Financial Stability Comparison between Islamic and Conventional Banks pre and post the 2007 Financial Crisis using the GARCH Models

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Abstract

This study aims to empirically examine and compare the financial stability of Islamic and conventional banks pre and post the 2007 financial crisis, using the daily returns for the period (02/04/1999 to 01/10/2015.). The study covers a sample of fifteen conventional and fifteen Islamic banks. The conditional variance (volatility) of returns was used to measure the stability.

The GARCH, E-GARCH and GJR-GARCH models are used to estimate volatility due to their ability to take into account the leverage effect but depending on the log likelihood results, the E-GARCH is seemed to be the best model that captured the stability of banks followed by the GJR-GARCH. Before performing the analysis a set of preliminary tests are applied :(normality, unit root and ARCH Effects (or Heteroskedasticity) tests).

The results showed that Islamic bank were more stable than conventional banks, which may due to their links with the real economy and to the nature of Islamic banking that works on the basis of risk sharing. The customer and the bank share the risk of any investment on agreed terms, which increases the confidence of investors in these banks. Especially that it does not deal in debt trading or rely on bonds or stocks and distances itself from market speculation. These are prohibited under Islamic Shariah law, unlike most conventional banks. These features make Islamic banks' activities more closely related to the real economy and tend to reduce their contribution to excesses and bubbles.

Keywords: Islamic Banks, Conventional Banks, Financial Stability, Global Financial Crisis, GARCH Models.

الملخص

مقارنة الاستقرار المالي للمصارف الإسلامية والتقليدية قبل وبعد الازمة المالية ل 2007 باستخدام نماذج ال GARCH

هدفت هذه الدراسة لاختبار ومقارنة استقرار المصارف الإسلامية والتقليدية قبل وبعد الأزمة المالية، باستخدام العوائد اليومية للأسهم خلال الفترة الممتدة ما بين (1999/04/02 - 01 /2015/10). وقد شملت عينة الدراسة خمسة عشرة مصرفا اسلاميا وخمسة عشرة مصرفا تقليديا. استخدمت الدراسة التباين المشروط لعوائد الأسهم لإختبار استقرار المصارف ، من خلال تطبيق نماذج عدم ثبات التباين المشروط بالارتباط المتسلسل (أو ما يعرف بنماذج الــــ GARCH) وذلك باستخدام ثلاثة نماذج أساسية وهي: (GJR- GARCH) و(E-GARCH) و(GARCH).

أظهرت نتائج هذه الإختبارات أن المصارف الإسلامية كانت اكثر استقرارا من المصارف التقليدية قبل وبعد الازمة المالية. وقد يرجع تفسير هذا الاستقرار الى ارتباط هذه الاخيرة بالاقتصاد الحقيقي و لطبيعة البنوك الاسلامية التي تعتمد اساسا على مبدأ المشاركة بالربح والخسارة مع زبائنها وابتعادها عن الربا وبيع الديون والتعامل بالسندات والمقامرة بعتبارها أنشطة محرمة شرعا الأمر الذي يعزز ثقة متعامليها فيها وهذا ما يجعل البنوك الاسلامية اكثر ارتباطا بالاقتصاد الحقيقي والذي يجنبها الوقوع في الأزمات المختلفة.

الكلمات الدالة: مصارف إسلامية، مصارف تقليدية ، الإستقرار المالي ، الأزمة المالية، نماذج الــــ (GARCH).

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1. Introduction and Problem

Islamic banking and finance is one of the fastest growing sectors of the global banking industry and has risen to prominence recently through its distinctive characteristics. This industry has gained a significant global exposure and experienced a phenomenal growth in the last three decades. From only US$137 billion of the total assets in 1996, it expanded to reach US$895 billion in 2010 (The Financial Express, 2011) with growth of between 10% and 15% over the last ten years (Ilias, 2010). There are now about 270 Islamic financial institution worldwide, including banks, mutual funds, mortgage companies, and insurance firms. However, Islamic finance is not limited to stakeholders with common religious backgrounds. Britain, as an example, has announced plans to turn London into the world centre of Islamic finance (Ariss, 2010). Islamic banks appeared to operate alongside conventional banks. This was done either through the opening of Islamic windows in conventional institutions or establishing separate banks or branches under the Islamic law that specialized in Islamic financial operations.

Given the complexity of modern financial systems as well as the global trends observed in recent years, financial stability has been associated with multidimensional conditions broadly attached to the well-functioning of financial systems, . Financial stability is also considered as a dynamic concept that allows for further development in the financial system rather than rigidly prevents natural fluctuations and changes. Furthermore, uncertainty and volatility are the main attributes of today’s nations’ economies and a stable banking system is a key ingredient for a healthy and successful economy. Since, the economy health is closely related to the soundness of its banking system, people need to have confidence that the system is safe and stable and performs in the best way. While, banks represent the major players in economies, its stability is a crucial issue that needs more investigation. Particularly that the banking sector suffered from the latest financial crisis which hit its stability and profitability, the same as many other financial institutions.

The 2007 financial crisis as a major macroeconomic phenomenon is considered as an ongoing economic crisis. Many economists stated that it is the worst financial crisis since the Great Depression during the 1930 (Melvin and Taylor, 2009). Avgouleas (2009) declared that this global crisis reached its peak with the catastrophic events of September and October 2008. Because of their losses caused by the financial crisis, many financial institutions mainly banks have been forced to recapitalize; others have gone under, some of them outright and some by being taken over by other, presumably healthier institutions.

Islamic banks were relatively unaffected during the recent financial meltdown. This has raised the possibility that financial institutions, operating on Islamic principles are more stable compared to their conventional counterparts. Moreover, Islamic banks in Reflecting the increased role of Islamic banks, the literature on these banks has grown, but while there has been plenty of research into risk management and risk analyses within Islamic banks, the financial stability has only been addressed from a theoretical viewpoint and treated this issue for the financial system in general, and not on an individual financial institution or a bank itself. So, the objective of this paper is to examine and compare empirically banks’ financial stability pre and post the recent financial crisis by estimating the volatility of returns on banks’ shares using the GARCH, E-GARCH, and GJR-GARCH models.

For this end the researchers seeks to answer the following two main questions: *"Do Islamic banks show a relative financial stability comparing with conventional banks during the recent financial crisis? And is there a statistical significant difference in financial stability between these banks pre and post the recent financial crisis?"*.

This study firstly sets out the theoretical background and previous studies to provide support for the issue under investigation. Secondly, the research design and methodology, finally, the empirical results are presented and discussed.

2. Study Objectives

In order to examine the financial stability of Islamic and conventional banks, the following objectives are addressed and highlighted:

1. To assess the financial stability of Islamic and conventional banks, pre and post the recent financial crisis using the GARCH models.
2. To compare the financial stability of Islamic and conventional banks, pre and post the recent financial crisis and to investigate if there is a significant difference in their stability.
3. To examine the effect of the 2007 financial crisis on Islamic and conventional banks' stability.

3. Theoretical Background

The researchers in this section, discusses some issues that may help for understanding and providing insights, descriptions and some definitions for the study variables and the related issues including banks' stability, Islamic banks and the recent financial crisis.

3.1 Financial Stability

Given the ambiguity, the interdependence associated with defining financial stability,and the complex interactions of different elements of the financial system among themselves and with the real economy, most authors associated the loss of stability with excessive risk, crisis and negative externalities (e.g. Schinasi 2004, Goodhart, 2006 Gadanecz and Jayaram 2009, Pereira da Silva et al., 2012). Hence, to attempt to clearly define what financial insatiability is, one has to look into its driving sources and identify when the financial system is said to lose its stability and function in a way that adversely impacts economic conditions.

Crockett (1997) expresses financial stability as requiring "that the key institutions in the financial system are stable, in that there is a high degree of confidence that they continue to meet their contractual obligations without interruption or outside assistance; and that the key markets are stable, in that participants can confidently transact in them at prices that reflect the fundamental forces and do not vary substantially over short periods when there have been no changes in the fundamentals". Mishkin (1999) states that *"financial instability occurs when shocks to the financial system interfere with information flow so that the financial system can no longer do its job of channeling funds to those with productive investment opportunities"*. Whereas, Davis (2001), defines systemic risk and financial instability as "a heightened risk of a financial crisis", a financial crisis is then described as "a major collapse of the financial system, entailing inability to provide payments services or to allocate credit to productive investment opportunities".

Moreover, Foot (2003), argues that "…we have financial stability where there is: (a) monetary stability; (b) employment levels close to the economy's natural rate; (c) confidence in the operation of the generality of key financial institutions and markets in the economy; and (d) where there are no relative price movements of either real or financial assets within the economy that will undermine (a) or (b)". Chant (2003) defined financial instability as "…conditions in financial markets that harm or threaten to harm an economy's performance through their impact on the working of the financial system". Similarly, Illing and Liu (2003), talk about financial stress in relation to financial stability. This type of stress is a continual variable over time, extreme values of which are known as crises.

Moreover, Schinasi (2004) adds that "A financial system is in a range of stability whenever it is capable of facilitating (rather than impeding) the performance of an economy and of dissipating financial imbalances that arise endogenously or as a result of significant adverse and unanticipated events". However, other researchers argued that financial stability could best be understood by considering its absence, i.e. financial instability. In addition, Allen and Geoffrey (2006) define financial stability as a period where there is an absence of instability: "We define episodes of financial instability as episodes in which a large number of players, whether they are households, companies or governments, subjected to financial crises which are not justified by their previous behavior; and where, collectively, these crises have seriously unfavorable macroeconomic effects." Financial stability, then, is a period during which the probability of an episode of financial instability occurring is very low. The statement considers periods of asset price volatility as evidence of instability.

Aside from the aforementioned division between those defining financial stability and those defining instability, there are additional differences in the definitions that have been reviewed. For instance, Mishkin (1999) is unique in emphasizing the role of asymmetric information in financial crises while Schinasi (2004) stands out in its view of financial stability as a continuum. Foot (2003) also explicitly incorporates monetary stability into his definition of financial stability. However, most definitions agree on the basics, in particular that financial stability is about the absence of system-wide episodes in which the financial system fails to function (crises), and about resilience of financial systems to stress. The fact that there are differences in definitions is not unique to financial stability (Čihák, 2007).

Despite the disagreement in giving a common definition for the financial stability, the identification of risks and vulnerabilities of banking systems is necessary, because the monitoring of financial stability must be forward looking for example: inefficiencies in the allocation of capital or shortcomings in the pricing and management of risk can, if they lay the foundations for vulnerabilities, compromise future financial system stability and therefore economic stability.

3.2 The Theory of Islamic Banking

In the following section the researcher provides the main issues related to Islamic banks:

3.2.1 What is Islamic Banking?

Islamic banking refers to a system of banking or banking activity which is consistent with Islamic law and guided by Islamic economics. In particular, Islamic law prohibits the collection and payment of interest, also commonly called Riba in Islamic literature. Instead, Profit-Loss-Sharing arrangements (PLS) or purchase and resale of goods and services form the basis of contracts. In PLS modes, the rate of return on financial assets is not known or fixed prior to undertaking the transaction. Islamic law also generally prohibits trading in financial risk (which is seen as a form of gambling) and investing in businesses that are considered unethical such as businesses that make tobacco, alcohol or produce non-Islamic media. (Cihak & Hesse 2008).

Definitions of Islamic banking range from the very narrow (interest-free banking) to the very broad (financial operations conducted by Muslims). A useful definition is the following: Islamic financial institutions are those that are based, in their objectives and operations, on Islamic law (the Shariah). They are thus set apart from “conventional” institutions, which have no such preoccupations (Warde, 2010, p:7).

Al-Jarhi and Iqbal (2001) identify an Islamic bank as a deposit-taking banking institution whose scope of activities includes all currently known banking activities, excluding borrowing and lending on the basis of interest. On the liabilities side, it mobilizes funds on the basis of a Mudarabah or Wakalah (agent) contract. It can also accept demand deposits which are treated as interest-free loans from the clients to the bank and which are guaranteed. On the assets side, it advances funds on a profit-and–loss sharing or a debt-creating basis, in accordance with the principles of the Shariah.

3.2.2 Differences between Islamic Conventional Banks:

In this section, a brief comparison between the Islamic and conventional banks is highlighted. The main differences between the conventional and Islamic banks are listed in table (1) below:

Table (1): Main Differences between the Conventional and Islamic Banks

	Islamic Bank	**Conventional Bank**
Main Principle	The customer shares the profit and loss with the bank. High degree of risk with variable returns.	The customer obtains fixed interest from the banks and does not share the loss.
Liabilities (sources of funds)	External funds, savings of clients, Islamic charitable sources.	External funds, savings of clients.
Assets (mode of financing)	Islamic financial instruments.	Interest based.
Financing the poorest	Poorest can be included by integrating zakah	Poorest are left out.
Stability	Higher degree of stability.	Lower degree of stability.
Treatment of interest	Uses Profit and Loss Structure (PLS) accounts. Interest is prohibited.	Interest based on products.

Profitability	PLS is based on partnership (*Musharaka*) or joint Investment without participation in management (*Mudaraba*).Based markup principle. Leasing contrast (*ijara*).	Higher concentration leads to higher interest rates which lead to higher profitability.Higher rates of inflation lead to higher profit margins.

Source: (Smolo and Ismail, 2010; AL-Rifaee, 2008; Abd Rahman, 2007).

3.3 Literature Review

Since, banks' profitability has been a popular research topic for several decades; banks' stability represented also an important area for research mainly with the aggravation of the recent financial crisis's effects. Therefore, the literatures that have treated these issues are presented in the following:

Hesse and Čihák (2007) "Cooperative Banks and Financial Stability" The researchers in this study explicitly (and empirically) dealt with the issue of banks' stability, by analyzing the role of cooperative banks in financial stability using the z-score method. Two related issues were examined: First, cooperative banks' soundness and resilience to stress. Where, the researchers tested the hypothesis that cooperative banks are relatively weaker in responding to stress because of the features of their business model. Second, cooperative banks' impact on other banks where the researchers tested the hypothesis, that the presence of cooperative banks reduces the stability of other banks. Data on 16,577 banks from 1994 to 2004, comprising 11,090 commercial banks, 3,072 cooperative banks, and 2,415 savings banks was used, from 29 major advanced economies and emerging markets that are members of the Organization for Economic Cooperation and Development. The main findings of this study were first, cooperative banks were more stable than commercial banks. Second, in systems with a high presence of cooperative banks, weak commercial banks were less stable than they would be otherwise.

Čihák and Hesse (2008) "Islamic Banks and Financial Stability: An Empirical Analysis" The researchers argued that this work was the first one that provided a cross-country empirical analysis of the role of Islamic banks in financial stability. The researchers analyzed the financial stability of 77 Islamic banks, and 397 commercial banks, the sample covered banks in the following jurisdictions (Bahrain, Bangladesh, Brunei, Egypt, Gambia, Indonesia, Iran, Jordan, Kuwait, Lebanon, Malaysia, Mauritania, Pakistan, Qatar, Saudi Arabia, Sudan, Tunisia, United Arab Emirates, West Bank and Gaza, and Yemen). The main part of the researchers' approach was to test, using regressions of z-scores as a function of a number of variables, whether Islamic banks are less or more stable than commercial banks. Finally, the researchers found that (1) small Islamic banks (with assets under US$ 1 billion) were financially more solid than conventional banks of the same size; (2) large Islamic banks were less solid than conventional banks of the same size; and (3) small Islamic banks are financially more solid than large Islamic banks.

Boumediene and Caby (2009) "The Stability of Islamic Banks during the Subprime Crisis" The researchers in this paper examined the stability of Islamic banks during the subprime crisis, and empirically observed the specific nature of their risks at the time of the 2007 banking crisis. The study used a sample of fourteen Islamic banks and fourteen conventional banks; furthermore, the

E-GARCH and GJR-GARCH asymmetric models were used to estimate volatility of stock returns.The results implied that Islamic banks were at least partially immune to the subprime crisis, and that these banks were not subjected to the same risks as conventional banks. But the researchers indicated that this result did not mean that Islamic banks are exempt from risk, and prudential management methods suited to conventional banks may not be applied to them indiscriminately. Finally, the researchers recommended that the risks specific to Islamic banks should therefore be characterized and risk management tools be developed accordingly.

3.4 Research Hypotheses

Based on the theoretical framework and previous studies, aiming for achieving the study objectives, the researcher tries to answer the following two main questions:
Do conventional banks show a significant stability during the recent financial crisis in comparison with the Islamic banks? To answer this main question the following alternative hypotheses are developed and tested:
$\mathbf{H_1}$: There is a significant statistical difference in the Stability of Islamic and conventional banks before the crisis.
$\mathbf{H_2}$: There is a significant statistical difference in the Stability of Islamic and conventional banks after the crisis.
$\mathbf{H_3}$: There is a significant statistical difference in the Stability of Islamic banks before and during the crisis.
$\mathbf{H_4}$: There is a significant statistical difference in the Stability of conventional banks before and during the crisis.

4. Research Methodology

The methodology of this research includes: an illustration of the study sample, the econometrics techniques that are used, and finally, a brief explanation the operational definitions of the research variables.

4.1 Data and Sample

The data used in this paper comprises a representative sample of banks operating in different countries. The sample used to assess the stability of banks pre and post the recent financial crisis is consisting of 15 Islamic (Abu Dhabi Islamic Bank (UAE), Al Rajhi Bank (Saudi Arabia), Al Arafa Bank(Bangladesh), Bahrain Islamic Bank (Bahrain), Bank Aljazira (Saudi Arabia), Dubai Islamic Bank (UAE), Faisal Islamic Bank of Egypt (Egypt), Islami Bank Bangladesh (Bangladesh), Islamic Bank of Britain (UK), Islamic International Arab Bank (Jordan), Kuwait Finance House (Kuwait), Meezan Bank (Pakistan), Qatar Intl.Islamic Bank (Qatar), Qatar Islamic Bank (Qatar), Sharjah Islamic Bank (UAE)), and 15 conventional banks (Ahli United Bank Egypt (Egypt), Arab Bank (Jordan), Bank Of Kw.& The Mde. (Kuwait),Bank Of Sharjah (Uae), Burgan Bank (Kuwait), Commercial Bank Intl (UAE) Commercial Bk.of Kuwait (Kuwait), Coml.Intl.Bank (Egypt), Dutch Bangla Bank (Bangladesh), Eastern Bank (Bangladesh), Gulf Bank of Kuwait (Kuwait), Mashreq Bank (UAE), National Bank of Bahrain (Bahrain), Natwest (UK), Nib Bank (Pakistan)) , over the periods of 02/04/1999to 01/10/2015.

Various banks' daily share prices were gathered via DataStream (http1, http2). The number of observations and the periods in which they were made are summarized in table (2).

Table (2): Number of Daily Observations, Start and End Dates

Name of index	Start date	End date	No. of observations
CBRA: Conventional Banks Return Ante	02/04/1999	17/07/2007	2163
CBRP: Conventional Banks Return Post	18/07/2007	01/10/2015	2163
IBRA: Islamic Banks Return Ante	02/04/1999	17/07/2007	2163
IBRP: Islamic Banks Return Post	18/07/2007	01/10/2015	2163

Note: Ante – before the crisis; post – during the crisis.

4.2 Measuring Stability

The stability of banks is measured by the volatility of their returns on shares quoted on stock markets and banks websites. The GARCH method (*Generalized Autoregressive Conditional Heteroskedasticity*) is used to estimate this volatility. This research uses a symmetric GARCH model and examines the asymmetric reactions of the conditional mean and volatility by using the GARCH, E−GARCH and GJR-GARCH.

The stocks' returns used to investigate banks stability are calculated using the following formula: **(**Boumedien and Caby, 2009).

$$\mathbf{Rt = ln\ (Pt / Pt\text{-}1)} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad \mathbf{(1)}$$

Where, *Pt* and *Pt-1* are the daily closing prices of the stocks index at time *t* and *t-1*.

Let y_t equal the return on a share or portfolio between t-1 and t; and let F_{t-1} be the information held by investors at t-1. In this case, the best estimate of the value of the return and its volatility is the expected value of y_t for a given value of F_{t-1}; and the variance of y_t for a given value of F_{t-1}. These are respectively denoted: $m_t = E\ (y_t\ /F_{t-1})$ and $h_t = Var\ (y_t\ /F_{t-1})$. Therefore, the unexpected return is $\varepsilon_t \equiv y_t - m_t$ (Engle and Ng, 1993). The value of ε_t is a measure of the impact of information between t-1 and t. A negative (positive) value means that the information was bad (good) news. The size of the difference between y_t and m_t gives an idea of the significance of the news between t-1 and t (Engle and Ng, 1993).

ARCH models were introduced by Engle (1982) and generalized as GARCH (Generalized ARCH) by Bollerslev (1986). Therefore it became the bedrock of the dynamic volatility models .These models are widely used in various branches of econometrics, especially in financial time series analysis. In the original formulation of the ARCH model proposed by Engle (1982) the variance is forecasted as a moving average of past error terms:

$$\mathbf{h_t = \omega + \sum_{i=1}^{p} \alpha_i\, \varepsilon_{t-i}^2} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad \mathbf{(2)}$$

Where α and ω are constant parameters, p is the order of the moving average ARCH terms. The model for one period is:

$$\mathbf{h_t = \omega + \alpha\varepsilon_{t-1}^2} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad \mathbf{(3)}$$

First, the mean, ω. Second, news about volatility from the previous periods are measured by the *lag* of the squared residuals from the mean equation, ε_{t-1} the (ARCH term). α, Shows the impact of current news on the conditional variance.

The Symmetric GARCH Model.

Bollerslev (1986) suggested the following natural generalization of the ARCH model by modeling conditional variance as a function of the residual "ε_t" and of the volatility of past periods, using the following GARCH (p, q) formula:

$$\boldsymbol{h_t = \omega + \sum_{i=1}^{p} \alpha_i \, \varepsilon_{t-i}^2 + \sum_{i=1}^{q} \beta_i \; h_{t-i}} \quad \text{(4)}$$

Where, q is the order of the autoregressive GARCH terms and p is the order of the moving average ARCH terms.

Accordingly, the GARCH (1, 1) model for one period can be summarized as follows:

$$\mathbf{h_t = \omega + \alpha\varepsilon_{t-1}^2 + \beta h_{t-1}} \quad \text{(5)}$$

In this model, the conditional variance is a function of three terms:

First, the mean:"ω". Second, news about volatility from the previous periods are measured by the *lag* of the squared residuals from the mean equation, "ε_{t-1}" the (ARCH term). "h_{t-1} " represents the GARCH term)." α", Shows the impact of current news on the conditional variance." β", the persistence of volatility to a shock or alternatively the impact of “old” news on volatility.

The Exponential GARCH (E-GARCH) Model

The E-GARCH or Exponential GARCH model was proposed by Nelson (1991). The γ parameter measures the asymmetry or the leverage effect, the parameter of importance so that the E-GARCH model allows for testing of asymmetries. In other words, the existence of the asymmetry effect is presumed if the result of testing null hypothesis, H_0: $\gamma = 0$ comes to $\gamma \neq 0$, especially in case of $\gamma < 0$, the leverage effect is considered to be existent as well. When $\gamma < 0$, then positive shocks (good news) generate less volatility than negative shocks (bad news).When $\gamma > 0$, it implies that positive innovations are more destabilizing than negative innovations (in this study bad news represent the financial crisis). The specification for the conditional variance of E-GARCH (1, 1) is:

$$\mathbf{Log\ h_t = \omega + \alpha g(z_{t-1}) + \beta log(\ h_{t-1})} \quad \text{(6a)}$$

$$\mathbf{g(z_{t-1}) = \theta z_{t-1} + \gamma[|z_{t-1}| - E|z_{t-1}|]} \quad \text{(6b)}$$

$$\mathbf{z_{t-1} = \frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}}}} \quad \text{(6c)}$$

$$\boldsymbol{E|z_{t-1}| = \sqrt{\frac{2}{\pi}}\ if\ z_t \sim N(0,1)}$$

The preceding equation for E-GARCH (p, q) can be summarized as follows:

$$\boldsymbol{\text{Log}\ h_t = \omega + \sum_{j=1}^{q} \beta_j \log(\ h_{t-j}) + \sum_{i=1}^{q} \alpha_i \left| \frac{\varepsilon_{t-i}}{\sqrt{h_t}} - \sqrt{\frac{2}{\pi}} \right| + \sum_{k=1}^{r} \gamma_k \frac{\varepsilon_{t-k}}{\sqrt{h_t}}} \quad \text{(6d)}$$

Note that the left-hand side is the log of the conditional variance. This implies that the leverage effect is exponential, rather than quadratic, and that forecasts of the conditional variance are guaranteed to be nonnegative.

The E-GARCH (1, 1) model for one period can be summarized as follows:

$$\mathbf{Log}\ \boldsymbol{h_t = \omega + \beta \log(h_{t-1}) + \alpha \left| \frac{\varepsilon_{t-1}}{\sqrt{h_t}} - \sqrt{\frac{2}{\pi}} \right| + \gamma \frac{\varepsilon_{t-1}}{\sqrt{h_t}}} \quad \ldots\ldots\ldots.\ (6e)$$

(Nelson, 1991)

Where ω, α, γ, θ and β are constant parameters.

GJR-GARCH (TARCH)

TARCH or Threshold ARCH and Threshold GARCH were introduced independently by Glosten, Jaganathan, and Runkle (1993). The generalized specification for the conditional variance is given by:

In this model good news ($\varepsilon_{t-1} > 0$) and bad news ($\varepsilon_{t-1} < 0$), have differential effects on the conditional variance; good news have an impact of α_i , while bad news has an impact of $\alpha_i + \gamma_i$. If $\gamma_i > 0$, bad news increase volatility, and it stated that there is a leverage effect for the *i-th* order. If $\gamma_i \neq 0$, the news impact is asymmetric.

$$\boldsymbol{h_t = \omega + \sum_{i=1}^{p} \alpha_i\, \varepsilon_{t-i}^2 + \sum_{i=1}^{p} \beta_i\, h_{t-i} + \sum_{k=1}^{r} \gamma_k\, S_{t-k}^{-}\, \varepsilon_{t-k}^2} \ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ (7)$$

(Glosten, Jaganathan, and Runkle, 1993)

The GJR-GARCH model for one period (GJR-GARCH (1, 1)) can be shown as follows:

$$\boldsymbol{h_t = \omega + \alpha\varepsilon_{t-1}^2 + \beta h_{t-1} + \gamma S_{t-1}^{-}\, \varepsilon_{t-1}^2} \ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ (8)$$

(Glosten, Jaganathan, and Runkle, 1993)

Where S_t^-=1 if $\varepsilon_t < 0$, S_t^-=0 elsewhere ω, α, γ and β are constant parameters.

In this study the researcher used GARCH (1.1), E-GARCH (1.1) and GJR-GARCH (1.1). In other words, volatility depends on the residual (of information) from a single past period.

4.3 Methods of Analyses

The study conducts several tests and statistical analyses to investigate the stability of Islamic and conventional banks:

First, the study calculates the stock returns, of Islamic as well as conventional banks.

Second, the study displays a descriptive statistics of the used variables by calculating: Means, Medians, Maximums, Minimums, Standard deviations, Skewness, and Kurtosis. The study tests the normality using the Jarque-Bera test. In addition the Wilcoxon test is used to test the hypotheses relating to the stability of banks rather than the T-test.

4.4 Statistical Techniques

Before performing the analyses, some statistical techniques should be applied to ensure the validity and the suitability of the used data and models:

4.4.1 Unit Root Test

The *unit root* test examines the stationarity of the data, the data series is stationary if its mean and variance are constant over time and the value of the covariance between the two time periods depends only on the distance or lags between the two time periods (Gujarati and porter, 2010).To single time series the early work that used the *unit root* is backed to (Dickey and Fuller, 1979). To test the stationarity of the data the *E-views software* can be used by simply choosing a unit root test, if the DF is employed, the results gives two values: computed DF and critical or tabulated DF values. If the computed DF values exceed the critical or tabulated values, then the null hypothesis that the variable has a unit root (nonstationary) must be accepted. However, if the computed DF values are less than the critical or tabulated values, then the null hypothesis must be rejected, and the variable will be stationary (Franses, 1998).

4.4.2 Autocorrelation and the ARCH Effect Tests (or Heteroskedasticity Tests)

The term *Autocorrelation* may be defined as "correlation between members of series of observations ordered in time [as in time series data] or space [as in cross-sectional data. In the regression context, the classical linear regression model assumes that such autocorrelation does not exist in the disturbances u_i Symbolically, $E\ (u_i u_j) \neq 0,\ i \neq j$. Where, the expected values of the product of two different error terms $u_i u_j$ which represent the covariance of $u_i u_j$don't equal to zero (Guajarati, 2004).

Guajarati added that the absence of autocorrelation is from the most important LS assumptions because its presence leads to:

1. The coefficients are not efficient, that is they do not have minimum variance.
2. The *F* and *T* tests are not generally reliable.
3. The computed R^2 may be an unreliable measure of true R^2.

Box-Pierce/Ljung-Box Q-statistics

Statistical tests on the residuals include the Ljung- Box statistic, and plots, such as the autocorrelation and partial correlation of the residuals see Brooks (2001) and Franses and Ghijsels (1999). The null hypothesis is that no serial correlation exists and the hypothesis is accepted when the p-values are high. If there is no serial correlation in the residuals, the autocorrelations and partial autocorrelations at all lags should be nearly zero, and all Q-statistics should be insignificant with large p-values (Fidan, 2006). If the variance and the mean equations are correctly specified, all Q-statistics should not be significant.

Autocorrelation LM Test

ARCH test is a Lagrange Multiplier (LM) test for autoregressive conditional heteroskedasticity (ARCH) in the residuals (Engle 1982).

This test is an alternative to the Q-statistics for testing serial and autocorrelation. The test belongs to the class of asymptotic (large sample) tests known as Breusch-Godfrey Lagrange multiplier test for general Lagrange multiplier (LM) tests. The ARCH LM test statistic is computed from an auxiliary test regression.

4.4.3 Normality Tests

To test the normality of the data distributions the researcher uses the following statistical techniques:

Skewness and Kurtosis:

Skewness is a measure of symmetry, or more precisely, the lack of symmetry. A distribution, or data set, is symmetric if it looks the same to the left and right of the center point.

Kurtosis is a measure of whether the data are peaked or flat relative to a normal distribution. That is, data sets with high kurtosis tend to have a distinct peak near the mean, decline rather rapidly, and have heavy tails. Data sets with low kurtosis tend to have a flat top near the mean rather than a sharp peak. Kurtosis with values of K less than 3 are called platykurtic (fat or short-tailed), and those with values greater than 3 are called leptokurtic (slim or long tailed). a kurtosis value of 3 is known as mesokurtic, of which the normal distribution is the prime example. For a normal distribution skewness = 0 and kurtosis = 3; that is, a normal distribution is symmetric and mesokurtic.

Jarque-Bera (JB)

Jarque-Bera (JB) is a test statistic for testing whether the series is normally distributed. The test statistic measures the difference of the skewness and kurtosis of the series with those from the normal distribution. Under the null hypothesis of a normal distribution, the JB statistic is distributed as x^2 with 2 degrees of freedom (Guajarati, 2004).

5. Empirical Findings and Analyses

This section starts by reviewing a preliminary analysis that confronts the following issues first; the study variables' descriptive statistics are presented, second, the stationarity tests using a unit root tests are performed. Third, an ARCH effect (heteroskedasticity) test is performed. Fourth, the autocorrelation is tested for the GARCH models. Finally, the results of the estimated models are analyzed.

5.1 Banks' Stability

In this section the stability of Islamic and conventional banks, pre and post the recent financial crisis is analyzed.

5.1.1 Descriptive Statistics

To examine the distributional properties of the daily stock returns for Islamic and conventional banks before pre and post the financial crisis, various descriptive statistics are calculated and reported in table (3). These descriptive statistics include mean, standard deviation, Skewness, and kurtosis as well as Jarque-Bera statistics for normality test.

Before the crisis, the Islamic banks returns' mean (0.0003) is lower than the one for conventional banks (1.0033). Whereas, during the crisis the value of the mean returns increases for Islamic banks to (0.0008). While, it decreases to (-5.84E-05) for conventional banks at the same period.

The standard deviation for all the period is 0.0511 and 0.0157 for conventional and Islamic banks respectively. The standard deviation for conventional banks drops to 0.0274 during the financial crisis while its value is relatively persistent for Islamic banks.

The high values of Jarque-Bera test for normality decisively rejects the hypothesis of a normal distribution at 1% significance level. Further evidence of the nature of deviation from normality may be gleaned from the sample Skewness and kurtosis measures:

The returns for both indices of the two types of banks are negatively skewed post the crisis. The null hypothesis for Skewness coefficients that conform to a normal distribution's value of zero has been rejected at 5 percent significance level for both types of banks and at all periods. This indicates that the distributions have a long left tails and thicker lower tails. Moreover, Elyasiani, Getmansky and Mansur (2010) argued that the negative Skewness is an indication that extreme negative returns are more likely than sharp positive returns. This suggests a high level of risk for the investors.

The returns for both types of banks indices also display excess kurtosis (kurtosis higher than 3), the high value of kurtosis indicates that the null hypothesis for kurtosis coefficients that conform to the normal value of three is rejected. As a result, the distributions are somewhat sharp with thicker tails than a normal distribution; in addition coefficients of kurtosis are all significant referring that stock market return volatility exist in all exchanges. Therefore, it can be concluded that both types of banks return series are said to follow *leptokurtic* distributions.

Table (3): Descriptive Statistics of Stock Returns

	Conventional banks			**Islamic banks**		
	All the period	Ante crisis	Post crisis	All the period	Ante crisis	Post crisis
Mean	0.0010	1.0033	-5.84E-05	0.0006	0.0003	0.0008
Std. Dev.	0.0511	0.1092	0.0274	0.0157	0.0152	0.0162
Skewness	4.6993	18.946	-12.727	0.4939	-0.0088	0.9027
Kurtosis	441.844	448.215	258.902	5.4285	4.8531	5.772
Jarque-Bera	983434	5091150	1686423	350.844	87.58155	279.165
Observations	1225	612	612	1225	612	612

Before using the GARCH models to perform analysis, rigorous statistical hypotheses testing should be applied to validate the models' assumptions concerning GARCH models' specifications. The diagnosis checks verify the statistical significance and assumptions of the parameters in the GARCH models and its residuals.

5.1.2 Unit Root Test Results

In order to avoid spurious conclusions due to model misspecification, the Dickey-Fuller (DF) stationarity test is performed to identify whether the time series of banks' returns are stationary, and the following null hypothesis (H_0: there is a unit root) is tested the number of lags is equal to zero. The findings reported in table (4) indicate that the null hypotheses concerning the existence of the unit root (non stationarity) is rejected at 1% level (the DF absolute computed values are greater than the absolute critical values) which means that all returns series are considered to be ***stationary*** for both types of banks covering all the study periods. That allows for applying the ARCH and GARCH methods.

Table (4): Unit Root Test Results

	Conventional banks			Islamic banks		
	All the period	Ante crisis	Post crisis	All the period	Ante crisis	Post crisis
Dickey-Fuller	-27.38	-30.77	-26.23	-36.28	-26.10	-25.19
T-statistic	-3.43	-3.44	-3.44	-3.43	-3.44	-3.44
Probability	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
Decision	Reject H_0	Reject H_0	Reject H_0	Reject H_0	Reject H_0	Reject H_0

***Significant at 1% level

5.1.3 Tests of ARCH Effects (or Heteroskedasticity Tests)

For testing the validation of GARCH models, different tests are performed to investigate the present of the autocorrelation and to see then if the autocorrelation in the squared return has successfully been removed after the estimation. Box Pierce, Ljung Box Q-test in the validation part is to examine autocorrelations and partial autocorrelations of the squared standardized residuals by testing the null hypotheses:

$\boldsymbol{H_0}$**:** There is no autocorrelation **(**E $(u_i u_j) \neq 0,\ i \neq j$).

The test is made on the squared standardized residuals with 12 lag to test for remaining ARCH in the variance equation, and to check the specification of the variance equation. If the variance equation is correctly specified, all Q-statistics should not be significant.

The Q^2 and Q statistics (Box Pierce, Ljung Box) and Lagrange Multiplier (LM) tests are used for testing the serial correlation on the ε_t^2. The findings in table (05) indicate the presence of ARCH processes in the conditional variance for both Islamic and conventional banks approximately during the three periods of the study (all the study period, before the crisis, and after the crisis). Most returns show signs of heteroskedasticity in sample, indicating the legitimacy of using ARCH/GARCH type models.

Table (5): ARCH Effects (or Heteroskedasticity) Tests

	Conventional banks			Islamic banks		
	All the period	Ante crisis	Post Crisis	All the period	Ante crisis	Post crisis
Q^2(12)	275.592 (0.000)***	3.020 (0.995)	5.529 (0.949)	85.985 (0.000)***	46.39 (0.000)***	49.658 (0.000)***
Q (12)	215.00 (0.000)***	31.535 (0.002)***	5.1066 (0.995)	23.25 (0.026)***	26.124 (0.010)***	13.733 (0.318)
LM(12)	27.98 (0.000)***	2.754 (0.001)***	30440.78 (0.000)***	2.069 (0.016)***	2.227 (0.009)**	1.320 (0.202)

"***", "**"mean that the coefficients are significant at 1% and 5 % respectively.

Note: The values in parentheses indicate the probability.

5.1.4 Test for the ARCH Effect after Estimation

All the models seem to do well in describing the dynamic of the first two moments of the series as shown by the Box-Pierce statistics for the squared and the standardized residuals which are all non-significant at 5% level (table 6).

LM test for the presence of ARCH effects at 12 lags, indicates that the conditional heteroskedasticity that existed when the test was performed on the pure return series for banks (see table 6), is successfully removed for the three models GARCH, E-GARCH and GJR-GARCH since LM statistics are all non-significant at 5% level using the Gaussian distribution. Therefore, it can be concluded that the variance and the mean equations are correctly specified and the used GARCH models are suitable for the used data.

Table (6): ARCH Effect (Heteroskedasticity) After Estimation

	Conventional Banks			Islamic Banks		
	GARCH	**E-GARCH**	**GJR-GARCH**	**GARCH**	**E-GARCH**	**GJR-GARCH**
Q^2(12)	0.2290 (1.000)	5.225 (0.950)	0.1524 (1.000)	5.7019 (0.930)	7.3867 (0.831)	6.269 (0.902)
Q(12)	20.32 (0.061)	5.8418 (0.120)	2.04 (0. 27)	19.154 (0.085)	19.598 (0.075)	19.148 (0.085)
LM(12)	0.01860 (1.000)	0.3990 (0.964)	0.0183 (1.000)	0.4678 (0.933)	0.6097 (0.8354)	0.5145 (0.906)

*The values in parentheses indicate the probability.

5.1.5 Estimation of GARCH, E-GARHC and GJR-GARCH Parameters

The researcher in this section uses the banks' returns of shares to estimate the parameters of the GARCH, E-GARCH and GJR-GARCH models employing the FIML (Full Information Maximum Likelihood) method, which estimates the likelihood function under the assumption that the contemporaneous errors have a joint normal distribution. Provided that the likelihood function is correctly specified, FIML is fully efficient. The results of estimates are presented in table (7).

Table (7): Results of GARCH, E-GARCH, and GJR-GARCH Estimates

Islamic Banks
GARCH (1,1) before the crisis $h_t = 1.00\text{E}-05 + 0.045734\,\varepsilon_{t-1}^2 + 0.903924\,h_{t-1}$ (2.750496)**** (3.451670)*** (45.12518)*** Log L 1715.850

GARCH (1,1) during the crisis

$$h_t = 2.65\text{E}-05 + 0.209246\ \varepsilon_{t-1}^2 + 0.712960\ h_{t-1}$$

(4.5192)*** (6.3471)*** (17.006)***

Log L 1685.370

E-GARCH (1,1) before the crisis

Log h_t=-0.361907+ 0.050257log (h_{t-1}) -0.047421$\left|\frac{\epsilon_{t-1}}{\delta_{t-1}}\right|$ + 0.961563 $\frac{\epsilon_{t-1}}{\delta_{t-1}}$

(-3.4083)*** (2.4032) *** (-2.605912)*** (77.31491)***

Log L 1719.735

E-GARCH (1,1) during the crisis

Log h_t= -1.775887+ 0.399055log (h_{t-1})+ 0.015727$\left|\frac{\epsilon_{t-1}}{\delta_{t-1}}\right|$+0.819345 $\frac{\epsilon_{t-1}}{\delta_{t-1}}$

(-6.5739)*** (9.6025)*** (0.6464)** (26.6364)**

Log L 1688.224

GJR-GARCH (1,1) before the crisis:

$$h_t = 1.30\text{E}-05 + 0.005844\ \varepsilon_{t-1}^2 + 0.071220 h_{t-1} - 0.895086\ S_{t-1}^{-}\ \varepsilon_{t-1}^2$$

(2.602868)*** (0.7401)*** (0.0199)** (0.0000)***

Log L 1719.647

GJR-GARCH (1,1) during the crisis:

$$h_t = 2.65\text{E}-05 + 0.202812\ \varepsilon_{t-1}^2 + 0.013730 h_{t-1} - 0.713233\ S_{t-1}^{-}\ \varepsilon_{t-1}^2$$

(4.5330)*** (5.6452)*** (0.3387) (17.0520)***

Log L 1685.400

Conventional banks

GARCH (1,1) before the crisis

$$h_t = 0.014037 + 0.027559\ \varepsilon_{t-1}^2 + -0.123383\ h_{t-1}$$

(6.2932)*** (10.4787)*** (8.1980)***

Log L 501.1915

GARCH (1,1) during the crisis

$$h_t = 0.000145 + 1.343645\ \varepsilon_{t-1}^2 + 0.028609\ h_{t-1}$$

(11.5548)*** (28.34427)*** (1.184683)

Log L 1588.206

E-GARCH (1,1) before the crisis

Log h_t= -4.525758 - 0.434885log (h_{t-1}) + 0.559626$\left|\frac{\epsilon_{t-1}}{\delta_{t-1}}\right|$ + 0.019792 $\frac{\epsilon_{t-1}}{\delta_{t-1}}$

(-4.1584)*** (-6.7880)*** (8.6608)*** (0.0913)

Log L 543.4233

E-GARCH (1,1) during the crisis

Log h_t=-7.041757+ 1.108109log (h_{t-1}) + 0.471912$\left|\frac{\epsilon_{t-1}}{\delta_{t-1}}\right|$ - 0.221147$\frac{\epsilon_{t-1}}{\delta_{t-1}}$

(-13.510)*** (24.8976) *** (10.0651)*** (3.5006)***

Log L 1617.940

GJR-GARCH (1,1) before the crisis

$$h_t = 0.007616 + 0.010031\varepsilon^2_{t-1} - 0.075779h_{t-1} + 0.592995\, S^-_{t-1}\,\varepsilon^2_{t-1}$$

(1.0177) (1.7023)* (-2.4640)*** (1.4787) ***

Log L 471.1892

GJR-GARCH (1,1) during the crisis

$$h_t = 0.000165 - 06 + 1.769974\varepsilon^2_{t-1} - 1.433183\, h_{t-1} + 0.001626S^-_{t-1}\,\varepsilon^2_{t-1}$$

(16.18417)*** (24.46424) *** (-12.69508)*** (-37.5391)***

Log L 1615.740

Notes: - Z-values are reported in parentheses, Log L = Log Likelihood.
- "*", "**", "***" indicate the significance of the estimated coefficients at 10%, 5% and 1% respectively.

5.1.6 Results and Discussion for the Estimated Parameters of GARCH Models

The results are presented and discussed separately for each period and banks' type:

First: Before the Crisis

Conventional Banks

Concerning conventional banks before the crisis the E-GARCH (543.4233) model is observed to have the highest log L value which means that it provides a better explanation of volatility, flowed by the GARCH (501.1915) then the GJR-GARCH (471.1892) models. And all the parameters are significant at 1% level.

The parameters of E-GARCH are almost all significant at a threshold of 1% except γ $that$ is insignificant which proves that there was no leverage effect before the financial crisis. γ is different from zero which indicates that the impact is asymmetric.

Islamic Banks

For Islamic banks the E-GARCH (1719.735) and GJR-GARCH (1719.735) are considered as the best model for illustrating the volatility followed by the GARCH (1715.850) model. The parameters of E-GARCH are almost all significant at a threshold of 1% and $\gamma > 0$ which proves that there was no leverage effect before the financial crisis. While β and α are significant parameters estimated by the GJR-GARCH at 1% threshold γ significantly different and lower than zero. Which indicates that bad news have no effect on the conditional variance (volatility) of Islamic banks during this period. This can be justified by the confidence and trust of investors in these banks.

Second: During the Crisis

Conventional Banks

During the crisis for conventional banks the E-GARCH gives the best explanation of volatility with the highest Log L value (1617.940) followed by GJR-GARCH (1615.740) the and the GARCH (1588.206) respectively.

Parameters of E-GARCH are almost all significant at a threshold of 1% and < 0 . While, all the GJR-GARCH parameters (β, α and γ) are significant at 1% level and γ is positive. This proves that there was a strong leverage effect during the crisis period.

Islamic Banks

For Islamic banks the results proves that E-GARCH (1688.224) is the best model that captures the volatility of stocks' returns followed by the GJR-GARCH (1685.400) and the GARCH (1685.370) models. The parameters of E-GARCH are almost all significant at a threshold of 1% and $\gamma > 0$ which proves that there was no leverage effect before the financial crisis. All the GJR-GARCH parameters (β, α and γ) are significant at 1% percent level, moreover γ is negative which indicates that bad news have no impact on the volatility (conditional variance) of Islamic banks stock returns, which may be explained by the confidence and the trust of clients and customers of these type of banks, even in the worst and instable periods like the last turbulence that was caused by the crucial effects of the recent financial crisis.

In general it can be concluded that the GARCH gives the worst explanation for volatility in addition, even that this model has a distinctive advantage in that it can track the fat tail of asset returns or the volatility clustering phenomenon very efficiently, it also has a weak point in that the conditional variance in GARCH model is merely dependent on the magnitude of the previous error term and is not related to its sign. In other words, it cannot reflect *leverage effects*, a kind of asymmetric information effects that have more crucial impact on volatility when negative shocks happen than positive shocks do (Yoon, 2008).

Asymmetric GARCH models, (e.g., GJR-GARCH and E-GARCH) are generally better than that of the standard GARCH model, which indicate that the stock markets are asymmetric and nonlinear with time. The E-GARCH model is able also to overcome the drawbacks in a standard GARCH model for computing the effects of past variance on the present (Nelson, 1991). Jalolov and Miyakoshi (2005) argued that the E-GARCH had been shown to be a parsimonious representation of conditional variance that adequately fits many financial time series. In addition GJR-GARCH and E-GARCH models also can capture the asymmetry and nonlinearity of the markets, and it exhibits better forecasting skill than the other models (Hung, 2009). Moreover, the E-GARCH and GJR- models do not require the parameters to be positive, as required by GARCH model. This fact is supported by the previous results where these two models proof their ability to better capture the returns' volatility.

5.1.7 Estimates of Conditional Variances

Table (8) indicates that before the crisis conventional banks showed volatility of 0.008522 versus 0.000243 for Islamic banks with standard deviation of 0.00427 and 0.000196 for conventional and Islamic banks respectively (the researcher uses the results of E-GARCH only in this section, as it proved its ability to better capture the stability of banks, than the GARCH and GJR-GARCH models depending on the log likelihood results).

Conventional banks show higher volatility and risk than Islamic banks during that period, which indicates the confidence and the trust of investors in Islamic banks. Table (8) indicates that post the crisis conventional banks showed volatility of 0.00085 versus 0.000273 for Islamic banks with standard deviation of 0.008907 and 0.000174 for conventional and Islamic banks respectively. Obviously, the confidence of investors in the n Islamic banking sector was not affected by the recent financial crisis. These findings support the previews results which indicate that bad news (the financial crisis in this case) have no impact on the volatility of Islamic banks. Plots of volatility for Islamic and Conventional banks are presented, for both periods, in the following figures. Values in vertical axis show clearly the difference in volatility levels between both types of Banks.

Note: All the graphs bellow are prepared by the researcher based on the Eviews results

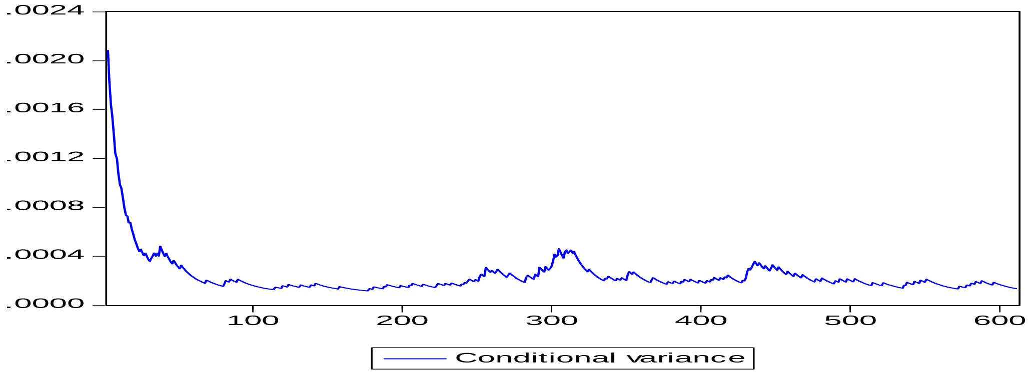


Figure (1): Plots of Islamic Banks Volatility before the Financial Crisis

Figure (2): Plots of Conventional Banks Volatility before the Financial Crisis

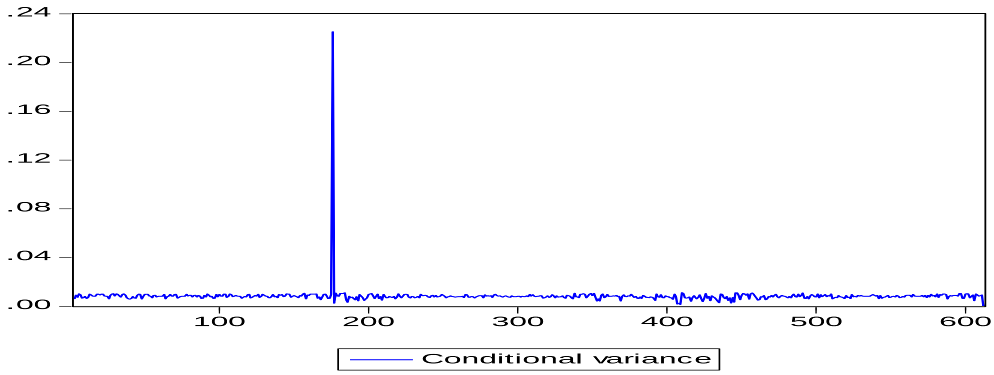


Figure (3): Plots of Islamic Banks Volatility during the Financial Crisis

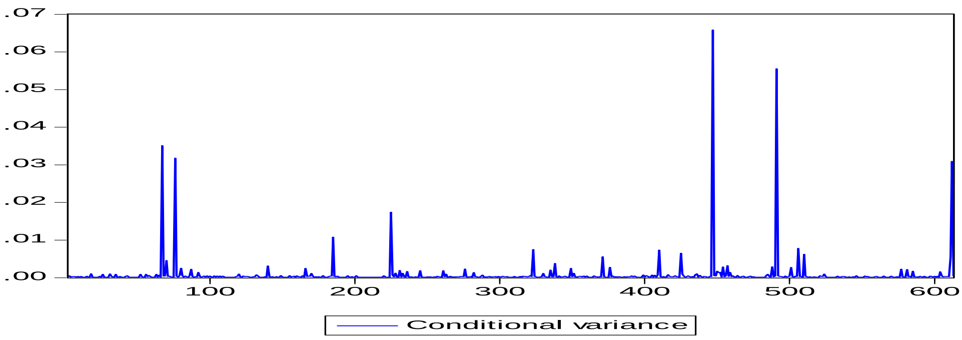
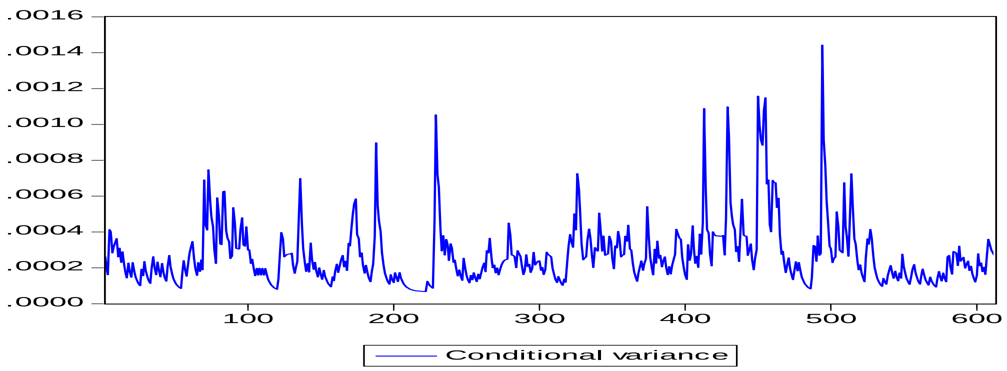


Figure (4): Plots of Conventional Banks Volatility during the Crisis



Both Islamic and conventional banks' results show that Skewness is positive for both periods, which indicates that the distribution is skewed to the left relative to its mean with long right tails. The kurtosis vales are higher than 3 for both types of banks during both periods, that indicates the flatness of the distributions with a longer and fat tails than a normal distribution (the distributions are leptokurtic).

Table (8): Statistical Estimates of Conditional Variances

		Mean	Max	Min	Std. Dev.	Skewness	Kurtosis
GJR-GARCH	*CBRVA*	0.018715	0.081054	0.000243	0.002759	18.23878	431.6614
	CBRVP	0.000644	0.101072	7.72E-07	0.00418	22.78875	546.4206
	IBRVA	0.000240	0.002142	0.000138	0.000191	6.328438	51.22491
	IBRVP	0.000283	0.001446	9.29E-05	0.000207	2.583686	11.15183
E-GARCH	*CBRVA*	0.008522	0.225239	3.77E-05	0.004270	23.58227	574.4779
	CBRVP	0.00085	0.065844	0.000143	0.008907	11.40962	147.9837
	IBRVA	0.000243	0.002084	0.000117	0.000196	5.783613	44.15660
	IBRVP	0.000273	0.001442	6.81E-05	0.000175	2.441881	11.60198

- *CBRVA: Conventional Banks Return Volatility Ante.*
- *CBRVP: Conventional Banks Return Volatility Post.*
- *IBRVA: Islamic Banks Return Volatility Ante.*
- *IBRVP: Islamic Banks Return Volatility Post.*

Form the results above many conclusions can be drawn: First, Islamic banks show higher stability than conventional banks before and during the financial crisis, and investors have more confidence in this type of banks. Second, the financial crisis that hits the American and many markets around the world has no effect or its effect is limited on Islamic banks, but its impact on conventional banks is obvious and reflected in the confidence of investors, as it was explained in the previous sections.

5.1.8 Hypotheses Testing

To test the research hypotheses concerning banks stability Wilcoxon signed rank test is used. Okpara (2010) indicated that the Wilcoxon signed rank test is a nonparametric alternative to the two sample t-test when the population cannot be assumed to be normally distributed, and that the Wilcoxon signed rank test is also based on the differences between matched pairs, it considers both the direction and the magnitude of the differences between matched pairs. The corresponding z-score for the Wilcoxon signed rank statistic is given by:

$$\boldsymbol{Z = (T - \mu_t)/\sigma_t = \frac{T-n}{\sqrt{n}(n+1)(n+2)/24}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \textbf{(09)}$$

Wilcoxon rank sum test is utilized in this research to assess whether the difference in volatility between both types of banks in both periods (before and during the financial crisis) is statistically significant.

Results in table (9) show that the mean volatility for Conventional Banks is significantly higher than the mean volatility for Islamic Banks at 1% level (p-value =0.0000); and this is so for both periods which mean that the following hypotheses are *accepted* ($\mathbf{H_1}$: There is a significant statistical difference in the Stability of Islamic and conventional banks before the crisis and $\mathbf{H_2}$: There is a significant statistical difference in the Stability of Islamic and conventional banks after the crisis). Whereas, the hypothesis concerning Islamic banks stability is rejected ($\mathbf{H_3}$: There is a significant statistical difference in the Stability of Islamic banks before and during the crisis) at 1% level (p-value = 0.7438). Finally, the fourth hypothesis ($\mathbf{H_4}$: There is a significant statistical difference in the Stability of conventional banks before and during the crisis) is also accepted at 1% level (p-value =0.0000).

These results corroborate both the hypothesis that Islamic banks were at least partially immune to the recent financial crisis, this is supported by the previous finding, which indicates that bad news (financial crisis in this case) have no impact on Islamic banks stability. As well as the underlying hypothesis that Islamic banks are not subject to the same risks as conventional banks (are more stable than conventional banks) – although, due to their nature as the links with the real economy, and to their main principles as the risk sharing, in addition these banks are not involved in the buying and selling of debt unlike most conventional banks and they are distinguished by the fact that it is prohibited from buying debts under Islamic Shariah law; therefore, Islamic banks are safer from the effects of the global financial crisis.

Islamic banks have several alternatives [to conventional banking products] such as Ijara Bitamlik [a renting contract that ends in ownership], Murabaha, Musharaka, Mudaraba, sukuk, Amana etc. which demonstrate that Islamic banking is a sound and systematic alternative banking system that others should take as an example. Islamic finance is expected to increase on the international level and its number of customers is also expected to rise as they search for an alternative [banking system].

Table (9): Mean Volatility of Islamic and Conventional Banks Before and During the Financial Crisis

	Before the crisis	During the crisis	Statistic*	P-value
IB	0.000243	0.000273	0.326761	0.7438
CB	0.008522	0.00085	30.50661	0.0000
Statistic*	30.28606	31.3014	-	-
P – value	0.0000	0.0000	-	-

* *Wilcoxon Two-Sample Test statistic. The null hypothesis is that the mean value of volatility is equal for Islamic and Conventional Banks; the p-value is the probability that the null hypothesis is rejected (at 1% significance level) in favor of the alternative hypothesis that the stability is higher for Islamic Banks.*

6. Conclusion

This study aims to investigate and compare the financial stability of Islamic and traditional banks before and after the 2007 financial crisis, using different GARCH models between (02/04/1999 to 01/10/2015) the preliminary analysis that is performed before analyzing the data concerning banks' stability gives the main following results:

First, In order to avoid spurious conclusions due to model misspecification, the Dickey-Fuller (DF) stationarity test is performed to identify whether the time series of banks' returns are stationary. The findings indicate that the null hypotheses concerning the existence of the unit root (non stationarity) is rejected at 1% level which means that all returns series are considered to *be stationary* for both types of banks covering all the study periods. That allows for applying the ARCH and GARCH methods. Second, The Q statistic (Box Pierce, Ljung Box) and Lagrange Multiplier (LM) tests are used for testing the serial correlation on the ε_t^2.The results of the Q statistic and LM tests for the presence of ARCH effects and serial correlation, indicate that the conditional heteroskedasticity that existed when the test was performed on the pure return series for banks is successfully removed for the three models GARCH, E-GARCH and GJR-GARCH. Third, Depending on the log likelihood results, the E-GARCH is seemed to be the best model that can be applied to test the stability of banks followed by the GJR-GARCH, rather than the standard GARCH model.

Moreover, the hypotheses testing indicates that: first, Islamic banks are more stable than conventional banks pre and post the recent financial crisis, and their stability appeared to be less affected by bad news, represented in this study by the recent financial crisis. Second, The estimated parameters of the GARCH models indicate that Islamic banks' stability is not affected by the harmful effects of the recent financial crisis. This result proves the high confidence of investors in this kind of banks. Finally, The GARCH models results indicate, obviously, that conventional banks' stability is affected by the damaging effects of the recent financial crisis; this can be clearly concluded form the estimated parameters of the GARCH models, which indicate that the investors' confidence is diminished after the crisis.

The results of the selected banks are supporting the viewpoint that Islamic finance is more stable and safe way of financing. Islamic banks are characterized by the compliance to Islamic laws and practices, the main ones being the prohibition of interest and loans trading. Remarkably, during the 2008-2009 financial crisis, when a large number of conventional banks have announced bankruptcy, no single Islamic bank failure has been reported, which, means that Islamic banks' stability may due to the nature of Islamic banking that works on the basis of risk sharing. The customer and the bank share the risk of any investment on agreed terms, which increases the confidence of investors in these banks. Especially that it does not deal in debt trading or rely on bonds or stocks and distances itself from market speculation. These are prohibited under Islamic Shariah law, unlike most conventional banks. These features make Islamic banks' activities more closely related to the real economy and tend to reduce their contribution to excesses and bubbles.

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