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Impact of Islamic Finance on Economic Growth

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ABSTRACT

We estimate the influence of relative strength of Islamic finance on GDP growth for OIC countries, as well as the whole world. We examine both static and dynamic relationship between Islamic finance and economic development using the panel data. We find that Islamic finance has a strong positive relationship with economic growth. We also use propensity score matching in our analysis to account for variables predictive of log(GDP). Finally we address selection bias by using an iterative Markov Chain Monte Carlo method to fill in the missing variables. Both of these techniques reinforce our primary findings.

ملخص

نقدر تأثير القوة النسبية للتمويل الإسلامي على نمو الناتج المحلي الإجمالي لدول منظمة التعاون الإسلامي، وكذلك العالم بأسره. وندرس العلاقة الثابتة والديناميكية بين التمويل الإسلامي والتنمية الاقتصادية باستخدام بيانات اللوحة. ووجدنا أن التمويل الإسلامي له علاقة إيجابية قوية مع النمو الاقتصادي. ونستخدم أيضا مطابقة درجة الميل في تحليلنا لحساب المتغيرات التنبؤية للسجل (الناتج المحلي الإجمالي).وأخيرا، نتعامل مع تحيز الاختيار باستخدام طريقة سلسلة ماركوف مونتي كارلو التكرارية لملء المتغيرات المفقودة. وكلتا الطريقتين تعزز النتائج الأولية التي توصلنا إليها.

ABSTRAITE

Nous estimons l'influence de la force relative de la finance islamique sur la croissance du PIB pour les pays de l'OCI, ainsi que pour le monde entier. Nous examinons la relation statique et dynamique entre la finance islamique et le

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développement économique en utilisant des données de panel. Nous constatons que la finance islamique a une forte relation positive avec la croissance économique. Nous utilisons également l'appariement par score de propension dans notre analyse pour tenir compte des variables prédictives du log (PIB). Enfin, nous nous attaquons au biais de sélection en utilisant une méthode itérative de Monte Carlo par chaîne de Markov pour combler les variables manquantes. Ces deux techniques renforcent nos principaux résultats.

Keywords: *Islamic banking; financial inclusion; economic development; poverty*

JEL Classification: E44; E52; F6; G2; O16

1. Introduction

Developing a robust banking sector can lead to economic development. The development can be achieved through better capital accumulation, formation and allocation, monitoring, and diversification. However, religious restrictions among Muslim majority countries can discourage people to participate in the conventional banking industry as receiving or paying interests is forbidden in Islam.

There are almost 1.6 billion Muslims in the world, making up about 24% of the world's population. According to Naceur, Bajaras, and Massara (2015), only 27 percent of Organisation of Islamic Cooperation (OIC) countries households have an account at a formal institution, which compared to the rest of the world at 55 percent, is very low. Many of these individuals are voluntarily excluded from the financial system since the current financial system goes against the system of Islamic religious rules known as the Shari'a. In recent years, there has been an increase in Shari'a compliant financial products and insurances, which plays a significant role in increasing the level of financial inclusion of Islamic countries.

The positive impact of financial sector development on growth is already established in the literature (see among others Beck, Levine, and Loayza (2000)). Researchers have argued that the presence of Islamic finance promotes higher financial inclusion by attracting voluntarily excluded people to the financial system, thereby promoting growth in the country

and reducing poverty (Beck, Demirgüç-Kunt, and Levine, 2004). We are reexamining the argument that Islamic financial institutions can have a more pronounced effect on growth than their conventional counterparts.

We empirically study whether the strengthening of Islamic finance relative to conventional finance in a country promotes higher growth. Here, we are assuming that the development of the banking sector positively impacts growth. This study tests whether bringing in Islamic banks in the mix adds anything to growth. We contribute to the literature by presenting proof that Islamic finance can contribute to growth on an economy on a higher scale than their conventional counterparts. This better performance can be achieved through mitigating voluntary financial exclusion, unique investment participation, or monitoring practices.

This study is important for multiple reasons. First, researching Islamic countries will provide useful information about the relationship between financial system catered to a high voluntarily excluded population and economic growth. The demand for Shari'a compliant financial services is expected to increase and this information will be useful to provide the desired financial products. Secondly, Shari'a compliant financial products have relatively low speculative characteristics compared to conventional financial services and therefore has attracted a lot of attention in recent years. Being able to see whether such products can do any better than their conventional counterparts to promote growth may help policymakers move towards a more inclusive financial system.

We begin our study by generating proxy variables for growth and relative strength of Islamic finance. We also identify a few control variables that have been shown to impact growth. We use both static and dynamic panel models to identify the effects of Islamic finance in short-run and long-run growth. The results show that Islamic finance promotes economic growth in the short-run. However, any significant short-run impact of Islamic finance in absent in the OIC subsample. In the long-run, the contribution of Islamic finance is much stronger for OIC countries.

The study further uses propensity score matching to see the likelihood of Islamic finance promoting growth. The results indicate that Islamic finance has a significantly positive impact on growth. Considering a large number of missing observations in OIC subsample, we impute the missing variables using an iterative Markov Chain Monte Carlo method and run the same analyses for further consistency. The findings stay consistent in general.

The rest of the paper is organized as follows: Section 2 is Literature Review, Section 3 goes over the data and methodology, Section 4 shows the results, and Section 6 concludes.

2. Literature Review

There have been several studies linking Islamic finance to economic growth. Furqani and Mulyany (2009) conducted one of the earliest studies to connect Islamic finance with growth where they examine the dynamic interactions between Islamic banking and economic growth of Malaysia. They find that in the short-run only fixed investment that granger cause Islamic Bank to develop. Whereas in the long-run, there is evidence of a bidirectional relationship between Islamic bank and fixed investment and there is evidence to support 'demand following' hypothesis of GDP and Islamic bank, where an increase in GDP causes Islamic banking to develop and not vice versa.

A study by Gheeraert (2014) shows that the increase of Islamic banking in Muslim countries does increase banking sector development with increased private credit and bank deposits (scaled to GDP). They find that the Islamic banking sector complements the conventional banking sector and should not replace it but co-exist in Muslim countries. We are trying to build on the results of Gheeraert (2014) in this study to see how increasing Islamic banking in Muslim countries will better their economies.

Kassim (2016) evaluates the contribution of Islamic finance to real economic activity. Their findings suggest that Islamic finance has

important contributions to the real economy. They believe that Islamic banking needs to increase in Malaysia to keep growing their economy.
Expanding on the previously mentioned study, Daly, and Frikha (2016) studies the role of Islamic banks in the growth of GDP of developing countries. Their investigation reveals that the development of Islamic banks supports economic growth. As was found in previous studies, they also find that the cooperation of Islamic and conventional banking improves economic growth. Imam and Kpodar (2016) also study the relationship between Islamic banking development and economic growth. And also finds that Islamic banking is positively associated with economic growth.

In this paper, we are building on previous studies done on Islamic banking and economic growth. We are trying to prove, as others have done, that Islamic banking is a very useful tool in growing the economy in developing Muslim countries and that in working with conventional banks these countries can grow and stabilize their economies and in turn improve the lives of its' citizens.

3. Data and Methodology

3.1. Data

We use the growth[4] of Gross Domestic Product (GDP) per capita (constant in 2005 USD) as a measure of economic development (henceforth, GDPG). Previous studies show that a number of economic variables contribute to GDPG. Education level, average income, national capital accumulation, national capital formation, openness to trade (or dependence on external sector), and macroeconomic stability are some of the most widely accepted contributors to growth. We use these variables as controls in measuring the effect of Islamic finance on growth.

We use the average years of total schooling completed among people over the age of 15 as a proxy for the level of education (SCH). We use GDP per capita as a proxy for average national income (INC). The ratio of gross

[4] $GDPG_t = \ln(GDP_t) - \ln(GDP_{t-1})$

national savings in current local currency and GDP in current local currency proxies for national capital accumulation (SAV). The ratio of total investment in current local currency and GDP in current local currency proxies for national capital formation (INV), the ratio of international trade (import plus export of goods and services) and GDP in current local currency proxies for dependence on external sector (TR), and the percentage change in consumer price index (inflation) proxies for macroeconomic stability (INF). We normalize each of the variables by taking logarithms.

Proxies for SAV, INV, and INF are collected from IMF World Economic Outlook (WEO), GDPG and INC are from Global Financial Development Database (GFDD), TR from IMF Balance of Payments Statistics Yearbook and data files, and SCH from World Development Indicators of the World Bank.

We use three different measures as proxies for the strength of Islamic finance, we could follow Imam and Kpodar (2016), where Islamic banking asset, deposit, and lending as a share of GDP are used as proxies for development of Islamic banking. We deviate from their measure because using both dependent and our focus independent variable as a function of GDP can give rise to potential bias in a linear setting. It can also make the results difficult to interpret. So, we use ratios of Islamic banking variables and non-Islamic banking variables. This approach will show how Islamic banks are doing compared to non-Islamic banks. Specifically, we use the following three measures as proxies for the strength of Islamic finance in our analysis.

1. $IS_{AT} = \frac{Islamic\ Banking\ Assets}{Non{-}Islamic\ Banking\ Assets}$
2. $IS_{DEP} = \frac{Islamic\ Banking\ Deposits}{Non{-}Islamic\ Banking\ Deposits}$
3. $IS_{LIAB} = \frac{Islamic\ Banking\ Liabilities}{Non{-}Islamic\ Banking\ Liabilities}$

Each of these measures provides the relative strength of Islamic baking in terms of asset share, deposit share and liability share in a country. These measures will show whether Islamic banking is contributing enough in overall banking sector development. For example, if the overall banking system is doing very well in a country where Islamic banking sector is barely improving, the measures will show that Islamic banking is relatively worsening. This approach will allow us to investigate whether Islamic banking by itself (unique banking practice) adds anything to growth.

We collect banking data from Bankscope. We add assets, deposits, and liabilities of all Islamic (non-Islamic) banks to get total Islamic (non-Islamic) banking assets, deposits, and liabilities respectively. After estimating the strength variables, we use the first difference of each of these variables as a measure of improvement (or dis-improvement when negative) of relative strength of Islamic finance. We focus our analyses on relative strength, rather than just strength, because the banking sector rarely contracts. It is always expanding (both Islamic and non-Islamic), whereas the economic strength can vary between years. Using a measure for relative strength will be able to capture how aggressively Islamic finance is moving compared to conventional finance in a particular country.

Our combined database includes economic variables and Islamic finance measures from a sample of 230 countries during the period 1990 through 2014. However, many countries have a number of missing observations; therefore, we only keep countries with at least 15 years of available data. In doing so we end up with 154 countries and 3596 country-year observations. Summary statistics of macroeconomic variables are shown in Table 1 and Islamic finance variables are shown in table 2. Difference in means are also provided in these tables. Table 1 shows that countries with Islamic banking and OIC countries achieved lower growth, compared to their counterparts. The same trend is found in education, income level, capital accumulation and formation, and openness to external market. Only capital accumulation is found to be higher in Islamic banking countries. OIC and Islamic banking countries are also suffering from higher macroeconomic volatility.

Table 1: Macroeconomic variables

	Whole Sample							OIC subsample			
	Combined	Non-OIC	OIC	Difference in Means	Non-IB	IB	Difference in Means	Combined	Non-IB	IB	Difference in Means
GDPG	0.0217	0.0226	0.0193	0.0033*	0.0223	0.0177	0.0046**	0.0193	0.0214	0.0158	0.0056*
	(0.0446)	(0.0441)	(0.0459)	(0.0017)	(0.0456)	(0.0367)	(0.0022)	(0.0459)	(0.0501)	(0.0380)	(0.0031)
	3543	2618	925		3087	456		925	572	353	
SCH	2.0325	2.1526	1.6613	0.4912***	2.0584	1.8807	0.1777***	1.6613	1.5516	1.7928	-0.2412***
	(0.4512)	(0.3518)	(0.5179)	(0.0170)	(0.4533)	(0.4070)	(0.0232)	(0.5179)	(0.5718)	(0.4084)	(0.0374)
	2996	2264	732		2560	436		732	399	333	
INC	8.2210	8.5035	7.4200	1.0835***	8.2241	8.2001	0.0239	7.4200	6.9717	8.1456	-1.1739***
	(1.5832)	(1.5417)	(1.4172)	(0.0577)	(1.6075)	(1.4091)	(0.0793)	(1.4172)	(1.1949)	(1.4494)	(0.0877)
	3555	2628	927		3098	457		927	573	354	
SAV	2.9242	2.9463	2.8623	0.0840***	2.9031	3.0643	-0.1612***	2.8623	2.7577	3.0308	-0.2732***
	(0.5982)	(0.5347)	(0.7450)	(0.0234)	(0.5869)	(0.6521)	(0.0304)	(0.7450)	(0.7528)	(0.7012)	(0.0507)
	3365	2480	885		2923	442		885	546	339	
INV	3.1112	3.1263	3.0702	0.0561***	3.1120	3.1058	0.0062	3.0702	3.0572	3.0918	-0.0346
	(0.3593)	(0.3206)	(0.4459)	(0.0139)	(0.3663)	(0.3089)	(0.0183)	(0.4459)	(0.5083)	(0.3144)	(0.0306)
	3382	2475	907		2940	442		907	568	339	
TR	4.3130	4.3427	4.2295	0.1133***	4.3205	4.2623	0.0582**	4.2295	4.2054	4.2685	-0.0631*
	(0.5247)	(0.5378)	(0.4765)	(0.0201)	(0.5151)	(0.5829)	(0.0264)	(0.4765)	(0.3999)	(0.5781)	(0.0324)
	3484	2569	915		3032	452		915	566	349	
INF	0.0691	0.0683	0.0714	-0.0031	0.0687	0.0716	-0.0029	0.0714	0.0728	0.0691	0.0038
	(0.1064)	(0.1060)	(0.1076)	(0.0041)	(0.1082)	(0.0938)	(0.0053)	(0.1076)	(0.1133)	(0.0983)	(0.0073)
	3453	2535	918		2992	461		918	560	358	

Descriptive statistics of economic variables from a sample of 230 countries during the period 1990 through 2014. GDPG is defined as GDP growth per capita constant in 2005 USD. SCH education is a country proxied by average years of total schooling completed among people over age 15, INC is initial income defined as log of GDP per capita, SAV is national saving defined as log of the ratio of gross national savings in current local currency and GDP in current local currency, INV is national investment defined as log of the ratio of total investment in current local currency and GDP in current local currency, and TR is national trade defined as the log of the ratio of import and export of goods and services and GDP in current local currency. Proxies for SAV, INV and INF are collected from IMF World Economic Outlook (WEO), GDPG and INC are from Global Financial Development Database (GFDD), TR from IMF Balance of Payments Statistics Yearbook and data files, and SCH from World Development Indicators of the World Bank.

For each variable, the first row is mean, the second row (the number in parenthesis) is standard deviation (standard error for the difference in means column), and the last row is the count of observations. Statistics are reported for the whole sample and the OIC countries sample. Difference in means performs t-test on means equality.

Numbers in parentheses are robust standard error. *** indicates significance at 1%, ** indicates significance at 5%, and * indicates significance at 10%.

Table 2: Islamic finance variables

	Combined	Non-OIC	OIC	Difference in Means
IS_{AT}	0.1704	0.0531	0.5023	-0.4491***
	(2.4932)	(1.5600)	(4.0979)	(0.0950)
	3552	2625	927	
IS_{DEP}	0.1578	0.0424	0.4827	-0.4403***
	(2.2876)	(1.2404)	(3.9383)	(0.0873)
	3527	2603	924	
IS_{LIAB}	0.1677	0.0527	0.4933	-0.4406***
	(2.4547)	(1.5475)	(4.0220)	(0.0935)
	3552	2625	927	

Descriptive statistics of Islamic finance variables. Here, IS_{AT} is the ratio of assets, IS_{DEP} is the ratio of deposit, and IS_{LIAB} is the ratio of liabilities shares of Islamic banks and non-Islamic banks in a country.

For each variable, the first number is mean, the second number (the number in parenthesis) is standard deviation (standard error for the difference in means column), and the last number is the count of observations. Statistics are reported for the whole sample and the OIC countries sample. Difference in means performs t-test on means equality.

Numbers in parentheses are robust standard error. *** indicates significance at 1%, ** indicates significance at 5%, and * indicates significance at 10%.

People in OIC countries are more likely to voluntarily exclude themselves from the financial system for the lack of access to Shari'a compliant financing. Considering that the need of Islamic finance is much more dominant in these countries, we separate them from the sample and analyze them separately. In table 2, we see that the difference in means analysis for Islamic finance measures show very large and significant difference between OIC and non-OIC countries. We see that in general, Islamic banking countries show higher strength in education, income, capital accumulation and formation, and macroeconomic stability, but shows more dependence on external trade, and less per capita GDP growth.

Although we start with 154 countries in our sample, we will be able to use 118 countries in our primary analyses, because these analyses will require all the variables present for each country in each year.

3.2. Methodology

In any macroeconomic analysis, country-specific factors can give rise to heterogeneity in the sample. It is of paramount importance that we control for such heterogeneity before drawing any conclusion from our analyses. Therefore, we use a GLS measure to find the effect of Islamic finance on economic development. However, we do not make any prior assumption as to whether the country specific effects are correlated with independent variables. We perform a Durbin-Wu-Hausman test to tackle this problem and find that they are correlated which makes the fixed effects model applicable to our analysis. So, we fit the following GLS fixed effect estimator.

$$GDPG_{i,t} = IS_{i,t}\beta + X'_{i,t}\gamma + \alpha_i + u_{i,t} \quad (1)$$

Where,

GDPG = GDP growth per capita in 2005 US dollars,

$IS_{i,t}$= Islamic finance measures, such as $IS_{AT}, IS_{DEP}, and\ IS_{LIAB}$, for country i and year t,

$X_{i,t}$= A vector of control variables, such as SCH, INC, SAV, INV, TR, and INFL, for country i and year t,

α_i= Unobserved time-invariant individual effects, and

$u_{i,t}$=error term

We are also concerned that the lagged dependent variables and the error terms could be correlated, and thus make our estimation biased. To handle this issue, Arellano and Bond (1991) suggested a generalized method of moments (GMM) method that estimated a dynamic panel model, which can remove the autocorrelation of the error term and reduce the correlation between endogenous variables and the error term. They suggest first-difference the regression equation to eliminate the country-specific effect, as follows.

$$y_{i,t} - y_{i,t-1} = \alpha'\left(X^1{}_{i,t-1} - X^1{}_{i,t-2}\right) + \beta'\left(X^2{}_{i,t} - X^2{}_{i,t-1}\right) + (\varepsilon_{i,t} - \varepsilon_{i,t-1}) \quad (2)$$

However, first-differencing can some problems. First, we lose the pure cross-country dimension of the data. Second, differencing may decrease the signal-to-noise ratio, thereby exacerbating measurement error biases. Also, Alonso-Borrego and Arellano (1999) and Blundell and Bond (1997) show that if the lagged dependent and the explanatory variables are persistent over time, lagged levels of these variables are weak instruments for the regressions in differences. Therefore, to deal with these issues we use an alternative method that estimates the regression in differences jointly with the regression in levels, as proposed by Arellano and Bover (1995).[5] They argue that lagged differences are valid instruments for the regression in levels, and propose the moment conditions for the regressions in levels as follows:

$$E\left[\left(X_{i,t-s} - X_{i,t-s-1}\right)(\varepsilon_{i,t} + \mu_i)\right] = 0 \; for \; s = 1; t = 3, \ldots, T. \quad (3)$$

Moreover, they design this model particularly for a dataset of many panels and few time periods. Our sample is similar in nature with 154 panels and up to 25 time periods. Here, we define y as GDPG and X^2 as IS variables and control variables.

We then do propensity score matching to estimate the effect of Islamic finance on log(GDP) by accounting for variables predictive of log(GDP). We follow the methodology proposed by Abadie and Imbens (2006). This technique allows a look at two treatment levels: the treatment group with $t = 1$ and a control group with $t = 0$. We follow the binary treatment potential outcome model where $\log(GDP)_1$ is the potential outcome obtained by each country if Islamic finance treatment is given a level $t = 1$ and $\log(GDP)_0$ is the potential outcome if the level $t = 0$ for each country i. Then, we estimate the average treatment effect (ATE), $\tau_1 =$

[5] Using Monte Carlo experiments, Blundell and Bond (1997) show that this system estimator reduces the potential biases in finite samples and asymptotic imprecision associated with the difference estimator.

$E(\log(GDP)_1 - \log(GDP)_0)$ and average treatment effect among treated (ATET), $\delta_1 = E(\log(GDP)_1 - \log(GDP)_0 | t = 1)$. The advantage of using this model is that the treatment probability model parameterizes the bias-correction term. This way it reduces the bias coming from confounding variables and reduces the likelihood of ending up with a spurious association.

The focus of our analysis is countries with Islamic finance. Many of these countries have missing observations in our sample. We want to make sure that the dropped country-years due to missing observations are not influencing our findings. To do so, we replace the missing observations and run the same models to see whether our findings are caused by selection bias, that is whether we are drawing a generalized conclusion from countries with more available data. We use an iterative Markov Chain Monte Carlo method to fill in the missing variables (see Gelman, Carlin, Stern, and Rubin (2004); Little and Rubin. (2002)). This method uses observed data to simulate imputed values from the posterior predictive distribution of the missing observations. We use a multivariate normal regression model and 3000 iterations for each missing observation. More specifically, we subsample the non-missing data and run a sequence of 3000 iterations until the sequence reaches stationarity to produce a sequence of independent draws from the distribution.

4. Results

4.1 Short-term analyses

We focus our analysis on the short-term effect of an increase (or decrease) in the strength of Islamic finance at the beginning. We start with a panel fixed effect model (a static panel data model), where we regress three Islamic finance measures on GDP growth per capita while controlling for a few macroeconomic variables, such as education level, average income, national capital accumulation, national capital formation, openness to trade (or dependence on external sector), and macroeconomic stability. We select a fixed effect model instead of a random effect model because this model will always provide consistent results. The Durbin-Wu-

Hausman test, reported in Table 3, shows that the random effect model would be inconsistent for our sample.

Table 3: Short-term development of Islamic finance (Static Panel Model)

	Whole Sample			**OIC subsample**		
ΔIS_{AT}	0.0002**			0.0000		
	(0.0001)			(0.0001)		
ΔIS_{DEP}		0.0006***			0.0004*	
		(0.0001)			(0.0002)	
ΔIS_{LIAB}			0.0001			0.0000
			(0.0001)			(0.0001)
SCH	-0.0200*	-0.0190	-0.0200*	-0.0171	-0.0171	-0.0171
	(0.0122)	(0.0122)	(0.0122)	(0.0127)	(0.0128)	(0.0127)
INC	-0.0035	-0.0039	-0.0035	0.0144	0.0142	0.0145
	(0.0088)	(0.0089)	(0.0088)	(0.0137)	(0.0139)	(0.0137)
SAV	0.0096***	0.0098***	0.0097***	0.0118**	0.0123**	0.0118**
	(0.0026)	(0.0026)	(0.0026)	(0.0048)	(0.0047)	(0.0047)
INV	0.0299***	0.0300***	0.0299***	0.0134	0.0131	0.0134
	(0.0068)	(0.0068)	(0.0068)	(0.0104)	(0.0105)	(0.0104)
TR	0.0094	0.0097***	0.0093	-0.0075	-0.0066	-0.0075
	(0.0058)	(0.0058)	(0.0058)	(0.0145)	(0.0146)	(0.0145)
INFL	-0.0743***	-0.0762***	-0.0743***	-0.0621*	-0.0665*	-0.0621*
	(0.0207)	(0.0206)	(0.0207)	(0.0339)	(0.0344)	(0.0339)
α	-0.0653	-0.0657	-0.0654	-0.0987	-0.1017	-0.0992
	(0.0507)	(0.0507)	(0.0507)	(0.1034)	(0.1049)	(0.1035)
N	2524	2520	2524	642	640	642
Countries	118	118	118	31	31	31
F-test	9.60	9.65	9.39	14.36	4.34	570.62
$\bar{\chi}^2$	180.56	179.73	180.36	28.07	28.59	28.04
χ^2	29.65	21.59	30.17	21.25	21.85	21.26
R^2	0.0661	0.0688	0.0662	0.0025	0.0021	0.0026

Panel regression using GLS estimator of first difference of three different Islamic finance variables, IS_{AT}, IS_{DEP}, and IS_{LIAB} on GDP growth, where SCH, INC, SAV, INV, TR, and INFL are used as control variables. Here, ΔIS_{AT}, ΔIS_{DEP}, and ΔIS_{LIAB} represent growth in relative market share of assets, deposits, and liabilities for Islamic banks. SCH represents the level of education, INC represents the level of development, SAV represents gross capital accumulation, INV represents gross capital formation, TR represents the effect of external sectors, and INFL represents macroeconomic stability.

N is number of observations, $\bar{\chi}^2$ reports Breusch and Pagan Lagrangian multiplier test statistic, and χ^2 reports Durbin-Wu-Hausman test statistic.

Numbers in parentheses are robust standard error. *** indicates significance at 1%, ** indicates significance at 5%, and * indicates significance at 10%.

Table 3 reports the results for both whole sample and OIC countries sample. The results indicate that increase in relative strength of Islamic finance assets and deposits have significantly contributed to the growth of the countries. Islamic finance liabilities, however, have no significant relationship with growth. As for the OIC subsample, only Islamic finance deposits have a significant (positive) effect on growth.

We further use a dynamic panel data model, that uses generalized methods of moments (GMM) to estimate the effect of Islamic finance on growth. This technique uses lagged difference of growth and a constant as instruments for level equation, and two lags of growth, second difference of Islamic finance measure and first difference of controls as instruments for difference equation. The results are presented in Table 4.

Here, we can see that the increase in relative strength of Islamic finance assets and liabilities significantly contributes to the growth in our full sample. On the other hand, Islamic finance has no significant contribution to growth in the OIC subsample.

Our analyses indicate that Islamic finance on average is positively related to growth in the short run for the whole sample. However, the group (OIC countries) which is more likely to have higher voluntary financial exclusion fails to show any immediate outcome of Islamic finance. It would not be wise to draw final conclusions from only the short-term effect of Islamic finance. Many economic factors take years to bring fruit to the economy. So, we look at the long-term effect of Islamic finance on growth in the next section.

Table 4: Short-term development of Islamic finance (Dynamic Panel Model)

	Whole Sample			**OIC subsample**		
$GDPG_{t-1}$	0.1734***	0.1730***	0.1734***	0.0570	0.0580	0.0569
	(0.0392)	(0.0392)	(0.0392)	(0.0860)	(0.0861)	(0.0860)
ΔIS_{AT}	0.0005**			0.0003		
	(0.0002)			(0.0002)		
ΔIS_{DEP}		0.0005			0.0002	
		(0.0004)			(0.0002)	
ΔIS_{LIAB}			0.0004*			0.0002
			(0.0002)			(0.0002)
SCH	-0.0323	-0.0329	-0.0323	0.0066	0.0057	0.0065
	(0.0231)	(0.0236)	(0.0231)	(0.0163)	(0.0162)	(0.0163)
INC	-0.0058	-0.0057	-0.0058	-0.0132**	-0.0130**	-0.0132**
	(0.0080)	(0.0081)	(0.0080)	(0.0054)	(0.0054)	(0.0054)
SAV	0.0161***	0.0164***	0.0161***	0.0164**	0.0165**	0.0164**
	(0.0050)	(0.0051)	(0.0050)	(0.0069)	(0.0069)	(0.0069)
INV	0.0627***	0.0625***	0.0627***	0.0169	0.0166	0.0169
	(0.0109)	(0.0109)	(0.0109)	(0.0202)	(0.0202)	(0.0202)
TR	0.0318***	0.0318***	0.0318***	-0.0011	-0.0006	-0.0013
	(0.0115)	(0.0115)	(0.0115)	(0.0161)	(0.0158)	(0.0161)
INFL	-0.0510*	-0.0527*	-0.0510*	-0.0686	-0.0706	-0.0685
	(0.0307)	(0.0311)	(0.0307)	(0.0470)	(0.0473)	(0.0470)
α	-0.2439***	-0.2442***	-0.2437***	0.0138	0.0122	0.0141
	(0.0575)	(0.0589)	(0.0575)	(0.0698)	(0.0700)	(0.0697)
N	2515	2511	2515	640	638	640
Countries	118	118	118	31	31	31
Instruments	307	307	307	307	307	307
Wald χ^2	104.66	104.20	104.25	24.22	24.99	23.98
AR(1) (z test)	-7.4920	-7.4883	-7.4926	-4.3653	-4.3613	-4.3660
AR(2) (z test)	-1.1053	-1.1263	-1.1065	0.9522	0.9590	0.9508

A system estimator using additional moment conditions, where a lag of GDP growth, and first difference of three different Islamic finance variables, IS_{AT}, IS_{DEP}, and IS_{LIAB} on GDP growth, where SCH, INC, SAV, INV, TR, and INFL are used as control variables. Here, ΔIS_{AT}, ΔIS_{DEP}, and ΔIS_{LIAB} represent growth in relative market share of assets, deposits, and liabilities for Islamic banks. SCH represents the level of education, INC represents the level of development, SAV represents gross capital accumulation, INV represents gross capital formation, TR represents the effect of external sectors, and INFL represents macroeconomic stability.

Numbers in parentheses are robust standard error. *** indicates significance at 1%, ** indicates significance at 5%, and * indicates significance at 10%.

4.2. Long-term analyses

Our long-term analyses follow the footsteps of Beck, Levine, and Loayza (2000), where they transform their data to analyze the effects of financial inclusion on growth. They transform their dataset by taking non-overlapping mean of observations over five-year periods and treat each of these five-year periods as one period for analysis. Such a transformation allows the use of simple and intuitive econometric techniques for long-term analyses. Moreover, it smoothens the extreme observations in a dataset.

Beck, Levine and Loayza (2000) smooth their data for five-year periods. However, our main focus in this study is developing or underdeveloped countries which have many missing variables before 1991, therefore we smooth our data over three-year periods. Given that we are using three-year periods, the forecasting horizon for the growth innovation, which is an unanticipated component, extends about three years into the future. We average the data over 8 non-overlapping 3-year periods from 1991 to 2014.

We run a fixed effect model and a dynamic GMM model on these data as we did earlier. The results are reported in Table 5 and Table 6. Both the static and dynamic panel models show that Islamic finance measures are positively related to growth. The dynamic GMM model further shows that the effect of Islamic finance is more pronounced for the OIC subsample.

Table 5: Long-term development of Islamic finance (Static Panel Model)

	Whole Sample			OIC subsample		
ΔIS_{AT}	0.0004***			0.0003***		
	(0.0001)			(0.0001)		
ΔIS_{DEP}		0.0003***			0.0002***	
		(0.0001)			(0.0001)	
ΔIS_{LIAB}			0.0004***			0.0003***
			(0.0001)			(0.0001)
SCH	-0.0139	-0.0125	-0.0139	-0.0062	-0.0051	-0.0062
	(0.0113)	(0.0114)	(0.0113)	(0.0145)	(0.0147)	(0.0145)
INC	-0.0143*	-0.0144*	-0.0143*	-0.0059	-0.0045	-0.0059
	(0.0076)	(0.0076)	(0.0076)	(0.0139)	(0.0142)	(0.0139)
SAV	0.0093**	0.0095**	0.0093**	0.0069	0.0073	0.0068
	(0.0041)	(0.0041)	(0.0041)	(0.0092)	(0.0092)	(0.0092)
INV	0.0276***	0.0279***	0.0276***	0.0174	0.0176	0.0175
	(0.0070)	(0.0070)	(0.0070)	(0.0145)	(0.0146)	(0.0145)
TR	0.0002	0.0005	0.0002	-0.0075	-0.0063	-0.0075
	(0.0066)	(0.0066)	(0.0066)	(0.0135)	(0.0135)	(0.0135)
INFL	-0.0685**	-0.0681**	-0.0684**	-0.0573**	-0.0557*	-0.0571**
	(0.0295)	(0.0298)	(0.0295)	(0.0276)	(0.0281)	(0.0275)
α	0.0607	0.0560	0.0607	0.0347	0.0154	0.0350
	(0.0467)	(0.0468)	(0.0467)	(0.0858)	(0.0873)	(0.0859)
N	784	781	784	203	202	203
Countries	118	117	118	31	31	31
F-test	44.55	8.04	34.14	28.30	3.01	19.05
$\bar{\chi}^2$	49.33	50.6	49.22	7.71	8.34	7.69
χ^2	30.41	28.05	30.45	11.37	9.63	11.29
R^2	0.0539	0.0558	0.0539	0.0992	0.1026	0.0991

Panel regression using GLS estimator of first difference of three different Islamic finance variables, IS_{AT}, IS_{DEP}, and IS_{LIAB} on GDP growth, where SCH, INC, SAV, INV, TR, and INFL are used as control variables. The sample is averaged for three years starting from 1991. Here, ΔIS_{AT}, ΔIS_{DEP}, and ΔIS_{LIAB} represent growth in relative market share of assets, deposits, and liabilities for Islamic banks. SCH represents the level of education, INC represents the level of development, SAV represents gross capital accumulation, INV represents gross capital formation, TR represents the effect of external sectors, and INFL represents macroeconomic stability.

N is number of observations, $\bar{\chi}^2$ reports Breusch and Pagan Lagrangian multiplier test statistic, and χ^2 reports Durbin-Wu-Hausman test statistic.

Numbers in parentheses are robust standard error. *** indicates significance at 1%, ** indicates significance at 5%, and * indicates significance at 10%.

Table 6: Short-term development of Islamic finance (Dynamic Panel Model)

	Whole Sample			OIC subsample		
$GDPG_{t-1}$	0.2567***	0.2576***	0.2565***	0.2008**	0.2035**	0.2001**
	(0.0722)	(0.0722)	(0.0722)	(0.0942)	(0.0947)	(0.0942)
$GDPG_{t-2}$	-0.1848***	-0.1852***	-0.1847***	-0.1829**	-0.1832**	-0.1831**
	(0.0532)	(0.0532)	(0.0532)	(0.0870)	(0.0870)	(0.0869)
ΔIS_{AT}	0.0004***			0.0006**		
	(0.0002)			(0.0003)		
ΔIS_{DEP}		0.0003***			0.0005**	
		(0.0001)			(0.0002)	
ΔIS_{LIAB}			0.0004**			0.0006**
			(0.0002)			(0.0003)
SCH	-0.0521*	-0.0530*	-0.0522*	0.0160	0.0166	0.0158
	(0.0280)	(0.0281)	(0.0280)	(0.0177)	(0.0179)	(0.0176)
INC	0.0057	0.0062	0.0057	-0.0197***	-0.0202***	-0.0196***
	(0.0090)	(0.0091)	(0.0090)	(0.0063)	(0.0064)	(0.0063)
SAV	0.0052	0.0053	0.0051	0.0018	0.0026	0.0016
	(0.0069)	(0.0069)	(0.0069)	(0.0114)	(0.0116)	(0.0114)
INV	0.0283***	0.0281***	0.0283***	0.0159	0.0149	0.0161
	(0.0093)	(0.0093)	(0.0093)	(0.0148)	(0.0152)	(0.0147)
TR	0.0299***	0.0302***	0.0299***	0.0056	0.0072	0.0055
	(0.0100)	(0.0100)	(0.0100)	(0.0186)	(0.0187)	(0.0186)
INFL	-0.1101***	-0.1111***	-0.1098***	-0.1606**	-0.1669**	-0.1590**
	(0.0394)	(0.0395)	(0.0394)	(0.0668)	(0.0688)	(0.0669)
α	-0.1470**	-0.1507**	-0.1469**	0.0677	0.0647	0.0676
	(0.0607)	(0.0610)	(0.0607)	(0.0705)	(0.0698)	(0.0704)
N	665	664	665	173	173	173
Countries	118	117	118	31	31	31
Instruments	34	34	34	34	34	34
Wald χ^2	105.09	105.43	103.98	45.74	46.05	45.50
AR(1) (z test)	-4.4367	-4.4444	-4.4353	-3.1206	-3.1318	-3.1192
AR(2) (z test)	0.2377	0.2561	0.2357	-0.3826	-0.3087	-0.3912

A system estimator using additional moment conditions, where two lags of GDP growth, and first difference of three different Islamic finance variables, IS_{AT}, IS_{DEP}, and IS_{LIAB} on GDP growth, where SCH, INC, SAV, INV, TR, and INFL are used as control variables. The sample is averaged for three years starting from 1991. Here, ΔIS_{AT}, ΔIS_{DEP}, and ΔIS_{LIAB} represent growth in relative market share of assets, deposits, and liabilities for Islamic banks. SCH represents the level of education, INC represents the level of development, SAV represents gross capital accumulation, INV represents gross capital formation, TR represents the effect of external sectors, and INFL represents macroeconomic stability.

Numbers in parentheses are robust standard error. *** indicates significance at 1%, ** indicates significance at 5%, and * indicates significance at 10%.

Daly and Frikha (2016) and Imam, and Kpodar (2016) did somewhat similar analyses and report similar findings. Our findings show that the positive impact of Islamic finance is not just a country-specific phenomenon, but a general one. Overall, the results show positive impact of relative growth of Islamic finance on economic growth, except for the OIC subsample in short-term dynamic panel model.

4.3 Propensity Score Matching

We further estimate the treatment effect of Islamic finance on growth using a logistic model to predict the propensity scores of logarithmic values of GDP per capita using covariates SCH, INC, SAV, INV, TR, and INFL. We match with only the closest neighbor because matching with distant neighbors reduces variance at the expense of increased bias. We first test how being an OIC member corresponds to growth and how having Islamic banking corresponds to growth in the whole sample. The coefficients for matching treated and control subjects are reported under ATE and matching only treated are reported under ATET. The results are reported in Table 7.

Table 7: Propensity Score Matching

		N	ATE	ATET
Whole Sample	OIC (1 v 0)	2662	-0.6789***	0.3849***
			(0.1093)	(0.1844)
	IB(1 vs 0)	2662	0.7472***	0.9238***
			(0.1283)	(0.1320)
OIC subsample	IB(1 vs 0)	677	0.3727***	0.5535***
			(0.1034)	(0.1566)

Logit model treatment-effects estimation of OIC and Islamic Banking dummy variable on log(GDP) for the whole sample and OIC subsample. N is number of observation. The average treatment effect (ATE) takes the difference between observed and potential outcomes and uses the average of the difference. It estimates the effect of treatment on population. The average treatment effect on the treated (ATET) uses similar technique to estimate the effect of treatment on the treated.

Numbers in parentheses are robust standard error. *** indicates significance at 1%, ** indicates significance at 5%, and * indicates significance at 10%.

We find that having Islamic finance improves the likelihood of higher GDP per capita. OIC countries, however, show a lower likelihood of GDP per capita when we match both treated and controls. So, we separate the OIC countries again to see how Islamic finance contributes to GDP per capita. We find that Islamic finance has a positive impact on GDP per capita.

4.4 Imputation of missing variables

The primary focus of this study is OIC countries. These countries have many missing observations. As an effort to minimize the effect of missing observations on our findings, we fill in the missing variables using an iterative Markov Chain Monte Carlo method. The number of observations replaced for each variable is reported in Table A1. Figure A1 and A2 show how well the estimates fare in terms of iteration number.

We run the same static and dynamic models to estimate short-term effects (Table 8 and 9) and long-term effects (Table 10 and 11) of the increase in relative strength of Islamic finance. However, we report the results of random effect GLS regression for OIC subsample in static panel models (Table 8 and 10). The Durbin-Wu-Hausman test statistics indicate that the random effect model produces efficient and consistent results for imputed OIC subsample.

Table 8: Short-term development of Islamic finance using imputed data (Static Panel Model)

	Whole sample (Fixed Effect)			OIC subsample (Random Effects)		
ΔIS_{AT}	0.0002**			0.0002**		
	(0.0001)			(0.0001)		
ΔIS_{DEP}		0.0003			0.0002	
		(0.0002)			(0.0002)	
ΔIS_{LIAB}			0.0002**			0.0002*
			(0.0001)			(0.0001)
SCH	0.0167*	0.0167*	0.0167*	0.0242***	0.0242***	0.0242***
	(0.0094)	(0.0094)	(0.0094)	(0.0092)	(0.0092)	(0.0092)
INC	-0.0095	-0.0096	-0.0095	-0.0115***	-0.0115***	-0.0115***
	(0.0072)	(0.0072)	(0.0072)	(0.0028)	(0.0028)	(0.0028)
SAV	0.0090***	0.0090***	0.0090***	0.0060***	0.0060**	0.0060**
	(0.0028)	(0.0028)	(0.0028)	(0.0031)	(0.0031)	(0.0031)
INV	0.0268***	0.0268***	0.0268***	0.0206**	0.0207***	0.0206***
	(0.0063)	(0.0063)	(0.0063)	(0.0055)	(0.0055)	(0.0055)
TR	0.0063	0.0063	0.0063	-0.0031	-0.0032	-0.0032
	(0.0059)	(0.0059)	(0.0059)	(0.0068)	(0.0068)	(0.0068)
INFL	-0.0554***	-0.0557***	-0.0554***	-0.0147	-0.0154	-0.0146
	(0.0141)	(0.0141)	(0.0141)	(0.0273)	(0.0278)	(0.0273)
α	-0.0666	-0.0663	-0.0667	-0.0019	-0.0018	-0.0019
	(0.0430)	(0.0430)	(0.0430)	(0.0288)	(0.0289)	(0.0288)
N	3437	3437	3437	889	889	889
Countries	154	154	154	41	41	41
F-test (Wald χ^2)	9.52	9.40	9.44	(64.95)	(59.97)	(64.64)
$\bar{\chi}^2$	435.99	435.71	435.98	70.01	69.98	69.96
χ^2	24.17	22.93	24.18	8.76	8.73	8.75
R^2	0.1246	0.1249	0.1246	0.1107	0.1106	0.1106

Panel regression using GLS estimator of first difference of three different Islamic finance variables, IS_{AT}, IS_{DEP}, and IS_{LIAB} on GDP growth, where SCH, INC, SAV, INV, TR, and INFL are used as control variables. Here, ΔIS_{AT}, ΔIS_{DEP}, and ΔIS_{LIAB} represent growth in relative market share of assets, deposits, and liabilities for Islamic banks. SCH represents the level of education, INC represents the level of development, SAV represents gross capital accumulation, INV represents gross capital formation, TR represents the effect of external sectors, and INFL represents macroeconomic stability.

N is number of observations, $\bar{\chi}^2$ reports Breusch and Pagan Lagrangian multiplier test statistic, and χ^2 reports Durbin-Wu-Hausman test statistic.

Numbers in parentheses are robust standard error. *** indicates significance at 1%, ** indicates significance at 5%, and * indicates significance at 10%.

Table 9: Short-term development of Islamic finance using imputed data (Dynamic Panel Model)

	Whole Sample			OIC subsample		
$GDPG_{t-1}$	0.2477***	0.2473***	0.2476***	0.1369**	0.1363**	0.1368**
	(0.0341)	(0.0341)	(0.0341)	(0.0640)	(0.0640)	(0.0640)
$GDPG_{t-2}$				0.0449	0.0458	0.0449
				(0.0302)	(0.0300)	(0.0302)
ΔIS_{AT}	0.0004***			0.0004***		
	(0.0002)			(0.0002)		
ΔIS_{DEP}		0.0004			0.0001	
		(0.0002)			(0.0003)	
ΔIS_{LIAB}			0.0004***			0.0003**
			(0.0001)			(0.0001)
SCH	0.0846***	0.0849***	0.0846***	0.0353	0.0351	0.0353
	(0.0295)	(0.0295)	(0.0295)	(0.0245)	(0.0245)	(0.0245)
INC	-0.0284***	-0.0285***	-0.0284***	-0.0191***	-0.0189***	-0.0191***
	(0.0089)	(0.0089)	(0.0089)	(0.0071)	(0.0071)	(0.0071)
SAV	0.0105**	0.0104**	0.0105**	0.0120**	0.0117**	0.0120**
	(0.0044)	(0.0044)	(0.0044)	(0.0049)	(0.0049)	(0.0049)
INV	0.0480***	0.0482***	0.0480***	0.0149	0.0154	0.0150
	(0.0100)	(0.0100)	(0.0100)	(0.0110)	(0.0110)	(0.0110)
TR	0.0000	-0.0002	0.0000	0.0041	0.0038	0.0040
	(0.0102)	(0.0102)	(0.0102)	(0.0139)	(0.0139)	(0.0139)
INFL	-0.0402**	-0.0409**	-0.0402**	-0.0417	-0.0431	-0.0417
	(0.0189)	(0.0189)	(0.0189)	(0.0485)	(0.0470)	(0.0486)
α	-0.0975**	-0.0969**	-0.0974**	0.0024	0.0024	0.0025
	(0.0488)	(0.0489)	(0.0488)	(0.0611)	(0.0611)	(0.0611)
N	3437	3437	3437	846	846	846
Countries	154	154	154	41	41	41
Instruments	307	307	307	306	306	306
Wald χ^2	112.40	109.78	112.06	49.07	44.26	49.68
AR(1) (z test)	-8.4431	-8.4476	-8.4436	-4.5820	-4.5865	-4.5817
AR(2) (z test)	-0.0892	-0.0695	-0.0892	1.0926	1.1194	1.0911

A system estimator using additional moment conditions, where a lag of GDP growth, and first difference of three different Islamic finance variables, IS_{AT}, IS_{DEP}, and IS_{LIAB} on GDP growth, where SCH, INC, SAV, INV, TR, and INFL are used as control variables. Here, ΔIS_{AT}, ΔIS_{DEP}, and ΔIS_{LIAB} represent growth in relative market share of assets, deposits, and liabilities for Islamic banks. SCH represents the level of education, INC represents the level of development, SAV represents gross capital accumulation, INV represents gross capital formation, TR represents the effect of external sectors, and INFL represents macroeconomic stability.

Numbers in parentheses are robust standard error. *** indicates significance at 1%, ** indicates significance at 5%, and * indicates significance at 10%.

Table 10: Long-term development of Islamic finance using imputed data (Static Panel Model)

	Full Sample (Fixed Effects)			OIC subsample (Random Effects)		
ΔIS_{AT}	0.0003			0.0000		
	(0.0003)			(0.0001)		
ΔIS_{DEP}		0.0002			0.0000	
		(0.0002)			(0.0001)	
ΔIS_{LIAB}			0.0003			0.0000
			(0.0003)			(0.0001)
SCH	0.0260*	0.0260*	0.0260*	0.0209***	0.0209***	0.0209***
	(0.0150)	(0.0150)	(0.0150)	(0.0073)	(0.0073)	(0.0073)
INC	-0.0154**	-0.0154**	-0.0154**	-0.0121***	-0.0121***	-0.0121***
	(0.0073)	(0.0073)	(0.0073)	(0.0028)	(0.0028)	(0.0028)
SAV	0.0114***	0.0112***	0.0114***	0.0056	0.0055	0.0055
	(0.0033)	(0.0033)	(0.0033)	(0.0041)	(0.0040)	(0.0041)
INV	0.0261***	0.0263***	0.0261***	0.0236***	0.0237***	0.0237***
	(0.0061)	(0.0060)	(0.0061)	(0.0068)	(0.0067)	(0.0068)
TR	0.0006	0.0006	0.0006	-0.0025	-0.0024	-0.0025
	(0.0065)	(0.0065)	(0.0065)	(0.0059)	(0.0059)	(0.0059)
INFL	-0.0540**	-0.0535**	-0.0540**	0.0000	0.0001	0.0001
	(0.0219)	(0.0219)	(0.0219)	(0.0269)	(0.0267)	(0.0269)
α	-0.0172	-0.0176	-0.0172	-0.0041	-0.0042	-0.0041
	(0.0430)	(0.0429)	(0.0430)	(0.0256)	(0.0254)	(0.0256)
N	1044	1044	1044	272	272	272
Countries	154	154	154	41	41	41
F-test (Wald χ^2)	11.72	11.65	11.72	178.84	140.78	138.56
$\bar{\chi}^2$	76.51	76.65	76.49	17.32	17.41	17.31
χ^2	12.97	12.05	13.01	2.82	2.76	2.82
R^2	0.1246	0.1249	0.1246	0.2114	0.2115	0.2114

Panel regression using GLS estimator of first difference of three different Islamic finance variables, IS_{AT}, IS_{DEP}, and IS_{LIAB} on GDP growth, where SCH, INC, SAV, INV, TR, and INFL are used as control variables. The sample is averaged for three years starting from 1991. Here, ΔIS_{AT}, ΔIS_{DEP}, and ΔIS_{LIAB} represent growth in relative market share of assets, deposits, and liabilities for Islamic banks. SCH represents the level of education, INC represents the level of development, SAV represents gross capital accumulation, INV represents gross capital formation, TR represents the effect of external sectors, and INFL represents macroeconomic stability.

N is number of observations, $\bar{\chi}^2$ reports Breusch and Pagan Lagrangian multiplier test statistic, and χ^2 reports Durbin-Wu-Hausman test statistic.

Numbers in parentheses are robust standard error. *** indicates significance at 1%, ** indicates significance at 5%, and * indicates significance at 10%.

Table 11: Short-term development of Islamic finance using imputed data (Dynamic Panel Model)

	Whole Sample			OIC subsample		
$GDPG_{t-1}$	0.3220***	0.3221***	0.3220***	0.1924*	0.1916*	0.1923*
	(0.0490)	(0.0490)	(0.0490)	(0.1091)	(0.1093)	(0.1090)
$GDPG_{t-2}$	-0.1246***	-0.1247***	-0.1246***	-0.1191**	-0.1196**	-0.1191**
	(0.0351)	(0.0351)	(0.0351)	(0.0493)	(0.0492)	(0.0493)
ΔIS_{AT}	0.0004***			0.0004*		
	(0.0001)			(0.0002)		
ΔIS_{DEP}		0.0004***			0.0003	
		(0.0001)			(0.0002)	
ΔIS_{LIAB}			0.0004***			0.0004*
			(0.0001)			(0.0002)
SCH	0.0590*	0.0591*	0.0589*	0.1023***	0.1022***	0.1022***
	(0.0317)	(0.0317)	(0.0317)	(0.0412)	(0.0412)	(0.0412)
INC	-0.0183**	-0.0183**	-0.0183**	-0.0272**	-0.0273**	-0.0272**
	(0.0075)	(0.0075)	(0.0075)	(0.0134)	(0.0134)	(0.0134)
SAV	0.0089*	0.0090*	0.0089*	0.0066	0.0066	0.0066
	(0.0053)	(0.0053)	(0.0053)	(0.0096)	(0.0096)	(0.0096)
INV	0.0266**	0.0266**	0.0266**	0.0264	0.0263	0.0264
	(0.0123)	(0.0123)	(0.0123)	(0.0192)	(0.0193)	(0.0191)
TR	0.0281**	0.0282**	0.0280**	0.0093	0.0098	0.0092
	(0.0117)	(0.0116)	(0.0117)	(0.0162)	(0.0163)	(0.0162)
INFL	-0.1157***	-0.1163***	-0.1155***	-0.0388	-0.0393	-0.0382
	(0.0333)	(0.0333)	(0.0333)	(0.0878)	(0.0892)	(0.0877)
α	-0.1768***	-0.1774***	-0.1768***	-0.0939	-0.0958	-0.0939
	(0.0599)	(0.0600)	(0.0599)	(0.1172)	(0.1170)	(0.1171)
N	890	890	890	231	231	231
Countries	154	154	154	41	41	41
Instruments	34	34	34	34	34	34
Wald χ^2	220.19	191.35	221.36	88.31	93.21	88.30
AR(1) (z test)	-5.2016	-5.2059	-5.2017	-2.9594	-2.9635	-2.9595
AR(2) (z test)	-0.3527	-0.34628	-0.3539	0.7359	0.7332	0.7353

A system estimator using additional moment conditions, where two lags of GDP growth, and first difference of three different Islamic finance variables, IS_{AT}, IS_{DEP}, and IS_{LIAB} on GDP growth, where SCH, INC, SAV, INV, TR, and INFL are used as control variables. The sample is averaged for three years starting from 1991. Here, ΔIS_{AT}, ΔIS_{DEP}, and ΔIS_{LIAB} represent growth in relative market share of assets, deposits, and liabilities for Islamic banks. SCH represents the level of education, INC represents the level of development, SAV represents gross capital accumulation, INV represents gross capital formation, TR represents the effect of external sectors, and INFL represents macroeconomic stability.

Numbers in parentheses are robust standard error. *** indicates significance at 1%, ** indicates significance at 5%, and * indicates significance at 10%.

Short-term analyses in Tables 8 and 9 show that improvement in relative strength of Islamic assets and liabilities contributes to growth in the short run. However, the static panel technique in Table 10 fails to find any significant relationship of Islamic finance and growth in the long-run. The dynamic model shows very significant positive impact of Islamic finance on growth for the whole sample. The Islamic asset and liabilities are barely significant (10% level) in OIC subsample and show positive impact on growth.

5. Conclusion

This study empirically shows that the presence of stronger Islamic finance contributes to long-term economic growth. The study considers that countries with Islamic finance are usually developing or underdeveloped and such countries usually experience higher GDP growth than their developed counterparts. So, it uses a number of well-established control variables and econometric techniques to reach the conclusion. One possible avenue Islamic finance is contributing towards economic growth could be financial inclusion.[6] However, identifying the ways Islamic finance contributes to economic growth would be off-scope for this study. We leave such studies for future research.

We conclude by saying that Islamic finance can help increase economic growth. However, the countries covered in this study are mostly developing and underdeveloped nations who may be experiencing a large amount of growth, and the data was hard to come by since such countries lack data. There is no Islamic financial development index, which would have been useful to truly study the effects of Islamic finance in this region, and may be an idea for future research.

[6] Beck, Demiriguc-Kunt and Levine (2004) report the positive role of Islamic finance on development and poverty alleviation.

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Appendix A

Table A1: Imputation

Variable	Complete	Incomplete	Imputed	Total
GDPG	3543	53	53	3596
SCH	2996	600	600	3596
INC	3555	41	41	3596
SAV	3365	231	231	3596
INV	3382	214	214	3596
TR	3484	112	112	3596
INFL	3453	143	143	3596
IS_{AT}	3552	44	44	3596
IS_{DEP}	3527	69	69	3596
IS_{LIAB}	3552	44	44	3596

This table reports multivariate imputation using 3000 iterations. Incomplete column reports the number of missing observations in each variable and Imputed column reports the number of missing observations replaced using an iterative Markov Chain Monte Carlo method.

Figure A1: Estimates of Worst Linear Function with respect to the iteration number

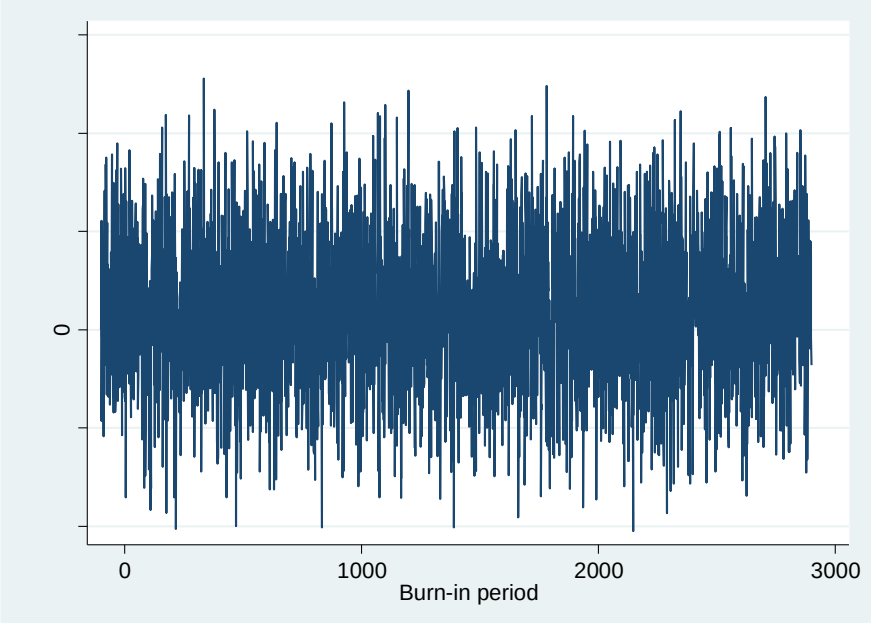

Figure A2: Autocorrelations of Worst Linear Function with respect to the iteration number