive government policies can be carried out more easily in a bank-based system because it provides governments with more measures with which to intervene in the financial sector (such as credit policy and interest rate regulation) than a market-based system (Pollin, 1995).

However, the bank-based financial system is not without its own disadvantages. According to Odhiambo (2011), a bank-based system is vulnerable to problems, such as inefficient capital allocation, an intimate relationship between banks and firms and a higher debt ratio. Banks may not be effective gatherers or processors of information in new, uncertain situations involving innovative products and processes (Allen & Gale, 1999). This situation has prompted some to lend support to a market-based financial system, arguing that markets provide a richer set of risk-management tools that permit greater customization of risk-ameliorating instruments (Nyasha and Odhiambo, 2015).

According to Levine (2004), while bank-based systems may provide inexpensive, basic risk-management services for standardized situations, market-based systems provide greater flexibility through tailor-made products.

Thus, as economies mature and require a richer set of risk-management tools and vehicles for raising capital, they may benefit from a concomitant legal and regulatory environment that supports the evolution of market-based activities; otherwise, overall growth may be retarded (Levine, 2004).

2.2 Experimental background

Gupta (1984) conducted the first time-series investigation of the relationship between financial development and economic growth in 14 countries. The results showed the causal direction from financial development to economic growth, which suggests that financial development is a catalyst for economic growth. In this study, the industrial production was used as an index of economic development due to the lack of an alternative variable. This variable is only a small fraction of total production in many developing countries; therefore, it cannot be a suitable alternative variable to economic development.

Levine (1996) has several points in the context of the effect of the capital market on the level of economic growth: First, the capital market improves long-term economic growth. In the second perspective, market liquidity plays an important role in economic growth. The liquidity in the capital market can provide suitable resources for investment and leads to the creation of permanent assets through the stock issuing. In the second perspective, there is a doubt about the long-term relationship between capital market and economic growth.

Levine and Beck (2001) examined the effect of the stock market and the banking sector on economic growth using panel data for 42 countries. The results of the study indicate that there is a positive and significant relation between the development of the stock market and the bank and economic growth. The findings also show that the stock market offers various and more financial services than banks, and in the developed stock markets, the effect of the stock market development on economic growth is more than the effect of the index of banking development.

Liu and Hsu (2006) studied the role of financial development in economic growth in Taiwan, Korea and Japan using the generalized method of moments (GMM). The results indicate that high investment had accelerated economic growth in Japan, while high investment to GDP ratio did not necessarily lead to better growth performance if investment has not been allocated efficiently. Also, the financial development had positive effects on Taiwan's economy, but had a negative effect on Korea and Japan.

Al-Khouri (2008) examined the effect of financial development on sustainable economic growth in regional convergence markets for a set of seven Middle East and North African countries over the period 1965-2002. He concluded that

in six of the seven countries, banking-sector development increases economic growth. However, in three of those six countries, economic growth also causes banking development. Using co-integration analysis, he reveals that there is a stable long-run equilibrium relationship between banking-sector development and economic growth for all our countries. However, based on vector error-correction models, in the short-run, the development of the banking sector does not have a significant effect on economic growth in these countries.

James (2010) explores the mechanism of financial development and economic growth in Malaysia. To evaluate this mechanism, he estimated six equations in his study. The results of the estimation of these equations showed that financial development has led to high economic growth in Malaysia through an increase in savings and private investment. The results of his studies confirmed the endogeneity hypothesis of financial development and growth, which financial development has led to economic growth through increased investment efficiency.

Zivengwa et al. (2011) investigate the causal link between stock market development and economic growth in Zimbabwe over the period 1980 to 2008. They used the ratio of stock market capitalization to GDP and the stock market turnover to measure stock market development. The empirical results showed a unidirectional causal link that runs from stock market development to economic growth.

Chung and Lim (2013) examined the relationship between financial development and economic growth through the generalized method of moments (GMM) for 70 developed and developing countries during the period 1988-2002. The results show that foreign direct investment has a significant negative effect on economic growth.

Fotros and et al. (2010) investigate the long-run relationship between financial development and economic growth since 1340 to 1385. In this research, 8 financial development indices have been used. By introducing and expressing the characteristics of the factor analysis method, these indices are transformed into index which indicates the variable of financial development. Results of factor analysis method for determining a single index for financial development show that there is a direct relationship between financial development and economic growth. Secondly, the direction of causality is from economic growth to financial development.

Hosseini and et al. (2011) investigate the relationship between financial development and economic growth, by using new variables such as domestic credit provided by banking sector, domestic credit to the private sector, broadest definition of money, gross domestic saving and also government expenditure and trade (as a real sector of economy) and inflation, during 1967-

2007. The estimate of long-run relationships between variables shows negative relationship between growth and financial development. However, short-run relationship between growth and financial development have been done by Granger causality block erogeneity test that findings show domestic credit provided by banking sector doesn't entails causality Granger of growth. Finally, the results confirm that the relationship between growth and domestic credit to the private sector is the two way causality.

Abonouri and Teimouri (2013) analyze the effect of financial development on economic growth in selected member states of Organization of Economic Cooperation and Development (OECD) with upper middle income countries and compare them with each other. The results indicate that financial development has negative and significant effect on economic growth of selected countries. Since the OECD countries have a higher level of development, the impact of this effect for this class of countries is lower. Also, the effects of other variables such as government size, inflation rate, lag of real GDP per capita, investment and openness is based on theoretical expectation.

Mohammadi (2016) studied the nonlinear effects of main socio-economic variables as well as the financial development index (measured by private credit to GDP ratio) on the environmental pollution. Specifically, the interaction of the socio-economic variables with financial development as a threshold variable in affecting CO2 emission is studied. In this respect the PSTR (Panel Smooth Transition Regression) technique is applied to a panel-data set for 16 middle income countries (including Iran) during the period 1970-2013.It is found that output level and energy use have positive significant effect on CO2 emission on the whole but their effects at higher levels of financial development decrease and increase respectively i.e. financial development has provided motivations for shifting to eco-friendly technologies on the whole but has not been effective for applying fuel efficient technologies . The effect of population on CO2 emission at higher levels of financial development, intensifies . As to the effect of financial development ,it has a positive significant effect on pollution with a threshold level of 34 percent for financial development index i.e. up to this point ,the effect of financial development on the increase of pollution, rises at an increasing rate.

Djeneba (2017) considered the non-linear relationship between financial development and economic growth. It mainly relies on the Panel Smooth Transition Regression (PSTR) model of Gonzalés et al. (2005) and three metrics of financial development to endogenously assess the impact of financial development on growth. Using a sample of 43 advanced and developing economies over the period 1975–2009, the paper highlights that financial development supports economic growth in low-income and lower

middle income countries by enhancing saving and investment behaviour. However, in more developed economies, the impact of financial development is nil or negative, reflecting that further credit provisioning in these economies tend to exacerbate financial vulnerabilities, which is detrimental to growth.
DilekDurusu-Ciftci and et al (2017) considered the role of financial development on economic growth. In the theoretical part of this paper, by developing a Solow–Swan growth model augmented with financial markets in the tradition of Wu, Hou, and Cheng (2010), they show that debt from credit markets and equity from stock markets are two long run determinants of GDP per capita. In the empirical part, the long-run relationship is estimated for a panel of 40 countries over the period 1989–2011 by means of Augmented Mean Group (AMG) and Common-Correlated Effects (CCE), both of which allow cross-sectional dependencies. While the cross-sectional findings vary across countries, the panel data analyses reveal that both channels have positive long-run effects on steady-state level of GDP per capita, and the contribution of the credit markets is substantially greater.

3 Empirical Results

The purpose of this paper is to examine the asymmetric effects of banking sector and stock market development indices on economic growth in Iran. In this regard, unit root and co-integration tests are performed between the research variables. In the second step, we examined the linear and nonlinear hypothesis, the predictability of variables, the independence of variables, and the randomness of the observations with statistical tests. In the third step, we investigate the asymmetric effects of the financial development index on economic growth using the Smooth Transition Regression (STR) model. In this paper, Ox-Metrics and Eviews software packages were used to test hypotheses.
We apply a several variable model to examine the relationship between financial development and economic growth that this variable is such as GDP, liquidity, Inflation rate, Degree of economic openness, capital stock, government expenditure, oil income, the ration of stock market value to GDP, the stock market total value traded to GDP ratio, ratio of domestic credit provided by banking sector to GDP, ratio of domestic credit to the private sector to GDP and FDI. Data used in the analysis are annual time series during the period 1989-2017 in constant 2000 prices. Annual data are obtained from World Development Indicators (WDI, 2018) and Central Bank of Islamic Republic of Iran (CBI, 2018). The empirical period depends on the availability of data, where the time period used is 1989–2017. In this study, the seasonal

observations of 1989-2017 were used. According to the literature, the follow equation will be estimated:

$$\begin{aligned} DLGDP_t = {} & \beta_0 + \beta_1(LGFCF)_t + \beta_2(OPEN)_t + \beta_3(LFDI)_t + \beta_4(LOIL)_t \\ & + \beta_5(LM2_t) + \beta_6(DLGDP)_{t-1} + \beta_7(INF)_t + \beta_8(LPGDP)_t \\ & + \beta_9(LBGDP)_t + \beta_{10}(TVGDP)_t + 1(MVGDP)_t \end{aligned}$$

The data used in this study was seasonally adjusted. Seasonal adjustment provides a clearer view of non-seasonal changes in times series data that could otherwise be overshadowed by the seasonal differences. A seasonal adjustment is therefore aimed to obtain a clear picture of the general trend. All the variables were seasonality by X_12 method. Also all data of variable has been collected from central bank of Iran.

3.1 Diagnostics Test

Nelson and Plosser (1982) argue that almost all macroeconomic time series typically have a unit root. Thus, by taking first differences the null hypothesis of nonstationarity is rejected for most of the variables. Unit root tests are important in examining the stationarity of a time series because nonstationary regressors invalidates many standard empirical results and thus requires special treatment.

In the first part, before the co-integration analyses, firstly, the stationarity of all variables are tested by Augmented Dickey-Fuller (ADF), Phillips-Perron (PP), Elliott, Rothenberg and Stock (ERS) and Kawasaki, Phillips, Smith and Shane (KPSS) methods. The unit root test is done to prevent the occurrence of spurious regression, the variability of the mean time series over the time and unreliable results. The unit root test is investigated at the level and in the presence of intercept and trend terms. The results of unit root, auto-correlation and heteroskedasticity tests are presented in Table (1).

Table 1. Results of unit root, auto-correlation and heteroskedasticity tests

Statistic	Logarithm of oil income	Logarithm of government expenditure	Logarithm of capital stock	Degree of economic openness	Inflation rate	Logarithm of liquidity	Logarithm of GDP
ADF	-1.65 (-3.43) {%95}	-2.54 (-3.46) {%95}	-2.12 (-3.43) {%95}	-2.40 (-3.46) {%95}	-2.91 (-3.43) {%95}	-2.98 (-3.45) {%95}	-2.29 (-3.46) {%95}
Philiphs-Perron	-1.85 (-3.45) {%95}	-1.82 (-3.46) {%95}	-1.19 (-3.45) {%95}	-2.91 (-3.46) {%95}	-2.43 (-3.45) {%95}	-0.57 (-3.45) {%95}	-1.48 (-3.45) {%95}
ERS	-2.55 (-3.05) {%95}	-1.77 (-3.07) {%95}	-2.69 (-3.05) {%95}	-0.70 (-3.08) {%95}	-2.75 (-3.07) {%95}	-0.87 (-3.05) {%95}	-2.35 (-3.08) {%95}
KPSS	0.18 (0.14) {%95}	0.26 (0.14) {%95}	0.30 (0.14) {%95}	0.21 (0.14) {%95}	0.07 (0.14) {%95}	0.25 (0.14) {%95}	0.20 (0.14) {%95}
Ljung-Box Q(10)	466 (0.00)	547 (0.00)	687 (0.00)	511 (0.00)	265 (0.02)	46.32 (0.00)	524 (0.00)
McLeod-Li $Q^2(10)$	3.78 (0.59)	1.79 (0.37)	5.20 (0.84)	1.34 (0.32)	42.49 (0.00)	68.54 (0.01)	34.23 (0.00)
ARCH(10) = F(Prob)	1.39 (0.45)	1.82 (0.36)	3.33 (0.52)	2.84 (0.59)	52.34 (0.03)	25.21 (0.00)	17.52 (0.01)

Table 2. Results of unit root, auto-correlation and heteroskedasticity tests

Statistic	Logarithm of FDI	Ratio of domestic credit to the private sector to GDP	Ratio of domestic credit provided by banking sector to GDP	The stock market total value traded to GDP ratio	The stock market value to GDP ratio
ADF	-2.21 (-3.45) {%95}	-2.57 (-3.45) {%95}	-2.42 (-3.45) {%95}	-2.87 (-3.46) {%95}	-2.85 (-3.46) {%95}
Philiphs-Perron	-1.98 (-3.45) {%95}	-2.87 (-3.45) {%95}	-2.59 (-3.45) {%95}	-1.38 (-3.46) {%95}	-1.96 (-3.46) {%95}
ERS	-2.43 (-3.07) {%95}	-2.21 (-3.07) {%95}	-2.21 (-3.07) {%95}	-1.19 (-3.08) {%95}	-1.12 (-3.07) {%95}
KPSS	0.29 (0.14) {%95}	0.22 (0.14) {%95}	0.30 (0.14) {%95}	0.25 (0.14) {%95}	0.23 (0.14) {%95}
Ljung-Box Q(10)	657 (0.00)	332 (0.00)	675 (0.02)	448 (0.00)	559 (0.00)
McLeod-Li $Q^2(10)$	4.23 (0.38)	23.67 (0.00)	28.89 (0.00)	35.23 (0.00)	20.55 (0.02)
ARCH(10)= F(Prob)	1.56 (0.35)	10.54 (0.00)	9.39 (0.01)	5.23 (0.01)	2.88 (0.04)

In the above table, the numbers in parentheses represent the critical values and the numbers in bracket represent the level of confidence. Based on the comparison of the test statistic and the critical value in the ADF test, it can be seen that all the variables in the research are non-stationary, but by first one differentiating is stationary. According to the PP test, it was found that for all variables the absolute value of the test statistic is less than the absolute value of the critical value, and this variable is non-stationary at the level. Based on the ERS test, all variables in the research are non-stationary, but by first one differentiating is stationary. Finally, according to the KPSS test, if the test statistic is larger than the critical value, the null hypothesis which is based on stationarity of the variable is rejected. As can be seen, all variables of the research are non-stationary and have the unit root based on KPSS test. Consequently, an examination of stationary test statistics suggests that it is impossible to definitely comment on the stationarity of this series, because the dichotomy in the test results causes the researcher to be unable to achieve the unique result about the stationarity.

This asymmetry in results is that the Augmented Dickey-Fuller test, Phillips-Perron and KPSS tests represent research variables are non-stationary, while the ERS test results indicate that all variables are stationary. Accordingly, it is necessary to note that this asymmetry in the results of various tests is rooted in the chaos of these series. Because of the fractal dimension of chaotic time series, firstly, with a slight change in the initial conditions, the process of their data generating will be heavily influenced, so in this study when the time period of examined time series was changed slightly, the results of the test changed very strongly. Secondly, the existence of differences in the test method used in this study also greatly changes the results.

The Ljung-Box test (with ten lags) rejects the null hypothesis that there is no serial correlation between terms of series, and the high value of the test statistic shows a strong correlation between the lags of these series.

Also, the McLeod-Li statistics rejected null hypothesis (based on the absence of serial correlation between the squared returns), which indicates the presence of non-linear effects in these series.

It should be noted that the results of the Engle's ARCH test (ARCH effect test) also corroborates the heteroskedasticity hypothesis of series of the economic growth, the inflation rate, the liquidity ratio, the stock market value to GDP ratio, the stock market total value traded to GDP ratio, the ratio of domestic credit provided by banking sector to GDP and the ratio of domestic credit to the private sector to GDP.

3.2 Cointegration Test

In this part, the cointegration method of Johansen-Juselius was used to study the presence of long-term relationship between model variables. The reason for using the Johansen-Juselius method is that this method considers more than one co-integrated vector between the variables of the model and, by using this method, estimators will be asymptotic.

In order to estimate the long-term relationship using the Johansen-Juselius method, it is necessary to determine the optimal lag length of the model using the lag length selection criteria of the vector autoregressive model, then the long-run relationship between variables of the model has been estimated, and finally, the number of co-integrated vectors between the variables of the model is determined using test statistics of matrix trace and the maximum of Eigen values.

Next, in order to find optimum order of VAR lags, the Schwarz criteria are used. The results are shown in table 3.

Table 3. Determining optimum lag length in the model

Lags	Information Criteria	
	AIC	SIC
1	-31.23	*-34.45
2	-23.45	-25.67
3	-17.49	-22.59

As shown in the table above, we select one-lag model as an optimal model based on the Schwarz criterion. In the next step, the presence of long-run relationship between variables is examined. For this purpose, Johansson's co-integration test has been used to determine the long-term relationship between variables based on the test statistic. The results are listed in the table below.

Table 4. Results of Johansson cointegration test

λ_{max} test				Trace test			
Null hypothesis	Alternative hypothesis	t-statistic	Critical value (95%)	Null hypothesis	Alternative hypothesis	t-statistic	Critical value (95%)
r=0	r=1	229.85	64.50	r=0	r≥1	720.92	239.23
r≤1	r=2	176.06	58.43	r≤1	r≥2	491.07	197.37
r≤2	r=3	102.99	52.36	r≤2	r≥3	315.00	159.85
r≤3	r=4	76.95	46.23	r≤3	r≥4	212.04	125.61
r≤4	r=5	62.93	40.07	r≤4	r≥5	135.06	95.75
r≤5	r=6	30.58	33.87	r≤5	r≥6	62.13	69.81
r≤6	r=7	17.06	27.58	r≤6	r≥7	41.55	47.85
r≤7	r=8	12.54	21.13	r≤7	r≥8	24.48	29.79
r≤8	9=r	8.66	9.84	r≤8	r≥9	10.66	12.84
r≤9	r=10	6.39	7.45	r≤9	r≥10	6.39	8,98
r≤10	r=11	1.66	3.84	r≤10	r≥11	1.66	3.84

According to the results, it is clear that for both tests statistic the null hypothesis, which is based on the absence of long-term relationship between variables, is rejected at a significant level of 95%; therefore, there is a long-term relationship between variables. Based on the results, there are at most five long-term equilibrium relationships between variables.

3.3 Smooth Transition Regression (STR)

In the next step we estimate the STR model. If the long-term adjustment process between the two variables is asymmetric, then the Engle-Granger test may have a specification error; therefore, its estimation resulting cannot indicate the exact relationship between the two variables. Accordingly, in order to investigate the asymmetric relationship between economic growth and other variables, another method has been used by Enders and Siklos to test the asymmetric co-integration relation. The results of this method, in which two models of Threshold Auto-Regressive (TAR) and Smooth Transition Regression (STR) are presented in the following two tables. In this method, the two null hypotheses of ($H_0 = p_1 = p_2$) and ($H_0 = p_1 = p_2 = 0$) is tested by Wald test. According to Table (5), since the probability levels and calculated F represent the rejection of hypothesis H_0, as a result, there is an asymmetric co-integration relationship between economic growth and financial and banking development indices.

Table 5. Asymmetric cointegration using TAR model

Variable	Coefficient	Standard Error
Above Threshold	-0.260949	0.266679
Below Threshold	-0.563238	0.193249
Differenced Residuals(t-1)	-0.033703	0.182255
Differenced Residuals(t-2)	0.126502	0.163257
Threshold value (tau):	0.000000	
F-equal:	1.013361	
T-max value:	-0.978512	
F-joint (Phi):	4.357265	

According to the table above, the value of F statistic is higher than the above threshold value, the hypothesis of H_0 is rejected. Also, based on the Wald test, the hypothesis of the presence of asymmetric co-integration between economic growth and financial and banking sector development indices is confirmed.

Table 6. Asymmetric convergence using TAR model

Variable	Coefficient	Std. Error
Above Threshold	-0.756935	0.429985
Below Threshold	-0.410726	0.187622
Differenced Residuals(t-1)	-0.065336	0.185369
Differenced Residuals(t-2)	0.232171	0.195978
Threshold value (tau):	0.010000	
F-equal:	0.532567	
T-max value:	-1.760373	
F-joint (Phi):	4.068165	

Conventional co-integrated approaches, such as Johansson, as well as the Engle-Granger co-integration test provide co-integrated estimates (long-term relationship) with the assumption of symmetric adjustment. When there is an asymmetric adjustment, the Engle-Granger co-integration test is not possible; therefore the augmented co-integration test of Enders-Siklos is presented for extracting asymmetric co-integrated relationships. An asymmetric co-integration model with null hypothesis of the presence of symmetry in the long-run coefficients has been estimated. Wald's test is used to test the coefficients. The null hypothesis of the Wald test is based on the symmetry of the long-term coefficients in the STR model is rejected, As a result, the asymmetry in co-integrated coefficients between the research variables is confirmed. Therefore, if there is a nonlinear relationship, then the appropriate transition variable and the number of non-linear model regimes must be determined by test statistics F, F_2, F_3 and F_4. The estimated results are presented in Table (7).

Table 7. Model type and transition variable

Proposed model	**F_2 P-value**	**F_3 P-value**	**F_4 P-value**	**F P-value**	Transition Variable
LSTR1	0/0024	0/012	0/182	0/00063	$\mathbf{LGFCF_t}$
LSTR1	0/0012	0/064	0.058	0.00069	$\mathbf{OPEN_t}$
LSTR1	0/0014	0/031	0.042	0.00061	$\mathbf{LFDI_t}$
LSTR2	0/046	0.0002	0.102	0.00011	$\mathbf{LOIL_t}$
LSTR1	0.0022	0.0031	0.055	0.00035	$\mathbf{LM2_t}$
LSTR1	0.011	0.0091	0.059	0.008	$\mathbf{GDP_t}$
LSTR1	0.000089	0.0014	0.59	0.000065	$\mathbf{DLGDP_{t-1}}$*
LSTR1	0.0135	0.0296	0.24	0.034	$\mathbf{INF_t}$
Linear	0.005	0.0052	NAN	NAN	$\mathbf{LPGDP_t}$
LSTR2	0.387	0.0088	0.02	0.0025	$\mathbf{LBGDP_t}$
LSTR1	0.208	0.067	0.0007	0.0004	$\mathbf{TVGDP_t}$
LSTR2	0.0061	0.0052	0.064	0.0012	$\mathbf{MVGDP_t}$
LSTR1 (H_{02} is rejected)		Non-linear two-regime with 1 thresholds			$\mathbf{H_{02}}: \beta_1 = 0 \mid \beta_2 = \beta_3 = 0$
LSTR2 (H_{03} is rejected)		Non-linear three-regime with 2 thresholds			$\mathbf{H_{03}}: \beta_2 = 0 \mid \beta_3 = 0$
LSTR1 (H_{04} is rejected)		Non-linear two-regime with 1 thresholds			$\mathbf{H_{04}}: \beta_3 = 0$
Linear (linearity is not rejected)		Linear no-threshold			Exclusion of non-linear relationship

Regarding the value of the F-statistic P-value reported in Table (8), except for LPGDP, the null hypothesis of this test which is based on the linearity of the model for variables, is rejected; therefore, the assumption of the presence of a non-linear relation is acceptable.

The next step is to select the appropriate transition variable for the nonlinear model from the set of possible transition variables. To select the transition variable, each potential variable can be considered, but the priority is a transition variable for which the null hypothesis of the F test is more strongly rejected. Accordingly, the most suitable transition variable is the first lag of economic growth ($DLGDP_{t-1}$) and logistic transition function of LSTR1 is estimated by the smooth transition regression model.

In the next step, the model parameters are estimated using the Newton-Raphson algorithm. It is necessary to note that only the variables in the linear or nonlinear sections are considered whose coefficients are statistically significant at the confidence level.

The final estimation of the transition speed parameter value (γ) is 7.33% and for the threshold value (c) is equal to 1.5% (equals to 6% per year).

$$G\left(DLGDP_{t-1}, 1.33, 1.5\right) = \left\{1 + exp\left[-1.33\prod_{j=1}^{J}(\log(GDP)_{t-1}) - (1.5)\right]\right\}^{-1}, \gamma > 0$$

The results of model estimation are presented in Table (9). (As mentioned, ϕ' is the vector of linear parameters and θ' is the vector of nonlinear parameters).

Table 8. Result of the model estimation

Variable	**Coefficient (ϕ)**	Coefficient (θ)
CONST	***0.08	***0.07
$LGFCF_t$	***0.03	**0.03
$OPEN_t$	***0.05	**0.04
$LFDI_t$	-	*0.23
$LOIL_t$	**0.10	**0.12
$LM2_t$	*0.04	**0.16
$DLGDP_{t-1}$	-	*-0.07
INF_t	*0.30	*0.13
$LPGDP_t$	***0.19	***0.11
$LBGDP_t$	**0.11	**0.09
$TVGDP_t$	**0.17	**0.21
$MVGDP_t$	*0.06	*0.03

Note: significance at level of 99% (***), 95% (**), 90% (*)

By choosing the first lag of economic growth as a transition variable, the two-regime model is distinguished by high economic growth and low liquidity growth. The threshold for regime-switching is 1.5% (6% per year) for economic growth. According to the points mentioned, in the first regime G = 0 and in the second regime G = 1. Therefore, the equations are defined as:

Table 9. Regime equation

Lower regime, economic growth less than 1.5%			
$\mathbf{DLGDP_t = 0.07 + 0.03(LGFCF)_t + 0.04(OPEN)_t + 0.23(LFDI)_t + 0.12(LOIL)_t + 0.16(LM2_t) - 0.07(DLGDP)_{t-1} + 0.13(INF)_t + 0.11(LPGDP)_t + 0.09(LBGDP)_t + 0.21(TVGDP)_t + 0.03(MVGDP)_t}$			
Upper regime, economic growth more than 1.5%			
$\mathbf{DLGDP_t = 0.15 + 0.06(LGFCF)_t + 0.09(OPEN)_t + 0.23(LFDI)_t + 0.22(LOIL)_t + 0.20(LM2_t) - 0.07(DLGDP)_{t-1} + 0.33(INF)_t + 0.30(LPGDP)_t + 0.20(LBGDP)_t + 0.38(TVGDP)_t + 0.09(MVGDP)_t}$			
R^2adjusted	AIC	HQIC	SIC
88%	-7.77	-7.54	-7.20

Result show that the coefficient of financial development in banking sector and stock market is positive, implying the existence of a positive long-run relationship between financial development and economic growth. Therefore, if the economic growth rate is higher than 6%, then we have a regression and when economic growth is lower than 6% will have another regression in order to effect of financial development of economic growth. In addition, results show that that the relationship between private sector credit and economic growth is much stronger than the relationship between stock market and economic growth.

The results displayed in Table 9 show that the model passes all the diagnostic tests performed for serial correlation, functional form, normality and heteroscedasticity.

4 Conclusion

The purpose of this paper was to examine the asymmetric effects of banking sector and stock market development indices on Iran's economic growth. For this purpose, the Smooth Transition Regression (STR) method was used. The results indicate that in the above and below growth rate of 6%, the impact of financial and banking development indices on economic growth is different. In this study, we attempt to test how the development of financial institutions affects economic growth. Given the theoretical literature and previous studies, the effect of financial development on Iran's economic growth was modeled and estimated during the period from 1989 - 2017. In general, results of the estimation indicate that the effect of the financial development variable on the economic growth is positive. The direct effect of financial development on economic growth also indicates that financial development increases economic growth and improves the country's standard of living. In order to increase the

impact of financial depth on economic growth, financial market and institutions need to be developed and do not rely on banks to finance them; also, it should prevent the government from severe controlling on these institutions. It also leads to an increase in the efficiency of financial institutions and a reduction in the high cost of financial intermediary services to transfer loans to companies and small firms, and to lower the high risk of investment in developing countries, such as Iran. It also removes unorganized financial sectors with higher interests paid, and will solve one of the most fundamental and major bottlenecks in financial markets in these countries. Accordingly, it does not only hinder the formation of informal financial markets, but also hinders the effectiveness of these markets on the economy.

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