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Investigating the asymmetric effects of corporate liquidity and dividend on economic growth in Iran using Smooth Transition Regression (STR) model

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ABSTRACT

The objective of this paper is to examine the asymmetric effects of corporate liquidity and dividend in banking sector and stock market on economic growth in Iran. For this purpose we used the Smooth Transition Regression (STR) method based on period 1980-2018. The results indicate that the impact of corporate liquidity and dividend indices on economic growth is different for economic growth rates above and below 8.5%. Results show that earnings have a net positive impact on firm value in the presence of growth options, high external financing costs and low default risk. High levels of retained earnings enhance debt capacity but have a negative effect on equity value due to the likelihood of losing accumulated cash balances in case of default, unless offset by high external financing costs. Opposite directional effects of retained earnings on equity and debt create a U-shaped relation with firm value.

***Keywords*:** Corporate liquidity, Dividend policy, Capital market, Money market, Economic growth, Smooth transition regression model

JEL classification: B23, O40, P44, N20, D53

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1. INTRODUCTION

One of the characteristics of developed countries is the existence of efficient financial markets and institutions that play an important role in the economies of these countries and are the basis of economic growth and development. On the path of economic growth, the importance of capital as an important factor in production is continuously increasing, and this has led to the adoption of policies to attract capital. For this purpose, one of the most important actions of developed countries is the expansion of capital markets and the attraction of foreign investors. The stock exchange market, as one of the main pillars of the capital market, leads the savings of society into production. Today, in all countries, stock market prosperity is seen as one of the indicators of the health and dynamism of the economy. Undoubtedly, the prosperity and expansion of the stock market depends on the prosperity and performance of the companies that are accepted there. The more successful these companies do in their performances, the more confidence and satisfaction of investors will be gained, and society's trust in the capital market will increase, therefore, we will see growth and prosperity of the economy.

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).

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 as indices of financial development in the banking sector and the stock market capital market. Many financial researches has 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. This paper is organized as follows. In section two, previous studies have been investigated. Section three presents a brief review of theoretical literature. Section four is devoted to estimate the empirical model of research and section five concludes and presents implications.

2. LITERATURE REVIEW

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 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 publishing. In the second perspective, there is 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 bank 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 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 did not have been allocated efficiently. Also, the financial development had positive effects on Taiwan's economy, but had negative effect on Korea and Japan.

Al-Khouri (2008) examined the effect of financial development on sustained 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 causes increases in 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 and 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 an unidirectional causal link that runs from stock market development to economic growth.

Fotros and et al. (2011) investigate the long-run relationship between financial development and economic growth since 1962 to 2007. 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.

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.

3. THEORETICAL LITERATURE

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 to 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 induce 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.

According to macroeconomic theories, the accumulation of physical capital is one of the prerequisites for the growth of the national economy. In other words, the optimum use of labor in the production process depends on the level of existing capital; therefore, accumulation of capital plays a crucial role in determining the output and output per labor employed. By expanding the production and increasing productivity in the national economy, the degree of progress of society has a direct and proportional relationship with the amount of investment in it. Many economic studies confirm that in the absence of sufficient capital, economic growth is facing a serious problem. According to the classical economists, the economy consists of a real and financial sector. Achieving higher economic growth in any society requires two efficient,

complementary and powerful sectors of real and financial. It seems that in the less developed countries, at first, the growth and expansion of the financial sector leads to economic growth, and then over time, the importance of the financial sector in economic development is diminishing and the development of the real sector becomes more important. With the expansion of financial markets, various investment opportunities are emerging, and the private sector is able to choose a variety of actions tailored to their needs for savings in less risky situations. It can also boost the economic growth through mobilize saving funds and leading them to profitable economic activities with high added value. It is important to note that due to the lack of similarity of financial structure in all countries, it is not possible to prescribe a single version for how financial development relates to economic growth. A set of criteria is used to illustrate financial development. One criterion is the proportion of people's savings in banks or the share of loans allocated to the private sector. By reducing the cost of transactions in the economy, the financial sector will ultimately lead to an increase in the level of savings, capital accumulation, technological growth and economic growth. This effect can occur from several different paths. Financial development occurs when the financial market's ability to carry out these tasks develops and, by improving the decision-making process for saving and investing, financial development ultimately generate economic growth.

4. EMPIRICAL RESULTS

The purpose of this paper is to examine the asymmetric effects of banking 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 the variables, the independence of the 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 E-views softwares were used to test hypotheses. In this study, the seasonal observations of 1368-1393 were used. Before analyzing the observations, the seasonal component of variables are removed by using economic filters.

4. 1. Unit root test, auto-correlation and heteroskedasticity of research variables

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 a presence of intercept and trend terms. The results of unit root, auto-correlation and heteroskedasticity tests are presented in Table (1).

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 be 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 variable is rejected. As can be seen, all the 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 unique result about the stationarity.

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)

This asymmetry in the 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 root 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.

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)

4. 2. Co-integration test between research variables

In this part, the co-integration 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.

4. 3. Determining optimum lag length of model using lag length selection criteria

At this stage, it is necessary to determine the optimal lag length of the vector auto-regressive model using the lag length selection criteria. Selection the optimal lag length should be based on the number of model variables and sample size. In the table below, optimal lag of considered model are shown based on different criteria for selecting the optimal lag length. Because the use of the Schwartz criterion leads to a fewer loss of degree of freedom than the other criteria, the optimal lag length is chosen by Schwartz criterion in this research.

Table 3. Determining optimum lag length in 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 co-integration 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 test 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.

4. 4. Investigating the asymmetric behavior and regime switching in the series of variables

Despite the many diagnostic tests of asymmetric processes and regime-switching, some of these tests can be considered for studying the randomization hypothesis of a process (indirect process) and others to test nonlinear regime-switching processes (direct tests). In indirect tests, such as BDS test, the randomness of process residuals is usually tested, provided that any linear dependence is eliminated among its elements (through ARIMA process or differentiation of log data). Therefore, by rejecting the randomness of the residuals, it is impossible to determine the nonlinearity and the regime-switching of the process, because this may be due to the type of specification of the model (linear or non-linear) used in the test. However, the rejection of the null hypothesis of this test can be a sign of the asymmetric behavior of the variable over a period of time; in other words, it can be a sign of the difference in mean and variance of series in two different periods.

This test which was introduced in 1987 by Brock, Dechert and Scheinkman (BDS) acts based on the correlation integral which tests the randomness of the process of a time series against the existence of a general correlation in it. This test can be used to assess the existence of a general nonlinear process, including the regime-switching process in the observed time series. Based on this (and according to the concepts described in the previous section), we first derive the residuals of estimated linear model (ARIMA) and perform the above test on it. The results of this test are listed in Table (5).

According to the results, the null hypothesis of this test, which implies that there is no randomness of the disturbance terms of the model, is rejected. Therefore, a nonlinear process (which can also have a regime-switching process) can be found in the series of research variables. It should be noted that whenever in a BDS test result, the randomness of a series is exceeded in more than two dimension, the probability of non-linearity of that series will be high (since the alternative hypothesis in this test is unclear). Therefore, this test is also another reason for the non-linearity of the series of variables used.

Table 5. Results of BDS test

Dimension	Inflation rate	Economic growth	Liquidity growth	The stock market total value traded to GDP ratio	The stock market value to GDP ratio	Ratio of domestic credit to the private sector to GDP	Ratio of domestic credit provided by banking sector to GDP
2	15.45 (0.00)	10.24 (0.00)	14.18 (0.02)	12.32 (0.00)	12.21 (0.00)	12.21 (0.00)	18.59 (0.00)
3	15.75 (0.00)	10.35 (0.00)	14.20 (0.02)	13.39 (0.00)	12.31 (0.00)	12.31 (0.00)	18.68 (0.00)
4	15.89 (0.00)	10.75 (0.01)	14.42 (0.02)	14.23 (0.01)	12.89 (0.00)	12.89 (0.00)	19.05 (0.00)
5	16.13 (0.00)	10.89 (0.01)	14.76 (0.03)	15.90 (0.00)	13.03 (0.01)	13.03 (0.01)	19.57 (0.00)
6	16.39 (0.00)	11.15 (0.02)	14.95 (0.03)	15.99 (0.02)	13.42 (0.01)	13.42 (0.01)	19.84 (0.00)

4. 5. Smooth Transition Regression (STR)

If the long-term adjustment process between the two variables is asymmetric, then the Engle-Granger test may have a specification error, therefore, the resulting of its estimation 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 (7), 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 6. Asymmetric co-integration 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 development indices is confirmed.

Table 7. 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 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, asymmetry in the 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 (8).

Table 8. 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	$LGFCF_t$
LSTR1	0/0012	0/064	0.058	0.00069	$OPEN_t$
LSTR1	0/0014	0/031	0.042	0.00061	$LFDI_t$
LSTR2	0/046	0.0002	0.102	0.00011	$LOIL_t$
LSTR1	0.0022	0.0031	0.055	0.00035	$LM2_t$
LSTR1	0.011	0.0091	0.059	0.008	GDP_t
LSTR1	0.000089	0.0014	0.59	0.000065	$DLGDP_{t-1}$*
LSTR1	0.0135	0.0296	0.24	0.034	INF_t
Linear	0.005	0.0052	NAN	NAN	$LPGDP_t$
LSTR2	0.387	0.0088	0.02	0.0025	$LBGDP_t$
LSTR1	0.208	0.067	0.0007	0.0004	$TVGDP_t$
LSTR2	0.0061	0.0052	0.064	0.0012	$MVGDP_t$
LSTR1 (H_{02} is rejected)		Non-linear two-regime with 1 thresholds			$H_{02}: \beta_1 = 0 \mid \beta_2 = \beta_3 = 0$
LSTR2 (H_{03} is rejected)		Non-linear three-regime with 2 thresholds			$H_{03}: \beta_2 = 0 \mid \beta_3 = 0$
LSTR1 (H_{04} is rejected)		Non-linear two-regime with 1 thresholds			$H_{04}: \beta_3 = 0$
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 (9), 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 section are considered that the coefficients of these variables are statistically significant at 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).

$$G\left(DLGDP_{t-1}, 7.33,5\right) = \left\{1 + exp\left[-7.33\prod_{j=1}^{J}(\log(GDP)_{t-1}) - (1.5)\right]\right\}^{-1}, \gamma > 0$$

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 9. Result of 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 90% (*), 95% (**), 99% (***).

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 10. Regime equation

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

Regarding the logistic transition function of regime-switching, it is seen in figure (1) that transition occurs at a smooth pace from regime to another regime.

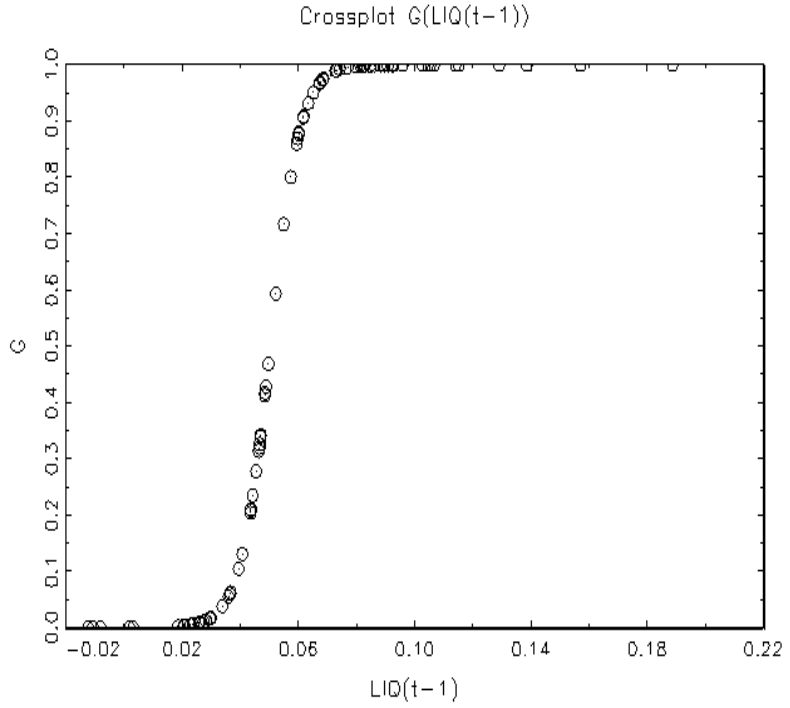

Figure 1. Logistic function graph of regime-switching.

Specification error tests of non-linear smooth transition pattern are shown in Table (11).

Table 11. Results of Specification error tests of non-linear smooth transition pattern.

1- Test of the non-existence of auto-correlation*		
Lags	p-value of F-stat	Null hypothesis: non-existence of auto-correlation
1	0.56	Not rejected
2	0.79	Not rejected
3	0.78	Not rejected
4	0.82	Not rejected
5	0.82	Not rejected
6	0.78	Not rejected
7	0.80	Not rejected
8	0.79	Not rejected
2- Test of parameter instability in different regimes		
Transition function	p-value of F-stat	Null hypothesis: equality of coefficient
H_1	0.03	Rejected
H_2	0.008	Rejected
H_2	0.09	Rejected (at significance level 90%)
3- Test of the non-existence of non-linear relations		
P-value of F-stat	Null hypothesis: non-existence of an additional nonlinear relationship	
0.36	Not rejected	
4- Test of non-existence of conditional heteroskedasticity		
P-value of F and χ^2 stats	Null hypothesis: non-existence of conditional heteroskedasticity or ARCH components	
0.88 and 0.58	Not rejected	
5- Test of normality of residuals		
P-value of χ^2 stat	Null hypothesis: normality of residuals	
0.87	Not rejected	

Note: *According to the seasonality of the study period, test of non-existence of auto-correlation is used with 8 lags. ** The hypotheses are tested at 95% confidence level.

In summary, based on all diagnostic tests, the estimated nonlinear model passes all these tests and is considered as satisfactory.

5. CONCLUSIONS

The objective of this paper was to examine the asymmetric effects of banking 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 effect on economic growth. Given the theoretical literature and previous studies, the effect of financial development on Iran's economic growth was modelled and estimated during the period from 1990 to 2015. In general, the results of estimation indicate that the effect of the financial development variable on the economic growth is positive. Trade liberalization, liquidity growth, oil revenues, foreign direct investment and inflation have a positive effect on economic growth in this model. The direct effect of financial development on economic growth also indicates that financial development increases economic growth and improves standard of living in the country. Trade liberalization, liquidity growth, oil revenues, foreign direct investment and inflation also increase economic growth. In order to increase 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 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 interest 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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