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Credit Risk and Efficiency: Comparative Study between Islamic and Conventional Banks during the Current Crises

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Abstract This study deals with the credit risk and the efficiency of the Islamic and conventional banks in 28 countries during the current crises. For this purpose, we take a sample of 99 Islamic banks and 110 classics during the 1999-2010 period. The generalized method of moments (GMM) is applied to measure the relationship of the credit risk, capital efficiency and banking industries during the current crises. The results show that most of conventional banks have a higher credit risk than the Islamic ones. This risk has a high impact on the exposure to the financial crises. The inefficiency degree of Islamic banks does not differ from that of the conventional ones.

Keywords: *Credit risk, Efficiency, Islamic banks, Conventional banks, financial crises, GMM*

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1. Introduction

In recent decades, theoretical development has contributed to the risk analysis. First of all, there has been a greater reflection on risk mitigation as a result of the frequent episodes of financial crises. Secondly, financial diversification and product innovation have brought new dimensions and types of risk in the interface. Thirdly, the efforts of the financial community to develop and innovate the financial system, which led, among other things, to the Basel II agreements, evolved after a rich debate to understand the risks faced by financial institutions and markets. However, all these changes have so far focused on the conventional financial system gradually benefiting from financial engineering and from product innovation and esoteric structures. Nevertheless, Islamic finance has grown exponentially in the past few years, and the appreciation of the architecture of its risk profile is still evolving.

Despite the extensive literature on the efficiency features of the modern banking industry, particularly the work on the American and European banking markets as well as in the rest of the world, the work on Islamic finance is still at its very early stage.

According to McNeil et al. (2005), credit risk is the portfolio change due to unforeseen variances in the credit quality of the issuer or trading partner. Arunkumar and Kotreshwar (2005) see that the credit risk causes 70% of the overall banking risk whereas the remaining 30% are shared between the market and operational risk. Moreover,Khan (2003) stated that the credit risk is the main instability score in the banking system.

On studying the risk and stability in Islamic finance for the period 1999-2009, Abedifar et al. (2012) found that, regarding insolvency risk, small Islamic banks seemed to be more stable, and their loan quality less sensitive to the domestic interest rates compared to conventional banks .

Alam (2012) examined the relationship between risk and efficiency in both banking systems. He stated that inefficiency and bank risk are positively correlated for Islamic banks, the thing which clearly shows the difference in nature of the risk-return relationship between these two distinct types of banks.

Martiana and al. (2011)showed that operational risk in Islamic banks was important but very complicated compared to that of conventional banks due to specific contractual features and the general legal environment.

ForSrairi (2009), Islamic banks tend to have higher risk than western banks because of their lack of experience and unfamiliarity with all the financial tools that can help them provide more capital to handle this degree of risk.

This paper consists, first, in identifying and assessing the credit risk and the efficiency of the Islamic and conventional banks before and after both the subprime crisis, which broke out in the early 2007, and that of liquidity of 2009. This latter one, which occurred after the former, affected 28 countries, such as Saudi Arabia, Bahrain, Egypt, Iran, Jordan, Kuwait, Malaysia, Sudan, United Arab Emirates, Yemen, Qatar, Pakistan, Bangladesh, Tunisia, Turkey, Brunei Darussalam, Indonesia, Federal Russia, Iraq, the United Kingdom, the Cayman Islands, Singapore, the Palestinian Territory, Gambia, Syria, Thailand, Lebanon, Mauritania, and consists of 209 banks over the period 1999-2010.

2. Data and Model Specification

The data used in this part of the study are preliminary data about Islamic and conventional banks in 28 countries including 99 Islamic banksand 110 conventional banks over the 1999/2010 period. Our sample consists of financial institutions found in the database of the Bank scope. This database, as much as possible, converts the data into common international standards to facilitate the comparisons. Furthermore, to trust the accuracy of the Bank scope database, we should compare some original data issued by several Jordanian banks with data extracted from the Bank scope database of 2004. The data proved to be the same.

In our study, risk is measured using the GMM methods, in the same vein as Altunbas and al (2007) and Fiordelisi and al (2010), we use the equation system to study the characteristics, the risk and the efficiency of the Islamic banks and compare them to their conventional counterparts.

$$Risk_{i,t} = \alpha_1 + \alpha_2 \times ISBD_{i,t} + \alpha_3 \times Size_{i,t} + \alpha_4 \times MS_{i,t} + \alpha_5 \times ETA_{i,t} + \alpha_6 \times Ineff_{i,t} + \alpha_7 \times NII_{i,t-1} + \alpha_8 \times GLG_{i,t-1} + \sum_{m=1}^{5} \alpha_{9,m} \times MacroVar_{i,t,m} + \sum_{t=1}^{7} \alpha_{10,t} \times YearD_t + \varepsilon_{1,i,t} \quad (1)$$

$$ETA_{i,t} = \beta_1 + \beta_2 \times ISBD_{i,t} + \beta_3 \times Size_{i,t} + \beta_4 \times MS_{i,t} + \beta_5 \times Risk_{i,t} + \beta_6 \times Ineff_{i,t} + \beta_7 \times ROAA_{i,t-1} + \sum_{m=1}^{5} \beta_{8,m} \times MacroVar_{i,t,m} + \sum_{t=1}^{7} \beta_{9,t} \times YearD_t + \varepsilon_{2.i.t} \quad (2)$$

$$Ineff_{i,t} = \gamma_1 + \gamma_2 \times ISBD_{i,t} + \gamma_3 \times Size_{i,t} + \gamma_4 \times MS_{i,t} + \gamma_5 \times Risk_{i,t} + \gamma_6 \times ETA_{i,t} + \gamma_7 \times TNEAR_{i,t-1} + \sum_{m=1}^{5} \gamma_{8,m} \times MacroVar_{i,t,m} + \sum_{t=1}^{7} \gamma_{9,t} \times YearD_t + \varepsilon_{3,i,t} \quad (3)$$

Where the i subscript denotes individual banks and t denotes the time dimension. Risk (Risk), equity capital (ETA) and inefficiency (Ineff) are modeled in equations 1 to 3, respectively. We analyze the Credit risks. Annex 1 illustrates our credit risk proxies, dependent and control variables. The effect of being an Islamic bank is captured by a dummy variable which takes the value of one when the bank is Islamic and zero otherwise (ISBD).

3. Estimation Results

Table 1 and Table 2 below show the estimation results of the simultaneous equations of risk capital and inefficiency by using the generalized method of moments on a balanced panel for the 1999/2010 period. In systems (1) and (4), the LLRGLis used as a proxy for credit risk. The first estimate is obtained from the basic model. In estimation (2), we add an interaction term by multiplying the nominal variable of Islamic banking by its size to capture potential differences in the relationship between risk and the size of the Islamic and conventional banks. System (3) estimation is based on Hughesand Moon's Studies (1995) and Hughes and Mester's (1998). We estimate a system of two equations of risk and capital in which the level of inefficiency is controlled. In this configuration, the delayed inefficiency value is used as a preset variable.

In the fourth estimation, we add the interaction term of the dummy variable of Islamic banks and the size of system (3). In the latter four sets of estimates, i.e. from (5) to (8), we believe that our models use the PLGLinstead of LLRGL.

In Table 1 below, we will present the first system, which is composed of three basic equations, by considering the LLRGLas the proxy of the credit risk.

Table 1. Results of the estimates of the simultaneous equations of LLRGL (Loan Loss Reserves / Gross Loans), capital and inefficiency

	(1)			(2)		
	(1)	(2)	(3)	(4)	(5)	(6)
Vbls	LLRGL	ETA	Ineff	LLRGL	ETA	Ineff
C	24.185 0.637	-1.416 0.001	0.553 0.000	20.93 0.022	-1.157 0.057	0.541 0.000
ISBD	- 2.224 0.045	0.102 0.035	0.043 0.021	- 1.39 0.006	0.272 0.347	0.031 0.671
Size	-2.682 0.043	0.116 0.093	-0.059 0.000	-2.189 0.039	0.071 0.039	-0.066 0.000
Size X ISBD				0.099 0.005	0.053 0.013	0.004 0.004
MS	-1.080 0.830	-0.028 0.020	-0.038 0.377	-0.980 0.868	-0.014 0.939	-0.046 0.048
MABD	-0.915 0.796	0.233 0.007	-0.006 0.813	-1.219 0.803	0.248 0.005	-0.007 0.797
CGDP	-2.51 0.699	0.095 0.500	-0.052 0.086	-2.022 0.807	0.079 0.022	-0.049 0.115
HHI	1.888 0.042	0.005 0.046	0.058 0.021	1.437 0.006	-0.003 0.022	- 0.06 0.085
GLG1	- 0.056 0.042			-0.013 0.023		
NII1	0.077 0.007			0.095 0.042		
ETA	9.016 0.023		- 0.17 0.001	- 8.96 0.001		- 0.17 0.009
Inefficience	-45.547 0.727	2.220 0.000		-35.97 0.831	1.971 0.000	
D9	-1.877 0.04	0.149 0.327	-0.044 0.191	-1.580 0.000	0.136 0.437	-0.037 0.369
D10	-1.863 0.019	0.145 0.308	-0.041 0.193	-1.572 0.004	0.132 0.409	-0.034 0.361
D11	-1.149 0.009	0.0735 0.475	-0.026 0.270	-0.923 0.013	0.069 0.502	-0.024 0.319
D12	0.607 0.058	-0.015 0.880	0.014 0.571	0.539 0.001	-0.010 0.915	0.016 0.513
ROAA		0.004 0.046		0.004 0.045	0.004 0.045	
LLRGL		0.111 0.418	-0.023 0.419		0.100 0.568	-0.015 0.712
TNEAR			0.002 0.046			0.007 0.039

When analyzing the preceding table, we notice that, for equations (1) and (4) where the LLRGL is used as proxy of the credit risk, the probabilities of the dummy variable of the Islamic banks (isbd) take values lower than 5% but these coefficients take negative values equal to (-2.224195) and (- 1.390625), respectively. These results show that conventional banks' credit risk is higher than that of their Islamic counterparts. Several studies, such as that of Pirner (2003) and Coyle (2000), state that credit risk has a high effect on the exposure to financial crises. As a consequence, credit risk can threaten the bank if not managed correctly.

For the variable size, which implies the bank size, and according to the estimated results of equations (1) and (4), the probabilities take positive values equal to (0. 043) and (0.039) respectively which are lower than 5% whereas their coefficients take negative values equal to (- 2.682952) and (- 2.189806). Therefore, the relationship between the size and the credit risk degree is negative, which seems coherent with the diversification possibility and the advantages of the economies of scale. According to these results, it appears that the positive impact of the size on the quality of the loans for Islamic banks is lower than that of traditional banks.

According to the methodology adopted by Morgan and Samolyk (2003), Stiroh (2004), Stiroh and Rumble (2006) and Mercieca et al. (2007), we measure diversification using the herfindhal Hirschman index (HHI), which is a concentration index. The higher the HHI index, the more the bank is largely concentrated and less diversified in a given segment. Based on the obtained results using equations (1) and (4), where LLRGL is introduced as a credit risk proxy, the HHI concentration index is significant and positive. These results show that, the more the concentration within the Islamic banks increases, the higher the credit risk will be.

This phenomenon can be explained by the fact that credit concentration can take the form of a risk higher than the average in relation to any economic or geographical sector, making the lending bank vulnerable to the difficulties of an industry or to a particular area. It is therefore important that banks systematically identify and evaluate sectoral or regional risk so that the management will be aware of the incurred risks and sets up a better balance, if necessary. It seems that the relationship between concentration and risk continues to be a subject of debate between researchers. There are several studies which claim that this concept is said to improve the profitability of the banking institutions and therefore reduce risk. However, some claim the opposite by providing evidence that concentration is the cause of a risk increase and a decline of banking performance.

The ETA negative sign in equations (1) and (4), means that a more important equity capital leads to a weaker risk. The conclusions of Konishi and Yasuda, (2004), show that requirements for equity capital reduce risk taking of the banking incentives. For Demsetzand Strahan (1997), banking capitalization positively and significantly affects the probability of bank defect. These authors find a negative correlation between overall risk and equity capital. According to our results, Islamic banks are more affected than conventional ones by the negative impact of the ETA on the credit risk.

It can also be noted that the variables D9, D10 and D11, which represent years 2007, 2008 and 2009, and the results in columns (1) and (4), take negative but significant signs. On the other hand, variable D12, which indicates the year 2010, seems to have a significant and positive effect. One can conclude that Islamic banks are less risky than the conventional ones during the three mentioned years. Year 2007 is the outbreak of the subprime crisis.

Several authors assessed the level of losses of conventional banks during the period of this crisis. Among these authors, we find Mark Zandi (2009), an economist of the agency of Moody swimming, who states that there are great losses which can reach 225 billion dollars. Another study carried out by Deustche Bank assessed these losses at 400 billion dollars.

Therefore, our results show that, in case the LLRGL presents the credit risk proxy, Islamic banks are not hit by the subprime crisis. This can be explained by the fact that the Islamic banks are far from developing mortgages as are prohibited by Islamic law (Sharia). For this reason, all researchers and experts said that the subprime crisis has not affected the Islamic financial institutions.

The difference between systems (1) and (2) lies in the fact that we added the variable Size X ISBD (the interaction between the size and the dummy variable of Islamic banks). The interaction term between the size and the dummy variable of Islamic banks is positive and significant in equation (4) where the LLRGL variable is the credit risk proxy. This indicates that the positive impact of the size on the credit risk is lower for conventional banks.

Our results in equation (6) show that the larger the size of Islamic banks the higher inefficiency will be.

Table 2. Estimation results of the ETA and LLRGL simultaneous equations

	(1)		(2)	
	(1)	(2)	(3)	(4)
Vbles	LLRGL	ETA	LLRGL	ETA
Constant	71.407 0.001	0.460 0.021	68.012 0.014	0.250 0.031
ISBD	- 8.685 0.001	0.033 0.006	-3.178 0.888	0.392 0.021
Size	-10.585 0.038	0.0228 0.846	-10.913 0.007	-0.0405 0.655
MS	-5.674 0.015	- 0.007 0.005	-4.626 0.836	- 0.014 0.038
MABD	2.7083 0.881	0.3004 0.001	2.242 0.902	0.304 0.001
CGDP	-8.714 0.804	0.004 0.978	-7.455 0.817	0.005 0.972
HHI	11.369 0.014	0.012 0.008	9.851 0.827	-0.011 0.959
GLG1	- 0.831 0.002		- 0.696 0.009	
NII1	2.794 0.001		2.398 0.019	
ETA	- 12.760 0.001		- 11.623 0.030	
Inefficience	-173.356 0.810	- 0.488 0.019	-147.862 0.824	0.527 0.413
Isbd * size			3.179175 0.010	- 0.107 0.033
ROAA1		0.006 0.02		0.006 0.048
LLrgl		0.056 0.837		0.056 0.788
D9	-5.523177 0.783	0.064 0.790	-4.6775 0.793	0.0711 0.716
D10	-5.440 0.783	0.0646 0.766	-4.629 0.793	0.069 0.694
D11	-4.0383 0.803	0.0355 0.741	-3.310 0.814	0.0415 0.680
D12	2.0497 0.832	0.003 0.973	1.941 0.843	0.106 0.914

Both systems in the table above are based on Hughes and Moon (1995) and Hughes and Mester (1998). A two-equation system of both the (LLRGL) risk and the capital in which the level of inefficiency is controlled is estimated. In this configuration, the inefficiency lagged value is used as a preset variable.

The results show that Islamic banks have a lower credit risk and a higher capital than their conventional counterparts. According to these two equations, improvement in profitability and efficiency helps strengthen bank capital. Our results are similar to those generated by Fiordelisi and al (2010). By adding the interaction term between the size and the dummy variable of Islamic banks to the third and fourth equation, we notice thatIslamic banks profit less from the negative impact of the size on the credit risk than conventional banks.

Table 3. Estimation results of the simultaneous equations of PLGL (Problem Loans / Gross Loans), capital and inefficiency

	(1)			(2)		
Vbles	**PLGL (1)**	**ETA (2)**	**Ineff (3)**	**PLGL (4)**	**ETA (5)**	**Ineff (6)**
C	142.655 0.035	-1.275 0.081	0.273 0.034	192.961 0.004	-1.011 0.114	0.261 0.007
ISBD	17.84181 0.797	-0.153 0.726	0.053 0.794	-6.421 0.006	-0.36 0.170	-0.028 0.020
Size	-21.690 0.010	0.188 0.000	-0.073 0.000	-32.098 0.042	0.134 0.061	- 0.078 0.000
MS	-10.788 0.006	-0.025 0.004	-0.024 0.679	-13.415 0.022	-0.032 0.001	-0.032 0.614
MABD	5.407 0.872	0.239 0.039	-0.0525 0.219	8.2491 0.871	0.253 0.018	-0.055 0.227
CGDP	-16.814 0.797	0.050 0.790	-0.010 0.831	-20.849 0.819	0.038 0.847	-0.006 0.897
HHI	21.252 0.023	0.101 0.003	- 0.049 0.001	27.334 0.830	-0.086 0.714	0.053 0.459
ETA	-25.7 0.000		0.229 0.001	-28.481 0.003		0.233 0.005
Ineff	-338.7 0.801	2.542 0.000		-421.851 0.822	2.331 0.000	
D9 (2007)	-9.511 0.799	0.0529 0.736	0.0105 0.812	-11.474 0.012	0.047 0.745	0.014 0.746
D10 (2008)	-9.784 0.791	0.062 0.730	0.194 0.700	-11.728 0.021	0.055 0.742	0.026 0.615
D11 (2009)	-8.409 0.780	0.046 0.842	0.0391 0.540	-9.867 0.011	0.039 0.854	0.047 0.465
D12 (2010)	3.882878 0.830	-0.071 0.780	0.0894 0.201	5.516 0.842	-0.071 0.760	0.099 0.156
Isbd*size				8.596 0.045	0.066 0.382	0.007 0.001
GLG1				-1.788 0.010	-0.020 0.916	
NII1				6.0648 0.845		
ROAA1		0.004 0.012			0.004 0.020	
PLGL		-0.013 0.953	0.064 0.265		-0.020 0.916	0.072 0.201
TNEAR1			0.003 0.020			0.004 0.003
TNEAR1			0.003 0.020			0.004 0.003

In the first equation, and according to the results identified in the table above, where the PLGL(Problem Loans / Gross Loans) is used as a proxy, the coefficient on the dummy variable for Islamic banks (ISBD)is insignificant with a probability greater than 5%.

On the basis of the third equation, we can say that the level of inefficiency of Islamic banks is not significantly different from that of conventional banks.

The size measured by the logarithm of total assets is said to be a control variable as it can affect the capital level, the risk and the profitability of the bank through the economies of scale. According to our results, there is a negative relationship between the size and the credit risk level, in other words, large banks can easily enter capital markets and draw a greater diversification of their portfolio. They are supposed to have a lower capital and risk level than smaller banks.

In the second system, the term of interaction between the size and the dummy variable of the Islamic banks is added. It appears from estimation (4) that the dummy variable of Islamic banks (isbd) has a value lower than 5% whereas this coefficient has a value of (-0.3625112). This shows that Islamic banks have lower risk than their conventional counterparts.

We also see that, according to equation (6), the dummy variable of Islamic banks is equal to (0.020) and lower than 5% and their coefficient is equal to (- 0.0280105). One can thus say that the efficiency level of Islamic banks is higher than that of conventional ones.

Regarding the variables D9, D10, D11 and D12, which indicate the years 2007, 2008, 2009 and 2010, respectively, we concluded, according to results in the table above, that during the first three years, the credit risk of Islamic banks is lower than that of conventional banks.However, at the end of the year 2010, we noticed that there is not a great difference between the Islamic banks and their conventional homologous.

These results make us say that, during the subprime crisis period, Islamic banks were not affected since the mortgages are prohibited by the Islamic laws.

However, on the basis of the results of 2010, we can say that IB were not excluded from the credit risk which can occur in several types of contracts of Islamic banks, such as Salam, Mourabaha, Musharaka, and Mudaraba contracts.The credit risk rose during that year since 2010 is the fourth phase of the current financial crisis called “the sovereign debt crisis”. This crisis affected the world markets in the East as well as in the West, such as the Japanese stock exchange market and other markets in

Europe and in the United States and many countries around the world. This crisis also affected the Islamic banks as these ones have economic ties with the global equity markets as well as the International Monetary Fund.

Table 4. Estimation results of the PLGL (Problem Loans / Gross Loans) and ETA simultaneous equations.

	(1)		(2)	
Vbles	**PLGL (1)**	**ETA (2)**	**PLGL (3)**	**ETA (4)**
Constant	127.26 0.006	0.543 0.005	89.83 0.000	0.316 0.038
ISBD	16.11 0.813	-0.042 0.523	-1.184 0.022	0.504 0.048
Size	-19.73 0.022	0.048 0.039	-14.70 0.012	-0.033 0.689
MS	-10.87 0.018	- 0.033 0.005	-6.780 0.008	-0.047 0.007
MABD	4.802 0.884	0.297 0.013	2.291 0.929	0.298 0.004
CGDP	-15.47 0.809	-0.018 0.913	-9.926 0.822	-0.013 0.937
HHI	21.67 0.007	-0.060 0.772	14.34 0.017	-0.066 0.046
GLG1	1.511 0.828		0.921 0.022	
NII1	5.015 0.015		3.183 0.021	
ETA	- 23.68 0.013		- 18.46 0.004	
Ineff	-311.23 0.813	-0.44 0.031	-197.69 0.833	- 0.48 0.042
Isbd * size			3.442 0.030	0.138 0.065
ROAA1		0.006 0.200		0.006 0.000
PLGL		0.064 0.789		0.079 0.629
D9	-8.88 0.808	0.043 0.778	-5.61 0.824	0.059 0.644
D10	-9.06 0.802	0.060 0.741	-5.849 0.814	0.077 0.601
D11	-7.776 0.792	0.078 0.749	-5.087 0.798	0.100 0.587
D12	3.096 0.860	0.050 0.857	1.904 0.890	0.075 0.709

According to the first equation, the credit risk level (PLGL) does not greatly differ from that of conventional banks. On the other hand, and according to the result estimated in equation (3), the dummy variable of Islamic banks (ISBD)is equal to (0.022) and lower than 5% and its coefficient is equal to (- 1.184548). We can thus conclude that the credit risk level (PLGL) within Islamic banks is lower than that in conventional banks.

The interaction between the size and the dummy variable of Islamic banks (ISBD) in the third equation prove to be significant and positive with a probability equal to (0.030) and a coefficient equal to (3.442718). This result shows that Islamic banks benefit less than the traditional banks from the negative impact of the size on the credit risks.

In the third equation, the HHI concentration degree is significant and positive with a coefficient equal to (14.34249) and a probability of (0.017). These results show that Islamic banks are less affected than conventional banks by the diversification impact on the rise of the credit risk. The relationship between inefficiency and ETA in equations (2) and (4) seems to be negative and significant. This implies that the improvement of banks' profitability and efficiency increases and strengthens the bank capital. Our results confirm the conclusions of Van Roy (2003) who state that capital regulation can help increase the banks' capitalization level. Moreover, the improvement of the capital was accompanied by a decline of the credit risk and by a rise of the interest margin.

Table 5. Estimation results of the simultaneous equations of LLPAGL (Loan Loss Provisions /Average Gross Loans), ETA and Inefficiency

	(1)			(2)		
Vbles	**LLPAGL (1)**	**ETA (2)**	**Ineff (3)**	**LLPAGL (4)**	**ETA (5)**	**Ineff (6)**
C	0.301 0.006	-1.314 0.006	-0.852 0.164	-0.116 0.04	-1.313 0.019	-1.015 0.078
ISBD	-0.073 0.022	0.082 0.023	-0.051 0.387	- 0.445 0.042	-0.224 0.400	-0.175 0.410
Size	0.085 0.934	0.105 0.061	0.067 0.300	0.200 0.895	0.094 0.263	0.070 0.355
Size X ISBD				0.161 0.005	0.039 0.616	0.031 0.613
MS	0.359 0.559	-0.190 0.269	-0.140 0.256	0.357 0.602	-0.177 0.294	-0.151 0.276
MABD	-0.260 0.561	0.132 0.279	0.089 0.288	-0.285 0.605	0.129 0.285	0.104 0.278
CGDP	0.193 0.812	-0.141 0.933	-0.010 0.927	0.210 0.826	-0.003 0.985	-0.004 0.972
HHI	-0.414 0.715	0.145 0.451	0.110 0.400	-0.436 0.746	0.131 0.484	0.115 0.446
GLG1	-0.017 0.836			-0.020 0.840		
NII1	-0.058 0.828			-0.070 0.828		
ETA	1.1644 0.161		-0.065 0.017	1.183 0.211		-0.789 0.000
Ineff	5.362 0.744	-1.420 0.000		5.673 0.772	-1.165 0.000	
D9	-0.153 0.003	0.194 0.080	0.127 0.185	-0.152 0.045	0.198412 0.064	0.156 0.104
D10	- 0.039 0.000	0.046 0.652	0.030 0.669	- 0.041 0.001	0.054 0.587	0.041 0.606
D11	0.335 0.004	-0.198 0.058	-0.132 0.102	0.333 0.000	-0.186 0.070	-0.149 0.085
D12	0.046 0.045	-0.067 0.536	-0.040 0.583	0.036 0.037	-0.06 0.531	-0.046 0.563
ROAA1		-0.002 0.864			-0.001 0.832	
LLPAGL		0.77 0.000	0.517 0.028		0.759 0.000	0.606 0.002
LLPAGL		0.77 0.000	0.517 0.028		0.759732 0.000	0.606 0.002
TNEAR1			0.004 0.816			0.0003 0.781

The LLPAGL (Loan Loss Provisions /Average Gross Loans) is the credit risk proxy in both estimates (1) and (2) in the table above. According to the result estimation in equation (1), we can say that the dummy variable of Islamic banks (ISBD)is equal to (0.022) and lower than 5% and its coefficient is equal to (- 0.073586). These results show that Islamic banks are less affected by the credit risk than the conventional ones.

As for the four variables D9, D1, D11 and D12, which respectively indicate the years 2007, 2008, 2009 and 2010, we notice that, according to the results in equations (1) and (4), during the first two years, the credit risk of

Islamic banks is lower than that of conventional banks. However, at the end of the third and the fourth year, it rose in Islamic banks.

In the second system, we added the variable Size X ISBD (it is the interaction between the size and the dummy variable of Islamic banks).

According to the results of the table above, in which LLPAGL is the credit risk proxy, we notice that the relationship between risk credit (LLPAGL) and the interaction term between the size and the dummy variable for Islamic banks is significant and positive with a probability of (0.005) and a coefficient equal to (0.1615581). This means that credit risk (LLPAGL) is higher for large-sized Islamic banks.

Table 6. Estimation results of the simultaneous equations LLPAGL and ETA

	(1)		(2)	
Vbls	**LLPAGL (1)**	**ETA (2)**	**LLPAGL (3)**	**ETA (4)**
Constant	0.583 0.952	-1.784 0.004	-0.006 1.000	-1.752 0.015
ISBD	-0.056 0.965	-0.134 0.060	0.046 0.612	-0.187 0.491
Size	0.055 0.971	0.173 0.015	0.195 0.925	0.164 0.114
MS	0.373 0.677	-0.161 0.362	0.382 0.678	-0.160 0.365
MABD	-0.287 0.643	0.106 0.383	-0.321 0.659	0.106 0.384
CGDP	0.175 0.885	0.038 0.824	0.206 0.875	0.038 0.822
HHI	-0.424 0.801	0.091 0.634	-0.466 0.799	0.091 0.633
GLG1	-0.021 0.866		-0.024 0.861	
NII1	-0.077 0.849		-0.088 0.841	
ETA	1.233 0.332		1.233 0.344	
Ineffi	5.022 0.840	-0.279 0.704	5.649 0.834	-0.2720.710
Isbd * size			-0.166 0.803	
ROAA1		-0.0009 0.786		0.0009 0.761
LLPAGL		0.743 0.004		0.742 0.003
D9	-0.159 0.820	0.215 0.062	-0.148 0.840	0.215 0.056
D10	0.021 0.975	0.076 0.440	0.031 0.966	0.077 0.431
D11	0.324 0.568	-0.163 0.153	0.330 0.570	-0.162 0.158
D12	0.053 0.880	-0.080 0.444	0.036 0.929	-0.079 0.452

The table above contains both equations of the credit risk proxy (LLPAGL) and the capital. On the basis of the estimated result of equation (1), we can see that the dummy variable of Islamic banks (ISBD) is equal to (0.965) and higher than 5% and its coefficient is equal to (-0.056568). These results show that there is no difference between Islamic and conventional banks regarding credit risk.

The same results are found in equation (3) where the dummy variable of Islamic banks (ISBD) has a value higher than 5%. This result shows that these banks are less affected by the risk of credit than the conventional ones.

4. Conclusion

Throughout the current study, we attempted to analyze the credit risk of Islamic and conventional banks during the current crises and its relationship with efficiency. These financial and economic crises, which caused a range of failures in many conventional banks, led many economists to recommend the development of Islamic banks by promoting their high solidity during the current crises.

Using the generalized method of moments, we found that the credit risk in conventional banks is higher than that of the Islamic ones. This risk has a very high impact on the exposure to financial crises. Consequently, credit risk can threaten the bank if it is not properly managed. Our results are consistent with several studies, such that of Pirner (2003) and Coyle (2000).

Our results also show that the higher concentration within the Islamic banks, the greater the credit risk will be.

We also found that the positive impact of the size on the loan quality is lower for Islamic banks compared than it is for the traditional ones.

We also noticed that, during 2007, 2008 and 2009, the credit risk of the Islamic banks was lower than that of the conventional ones. However, at the end of the fourth year (2010), we noticed that there was no difference between both (Islamic and conventional) financial systems These results led us to conclude that, during the subprime crisis period, Islamic banks were not affected by the crisis since mortgages are prohibited by both the Islamic laws. However, during 2010, we cannot deny that there is an impact of this financial crisis on the Islamic banks but in a disproportionate way because of their effects on the real economy and the financial markets, such as the traditional financial institutions and the other economic sectors.

The year 2010 represents the fourth phase of the current financial crisis, also called the “crisis of the sovereign debt”. Due to the current institutional framework of the European Union, the systemic links between banks and sovereign debts are great challenges. The Greek crisis spread to the countries of the Euro zone and became a major concern throughout the world. This crisis hit international markets in the East as well as in the West, namely, the Japanese stock exchange market and other markets in Europe such as those of the United States and many other countries around the world. The Gulf countries were not immune to the crisis although they had no direct connections with it.

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Appendix 1

Description of the variables used in the analysis

Independent variables	Description
Credit risk	We use three proxies for the credit risk: the ratio of the impaired loans to gross loans (PLGL), the ratio of loan loss reserves to gross loans (LLRGL) and the ratio of allowances for bad debts to the gross loans (LP).
Problem Loans / Gross Loans (PLGL)	Problem Loans (PL) increases when a bank classifies a specific loan or a part of loans portfolio as the bad loans. It decreases when either a bank re-assesses a problem loan or a part of the portfolio of loans as the good loans or when a bank writes off a loan or a part of portfolio of loans.
Loan Loss Reserves / Gross Loans (LLRGL)	Loan Loss Reserves (LLR) is considered for the whole loans portfolio, and not only for the Problems Loans. The managers assess the quality of the loans portfolio and determine the required reserves. Then the current level of LLR will be adjusted to reach to the required level. The adjustment will be reflected in the Loan Loss Provision stipulated in the income statement. When a bank decides to write off a loan, the loan amount would be deducted from the LLR.
Loan Loss Provisions / Average Gross Loans (LLPAGL)	Loan Loss Provision (LLP) is the incurred cost by banks as a result of adjusting the LLR or writing off a loan. Hence, despite of PL and LLR which are stock. LLP is flow and is stipulated in the income statement. It is possible to have a negative LLP in one period, when the required loan loss reserve is lower than the current reserve.
Capital	Generally, the measurement of capitalization is carried out by the ratio of the stockholders' equity to the assets.
Inefficiency	Using the approach of the stochastic frontier developed by Aigner, Lovell & Schmidt [1977] and Meeusen& Van Den Broek [1977], we can estimate cost inefficiency (INEFF) for each bank. (Appendix 2)
Control variables	
The size	The size is measured by means of the logarithm of the total assets.
The market share (MS)	The market share is measured by the ratio of the bank's total deposits to the total deposits in the banking system as a whole.
Annual growth rate of gross loans (GLG)	calculated using the annual growth of the gross loans
ROAA	The ROAA is the ratio of the net income to the total assets in the balance sheet. It shows the capacity of the bank to generate profit on the basis of assets.
The bank age	We will integrate this variable in our analysis by using "dummy variables". We divide the banks into two groups: young banks (takes "1" if the bank operates for more than three years and zero otherwise) and average-aged banks (Takes "1" if the bank operates for between three and seven years, and zero otherwise).
Growth per capita	Annual growth per capita of the GDP
Hirschman-Herfindahl index (HHI)	We include a Herfindahl-Hirschman index based on the total assets to control the degree of concentration in the banking environment. For n companies in an industry with market shares, s_i , (i = 1,2, ..., n), l'HHI is defined as follows: $HHI = \sum_{i=1}^{n} s_i^2$
The ratio of the free-interest productive asset to total assets (TNEAR)	The ratio of the interest-free productive assets to the total assets
Non-interest income (NII)	Represented by Net Comm. & Trading Income to Total Operating Income Ratio
Dummy variable «year»	In statistics and econometrics, particularly in the regression analysis, a dummy variable is the one that takes value 0 or 1 to indicate the presence or absence of a categorical effect which can be expected to change the result. The dummy variable "year" is introduced into the model to neutralize the fixed effects over time.

Appendix 2

country	IB	CB
1. Saudi Arabie	Al Rajhi Banking§Invemt	National Commercial Bank
	Islamic Developement Bank	Riyad Bank
	Alinma Bank	Saudi British Bank (The)
	Bank AlBilad	Banque Saudi Fransi
		Arab National Bank
		Saudi Hollandi Bank
		Saudi Investment Bank (The)
		Bank Al-Jazira
		Samba Financial Group
2. Bahrain	Al baraka banking groupe B.S	Arab Banking Corporation BSC
	Kwait Finance House	Ahli United Bank BSC
	Investors Bank Bank BSC	BMB Investment Bank-Bahrain
	Shamil bank of bahrain B.S	Gulf International Bank BSC
	Bahrain Islamic Bank B.S.C	BBK B.S.C.
	Gulf finance house BSC	Investcorp Bank BSC
	Unicorn Investment Bank BSC	National Bank of Bahrain
	Al Amin Bank	United Gulf Bank (BSC) EC
	Arcapita Bank B.S.C.	BMB Investment Bank-Bahrain
	Al-Salam Bank-Bahrain B.S.C.	Awal Bank
	ABC Islamic Bank (E.C.)	International Banking copt
	Khaleeji Commercial Bank	BMI Bank BSC
	Venture Capital Bank BSC	
	Capivest	
	Global Banking Corporation	
3. Egypt	Faisal Islamic Bank of Egypte	National Bank of Egypt
	Albaraka bank egypte SAE	BanqueMisr SAE
	MISR Iran developement bank	National SocieteGenerale B
	Arkapita bank BSC	Arab African Internatio
	Egyptian Saudi Finance Bank	Banque du Caire SAE
		HSBC Bank Egypt S A E
		Suez Canal Bank
		Commercial International B
		Bank of Alexandria
		Arab International Bank
		Barclays Bank - Egypt S.A.E.
		Al Watany Bank of Egypt
		National Bank for Developm
4. Iran	Bank Milli Iran	
	Bank Mellat	
	Bank Sadirat Iran	
	Bank tejarat	
	Bank Sepah	
	Parsian Bank	
	Bank keshavarzi-Agriculture	
	Bank Refah	
	Bank of industry and Mine	
	Saman Bank	
	Export Development Bank Of	
	Agricultural Bank of Iran-B	
5. Jordan	Jordan islamic bank	Arab Bank Group
	Islamic international arab	Arab Bank PLC
	First investment company k	Jordan Ahli Bank Plc
	Jordan dubaiislamic bank	Housing Bank for Trade & F
		Bank of Jordan Plc
		Cairo Amman Bank
		Union Bank
		Capital Bank of Jordan
		Arab Jordan Investment Bank
		Invest Bank
		Jordan Commercial Bank
		Arab Banking Corporation (J
6.Kuwait	Kuwait Finance House	National Bank of Kuwait S.A.
	International investor company	Kuwait Projects Company H
	A'Ayan Leasing &Investme	Gulf Bank KSC (The)
		Ahli United Bank KSC
		Gulf Investment Corporation
7. Malaysia	RHB islamic bank berhard	Malayan Banking Berhad
	Bank Muamalat MalaysiaBerh	Public Bank Berhad
	Maybank Islamic Berhad	CIMB Bank Berhad
	Bank Islam Malaysia Berhad	RHB Bank Berhad
	CIMB Islamic Bank Berha	AmBank (M) Berhad

	AmIslamic Bank Berhad	Hong Leong Bank Berhad
	Kuwait Finance House (Mala	HSBC Bank Malaysia Berhad
		OCBC Bank (Malaysia) Berhad
		United Overseas Bank (Malay
		Deutsche Bank (Malaysia) Bhd.
		Bank of Tokyo-Mitsubishi UFJ
		Royal Bank of Scotland Berh
8. Sudan	Tadamon Islamic Bank	Omdurman National Bank
	Islamic Co-operative devel	Blue Nile Mashreq Bank Ltd
	Al baraka bank sudan	Saudi Sudanese Bank
	Sudanese Islamic Bank (mil sdg)	Savings & Social Development Bank
	Al shamalislamic bank	Animal Resources Bank
	National Bank of Sudan	Export Development Bank
		Sudanese French Bank (The
		Farmers Commercial Bank
		Elnilein Bank
9. United Arab Emirates	Dubai Islamic Bank PLC	National Bank of Abu Dhabi
	Abu dhabi Islamic Bank P	Emirates Bank International PJSC
	Emarateislamicbanckpjsc	Abu Dhabi Commercial Bank
	Sharjahislamic bank	First Gulf Bank
	Tamweelpjsc	Mashreqbank
		National Bank of Dubai Public
		Union National Bank
		Commercial Bank of Dubai P.S.C.
		National Bank of Ras Al-Khaimah (P.S.C.)
		Bank of Sharjah
		Arab Bank for Investment &
10. Yemen	Shamil bank of yemen § bah	International Bank of Yemen YSC
	Islamic bank of yemen for	National Bank of Yemen
	Tadhamon International Islamic Bank	Yemen Kuwait Bank for Trade and
	Saba Islamic bank	
11. Qatar	Qatar islamic bank SAQ	Qatar National Bank
	Qatar international islamic bank	Masraf Al Rayan (Q.S.C.)
	First Finance Company (Q.S.C.)	Commercial Bank of Qatar (The) QSC
		Doha Bank
		International Bank of Qatar Q.S.C.
		Ahli Bank QSC
12. Pakistan	Meezan bank limited	
	Albarakaislamic bank BSC	
	First habibmodaraba	
	Dubai Islamic Bank Pakistan Limited	
	Dawood Islamic Bank	
	Standard Chartered Modaraba	
	First National Bank Modaraba	
13. Bangladesh	shahjalalislami bank ltd	
	ICB islamic bank limited	
14. Tunisia	AlbarakaTunisie	BanqueNationaleAgricole
	Bank EttamouilSaoudiTounsi	Union Bancaire pour le Commerce et l'Industrie
	TürkiyeFinansKatilimBankasi AS	North Africa International Bank
	Kuwait Turkish Participation Bank	Tunisian - Kuwaiti Development Bank-
15. BRUNEI DARUSSALAM	Islamic Bank of Brunei bhd	
	Islamic Development Bank of Br	
16. INDONESIA	Bank Syariah Muamalat Indonesia	
	Bank SyariahMandiri	
17. RUSSIAN FEDERATION	Badr-Forte Bank	
18. Iraq	Kurdistan International Bank	Dar Es Salaam Investment Bank
19. UNITED KINGDOM	Bank of London and The Mid	
	Islamic Bank of Britain Plc	
	European Islamic Investment Ban	
20. CAYMAN ISLANDS	Al-Tawfeek Company for Investme	
21. SINGAPORE	Islamic Bank of Asia (The)	
22. PALESTINIAN TERRITORY	Arab Islamic Bank	
23. GAMBIA	Arab Gambian Islamic Bank	
	Syria International Islamic Bank	
	Cham Islamic Bank SA	
24. THAILAND	Islamic Bank of Thailand	
25. LEBANON	Arab Finance House Holding SAL	Banque de l'Industrie et du Travail 123
		Syrian Lebanese Commercial Bank SAL
		Bank Audi SAL -
		BLOM Bank s.a.l.
		Byblos Bank S.A.L
		Bankmed, sal
		Fransabank sal
		Banque Libano-Francaise
26. MAURITANIA	Banque Al Wava Mauritanienne Islamique- 111	

27. SYRIA		International Bank for Trade and
		Arab Bank Syria SA
		Banque Bemo Saudi Fransi SA
		Bank Audi Syria

Appendix 3

The applied model is based primarily on the trans-log method. Let Y be the endogenous variable that can take the value of the total cost (TC), or the value of the profit. Three outputs (y1, y2, y3) and three inputs (I1, I2, I3) are taken into account. It should be noted that in the expression of cost function, the inputs are represented by their price in which we note that p_1 is the PERSONEXP, p2 the OTHEREXP, and p3 the INTERESTEXP. The outputs, the shape of the cost function or profit are taken into account in terms of quantity.

Therefore, the general form of this expression is presented as follows:

$$
\begin{aligned}
LogCT &= \alpha_0 + \sum_{m=1}^{n=3} \alpha_m Ly_m + \sum_{s=1}^{k=3} \beta_s LogP_s + \alpha_t t \\
&+ \tfrac{1}{2}\alpha_u t^2 + \tfrac{1}{2}\sum_{m=1}^{3}\sum_{m'=1}^{3} \zeta_{mm'} Ly_m Ly_{m'} \\
&+ \tfrac{1}{2}\sum_{s=1}^{3}\sum_{s'=1}^{3} \zeta_{ss'} Lp_s Lp_{s'} + \sum_{m=1}^{3}\sum_{s=1}^{3} \gamma_{ms} Ly_m Lp_s \\
&+ \sum_{m=1}^{3} \delta_{mt} tLy_m + \sum_{s=1}^{3} \delta_{st} tLp_s + \gamma_E \ln E + \tfrac{1}{2}\gamma_{EE} (\ln E)^2 \\
&+ \phi_{E1} \ln E.Ln(p_1) + \phi_{E2} \ln E.Ln(p_2) \\
&+ \phi_{E3} \ln ELp_3 + v'Z
\end{aligned}
$$

With a Z vector of the control variables.

To appropriately specify the model, we apply a number of assumptions the most important of which is the homogeneity regarding the prices. In other words, we have to check the following relationship:

$$
\begin{aligned}
&LnCT(Y_1, Y_2, Y_3; \lambda p_1, \lambda p_2, \lambda p_3; t) \\
&= LnCT(Y_1, Y_2, Y_3; p_1, p_2, p_3; t) + Ln\lambda
\end{aligned}
$$

Checking the above hypothesis makes us draw the following constraints:

$$
\begin{aligned}
&\beta_1 + \beta_2 + \beta_3 = 1 \\
&\begin{cases} \zeta_{11} + \zeta_{12} + \zeta_{13} = 0 \\ \zeta_{22} + \zeta_{12} + \zeta_{23} = 0 \\ \zeta_{13} + \zeta_{23} + \zeta_{33} = 0 \end{cases} \\
&\begin{cases} \gamma_{11} + \gamma_{12} + \gamma_{13} = 0 \\ \gamma_{21} + \gamma_{22} + \gamma_{23} = 0 \\ \zeta_{31} + \zeta_{32} + \zeta_{33} = 0 \end{cases} \\
&\zeta_{tp1} + \zeta_{tp2} + \zeta_{tp3} = 0
\end{aligned}
$$