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Are Non-Conventional Banks More Resilient than Conventional Ones to Financial Crisis?

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2017/03

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Abstract

This paper presents empirical evidence of the impact of the recent global financial crises on Islamic and conventional banks in three GCC countries. Our assumptions are discussed within the framework of Khan (1976), Khan and Mirakhor (2005) and Chapra (2008). A diagonal BEKK model is used to examine the impact of the global crisis on conditional beta of the selected banks. Results show that Islamic and conventional banks have been largely affected by the global crisis, except for few banks. They reveal also that small banks have been less affected than larger banks. These results are in line with the other studies which have found that Islamic banks are not more resilient than conventional ones.

Keywords: GCC countries, Islamic Banks, Resilience, BEKK model

1. Introduction

The resilience of Islamic banks remains ambiguous from both an empirical and theoretical perspective. Khan (1986), Khan and Mirakhor (2005) and Chapra (2008) claimed that the presence of Islamic banks may enhance the resilience of the financial system. These authors among others (Iqbal and Mirakhor, 1987; Al-Omar and Abdel-Haq 1996; Sugema et al. 2010; Gudarzi Farahani and Dastan, 2013), have recommended the generalization of the Islamic finance principles. Conversely, Kuran (1995), among few others, argue that Islamic financial operations differ only “cosmetically” from conventional operations in the Banking services.

In this paper, we show that Islamic banks are more resilient than conventional banks, acting even as a stabilizer of the global financial system. This research is based on the previous works of Khan (1986), Khan and Mirakhor (2005) and Chapra (2008). The first author considers that, owing to the absence of the interest rate from the Islamic finance universe, Islamic banks are more stable than conventional ones. In this context, the author assimilates depositors in Islamic banks to shareholders: they hold shares whose value may increase or decrease depending on the bank’s performance. Therefore, depositors will bear a portion of the losses when they occur^a. Based on this hypothesis, Khan (1986) demonstrates that the flexibility of the value of those shares allows the Islamic banks to adapt and regulate imbalances on capital market^b. As for Khan and Mirakhor (2005), they argue that, compared to the interest-based system, the system based on PLS (i.e. profit and loss sharing) conduct to amortization in a more rapid and flexible manner of banking and financial crises, since the nominal value of investment deposits is not guaranteed, but depends on the performance of the bank. In fact, any shock in the real economy will be absorbed by the funds deposited in investment accounts (i.e. PSIA accounts). Chapra (2008 reminds that Islamic finance is perfectly correlated with the real economy, as any financial transaction must be backed by a real asset rather than by an imaginary or notional one^c. He indicates that the obligation of backing by a real asset helps to eliminate most unproductive and speculative transactions that involve *gharar* (high uncertainty) and *qimar* (bets), which, in turn, favors the accumulation of physical capital, hence stimulating the economic activity.

Although the estimation of the impact of the resilience of Islamic banks has been the subject of few empirical studies, the results found are not stable. In the light of the specific Tunisian experience over the period 1960-1984, Darrat (1988) has examined the hypothesis stipulating that the financial and banking systems become more stable as the interest is paralyzed. He has

^a This means that the depositors accept the change in the value of their deposits.

^b Similarly, Al-Omar and Abdel-Haq (1996:9) think that the prohibition of interest by the *Shari'a* is a way to establish justice between investors who provide the funds and entrepreneurs who provides labor to grow the investors’ funds: in an interest-based system, the income earned by the fund provider is disconnected from both the risks incurred by the entrepreneur and the real income that arises from the use of the funds provided.

^c This principle is of paramount importance for the structuring of most Islamic finance products. Sugema et al. (2010) show, through a theoretical model, that the products offered by Islamic finance, based on the PLS principle, improve the efficiency of the system and ensure equity between creditors and debtors. More recently, Boukhris and Nabi (2013) have studied the resilience of Islamic banks with respect to conventional banks before, during and after the recent financial crisis. They have found that: 1/ Islamic banks were more profitable than conventional banks before the crisis; 2/ Conventional banks become more profitable than Islamic banks after the crisis; 3/ Islamic banks were less resistant to the crises than Islamic banks.

come to the conclusion that the interest-free monetary system allows a better stability of the money velocity compared to the interest-based one. Furthermore, he has shown that the demand for money is structurally more stable in the absence of interest. He has also concluded that only the monetary and financial assets which do not bear interests may be used by the Tunisian monetary authorities as an appropriate intermediate target to reach its medium-term objectives.

Yousefi *et al.* (1997) replicate the study by Darrat (1988) to the Iranian case. Their empirical findings partially confirm the results of Darrat (1988) and, do not allow the validation of the superiority of the Islamic banks.

Charles *et al.* (2015) tested the hypothesis stating that the Islamic finance is more resilient to shocks than the conventional finance. They examined the assumption whether the Islamic stock Indices are more or less affected by the changes in the volatility regimes than the conventional stock indices. They found that the Islamic and the conventional indices were affected to the same degree by the volatility changes, and discovered no empirical evidence allowing to validate the hypothesis of the Islamic finance superiority. Arouri *et al.* (2013) have found that Islamic finance helps save investors from financial crises by comparing some Islamic stock indices to conventional ones.

Using a sample of 120 Islamic and conventional banks, Dridi and Hasan (2010) found that Islamic banks were more resilient than conventional banks during the crisis. But, by 2009, the profitability of Islamic banks declined sharply compared to conventional banks. Ouerghi (2014) found that Islamic banks are less profitable, more prone to credit and less efficient than conventional banks. She concluded that Islamic banks are less stable from a financial perspective than conventional banks, and that large Islamic banks perform better than large conventional banks.

This paper provides an empirical evidence of the resilience of Islamic banks with respect to the conventional banks in three GCC countries before, during and after the recent global financial crises.

This paper is organized as follows. Section 2 provides a short overview of the specificities of Islamic banking from a financial stability perspective. Section 3 describes the procedure used for sample selection. Section 4 presents the econometric methodology. Section 5 outlines the econometric results and their economic and statistical interpretation. Finally, section 6 highlights the major conclusions to be drawn and further directions for future research.

2. Islamic banks and financial stability: an overview

Hachicha and Ben Amar (2015) show that although the Islamic bank ensures a better capital allocation (i.e. channeling the deposits to the entrepreneurs that have financial needs), it does not allow the qualitative transformation of the liabilities *à la* Gurley and Shaw (1960). Theoretically, the Islamic banks' liabilities are, contractually, less liquid than those of the traditional banks; the depositors in Profit Sharing Investment Account (PSIA) know that their deposits do not represent a stock of money *stricto sensu*. Their deposits are effectively

correlated with the bank assets since the Islamic bank investments are theoretically backed by real assets. Any shock occurring at the level of the bank assets will be automatically transmitted to the liabilities, as indicated by Darrat (1988) and Yousefi et al. (1997)^d.

The share of profit and losses between parties in financial transactions is the Islamic alternative to the borrower-lender relationship brought by conventional banks. For several reasons, this alternative may strengthen financial stability. First, the structure of risk allocation implied by the PLS principle makes the providers of funds more enticed to collect, *ex ante*, information about the project and about the agent in need of finance, and to exercise, *ex post*, monitoring of the projects they fund (Khan and Bashar, 2008 ; Hachicha and Ben Amar , 2015). Second, while conventional credits are granted based on the assessment of borrowers' creditworthiness and not necessarily to the most intelligent or meritocratic (Thurow, 1980), some products offered by the Islamic finance are not based on the entrepreneur's creditworthiness but rather, on the project's economic viability and on the debtor's entrepreneurial abilities. Third, Islamic finance reduces speculation and encourages transaction backed by real assets (Chapra 2008). In fact, according to Ahmed (2002), the prohibition of *riba* and the narrow link with the real economy could enhance the stability of the financial system. Fourth, Islamic banks do not grant financing exclusively to Muslims, but also to all the economic agents who have a high potential to contribute to the value added creation (Hachicha and Ben Amar, 2015). Finally, the prohibition of selling/buying debt by Islamic banks has limited their access to toxic assets (Chapra, 2008; Ouerghi, 2014).

3. Sample Selection

Our sample is based on six GCC countries (Saudi Arabia, Bahrain, U.A.E, Kuwait, Oman and Qatar^e). We have chosen the GCC countries for four reasons. First, the GCC countries have very similar economic structures. Second, their financial systems are mixed, being characterized by the simultaneous presence of Islamic and non-Islamic financial Institutions. This allows us to compare Islamic banks to non-Islamic ones. Third, according to ICD Thomson Reuters, they hold about 48% of global assets of Islamic banks in 2013. Fourth, the GCC countries are among the pioneered countries in Islamic finance. This enables us to solve the problem of data unavailability characterizing the developing countries.

The second step is to list all the commercial banks (Islamic and non-Islamic) for each of the six GCC countries. The third step is to rule out the banks whose data do not go back to 31/12/2004 (daily frequency). The fourth step is to rule out countries which, after the third step, do not have at least two Islamic banks and two conventional banks. The fifth step is to rule out countries whose sectorial stock market data do not go back to 31/12/2014. The final step is to select four banks for each country (two Islamic and two non-Islamic banks) (cf. Table 1). The choice is based on their average market capitalization over the period ranging from December 31st, 2004 to November 7th, 2014: for each country, we retain the Islamic bank (resp. the non-

^d We refer to Dusuki (2008) for fundamental distinctions between Islamic and conventional banks.

^e For the U.A.E we distinguish between Dubai and Abu Dhabi as they each have a separate stock market

Islamic bank) having the highest average market capitalization and the one having the lowest value. Figure 1 illustrates the selection procedure.

Table 1: Retained banks

	Conventional Banks		Islamic Banks	
	H	L	H	L
Abu Dhabi	National Bank of Abu Dhabi (NBAD)	Commercial Bank Intl. (CBI)	Abu Dhabi Islamic Bank (ADIB)	Sharjah Islamic Bank (SIB)
Kuwait	National Bank of Kuwait (NBK)	Burgan Bank (BB)	Kuwait Finance House (KFH)	Kuwait Intl. Bank (KIB)
Qatar	Qatar National Bank (QNB)	Ahli Bank (AB)	Qatar Islamic Bank (QIB)	Qatar Intl. Islamic Bank (QIIB)

H and L refer to highest and lowest capitalization respectively.

4. Econometric methodology

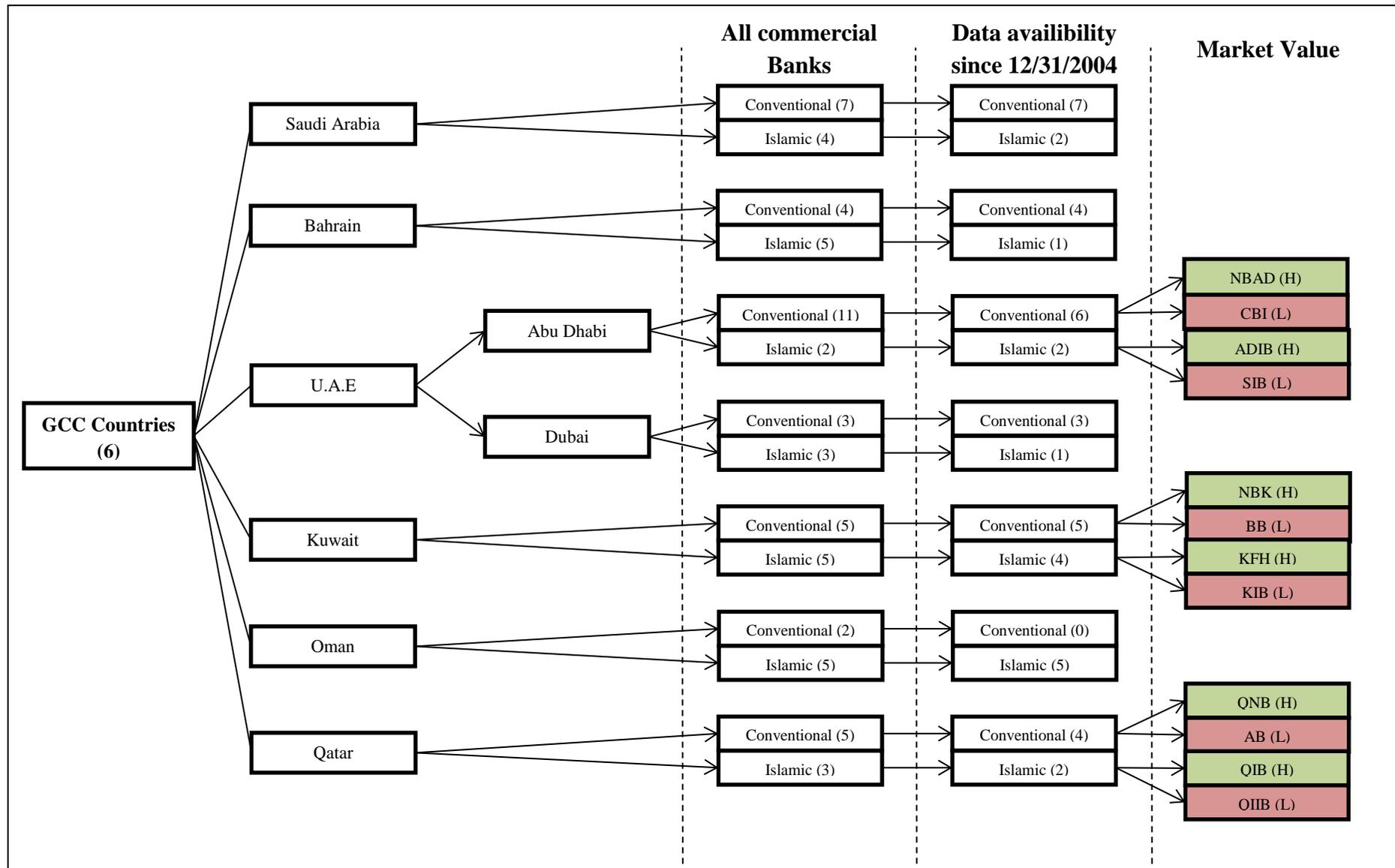
4.a. The MA-GARCH bivariate model

The ARCH models, introduced by Engle (1982), and the GARCH model, developed by Bollerslev (1986) are used in the literature. The use of GARCH models is widespread. The preference for these models is justified by their ability to introduce the correlation between securities in the expression of the conditional variances. Therefore, to estimate the effects of the recent financial crisis on Islamic and conventional banks of the GCC countries, we use the Diagonal-BEKK model, derived from the Full-BEKK model by Engle and Kroner (1995). The conditional covariance matrix of Full-BEKK model is given by:

$$\begin{aligned}
 y_t &= \mu_t + \varepsilon_t \\
 \varepsilon_t | \Omega_{t-1} &\sim N(0, H_t) \\
 H_t &= C'C + \sum_{k=1}^K \sum_{i=1}^q A'_{ki} \varepsilon_{t-1} \varepsilon'_{t-1} A_{ki} + \sum_{k=1}^K \sum_{j=1}^p B'_{kj} H_{t-j} B_{kj}
 \end{aligned} \tag{1}$$

Where $y_t = (r_{it}, r_{m,t})$ is a (2×1) vector containing the returns of the asset (i) and the market portfolio (m), μ_t is a (2×1) mean vector of y_t , ε_t is a (2×1) matrix of the conditional covariance, H_t is the conditional variance matrix, C is a (2×2) lower triangular matrix with intercept parameters, and A_{ki} ($i = 1, \dots, q$ and $k = 1, \dots, K$) and B_{kj} ($j = 1, \dots, p$ and $k = 1, \dots, K$) are (2×2) matrices of parameters.

Figure 1: Sample selection procedure



In some cases, the Full-BEKK model can present several technical difficulties due to the high number of parameters, such as a non-convergence and non-positivity of conditional variances matrix. This leads us to use the following diagonal version of this model:

$$H_t = C' C + \sum_{i=1}^q A_i' \varepsilon_{t-1} \varepsilon'_{t-1} A_i + \sum_{j=1}^p B_j' H_{t-j} B_j \quad (2)$$

Where A and B are diagonal matrices. The parameters in A reveal the extent to which the conditional variances of the two variables are correlated with past squared errors: the diagonal elements of A measure the ARCH effect on residuals of asset i (A_{11}) and on residuals of the market portfolio (A_{22}). The parameters in B depict the extent to which the current levels of the conditional variances are correlated with past conditional variances: the diagonal elements of B (i.e. B_{11} and B_{22}) reflect the level of persistence in the conditional variance.

The time varying beta of bank i is calculated as follows:

$$\beta_{i,t} = \frac{\hat{H}_{12,t}}{\hat{H}_{22,t}} \quad (3)$$

Where $\hat{H}_{12,t}$ is the estimated conditional covariance between the returns of bank (i) and the market portfolio returns, and $\hat{H}_{22,t}$ is the estimated conditional variance of the market portfolio returns from the bivariate GARCH model. Since the conditional covariance and conditional variance are time-dependent, the beta of each asset is also time dependent.

4.b. The effects of the crisis

For an investor, an increase in the volatility of an asset increases the investment risk level. Following the recent global financial crisis, an increase in the volatility of the GCC markets has been observed. To measure the effects of the financial crisis on Islamic and conventional banks over time, we perform a beta regression [eq.4]⁶. We also use binary variables (i.e. dummy variables) which can take the value 0 or 1. In this study, we perform two tests. For the first one, the dummy variable takes the value 0 over the pre and the post crisis periods, respectively from 31/12/2004 to 15/09/2008 and from 01/04/2009 to 07/11/2014, and the value 1 for the crisis period. For the second test, the dummy variable takes the value 1 from 16/09/2008 until the end of our study period (i.e. 07/11/2014). The determination of crisis period is based on the information provided by the Bank for International Settlements and the Federal Reserve Bank of St. Louis. Our regression is given by:

$$\beta_{i,t} = \alpha_0 + \gamma_0 D_t + \alpha_1 CV_{i,t} + \gamma_1 (CV_{i,t} D_t) + \alpha_2 MV_t + \gamma_2 (MV_t D_t) + \varepsilon_t \quad (4)$$

⁶ The β coefficient is widely used in financial applications. This coefficient measures to which extent an asset's expected return is correlated with the broad market return. In other words, it represents the systematic risk that cannot be eliminated, even with portfolio diversifications. In the classic CAPM model (Sharpe, 1964; Lintner, 1965), β is assumed to be time invariant. However, this assumption has been questioned in many studies. There now exists widespread evidence that β is unstable over time (among others: Blume, 1971; Fama and Macbeth, 1973; Fabozzi and Francis, 1978; Sunder, 1980; Bos and Newbold, 1984; Collins et al., 1987; Kim, 1993).

With $\beta_{i,t}$ the beta of the bank i at time t , $CV_{i,t}$ the conditional volatility of bank i , MV_t the conditional market volatility and ε_t the error term. The parameters α_1 and α_2 measure the effect of the conditional volatility of the individual bank and the market on the beta of the bank during the total period respectively. If the sign on both the parameters is positive, then a rise in the volatility of the bank or market should increase the beta of the bank.

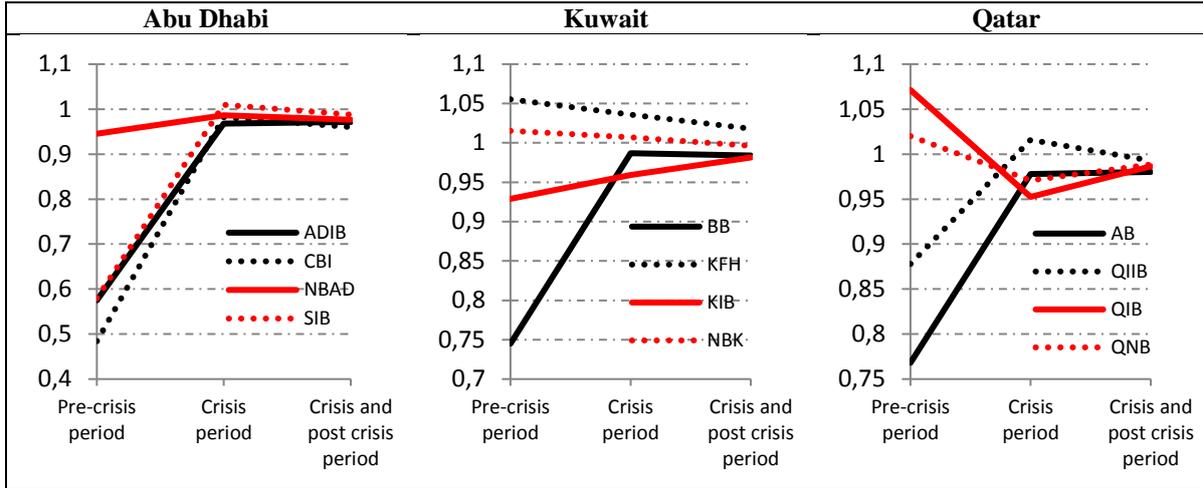
γ_1 and γ_2 capture the potential additional effect of the bank and market conditional volatility due to the financial crisis. If γ_1 and γ_2 are positive and significant, then the volatility of bank and market during the crisis period will affect the beta of the bank under study. Negative and significant γ_1 and γ_2 imply the opposite. Insignificant γ_1 and γ_2 imply that the volatility of bank and market during the crisis period have no extra effect on the beta of the bank.

5. Empirical results and policy implications

Tables 2, 3 and 4 present the BEKK bivariate MA-GARCH(1,1) results for Abu Dhabi, Kuwaiti and Qatari banks respectively. The bivariate GARCH results are quite stable. The ARCH coefficients (i.e. A_{11} and A_{22}) for the Abu Dhabi Banks (Table 2), Kuwaiti Banks (Table 3) and Qatari ones (Table 4) are all positive and highly significant, implying volatility clustering, both at the level of banks returns and sectorial markets returns. The persistence of the volatility is confirmed by the B_{11} and B_{22} coefficient which are both positive and significant. The positive coefficients highlight that volatility was a double-side phenomenon, generated both by idiosyncratic and systemic factors. From an economic perspective, the system is the sum of the individual components; volatility, as the result of individual and collective market contributors, captures the mutual influences between individual entities as well, underpinning a potential transmission chain phenomenon. This finding is in line with the concept of "shift-volatility" transmission in the East Asian equity markets revealed by Aloy et al. (2013) who unveiled the volatility propagation from a low to a high level.

The null hypothesis test of no serial auto-correlation uses the Ljung-Box Q statistic on standardized residuals and squared standardized residuals. As the results are significant for all banks, we reject the null hypothesis. This finding reveals the fact that volatility clustering is still a phenomenon marked by uncertainty. It is influenced by error factors impossible to be precisely captured in the light of economic quantitative models. The hazard component of the volatility, especially in the context of a financial crisis, was frequently analyzed by researchers (Chiara, 2013; Jurado et al. 2013). Bloom (2014) brought forth that error term captures even a cyclical component, prevailing especially in periods of economic turbulences, (i.e. it just rises sharply in recessions and decrease in booms). This means that in the context of a financial crisis, the unpredictability factor and implicitly the error term is more likely than during the upturn phase of the economic cycle, capturing inclusively auto-correlation effects. The potential explanations for this cyclical feature pertain both to micro and macro endogenous shocks, outlining the mixture between idiosyncratic and systemic dimensions, with deep implications for the auto-correlation phenomenon of the residuals.

Figure 2: The mean betas



Source: Authors Calculations⁷

Tables 5, 6 and 7 and Figure 2 illustrate the mean time varying beta ($\bar{\beta}_i$) for each country banks⁷. We clearly observe that $\bar{\beta}_i$ values during the “crisis period” is higher than its values during the “pre-crisis period”, and the “crisis and post crisis period” for all the Abu Dhabi banks, except for Abu Dhabi Islamic Bank in case of which $\bar{\beta}_i$ values show an uptrend through the three sub-periods.

The higher $\bar{\beta}_i$ values during the crisis period unveil that the correlation between the individual and systemic component is more significant during periods of financial turbulences. Poirson and Schmittmann (2013) explained this time-varying risk exposure in the light of structural trends generated especially by spillovers during crisis periods. The authors even emphasized that peaks in the estimated bank betas signal periods of generalized financial stress.

The lower $\bar{\beta}_i$ for the post crisis period might reflect the shock absorption effect in the virtue of sound macroeconomic fundamentals that have the potential to allow the dissipation of the impact generated by financial turbulences.

As for Qatar, the $\bar{\beta}_i$ values over the crisis period are lower than its pre- and post-crisis period values for two banks, namely the QIB and the QNB.

Eichengreen et al. (2009) highlighted that $\bar{\beta}_i$ variation is highly impacted by the degree of global financial integration; the lower value of $\bar{\beta}_i$ over the crisis period might reveal a certain de-correlation of Qatar from the other peers, both in terms of financial and macroeconomic dimensions. It might the case that Qatar exhibits a lower degree of financial integration in comparison with the other countries which mitigates the intensity of a potential spill-over phenomenon.

The lower $\bar{\beta}_i$ might reveal sound macro-financial fundamentals that are in measure to overcome the effects generated by a financial crisis. Indeed, according to IMF and OECD

analysis, Qatar has faced the global crisis from a position of strength and used their resources to stabilize the financial sector. Overall, in spite of a series of shocks, there has been no systemic breakdown and the impact on banking system has been moderate.

For the AB bank, the $\overline{\beta}_i$ value over the crisis period is higher than its pre-crisis value, but lower than its post-crisis value. Regarding the QIIB bank, the $\overline{\beta}_i$ value over the crisis period is higher than its pre- and post-crisis values’.

Fig. 3 illustrates the time-varying beta for all banks. The time-varying beta has been calculated based on Eq.4. The time-varying beta is more volatile during the financial crisis: this can be seen in all of the figures. The estimation of Eq.5 should help us to understand the reasons behind the increase in the volatility during the crisis period.

The statistic output reveals the intensity of the contagion phenomenon at the group level; even if at the country level there appeared slight differences in terms of $\overline{\beta}_i$ magnitude over versus the *pre-* and *post-*crisis period, at the group level the volatility generated by the financial crisis is overwhelming.

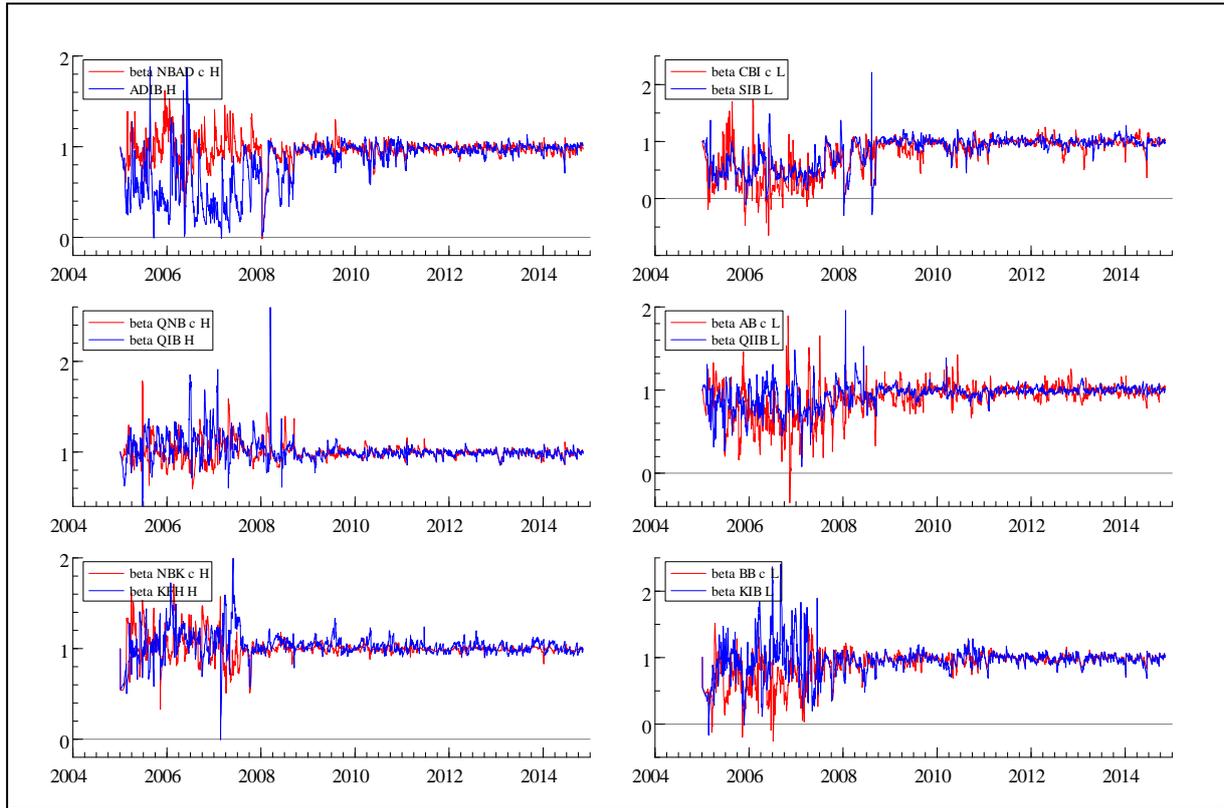
It can be concluded that Qatar banking system could not act as stabilizer for the region; at the group level, banks revealed a significant vulnerability to the shocks propagated by the financial turbulences, bringing forth the important exposure to global risk factor. This finding can have deep implications for the risk management systems of banks.

Tables 8, 9 and 10 show the results of the beta regression during the crisis period. We observe that all α_1 (i.e. one for each bank), measuring the effect of the conditional volatility of the individual bank on the beta of the bank, are positive and significant. This result confirms the direct effect of the banks volatilities on respective betas.

The size in absolute values of significant coefficient is greater than unity, implying a size effect of the bank’s volatility on betas. This finding is in line with Moussa (2014) who unveiled that larger financial institution exhibit a higher systematic risk in comparison with the smaller ones, although their overall risk is not significantly different from the latter. Larger banks are more exposed to systemic risk and their beta implicitly captures this enhanced sensitivity.

By adding the dummy variable to the volatility of the bank, we get significant and negative γ_1 coefficients in all cases, except of SIB which presents a positive γ_1 coefficient. The negative sign of γ_1 implies that the bank’s volatility affects inversely the beta during the crisis period, in line with the conclusions of Adam et al. (2012) who unveiled the predominance of the systemic dimension in the context of a financial crisis where the transmission of shocks is enhanced in the virtue of the international banking network During stressed periods, banks’ beta is mainly under the impact of systemic shocks while the idiosyncratic dimension of volatility reduces its intensity.

Figure 3: Time-varying betas



Source: Authors' estimations

This finding is in opposition with the conclusions related to the α_2 coefficients, which measure the effect of the conditional volatility of the market on the bank's beta; the statistic output highlights that it is significant and negative for all banks. In other words, the negative volatility coefficient implies that as volatility increases beta decreases.

Taking into account the negative impact of bank's volatility on beta, we would expect a positive effect of the market conditional volatility. This aspect can be explained in light of the size effect that is also brought forth by the absolute values of α_2 reflect the size of the banks' volatilities on their betas. All values are slightly higher than unity. γ_2 shows a positive and significant sign for all banks in all countries, except for SIB and AB. The absolute values of γ_2 coefficients are greater than one, which reflects a size effect of the market volatility on the beta of the bank over time. The values of γ_1 coefficients in absolute value are slightly higher than unity reflecting the size effect of the banks volatilities during crisis period on the banks betas.

These findings are in line with Yang and Tsatsaronis (2012) who revealed that larger and implicitly more profitable banks tend to be less correlated with the market return, facing therefore a lower risk premium.

Tables 11, 12 and 13 synthesize the results of the second beta regression, where the dummy variable equals 1 during "crisis and post crisis" period. α_1 coefficients are positive and significant for all banks, reflecting the direct effect of the conditional volatility of the individual bank on the beta of the bank. The γ_1 coefficients are negative and significant for all banks, except of NBAD bank in case of which γ_1 coefficient is positive and significant. The negative sign of γ_1 implies that the bank's volatility affects inversely the beta during the "crisis and post

crisis” period. Regarding NBAD bank, the positive sign of γ_1 reflects the pro-cyclicality of the volatility of this bank and its beta.

For all banks, except of the SIB bank, α_2 coefficients are negative and significant, while γ_2 coefficients are positive and significant. This implies that there is an inverse relationship between market volatility and the betas of the banks (except of the SIB bank). According to the absolute values of coefficients α_2 and γ_2 , both the bank and market volatilities during the crisis seem to impose a large size effect on the time varying beta of the bank. This aspect sets forth the alpha effect: banks with a lower beta might capture a significant alpha, being characterized by significantly lower distress during the crisis. In opposition, previous researchers pointed out that banks with a high beta exhibit, ex-post, significantly higher systematic risk (Altunbas et al. 2011).

6. Conclusions

This paper shows that Islamic banks are more resilient than conventional banks during crisis times. In fact, Islamic banks seem to act as a stabilizer of the global financial system. The absence of the interest rate from the Islamic finance universe could provide some stability to Islamic banks when compared to conventional ones. Depositors in Islamic banks like shareholders hold shares whose value fluctuates depending on the bank’s performance. The flexibility of the value of those shares allows the Islamic banks to adapt and regulate imbalances on capital market. When compared to the interest-based system, the Islamic system based on profit and loss sharing conduct to amortization in a more rapid and flexible manner of banking and financial crises, since the nominal value of investment deposits is not guaranteed, but depends on the performance of the bank.

Given the specific features of conventional and non-conventional banking, this paper brings forth the impact of the financial crisis on both Islamic and conventional banks in three GCC countries: Qatar, Kuwait and Abu Dhabi in UAE. In a first stage, a diagonal BEKK model has been constructed to calculate the daily beta for each bank of the sample over the period that lie between 31/12/2004 and 7/11/2014.

In a second stage, the calculated betas were used as endogenous variables to estimate the extent to which the conditional variances of the banks and of the sectorial capital stock markets (exogenous variables) explain the dynamics. We also introduced dummy variables to detect the effect of the crisis on the betas during the crisis period.

We find that Islamic and conventional banks have been largely affected by the crisis in the same way, except of Ahli Bank (Qatar) and the Sharjah Islamic Bank (Abu Dhabi) that were less affected by the crisis. The results also show that small banks (Islamic and conventional) have been less affected than larger banks. These results are in line with other studies which have found that Islamic banks are not more resilient than conventional ones.

This economic result can be explained by the structure of the Islamic-bank financing that marginalizes the PLS-based instruments. This turns out to be consistent with the economic

reality in the GCC countries, since the Islamic banks engage much more in non-participatory activities which are, technically, conventional-like products.

Table 2: Abu Dhabi MA-GARCH (1,1) (BEKK) banks results

Bank	Cst1	Θ_1	Cst2	Θ_2	C ₁₁	A ₁₁	B ₁₁	C ₂₂	A ₂₂	B ₂₂	C ₁₂	L
ADIB	-0.0022 (-1.99)	-0.1168 (-1.80)	-0.0021 (-2.27)	-0.0811 (-1.28)	0.0082 (1.67)	0.4145*** (6.39)	0.9046*** (37.58)	0.0076*** (6.39)	0.4262*** (6.29)	0.9046*** (37.58)	0.0009 (0.51)	7075.0
CAI	-0.0019 (-1.99)	-0.1283 (-2.03)	-0.0022 (-1.77)	-0.0577 (-1.02)	0.0071 (1.66)	0.4145*** (6.86)	0.9101*** (42.07)	0.0104*** (6.85)	0.4354*** (7.00)	0.9002*** (39.16)	0.0018 (0.91)	6106.6
NBAD	-0.0024 (-2.20)	-0.1578 (-2.39)	-0.0027 (-1.98)	-0.1216 (-1.78)	0.0064 (1.82)	0.4085*** (7.48)	0.9127*** (44.93)	0.0052*** (4.57)	0.4362*** (7.42)	0.8985*** (37.47)	0.0090* (2.61)	7779.3
SIB	-0.0020 (-1.72)	-0.2078** (-3.33)	-0.0035* (-3.08)	-0.1500 (-2.40)	0.0068 (1.54)	0.3955*** (6.27)	0.9185*** (35.46)	0.0068* (3.31)	0.4218*** (5.83)	0.9067*** (27.88)	0.0036 (0.91)	6839.9

***, **, * imply significance at the 1%, 5% et 10% levels respectively.

T-statistics in parentheses; L = log likelihood function value.

Test for serial correlation in the residuals

	ADIB	CBI	NBAD	SIB
Standardized squared residuals				
LB Bank	14.1299	13.7651	11.5098	6.8716
LB Market	8.6949	25.0536	32.6445	70.7850
Standardized residuals				
LB Bank	91.6717	152.5390	45.8853	66.1867
LB Market	41.5505	66.7722	50.3343	60.1115

LB=Ljung-Box statistics for serial correlation of the order 10.

Table 3: Kuwait MA-GARCH (1,1) (BEKK) banks results

Bank	Cst ₁	Θ ₁	Cst ₂	Θ ₂	C ₁₁	A ₁₁	B ₁₁	C ₂₂	A ₂₂	B ₂₂	C ₁₂	L
BB	-0.0002 (-0.28)	-0.1154 (-2.09)	0.0003 (0.45)	-0.0770 (-1.50)	0.0032*** (4.36)	0.3887*** (6.76)	0.9214*** (51.49)	0.0051*** (5.70)	0.4146*** (6.97)	0.9100*** (45.38)	0.0019 (2.33)	7809.6
KFH	0.0002 (0.36)	-0.1818 (-2.92)	0.0007* (1.16)	-0.1463 (-2.44)	0.0030** (3.38)	0.3697*** (5.68)	0.9291*** (43.07)	0.0032** (3.84)	0.3911*** (5.71)	0.9194*** (36.42)	0.0037* (2.58)	8340.7
KIB	-0.0001 (-0.23)	-0.1304 (-2.32)	-0.0005 (-0.56)	-0.0945 (-1.71)	0.0031** (3.79)	0.3902*** (6.03)	0.9207*** (41.75)	0.0062*** (0.92)	0.4227*** (5.72)	0.9063*** (33.56)	0.0040* (3.00)	7618.6
NBK	0.0002 (0.31)	-0.1525* (-2.66)	0.0009 (1.23)	-0.1038 (-1.91)	0.0030* (2.67)	0.3804*** (4.59)	0.9248*** (30.59)	0.0038* (2.60)	0.3970*** (4.81)	0.9170*** (29.17)	0.0035 (2.53)	8559.8

***, **, * imply significance at the 1%, 5% et 10% levels respectively.

T-statistics in parentheses; L = log likelihood function value.

Test for serial correlation in the residuals

	BB	KFH	KIB	NBK
Standardized squared residuals				
LB Bank	41.1825	76.4514	49.4054	36.2285
LB Market	121.2770	100.7820	105.0270	58.4250
Standardized residuals				
LB Bank	60.8093	4.5317	56.7920	46.4087
LB Market	43.1821	72.5232	50.5364	76.7154

LB=Ljung-Box statistics for serial correlation of the order 10.

Table 4: Qatar MA-GARCH (1,1) (BEKK) banks results

Bank	Cst ₁	Θ ₁	Cst ₂	Θ ₂	C ₁₁	A ₁₁	B ₁₁	C ₂₂	A ₂₂	B ₂₂	C ₁₂	L
AB	-0.0012 (-1.45)	-0.1479* (-3.01)	-0.0016 (-1.66)	-0.1115 (-2.42)	0.0054* (2.99)	0.3928*** (5.78)	0.9196*** (39.37)	0.0070*** (5.05)	0.4193*** (5.71)	0.9078*** (33.52)	0.0043 (2.16)	7048.44
QIIB	-0.0020 (-1.55)	0.0403 (0.49)	-0.0016 (-1.33)	0.0064 (0.09)	0.0061 (2.25)	0.4259*** (6.36)	0.9048*** (35.17)	0.0055* (3.85)	0.4040*** (6.55)	0.9147*** (40.19)	0.0042 (1.62)	8006.26
QIB	-0.0009 (-1.09)	-0.0977 (-1.57)	-0.0005 (-0.56)	-0.0715 (-1.23)	0.0055 (2.54)	0.4026*** (5.54)	0.9154*** (34.14)	0.0052* (2.82)	0.4214*** (5.80)	0.9058*** (31.94)	0.0068* (2.59)	8398.68
QNB	-0.0008 (-0.95)	-0.1676 (-2.15)	-0.0010 (-1.04)	-0.1611 (-2.05)	0.0053 (2.33)	0.3607*** (6.23)	0.9327*** (46.11)	0.0034 (2.45)	0.3809*** (6.25)	0.9242*** (43.33)	0.0064* (2.85)	8882.68

***, **, * imply significance at the 1%, 5% et 10% levels respectively.

T-statistics in parentheses; L = log likelihood function value.

Test for serial correlation in the residuals

	AB	QIIB	QIB	QNB
Standardized squared residuals				
LB Bank	70.2348	18.6862	3.7257	2.8392
LB Market	150.053	23.0453	108.964	174.514
Standardized residuals				
LB Bank	58.8493	46.9958	21.1761	21.7466
LB Market	52.6484	54.7248	27.7436	55.0237

***, **, * imply significance at the 1%, 5% et 10% levels respectively.

T-statistics in parentheses; L = log likelihood function value.

Table 5: Abu Dhabi mean beta during all periods

Banks	ADIB	CBI	NBAD	SIB
Total Period 31-12-2004 ----- 07/11/2014	0.8226	0.7814	0.9648	0.8344
Pre-crisis period 31-12-2004 ----- 15/09/2008	0.5750	0.4841	0.9453	0.5797
Crisis period 16/09/2008 ----- 31/03/2009	0.9681	0.9821	0.9863	1.0096
Crisis and post-crisis period 01/04/2009 ----- 07/11/2014	0.9715	0.9602	0.9765	0.9875

Table 6: Kuwait mean beta during all periods

Banks	BB	KFH	KIB	NBK
Total Period 31-12-2004 ----- 07/11/2014	0.8942	1.0320	0.9617	1.0034
Pre-crisis period 31-12-2004 ----- 15/09/2008	0.7450	1.0553	0.9289	1.0153
Crisis period 16/09/2008 ----- 31/03/2009	0.9868	1.0356	0.9591	1.0069
Crisis and post-crisis period 01/04/2009 ----- 07/11/2014	0.9839	1.0180	0.9814	0.9962

Table 7: Qatar mean beta during all periods

Banks	AB	QIIB	QIB	QNB
Total Period 31-12-2004 ----- 07/11/2014	0.9006	0.9495	1.0183	1.0003
Pre-crisis period 31-12-2004 ----- 15/09/2008	0.7681	0.8779	1.0712	1.0199
Crisis period 16/09/2008 ----- 31/03/2009	0.9780	1.0158	0.9525	0.9708
Crisis and post-crisis period 01/04/2009 ----- 07/11/2014	0.9802	0.9926	0.9865	0.9885

Table 8: Abu Dhabi beta Crisis period test results

Beta _t	Constant	Dummy	CV _t	CVD _t	MV _t	MVD _t	Rho	Diagnostics
ADIB	0.8270*** (27.80)	0.0686 (1.19)	3.9621*** (9.76)	-3.2230*** (-6.62)	-4.1373*** (-8.36)	3.4033*** (5.80)	0.9410*** (140.00)	R ² = 0.143, DW= 1.90 , SEE= 0.269 , SSR= 159.2
CBI	0.7705*** (24.50)	0.1387 (1.90)	3.0939*** (7.32)	-2.5264*** (-4.80)	-3.1685*** (-5.86)	2.6191** (3.98)	0.9252*** (123.00)	R ² = 0.145, DW= 2.12, SEE= 0.321, SSR= 226.6
NBAD	1.0014*** (59.50)	0.0043 (0.10)	3.6079*** (10.10)	-3.0087*** (-6.85)	-3.8787*** (-8.69)	3.2518*** (5.96)	0.9159*** (115.00)	R ² = 0.158, DW= 1.99 , SEE= 0.183, SSR= 72.9
SIB	0.8376*** (33.70)	0.0410 (0.72)	2.2267*** (4.52)	-1.8404 (-2.36)	-2.2565** (-3.92)	1.8681 (2.05)	0.9268*** (125.00)	R ² = 0.128, DW=2.26 , SEE= 0.248, SSR= 137.8

$Beta_{i,t} = \alpha_0 + \gamma_0 D_t + \alpha_1 CV_{i,t} + \gamma_1 (CV_{it} D_t) + \alpha_2 MV_t + \gamma_2 (MV_t D_t) + \varepsilon_t$; ***, **, * imply significance at the 1%, 5% et 10% levels respectively.

T-statistics in parentheses; CV= bank volatility; CVD= bank volatility x time dummy; MV= market volatility; MVD= market volatility x time dummy ; DW=Durbin–Watson statistics; SSE=standard error of estimate; SSR=sum of square residuals.

Table 9: Kuwait beta Crisis period test results

Beta _t	Constant	Dummy	CV _t	CVD _t	MV _t	MVD _t	Rho	Diagnostics
BB	0.8863*** (42.90)	0.0490 (0.95)	3.0770*** (4.78)	-2.5096** (-3.45)	-3.1888*** (-4.07)	2.6092* (2.97)	0.9157*** (115.00)	R ² = 0.088, DW= 1.93, SEE= 0.217, SSR= 110.2
KFH	1.0327*** (76.20)	0.0659 (1.94)	6.4767*** (9.28)	-5.8367*** (-5.67)	-6.9050*** (-9.33)	6.2123*** (5.67)	0.9177*** (116.00)	R ² = 0.047, DW= 2.02, SEE= 0.141, SSR= 48.9
KIB	0.9579*** (47.20)	0.0855 (1.44)	3.3609*** (4.76)	-2.7402* (-3.29)	-3.6438*** (-4.12)	2.9743* (2.86)	0.8950*** (101.00)	R ² = 0.038, DW= 1.95, SEE= 0.233, SSR= 134.2
NBK	1.0046*** (90.40)	0.0087 (0.29)	4.4253*** (7.59)	-3.9056*** (-5.55)	-4.7086*** (-7.30)	4.1579*** (5.33)	0.9055*** (108.00)	R ² = 0.060, DW= 2.01, SEE= 0.124, SSR= 37.2

$Beta_{i,t} = \alpha_0 + \gamma_0 D_t + \alpha_1 CV_{i,t} + \gamma_1 (CV_{it} D_t) + \alpha_2 MV_t + \gamma_2 (MV_t D_t) + \varepsilon_t$; ***, **, * imply significance at the 1%, 5% et 10% levels respectively.

T-statistics in parentheses; CV= bank volatility; CVD= bank volatility x time dummy; MV= market volatility; MVD= market volatility x time dummy ; DW=Durbin–Watson statistics; SSE=standard error of estimate; SSR=sum of square residuals.

Table 10: Qatar beta Crisis period test results

Beta _t	Constant	Dummy	CV _t	CVD _t	MV _t	MVD _t	Rho	Diagnostics
AB	0.8431*** (42.70)	0.2014** (3.58)	3.3924*** (5.99)	-2.3395** (-3.46)	-3.3935*** (-4.43)	2.1050 (2.31)	0.8981*** (101.00)	R ² = 0.154, DW= 2.03, SEE= 0.227, SSR= 112.5
QIIB	0.8702*** (49.90)	0.1574* (3.16)	3.4526*** (10.10)	-2.3462*** (-5.90)	-3.1103*** (-6.77)	1.9428* (3.69)	0.8983*** (102.00)	R ² = 0.191, DW= 2.05, SEE= 0.213, SSR= 93.6
QIB	0.9679*** (69.80)	0.0001 (0.00)	4.4321*** (11.80)	-3.7387*** (-8.50)	-4.8757*** (-9.32)	4.1003*** (6.78)	0.8824*** (93.30)	R ² = 0.129, DW= 1.92, SEE= 0.175, SSR= 68.5
QNB	1.0169*** (115.00)	-0.0710* (-2.90)	6.5347*** (8.96)	-6.1852*** (-6.92)	-7.0467*** (-8.69)	6.7127*** (6.76)	0.9033*** (105.00)	R ² = 0.008, DW= 1.87, SEE= 0.095, SSR= 23.4

$Beta_{i,t} = \alpha_0 + \gamma_0 D_t + \alpha_1 CV_{i,t} + \gamma_1 (CV_{it} D_t) + \alpha_2 MV_t + \gamma_2 (MV_t D_t) + \varepsilon_t$; ***, **, * imply significance at the 1%, 5% et 10% levels respectively.

T-statistics in parentheses; CV= bank volatility; CVD= bank volatility x time dummy; MV= market volatility; MVD= market volatility x time dummy ; DW=Durbin–Watson statistics; SSE=standard error of estimate; SSR=sum of square residuals.

Table 11: Abu Dhabi beta Crisis and post crisis period test results

Beta _t	Constant	Dummy	CV _t	CVD _t	MV _t	MVD _t	Rho	Diagnostics
ADIB	0.6099*** (24.60)	0.3468*** (11.30)	11.9573*** (10.70)	-10.5013*** (-9.22)	-6.7972*** (-7.87)	5.3281*** (5.88)	0.8903*** (98.70)	R ² = 0.521, DW= 1.87 , SEE= 0.269, SSR= 88.9
CBI	0.4986*** (19.00)	0.4436*** (13.50)	10.6036*** (8.01)	-9.2362*** (-6.86)	-5.3588*** (-4.75)	3.9662** (3.39)	0.8592*** (84.80)	R ² = 0.520, DW= 2.06, SEE= 0.321, SSR= 127.2
NBAD	1.0206*** (41.90)	-0.0399 (-1.34)	-7.7966*** (-8.04)	8.9114*** (9.44)	-6.1831*** (-8.74)	5.0366*** (6.63)	0.9117*** (112.00)	R ² = 0.216, DW= 1.99, SEE= 0.183, SSR= 67.9
SIB	0.6208*** (31.90)	0.3554*** (14.50)	4.5570*** (4.27)	-3.0607* (-2.67)	-1.3837 (-1.61)	-0.2475 (-0.25)	0.8536*** (82.30)	R ² = 0.535, DW= 2.18, SEE= 0.248, SSR= 73.4

$Beta_{i,t} = \alpha_0 + \gamma_0 D_t + \alpha_1 CV_{i,t} + \gamma_1 (CV_{it} D_t) + \alpha_2 MV_t + \gamma_2 (MV_t D_t) + \varepsilon_t$; ***, **, * imply significance at the 1%, 5% et 10% levels respectively.

T-statistics in parentheses; CV= bank volatility; CVD= bank volatility x time dummy; MV= market volatility; MVD= market volatility x time dummy ; DW=Durbin–Watson statistics; SSE=standard error of estimate; SSR=sum of square residuals.

Table 12: Kuwait beta Crisis and post crisis period test results

Beta _t	Constant	Dummy	CV _t	CVD _t	MV _t	MVD _t	Rho	Diagnostics
BB	0.7532*** (33.10)	0.2159*** (7.60)	18.2286*** (8.30)	-17.2216*** (-7.77)	-17.1778*** (-7.45)	16.1659*** (6.93)	0.8833*** (95.10)	R ² = 0.325, DW= 1.91, SEE= 0.217, SSR= 81.5
KFH	1.0331*** (52.30)	0.0017 (0.07)	15.1766*** (9.30)	-12.9161*** (-7.51)	-15.3276*** (-9.85)	12.9031*** (7.78)	0.9139*** (113.00)	R ² = 0.122, DW= 2.03, SEE= 0.141, SSR= 45.1
KIB	0.9085*** (30.80)	0.0815 (2.21)	18.4323*** (7.73)	-17.3980*** (-7.21)	-19.1571*** (-6.88)	18.0782*** (6.40)	0.8911*** (99.10)	R ² = 0.082, DW= 1.94, SEE= 0.233, SSR= 128.12
NBK	1.0117*** (63.10)	-0.0164 (-0.83)	15.9079*** (11.00)	-15.0541*** (-10.20)	-15.8599*** (-11.10)	14.9788*** (10.10)	0.9013*** (105.00)	R ² = 0.136, DW= 2.02, SEE= 0.124, SSR= 34.2

$Beta_{i,t} = \alpha_0 + \gamma_0 D_t + \alpha_1 CV_{i,t} + \gamma_1 (CV_{it} D_t) + \alpha_2 MV_t + \gamma_2 (MV_t D_t) + \varepsilon_t$; ***, **, * imply significance at the 1%, 5% et 10% levels respectively.

T-statistics in parentheses; CV= bank volatility; CVD= bank volatility x time dummy; MV= market volatility; MVD= market volatility x time dummy ; DW=Durbin–Watson statistics; SSE=standard error of estimate; SSR=sum of square residuals.

Table 13: Qatar beta Crisis and post crisis period test results

Beta _t	Constant	Dummy	CV _t	CVD _t	MV _t	MVD _t	Rho	Diagnostics
AB	0.6907*** (22.60)	0.2842*** (7.49)	95.6087*** (13.60)	-93.7985*** (-13.40)	-116.9270*** (-13.00)	114.8370*** (12.80)	0.9048*** (105.00)	R ² = 0.314, DW= 2.01, SEE= 0.227, SSR= 91.1
QIIB	0.7510*** (34.70)	0.1909*** (7.00)	2.3712*** (13.50)	-0.8188*** (-10.30)	2.6512 (2.15)	-4.3768** (-3.59)	0.8742*** (90.90)	R ² = 0.296, DW= 2.03, SEE= 0.213, SSR= 82.6
QIB	0.9576*** (48.90)	0.0013 (0.05)	33.2304*** (22.70)	-31.8703*** (-21.60)	-40.7973*** (-19.00)	39.3650*** (18.20)	0.8830*** (995.10)	R ² = 0.138, DW= 1.95, SEE= 0.175, SSR= 67.8
QNB	1.0040*** (79.10)	-0.0130 (-0.84)	129.6840*** (33.10)	-128.1570*** (-32.60)	-139.1860*** (-32.70)	137.5770*** (32.30)	0.9162*** (117.00)	R ² = 0.052, DW= 1.87, SEE= 0.095, SSR= 22.4

$Beta_{i,t} = \alpha_0 + \gamma_0 D_t + \alpha_1 CV_{i,t} + \gamma_1 (CV_{it} D_t) + \alpha_2 MV_t + \gamma_2 (MV_t D_t) + \varepsilon_t$; ***, **, * imply significance at the 1%, 5% et 10% levels respectively.

T-statistics in parentheses; CV= bank volatility; CVD= bank volatility x time dummy; MV= market volatility; MVD= market volatility x time dummy ; DW=Durbin–Watson statistics; SSE=standard error of estimate; SSR=sum of square residuals.

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