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Business cycle volatility, growth and financial openness: Does Islamic finance make any difference?

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Abstract

This paper presents an approach for assessing the contribution of Islamic finance in an economic system by modeling a composite index in order to analyze the risk of crises caused by financial openness and its impact on growth and volatility of business cycles. Through a sample of 14 industrialized countries in the world, of which 8 countries are considered as leaders of Islamic finance, this study aims to establish a comparative analysis between the economic performances of the two sets of countries. The considered period ranges from 1980 to 2013 covering the most important crises experienced by the selected countries.

Overall, the results showed a relatively similar performance between economies where Islamic finance prevails, and other conventional economic systems. Moreover, when considering some specific components of the financial stress index, countries that adopt the principles of Islamic finance are strongly positioned to avoid various situations of crisis and economic downturns.

JEL Classification: E32; F34; G01

Keywords: Business cycles; Growth; Volatility; Islamic finance

1. Introduction

In the relevant literature, Islamic finance has produced many interpretations, debates, and controversies through the comparison of Islamic banks performance against conventional banks from different perspectives. The comparison showed that Islamic banks were more competitive on some assessment criteria. In general, Islamic finance is well placed to meet the increased *return-to-basics* investor demand where investors are now more averse to the unknown risks embedded in complex financial instruments (IFSI Stability Report, 2013).[1] However, the main issue remains at a global economic policy, that is to say Islamic finance efficiency should be seen under a national implication. Therefore, it would be wiser to assess Islamic finance efficiency in a whole system, since the moment that Islamic economic institutions are forced to interact with other conventional financial and economic organizations in a country. Hence, one may wonder about differences on the business plan that can bring Islamic finance, especially to deal with financial and monetary crises. This is the first main objective of this paper which will try to highlight this issue by considering the following macroeconomic variables: business cycles volatility, growth and financial openness.

In the last decade, several works in the literature have tried to identify the effects of financial openness on economic performances. Most of these works have concentrated on two main macroeconomic effects: business cycle volatility (BCV) and growth. While there is a broad consensus on the effects of financial openness on BCV and growth, there is a little

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[1] Islamic Financial Services Board (IFSB). Islamic Financial Services Industry Stability Report (2013): http://www.mfw4a.org/fileadmin/data_storage/documents/external-url/2014-07-08_18-16-43_islamic_financial_services_industry_stability_report_2014.html.

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consensus on the contribution part of Islamic finance in these macroeconomics variables. The main question is to try to know if the adoption of Islamic finance principles put countries in safe situation against economic and financial crisis.

The frequent occurrence and severity of currency crises, particularly in the past decade, have resurrected interest among academics, financial market participants and policy makers in developing an effective early warning system (EWS). A brief look on the literature about the leading indicators of financial crises shows a wide range of issues and approaches that has been adopted, from theoretical examinations to empirical works on various theoretical models (Chui, 2002; Kaminsky, Lizondo, & Reinhart, 1998). Consequently, in view of the large costs associated with a financial crisis, the question how to predict a crisis has become central which resulted in the construction of a monitoring tool, the so-called early warning systems.

In this paper, we revisit the link between financial crises, expressed by financial openness, business cycle volatility and growth. To this end, we lay out a *dynamic mixed-effects* regression model on the business cycles volatility in order to derive empirically hypotheses on how financial crises (measured by a composite financial stress index and a bloc of other exogenous variables) may influence the impact of macroeconomic shocks on business cycles. To make the model more realistic, we use a resistance index, an international trade openness index, variables for measuring monetary policy, fiscal policy and fiscal convergence, population statistics and oil revenues as a percent of GDP to run the regression analysis.[2] A richer specification of the presented model was to add some specific variables to countries that adopt Islamic finance, like the ratio of Islamic assets to total assets, and the ratio of Muslim population to the whole population in order to extract the major differences between the two sets of countries. This allows as us to understand the weight of Islamic finance in an economic system.

The remainder of the paper is organized as follows. In Section 2, we present a brief literature review about the previous work on business cycles, growth, financial openness and financial stress index. In Section 3, we explain our methodology to assess the impact of financial openness on business cycle volatility and growth. In Section 4, we present the data and discuss the results. Section 5 summarizes the paper's main findings and gives some policy implications.

[2] In this paper, all the regression results are subjected to a bootstrapping resampling process with 1000 iterations. Bootstrapping provides a way of estimating standard errors and other measures of statistical precision (Guan, 2003). A great advantage of bootstrap is its simplicity. It is a straightforward way to derive estimates of standard errors and confidence intervals for complex estimators of complex parameters of the distribution. Bootstrap is also an appropriate way to control and check the stability of the results. Although for most problems it is impossible to know the true confidence interval, bootstrap is asymptotically more accurate than the standard intervals obtained using sample variance and assumptions of normality (DiCiccio & Efron, 1996).

2. Literature review

The list of studies on financial openness, financial crises and on business cycles volatility is long and vastly expanding. A full list is beyond the scope of this paper. Interested readers are referred to Kaminsky Lizondo and Reinhart (1998), Bustelo (2000), Burkart and Coudert (2002); Gonzalez-Hermosillo (1996), Dermirgüç-Kunt and Detragiache (1997), and Marchesi (2003). Typically, financial crises measured by an Exchange Market Pressure Index (EMPI) has an empirical structure with indicators contributing to a country's vulnerability against a future crisis and forecasting the likelihood of a financial crisis. EMPI models differ widely in terms of definition of financial crisis, the time horizon on which the EMPI is estimated and attempts to forecast, the selection of indicators, and the statistical or econometric used tools.

By looking to financial crises as a variant of financial openness, and when considering business cycles volatility and economic growth, recent theoretical work likewise supports that the openness of a financial system can have an impact on business cycles. For example, Sutherland (1996) and Senay (1998) use a variant of the dynamic sticky-price general equilibrium model developed by Obstfeld and Rogoff (1995) to demonstrate that the amplitude of real output fluctuations in the aftermath of monetary policy shocks should increase with the degree of international financial market integration. In contrast, increasing the degree of financial market integration diminishes the short-run output effects of fiscal policy and labor productivity shocks.

So far, the empirical literature has not been able to establish a statistically significant link between financial openness and business cycle volatility (Easterly, Islam, & Stiglitz, 2000; Razin & Rose, 1994),[3] because this could be due to the fact that idiosyncratic and global shocks are not distinguished properly. A further reason for the missing link could be structural differences of the underlying economies that empirical panel studies do not take into account (Mendoza, 1994).

Research focusing on capital account openness finds mixed results (Eichengreen, 2001), but articles focusing on equity market liberalization typically find significant positive average growth effects from financial liberalization (see for example Bekaert, Harvey, & Lundblad, 2001, 2005).

There is a perception that foreign capital not only increases volatility in the financial markets, but also in the real economy, and that such volatility is not desired (Agenor, 2003; Stiglitz, 2000). The perceived disadvantages of unbridled capital flows have recently brought back proposals for a Tobin tax on cross-border capital flows even between developed markets (Eichengreen, Rose, & Wyplosz, 1995).

A major component of the benefits of international risk sharing is the reduction of the variability of consumption

[3] Evidence on the impact of the structure of financial markets on business cycle volatility seems to be more robust. Easterly et al. (2000), Denizer, Iyigun, and Owen (2000), and Da Silva (2001) find a more sophisticated financial system to be associated with lower volatility.

growth, and often level effects are simply ignored (Obstfeld, 1994 is an important exception). So far, there appears to be no consensus about the extent of the benefits of international risk sharing (Lewis, 1999; Van Wincoop, 1999).

Despite the variety of approaches and tools used for assessing the relationship between financial openness and business cycles, we will try to introduce a model by creating a composite EMPI used to this end. In addition, we will highlight the difference between countries where conventional financial rules prevail and those where Islamic finance is increasingly growing through time.

3. Theoretical background and methodology

International financial markets were at the heart of the worldwide financial crisis that emerged in late 2007 and reaching a climax between August 2008 and February 2009 leaving the world's economy in a deficient situation. We focus in this section on the extent to which the financial openness shock adversely affected the external position of countries throughout the world, thereafter their business cycles volatility, but with a special attention to Islamic countries. We measure external position by looking at changes in exchange market pressure, a combination of exchange pressure index and a resistance index (RI), as well as considering these two components separately. We are interesting in two basic questions: Firstly, how the financial shocks affect the financial development and financial openness in Islamic and non-Islamic countries? Secondly, given the degree of the composite exchange market pressure index, what determines the tradeoff or choice between exchange rate depreciation and resistance policy in absorbing the shock?

By seeking answers to the raised questions, we point out that this work considers a set of variables to measure financial risk components that are often classified into various types such as market risk, credit risk, liquidity risk, operational risk, insurance risk and legal risk. The failure to control these risks could result in serious damages that affect deeply the financial system efficiency and performance. In this work, all the used variables to measure the financial openness and financial stability are directly related to market, credit and liquidity risks. In fact, our objective is to understand how Islamic financial institutions can moderate the density of financial pressure situations.

However, before trying to give an answer to these main questions, it would be wiser to begin with a brief overview on the Islamic finance instruments and design, as long as it is the heart of the subject.

First, contrary to conventional financial systems, the design of an Islamic financial system is characterized by two main distinctions, namely, the consideration of the *profit-and-lose* sharing mechanism and the *mark-up* financing. Furthermore, Mudarabah funds (inversible funds), Musyarakah funds (equity funds), Murabahah (mark-up financing) and Ijarah (capital leasing financing) are the mains mechanisms that drive the Islamic financial system. In other words, while the conventional finance operates under the credit system, the concept of profit sharing agreeable by the borrowers takes place instead of interest in Islamic finance (Aggarwal and Yousef (2000). According to them, when profit replace interest, some uncomfortable situation can be avoided by improving the efficiency of capital allocation.

Second, when a financial system is mainly based on the credit, and in the case of loses, the probability of repayment of capital to the issuing institution will be reduced according to the amount of loss. However, when the profit-and-loses system is considered, the money supply depends on the supply of goods and services and this equilibrium could slow down the situations of inflation in the economy (Abdul Ghafar & Ismail, 2006).

Third, in an Islamic financial system, the profit-and-lose sharing process in a guarantee of investment's renewal, jobs' creation and diversification because not only the projects with high expected profit are created to ensure interest rate plus added value income, but also economic activities which would bring added value in the profit-sharing system.

Fourth, in an Islamic financial system, the income inequalities could be much more reduced and wealth can be distributed more equitably. By doing so, incomes level and welfare could be enhanced over time by reducing the unjust distribution of wealth likely caused in an interest regime.

Overall, as prescribed by the Islamic law (Sharia), the abolition of interest in Islamic finance can deeply curtail speculation based on profit-sharing principles. This will bring sanity back to the market and allow rising of funds for enterprises and liquidity to equity holders.

3.1. Business cycle volatility

Business cycles can be defined as the periodic irregular ups and downs movements in economic activity, generally measured by the fluctuations in real GDP and – in some cases – other macroeconomic variables. According to the definition of the National Bureau of Economic Research (NBER),[4] a business cycle is identified as a sequence of four phases. *Contraction*, expressed as a slowdown in the pace of economic activity. The *lower turning point* of a business cycle, where a contraction turns into an expansion. *Expansion*, expressed as a speedup in the pace of economic activity. Finally, *Peak*, expressed as the upper turning of a business cycle.

Based on this definition, we will focus on the contraction periods of business cycles since they express both volatility and downturns.

Usually, the used time series data in assessing business fluctuations is the *de-trended* real GDP, by introducing filters for *cyclical* components. That is to say, the time series are decomposed into the sum of a slowly-evolving secular *trend* and a transitory deviation from it, which is classified as *cycle*:

$$x_t = \tau_t + \xi_t \tag{1}$$

[4] National Bureau of Economic Research: http://www.nber.org/.

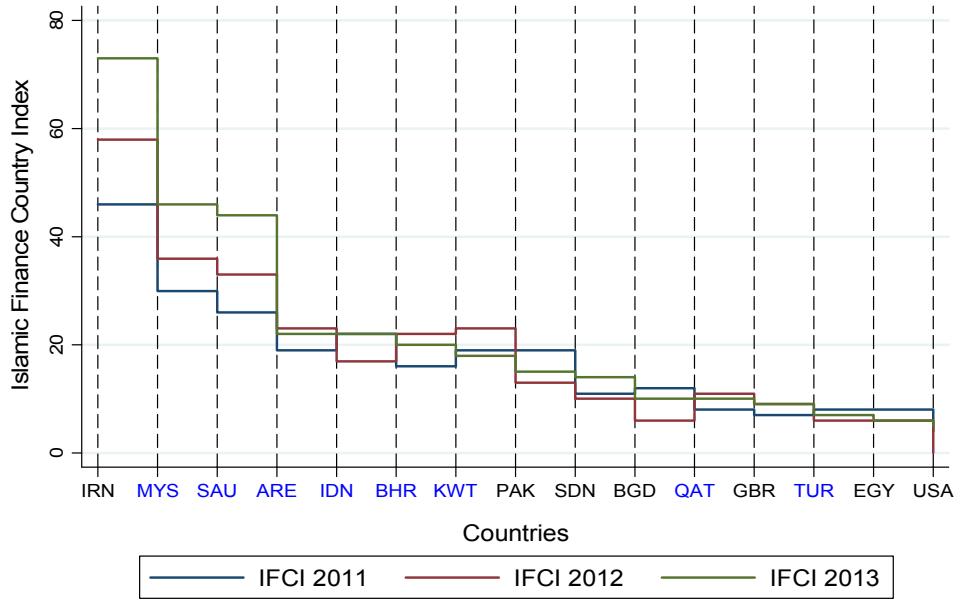


Fig. 1. Islamic finance index.

Observed Series = Permanent Trend + Cycle

One can rely on many different de-trending methods in order to compute the cyclical component of economic activity and, then, business cycle volatility measures. The widely used filters are: simple differencing (which approximates the annual GDP growth rate), Hodrick-Prescott (HP) filter, the Baxter–King (BK) filter, Christiano-Fitzgerald (CF) filer and the Butterworth (BU) filter. While minor differences among the results obtained by the last four filters are not difficult to detect, the main characteristics are remarkably similar. Overall, the HP filer is the most used one as long as it allows to introduce a smoothness parameter λ equal to 100. Then, the estimated trend will be secular.

However, there is another approach allowing to deal with filtering the cyclical and trend components in time series and panel data analysis, namely the Wavelet analysis. Wavelet analysis is a useful tool for studying the time and frequency properties of an economic time series. Applying wavelet analysis in assessing business cycles amplitude closely resembles the uses of other common filters. The technique is considered as a strong alternative. Moreover, Wavelet analysis provides better resolution in the time domain since Wavelet basis functions are time-localized in addition to being scale-localized, which is very useful for capturing the changing volatility of the business cycle (Yogo, 2008). In this paper, we have compared the filtering process based on HP filter and the SWT (Stationary Wavelets Transform).[5] The results were almost identical. The SWT de-trending results are presented in Appendix B. They can be compared with Figs. 2, 3 and 5.

From one hand, business cycle volatility is measured by the standard deviation of the cyclical component obtained by the filtering methods. Periods with *volatile business cycles are those where the absolute value of the cyclical component is greater than its standard deviation*. From another hand, *periods characterized by an economic downturn are identified as periods where the level of real GDP falls below trend identified using the Hodrick-Prescott filter* (Hodrick & Prescott, 1997).

3.2. Exchange market pressure index

Following Eichengreen and Portes (1987), it would be better to model, at the same time, currency crises, banking crises and debt crises. Unfortunately, we cannot adopt their main recommendation to deal with the three categories of crises simultaneously, because among other things the number of crisis observations is too low.

Furthermore, the use of Financial Stress Index (FSI)[6] is certainly more appropriate in investigating the occurrence and

[5] For further reading about SWT, see for example Nason and Silverman (1995).

[6] FSI literature could be perfectly combined with the one about financial soundness since financial soundness indicators are henceforth used as macro-prudential indicators to monitor the health and stability of financial systems as far as they give valuable information on financial stability, in particular helping to identify potential financial stability risks and financial crises at an early stage. Mainly developed by the IMF in collaboration with other international organizations (World Bank, Bank for International Settlements, Organization for Economic Cooperation and Development and the European Central Bank), these indicators contain certain data highlighted as of potential importance such as flow of funds data, financial prices, and monetary data. Furthermore, it has been advised to give more importance to data series regarded as essential (GDP data, Balance of Payments data, Monetary Aggregates, Exchange Rates and flow of funds data) and those regarded as important (asset information, foreign currency reserve assets, derivatives and Non-Performing Loans) (Moorhouse, 2004). However, due to data constraints, the core sets variables of Financial Soundness Indicators could not be all included in the analysis because we have find many difficulties in gathering relevant data, especially about Islamic economies. But we think at least we have included some important variables that could have a significant weight in measuring on financial soundness.

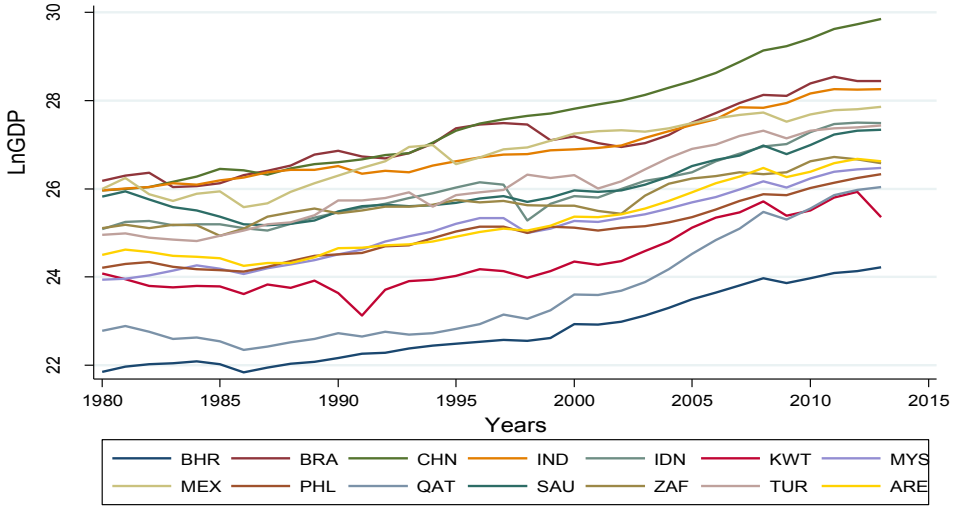


Fig. 2. lnGDP evolution in other in-sample countries.

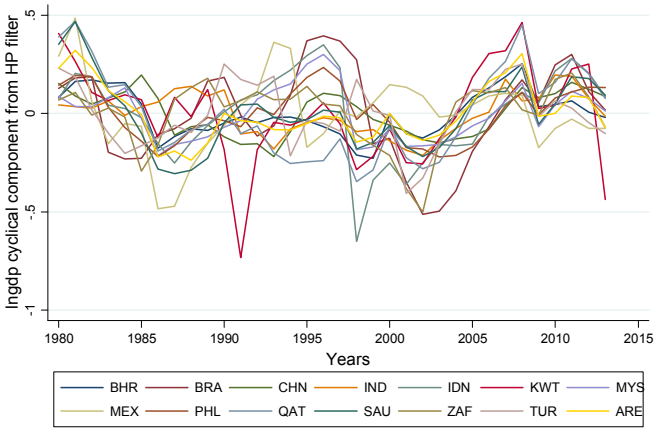


Fig. 3. The HP cyclical component from the lnGDP.

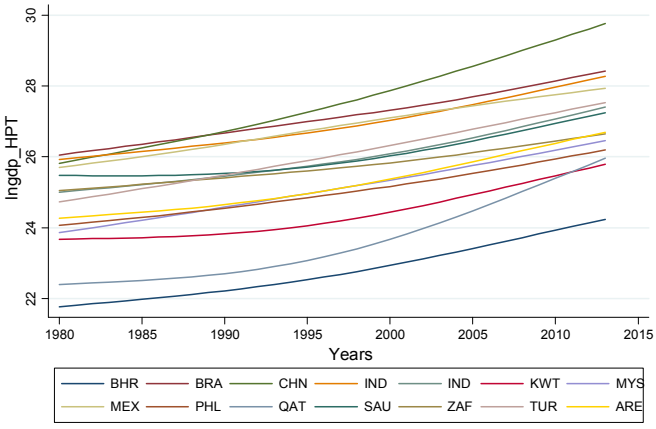


Fig. 4. The HP trend component from the lnGDP.

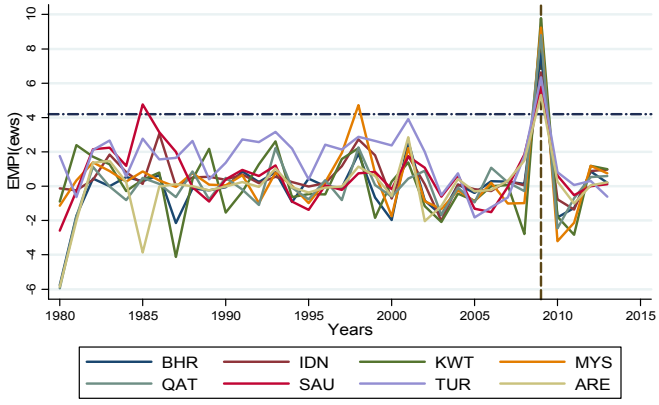


Fig. 5. EMPI in Islamic countries.

determinants of currency, banking, and sovereign debt crises. However, unfortunately although most of the abundant literature on FSI considers the four main pillars usually included (namely EMPI, Banking Beta, securities market and sovereign spreads), in this work, only EMPI is calculated as a measure of financial pressure. This can be justified by the fact that data of the majority of the determinant variables in building a strong measure of FSI are unavailable especially for countries with a high penetration of Islamic finance in their economic systems. At least, by considering only the EMPI, we hope establishing a framework of analysis which is admittedly incomplete but will allows us, as far as possible, to address the econometric analysis.

Even though there are a number of studies presenting methods to measure exchange market pressures index, most of them are derived from the model of Girton and Roper (1977). Three main studies developed by Eichengreen et al. (1995, 1996); Sachs, Tornell, and Velasco (1996a,b); and Kaminsky et al. (1998), and Kaminsky and Reinhart (1999) have proposed three different approaches in developing an index of exchange market pressure index.

The three approaches can be classified mainly according to the response function of the quantitative model which calculates the EMPI values. First, the Eichengreen, Rose and Wyplosz (ERW) approach used the response function fixed by *logit* or *probit* models. Other examples are Frankel and Rose (1996) and Dermirgüç-Kunt and Detragiache (1997, 2000).

Second, the works of Sachs et al. (1996a,b) are another alternative based on the cross-country regression models with dummy variables. Third, the probabilistic model proposed by Kaminsky et al. (1998) with a strong relationship with the signal processing approach.

Overall, the EMPI is a weighted average[7] of the rate of depreciation of the local currency (mostly against the US dollar in either nominal or real level), the percentage changes in international reserves, and the fluctuations in the interest rate. However, the common feature of all existing approaches is the use of fundamental determinants of the domestic and external sectors as explanatory variables.

Our paper investigates the episodes of financial crises in two sets of countries[8] identified as newly industrialized countries: countries with conventional precepts in finance (Brazil, China, India, Mexico, Philippines, South Africa) and economies characterized by a growing proportion of Islamic financial assets included in their economic activity (Bahrain, Indonesia, Malaysia, Kuwait, Qatar, Saudi Arabia, Turkey and United Arab Emirates).

Our results will show that it is highly recommended to adopt more than one EMP index to ensure the robustness and conclusiveness of findings. For this reason, we fellow the works of Eichengreen, Rose, and Wyplosz (1996), Zhang (2001), and Girton and Roper (1977) to justify the construction of our composite index. Our EMPI measure is a combination of two stress indexes plus a resistance index.[9]

According to Eichengreen et al., the speculative attack only exists in the form of extreme pressure in the foreign exchange market, which usually results in a devaluation (or revaluation), or a change in the exchange rate system, i.e. to float, fix or widen the band of the exchange rate.

However, speculative attacks on exchange rates can also be unsuccessful. When facing pressure on its currency, the authorities have the option to raise interest rates or to run down international reserves. Hence, speculative pressure is measured by an index that is a weighted average of normalized changes in the exchange rate, the ratio of gross international reserves to M1, and the nominal interest rates (Levy Yeyati & Sturzenegger, 2005). All variables are relative to a reference country, for which a country is selected with a strong currency that serves as an anchor to other countries. Usually, the US dollar is used as a reference country (Lestano & Kuper, 2003). The index of exchange rate pressure is defined as follows:

$$EMPI_{i,t}=\frac{1}{\sigma_e}\frac{\Delta e_{i,t}}{e_{i,t}}-\frac{1}{\sigma_r}\left(\frac{\Delta rm_{i,t}}{rm_{i,t}}-\frac{\Delta rm_{US,t}}{rm_{US,t}}\right)+\frac{1}{\sigma_i}\Delta(i_{i,t}-i_{US,t}) \quad (2)$$

Where $EMPI_{i,t}$, is the exchange rate market pressure index for country i in period t. $e_{i,t}$ the units of country i's currency per US dollars in period t. $rm_{i,t}$ the ratio of gross foreign reserves to *M1* for country i in period t, $i_{i,t}$ the nominal interest rates for country i in period t. $i_{US,t}$ the nominal interest rates for the reference country (US) in period t. σ_e the standard deviation of the relative change in the exchange rate $(\Delta e_{i,t}-e_{i,t})$, σ_r is the standard deviation of the difference between the relative changes in the ratio of foreign reserves and money *M1* in country i and the reference country (US) $[(\Delta r_{i,t}/r_{i,t})-(\Delta rm_{US,t}/rm_{US,t})]$, and σ_i the standard deviation of the nominal interest rate differential $\Delta(i_{i,t}-i_{US,t})$.

However, based on Sachs et al. work, some modifications are introduced on the above EMPI formula in order to incorporate weights to standardize the variances of each component instead of using conversion coefficients. In other words, we try to avoid the EMPI measure being driven by the most volatile component. Moreover, and according to Sachs et al. (1996a,b), the relation between foreign reserves and money in home and reference country are dropped. Hence, the EMPI measure become a *model-independent approach* that can be written as follows:

$$EMPI_{i,t}=\left(\frac{\frac{1}{\sigma_e}}{\left(\left(\frac{1}{\sigma_e}\right)+\left(\frac{1}{\sigma_{rm}}\right)+\left(\frac{1}{\sigma_i}\right)\right)}\right)\frac{\Delta e_{i,t}}{e_{i,t-1}}-\left(\frac{\frac{1}{\sigma_{rm}}}{\left(\left(\frac{1}{\sigma_e}\right)+\left(\frac{1}{\sigma_{rm}}\right)+\left(\frac{1}{\sigma_i}\right)\right)}\right)\frac{\Delta rm_{i,t}}{rm_{i,t-1}}+\left(\frac{\frac{1}{\sigma_i}}{\left(\left(\frac{1}{\sigma_e}\right)+\left(\frac{1}{\sigma_{rm}}\right)+\left(\frac{1}{\sigma_i}\right)\right)}\right)(\Delta(i_{i,t}-i_{US,t}))$$

[7] In most works in relation with EMPI, precision weights – which are inversely proportional to the variances of components – are used in order to prevent the more volatile components from dominating the index value (see for example Girton and Roper 1997). However, this approach has been criticized on several levels and subjected to controversy. Other works argue that the precision weighting scheme lacks an economic interpretation which can generate downward biases in the case of attacks on pegged currencies (Li, Rajan, & Willett, 2006). According to them, by doing so we eliminate the effect of cross-country differences in terms of volatility, for example when estimating the effect of country-specific imbalances in a pooled sample). This is why the precision weights approach tend to equalize the overall volatility of EMP index not only across components but also across countries. In this paper, Principal Components Analysis (PCA) is used as an alternative approach to correct weighting scheme. As it was suggested by Pentecost, Van Hooydonk, and Van Poeck (2001), through the PCA robustness check the weights are determined endogenously to optimally summarize the information contained in the underlying variables, rather than imposing arbitrary weights. The PCA results are presented in Appendix A. As it can be seen, the EMPI components are well presented on the first factor. High and significant correlations also exists between these components. Moreover, results also give us an idea about the importance of time factor. The first and the third decades have an important weight in the EMPI evolution which fit perfectly with the Resistance Index analysis for the Islamic economies presented in pages 29–30.

[8] In what follow, we use the country code table which includes the WITS System country names for statistical purposes and both the International Standards Organization (ISO) 3-digit alphabetic codes (http://wits.worldbank.org/WITS/wits/WITSHELP/Content/Codes/Country_Codes.htm). Our sample includes: Bahrain (BHR), Brazil (BRA), China (CHN), India (IND), Indonesia (IDN), Kuwait (KWT), Malaysia (MYS), Mexico (MEX), Philippines (PHL), Qatar (QAT), Saudi Arabia (SAU), South Africa (ZAF), Turkey (TUR) and United Arab Emirates (ARE).

[9] Eichengreen, Rose and Wyplosz exchange market pressure index will be denoted as $EMPI_{ERW}$, Zhang index by $EMPI_z$ and Resistance index by RI.

Where σ_e is the standard deviation of the rate of change in the exchange rate $\frac{\Delta e_t}{e_{t-1}}$ and other variables are denoted consistently with formula (2).

This measure is intuitively appealing. In case of speculative pressure, the index captures changes in the domestic exchange rate if the attack is successful and changes in international reserves or nominal interest rates if the speculative attack does not lead to a devaluation. A period of speculative attack is identified when the index exceeds some upper bound (Eichengreen et al., 1996):

$$Crisis = \begin{cases} 1 \ if \ EMPI_{i,t} > \beta\sigma_{EMPI} + \mu_{EMPI} \\ 0 \ otherwise \end{cases} \quad (3)$$

Where σ_{EMPI} is the sample standard deviation of *EMPI* and μ_{EMPI} is its sample mean. The β threshold is arbitrarily set to 2, i.e. two standard deviations above the mean.

In a second stage, our composite EMPI is raised to a more advanced level, by introducing the Zhang (2001) approach.

The EMPI developed by Eichengreen et al.'s (1996) was criticized by Zhang (2001) by pointing at two problems. First, changes in international reserves and interest rates may cancel against each other if the speculative attack is successful. According to Zhang (2001), a positive change in the exchange rate (in anticipation of a devaluation) may trigger a fall in the interest rate and an increase in international reserves. Secondly, movements in international reserves and exchange rate can be volatile in some periods and relatively tranquil in other ones. Thus, an event that results in high volatility dominates the whole sample.

To avoid both situations, Zhang suggested to decompose Eichengreen et al.'s EMPI into its components and to use time-varying thresholds for each component. Zhang (2001) excludes interest rate variables and also drops the link to the reference country:

$$Crisis = \begin{cases} 1, & if \begin{cases} \Delta e_{i,t}/e_{i,t} > \beta_1\sigma_{e,t} + \mu_{e,t} \\ \Delta r_{i,t}/r_{i,t} < \beta_2\sigma_{r,t} + \mu_{r,t} \\ \Delta i_{i,t} > \beta_3\sigma_{i,t} + \mu_{i,t} \end{cases} \\ 0, & otherwise \end{cases} \quad (4)$$

Where $e_{i,t}$ are units of country i currency per U.S. dollars at period t. $r_{i,t}$ the ratio of gross foreign reserves to *M1* for country i at period t. $i_{i,t}$ the interest rates for country i at period t, $\sigma_{e,t}$ standard deviation of $(\Delta e_{i,t}/e_{i,t})$ in the sample. $\sigma_{r,t}$ standard deviation of $(\Delta r_{i,t}/r_{i,t})$ in the sample, and $\sigma_{i,t}$ standard deviation of $\Delta i_{i,t}$ in the sample. As in the work of Eichengreen et al., the β thresholds are $\beta_1 = \beta_3$ and $\beta_2 = -2$.

In addition of these two included conditions, another index is constructed in order to consolidate the analyses, namely the *resistance index* used to characterize exchange rate policy.

Bayoumi and Eichengreen (1998) assume that for a pure float, the change in the exchange rate would exactly correspond to the index of exchange market pressures. At the other extreme, for a Price/Earnings To Growth (PEG ratio), the exchange rate would be constant and fluctuations in EMPI would be driven entirely by changes in reserves through intervention.

In what follow, we reproduce the work of Cardarelli, Elekdag, and Ayhan Kose (2009) to explain how the resistance index is constructed. Basically, the resistance index is another way to define pressure in exchange markets:

First, the percentage change of the nominal bilateral exchange rate of country i in year t, $\Delta\%er_{i,t}$ is defined against a reference country, where an increase implies an appreciation:

$$\Delta\%er_{i,t} = \frac{er_{i,t} - er_{i,t-1}}{er_{i,t-1}} \quad (5)$$

Second, the change in foreign reserves $\Delta res_{i,t}$ is calculated, where the change in net foreign assets (NFA) is scaled by the lagged value of the monetary base *MB*[10] (Girton & Roper, 1977):

$$\Delta res_{i,t} = \frac{NFA_{i,t} - NFA_{i,t-1}}{MB_{i,t-1}} \quad (6)$$

Third, the standard deviations for each year is calculated for each of these series. The EMPI is defined as:

$$EMPI_{i,t} = \frac{1}{\sigma_{\Delta\%er_{i,t}}}\Delta\%er_{i,t} + \frac{1}{\sigma_{\Delta res_{i,t}}}\Delta res_{i,t} \quad (7)$$

According to Cardarelli et al. (2009), by calculating this index, we maintain the scaled standard deviations of each component. These weights equalize the volatilities of each component and ensure that neither of them dominates the index as in other studies in the literature. Moreover, the proposed approach for the RI do not contaminate the EMPI with an interest rate variable, since we use fluctuations of the short-term interest rate as a separate measure to gauge the stance of monetary policy.

Finally, using the EMPI described above, the RI is obtained as follow:

$$RI_{i,t} = 1 - \left[\frac{\left(\frac{\Delta\%er_{i,t}}{\sigma_{\Delta\%er_{i,t}}}\right)}{EMPI_{i,t}}\right] = \left[\frac{\left(\frac{\Delta\%res_{i,t}}{\sigma_{\Delta\%res_{i,t}}}\right)}{EMPI_{i,t}}\right] \quad (8)$$

After obtaining the RI values, Cardarelli et al. (2009) suggests to standardize it since it could vary in a wide range so that it is bounded by the unit interval.[11] Cardarelli put forward that when the index is equal to 0, it means that no resistance is made to exchange market pressures: either the exchange rate is allowed to *float* freely, or a *leaning with the wind* policy is followed that exacerbates the exogenous

[10] Using the IMF's IFS database, we define NFA = FA − FL, where FA and FL denote foreign assets and foreign liabilities respectively.

[11] Specifically, if the raw index is negative or zero is given the value of 0; if it's between 0 and 0.25 is given the value of 0.2; if it's between 0.25 and 0.5 is given the value of 0.4; if it's between 0.5 and 0.75 is given the value of 0.6; if it's between 0.75 and 1, is given the value of 0.8; if it's 1 or above is given the value of 1.

pressures on the exchange rate, rather than relieving them. For these cases, the index would have negative values.

In the same way, when the index is equal to 1, it means that the maximum amount of resistance is attempted: either the exchange rate is *prevented* from moving at all, or extreme forms of a *leaning against the wind* policy are followed that make the exchange rate move in the opposite direction to which it would have occurred in the absence of intervention. These are the cases where the index would have values larger than 1.

Intermediate values of the index between 0 and 1 indicate the extent to which market pressures are relieved by intervention in the foreign exchange market. In sum, dividing the changes in foreign reserves by EMPI yields a ratio measuring the proportion of exchange market pressures that are resisted through intervention. Values of the resistance index closer to 1 imply a greater degree of resistance to exchange rate fluctuations (Cardarelli et al., 2009).

3.3. Dynamic panel data analysis

In panel data analysis, when we suspect at least a significant relationship between the dependent variable and its lagged value, it will be more suitable to resort to Dynamic Panel data techniques. In our case, we try to analyze the relationship between business cycle volatility as a component of economic growth and financial openness. By considering previous values of the GDP growth rates, one can suppose that they can impact the growth levels for the next years. In those cases, lagged values of the dependent variable must be treated as an endogenous explanatory variable since it contains a considerable part of information in the variance-covariance matrix.

Here, we consider a dynamic panel data model which includes p lags[12] of the dependent variable as covariates and contain unobserved panel-level effects, fixed or random (Arellano & Bond, 1991):

$$y_{i,t} = \sum_{j=1}^{p} \alpha_j y_{i,t-j} + x_{i,t}\beta_1 + w_{i,t}\beta_2 + \nu_i + \varepsilon_{i,t}, \quad i = \{1, \ldots, N\}; \quad t = \{1, \ldots, T_i\}$$

Where:

$\alpha_1, \ldots \alpha_p$ are p parameters to be estimated,

$x_{i,t}$ is a 1 * k_1 vector of strictly exogenous covariates,

β_1 is a k_1 * 1 vector of parameters to be estimated,

$w_{i,t}$ is a 1 * k_2 vector of predetermined covariates,

β_2 is a k_2 * 1 vector of parameters to be estimated,

υ_i are the panel-level effects (which may be correlated with x_{it} or $w_{i,t}$),

$\varepsilon_{i,t}$ are i.i.d or come from low-order moving-average process, with variance σ_ε^2

According to Arellano and Bond (1991), the unobserved panel-level effects can be correlated with the lagged dependent variables, making standard estimators inconsistent. For this reason, they introduce a consistent generalized method of moments (GMM) estimator for the parameters of this model. However, this estimator requires that there is no autocorrelation in the idiosyncratic errors. Hence, relevant tests for detecting autocorrelation must be run after the parameters estimation in order to know if we have more robust results or not.

3.3.1. Arellano–Bond dynamic panel-data estimation

Arellano and Bond (1991) introduce a consistent generalized method of moments (GMM) estimator for the parameters in the dynamic panel data models. They propose using further lags of the level or the difference of the dependent variable to instrument the lagged dependent variables that are included in a dynamic panel-data model after the panel-level effects have been removed by first-differencing.

3.3.2. Autocorrelation test

We introduce here the Cumby and Huizinga (1992) autocorrelation test which provides a framework that extends the implementation of the Breusch–Godfrey tests statistic to deal with its limitations such as in situation of overlapping data, as we often encounter in the financial markets or in the presence of conditional heteroskedasticity in the error process. Moreover, when serial correlation up to order q is expected to be present, the Breusch–Godfrey test can't test for serial correlation at orders $q + 1$; $q + 2\ldots$ for q > 0. Hence, Cumby and Huizinga test allows for testing for autocorrelation of order q + 1; q + 2…, where under the null hypothesis there may be autocorrelation of order q or less in the form of moving average process of order q MA(q) against the general alternative that autocorrelations of the regression error are nonzero at lags greater than q. Overall, the test is especially attractive because it can be used in frequently encountered cases where alternative such as the Box–Pierce test, Durbin's h test and the Breusch–Godfrey test are not applicable.

3.4. Mixed-effect regression models

Mixed-effect regression models are common used techniques in panel data. We introduce the two basic models for the analysis of panel data, the fixed effects model (FE) and the random effects model (RE). Later, we present consistent estimators for these two models.

Panel data are most useful when we suspect that the outcome variable depends on explanatory variables which are not observable but correlated with the observed explanatory variables. If such omitted variables are constant over time, panel data estimators allow to consistently estimate the effect of the observed explanatory variables (Kurt, 2014).

[12] In all the regressions, the lag length was selected based on the optimality of the Akaike information (Akaike, 1973) criterion and Schwarz information criterion (Schwarz, 1978). These two approaches are in general most relevant for this type of investigation. Result showed that the appropriate lag length is 1 year for all the estimated models (Kohler and Frauke, 2012; Swamy et al., 2014; Theofanis et al., 2016).

3.4.1. Fixed-effect regression models

Fixed-effects (FE) models are used when we are only interested in analyzing the impact of variables that vary over time. FE models explore the relationship between predictor and outcome variables within an entity (countries in our case). Each entity has its own individual characteristics that may or may not influence the predictor variables.

When using FE models we assume that something within the individual may impact or bias the predictor or outcome variables and we need to control for this. This is the rationale behind the assumption of the correlation between entity's error term and predictor variables. FE models remove the effect of those time-invariant characteristics so we can assess the net effect of the predictors on the outcome variable (Torres-Reyna, 2007).

Another important assumption of the FE model is that those time-invariant characteristics are unique to the individual and should not be correlated with other individual characteristics. Therefore, the regression equation of the FE models takes the following form:

$$Y_{i,t} = \beta_1 X_{i,t} + \alpha_i + u_{i,t} \quad (9)$$

Where α_i ($i = 1 \ldots n$) is the unknown intercept for each entity (n entity-specific intercepts). Y_{it} is the dependent variable where i is the entity and t the time. X_{it} represents one independent variable. β_1 is the coefficient for that independent variable. u_{it} is the error term.

The main idea is that if the unobserved variable does not change over time, then any changes in the dependent variable must be due to influences other than these fixed characteristics (Stock & Watson, 2007). Consequently, FE models are more suitable when we look to analyze changes between countries. These changes are called time-invariant characteristic, because it is constant for each person (Kohler and Kreuter, 2012).

3.4.2. Random-effect regression models

Sometimes, data represent situations with correlated error terms. Therefore, FE models could not be suitable to estimate coefficients since inferences may not be correct. In this case, it would be better to proceed differently by using Random-Effects models.

Unlike FE models, in the RE models it is assumed that the variation across entities is random and uncorrelated with the predictor or independent variables included in the model. The crucial distinction between FE and RE is whether the unobserved individual effect embodies elements that are correlated with the regressors in the model, not whether these effects are stochastic or not (Greene, 2008). In other words, if we suspect that differences across entities can modify the dependent variable trend, the RE models are more appropriate. Hence, in the RE models, it is possible to include the time-invariant variables that were absorbed by the intercept in the FE models. The regression equation for the RE models is:

$$Y_{i,t} = \beta X_{i,t} + \alpha + u_{i,t} + \varepsilon_{i,t} \quad (10)$$

In addition to the previous component, $u_{i,t}$ is the previous *Between-entity* error, and $\varepsilon_{i,t}$ is the *Within-entity* error.

In RE models it is assumed that the entity's error term is not correlated with the predictors which allows for time-invariant variables to play a role as explanatory variables. Then, we need to consider those individual characteristics that may or may not influence the predictor variables. The problem with this is that some variables may not be available, therefore leading to omitted variable bias in the model (Torres-Reyna, 2007). Consequently, RE models allows to generalize the inferences beyond the sample used in the model.

3.5. Time-varying coefficient approach (TVC)

However, in many situations, when we are estimating a regression model with time series or panel data, it is also highly recommended to know if the coefficients we are interested in are changing over time or if they are stable for subsamples of the time series or panel. In our case, we introduce a time-varying coefficient approach (TVC) which offer the possibility of consistently estimate the direct effect of an independent variable on a dependent variable with all of its other determinants held constant even in the presence of measurement error and omitted variables (Swamy, Tavlas, Hall, & Hondroyiannis, 2010). However, Time-varying-coefficient (TVC) estimation is a way of estimating consistent parameters of a model even when the true functional form is unknown, there are missing important variables, and the included variables contain measurement errors (Stephen et al., 2014).

4. Data and results

In the literature, most of the theoretical frameworks show that the nature of the relation between financial openness and business cycles volatility is ambiguous.

We study the macroeconomic implications of financial openness on business cycles volatility using a sample of newly industrialized countries. In particular, our dataset comprises annual data over the 1980–2013 period for 14 countries (8 Islamic countries and 6 newly industrialized countries). The latter group includes some emerging market economies while the first group corresponds to a sub-sample of the OIC (Organization of Islamic Cooperation) economies which are characterized with a growing rate of Islamic finance involvement in their business's strategy.

Most of our macroeconomic and financial series are from the IMF's International Financial Statistics and the World Bank Development Indicators.[13]

We focus on the real GDP annual data as a dependent variable. The choice of explanatory variables was subjective and widely inspired from the relevant literature. We opted for the following variables as explanatory variables: the EMPI calculated according to the Eichengreen's approach, the Resistance Index (Cardarelli et al., 2009), Money and quasi money (M2), the Openness Index calculated as the ratio of the

[13] http://www.imf.org/external/data.htm and http://www.worldbank.org/.

sum of imports and exports to GDP. The population growth rate and oil revenues as a percentage of GDP are used as control variables. The use of a control variables is a very relevant to detect the distinctive aspects between the various entities in the panel.

Besides, we include another important component to explain business cycle volatility, namely the fiscal policy. Of course, business cycle fluctuations are often attributed to the impact of fiscal policy variables. This finding where confirmed by a large set of relevant works like Lane (2003), Galli and Perotti (2003) and Alesina, Campante, and Tabellini (2008), Papageorgioua, Panayotis & Efthymios (2016). In this framework, a question of great importance is whether fiscal policy is related to business cycle volatility in both cases: Islamic financial system and non-Islamic financial systems. We consider two measures of fiscal policy. The first one is the capital expenditures (CE), which refers to government capital expenditures, thus spending in assets. The second is, of course, taxation (TX) with its two components, direct and indirect taxes.

Furthermore, the question about the relationship between fiscal policy and business cycles volatility can be extended by considering the fiscal divergence (FD) expressed as the government budget positions in terms of GDP as it was argued by Darvas, Rose, and Szapáry (2007). Generally, fiscal divergence is associated with greater business cycle synchronization and reduced business cycle volatility (Furceri, 2009). In other words, if fiscal policy is pro-cyclical, fiscal divergence will be associated with reduced business cycle synchronization and higher business cycle volatility. to get a measure of fiscal divergence, we follow Furceri (2009) approach.

First, we calculate the difference in the general government budget surplus or deficit, measured as a percentage of national GDP between countries, and then take its average over the considered period of time a decade of annual data yields our measure of fiscal divergence between countries:

$$FD_{ij\tau} = \sum_{\tau} \left(\left| Bg_{it} - Bg_{jt} \right| \right)$$

Second, we take the average of the previous measure over the set of j countries (with j = …n−i): in order to get a value of fiscal divergence for each country:

$$FD_{i\tau} = \sum_{j} FD_{ij\tau}$$

Where Bg_{it} is the general government budget surplus or deficit at time t expressed as a percentage of nominal GDP for country i. A higher value of FD_i is a sign of dissimilarities in terms of its budget of country i in comparison with other countries.

Finally, two other variables are included in the regression for the Islamic countries, namely the percentage of Muslim population to the total population and the Islamic Net Assets to M2. Far from being exhaustive, we think that these two variables allow to establish the link between Islamic finance, financial openness and business cycles volatility.

4.1. FE and RE effects regression results

The results of the FE and RE regression models are realized in four steps: First, run the FE regression. Second, run the RE regression. Third, run a Hausman test in order to decide which model is more appropriate to our data. Finally, run the Pesaran CD test to analyze cross-sectional dependence in our data.

Tables 1 and 2 show results of FE and RE regression respectively. Overall, when we run the first FE and RE regression, the problem of endogenous lagged right-hand side variable has been emerged, which is mostly the case of this econometric issue. Whereas in a lot of applications the resulting so-called Nickell-bias can be neglected since the time dimension is relatively large as compared to the cross-section dimension, this does not hold in our case (Buch, Döpke, & Pierdzioch, 2002). The use of logarithm of the GDP cyclical component without lags implies that our panel leads to inconsistent and biased estimators. Therefore, we apply the Arellano and Bond's one-step GMM-estimator (Arellano & Bond, 1991) to outperform alternative estimators with lagged time-observations to check the robustness of our results. This approach seems to be rather justified for two reasons. First, the use of non-lagged observations gave us some conflicting results in comparison to the theory. Indeed, in the previous literature, a negative correlation between EMPI and business cycle volatility could not exist (which is the case for our regressions with the lnGDP_HPC dependent variable). Second, in most of the works in relation with business cycles volatility and economic downturns, it is noted that when a financial crisis is triggered, it cannot have a direct and immediate impact on the business cycles volatility, and consequences of the crisis are systematically and usually recorded after a certain period of time (6−12 months).

When looking to Tables 1 and 2, we can perform analysis on two levels, the relevance of the variables' choice and the regression model appropriateness:

From one hand, the most appropriate variables in assessing business cycles volatility are $EMPI_{EWS}$, fiscal policy and population growth rate for the other in-sample countries. The specific variables used to measure the impact of Islamic finance, are also significant in the regression.

The result of a non-significant correlation between trade openness and business cycle volatility does not seem surprising since it is a confirmation of the previous works. For instance, Cavalloi and Frankel (2004) find that openness indeed makes countries less vulnerable, both to severe sudden stops and currency crashes, and that the relationship is even stronger when correcting for the endogeneity of trade. This will lead to less volatile business cycles. Rotter (2013) argues that there is a negative relationship between an increase in trade openness and volatility in business cycles. Although, trade shows some impact on volatility, most instability arises from systematic risks that are felt globally.

Table 1
All other in-sample countries FE & RE regression.

		Fixed-effects (within) regression		Random-effects GLS regression	
		lnGDP_HPC	L.lnGDP_HPC[a]	lnGDP_HPC	L.lnGDP_HPC[a]
$EMPI_{ERW}$	z test	***−2.15***	**3.87**	***−2.01***	**3.83**
	P>|z|	0.031	0.000	0.044	0.000
	Bootstrap. Std. Err.	(6.25e−16)	(0.0068822)	(5.40e−16)	(0.0067412)
RI_{CEK}	z test	−0.69	***−2.32***	−0.55	***−2.24***
	P>|z|	0.493	0.021	0.586	0.025
	Bootstrap. Std. Err.	(0.0082563)	(0.0018909)	(0.0027773)	(0.0018597)
M2	z test	0.56	1.75	−0.74	1.54
	P>|z|	0.575	0.082	0.462	0.124
	Bootstrap. Std. Err.	(0.0029664)	(8.27e−16)	(0.0079618)	(7.29e−16)
Trade	z test	0.01	−0.22	0.05	0.35
Openness	P>|z|	0.992	0.826	0.959	0.724
	Bootstrap. Std. Err.	(0.2264894)	(0.1022367)	(0.0742599)	(0.0777804)
CE	z test	**4.32**	**8.33**	**3.23**	**6.33**
	P>|z|	0.001	0.000	0.002	0.000
	Bootstrap. Std. Err.	(0.0032569)	(0.0012365)	(0.0025633)	(0.0019856)
TX	z test	**3.52**	**6.77**	**4.21**	**5.57**
	P>|z|	0.001	0.000	0.002	0.000
	Bootstrap. Std. Err.	(0.0025981)	(0.0015698)	(0.0020123)	(0.0025459)
FD	z test	0.43	−0.21	−0.33	−0.65
	P>|z|	0.645	0.756	0.985	0.889
	Bootstrap. Std. Err.	(0.0021636)	(0.1122345)	(0.1253694)	(0.0252239)
POPgr	z test	**8.66**	**2.64**	**6.21**	**4.21**
	P>|z|	0.000	0.025	0.0000	0.0008
	Bootstrap. Std. Err.	(0.0022356)	(0.0034596)	(0.0020863)	(0.0002404)
Oil rent	z test	−0.02	0.05	−0.04	0.03
% GDP	P>|z|	0.824	0.714	0.654	0.944
	Bootstrap. Std. Err.	(0.3245631)	(0.2253611)	(0.4442122)	(0.252531)

Significant values at 5% level of significance are in bold italics.
[a] Lagged value of the cyclical component of logarithm of GDP data from order 1.

According to Friedman & Schwartz, the outstanding cyclical fact about the stock of money is that it has tended to rise during both cyclical expansions and cyclical contractions in business cycles, which makes the relationship between business cycles volatility and M2 ambiguous (Friedman & Schwartz, 1963). For this reason, there is not a significant correlation between these two variables in our regression for both Islamic and non-Islamic countries.

Results show also that the variables measuring fiscal policy are highly-positively correlated with business cycle volatility in the case of Islamic countries. Capital expenditures are found to be pro-cyclical and statistically significant. Similarly, taxation is found to be highly pro-cyclical and significant. By looking at the fiscal policy coefficients, it can be clearly seen that fiscal policy has much stronger impact on business cycle volatility when Islamic countries started to move toward worldwide economic integration and globalization. Thereafter, it seems that they adopt a pro-cyclical fiscal policy vis-à-vis the business cycle volatility. These results can be explained by the fact that some in-sample Islamic countries are still unable to access to financing sources for example, but also the lower levels of implantation of Islamic financial institutions.

On the other hand, for the other in-sample countries the coefficients of fiscal policies for both variables are significant and have a positive effect on business cycle volatility. Indeed, cyclicality of fiscal policy having a positive correlation with business cycle volatility is mainly a characteristic of the other in-sample countries. Here we point out that most of the selected countries, are emerging countries, and that many emerging economies have changed from counter to pro-cyclical polices.

Also, it is in that sense that whenever the independent variable is lagged, the coefficients of fiscal policy are still significant and with the same sign. Therefore, a reduction in the cyclicality of fiscal policy is associated with a reduction of business cycle amplitude. Overall, results concerning fiscal policy indicate that there are not fundamental differences between Islamic countries and other countries when taking into account differences in the behavior of fiscal policy.

Results about fiscal convergence in other in-sample countries show clearly that there is not a significant relationship between fiscal divergence and business cycle volatility. Actually, this result was expected and not at all surprising as long as this sub-sample includes a set of countries highly heterogeneous in terms of macroeconomic structure, economic cycles and growth. However, comparing the results for the two sub-sample, one can conclude that there is a more important impact of fiscal divergence on business cycles volatility in the case of Islamic countries than other countries since the relationship between the two variables is statistically positive and significant: the higher is the level of fiscal convergence, the less volatile is the business cycle. This statement can be justified by the fact that the selected Islamic countries are characterized by a higher convergence of fiscal position, even

Table 2
Islamic countries FE & RE regression.

		Fixed-effects (within) regression		Random-effects GLS regression	
		lnGDP_HPC	L.lnGDP_HPC[a]	lnGDP_HPC	L.lnGDP_HPC[a]
$EMPI_{ERW}$	z test	***−3.67***	**5.32**	***−2.91***	**5.64**
	P>|z|	0.000	0.000	0.004	0.00
	Bootstrap. Std. Err.	(0.0049843)	(0.0045632)	(0.0050255)	(0.0042213)
RI_{CEK}	z test	−0.22	−0.33	−0.53	−0.49
	P>|z|	0.825	0.582	0.596	0.7702
	Bootstrap. Std. Err.	(0.0024516)	(0.0040221)	(0.0029705)	(0.0020532)
M2	z test	−0.60	−0.69	***−3.18***	−1.62
	P>|z|	0.550	0.606	0.002	0.225
	Bootstrap. Std. Err.	(1.03e−15)	(3.51e−16)	(7.70e−16)	(3.24e−16)
Trade	z test	−1.00	−0.16	0.52	1.21
Openness	P>|z|	0.317	0.775	0.604	0.314
	Bootstrap. Std. Err.	(0.0729407)	(0.0655002)	(0.0408312)	(0.0328772)
CE	z test	**4.31**	**5.05**	**3.32**	**6.31**
	P>|z|	0.001	0.000	0.002	0.000
	Bootstrap. Std. Err.	(0.0021211)	(0.0011252)	(0.0021536)	(0.0015226)
TX	z test	**3.12**	**4.22**	**3.55**	**5.56**
	P>|z|	0.002	0.002	0.002	0.000
	Bootstrap. Std. Err.	(0.0022456)	(0.0023666)	(0.0013365)	(0.0014566)
FD	z test	1.57	**5.66**	−1.22	**4.32**
	P>|z|	0.010	0.000	0.333	0.001
	Bootstrap. Std. Err.	(0.0098763)	(0.0014444)	(1.55e−10)	(3.05e−15)
POP_{MU}	z test	−0.03	−0.72	**2.37**	**3.21**
	P>|z|	0.976	0.7138	0.018	0.023
	Bootstrap. Std. Err.	(2.03e−09)	(1.92e−09)	(3.77e−10)	(3.24e−10)
IA/M2	z test	**2.65**	0.88	**3.59**	**2.38**
	P>|z|	0.0037	0.3802	0.000	0.0103
	Bootstrap. Std. Err.	(9.89e−15)	(3.28e−15)	(0.0003064)	(3.13e−15)
POP_{GR}	z test	**8.84**	**6.66**	**6.70**	**5.22**
	P>|z|	0.000	0.000	0.000	0.0000
	Bootstrap. Std. Err.	(0.0036121)	(0.00344521)	(0.0033704)	(0.0027222)
Oil rent	z test	1.81	1.91	1.56	1.77
% GDP	P>|z|	0.098	0.062	0.156	0.113
	Bootstrap. Std. Err.	(2.12e−10)	(1.66e−10)	(2.54e−10)	(2.22e−10)

Significant values at 5% level of significance are in bold italics.
[a] Lagged value of the cyclical component of logarithm of GDP data from order 1.

though they are not in terms of growth. These countries should manifest a strong convergence process of their fiscal policy in order to reduce costs associated with the OIC economic stability preserving. Moreover, there is a strong motivation to explain this results since that the sub-sample of Islamic countries contains five countries belonging to GCC. From an economic point of view, the Islamic economies under investigation, (especially those belonging to GCC) are more interdependent, amplifying spillover effects of stabilization policies from one country to others.

In Table 3, the estimate of the impact of fiscal divergence and business cycle volatility on growth is reported. We can see that the effect of business cycle volatility on growth is significant and negative for the both sub-samples. In the same way, fiscal divergence has also a negative significant effect on growth. In both cases, the estimate is highly significant and negative and implies that reduced volatility in business cycle determined by fiscal convergence has positive effects on growth. This results are in agreement with the works of Ramey and Ramey (1995), Darvas et al. (2007) and Furceri (2009):

In terms of oil revenues variable and it relationship with business cycles volatility, results show that there are important differences between Islamic and non-Islamic countries. Since the other considered countries are especially new emerging ones, they express more volatile business cycles than Islamic countries (mainly considered as developed ones). This can be explained by the fact that in the two sub-samples, countries exhibit sufficient diversity among them. Indeed, there are some oil-exporting countries in both Islamic and non-Islamic countries. That is, it is difficult to find an impact on business cycles dynamics in oil exporting countries. Furthermore, this result can be also possible because an oil price shock could not explain the majority of variation in business cycles. Other

Table 3
Impact of fiscal divergence and business cycle volatility on growth.

		lnGDP (Islamic countries)	lnGDP (all other in-sample countries)
FD	z test	***−2.32***	***−3.13***
	P>|z|	0.020	0.002
	Bootstrap. Std. Err.	(0.7418997)	(3.83e+11)
lnGDP_HPC	z test	***−3.76***	***−2.63***
	P>|z|	0.000	0.009
	Bootstrap. Std. Err.	(0.3994328)	(0.4445076)

macroeconomic aggregates in these economies are highly correlated with financial openness, showing that they are exposed to world business cycles.

Finally, for just Islamic countries, the variables Muslims population percentage and Islamic financial assets to M2 are significant variables in the RE regression model, which is quite logical since these two variables are usually used in the construction of the Islamic Finance Country Index.[14] Fig. 1 gives the evolution of this index in the first fifteen countries over three years, 2011, 2012 and 2013. Our Islamic in-sample countries are identified by a blue color.

When we take a look at this figure, and also on some statistics of Islamic finance business, one can think that, overall, Islamic markets are far from being homogenous. Each of them are in a different stage of maturity, and hence presenting a different opportunity. However, according to the World Islamic Banking Competitiveness Report (2013)[15] despite of the persistence reluctance of many analysts about the competitiveness of financial markets where Islamic finance is growing by impacting Islamic business in emerging markets, Islamic finance continues to be an exciting challenge characterized by robust macro outlook of core Islamic finance markets and increasing share of system assets. It is increasingly gaining acceptance, especially in high-growth emerging markets, as an effective means to build an inclusive financial system and to replace the shadow economy.

From another hand, the variables choice is not the only important result to assess the role of Islamic finance in an economic cycle. Furthermore, we need also to determine which model to adopt, FE or RE model?

To give an answer to this question, let concentrate on the estimates between explanatory variables and the lagged cyclical component of lnGDP for both Islamic and other countries. Three fundamental components should be considered to assess each model (FE and RE). First, in the regression results, the error u_i are found correlated with the regressors in the FE model with values of −0.6814 and −0.4376 for the Islamic countries and the other countries respectively. Second, the value of the test (F) is less than 5% in both sets of countries, meaning that all the coefficients in the model are different than 0. Once again, this is the case for the two groups of countries. Third, the *t*-values testing the hypothesis that each coefficient is different from 0. The t-value has to be higher than 1.96 for a 95% confidence level. If it is the case, then we can say that the variable has significant influence on the dependent variable. The higher the *t*-value, the higher the relevance of the variable. It is worth mentioning that the regression also provides a *rho* variance which represents the variance due to differences across panels. *Rho* is known as the interclass correlation. The higher its value, the less is relevant the model structure. It is calculated as:

$$rho = \frac{(\sigma_u)^2}{(\sigma_u)^2 + (\sigma_e)^2} \tag{11}$$

Where: σ_u is the standard deviation within groups u_i and σ_e the standard deviation of residuals (overall error term) e_i. It takes the value of 18.43% and 4.18% in Islamic countries and other countries, respectively.

In addition, RE regression model gives some differences other things being equal, among others differences across entities are uncorrelated with the regressors, and the interpretation of the coefficients is sticky since they include both the within-entity and between-entity effects. The value of the coeffcients represents the average effect of an explanatory variable over the dependent variable when the first change across time and between countries by one unit.

Regardless of the considered regression (FE or RE model), the signs and robustness of the regressors remains the same for both models. However, in order to make a choice, we should run a *Hausman test* where the null hypothesis is that the preferred model is random effects vs. the alternative the fixed effects (Greene, 2008). It basically tests whether the unique errors u_i are correlated with the regressors, the null hypothesis is they are not. Because we are studying the factors that affect business cycles volatility in a set of countries between 1980 and 2013, we believe that a RE specification is appropriate for country-level effects in our model. Then, when we fit a FE model, it will capture all temporally constant country-level effects. However, when we fit a RE model as a fully efficient specification of the country effects, we assume that they are random and follow a normal distribution. We can compare these estimates with the Hausman test which gives us the probability of the Chi^2 test: 0.9360 for all other in-sample countries and 0.9276 for the islamic countries. Since the two probabilities are higher than 5%, we can say that under the current specification, our initial hypothesis that the country-level effects are adequately modeled by a fixed-effects model is resoundingly rejected. This result is based on the rest of our model specification, and random effects might be appropriate for some alternate model of business cycles.

Finally, we must check the cross-sectional dependence in our panel-data model. Cross-sectional dependence is more of an issue in macro panels with long time series (over 20–30 years) than in micro panels. Pesaran CD (cross-sectional dependence) test is used to test whether the residuals are correlated across entities (Hoechle, 2007). Cross-sectional dependence can lead to bias in tests results (also called contemporaneous correlation). The null hypothesis is that residuals are not correlated. Our results show a value of Pesaran CD test equal to: 0.395 for all other in-sample countries and 0.489 for Islamic countries (more than 5%), which leads us to conclude that there is no cross-sectional dependence in our data.

[14] Edbiz Consulting: http://edbizconsulting.com/ and Global Islamic Finance Report www.gifr.net/publications/gifr2014/ifci.pdf.

[15] World Islamic Banking Competitiveness Report 2013: http://www.ey.com/Publication/vwLUAssets/EY_-_World_Islamic_Banking_Competitiveness_Report_2013%E2%80%9314/$FILE/EY-World-Islamic-Banking-Competitiveness-Report-2013-14.pdf.

4.1.1. Cumby–Huizinga test for autocorrelation

The Cumby–Huizinga test results show that there is an autocorrelation in our panel data starting from the second lag for the dependent variable (lngdp_HPC) in the case of islamic countries at 5% level of significance and that there is no autocorrelation for the whole panel data of the other in-sample countries also at 5% level of significance. This confirms the selection of only one lag of the cyclical component of GDP as a measure of volatility in business cycle. The autocorrelation test confirm the robustness of our result estimated by Arellano–Bond approach Table 4:

Table 4
Autocorrelation test.

H_0: Variable is MA (mean average) process up to order q
H_A: Serial correlation present at specified lags >q

	Onther in-sample countries			Islamic countries		
Lag	Chi^2	df	p-val	Chi^2	df	p-val
1	3.672	1	**0.0553**	0.004	1	**0.9485**
2	2.112	1	**0.1462**	7.116	1	0.0076
3	0.433	1	**0.5105**	6.479	1	0.0109
4	2.027	1	**0.1545**	4.278	1	0.0386

4.2. Time-varying approch

In what follow, the regression results are presented after the use of a Time-Varying Coefficient (TVC) approach for each variable in order to know if the coefficients change over time and also to know if our selected variables are suitable to assess the relationship between business cycles volatility and financial openness in both cases of Islamic finance and conventional financial systems. After specifying our multiple regression model and which coefficient to examine, the principle is to run a sequence of regressions for a moving window of specified length.

The main objective under using the TVC approach is to validate or not the previous regression results. Obviously, even when we consider a TVC process, the regression results does't change in terms of significance. All the significant variables are the same as in the case of FE and RE regressions (see Table 5). Our results suggest that the magnitude of the coefficient for all measures and for the two groups of countries is remarkably alterable over time.

4.3. EMPI and business cycles volatility results

In this section, we discuss the results of EMPI and business cycles volatility. The most important results are presented in Table 6. The table summerizes, in the same time, results of exchange market pressure index ($EMPI_{ERWZ}$, $EMPI_Z$ and composite index $EMPI_{ERWZ}$), resistance index (RI), business cycles volatility and economic downturns. Te composite index will mark a financial crisis if one of the two sub-indexes indicates a crisis situation related to the bounds identified as two time the standard deviation σ plus the mean μ. The second component in the table, Resistance Index, is classified according to the weighting given above for episodes with low, medium and high resistance. Finally, the table contains results about economic downturns divided into downturns episodes preceded by a crisis or not. Also, the table distinguishes Islamic countries and other in-sample countries in order to understand how Islamic financial system could deal or avoid financial crisis and volatility of business cycles.

Table 5
TVC regression model.

Dependent variable		Islamic countries	Other in-sample countries
		lnGDP_HPC	lnGDP_HPC
$EMPI_{ERW}$	z test	***−3.71***	−0.09
	P>|z|	0.000	0.928
	Bootstrap. Std. Err.	(0.2703887)	(0.5278289)
RI_{CEK}	z test	***−3.75***	0.32
	P>|z|	0.000	0.750
	Bootstrap. Std. Err.	(0.3547596)	(0.2070305)
M2	z test		
	P>|z|	(omitted)[a]	(omitted)
	Bootstrap. Std. Err.		
Trade	z test	−0.08	0.37
Openness	P>|z|	0.933	0.821
	Bootstrap. Std. Err.	(0.0530431)	(0.0655111)
CE	z test	**3.78**	**4.95**
	P>|z|	0.001	0.002
	Bootstrap. Std. Err.	(0.0236596)	(0.0225367)
TX	z test	**4.21**	**5.66**
	P>|z|	0.002	0.001
	Bootstrap. Std. Err.	(0.0020159)	(0.0122556)
FD	z test	2.25	3.12
	P>|z|	0.004	0.003
	Bootstrap. Std. Err.	(0.00458892)	(0.01221425))
POP_{MU}	z test	***−4.74***	
	P>|z|	0.000	(not included)
	Bootstrap. Std. Err.	(0.5625484)	
IA/M2	z test		
	P>|z|	(omitted)	(not included)
	Bootstrap. Std. Err.		
POP_{GR}	z test	**6.18**	***−2.11***
	P>|z|	0.000	0.035
	Bootstrap. Std. Err.	(0.4286844)	(0.1540706)
Oil rent	z test	1.33	1.41
% GDP	P>|z|	0.084	0.077
	Bootstrap. Std. Err.	(0.2153366)	(0.1915233)

Significant values at 5% level of significance are in bold italics.
[a] Omitted-Variable Bias is the bias that appears in the estimates of parameters in a regression analysis, when the assumed specification is incorrect in that it omits an independent variable that is correlated with both the dependent variable and one or more included independent variables (Wooldridge, 2009).

As we can see, when we consider the EMPI, there is not a big difference between Ismalic countries and the other ones meaning that countries that adopt Islamic finace in their economic cycles are not more sheltered from financial crisis than other countries in the considered period. Indonesia, Kuwait and Saudi Arabia are countries with the higher number of crisis situations among Islamic countries. In parallel, India, Mexico and Philippines are countries in the same situation in the group of other countries. In addition, when we look at the economic downturns column, Islamic countries have more recessions periods preceded by financial crises (see Table 6).

Table 6
Financial crises and economic downturns episodes.

	Coun	$EMPI_{(ERW)}$		$EMPI_{(z)}$	$EMPI_{(ERWZ)}$	RI (34 periods)			BC volatility & economic downturns (ED)		
		Bounds	Crisis episo			RI_{weak}	RI_{med}	RI_{strong}	Preceded by crisis (ED)	Not preceded by crisis	Total (BCV)
Islamic Countries	BHR	3.911671	1	3	3	1	0	33	2	13	15
	IDN	3.529867	1	4	5	3	8	23	3	11	14
	KWT	4.913205	1	4	4	11	11	12	1	17	18
	MYS	4.571440	2	3	3	5	9	20	2	14	16
	QAT	4.238243	1	2	2	1	0	33	0	15	15
	SAU	4.022344	2	3	4	5	2	27	2	18	20
	TUR	4.803108	1	2	3	13	11	10	1	11	12
	ARE	3.568979	1	2	3	2	0	32	3	18	21
Islamic Countries		–	**10**	**23**	**27**	**41**	**41**	**190**	**14**	**117**	**131**
Other Countries	BRA	4.443766	2	2	3	17	3	14	1	16	17
	CHN	3.953371	1	2	3	2	11	21	1	17	18
	IND	4.845766	1	5	6	13	12	9	2	15	17
	MEX	4.617462	1	5	6	8	10	16	3	14	17
	PHL	3.784823	2	4	5	6	8	20	3	15	18
	ZAF	4.154431	1	3	3	16	7	11	2	11	13
Non-Islamic countries		–	**8**	**21**	**26**	**62**	**51**	**91**	**12**	**88**	**100**
All In-sample Countries		–	***18***	***44***	***53***	***103***	***92***	***281***	***26***	***205***	***231***

Significant values at 5% level of significance are in bold italics.

As it was mentioned above, the object of interest of our first analysis is the cyclical component of the real GDP series. By looking at the following figure, it looks more difficult to make any statement about countries that represent strong growth rates, or those with a more volatile business cycles (Fig. 2). This is the reason for what the splitting-up of the real GDP value to a trend and a cyclical component will allow us to distinguish between the two cases including countries with high growth rates and those characterized by more volatile business cycles (Figs. 3 and 4). For instance, United Arab Emirates, Saudi Arabia, Kuwait, China and Philippines are the most countries characterized by volatile business cycles. Therefore, Islamic countries show more volatility in their business cycles (see Table 6 and Fig. 5). In return, some countries show a very important levels of growth, namely China, Qatar and Turkey. Then, the relationship between growth and business cycles volatility is not clear in our case, since the moment that there are some countries with high growth rate and high volatility, and others with high growth rates and less volatile business cycles (Figs. 3 and 4).

Once again, the positive estimate between EMPI and business cycles volatility indicates that a decrease in EMPI is associated with reduced business cycle volatility. That is, EMPI decreasing is linked to smoother business cycles. Thus, in principle, financial openness could be helpful for growth through reduction of business cycle volatility. Of course, economic stability is a pre-requisite for growth. Since financial openness can be seen as a strong lever for growth, then we can say that it can positively influence economic growth through financial stability and subsequently the economic stability characterized by less volatile economic cycles. We find that financial openness has a positive and significant effect on economic growth but not only for countries where Islamic finance prevails. This positive relationship implies that opening a domestic financial system to foreign capital inflows benefit growth. However, we find that the effect of financial openness on growth tends to be weaker in Islamic countries. One possible interpretation is that the financial systems of the other in-sample countries are better able to allocate foreign capital inflows to productive uses. We point here that it is about a set of countries classified as emerging economies. Islamic countries, with less efficient economic system, continue to fail in developing country financial systems to efficiently allocate foreign capital. But somewhat paradoxically, we also find that the effect of financial openness on growth tends to be weaker in some financially more developed Islamic countries (Turkey). This can be explained by the fact that the used measure of financial openness is a quantitative indicator that captures the relative size of the finance sector in the real economy.

Moreover, we identify 53 warning signs of EMPI, among them there is 27 recorded for Islamic countries. Also, there is

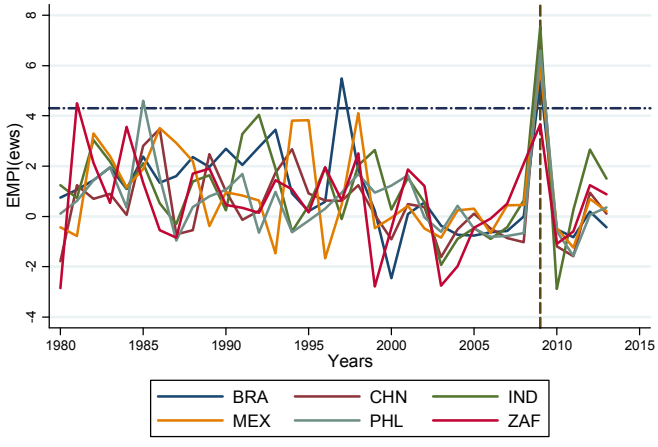


Fig. 6. EMPI in other in-sample countries.

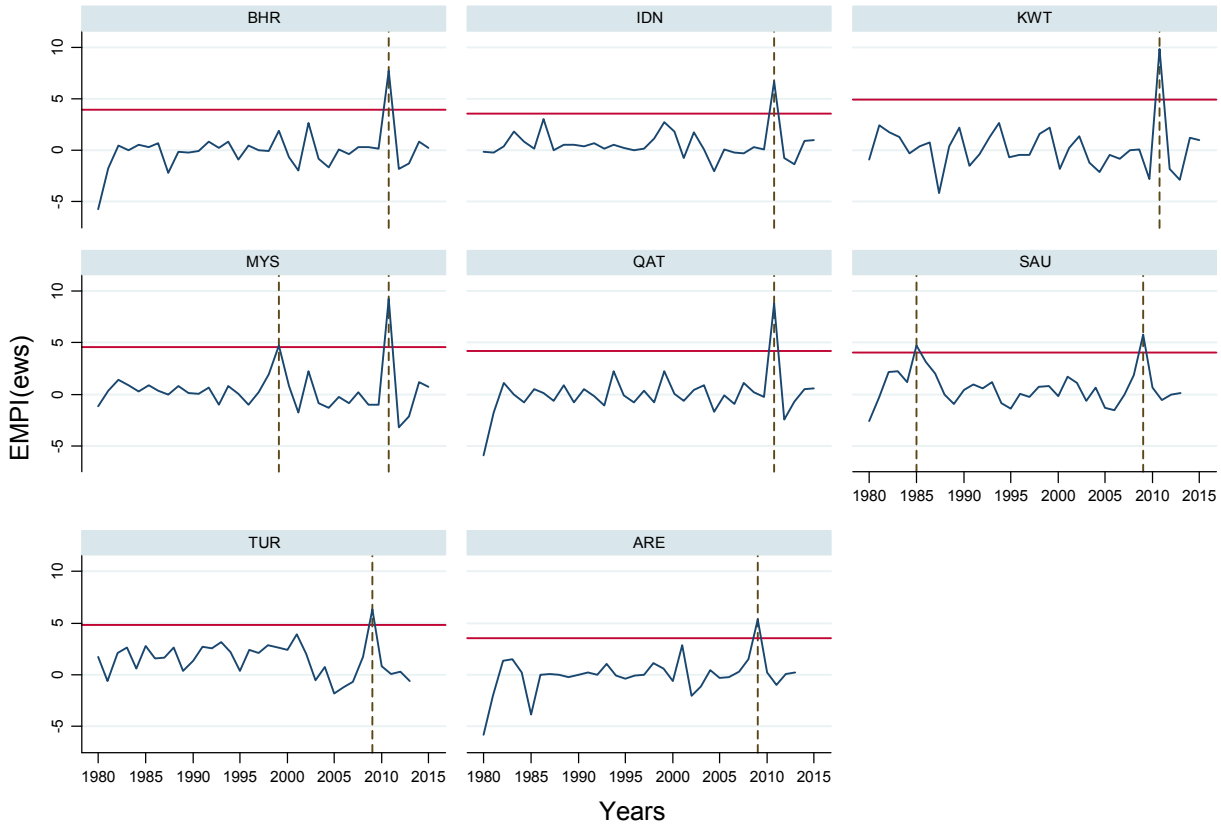


Fig. 7. EMPI in Islamic countries.

231 episodes of volatility in business cycles, among them 131 are episodes in Islamic countries. At this point of analysis, we cannot say that Islamic finance is absolutely a strong alternative in the critical periods. But when we look to the RI results, we can notify that Islamic countries are more resistant to financial shocks than the other countries. On 231 episodes of high resistance, there is only 91 episodes of the other countries. Then, Islamic countries are far away from the others countries when considering the RI.

The EMPI episodes show several interesting patterns. Figs. 5 and 6 represent the EMPI all-in-one-graph of the whole countries, while Figs. 7 and 9 show the evolution of EMPI for each country. Viewed from an Islamic finance perspective, we can compare the EMPI graphs for Islamic countries and for the remaining ones (see Fig. 8):

First, for Islamic countries the EMPI episodes have minor changes over time than other countries, with three waves of episodes of large EMPI variability: between 1985 and 1990, between 1997 and 2003, and between 2007 and 2010. The EMPI average value was crossed only 3 times against 4 times for the other countries. Second, EMPI episodes completed during the two first waves (between 1985 and 2002) generally involved a smaller rate of GDP growth, especially compared to episodes of the last wave that were started after 2007 with higher growth rates and less volatile business cycles except the episodes of the worldwide economic crisis between 2008 and 2009. At this level, Islamic countries do not seem to get ahead of others countries. Third, Islamic countries dominated the first wave of business cycles episodes with less volatile cycles, while recent episodes have been more concentrated in other non-Islamic countries. Fourth, about 10% of the completed volatile episodes of business cycles was preceded by a currency crisis in Islamic countries, while 12% is the percentage of other non-Islamic countries.

In particular, even if Islamic countries were characterized by volatile business cycles, there are some countries that have recorded very interesting results with less financial crisis and less volatile business cycles under situations of financial openness and high levels of growth (Qatar and Bahrain, and with less degree Kuwait).

Our results show that the implications of financial openness for business cycles volatility and growth in Islamic countries is not decisive because it depends upon the nature of the underlying shocks (in both Islamic and non-Islamic countries). Moreover, in Islamic countries, it is not easy to unveil the complex relationships between financial Islamic institutions and conventional institutions. Because this relationship is different from one country to another, the legal framework is highly decisive in regulating the status of Islamic financial institutions. From one hand, in some Islamic countries special issued laws and specific government structures are established in order to supervise activities and regulate operations in

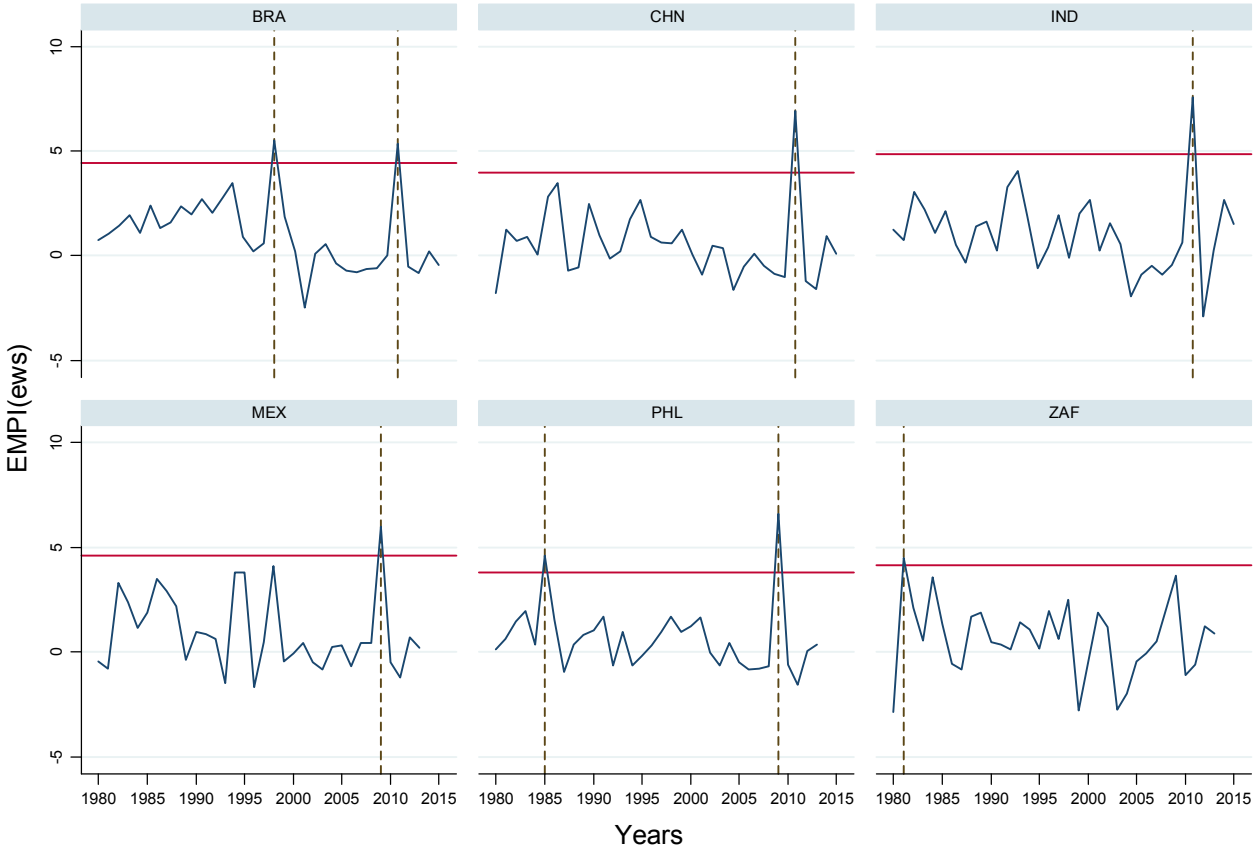


Fig. 8. EMPI in other in-sample countries.

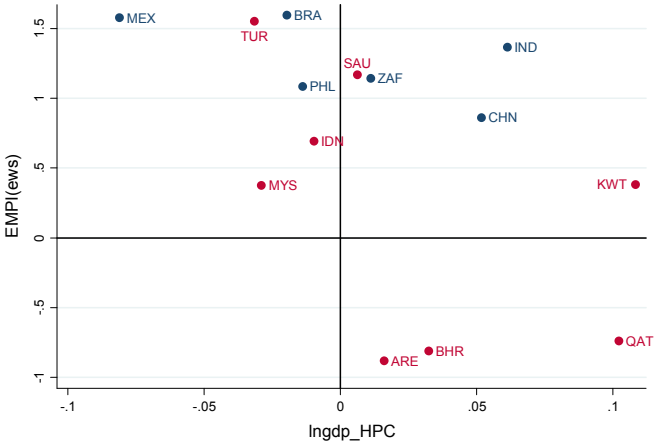


Fig. 9. Relationship between EMPI and lnGDP_HPC (1980–1989).

Islamic financial institutions separately from conventional financial institutions (Turkey, Malaysia, Jordan, and the United Arab Emirates are good examples). In this case, the relationship between central banks and Islamic financial institutions is highly regulated. From another hand, in other countries, Islamic institutions are not exempt from the laws regulating financial operations of other banks. They operate as small units within a large group of institutions which are regulated by the state law, and supervised by the central bank. Such situation can be found in Egypt, Sudan, Kuwait, Bahrain, etc. In this case, Islamic financial institutions are very distinctive from conventional ones which make them evolving in a specific environment leading to rigid activities with a less ability of responding to new trends. It goes without saying that the second situation deeply hinders the Islamic finance development in an economic system.

However, we could not deny that Islamic finance forges a closer link between real economic activity that creates value, and financial activity that facilitates it. Also it is a more efficient as it allocates investible funds on the basis of expected value productivity of projects rather than on the criterion of creditworthiness, as is the case in debt-based finance. Moreover, Islamic finance will be less prone to inflation and less vulnerable to financial pressure and speculation (Siddiqi, 2001).

Furthermore, the link between macroeconomic policy, financial openness, and business cycles volatility has undergone changes over time. Parameter instability may, thus, be one reason why previous empirical studies have not been able to detect a statistically significant link between financial openness and business cycle volatility in countries where Islamic finance is growing continuously. For this reason, we tried to develop a profile of Islamic countries against non-Islamic countries in terms of financial openness and business cycles volatility by introducing the estimates for separated

decades in order to understand why business cycle amplitudes have changed.

In the following graphs, we crossed data about EMPI and RI with the lnGDP cyclical component extracted by the HP filter. The time period is divided into three decades, 1980–1989, 1990–1999 and 2000–2013.

It is worth mentioning that for the EMPI matrix (left side), the most advantageous quadrant is the southeast (negative value of the EMPI and positive value of lnGDP_HPC), against the less advantageous one located in northwest (positive values of EMPI with negative values of lnGDP_HPC). The remaining two cases represent countries that are not experiencing crises, but are in an economic downturn period (southwest quadrant); and other countries that are in crises situations without economic downturn. Moreover, in the RI matrix (right side), the best situation is presented by the northeast quadrant, against the most critical case presented by the southwest quadrant.

In the first decade, we notice that three Islamic countries are situated in a very strong position (ARE, BHR and QAT). They are characterized by a steady growth without financial crisis. This is not the case of TUR, IDN and MYS completely opposed to the first set. Nevertheless, more than the half of Islamic countries are not in a critical situation in this decade. Non Islamic countries are more vulnerable, at least for their ability to avoid situations of financial crises caused by high financial openness.

In terms of the RI, the Islamic countries are outpacing other countries with a strong resistance against financial crises. There are five Islamic countries against only three non-Islamic countries characterized by strong resistance to financial shocks allowing them to reduce the number of economic downturns (Figs. 9 and 10).

In the second decade (Figs. 11 and 12), the least we can say is that Islamic countries are not the same as before in terms of economic performance. Indeed, we easily notice that the economies of Islamic countries are more exposed to risk of financial crises and the resultant economic downturns. The best positioned countries in the previous decade were moved

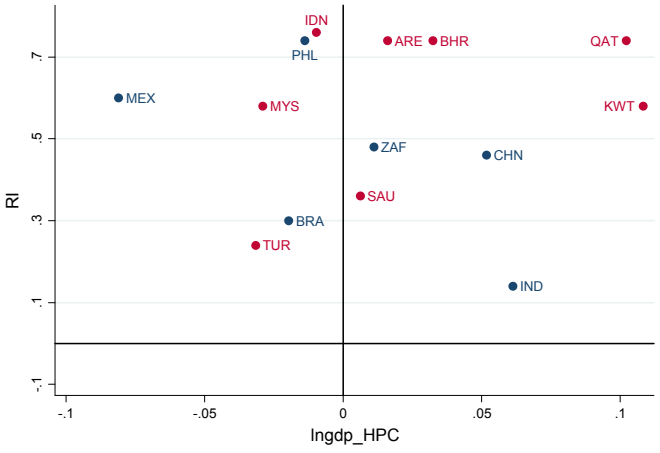


Fig. 10. Relationship between RI and lnGDP_HPC (1980–1989).

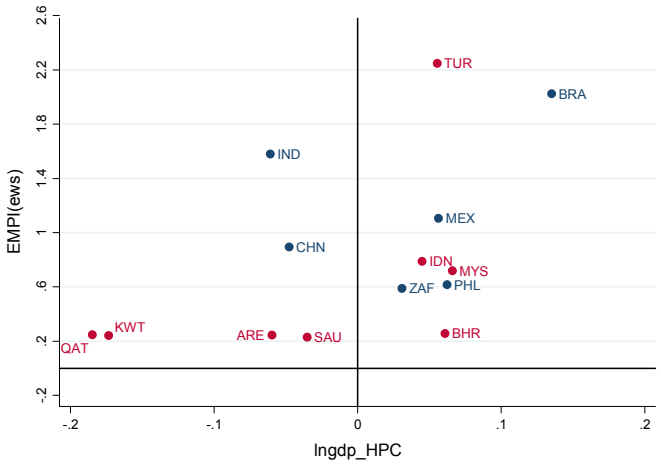


Fig. 11. Relationship between EMPI and lnGDP_HPC (1990–1999).

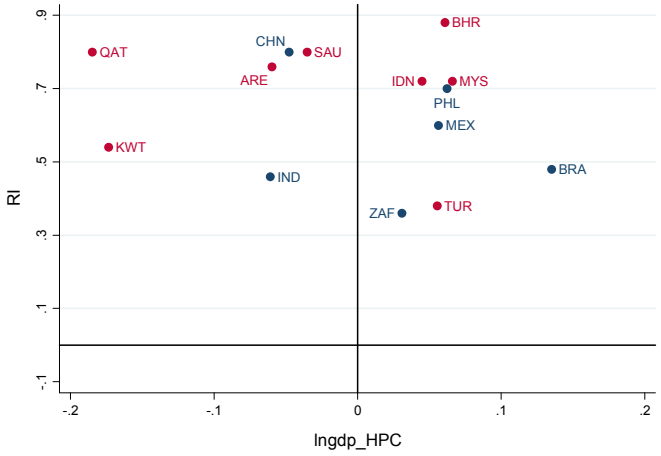


Fig. 12. Relationship between RI and lnGDP_HPC (1990–1999).

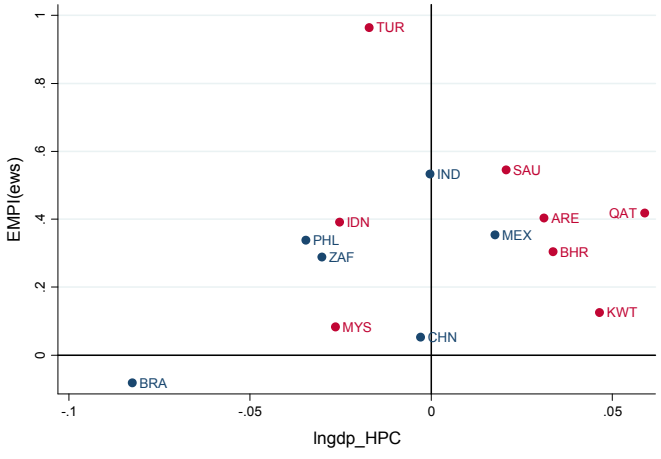


Fig. 13. Relationship between EMPI and lnGDP_HPC (2000–2013).

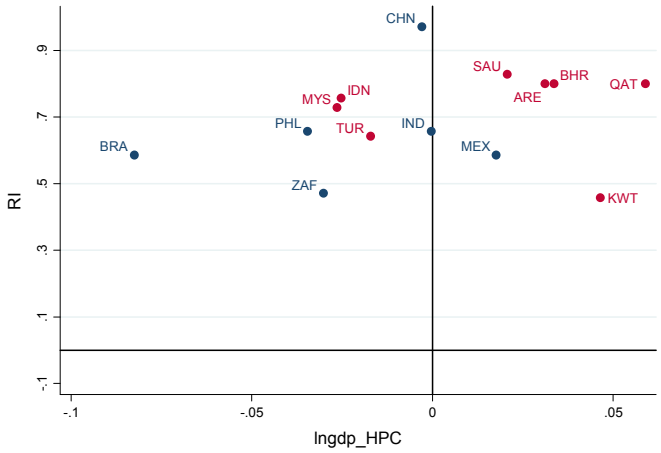


Fig. 14. Relationship between RI and lnGDP_HPC (2000–2013).

to situations of high risk of financial crises and volatile business cycles followed by downturns (QAT, KWT, SAU and BHR). The fluctuations in business cycles seems not decisive, because we have half of Islamic countries with relatively stable business cycles. Overall, this decade is more unstable compared to previous even for the other countries supposed to be characterized by higher financial openness than Islamic countries (see for example the situation of CHN, BRA, MEX and IND).

The last decade is, again, more advantageous for almost the whole Islamic countries with lower values of EMPI compared to other countries, and we can say the same thing about the RI. However, this decade gives rise to more financial crises for all countries. This seems to be more logical since the global economic crisis have a large weighting compared to other years. Nevertheless, the most outstanding result is still the degree of resistance against crises in the case of Islamic countries which is significantly higher than the other countries. Hence, in this decade, financial openness seems to have been cushioning rather than magnifying business cycle fluctuations, but not in earlier decades (Figs. 13 and 14).

4.4. Discussion

Our paper contributes to this large literature in at least three major dimensions. First, we identify the relationship between financial openness and business cycles volatility and growth, by extracting episodes of crisis followed by economic downturns in a sample of Islamic and non-Islamic countries using a consistent set of criteria. Our results show that, in some cases, Islamic finance was not a decisive alternative to avoid financial crisis. Second, we provide an extensive discussion of various policy measures and identify them using a composite index for measuring the impact of financial openness on the business cycles volatility and growth. In particular, we use a variety of quantitative indicators to describe policies of financial openness and business cycles. Third, unlike earlier studies, we study the impact of this financial openness by introducing a resistance index to measure countries' responses against crisis, and we have found that at this point, Islamic countries express more effectiveness in facing financial crisis. Thereafter they could reduce episodes of economic downturns preceded by crisis and moderate decline in their GDP growth rates.

Our findings indicate that episodes of strong resistance against crisis were associated with an acceleration of GDP growth, but afterwards growth often dropped significantly in Islamic countries. In fact, post-crisis decline in GDP growth is significantly larger for episodes that end abruptly and for this reason Islamic countries are more characterized by volatile business cycles than non-Islamic countries.

With respect to policy choices, four interesting results emerge. First, countries that experience more volatile business cycles, including a sharp decrease in growth, tend to be those with higher financial openness and with fragile resistance policies in facing financial shocks. Second, episodes where the decline in GDP growth following the surge of financial crisis was more moderate and tend to be those in which the authorities exercised some efforts to resist against crises. These findings were more confirmed in Islamic countries with better macroeconomic outcomes in their aftermath. Third, between 1990 and 1999, the evolution of the composite index used as an expression of financial openness has not, in general, been associated with lower levels of growth, nor with a higher volatility in business cycles in almost all cases, whether for Islamic countries or other countries. Fourth and finally, an additional feature of our paper is that we distinguish two EMP indexes and a resistance index. Our results reveal that the composite EMPI between the methods of Eichengreen, Rose and Wyplosz and the one of Zhang is a strong combination to assess the link between financial openness, business cycles volatility and growth.

Overall, the motivations for the development of Islamic finance are undoubtedly various and mainly inspired by religious considerations that prevail broadening and deepening the process of financial intermediation.

Even though the size of the Islamic financial is still small as a proportion of the world's total financial assets, it has promising potential since it is growing continuously by multiplying financial institutions and networks maintained by their regulatory and supervisory systems basically across Islamic countries. This is because Islamic finance aims to reach a double perspective objective, namely enhancement of the economic and social conditions. In fact, Islamic finance can thus help in reducing poverty and inequality through including a larger proportion of the population into the financial system, by providing an easy and transparent access a diversified portfolio of services.

We think that the main challenge lies on how the international community accept and adopt Islamic finance in order to ensure its sustainability of Islamic. Often, this challenge is not ordinary and requires some creative approaches in order to meet it. First, enhancing the legal and regulatory framework of Islamic finance. Second, conform and align banking products with Sahria principles in order to motivate people to turn to this alternative solution. Third, Islamic finance should be seen from an international perspective as a strong lever in boosting capital

flows through globalization and financial integration. Forth, promote financial development by according more importance to financial innovation and capital market diversification.

5. Conclusion

The main objective of this paper was to introduce a composite index of foreign financial markets used to measure the impact of financial openness on growth and volatility in business cycles.

From one hand, the results allow the general conclusion that the components of our composite EMPI inspired from the main previous works (Eichengreen et al.'s, 1996 and Zhang, 2001) do work, both in the case of Islamic and non-Islamic countries. This finding is in contrast with Edison and Warnock (2003), who claim that the performance of Eichengreen et al. index is generally poor.

In particular, we find that EMPI, fiscal policy, Muslim population percentage and Islamic financial assets to M2 strongly correlate with business cycles volatility, whereas the M2 and the resistance index (RI) play an additional role in assessing growth and business cycles volatility.

Form another hand, restricting the analysis to two samples of countries (Islamic and non-Islamic countries) offers several advantages. Firstly, a longer span of data is available than for a broader set of countries, including, for instance, newly industrialized countries. Secondly, data quality and cross-country comparability are also likely to be a good opportunity to understand how Islamic finance could bring more interesting situations in facing crises. This is extremely important when we consider the measure of business cycle volatility, since volatility would increase in presence of measurement errors. Thirdly, as argued by Grier and Tullock (1989), data from the industrialized countries and the rest of the world do not share a common set of coefficients in cross-country growth regressions and thus should not be pooled.

Our results also suggest that even if the fluctuations in GDP growth have been preceded by a large number of critical financial situations, Islamic countries were slightly more competitive in terms of resistance index than others. Then, Islamic finance could be sometimes a good alternative to conventional finance to lead to more quite stable business cycles periods. These findings support some relevant previous works that confirm the relatively better performance of Islamic finance during financial crisis (Beck, Demirgüç-Kunt, & Merrouche, 2013; Hasan & Dridi, 2010).

Broadly, the key elements in boosting growth and dampening financial shocks' transmission are financial Islamic institutions especially in countries with significant Muslim populations. Thereafter, financial stability may be improved by the adoption of Islamic principles by financial institutions and their clients because most Islamic countries are classified as developing economies suffering from a great degree of information imperfection. Hence, agency problems are multiplied because actors may use the funds provided by banks for their own benefits, which makes banks biased towards debt-based contracts especially with less knowledgeable borrowers (Aggarwal & Yousef, 2000; Mirakhor & Zaidi, 2007; Nethercott, 2012). Therefore, Islamic financial institutions tend to rely heavily on debt-based modes, which dominate the assets of Islamic banks, rather than profit-and-loss sharing or investment contracts.

With respect to policy choices, we can say that financial openness, especially in newly industrialized countries, to which belong a large part of Islamic countries, played an important role in assessing business cycles volatility. In fact, introducing a quantitative approach of EMPI allow to not only understand how countries could avoid (or at least reduce disastrous consequences) in terms of business cycles amplitudes associated with financial openness in different groups of countries but also contribute, through reduction of output volatility, to higher long-term growth.

The relationship between financial openness and business cycle volatility is of particular importance. Since we only analyze the relationship between financial openness and business cycles volatility through growth in this paper, future research can extend and strengthen the analytical framework in various ways particularly by considering the overall structure of a financial system by including financial development and financial stability variables in a comparative way between Islamic financial systems and conventional financial systems. Still, a question that remains open is the extent to which Islamic finance could be adopted in the world. While developments in some Islamic countries are encouraging, it will take many years before Islamic finance takes off in advanced economies. Clearly, future and more extended research would be of interest.

Appendix

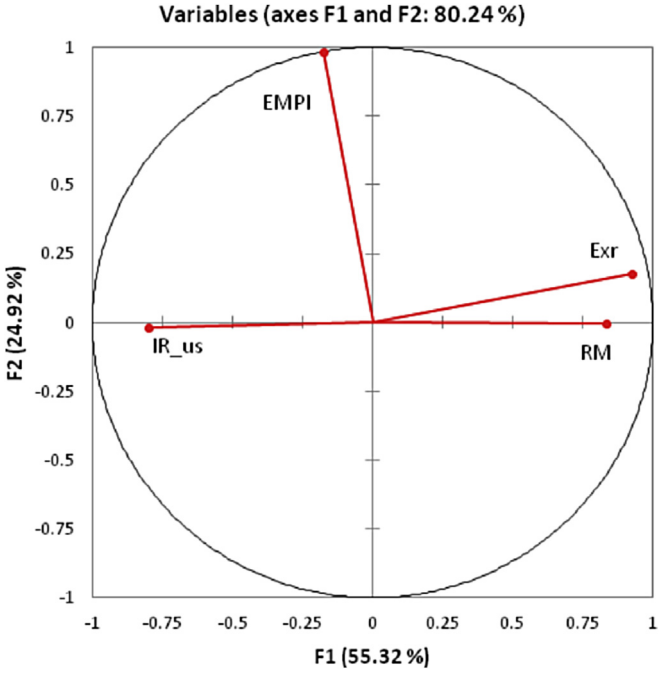
A. Principal Component Analysis (PCA) on EMPI and its components:

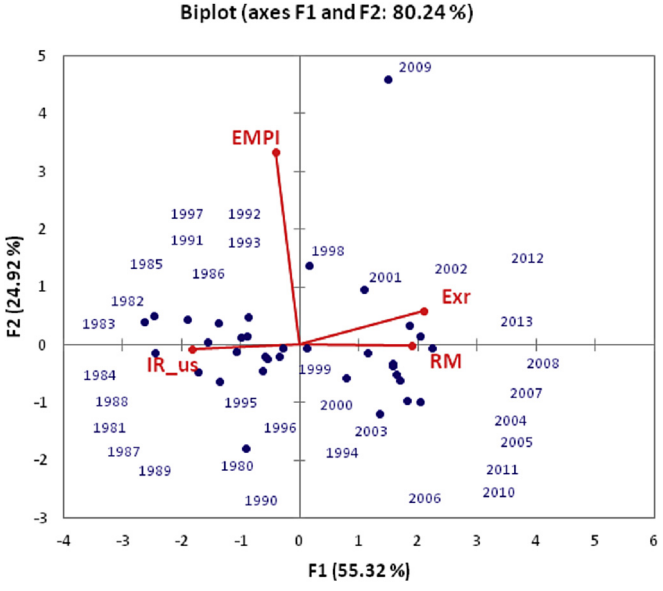
Correlation matrix (Pearson)

Variables	RM	Exr	IR_us	EMPI
RM	**1**	0.7122	−0.4111	−0.1348
Exr	0.7122	**1**	−0.6572	−0.0096
IR_us	−0.4111	−0.6572	**1**	0.1150
EMPI	−0.1348	−0.0096	0.1150	**1**

Correlations between variables and factors:

	F1	F2
RM	0.8321	−0.0050
Exr	0.9228	0.1750
IR_us	−0.7987	−0.0190
EMPI	−0.1756	0.9827





Squared cosines of the variables:

	F1	F2
RM	**0.6924**	0.0000
Exr	**0.8516**	0.0306
IR_us	**0.6380**	0.0004
EMPI	0.0308	**0.9657**

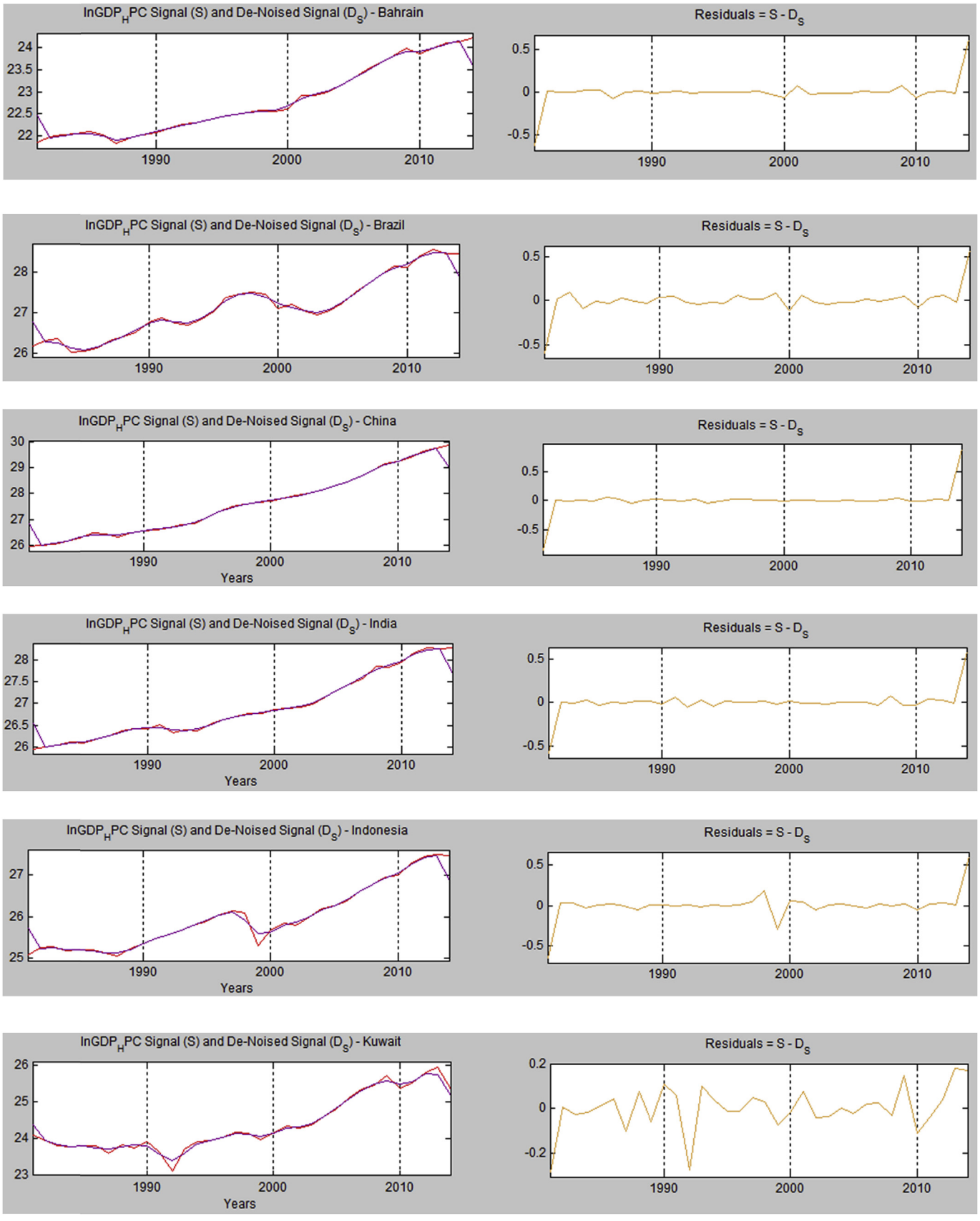
Values in bold correspond for each variable to the factor for which the squared cosine is the largest.

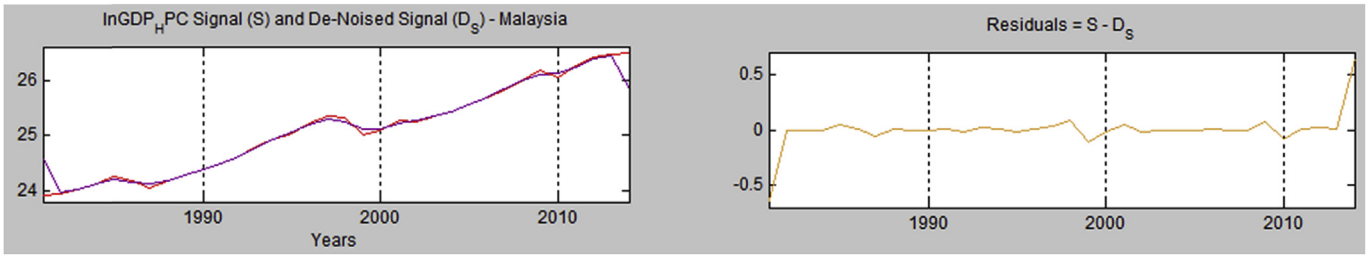
Squared cosines of the observations:

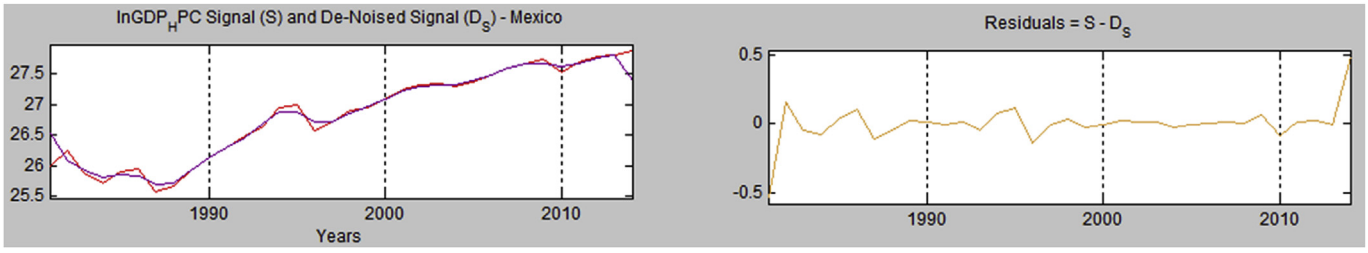
Years	F1	F2
1980	0.1980	**0.7635**
1981	**0.6350**	0.0483
1982	**0.9417**	0.0383
1983	**0.7767**	0.0186
1984	**0.9413**	0.0026
1985	**0.9116**	0.0499
1986	**0.8935**	0.0667
1987	**0.6813**	0.1538
1988	**0.8151**	0.0010
1989	**0.7606**	0.0074
1990	0.2707	0.0316
1991	**0.7213**	0.0119
1992	0.0886	0.0023
1993	0.2688	0.0840
1994	0.1779	0.0535
1995	0.2783	0.1363
1996	0.2574	0.0449
1997	**0.7308**	0.0237
1998	0.0057	**0.4602**
1999	0.0121	0.0039
2000	0.1831	0.0921
2001	**0.4761**	0.3719
2002	**0.6662**	0.0100
2003	**0.4008**	0.3129
2004	**0.6549**	0.0275
2005	**0.8526**	0.1102
2006	**0.6743**	0.0635
2007	**0.5693**	0.0288
2008	**0.9069**	0.0007
2009	0.0946	**0.8924**
2010	**0.7190**	0.2010
2011	**0.7216**	0.1667
2012	**0.8226**	0.0287
2013	**0.9105**	0.0046

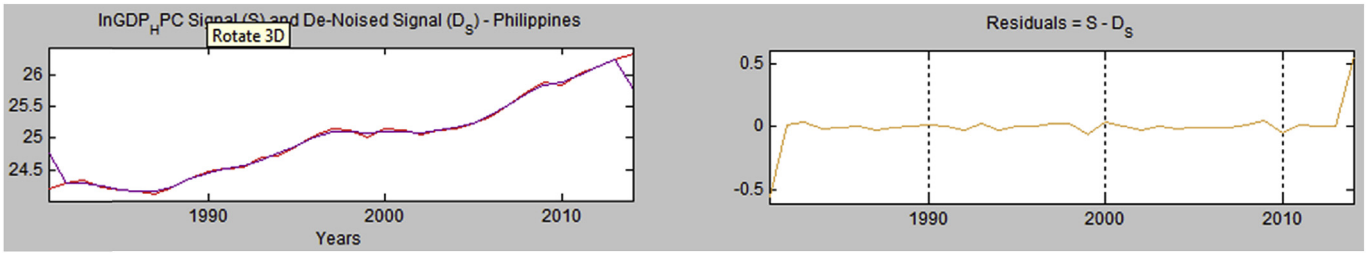
Values in bold correspond for each observation to the factor for which the squared cosine is the largest.

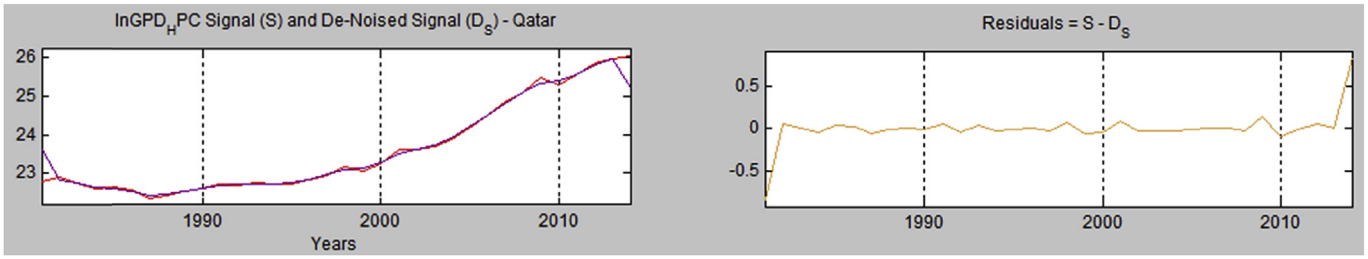
B. Stationary Wavelet Transform Denoising for the lnGDP cyclical component

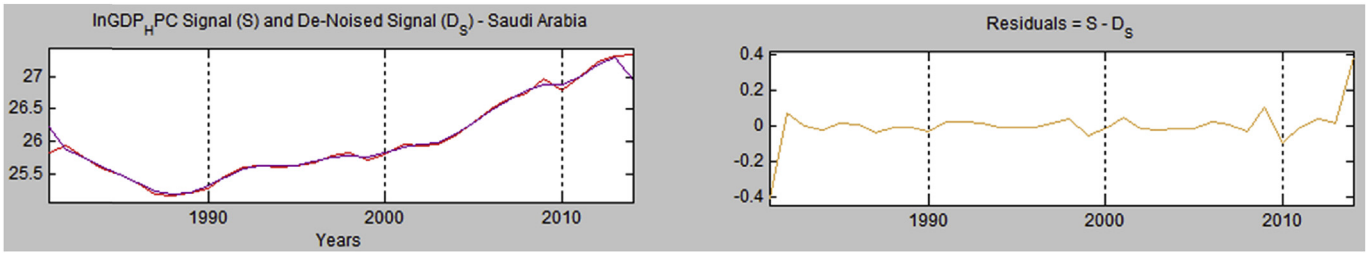


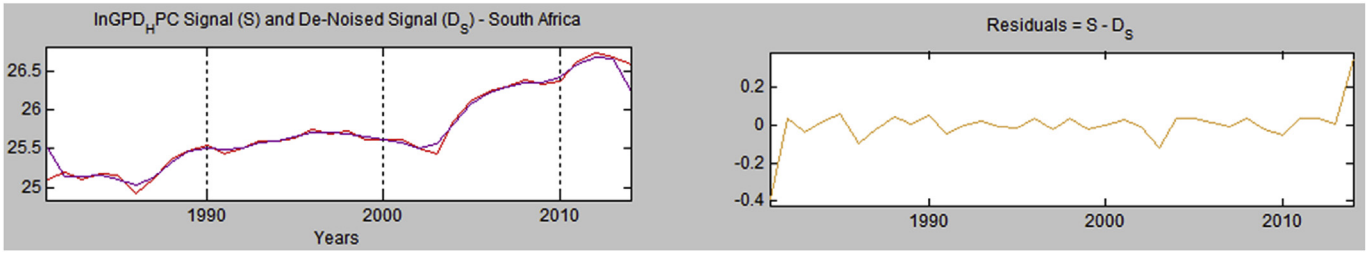

lnGDP_HPC Signal (S) and De-Noised Signal (D_S) - Malaysia
Residuals = S - D_S
Years

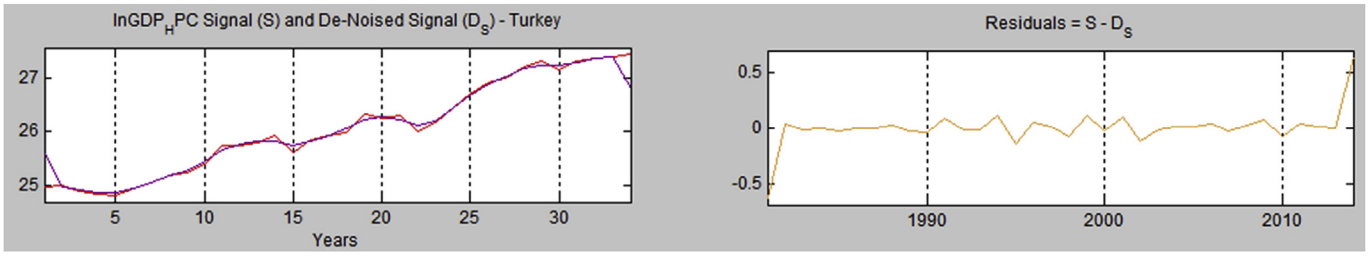

lnGDP_HPC Signal (S) and De-Noised Signal (D_S) - Mexico
Residuals = S - D_S
Years

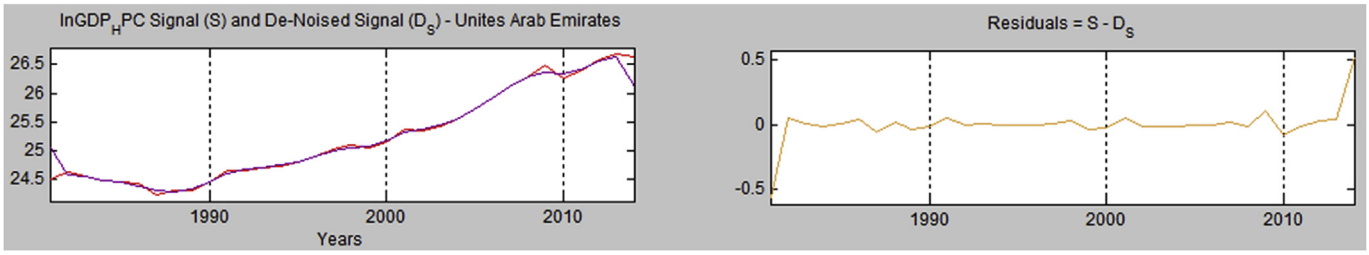

lnGDP_HPC Signal (S) and De-Noised Signal (D_S) - Philippines
Rotate 3D
Residuals = S - D_S
Years


lnGPD_HPC Signal (S) and De-Noised Signal (D_S) - Qatar
Residuals = S - D_S
Years


lnGDP_HPC Signal (S) and De-Noised Signal (D_S) - Saudi Arabia
Residuals = S - D_S
Years


lnGPD_HPC Signal (S) and De-Noised Signal (D_S) - South Africa
Residuals = S - D_S
Years


lnGDP_HPC Signal (S) and De-Noised Signal (D_S) - Turkey
Residuals = S - D_S
Years



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