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Impact of Islamic banking development and major macroeconomic variables on economic growth for Islamic countries: Evidence from panel smooth transition models

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ABSTRACT

This study examines the nonlinear relationship between Islamic banking development, major macroeconomic variables and economic growth in Islamic countries. Using the panel smooth transition model, the results show a positive nonlinear relationship between Islamic banking development and economic growth. Moreover, the relationship between the macroeconomic variables and economic growth is asymmetric and regime-dependent. Further, by using the dynamic panel quantile model, we show that for many cases the Islamic banking variables lead economic growth across the quantiles. More specifically, foreign direct investment, oil production and inflation have a positive impact on economic growth during the normal financial development state, while government consumption, one-lag economic growth, terms of trade and financial development have a negative impact on economic growth for this state. The human capital index, education and the rule of law have an insignificant impact, regardless of the prevailing regime. The results for the separated oil-importing and oil-exporting economies are generally consistent with the combined sample regarding the Islamic banking development variables. As for the macro variables, they have a positive and significant (insignificant) effect on EG for the oil-importing (oil-exporting) economies for almost all models.

1. Introduction

The global Islamic finance service industry (GIFSI) (e.g., Islamic banking, Takaful, Sukuk, Islamic funds and Islamic stock markets), as a business model of ethical investing and an alternative vehicle to conventional finance, has been in an upward growth trajectory (achieving a 8.3 % growth rate in 2017) and gained momentum in the wake of the 2008–2009 global financial crisis (GFC).[1] As this industry grew substantially in 2017, it reached $2 trillion in that year (IFSB's IFSI Stability Report, 2018). The global

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[1] The Islamic finance industry is expected to achieve further development in the future, particularly by introducing new products and services and tapping new markets to reach a wider range of customers.

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Islamic finance is estimated to grow at 5 percent in 2018 and 2019. According to *The Banker* (2017), the total sharia-compliant assets reached $1509 billion in 2017. Standardization and financial technology have expedited the growth of this industry in the short and medium horizons (S&P Global Ratings, 2018). It is worth noting that 80 percent of Islamic finance activity is concentrated in the Gulf Cooperation Council (GCC), Iran and Malaysia.[2] According to IFSI (2017), global Islamic banking assets dominate the GIFIS and reached $1,493.4 billion (78.9 % of the total industry's assets) in 2016. They are divided as follows: $218.6 billion in Asia, $650.8 billion in GCC, $540.5 billion in MENA outside the GCC, $26.6 billion in Africa excluding North Africa, and $56.9 billion for others.

As the serious 2009-2009 crisis morphed into a series of unparalleled financial meltdowns and disruptions in the international financial system, it became clear that Islamic financial institutions were less affected, perhaps due to their sharia-based fundamental operating principles of risk-sharing, avoidance of leverage and speculative financial products. Islamic banks also have a relatively high capitalization, which, when combined with high liquidity reserves, served as a buffer during the global financial crisis.

There are views arguing that the Islamic banking sector was largely insulated from the GFC across the globe (Yılmaz, 2009) through its principled environment, that is, by providing Sharia-compliant modes of funding and financing. This banking sector continues to show rapid growth and demonstrates resilience despite the highly persistent uncertainty prevailing in the world's economy.[3] It complies with the Sharia principles that prohibit the payment or acceptance of interest charges (known as *Riba* or interest) on lending and accepting money. These principles also forbid conducting business in certain industrial activities that provide goods or services considered contrary to Islamic rules (an act known as *Haram* or the forbidden). The Islamic banking sector is the largest segment of the global Islamic finance industry with 80 % of Islamic financial assets held there. While the sector provides alternative and viable investment possibilities to Muslim investors, Islamic banking is not restricted to Muslims or Muslim countries. There are over 700 globally recognized Islamic financial institutions serving 38 million customers and operating in over 60 countries. 250 of these institutions are located in the Gulf Cooperation Council (GCC) countries, about 100 in other Arab countries, 41 in Malaysia and 28 in Iran (The Banker, 2013).[4]

An Islamic banking jurisdiction is considered systematically important when the local Islamic banking sector commands a certain percentage in the total domestic banking industry or a certain proportion in the global banking industry. The sector in a country is considered systemically important when the Islamic banking assets in that country comprise more than 15 % of the assets of its total domestic banking sector or when they hold at least 5 % of the global Islamic banking assets. Based on this consideration, Iran, Sudan, Brunei, Saudi Arabia, Kuwait, Yemen, Qatar, Malaysia, United Arab Emirates (UAE), Jordan, Djibouti and Bangladesh can be considered systematically Islamic jurisdictions. The Saudi Islamic banking sector represents 51.1 % of the total domestic banking assets in the first half of 2016. In Malaysia, Islamic banking assets represent a 23.8 % proportion of the total domestic banking assets. The corresponding proportions for the UAE and Bangladesh are about 19.6 % and 19.4 % of their total domestic banking assets, respectively. With these important shares of Islamic banking in the financial sectors of Islamic countries, it is interesting and valuable to examine the relationship between Islamic banking and economic development in those countries, taking into account the nature of this relationship and the nuances of Islamic financial development.

Since financial development is indispensable for economic growth, a large body of the literature addresses the relationship between conventional banking sector development and economic growth (see Abu-Bader and Abu-Qarn, 2008; Ang, 2008; Bojanic, 2012; Chaiechi, 2012; Hsueh et al., 2013; Jalil et al., 2010; Kar et al., 2011; Menyah et al., 2014; Pradhan et al., 2014; Wu et al., 2010, among others). In contrast, little attention has been paid to examining whether the Islamic banking sector fosters economic growth, despite the fact that Islamic finance has been one of the most prominent emerging phenomena in the banking industry in the Middle East and South-East Asia over the last decade (Gheeraert, 2014).

Islamic banks give a high proportion of their loans to construction and real estate projects, which in turn contribute to expanding capital stock, which is a primary source of economic growth. They can increase the savings of pious individuals who refrain from depositing their money in conventional banks, which sequentially raises the pool of domestic savings and enhances financial intermediation. Islamic banks also contribute to financial stability, which is a catalyst for economic growth. There is also evidence that the development of Islamic banking influences macroeconomic efficiency in many countries (Gheeraert and Weill, 2015).

In this framework, the broad aim of this study is to explore whether Islamic banking development and macro variables lead to economic growth (*EG*) in Islamic countries in the Middle East and North Africa (MENA) and in non-MENA regions over the period 1994–2014. More precisely, we address the following unanswered questions: (i) Are the relationships between Islamic banking development, the influential macroeconomic factors under consideration and the economic growth for the Islamic countries asymmetric and nonlinear? (ii) Do the linkages between these variables depend on the regimes of financial development? It is also worth noting that the development of Islamic banking can be represented by different measures including the amount of loans extended by these banks to the private sector over GDP, Islamic banking total assets/GDP, and deposits in Islamic banks/GDP. The latter measure is a useful indicator because it can gauge the ability of Islamic banks to mobilize savings.

We consider various economic and financial key factors within the Islamic financial development-economic growth nexus, including government consumption, foreign direct investments, human capital, inflation, oil production, trade openness, rule of law and terms of trade. To conduct further robustness analyses, we split the full sample into oil-importing and oil-exporting economies; this step is important as our sample is composed of oil-rich economies and oil-importing countries. Our analyses are motivated by the

[2] For more information, see Islamic Finance Outlook, 2018 Edition.

[3] The firm Ernst and Young reports that, although Islamic banks serve 38 million customers globally, almost 80% of the potential customer base for Islamic finance remains untapped, as Sharia-compliant assets constitute about 1% of the global financial assets.

[4] http://www.uabonline.org/en/research/financial/recentglobaldevelopmentsofislamicbanking/7471/0.

fact that the Islamic banking-economic growth nexus is also of significant interest to policymakers and institutional organizations due to the reasons indicated earlier. In fact, this topic is of great importance for countries concerned with developing Islamic banking.

The contribution of this study to the related literature is three-fold. First, it examines the nonlinear relationship between Islamic banking development and global macroeconomic variables, and economic growth under different financial regimes.[5] This has several implications for policymakers who favor the expansion of their country's Islamic banking sector. Second, it considers Islamic countries in both the MENA and non-MENA regions in which the Islamic banking sector exhibits an impressive growth trend. Islamic banks' assets are growing at a faster rate than those of their conventional counterparts in those countries and have become an important element in their societies' development endeavors. Third, as far as the empirical methodological framework is concerned, the paper applies a non-linear hybrid approach, namely dynamic panel smooth transition models, to assess the behavioral relationships between Islamic banks and economic growth under several economic conditions.

More precisely, we attempt to capture whether these linkages vary under different regimes. Specifically, the panel smooth transition regression (PSTR) model allows us to obtain a better understanding of this topic. It is also worth noting that the main shortcoming of the dynamic panel model without smooth transition is related to its inability to capture the nonlinear behavior relationships between the variables during different economic or financial conditions. However, PSTR gives room to incorporate regime-switching behavior both when the exact time of the regime change is not known with certainty and when there is a short transition period to a new regime. Therefore, the smooth transition (STR) model provides additional information on the dynamics of variables that show their values even during the transition period, and it is thus a good candidate to be added to the dynamic panel to form the PSTR in order to determine the nonlinearities and regime-switching present in the data.

The selection of this model is usually justified by the fact that the responses of economic variables, particularly economic growth, to shocks in the financial variables are slow and not abrupt during the recession-normality-expansion economic stages of the business cycles. Thus, the PSTR allows the coefficients of the exogenous variables to vary between the variables and over time, depending on the changes in the threshold variable(s). This model also provides a parametric approach to cross-bank heterogeneity and the time instability of the coefficients, since these parameters change smoothly as a function of a threshold variable. Analyzing this relationship in the recession-normal-expansion framework contributes to the literature on the Islamic banking development-economic growth nexus.

Our results show evidence of a threshold level for financial development. In addition, they highlight that for the Islamic countries there is a nonlinear relationship between Islamic banking development, macroeconomic variables and economic growth. Specifically, the Islamic bank development variables are statistically significant and positive for the intermediate (i.e., normal financial development) regime and negative for the high (i.e., highly expansionary development) regime. Moreover, we find that almost all macroeconomic conditions have a significant asymmetric impact on economic growth. More precisely, increases in foreign direct investments, inflation and oil prices affect economic growth significantly and positively in the normal regime. Education has a positive impact in the intermediate regime, but the impact is negative in the high regime. Financial development has an asymmetric effect on EG. The variables including the rule of law and the human capital index have insignificant effects on EG. Trade openness and foreign direct investment influence EG negatively in the high regime. The results for the separated oil-importing and oil-exporting economies are generally in line with those of the combined sample regarding the Islamic banking development variables. As for the macroeconomic variables, they have a positive and significant (insignificant) effect on EG in the oil-importing (oil-exporting) economies only for the high regimes and for almost all models. The oil-exporting countries are heavily dependent on the oil-related variables.

By using the dynamic panel quantile model, we find a positive relationship between Islamic banking development and economic growth for different quantiles. For the remaining variables, only foreign direct investment and terms of trade affect economic growth positively at different quantiles, while the other variables affect economic growth negatively for almost all quantiles.

The remainder of this paper is organized as follows. Section 2 presents the literature review and Section 3 discusses the methodology. Section 4 provides the data and the descriptive statistics. Section 5 reports and analyzes the empirical results. Section 6 concludes the paper and presents policy implications.

2. Literature review

Due to the importance of the relationship between financial/banking sector development and economic growth for a country, many studies have been conducted on this causal relationship since the seminal works of McKinnon (1973); Shaw (1973), and King and Levine (1993). Following the onset of the GFC, an emerging body of literature has addressed the Islamic banking development-economic growth nexus. For instance, Abduh and Omar (2012) evaluate the short- and long-run relationship between Islamic banking development and economic growth in Indonesia. Using the bounds-testing approach of cointegration and the error correction model, developed within the autoregressive distributed lag (ARDL) framework, the authors find evidence of short- and long-run relations between Islamic financial development and economic growth. They add that this is neither a Schumpeter's supply-leading nor a Robinson's demand-following relationship, but rather appears to be bidirectional.

Pradhan et al. (2014) examine the relationship between banking sector development, stock market development, economic growth and four other macroeconomic variables. Using a panel vector auto-regressive model for testing the Granger causalities, the authors find strong evidence of both unidirectional and bidirectional causality links between the considered variables. Moreover, Pradhan et al. (2015) examine the linkages between economic growth, oil prices, stock market depth, real effective exchange rate,

[5] The objective is not to test whether Islamic banks contribute more to economic growth than conventional banks.

inflation rate and real rate of interest for the G20 countries. The results show evidence of a long-run relationship between economic growth, oil prices, stock market depth, real effective exchange rate, inflation rate and real interest rate. The real economic growth responds to any deviations in the long-run equilibrium relationship that are found to exist between different measures of stock market depth, oil prices and other macroeconomic variables. Further, the authors show a complex short-term causal nexus between the considered variables

Focusing on the Malaysian economy, Furqani and Mulyany (2009) use the cointegration test and vector ECM to examine the dynamic linkage between Islamic banking and economic growth, and provide evidence of a short-run causality from fixed investment to Islamic banking. In addition, the authors provide evidence of bidirectional long-term causality between Islamic banking and fixed investment. They further find evidence supporting the demand-following hypothesis of the GDP-Islamic banking nexus, attesting that increases in GDP cause development of the Islamic banking sector. Using the panel cointegration approach models, Farahani and Dastan (2013) also document the presence of positive long-run evidence between Islamic banks' financing and both economic growth and capital accumulation in Islamic countries.[6] Applying the Granger causality test, the authors reveal a positive linkage between economic growth and Islamic banks' financing in both the short and the long run. In addition, they show that the long-run relationship is more evident than the short-run relationship. Tabash and Dhankar (2014) evaluate the linkage between the development of the Islamic finance system and economic growth and its direction in Qatar using the unit root test, cointegration and Granger causality tests. The results show strong evidence of a positive long-run relationship between Islamic banks' financing and economic growth. Furthermore, the authors also indicate that Islamic banks' financing has contributed to a positive increase in investment in the long term in Qatar.

More interestingly, Gheeraert and Weill (2015) assess whether the development of Islamic banking impacts macroeconomic efficiency. Using a stochastic frontier approach to estimate technical efficiency, the authors provide evidence that Islamic banking development enhances macroeconomic efficiency. Moreover, they show a non-linear relationship between efficiency and Islamic banking development. Imam and Kpodar (2016) study the relationship between Islamic banking development and economic growth in a sample of low and middle-income countries over the period 1990–2010 and find that Islamic banking is positively associated with economic growth even after controlling for various determinants, including the level of financial depth.

Applying the panel cointegration approach to Islamic countries, Farahani and Dastan (2013) show that Islamic banks' financing is positively related to economic growth and capital accumulation in the long run. Their results on the Granger causality test exhibit a positive relationship between economic growth and Islamic banks' financing in the short run. More interestingly, the obtained long-run relationship is more apparent than the short-run relationship.

More recently, Caporale and Helmi (2018) have examined the impacts of Islamic banking development on the credit-economic growth nexus. The authors consider a first set of emerging countries without Islamic banks and then a second set with a dual banking system (Islamic and conventional banks). The results show a significant long-run causality running from credit to GDP in the economies with Islamic banks. Focusing on MENA countries, Boukhatem and Ben Mousa (2018) find a positive relationship between financial system development and economic growth in those countries. In addition, they show that this relationship is hindered by underdeveloped institutional frameworks. The selected net-oil-exporting economies do not benefit from large oil-fueled deposits that are likely to increase the scale of loans.

Our study complements the existing literature by investigating the impacts of Islamic banking development and macroeconomic variables on economic growth in Islamic economies, using the PSTR and dynamic panel quantile models. For a deeper analysis, we have examined this relationship for two subsamples, oil-importing and oil-exporting countries, since the total sample is also composed of very rich oil countries including the Gulf economies, which are different from the included oil-importing countries. A set of major macroeconomic variables (i.e., inflation, oil production, government consumption, trade openness, terms of trade, rule of law, education, human capital index, foreign direct investment and financial development) that are consistent with the previous literature (Bassanini et al., 2001; Boukhatem and Ben Mousa, 2018; Garrison and Lee, 1995; Goldsmith, 1969; King and Levine, 1993; Pradhan et al., 2014) has been selected. The theoretical literature advances a common finding on the role of financial development on economic growth (Beck and Levine, 2004).[7]

3. Methodology

3.1. PSTR specification

Following Chang and Chiang (2011) and González et al. (2005), assuming a single transition function and two extreme regimes (e.g., recessions to expansions), we may specify a simple panel STR (PSTR) model as follows:

$$y_{it} = \mu_i + \beta'_0 x_{it} + \beta'_1 x_{it} g(q_{it}; \gamma, c) + \varepsilon_{it} \quad (1)$$

where $t = 1, \ldots, T$, and $i = 1, \ldots, N$. N and T denote the time-dimension and the country, respectively, and y_{it} is the dependent variable and a scalar. The other parameters γ, μ_i, x_{it}, $g(.)$, q_{it}, c, and ε_{it} represent the slope parameter,[8] the country effects, a k-dimensional vector of time-varying exogenous variables, a transition function, a threshold variable (i.e., financial development, *FD*), a threshold

[6] Malaysia, Indonesia, Bahrain, UAE, Saudi Arabia, Egypt, Kuwait, Qatar and Yemen.

[7] For more details on the importance of our selected macroeconomic variables, see Boukhatem and Ben Mousa (2018).

[8] It denotes the smoothness of the switch from one regime to other regimes.

parameter (i.e., financial development) and a residual term. Further, note that as $\gamma \to \infty$, the transition function approaches the indicator function $I(q_{it} > c_j)$ that takes the value of 1 if $q_{it} > c_j$, respectively. Hence, $g(q_{it}; \gamma, c)$ is a continuous transition function of the threshold variable q_{it} and is standardised to be constrained between 0 and 1.

3.2. Specification testing procedure for the PSTR model

We begin with testing the presence of non-linearity in the data because if the data-generating process (*DGP*) is linear, the PSTR model will not be identified. The null hypothesis used to conduct this test is H_0: $\beta_1 = 0$. However, to overcome the problem of unidentified nuisance parameters included in the model, we replace $g(q_{it}; \gamma, c)$ by $\gamma = 0$(the first-order Taylor expansion)[9] and test the linearity hypothesis as H_0: $\gamma = 0$. The auxiliary regression, after re-parameterization for the m maximum number of thresholds, may be written as follows:

$$y_{it} = \mu_i + \beta'^{*}_{0} x_{it} + \beta'^{*}_{1} x_{it} q_{it} + \ldots + \beta'^{*}_{m} x_{it} q_{it}^{m} + \varepsilon^{*}_{it} \tag{2}$$

given that the parameter vectors $\beta'^{*}_{1}, \ldots, \beta'^{*}_{m}$ are multiples of γ and $\varepsilon^{*}_{it} = \varepsilon_{it} + R_m \beta'^{*}_{1} x_{it}$, where R_m is the residue of the Taylor extension.

Further, following Colletaz and Hurlin (2006), we can use Eq. (2) to test the null hypothesis of zero equality of the beta coefficients of the threshold variable, i.e., H_0*:β'^{*}_{1}=...=$\beta'^{*}_{m} = 0$. The Wald LM, the Fischer LM and the Likelihood Ratio tests may be specified as follows:

$$LM_W = \frac{NT(SSR_0 - SSR_1)}{SSR_0} \tag{3}$$

$$LM_F = \frac{NT(SSR_0 - SSR_1)/mk}{SSR_0(TN - N - mk)} \tag{4}$$

$$LR = -2[log(SSR_1) - log(SSR_0)] \tag{5}$$

where SSR_0 and SSR_1 denote the sum of the squared residuals of the panel model under the null hypothesis (i.e., fixed effect in the linear panel model) and the sum of the squared residuals of the panel data under the alternative hypothesis (i.e., m regime PSTR model), respectively. The Fischer LM test (i.e., $F(mk, TN - N - mk)$) approximately follows the $\chi^2(k)$ distribution under the null hypothesis, where *k, m, N* and *T* are the number of independent variables, the maximum number of thresholds, and the countries and time periods under consideration, respectively. Further, the transition function is tested for H0 of no remaining non-linearity following the suggestion of Teräsvirta (1994).[10]

4. Data and stochastic properties

4.1. Sample data

We use annual data for 16 Islamic countries in the MENA and non-MENA regions (see Table 1). The sample spans the period from 1994 to 2014, the start being dictated by the availability of data for all the countries under consideration. Further, this period is marked by several episodes of wide instabilities and crises, and thus covers major regional and global events such as intervals of sharp fluctuations in crude oil markets (particularly in summer 2008 and mid-2014), the 2001 NY terrorist attack, the 2003 Gulf war, the Lehman Brothers collapse on September 15, 2008, the 2008–2009 GFC and the 2010–2012 Eurozone sovereign debt crisis. The global economic factors we use in this study provide a further understanding of economic growth in Islamic countries.

The data cover the following variables: (a) economic growth, which is the dependent variable and measured by GDP growth and/or per capita GDP growth rate; and (b) the explanatory variables related to Islamic banking, which are the Islamic bank total assets-to-GDP ratio, the Islamic bank deposits-to-GDP ratio, the Islamic bank loans-to-GDP ratio and the Islamic bank net loans-to-GDP ratio. The control variables include measures of financial development, foreign direct investment, government consumption, education, trade openness, rule of law, terms of trade, oil production and the consumer price index as a proxy of inflation. The choice of this set of explanatory variables is motivated by their strong links with the economic growth literature. All variables are listed in Table A.1 in the Appendix.

For the Islamic banks, the data are compiled from the World Bank Islamic Group. The rest of the variables are taken from different sources including the World Bank, IHS Global Insight, Penn World Table (PWT) 8.0, and the U.S. Energy Information Administration (EIA).

4.2. Descriptive statistics

Table 2 presents the descriptive statistics of the variables used in this study. We find that the mean of all variables (except the rule of law) is positive. The FDI variable presents the highest volatility as measured by the standard deviation, followed by the four proxy

[9] Following Luukkonen et al. (1988).

[10] For a further discussion of this methodology, please refer to Chang and Chiang (2011) and González et al. (2005), among others.

Table 1
List of selected Islamic countries.

MENA	Non-MENA
Bahrain	Bangladesh
Kuwait	Brunei Darussalam
Qatar	Malaysia
Saudi Arabia	Pakistan
United Arab Emirates	Indonesia
Jordan	
Lebanon	
Turkey	
Tunisia	
Iran	
Sudan	

Note: This table presents the list of the economies used in this study.

variables of Islamic bank development. Further, all these considered variables deviate from the Gaussian distribution, since their skewness and kurtosis coefficients are different from zero and three, respectively. This result is confirmed by the Jarque-Bera test. The correlation matrix results, reported in Table A.2 in the Appendix, show no significant multicollinearity problem between the endogenous and exogenous variables as the correlation coefficients are low or negative; for example, that the economic growth variables (dependent variables) are negatively correlated with the Islamic bank variables (total loans, net loans, total assets and total deposits over GDP). The human capital index, inflation, oil production, the rule of law and financial development are negatively correlated with economic growth, but the correlations are weak. Furthermore, there is no collinearity between the exogenous variables themselves as the correlation coefficient values between those variables are very low and close to zero for almost all cases.

Before reaching the estimation step, we check the stationarity of the variables making up the panels under consideration. Specifically, we use four popular panel unit root tests, namely the panel Augmented Dickey and Fuller, Phillips and Perron, LLC and IPS tests, developed by Dickey and Fuller (1979), Philips and Perron (1988), Levine et al. (2002), and Im et al. (2003), respectively.[11] The results of the estimation of these tests for the series in both the level (Panel A) and the series in the logarithm (Panel B) are reported in Table A.3 in the Appendix. For the level series, we find weak evidence for stationarity (GDP growth, GDP per capita growth, human capital index and inflation series). When we examine the series in logarithmic form, we find strong evidence that the null hypothesis of the panel unit roots can be strongly rejected for all the logarithmic series under consideration. This indicates that the logarithmic series are stationary at a conventional level of significance (almost all cases are significant at the 1 % level). Thus, the empirical model can be regressed in this logarithmic form.

5. Empirical results

The estimated results are presented in three sequences. First, we consider the non-linearity tests and the determination of the number of location parameters. Second, we estimate the PSTR models. Finally, we test the robustness of our empirical analysis using an alternative model, namely the dynamic panel quantile model.

5.1. Linearity and no remaining non-linearity results

To justify the use of nonlinearity models, we use three linearity tests, namely the Wald test (LMW), the pseudo likelihood ratio (LRT) and the Fisher test (LMF). The results are reported in Table 3. Specifically, we test the null hypothesis of a linear model against the alternative hypothesis of the panel smooth transition (PSTR) model with at least one threshold variable. We consider financial development as the threshold variable. The choice of this variable is not arbitrary but based on its importance for economic growth. In fact, the contribution of financial development to EG may be traced back to Goldsmith (1969); McKinnon (1973) and Shaw (1973), who find positive evidence of the effect of financial development on EG. In addition, financial development is an important driver of the development of stock markets and banking systems (Goldsmith, 1969; Durusu-Ciftci et al., 2017).

As shown in Table 3, we strongly reject the null hypothesis of linearity for all models at the conventional levels of significance using the three linearity tests, thereby highlighting that the threshold variable is crucial to assess the nonlinear relationship between economic growth and both Islamic bank development and the macroeconomic variables. This result also confirms our intuition and motivation to consider the PSTR model.

In the next step, we apply the model selection test to determine the polynomial order in the nonlinearity test equation (m, which is the maximum number of thresholds). That is, we apply the model selection test to determine the number of thresholds based on the AIC criterion. The results are summarized in Table 4 and show evidence of the presence of one threshold (i.e., $m = 1$ is selected for all

[11] For the level data, we used the intercept and trend specification, while for the first difference we selected the intercept model based on the time series plot of the level and the first difference series.

Table 2
Descriptive statistics.

	FDIGDP	GRGDP	GOVCON	GRGDPPC	HC	IBASSET	IBDEPOSIT	IBLOAN	IBNETLOAN	INFCPI	OILPRODGDP	OPEN	RULELAW	EDU	FD	TOT
Mean	208.046	4.6371	0.426	1.603	3.834	30.503	45.649	104.363	119.434	6.272	1.931	2.278	−8.810	0.725	3.304	1.539
Median	−5.067	4.6555	−0.512	2.105	3.194	5.764	7.082	3.873	4.727	−4.224	−9.114	0.998	−1.740	0.445	1.972	1.397
Maximum	61138.63	35.980	67.961	15.654	26.579	1634.423	4312.089	9298.422	8944.668	2206.687	1433.530	116.433	400.154	325.338	73.875	18.312
Minimum	−26141.69	−9.6794	−24.223	−15.145	−7.277	−99.193	−99.896	−99.530	−99.586	−875.766	−73.209	−42.970	−1024.265	−82.904	−34.649	−11.779
Std. Dev.	3638.392	4.4291	11.036	3.797	3.854	142.290	259.127	714.109	732.187	187.414	91.759	14.970	97.607	18.685	12.902	5.148
Skewness	11.846	1.4742	1.892	−0.646	2.457	8.105	12.683	10.2019	9.220	3.609	13.442	2.268	−5.1438	13.196	0.828	0.235
Kurtosis	217.412	12.257	11.561	5.045	13.083	79.571	198.184	114.4109	95.215	57.787	200.684	17.846	51.605	243.67	6.026	2.6189
Jarque-Bera	736791.6	1494.568	1387.635	92.699	1992.207	96995.23	613392.2	203121.2	140025.5	48351.09	510789.8	3816.025	39082.32	928172.3	188.502	5.822
Probability	0.000	0.000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.000000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0544
Observations	380	380	380	380	380	380	380	380	380	380	308	380	380	380	380	380

Notes: This table presents the descriptive statistics of the economic growth, Islamic bank development and macroeconomic variables for the nineteen Islamic countries over the period 1994-2014. GRGDP is the GDP growth, GRGDPPC is the per capita GDP growth rate, IBASSET is the Islamic bank assets-to-GDP ratio, and IBDEPOSIT is the Islamic bank deposit-to-GDP ratio. IBLOAN is the Islamic bank loans-to-GDP and IBNETLOAN the Islamic bank Net Loan-to-GDP ratio. EDU is education, FD is financial development, FDIGDP is the foreign direct investments-to-GDP ratio, GOVCON is the government consumption-to-GDP ratio, HC is the human capital index (Source: Penn World Tables). INFCPI is CPI inflation, OILPROD is oil production, OPEN is openness, RULELAW is the rule of law and TOT is the terms of trade (Source: Penn Word Tables). All variables are converted into percentage growth rates.

Table 3
Estimated results of linearity tests.

	Lagrange multiplies-Wald tests (LMW)	Lagrange multiplies-Fisher tests (LMF)	Likelihood ratio tests (LRT)
Model 1	95.335	2.856	112.188
	(0.000)	(0.000)	(0.000)
Model 2	95.097	2.846	111.855
	(0.000)	(0.000)	(0.000)
Model 3	94.210	2.809	110.61
	(0.000)	(0.000)	(0.000)
Model 4	95.068	2.845	111.815
	(0.000)	(0.000)	(0.000)
Model 5	64.468	1.711	71.602
	(0.006)	(0.008)	(0.000)
Model 6	62.359	1.642	69.002
	(0.010)	(0.013)	(0.000)
Model 7	59.700	1.557	65.750
	(0.018)	(0.023)	(0.000)
Model 8	61.202	1.605	99.233
	(0.013)	(0.017)	(0.000)

Notes: The table reports the LM Wald (W), the LM Fisher and the pseudo likelihood ratio (LRT) tests of linearity against the PSTR model. The p-values are in parentheses.
Model 1: GRGDPPC = F (one-lag GRGDPPC, IBLOAN, EDU, FDI, FDIGDP, INFCPI, OPEN, GOVCON, HC, TOT, RULELAW, OILPRODGDP).
Model 2: GRGDPPC = F (one-lag GRGDPPC, IBNETLOAN, EDU, FDI, FDIGDP, INFCPI, OPEN, GOVCON, HC, TOT, RULELAW, OILPRODGDP).
Model 3: GRGDPPC = F (one-lag GRGDPPC, IBDEPOSIT, EDU, FDI, FDIGDP, INFCPI, OPEN, GOVCON, HC, TOT, RULELAW, OILPRODGDP).
Model 4: GRGDPPC = F (one-lag GRGDPPC, BASSET, EDU, FDI, FDIGDP, INFCPI, OPEN, GOVCON, HC, TOT, RULELAW, OILPRODGDP).
Model 5: GRGDP = F (one-lag GRGDP, IBLOAN, EDU, FD, FDIGDP, INFCPI, OPEN, GOVCON, HC, TOT, RULELAW, OILPRODGDP).
Model 6: GRGDP = F (one-lag G GRGDP, IBNETLOAN, EDU, FD, FDIGDP, INFCPI, OPEN, GOVCON, HC, TOT, RULELAW, OILPRODGDP).
Model 7: GRGDP = F (one-lag GRGDP, IBDEPOSIT, EDU, FDI, FDIGDP, INFCPI, OPEN, GOVCON, HC, TOT, RULELAW, OILPRODGDP).
Model 8: GRGDP = F (one-lag GRGDP, IBASSET, EDU, FDI, FDIGDP, INFCPI, OPEN, GOVCON, HC, TOT, RULELAW, OILPRODGDP).

Table 4
Model selection test results.

	F test: H03:B3 = 0	F test: H02:B2 = 0|B3 = 0	F test: H01:B1 = 0|B2=B3 = 0
Model 1	1.137	0.822	0.688
	(0.275)	(0.767)	(0.922)
Model 2	1.168	0.792	0.678
	(0.238)	(0.809)	(0.929)
Model 3	1.133	0.786	0.689
	(0.280)	(0.817)	(0.921)
Model 4	1.171	0.786	0.680
	(0.234)	(0.817)	(0.928)
Model 5	0.923	0.445	0.281
	(0.605)	(0.998)	(1.000)
Model 6	0.796	0.459	0.334
	(0.804)	(0.998)	(1.000)
Model 7	0.785	0.446	0.279
	(0.819)	(0.998)	(1.000)
Model 8	0.787	0.460	0.307
	(0.815)	(0.998)	(1.000)

Notes: F stands for the Fisher test. Select m = 2 if the rejection of H02 is the strongest one, otherwise select m = 1. Models 1–8 are defined in the notes of Table 3. The p-values are in parentheses. The parameters B1, B2 and B3 indicate the presence of one, two and three transition functions, respectively. One transition function means two regimes (low and high regimes).

cases), indicating the presence of one regime switch. Economically, this result means that the relationship between *EG* and the sets of Islamic banking development and macroeconomic variables depends on the financial over/under-development of an economy.

The estimation of the PSTR model with regime-switching requires testing the remaining non-linearity. In this study, we consider that the number of thresholds ranges between 1 and 3. The testing procedure works as follows. First, we test the null hypothesis of the presence of one threshold against the alternative hypothesis of the PSTR model with two thresholds. If we do not reject the null, we confirm the PSTR model with one threshold (or two regimes). In contrast, the rejection of the null requires testing the null of two thresholds against the alternative hypothesis of three thresholds. Further, we report only the estimation of no remaining non-linearity of the first model in Table 5.[12] As shown in this table, we reject the null of the presence of one threshold (or two regimes). In addition,

[12] To save space, the no remaining non-linearity results of the remaining models are not reported here but are available upon request.

Table 5
Testing the number of regimes (tests of no remaining non-linearity).

	H0: PSTR with r = 1 against H1: PSTR with at least r = 2		H0: PSTR with r = 2 against H1: PSTR with at least r = 3	
Test	Statistics	P-value	Statistics	P-value
Lagrange multiplies-Wald Tests (LMW)	33.178	0.002	28.142	0.009
Lagrange multiplies-Fisher Tests (LMF)	2.368	0.005	1.884	0.032
Likelihood ratio-LRT Tests (LRT)	34.938	0.001	29.395	0.006

Notes: Model based on GRGDPPC. r denotes the number of transition functions. r = 1 means one transition function (or two regimes).
Model 1: GRGDPPC = F (one-lag GRGDPPC, IBLOAN, EDU, FD, FDIGDP, INFCPI, OPEN, GOVCON, HC, TOT, TOTCH, RULELAW, OILPRODGDP).

if we look at the results of two thresholds, we again reject the null of double thresholds. This result implies that the model has three threshold functions or four regimes. The interpretations of the remaining tables are similar. In fact, we show that the optimal (LMR criterion) number of threshold functions is $r = 3(2)$ for Models 1–4 (5–8) given the choices of $rmax = 3$ and $m = 1$ (i.e., m is the maximum number of thresholds), respectively. In fact, we do not reject the null hypothesis of no remaining non-linearity. This result indicates no misspecification of our models.

5.2. PSTR model estimation

5.2.1. Transition parameters analysis

After checking for no remaining non-linearity, we conduct the estimation for the PSTR models employing the eight models. The transition function plots (see Appendix) clearly illustrate the non-linearity that exists between economic growth and financial development following the used threshold variables. Table 6a to d present the estimated PSTR model parameters when GDP per capita growth is considered as the dependent variable. The results of the GDP growth dependent variable are available upon request. We have further conducted a robustness analysis for the separated oil-importing and oil-exporting economies (see Tables A.4a-A.4d and A.5a-A.5d in the Appendix).[13]

The threshold levels are found to be 49.27 and 79.19 for Model 1 (three financial development regimes), 50.33 and 79.17 for Model 2 (three financial development regimes), 50.02 and 80.66 for Model 3 (three financial development regimes), and 50.23 and 80.93 for Model 4 (three financial development regimes), when GDP per capita growth is considered as the dependent variable.[14] For the first model, we show that the threshold value indicates that if the GDP growth rate crosses the growth rate level of 79 %, then we have the highest regime. Moreover, we have a low regime below a growth rate of 49 %, and the intermediate regime is defined between these threshold levels of growth rates. Looking at the last four models (Table 6e-h), the expected threshold is similar when GDP growth is the dependent variable. It is worth noting that the threshold levels for the first four models exceed those of the last four models.

5.2.2. Islamic banking development results

On the other hand, we show that the effect of almost all independent variables on *EG* is nonlinear. The relationship between the Islamic bank loans and *EG* is nonlinear. More precisely, the effect of Islamic banking loans on *EG* is statistically significant and positive in the intermediate regime (or normal financial development) where there are no excessive bad, or too little, lending and speculations. This result indicates that the loans of Islamic banking contribute to the development of the financial system and *EG* of the Islamic countries. In fact, the banking authorities in this regime are confident and extend more credit, which in turn increases investment and consumption, thereby resulting in improving EG. However, this relationship is negative in the high regime (strong financial development expansion). This result underscores the presence of an asymmetric relationship between these two variables and confirms the validity of using the nonlinear approach. The negative relationship may economically be explained by the excessive credit to the private sector offered by banks and nonbank financial institutions. For the low regime (financial development contraction), the relationship is insignificant. This result may be explained by credit rationing and lack of confidence of the banking authorities in the economic situation.

Similarly to Islamic bank loans, Islamic bank deposits and Islamic bank size as measured by the Islamic bank total assets have a positive and statistically significant effect on EG under the normal regime and a negative effect in the high regime. We can explain this result by the fact that Islamic agents prefer Islamic banks as a safe place for their funds. It is also possible that Islamic funds feed speculation in real estate in this regime. Also, the result could be due to the important size of some Islamic banks, particularly in Saudi Arabia (e.g., Al-Rajhi bank is the largest Islamic bank in the world). In the low regime, the relationship is insignificant in this environment of low financial development. The same results are found for the total assets of Islamic banks. In fact, we show that the total assets have a positive impact on economic growth in the normal regime and a negative effect in the high regime. For the oil-importing and oil-exporting countries, the results show that all Islamic banking development variables affect EG negatively, but only in the high regime. For this reason, we will not interpret them.

[13] For the separated oil-importing and oil-exporting economies, the results of the GDP growth dependent variable are available upon request.
[14] Figure A.1 in the Appendix plots the transition functions.

Table 6
PSTR model estimation.

a

	Model 1: Dependent variable (GRGDPPC), Islamic bank variable (IBLOAN)		
Variable	B0	B1	B2
one-lag GRGDPPC	−0.000034 [-0.359]	**- 0.00036 [2.179]**	**0.00037 [2.723]**
IBLOAN	0.0000 [0]	**0.004249 [2.448]**	**−0.002870 [-2.6525]**
EDU	−0.0000161 [-0.648]	**–0.000470 [-4.762]**	**0.000080 [2.3108]**
FD	**−0.000004 [-2.742]**	−0.000222 [-1.757]	**0.000213 [3.2212]**
FDIGDP	0.000037 [0.771]	0.000044 [0.749]	**−0.000144 [-2.8631]**
INFCPI	0.000034 [0.582]	**0.000585 [2.445]**	−0.000333 [-0.6355]
OPEN	−0.0000250 [-1.291]	0.000376 [1.302]	**−0.000369 [-3.3269]**
GOVCON	0.0000030 [0.0652]	**−0.000288 [-4.372]**	**0.00017 [2.4402]**
HC	−0.00007 [-0.727]	−0.00024 [-0.7066]	−0.000058 [-0.5116]
TOT	0.000047 **[1.536]**	**0.001156 [3.215]**	0.000283 [1.7981]
RULELAW	0.00125 [0.5331]	−0.00477 [-0.711]	−0.003421 [0.3645]
OILPRODGDP	0.00082 [0.6662]	**0.00773 [2.752]**	0.000756 [1.2265]
Intercept	0.12229 [0.400]	**−9.0656 [-2.516]**	0.79100 [1.281]
Transition parameters			
Threshold Location Parameters (c)	79.193		49.275
Slope (gamma)	14.557		0.715

b

	Model 2: Dependent variable (GRGDPPC), Islamic bank variable (IBNETLOAN)		
Variable	B0	B1	B2
one-lag GRGDPPC	−0.00001 [-0.12409]	**−0.00039 [-2.34914]**	**0.00038[2.95627]**
IBNETLOAN	0.00009 [0]	**0.00416 [2.38607]**	**−0.00269 [-2.80006]**
EDU	0.00000 [0.40302]	**−0.00045 [-4.68095]**	**0.00004 [1.21100]**
FD	**−0.00000 [-2.23341]**	−0.00020 [-1.59591]	**0.00020 [3.11698]**
FDIGDP	0.00003 [0.90158]	0.00001 [0.17991]	**−0.00010 [-1.97694]**
INFCPI	0.00002 [0.36681]	**0.00053 [2.25106]**	0.00002 [0.21524]
OPEN	−0.00002 [-1.26369]	0.00037 [1.29481]	**−0.00037 [-3.42822]**
GOVCON	0.00000 [0.20891]	**−0.00027 [-4.29240]**	**0.00014 [2.60488]**
HC	−0.00005 [-0.59687]	−0.00015 [-0.44519]	−0.00011 [-0.85227]
TOT	0.00005 [1.74300]	**0.00105 [2.94705]**	0.00020 [1.66116]
RULELAW	0.00115 [0.48233]	−0.00546 [-0.81942]	−0.00237 [-0.56562]
OILPRODGDP	0.00088 [0.70404]	**0.00677 [2.49247]**	−0.00005 [-0.03109]
Intercept	0.15583 [0.53298]	**−9.03632 [-2.60240]**	**0.81034 [1.37759]**
Transition parameters			
Threshold Location Parameters (c)	79.174		50.336
Slope (gamma)	17.355		23.578

c

	Model 3: Dependent variable (GRGDPPC), Islamic bank variable (IBDEPOSIT)		
Variable	B0	B1	B2
one-lag GRGDPPC	−0.000002 [-0.23182]	**−0.00004 [-2.53723]**	**0.00004 [3.12545]**
IBDEPOSIT	0.0000 [0]	**0.000513 [3.00655]**	**−0.00027 [-2.78292]**
EDU	−0.000001 [-0.94855]	**−0.00004 [-5.10253]**	**0.00000[1.31094]**
FD	**−0.0000044 [-1.99129]**	**−0.00002 [-2.04875]**	**0.00001 [2.9866]**
FDIGDP	0.0000025 [1.06788]	−0.00000 [-0.11213]	**−0.00000 [-1.74922]**
INFCPI	0.0000037 [0.43049]	**0.00005[2.59051]**	0.00000 [0.416360]
OPEN	−0.0000095 [-1.30662]	0.00001 [0.35752]	**−0.00003 [-3.26134]**
GOVCON	−0.0000060 [-0.08744]	**−0.00002 [-4.02219]**	**0.00001 [2.70892]**
HC	0.00000 [-0.95488]	−0.00002 [-0.73964]	−0.00001 [-0.90421]
TOT	0.00000 [1.93188]	**0.00012[3.71051]**	0.00001 [1.46159]
RULELAW	0.00009 [0.38713]	−0.00054 [-0.81559]	−0.00018 [-0.42209]
OILPRODGDP	0.00009 [0.73375]	**0.00083 [2.95938]**	−0.00001 [-0.09561]
Intercept	0.02128[0.70516]	−1.49373[-3.65398]	0.084029[1.39816]
Transition parameters			
Threshold Location Parameters (c)	80.668		50.025
Slope (gamma)	1.033		5.025

(*continued on next page*)

Table 6 (*continued*)

d

	Model 4: Dependent variable (GRGDPPC), Islamic bank variable (IBASSET)		
Variable	B0	B1	B2
one-lag GRGDPPC	−0.00000 [-0.21479]	**−0.00004 [-2.55616]**	**0.00004 [3.14535]**
IBASSET	0.0000 [0]	**0.00052 [3.03773]**	**−0.00026 [-2.65509]**
EDU	−0.00000 [-0.46414]	−0.00003 [5.11908]	0.00000 [0.86023]
FD	**−0.00000 [-2.06514]**	**−0.00002 [-2.11935]**	**0.00001 [2.90035]**
FDIGDP	0.00000 [1.01867]	−0.00000 [-0.10658]	**−0.00000 [-1.72262]**
INFCPI	0.00000 [0.49709]	**0.00005 [2.50445]**	0.00000 [0.36781]
OPEN	−0.00000 [-1.33002]	0.00000 [0.23848]	**−0.00003 [-3.07531]**
GOVCON	−0.00000 [-0.18492]	**−0.00002 [-3.84000]**	**0.00001 [2.71738]**
HC	−0.00000 [-0.85301]	−0.00002 [-0.74301]	−0.00001 [-0.84484]
TOT	0.00000 [1.86489]	**0.00012 [3.66770]**	0.00001 [1.35886]
RULELAW	0.00008 [0.35522]	−0.00049 [-0.68229]	−0.00018 [-0.43421]
OILPRODGDP	0.00008 [0.69001]	**0.00087 [3.01345]**	−0.00004 [-0.23019]
Intercept	0.01704[0.57253]	−1.52365[-3.72113]	0.08292[1.36293]
Transition parameters			
Threshold Location Parameters (c)	80.938		50.237
Slope (gamma)	0.923		4.872

Notes: Model 1 is based on GRGDPPC. B0, B1 and B2 stand for regime 1, regime 2 and regime 3, respectively. Bold values indicate significance at the 5 % level. The *t*-test statistics are in []. See the notes of Table 5 for more information.
Notes: Model 2 is based on GRGDPPC. B0, B1 and B2 stand for regime 1, regime 2 and regime 3, respectively. The bold values indicate significance at the 5 % level. The *t*-test statistics are in []. See the notes of Table 5 for more information.
Notes: Model 3 is based on GRGDPPC. B0, B1 and B2 stand for regime 1, regime 2 and regime 3, respectively. Bold values indicate significance at the 5 % level. The *t*-test statistics are in []. See the notes of Table 5 for more information.
Notes: Model 4 is based on GRGDPPC. B0, B1 and B2 stand for regime 1, regime 2 and regime 3, respectively. Bold values indicate significance at the 5 % level. The *t*-test statistics are in []. See the notes of Table 5 for more information.

5.2.3. Macroeconomic variables results

More precisely, the one-year lag economic growth has an asymmetric effect on *EG*. That is, the relationship between the past and the current *EG* is regime-dependent. This relationship is statistically significant and negative for the intermediate regime but positive for the high regime. This result indicates that past economic growth promotes current economic growth under the state of extremely high financial development. Thus, policymakers can make use of the economy's historical performance as a forecasting indicator to implement or alter programs.

An asymmetric relationship is found between the threshold variable (i.e., financial development) and *EG*. Indeed, threshold has a negative effect on EG during the low regime, which may be due to a slow financial development of the financial system. It also confirms the existence of deficiencies in credit allocation in the Islamic countries and suggests a presence of weak financial regulations and supervision or restrictions on credit. The same result is found for a few models for the intermediate regime. Finally, the EG-financial development relationship has a positive effect in the high regime, which entails high financial development. This result is in line with that of Levine (2005), who concludes that financial development contributes to growth by providing information about potential projects, monitoring the implementation of investments, enhancing risk management and diversification, pooling savings and facilitating the exchange of goods and services. In fact, we can conclude that financial development improves EG only in the high financial development regime.

Regarding foreign direct investment (FDI), this variable is negatively related to the growth of GDP per capita in the high regime (see Models 1 and 4). When examining the growth of GDP, we find that FDI has no effect on GDP growth. This result may be due to the crowding out effect in some countries and the insufficient FDI flows to promote their economies. Our results are in line with Alfaro et al. (2004), Carkovic and Levine (2005) and Hermes and Lensink (2003). The latter find that FDI affects EG only if the domestic financial system is developed. We also find little evidence of the effect of trade openness on *EG* in the high regime. In fact, we find that EG responds negatively to trade openness in this regime, which implies that trade openness discourages economic growth in accelerated financial development. This result may be because the financial markets of our countries are not sufficiently developed. Huang and Chang (2014) show that the growth effect of trade is related to the extent of equity market development. Kim et al. (2012) conclude that trade promotes economic growth in a high-income, low inflation environment. On the other hand, government consumption has a negative and statistically significant effect on EG for the intermediate regime for all models, but a positive effect in the low and high regimes. It is possible that there is a crowding out from increases in government spending in the normal regime. The human capital index and the rule of law have a generally insignificant effect on EG for all models. Only for Models 6–8, the rule of law-GDP relationship is negative in the high regime, that is, when the financial landscape is high. This result indicates an asymmetric relationship between these variables

Inflation has a statistically significant and positive effect on *EG* during the normal financial development regime for the first four models. In contrast, the result is insignificant for the low and high regimes for all cases. Inflation may create uncertainty in those

regimes that negatively affect economic growth. On the other hand, oil production has a positive effect on economic growth only during the normal regime, but this effect is insignificant in the other regimes. This result may be explained by the fact that the GCC and Iran are oil-rich countries. Oil revenues represent the greatest part of their GDP, and thus these economies are sensitive to the oil production level. However, the terms of trade affect economic growth positively in the intermediate or normal regime. This result shows the importance of imports/exports in improving the growth of any of these economies.

Regarding the oil-importing and oil-exporting economies, the sign and significance of the coefficients are nearly all close to those of the combined economies, with the exception of the human capital index and the rule of law, which have a significant effect on EG for all models. More precisely, the human capital index has a negative impact of EG for the low regime and a positive effect in the high regime for the oil-importing countries. As for the rule of law variable, it affects EG positively under the high regime of financial development. All macroeconomic variables (except trade openness and education) generally have a positive effect on EG for the oil-importing economies. For the oil-exporting economies, we find that the education and financial development variables have a positive effect on EG, while foreign direct investment has a negative effect on EG for the high regime, probably due to higher tension in the economy under this regime. For the rest of the macro variables, the results are generally insignificant.

5.3. Results of the dynamic panel quantile model: Additional insights

In order to get more insights from the data, and based on several economic conditions, we use the panel quantile regression model. The PSTR model captures the non-linearity of the data and is able to provide regime-wise information. However, the use of the panel quantile can definitely add value and provide additional insights, where PSTR fails to do so. This has motivated us to use the panel quantile model. It is important to note that since PSTR is based on the fixed effects model and thus able to capture the cross-sectional effect, we can use the advanced panel quantile model developed by Powell (2016), which is robust to cross-sectional dependence in the panel data and also allows dynamics to hold. Therefore, in this study, we estimate the dynamic panel quantile model.[15]

This model is well suited for capturing the nonlinear aspects of the exogenous variables during changes in the environment under consideration. This top-down model is a flexible tool that can model relationships between the covariates and the unobserved heterogeneity. The results of the dynamic panel quantile model are available upon request. They show that all the variables of interest are statistically significant at the conventional levels and across the quantiles.[16] We show that Islamic banking development, past economic growth, foreign direct investment and terms of trade affect economic growth positively under different financial development conditions. More interestingly, these coefficients vary across the quantiles, indicating a nonlinearity effect of the exogenous variables. As for financial development, human capital index, inflation, government consumption, trade openness, rule of law, terms of trade and oil production, these variables have a negative and statistically significant effect on economic growth across the quantiles (from the lower to the upper quantiles). The results of the dynamic panel quantile models confirm those of the PSTR models.

6. Conclusions and policy implications

The spectacular development of Islamic banking in many Islamic countries makes it relevant and timely for researchers to have a good understanding of its effects on economic growth in different financial development environments. This study examines the impact of Islamic banking development on economic growth for nineteen Islamic countries. We also consider the effect of several key macroeconomic variables (financial development, foreign direct investments, trade openness, education, inflation, human capital, government consumption, terms of trade, oil production and the rule of law) on economic growth in those countries. To this end, we apply the panel smooth transition (PSTR) model to discern the relationship between economic growth and those variables. This model is an extension of the smooth transition regression (STR) model to panel data embedded with heterogeneity across the individual panels and over time. For additional insights into the results, we apply the dynamic panel quantile model in order to assess the considered relationships under different financial development conditions (i.e., low, medium and high financial development).

We first test for the presence of threshold effects before using the non-linear methods. Using three popular tests, namely the Wald, Fisher and likelihood ratio tests, we find evidence that financial development is a threshold variable, thus underpinning the presence of different financial development regimes.

The estimated results for the PSTR models indicate that the relationships between economic growth and the independent variables are nonlinear during different financial development conditions. Moreover, past economic growth affects current economic growth positively in the high regime and negatively in the normal regime. All Islamic banking variables (Islamic bank loans, Islamic bank net loans, Islamic bank deposits and Islamic bank size) impact economic growth positively in the intermediate regime (normal financial development), while the relationship is negative for the high regime (strong financial development), indicating that Islamic banking loans reduce economic growth for Islamic countries, perhaps due to higher risk-sharing during economic overheating or to their disposition to real estate investments, which may not be very productive. This result confirms our intuition of the presence of an asymmetric relationship between these two variables under different financial development conditions.

[15] For further details on the dynamic panel quantile model, see Koenker (2004) and Galvao (2011).

[16] The lower quantiles (from $q = 0.05$ to $q = 0.15$) usually reflect economic recessions, but in this paper they represent low Islamic financial development. Similarly, the intermediate quantiles (from $q = 0.25$ to $q = 0.5$) reflect normal Islamic financial development, while the upper quantiles ($q = 0.75$ to $q = 0.95$) indicate high financial development.

In the low regime, the relationship is insignificant, which means that Islamic banking cannot help economic growth during financial development contraction or restrictions. Financial development has a negative effect on economic growth during the low and intermediate financial development regimes but a positive effect in the high regime.

Foreign direct investment is negatively related to growth in GDP per capita in the high financial development regime, probably because of high risk-bearing or a lack of incentives. However, when we look at the intermediate regime, we find that FDI contributes to EG. Furthermore, there is little evidence of an effect of trade openness on economic growth for these Islamic countries. Moreover, government consumption has a negative and statistically significant effect on economic growth in the intermediate regimes and a positive effect in the high regime. This result indicates that, at a high level of financial development, increases in government consumption improve economic growth.

The human capital index and the rule of law have an insignificant effect on economic growth in our setting. This result may be due to underinvestment in human capital or the presence of temporary foreign labor that fosters continuity in schooling and returns on education. Oil production and inflation have a statistically significant and positive effect on economic growth during the normal financial development regime. The terms of trade affect growth in the intermediate regime positively when GDP per capita growth is the dependent variable. Regarding the separated oil-importing and oil-exporting economies, we show that Islamic banking development variables have a negative impact on EG for the high regime. This result is generally in line with the findings of the combined sample. Macroeconomic variables have a positive and statistically significant effect on EG for the oil-importing economies only in the high regime. In contrast, for the oil-exporting economies we find little or insignificant effects on EG, with few exceptions.

These results have important policy implications. Domestic financing provided by the Islamic banking sector has been found to contribute to the growth of the MENA and non-MENA economies. This positive relationship means that the more developed the Islamic financial system is, the better the growth of the associated economy. The GCC countries, which have a strong financial system, should continue to promote Islamic banking, while other countries with slow economic growth could develop their Islamic banking by adopting and developing legislation and regulations to foster Islamic financial development. The Islamic financial system can thus support and sustain the leading economic sectors in the process of growth.

Policymakers should adopt economic and financial reforms to encourage foreign direct investment and relax constraints that hinder the entry of foreign investors. This is the aim of the future visions recently adopted by the GCC countries (e.g., Vision 2030 of Saudi Arabia and Qatar, among others). Further, banks should be cautious of allowing an acceleration of credits to the private sector. Finally, authorities should support more investment in human capital to allow the economy to grow faster, and increasing trade openness may be favorable to economic growth when institutional quality improves.

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Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.ecosys.2019.100739.

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