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Research Paper

Investigating the Effect of Institution's Financial Development on the Economic Growth in MENA Countries Using PSVAR and Markov Switching Models

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ABSTRACT

The financial sector plays a vital role in economic growth and development. Since the financial sector plays an intermediary role in allocating resources to all economic sectors, it has a considerable contribution to long-term economic growth by reducing finance costs, stimulating savings, and using them efficiently. Governments of oil-exporting countries can enter the financial markets and make many changes relying on oil revenue. Policymakers make some changes to stimulate economic growth. However, available studies indicate that financial development will not necessarily result in economic growth. On the other hand, the role of financial development in economic growth has not received great attention over recent decades. Hence, the extant study examines the impact of financial institutions' development on economic growth. The statistical population of the present study comprised MENA member states during 1980-2019. To do this study, Panel Structural Vector Autoregressive (P-SVAR) method was used to extract the shock's directions. PSTR model was used due to the nonlinear relationship between research variables, and Markov-Switching Time-Series Model was used to assess periods. This study considered financial depth, access, and efficiency as indicators of financial institutions' development. The results showed that all three components of financial institutions' development had a significant impact on economic growth, while tax revenues had no significant impact on economic growth.

1 Introduction

The effect of financial development on economic growth is one of the most important economic issues. Developed countries have more efficient financial sectors due to their diverse financial institutions and entities, different financial tools, and appropriate financial rules. Some economists believe that financial development has an undeniable effect on economic growth so the world economy considers a significant capacity for these markets. On the contrary, developing countries where a large part of their financial system is governmental have inefficient services and dual financial structures (formal

and informal). In developing countries, the informal sector is dominant and financial institutions are not efficient. Hence, some economists name inefficient and undeveloped financial sectors as the reason for slow economic growth in developing countries.

Economic growth and its impact on macroeconomic variables have been one of the topics examined in economic studies. There are abundant theories about economic growth. Different economic sectors of countries, including vital financial and tax sectors, usually progress in line with their economic development. However, different and sometimes conflicting views exist. In past decades, the mentioned (financial and tax) sectors were not at the centre of attention as much as they are today. Now, the financial sector is a substantial sector that plays a key role in the economy, so economic activities seriously require financial services. Therefore, the development of financial institutions is vital for economic growth. A powerful financial sector can direct financial resources (funds, credit, and capital) towards production and bring economic development. In other words, efficient financial systems enhanced investment opportunities by identifying and financing business opportunities, equipping savings, covering and diversifying risk, and facilitating the exchange of products and services. Therefore, the development of the financial sector is a factor that plays a vital role in achieving rapid and sustained economic growth. The financial sector is composed of various markets, such as money and capital market. The importance of financial sector development originates from the underlying role of an efficient financial sector in spending financial resources on investment, encouraging foreign capital, and optimizing resource allocation mechanisms [10]

Many studies have examined the impact of financial development on economic growth over recent years. The obtained results indicated different effects of financial development on the economic growth among all countries, and this effect depended on their financial development levels. Some factors determine the financial development level of countries: historical factors (legal, political, cultural, ethical, and geographical components), political factors (political environment and macroeconomics), institutional, legal, and information infrastructures, regulations and supervision, competition and efficiency, and ease of access to financial services. This effect is unclear in countries with low financial development levels, so this effect may be positive, neutral, or even negative. In countries with high development levels, however, this effect is positive. Hugs (1999) explains that more risk management opportunities exist in larger financial markets, so larger financial markets are more efficient. In this lieu, the extant study examines the impact of the development of financial institutions on the economic growth of MENA countries. The present study indeed aims to find whether there is a significant relationship between financial institutions' development and economic growth in these countries. This study asks if financial development affects the economic growth of developing countries. The following hypothesis will be tested based on the latter question: development of financial institutions affects the economic growth of MENA countries. Alternative indicators of financial institutions were used for more precise assessment. This is a novel study because this paper uses the Panel-VAR model to measure the effect of two important sectors of the economy (financial and tax sector) simultaneously on economic growth. The extant study uses financial institutions for financial development. This study also measures the abovementioned sector, by using standard indicators of financial development (provided by the International Money Fund (IMF)). This is a case study of MENA countries allowing us to compare results in different countries.

2 Theoretical Foundations and Background

Economists and policymakers have paid great attention to the association between economic growth and financial development over recent years. However, economists have different views about the relationship between financial development and economic growth and the role of financial development. For instance, Levine [16] believes that financial intermediaries increase economic efficiency by allocating resources to the capital optimally leading to economic growth. Other economists, such as Robinson [24] show that economic growth creates demand for financial services defining financial development as a response of financial markets to this increased demand. Results of some studies imply the low-important role of a financial institution in economic growth. The article by Lucas is the most important example in this case. Lucas believes that the role of financial markets in economic growth has been exaggerated. In his opinion, the best financial markets have a minor contribution to economic growth [11].

The new theories have emphasized a high correlation between economic growth and innovation, so this innovation is done by introducing new finance and financial development tools in financial markets, and new products in the real sector of the economy. The entrance of financial intermediaries in growth models indeed pursues some goals, such as risk reduction, capital efficiency increase through optimal resource allocation, and saving mobility by introducing new finance and financial development tools. finally, the mentioned goals aim to realize long-term economic growth in the economy (Hasan et al)[26].

Economists, researchers, and policymakers have always been interested in finding the causality between financial development and economic growth due to its effect on adopting different policies of economic development. Economists have presented different theories about the relationship between financial development and growth. There are three categories of studies on the impact of financial development and economic growth [1]:

The first group believes in the causality of financial development towards economic growth (supply leadership).

The second group assumes that economic growth will result in financial development, so the causality direction is from growth to financial development (demand leadership).

The third group includes theories that believe in bidirectional causality (a two-way relationship) between economic growth and financial development. Greenwood and Smith [27] support this theory.

Patrick [28] believes that the financial sector plays a vital role in the early phases of economic growth by expanding financial markets, creating financial institutions, and supplying financial assets (supply-side theory), while economic growth affects the financial sector at higher levels of economic growth (demand-side theory).

Makiyan et al. [2] studied the effect of the relationship between financial structure and financial development as financial system development indicators on the economic growth in selected Islamic countries for the period from 1989 to 2011. To do this, they used the fully modified least squares (FM-OLS). Dejpasand and Bokharaee [3] studied the relationship between financial development and economic growth using the post-Keynesian approach for the period from 1974 to 2014.

Mohamadzadeh Asl et al. [4] studied the impact of financial development channels on currency fluctuations and economic growth. Gohari et al. [5] analyzed an interactive effect of institutional quality and banking development on economic growth: the application of financial combined indicator. The results indicated that improvement of institutional quality along with its positive effect on economic growth reduces the negative impact of the banking sector development on economic growth.

Zaree and Lajevardi [6] examined the relationship between financial development and oil shocks

and their effect on economic growth instability. The results showed a positive association between oil shocks and economic growth instability in these countries. Aybaghi Isfahani et al. [7] studied the financial and institutional developments and their relationship with Iran's economic growth. The results indicated a negative impact of institutional and financial development on GDP during the studied period. This finding showed inconsistency between financial development and institutional development. Fathizadeh et al [23] studied the relationship between economic growth, energy intensity, and financial development in the agriculture, industry, mine, and service sectors of the Iranian Economy. The results showed the positive and significant effect of financial development on the economic growth in the agriculture, mine, and industry sectors. Chaiechi [8] carried out a study entitled "financial development and economic growth through a post-Keynesian lens: Hong Kong case study" to examine the relationship between financial development and economic growth in Hong Kong for the period 1990-2004 using the VAR method. Adusei [9] used time series data and the GMM method during 1981-2010 for 24 African countries. The results indicated that economic growth could improve financial development. Moreover, human capital and inflation had a positive and negative relationship with financial development, respectively. Islam (Muhammad) et al [21] studied the nexus between financial development and energy consumption in Malaysia, by using the ARDL model. The results show that economic growth and financial development affect energy consumption in the long term and short term. However, the nexus between population and energy is significant only in the long-term period. Ibrahim and Alagidede [12] carried out a study entitled "nonlinearities in financial development–economic growth nexus: evidence from sub–Saharan Africa" and found that a higher level of financial development is a necessary condition in long-run growth, and so is the overall level of income and human capital. Erdoğan et al. [22] studied the nexus between the effect of natural resource export on the economic growth and financial depth level using data from selected 11 countries from 1996 to 2016. Raghutla and Chittedi [13] investigated the empirical nexus between financial development, energy consumption, and economic growth in India from 1970 to 2018 using finite ARDL tests and the VECM method. This study concludes that financial development and energy consumption are core drivers of economic growth in India. Salehi et al. [34] studied the impact of institutional ownership on the relationship between tax and capital structure during 2005 -2014 for 98 companies in the Tehran Stock Exchange market. Findings showed that taxation has a negative and significant impact on capital structure. As a result, tax can leave a negative impact on the company's income and therefore economic growth by affecting the capital structure.

3 Materials and Methods

3.1 Method, Model, and Variables

This was applied research in terms of objective. This study was correlational research in terms of nature and content. The extant study was done based on deductive-inductive reasoning. In this regard, the theoretical foundations and background of the study were collected through bibliographic studies, articles, and websites within the deductive framework. The data were collected through the mentioned method to test hypotheses inductively. IMF and World Bank were data resources.

The extant study focused on the nexus between the development of financial institutions and the economic growth of MENA countries. Therefore, the results of this study can be used in macroeconomic policies. This study used a post-event (causal-comparative) methodology, which is based on data from

the past.

In this research, financial development is affected by different institutional levels, particularly government efficiency. Hence, a supply-based endogenous growth model should be used. Moreover, the PSTR model was used for assessment due to the nonlinear relationship between the studied variables. Moreover, this study used the time series Markov Switching model. It is worth noting that all computations and analyses were done through EViews software. The statistical population of the study comprised all MENA countries from 1980 to 2019. Table 1 reports the name of MENA countries.

Table 1: Studied Countries

Row	MENA country	Row	MENA country
1	Algeria	7	Saudi Arabia
2	Bahrain	8	Morocco
3	United Arab Emirates	9	Oman
4	Yemen	10	Jordan
5	Iran	11	Kuwait
6	Tunisia		

3.2 Variables and Models

This study designed a model to find nexus between research variables in the different economic sectors considering disagreements and different economic schools about the association between these variables and their impacts. This model could show the framework of theoretical foundations, including theoretical bases of economic growth, financial development, and tax revenues. This model considered the impact of financial development of the financial institution and tax revenues on the economic growth based on the different classic and neoclassic theories. Moreover, this model evaluated the impact of variables on the economic growth in studied countries considering the classic and neoclassic schools.

Panel structural vector autoregressive uses the SVAR mechanism and Panel data properties to analyze the relationships among variable. Panel data approach is a combination of cross-sectional data and time series, i.e. information on cross sectional data is observed over time. Such data have two dimensions, one dimension of which is related to different units at each specific time point, and the other dimension is related to time [33]. The research model is specified as:

$$Y_{it} = (revtax_{it}, depfinancel_{it}, effiencc\ financel_{it}, access_{it}, L_{it}, FDI_{it}) \quad (1)$$

Y_{it}: production rate of country i in time t

L_{it}: number of labors in country i in time t

FDI_{it}: foreign investment index of country i in time t

$revtax_{it}$: tax revenue of country i in time t; the direct tax was used as tax revenue of each country. Any income earned was considered as tax revenue due to the different tax structures of countries.

$depfinancel_{it}$: financial depth of country i in time t for financial institutions

$effiencc\ financel_{it}$: financial depth of country i in time t for financial institutions

$access_{it}$: access of country i in time t for financial institutions

Above model is designed based on three Panel SVAR, PSTR, and Panel-MS models.

3.3 Panel SVAR Model

According to linear combination of relation (1), we can introduce below Equation to demonstrate the panel SVAR model

$$\theta_{i,t}y_{i,t} = \Gamma_{0,i} + \Gamma_{i,t}y_{t-1} + U_{i,t} \quad (2)$$

in which $y_{i,t}$ refers to vector of endogenous variables. To measure this model, two sides of the equation are multiplied by θ_{it}^{-1}, and $\epsilon_{it} = \theta_{it}^{-1}U_{it}$ is obtained. One problem exists here: the number of abbreviated form's parameters is less than the structural form's parameters. Hence, some θ_{it} coefficients must become zero or constrained patterns. This process is done with different methods. This study used the Cholesky decomposition method, which applies minimum constraints to identify SVAR and just equals some coefficients of matrix θ_{it} to zero. A recursive structure is used to apply short-term constraints. Therefore, θ_{it}^{-1} is specified in form of a lower triangular matrix:

$$\epsilon_{it} = \begin{bmatrix} \varepsilon_t^{tax} \\ \varepsilon_t^{deph} \\ \varepsilon_t^{effiency} \\ \varepsilon_t^{access} \\ \varepsilon_t^{gdp} \end{bmatrix} \begin{bmatrix} \theta_{11} & 0 & 0 & 0 \\ \theta_{21} & \theta_{22} & 0 & 0 \\ \theta_{31} & \theta_{32} & \theta_{33} & 0 \\ \theta_{41} & \theta_{42} & \theta_{43} & \theta_{44} \end{bmatrix} \begin{bmatrix} U_{it}^{supply\ shock} \\ U_{it}^{demond\ shock} \\ U_{it}^{agg\ demand\ shock} \\ U_{it}^{financel\ market\ shock} \end{bmatrix} \quad (3)$$

3.4 PSTR Model

$$\begin{aligned} Y_{it} &= \mu_i + \alpha_0 \sum finance\ dept1_{it} + \beta_0 \sum access1_{it} + \theta_0 \sum Efficiency\ 1_{it} + \\ &\tau_0\left(\alpha_0 \sum finance\ dept1_{it} + \beta_0 \sum access1_{it} + \theta_0 \sum Efficiency\ 1_{it}\right) + \\ &\left(\alpha_0 \sum finance\ dept1_{it} + \beta_0 \sum access1_{it} + \theta_0 \sum Efficiency\ 1_{it}\right) g_1(q_{it};\ \gamma_1, c_1) + \\ &\tau_0\left(\alpha_0 \sum finance\ dept1_{it} + \beta_0 \sum access1_{it} + \theta_0 \sum Efficiency\ 1_{it}\right) + \\ &\tau_1 q_{it}\left(\alpha_0 \sum finance\ dept1_{it} + \beta_0 \sum access1_{it} + \theta_0 \sum Efficiency\ 1_{it}\right) + \cdots + \\ &\tau_n q_{it}^n\left(\alpha_0 \sum finance\ dept1_{it} + \beta_0 \sum access1_{it} + \theta_0 \sum Efficiency\ 1_{it} +\right) + u_{it} \end{aligned} \quad (4)$$

3.5 MS-SVAR Model

$$B_0 y_{i,t} = B_1 y_{i,t-1} + B_2 y_{i,t-2} + B_3 y_{i,t-3} + \cdots \ldots B_p y_{i,t-p} + \varepsilon_{i,t} \quad (5)$$

Table 2 reports how to measure the studied variables. W.

Table 2: Indicators and Variables

Row	Index	Type of variable	Variable	Measurement method
1	Development of financial institutions	Independent	Financial depth	The ratio of granted loans to GDP
				The ratio of pension funds' assets to GDP
				The ratio of investment funds' assets to GDP
				Life and non-life insurance premiums to GDP
			Access	Bank branches ratio per 100.000 adults
				ATMs ratio per 100.000 adults
			Efficiency	Net profit margin
				Bank deposit spread
				Interest-free income to total income
				Overhead costs to total assets

				Return on assets
				Return on equity
2	Economic growth	Dependent	gGDP	GDP

4 Research Variables and Models

4.1 Introducing and Specifying Models

As mentioned before, this study used the PSTR model due to the nonlinear nexus between research variables. Moreover, the time series Markov Switching model was used. These models have been introduced briefly.

Markov-Switching Models' Approach

If it is assumed that the studied time series occurs with regime switching, the assumption of fixed parameters in the VAR model will be rejected. In this case, the MS-VAR model is the best alternative. The main idea of this method is that VAR models' parameters depend on the regime variable (St). meanwhile, St is not observable but its probability should be measured. Therefore, the conditional density function of observable time-series Yt will be shown as follows:

$$p(y_t \mid y_{t-1} s_t) = \begin{cases} f(y_t | y_{t-1} \quad _1) if s_t = 1 \\ f(y_t | y_{t-1} \quad _m) if s_t = m \end{cases} \tag{6}$$

where Qt represents the vector of VAR's parameters in different regimes and Yt-1 indicates $[Y_{t-j}]_{j=1}^{\infty}$. It is possible to show Yt; St for a certain regime by using VAR(p) model:

$$y_t = v(S_t) + B_1(S_t) y_{t-1} + \cdots + B_p(S_t) y_{t-P} + u_t \tag{7}$$

where $u_t \sim NID[\cdot, \Sigma s_t]$. It is essential to know regime-switching (St) to complete the data generation process. MS models assume that the first-order Markov chain generates St:

$$pr\left\{ S_t \middle| [S_{t-}]_{=1}^{\infty}, [Y_{t-}]_{=1}^{\infty} = pr\{S_t | S_{t-1}; \rho\} \right\} \tag{8}$$

Where P consists of probability parameters related to regimes. According to this assumption, we can measure the probability of switching between different regimes.

$$p_{i,} = pr\{S_{t+1} = j \mid S_t = i\}, \Sigma_{j=1}^{n} p_{i,j} = 1 \forall i, j \in \{1,2,\dots,m\} \tag{9}$$

The transition probability matrix P is shaped by putting probabilities in an m*m matrix. This research uses the fixed transition probability method in which, each element Pj.i indicates the probability of regime occurring after the regime i:

$$P = \begin{bmatrix} P_{11} & \cdots & P_{m1} \\ \vdots & \ddots & \vdots \\ P_{1m} & \cdots & P_{mm} \end{bmatrix} \quad 0 \le p_{i,j} \le 1 \tag{10}$$

When parameter variation is considered in different regimes then the linear VAR model converts to

the MS-VAR model. In this model, all parameters depend on the regime variable state (St). Therefore, this model can be shown as the following equation:

$$y_t = \begin{cases} v_1 + B_{11}y_{t-1} + \cdots + B_{P1}y_{t-P} + u_t & if S_t = 1 \\ \vdots & \\ v_m + B_{1m}y_{t-1} + \cdots + B_{Pm}y_{t-P} + u_t & if S_t = m \end{cases} \quad (11)$$

The followings are parameters of the model introduced above:
V: intercept of MS-VAR model
B: lagged variable's coefficient
Ut: error term of the model

Introducing indexes
P: number of lags
M: number of regimes

Table 3: Different States of MS-VAR Models

		MSM		MSI	
		Varying μ	Fixed μ	Varying μ	Fixed μ
Fixed Ai	Fixed variance	MSM-VAR	Linear VAR	MSI	Linear VAR
	Varying variance	MSMH-VAR	MSH-VAR	MSIH-VAR	MSH-VAR
Varying Ai	Fixed variance	MAMA-VAR	MSA-VAR	MSIA-VAR	MSA-VAR
	Varying variance	MSMAH-VAR	MSAH-VAR	MSIAH-VAR	MSAH-VAR

4.2 VAR Approaches

VAR methodology highly resembles simultaneous equations models, except for some endogenous variables used in this method. However, each endogenous variable is explained using its former values and variables lagged the other endogenous variables of the model. Usually, no endogenous variable exists in the model. Moreover, the VAR model determines the short-term behavior of variables with other variables and lagged values of the variable. The following model is estimated in the autoregression process:

$$Y_t = \alpha + \sum_{j=1}^{p} \beta_j Y_{t-j} + \sum_{i=1}^{q} \gamma_i X_{t-i} + U_t \quad (12)$$

where Us are stochastic terms that are called the response or instant switch in VAR methodology.

4.3 SVAR Model

The basic VAR models used Cholesky decomposition to obtain impulse response functions. Cholesky decomposition refers to a causal order when the researcher aims to examine the effects of several shocks that might be impossible. Also, vector autoregressions can be estimated without the specification of a structural model which can require multiple identification restrictions [32]. Blanchard and Bernanke [29] developed the SVAR model by consideration of theoretical limitations on simultaneous effects of shocks. Then Clarida and Gali [30] identified impulse response functions by applying theoretical limitations on the long-term effects of shocks. SVAR models have an advantage compared to

the basic VAR models. Unlike unconstrained VAR models that identify structural shocks implicitly, SVAR models have explicit economic theirs-based economic logic to apply constraints and limitations. These constraints may be long-term or short-term. Structural shocks are identified after applying constraints. These shocks can be used to create impulse response functions and ANOVA for analysing the dynamic effects on different variables. VAR models in studies on transition mechanisms that used Cholesky decomposition have mainly emphasized partial identification. It means that only one shock can be examined in each model [3].

We consider time series y_t for the K dimension. Assume that y_t can be approximated with a finite-order autoregression vector p. The purpose is to find the parameters of the following SVAR model.

$$B_0 y_t = B_1 y_{t-1} + B_2 y_{t-2} + B_3 y_{t-3} + \cdots \ldots . B_p y_{t-p} + \varepsilon_t \quad (13)$$

where ε_t represents serial uncorrelated error terms with a mean value of 0, which are called structural shocks. Model (13) can be designed in the following brief form:

$$\boldsymbol{B(L)y_t} = \varepsilon_t \quad (14)$$

where $B(L) = B_0 - B_1 L \cdot - B_2 L^2 - \cdots . - B_p L^p$ is lag operator polynomial. The variance-Covariance matrix of the structural error term is normalized to achieve the following equation:

$$E(\varepsilon_t \varepsilon_t') = \sum \varepsilon = I_K \quad (15)$$

This equation firstly indicates that there are structural shocks as much as the number of variables existing in the structural model. Secondly, it implies that structural shocks are uncorrelated indicating $\sum \varepsilon =$ is a diagonal matrix. Thirdly, the variance of all structural shocks is normalized to one for simplicity; meanwhile, diagonal elements of B0 are not constrained. The structural VAR model is not directly observable. To estimate the structural model, its adjusted form should be extracted, which is specifying it based on its lags. Two sides of the structural form are multiplied by B_0^{-1} to derive the adjusted form:

$$B_0^{-1} B_0 y_t = B_0^{-1} B_1 y_{t-1} + B_0^{-1} B_2 y_{t-2} + \cdots + B_0^{-1} B_p y_{t-p} + B_0^{-1} \varepsilon_t \quad (16)$$

Therefore, a similar model is developed based on the observable elements:

$$y_t = A_1 y_{t-1} + A_2 y_{t-2} + \cdots + A_p y_{t-p} + u_t \quad (17)$$

where $A_i = B_0^{-1} B_i$ and i=1,2,….p. Moreover:

$$ut = B_0^{-1} \varepsilon_t \text{ or } \varepsilon_t = B_0 u_t \quad (18)$$

5 Findings

5.1 Results of Descriptive Statistics

According to the descriptive results reported in Figures (1) and (2), the considered variables have experienced some fluctuations caused by economic and political issues in MENA countries during 1995-2019. The mentioned volatilities led to ascending and descending trends of variables so that mean and skewness values indicated an increasing rate of variables. As seen in Figure (2) and Table (4), the

stylized facts of financial institutions' financial development in MENA countries indicate that banks' activities stimulate saving, which leads to technological innovation through efficient allocation of resources. Therefore, some policies that contribute to financial liberalization cannot improve financial development and economic growth. These findings are considered a shortcoming for a strong nexus between financial development and economic growth. There has been a gentle increase in access to bank branches and facilities in MENA countries. Higher volatility is seen in the financial depth of financial institutions compared to the efficiency and access indicators implying increased bank credits rather than GDP.

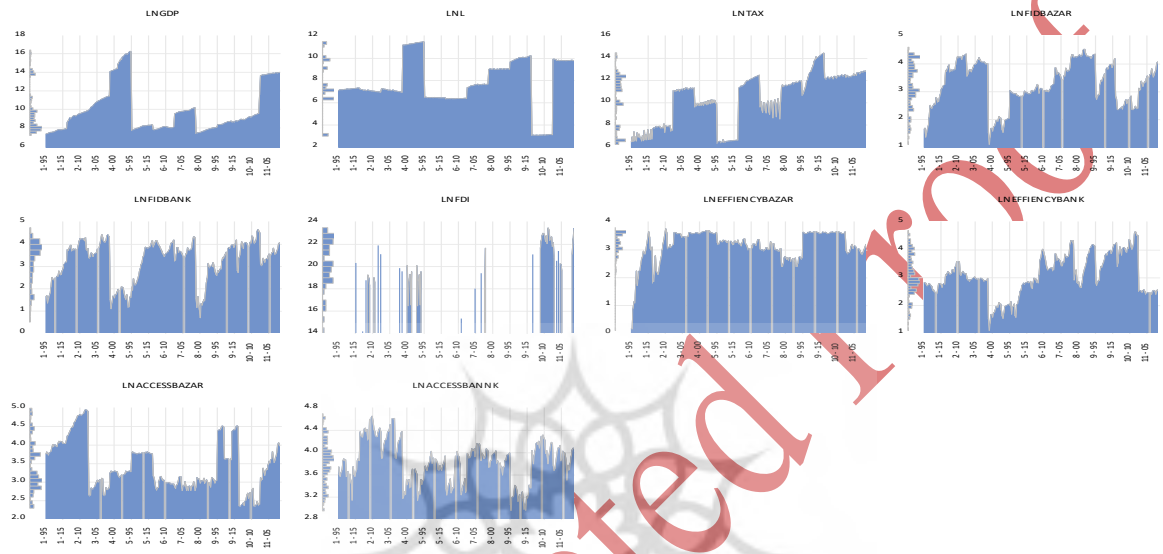

Fig 1: Describing Variables of MENA Countries During 1995-2019

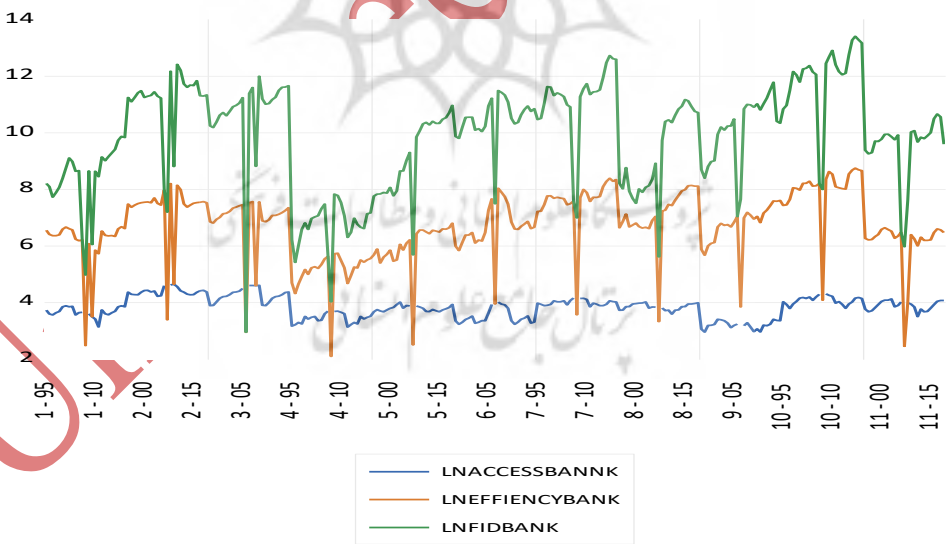

Fig 2: Describing Financial Institutions' Development Index in MENA Countries During 1995 to 2019

Table 4: Stylized Facts of Research Variables in MENA Countries During 1995-2019

Classification of countries	Variables	Efficiency	Access	Financial depth	Economic growth	Labor
MENA countries	Mean	3.017259	3.896943	3.353969	11.87188	7.726175
	Med	3.044522	3.940610	3.776203	10.80462	7.607354
	Max	4.655768	4.420045	4.655863	16.11870	11.44072
	Min	1.536867	3.139833	1.156881	7.902391	3.082369
	SD	0.953453	0.361097	1.031477	2.653878	3.072912
	Skewness	0.158279	-0.480577	-0.778477	0.254720	-0.372781
	Kurtosis	1.818218	2.169720	2.192502	1.461895	1.793182
	Jarek–Bra statistic	3.118370	3.360794	6.408668	5.469364	4.192237
	Prob.	0.210307	0.186300	0.040586	0.064915	0.122933

Source: Research Findings

5.2 Empirical Results

This study examined the impact of financial institutions' development on economic growth using Panel-SVAR and MS approaches. First, the extant study extracts and identifies shocks and regimes using Panel-SVAR and Panel-MS models, respectively for two groups of countries. This study then measures the Panel Smooth Transition Regression (PSTR) Model within two linear and nonlinear forms for MENA countries. Moreover, classic assumptions pertained to variables and models were tested before estimating the model.

5.3 Variables' Stationary Test

The present study used a panel data unit root test by Levin & Chu (2002) to examine the stationary state of variables. Table 5 reports the results of the stationary LLC test indicating variables are stationary at level.

Table 5: Result of LLC Unit Root Test With Intercept

	MENA countries	
Financial depth of financial institutions	-6.14821	0.0000
Financial institutions' access	-4.88975	0.0000
Financial institutions' efficiency	-8.77262	0.0000
Foreign investment	-3.14891	0.0008
Economic growth	-6.30611	0.0000
Labor	-7.62598	0.0000

Source: Research Calculations

Therefore, these variables do not lead to regression fallacy, so we can use the regression model of study to test hypotheses.

5.4 Cross-Sectional Dependence Test

Table 6 reports the results of the Cross-Sectional Dependence (CD) Test. According to Pesaran's CD, there is a cross-sectional dependency between variables. Therefore, second-generation tests' results should be used for the stationary analysis of these variables due to cross-sectional dependency. Hence, the Pedroni Panel cointegration test can be done.

Table 6: CD (Cross-Sectional Dependence) Unit Root Test

Variable	Pesaran's CD	P-value
Financial depth of financial institutions	-5.56574	0.0000
Financial institutions' access	-4.39493	0.0000
Financial institutions' efficiency	-3.73678	0.0001
Foreign investment	-0.320809	0.0000
Economic growth	-1.84112	0.0032
Labor	-16.6758	0.0000

Source: Research Calculations

5.5 Panel Cointegration Test

According to the results of the Panel Cointegration Test reported in Table 7, the majority of error rates reported for Pedroni statistics are less than 5% (0.05). Hence, the null hypothesis (lack of long-term nexus) is rejected. Therefore, there is a long-term nexus between variables so we can use PSTY and MS-VAR panel data methods for model fit.

Table 7: Results of Panel Cointegration Test

	MENA countries	
Statistic	With trend	
	Statistic	p-value
Panel v-statistic	-0.8760	-
Panel ρ-statistic	4.5670	0.001
Panel PP-statistic	6.4328	0.000
Panel ADF-statistic	6.2344	0.000
Group ρ-statistic	5.4439	0.002
Group pp-statistic	9.5438	0.000
Group ADF statistic	10.4320	0.003

Source: Research Calculations

5.6 F-Test Results

After examining variables' stationery to ensure a lack of regression fallacy, an estimation method is determined for each model. Research data are composite data regarding the study's nature. The appropriate model estimation (integrated or panel with fixed or random effects) should be determined before estimating the models. The f-Limer test was used to determine the integrated model rather than the panel model. Table 8 reports the results of the F-Limer test. The mixed method is used for observations with probabilities greater than 5% (or their test statistics are less than the table value), while the panel method is used for observations with probability values less than 5%. According to the results of the F-Limer test, the statistical probability of the F-Limer test was less than 5% for the research model in MENA countries. Therefore, H0 (integrated model) is not confirmed. In other words, individual or group effects exist so the panel data method should be used to estimate regression models. The second column of Table 8 indicates the results of the Hausman test for regression models indicating the random-effects model is used for observations that their test probability is greater than 5% or their test values are less than the table value. On contrary, the fixed-effects model is used for observations that their test probabilities are less than 5%. According to the obtained results, the Chi-square value of the Hausman test of the model is greater than the table value and the statistic's probability (P-Value) of the Hausman test of the model is less than 5%. This value is in the critical area; therefore, H0 (appropriateness of random-effects model) is rejected and H1 (fixed-effects model) is confirmed at a level of 95%.

Table 8: F-Limer and Hausman Tests

Regression models	F-value	Result		Regression models	Chi-square	P-Value	Result	
F-Limer Test	49.659 0.0000	H0 re-jected	Panel Model	Hausman test	354.134	0.0000	H0 re-jected	Panel model with fixed effects

Source: Research Calculations

5.6 Model Diagnostic Tests

Diagnostic tests were done before estimating the model. These diagnostic tests indicate the existence or lack of collinearity, lack of heteroscedasticity, and lack of model specification error. Moreover, the F-Limer test was used to find panel or pooling data. The results confirmed panel data.

Table 9: Results of Diagnostic Tests

	MENA countries	
Diagnostic test	Prob.	Value
Breusch–Pagan test	1.45	0.35
Collinearity average	2.19	-
Ramsey test	1.67	0.28

Source: Research Calculations

5.7 Estimating Panel-SVAR Model

5.7.1 Determine Optimal Lag

After examining variables' reliability in Panel-SVAR model estimation, the optimal lag should be determined for the studied group (MENA countries). It is highly important to determine the optimal lag of the model since any increase in lag length leads to a decline in degree of freedom. To do this, the Schwarz-Bayesian criterion is the most suitable option. According to results of optimal lag of model obtained through Eviews-13 software, model estimation realizes both required conditions for reliability in two studied groups. Table 10 reports the Akaike (AIC) and Schwarz-Bayesian (SB) values for lag 2, and the lowest values of these criteria are obtained in lag 2.

Table 10: AIC and SB Values to Determine Optimal Lag

Lag number	AIC	SB
1	-1.796	-1.360
2	-1.849	-1.588

Source: Research Calculations

Therefore, lag 2 is the optimal lag of the model. Analysis of dynamism mutual effects caused by shocks that occurred in the model was done using Impulse Response Functions (IRF) and ANOVA (structural decomposition). The important point in vector autoregressive models' estimation includes relationships between variables and their effects on each other. Hence, the significance test of parameters is a less-important case.

Analysis of variance (ANOVA) is another method used to describe the dynamic behaviour of a model. ANOVA is used to find how many forecast error variations of a variable are caused by its error terms or variations in other error terms of the model. The table shown in the appendix indicates ANOVA of financial development and tax revenues for the basic model so that Se shows the standard error of relevant variables. ANOVA separates variations in an endogenous variable compared to other

endogenous variables' shocks. Therefore, ANOVA provides information about the relevant importance of each random shock that affects the model's variables. ANOVA determines the contribution of imposed shocks on the different variables for forecast error variance of a variable in short term and long term.

The table (appendix) indicates the results of economic growth' ANOVA and standard deviation. We can see what shock has caused the change in the variable in what period of ten selected periods. For instance, variation or switch in GDP of MENA countries has been 100% caused by the variation in GDP during the first period, while 59% of this switch has been caused by output in the second period, and 10% caused by the third shock of the depth of financial institutions (FID1). Other variables can be interpreted in the same way.

The following part of the study presents and analyses the response of economic growth to occurred shocks. Therefore, impulse response functions is estimated to analyse the response of economic growth in MENA countries. IRF indicates the dynamism reaction of each endogenous variable over time to an error's standard deviation (SD) occurred in other variables of the system. For this purpose, first, the research model is estimated based on the panel structural vector autoregressive approach. Table 11 shows the results of the model estimation.

Table 11: Results of Panel SVAR

Studied Countries	Period	GDP	Financial Depth in Financial Markets	Financial Depth in Financial Institutions	Efficiency in Financial Markets	Efficiency in Financial Institutions	Access to services in financial markets	Access to Services of Financial Institutions	Foreign Investment	Labor	Tax Revenues
MENA Countries	1.000	81.07015	4.813592	0.066584	1.255776	0.250712	0.066621	4.055147	2.982684	1.698646	0.7643091
	2.000	59.75136	0.076298	0.109463	12.84815	4.724696	4.930268	1.497724	8.856088	6.057802	1.148156
	3.000	21.12845	42.05241	5.974431	8.340638	15.62272	1.340609	0.698438	2.609366	1.792624	0.440313
	4.000	10.25573	34.79221	6.298258	18.94634	26.33263	0.636957	0.963410	0.845885	0.777398	0.151187
	5.000	4.964531	36.12520	5.361416	20.04016	29.67883	0.366667	0.663298	0.607151	1.935855	0.256887
	6.000	4.107783	35.54972	4.428674	21.09985	32.70707	0.117307	0.326153	0.186124	1.295546	0.181767
	7.000	4.012405	37.50670	4.657069	19.79322	32.33284	0.064857	0.181580	0.083946	1.119849	0.247532
	8.000	3.613450	37.88200	4.203095	20.18075	32.58992	0.023939	0.152892	0.041358	1.095786	0.216812
	9.000	3.494651	37.90823	4.191131	20.41053	32.43652	0.017444	0.161763	0.027716	1.093884	0.258134
	10.000	3.427770	38.17371	3.993111	20.38431	32.52760	0.012753	0.146646	0.019708	1.068597	0.245788

Source: Research Calculations

5.7.2 IRF Results

Table 12: The Identified Shocks

Shocks	Shock 1	Shock 2	Shock 3	Shock 4	Shock 5	Shock 6	Shock 7
Variables	GDP	Financial depth in financial institutions	Efficiency in financial institutions	Access to services of financial institutions	Foreign investment	Labor	Tax revenues

According to results of the estimated SVAR model in MENA countries with 7 shocks (tax, financial depth of financial institutions, access to services of financial institutions, efficiency of financial institutions, labour, foreign investment, output), 55 constraints exist in MENA countries. All shocks are confirmed based on the significance level. The endogeneity nexus between variables in Table 12 indicates that variables (GDP, financial depth, access, efficiency, tax revenues, labour, and foreign investment) have endogenous nexuses in MENA countries. Accordingly, there is an endogenous nexus between financial depth in financial institutions and economic growth so that the first one affects the second one during the periods. This effect is more considerable in MENA countries so that the economic growth of these countries responds to all shocks. The effect rate differs in these countries based on their SVAR results. The results indicate that tax revenues shock also changes the economic growth in MENA countries and this effect in the first period differs from the next periods in groups of countries. The results of the estimated model are consistent with results obtained by Zhang et al. [14].

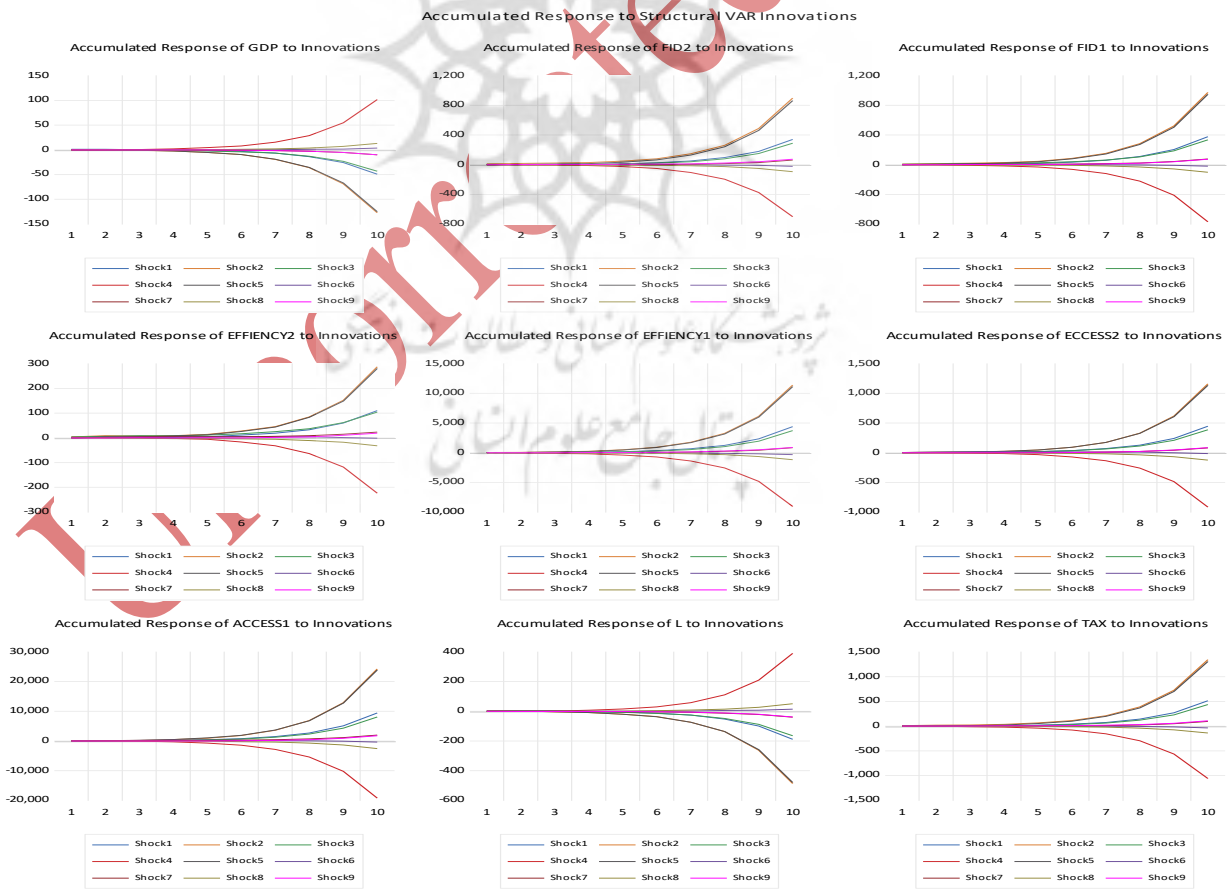

Fig 3: Response of Economic Growth to Occurred Shocks in MENA Countries

As seen in Figure 3, financial depth, access, and efficiency in financial institutions, tax revenue, labor, and foreign investment shocks have a positive impact on the economic growth at the beginning of the period, while this impact becomes negative after four periods. It can be stated that these shocks have a negative effect on economic growth in the mid-term, which is not in line with financial sustainability. However, these shocks do not affect the economic growth in the long term, so this effect tends toward zero after six periods. According to these regimes, we can state that economic growth has significantly responded to the shock imposed by tax revenues in both regimes. In regime one, economic growth responded to tax after a positive shock imposed on the tax variable and this response remained significant until the fifth period. After period five, the shock effect diminished and tended towards zero. Although the economic growth had a negative response to the shock after period 8, this response was not statistically significant. In other words, we cannot say that response of this variable is opposed to zero. Therefore, tax affected the economic growth only up to period five in regime one and showed no effect on this variable after this period. The tax effect was positive. In other words, a tax shock increases the growth level in a recession period. In the second regime, economic growth positively responded to tax revenues' shock during primary periods (up to the fifth period). Albeit this effect was significant only during the third and fourth periods. In other words, a tax shock will significantly affect the output market after three periods during the market boom. This effect then rapidly tends towards zero after a period (after period 4). The interesting point herein is the negative and significant effect of tax shock on the economic growth of the studied group during the seventh-ninth period.

5.8 Results of PSTR Estimation

5.8.1 Linearity Test and Lack of Nonlinear Correlation between Residuals

According to mentioned points in methodology, the null hypothesis (model linearity) is tested for the hypothesis of the PSTR model by consideration of financial development indicators as transition variables. The results reported for MENA countries in Table 13 indicate that all values of Wald Lagrange coefficient, Fisher's Lagrange coefficient, and Likelihood ratio follow a nonlinear pattern for two thresholds (M=1) and (M=2).

Table 13: Test of Nonlinear Relationship in MENA Countries

H_0=0	M=1			M=2		
H_1: r=1	Lmw	LMf	LR	Lmw	LMf	LR
	157.348 (0.000)	52.496 (0.000)	185.347 (0.000)	185.908 (0.000)	33.19 (0.000)	226.882 (0.000)
M represents the number of threshold points and r indicates the number of transition functions. Moreover, values in parentheses report the probability of each statistic.						

Source: Research Calculations

After ensuring the nonlinear nexus between studied variables, the residual nonlinear relation should be examined to determine the number of transition functions. To do this, the null hypothesis (presence of a PSTR model with one transition function) against the hypothesis of a PSTR model with at least two transition functions was tested based on the studies conducted by Gonzalez et al[1]. (2005) and

1 Gonzalez, A. and T. Terasvirta, and D. Van Dijk

Colletaz and Hurlin[2] [20]. Table 14 reports the result of this test for MENA countries. According to the results of the Wald Lagrange coefficient, Fisher's Lagrange coefficient, and Likelihood ratio, it is sufficient to consider one transition function to determine the nonlinear nexus between variables.

Table 14: Testing Nonlinear Nexus for MENA Countries

H0:r=1 H1:r=2	M=1			M=2		
	Lmw	LMf	LR	Lmw	LMf	LR
	5.825 (0.531)	1.318 (0.329)	4.308 (0.265)	9.144 (0.333)	1.078 (0.377)	9.191 (0.326)

Source: Research Calculations

5.8.2 Determining Number of Threshold Areas

Now an optimal state should be chosen between transition functions with one or two threshold limits after testing the linearity of one transition function choice. According to Colletaz and Hurlin [31] and Jude [32], the extant study estimated two PSTR models with one or two threshold limits, and residual sum of squares, Schwarz, and AIC criteria were calculated as determinants of threshold areas for all values to specify the best model. Among two limits (M=1) and (M=2), the threshold criterion with the lower residual sum of squares is chosen as the threshold. If this criterion is equal to two threshold limits, the minimum AIC criterion is used to find the optimal threshold.

According to Table 15 and the mentioned criteria, the PSTR model with one threshold limit is the optimal model for MENA countries.

Table 15: Determining the Optimal Lag Number in a Transition Function

Panel A: MENA countries					
M=1			M=2		
Schwarz criterion	AIC criterion	residual sum of squares	Schwarz criterion	AIC criterion	residual sum of squares
-4.7229	-4.7732	4.1025	-4.7086	-4.7672	4.1025

Source: Research Calculations

After selecting a PSTR model with one transition function and one threshold limit that indicates a two-regime model, the model is estimated for MENA countries.

5.9 Results of PSTR Model Estimation

Table 16: Result of PSTR Model Estimation for MENA Countries

Variable	The linear part of the model	Variable	Nonlinear part of the model
Financial depth.	0.004 (5.912)	Financial depth1	0.012 (-8.312)
Access.	0.007 (6.532)	Access1	0.001 (-5.043)
Efficiency.	0.312 (8.121)	Efficiency1	0.002 (5.064)
Fdi.	0.112 (8.112)	Fdi1	0.009 (5.431)
Regime switch area C=7.991 Adjustment coefficient (adjustment velocity) ý=3.123			

2 Colletaz, G. and C. Hurlin (2006)

Values reported in parentheses indicate t-values

Source: Research Calculations

Table 17 reports the results of the estimated PSTR model with two regimes indicating the significant impact of all three components (financial depth, efficiency, access) on economic growth. The slope is a parameter that indicates the velocity of transition from one regime to another equalled 3.12 for MENA countries. Moreover, the threshold limit of financial institutions' development index equalled 7.99 for MENA countries. In other words, when financial institutions' development index equals 7.99 for MENA countries then the direction or velocity of the impact of this index on the economic growth will change and this regime switch occurs with a velocity around 3.12. Hence, if the impact of financial institutions' development index and foreign investment on the economic growth exceeds 7.99 then variables behave in line with the second regime. If this value is less than the abovementioned threshold limit, variables will be in the first regime.

5.10 Estimate MA-VAR Model

The optimal lag of the model is determined using various criteria. This research used the Schwarz criterion which is suitable for large samples. The relevant model is estimated for MENA countries for one index in each turn. The optimal lag of the model in presence of financial institutions' development indicators equals 4 for MENA countries.

Table 17: Result of MS-VAR Model Estimation for MENA Countries

Financial Index (FI)				
		Quantity	t-value	Value
Regime 1	C1	-40.046	-4.670	0.000
	FIt-1	0.717	5.350	0.000
	FIt-2	-0.122	-0.709	0.483
	FIt-3	0.332	-2.090	0.044
	FIt-4	0.243	-0.492	0.626
	Fmt-1	0.585	1.770	0.085
	Fmt-2	0.666	1.550	0.130
	Fmt-3	0.055	-0.122	0.904
	Fmt-4	0.748	2.460	0.019
	fdi_{t-1}	0.273245	0.324078	0.424911
	fdi_{t-2}	-0.035717	0.108525	0.145516
	fdi_{t-3}	0.052416	-0.141830	-0.047926
	fdi_{t-4}	-0.057118	-0.146389	-0.064217
	C2	-14.523	-4.520	0.0000
	FI_{t-1}	0.302	3.460	0.001
	FI_{t-2}	0.115	1.210	0.232
	FI_{t-3}	-0.221	-2.380	0.022
	FI_{t-4}	-0.108	-1.670	0.104
	Fm_{t-1}	0.223	1.700	0.97
	Fm_{t-2}	-0.027	-0.157	0.876
	Fm_{t-3}	0.182	0.918	0.365
	Fm_{t-4}	-0.212	1.490	0.144
	fdi_{t-1}	0.147562	-1.828623	-0.554926
	fdi_{t-2}	0.027347	0.007997	0.066251
	fdi_{t-3}	0.075223	-0.018585	0.067051
	fdi_{t-4}	0.148158	0.142676	0.140479

Transition Probabilities Matrix	
P11=0.91	P12=0.09
P21=0.08	P22=0.92
Error terms tests	
Normality test	(0.28) 5.04
Test of non-autocorrelation	(0.40) 49.95
Test of variance homogeneity	(71) (0.71) 0.54

Source: Research Calculations

An autocorrelation test was done for 8 lags. The variance heterogeneity test was also done with one lag.

As reported in Table 17, variables of financial institutions' development index in regime one have a significant lag in the equation of financial institutions' development. The first and third lags of this variable are significant at levels 10% and 5%, respectively. In regime 2, the first and second lags of this variable are significant at the level of 10% and 5%. However, it should be noted that the standard deviation of the VAR model's coefficients is overestimated than the real value. Hence, it is not possible to be sure about the significance of coefficients. However, financial institutions' development index had a significant impact on the economic growth in both regimes one and two.

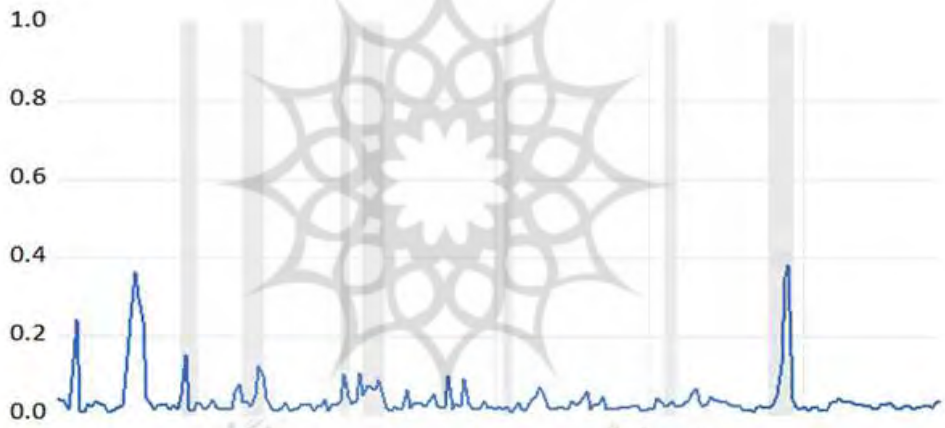

Fig 4: Classifying Extracted Regimes

Figure 4 indicates the classification of extracted regimes. This is a linear Figure that depicts the trend of FI and grey colored points to show periods which occurred in regime 2. White areas indicate periods pertained to regime one. As it is seen, regime 1 indicates periods when financial institutions experience a negative growth rate. In other words, these institutions have been in recession in this regime, while regime 2 indicates boom periods.

The main hypothesis considers whether there is a significant nexus between economic growth, financial institutions, and tax revenues. The results indicated a significant nexus between financial institutions' development and tax revenues in MENA countries.

6 Conclusion

Financial markets' performance, financial institutions, and taxes affect the economic performance of

developing countries. This effect is highly important in developing countries where the banking industry and financial markets are the main channels for monetary policy transition procedures. It is assumed that the performance of the banking system and financial markets can be promoted through an improved institutional framework despite the highly centralized market. No study has examined whether the development of financial institutions modifies the adverse effects of economic structure changes on the economic system's performance. Hence, this study examines the nexus between financial institutions and economic growth in MENA countries based on the indicators of each component in the frame of Panel-SVAR, PSTR, and MS-VAR models. The results showed a significant nexus between all three components of financial institutions' development, i.e., financial depth, efficiency, access to financial development, labor, investment, and economic growth. In other words, an increase in mentioned indicators leads to higher economic growth under economic stability, which increases security, and income, and reduces corruption in all countries, particularly in studied countries.

Findings indicate that there are different causal directions between financial development, tax revenue, and economic growth. On the other hand, indicators have different causal directions. Therefore, we cannot conclude that financial development indicators follow a supply-side or demand-side assumption. Research results indicate that among financial development indicators, the financial depth index led to economic growth in all selected countries except for Yamen. This result indicates the high dependence of these countries on the banking sector for finance. On the other hand, as results show that economic growth is the reason for development of financial institutions, financial markets, and tax revenues in four countries, it can be stated that financial institutions' development indicators are more affected by economic growth. On the other hand, increased income of these countries helps the real sector to accelerate financial development through credits granted to the private sector. Moreover, the results showed that the Iranian money market could not play an active role in the economic growth and development process during the studied period, so this market operated weakly. On the other hand, the stock market had the best effect on the economic growth in Iran compared to other countries except for Bahrain. The reason for such effects may stem from the development of Iran's exchange stock over recent years. Regarding the weak performance of the money market in Iran, it is recommended to pave the way for attracting investors and foreign markets in financial markets to improve the money market. on the other hand, the positive performance of financial markets implies that required infrastructures must be created to enhance and improve this market and encourage the private sector to perform in this market.

The results indicated long-term equilibrium nexus between tax and economic growth in 11 MENA countries from 1995 to 2019. The

There was also a causal association between tax and economic growth so tax had a negative effect on the economic growth of these countries. According to studies conducted on MENA countries (including studies conducted by foreign researchers and research results), an efficient financial system had a negative effect on economic growth. We selected MENA countries as a case study to achieve a criterion for obtaining results about the effect of tax on the economic growth in Iran comparing it to other countries with similar structures. Therefore, we can explain that the tax system is not efficient in Iran and many other countries. Although tax cannot affect growth in these countries, tax is required and the tax system of these countries should perform as the tax system of developed countries.

The results indicate that tax has a minor share in the income portfolio of the Iranian people; hence, tax has no negative effect (or it does not have any effect) on the economic growth of Iran, unlike the

developed countries. Hence, tax cannot be a fair tool in Iran, so tax loses its main function (equitable distribution of income) broadening the income gap in Iran. If tax has an accurate function, it will affect the economic growth negatively like in other developed and industrial countries.

7 Research Recommendations

Examine and compare the factors affecting the financial development index and exchange rate in different countries.

Conduct an effective analysis of price volatilities in financial markets and exchange market pressure under the different exchange systems.

Study the factors affecting the exchange market pressure and economic growth and tax shocks in developing and developed countries: a quantile panel approach

Investigate exchange regimes with two different approaches: Bayesian regression and SVAR

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