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STRESS TEST FOR ISLAMIC AND CONVENTIONAL BANKS USING SENSITIVITY SCENARIO TEST: Evidence from Qatari Banking Sector

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ABSTRACT

The objective of the paper is to assess the resilience of the banking sector in Qatar to shocks assumed to three risk types, namely, credit risk, interest rate risk and foreign exchange risk. Additionally we divide the banks in the sample into two groups by business model (i.e. 5 conventional banks, and 3 Islamic banks) and try to capture the impact of these shocks on each group of banks applying the same procedures as those followed for the whole banking sector. To achieve this we attempt to examine potential implications on the banks' capital adequacy ratio (CAR) in the case that banks have increased their provisioning to reflect loan quality deterioration, short-term interest rate has increased by 1.5% and the exchange rate of Qatari riyal against major currencies has depreciated. To this end, we apply a sensitivity stress test under which we assume that the presumed shocks to the three risk types materialize simultaneously and independently over the period from 2006 to 2010. The impact of shocks on the banking sector and the two groups of banks is expressed as post-shock capital adequacy (CAR) ratio (tier 1 capital relative to risk-weighted assets) compared to pre-shock (baseline scenario) capital adequacy ratio. The difference between these ratios has also been disintegrated into its component of each risk type to assess the size of impact of each risk type on the capital adequacy ratio. Besides, we compare post-shock CAR with Qatar Central Bank's minimum requirement for capital adequacy ratio of 10%, and Basel II directives, which mandate a minimum capital adequacy ratio of 8 %. Finally, we estimate the capital needs for the whole banking sector and each group of banks whenever post-shock CAR ratio happen to fall below any of the two minimum ratios required. The paper reveals that the overall pool of risk for the banking sector as a whole and for the conventional banking sector has declined whereas it increased for the Islamic banking sector. It further finds that the weight of individual risk type has remained unchanged in the period under analysis. in terms of overall impact on capital adequacy ratio, while credit risk continues to have the biggest impact there hardly has been any impact resulting from an increase in short term interest rates by 1.5% or exchange rate depreciation against foreign currencies other than the US$. In addition, Islamic banks appear to be more exposed to credit risk compared to conventional banks as the impact of credit quality would have been severer on Islamic banks as compared to conventional banks. Besides, Islamic banks seem to have assumed higher credit risk post the global crisis in 2008 compared to before the crisis.

1. INTRODUCTION

The events associated with the last global financial crisis have highlighted the importance of the awareness of financial systems' vulnerability to different types of economic disturbances, or shocks. Stress test is a method that has increasingly become an important tool used to identify this vulnerability. Originally, stress tests were used by large banks to assess the impact on the value of their portfolios of specific stress events and to examine portfolio future performance assuming an extreme move in the underlying risk types, such as interest rates or foreign exchange rates. In recent years, however, stress test techniques have been implemented in a more inclusive manner with the aim of enabling integration of information across the firm and hence allowing assessment of vulnerabilities to interrelated events across all risk and asset types. Scenario analysis and stress tests had also become a key element of macro-prudential analysis that helps determine the system's sensitivity to economic shocks through evaluating the soundness and common vulnerabilities across a financial system, which are often driven by banks' exposure to macroeconomic risk (Jones et al., 2004). The objective of this financial sector stress test is to provide informative information on a system's potential under exceptional but plausible

shocks, helping policy makers assess the significance of the system's vulnerabilities (Foglia, 2009). The importance of stress tests for macro-prudential analysis derives from the fact that it provides a uniform approach to aggregation of results, identification of key vulnerabilities at the level of the overall system and providing comparable information on risk profiles across banks[1].

Stress testing, however, as an analytical tool used to examine the strengths and weakness of banking and financial systems must not be used in isolation from other analysis methods used. To arrive at a comprehensive financial stability assessment and a sense of the strength and vulnerabilities in the system one needs to combine stress tests with other quantitative information on the financial system as well as qualitative information related to the financial institutions' frameworks and the regulatory environment (Čihák, 2005b). One fundamental weakness in the structural aspects of used stress testing which the global financial crisis that broke out in 2007 has revealed was that stress tests were performed routinely as an isolated exercise by risk functions within banks, and results rarely were communicated across the firm or used for decision making process[2]. This lack of inclusive approach towards stress test frameworks was not only perceived at the individual firm level. There appears to be a shared perception and agreement among macro prudential practitioners and analysts that due to incorrect structural assumptions that underlined most stress tests models, stress tests were not informative and robust enough to instigate an adequate policy response prior to global financial crises. See for example, Galati and Moessner, 2011; Alfaro and Drehmann, 2009; de larosiere, 2009, and Haldane, 2009. Conversely, Borio C et al (2012) argue that macro stress tests are only best suited to crisis management and resolution and given the current technology level are not reliable for identifying vulnerabilities in seemingly tranquil times.

Stress tests are particularly important from the perspective of supervisory authorities and policymakers since they provide useful benchmarks to assess the risks to the financial system as a whole (Čihák, 2004b). Accordingly, stress tests help develop the knowledge in risk assessment framework of the supervisors and the financial institutions engaged in the process, and encourage collaboration and wider understanding and perception of risks by different regulatory institutions. In turn, this can contribute to a better understanding of the links between the financial sector and the macro economy (Čihák, 2005b).

Stress testing as an analytical tool used in financial stability work has gained prominence in recent years that it became an integral part of all vulnerabilities assessment programs conducted by central banks and international regulatory and supervision bodies such as the International Monetary Fund (IMF), the World Bank (WB), and Basel Committee on Banking Supervision. For years, IMF has used stress tests to examine the financial stability in their member countries and to identify potential weaknesses that may possibly threaten the stability of member countries' financial systems. Stress tests, therefore, were usually performed as part of the Financial Sector Assessment Program (FSAP)—a joint effort by the IMF and the WB. Assessments under this program, which so far covered some 120 countries, have addressed a wide range of various risks within the broad categories of credit risk, market risk, liquidity risk, and contagion risk. The program as well has provided member countries several recommendations for improvements in their respective financial system framework. Many of these assessments are available on IMF and WB websites. See Čihák, 2005a and 2006; and Foglia, 2009) and for a survey of stress tests presented by central banks in their financial stability reports (FSRs) and an assessment review of stress test conducted therein.

The growing familiarity and awareness of stress testing techniques and the application scope of stress tests as an analytical tool used by banks have indeed broadened following the recommendation of Basel Committee on Banking Supervision in 1996 for the use of comprehensive stress testing framework by banks that have implemented the internal model approach to capital adequacy for market risk. In its revised framework for the new Basel Capital Accord (or Basel II) in 2004 Basel Committee on Banking Supervision goes even further in its recommendations with regard to stress testing and calls for banks to use stress tests for a variety of purposes covering almost all banks' operations. Furthermore, following the financial crisis in 2008 Basel Committee has developed a set of reform measures among which is enhancing standards for supervisory review process (Pillar 2) under which the Committee strengthens supervisory guidance in a number of key areas amongst them is stress testing. In May 2009, the Committee has published the "Principles for sound stress testing practices and supervisor" which introduced stronger stress-testing guidelines with the objective of ensuring that banks are able to meet capital and liquidity needs under stressed conditions. The document sets out a comprehensive set of

[1] See (Cihak, 2005b) for detailed discussion on conceptual definition of stress tests, and Buncic and Melecky (2011); Pritsker (2011); and Sorge (2004) for an overview of macro perspective of financial systems' stress testing.

[2] Committee on the Global Financial System "Stress testing at major financial institutions: survey results and practice" , BIS ,Jan 2005

principles for the sound governance, design and implementation of stress testing programs at banks and addresses as well the weaknesses in banks' stress tests that were highlighted by the financial crisis. it comprises of 15 recommendations and principles for banks and another 6 principles for supervisors to help improve performance of stress testing in stressful economic conditions.

In this paper, the focus of our analysis is the local banking sector in Qatar with an ultimate objective to assess the resilience of the banking sector to shocks assumed to three risk types, namely, credit risk, interest rate risk and foreign exchange risk. We extend our analysis further and divide the banks in the sample into two groups by business model (i.e. 5 conventional banks, and 3 Islamic banks) and capture the impact of these shocks on each group of banks applying the same procedure as that followed for the whole banking sector. To achieve this we attempt to provide an answer to the question of what the potential implications are on banks' capital adequacy ratio (CAR) if banks have increased their provisioning to reflect loan quality deterioration, the interest rate has increased by 1.5% and the exchange rate against major currencies has depreciated. To this end, we apply a sensitivity test under which we assume that the presumed shocks to the three risk types materialize simultaneously and independently over the period from 2006 to 2010. The impact of shocks on the banking sector and the two groups of banks is expressed as post-shock capital adequacy (CAR) ratio (tier 1 capital relative to risk-weighted assets) compared to pre-shock (baseline scenario) capital adequacy ratio. The difference between these ratios is further disintegrated into its component of each risk type to assess the size of impact of each risk type on the capital adequacy ratio. We as well compare post-shock CAR with the minimum requirement of Qatar Central Bank (QCB) that stipulates 10% minimum capital adequacy ratio and Basel II directives, which mandate a minimum capital adequacy ratio of 8 %. Finally we estimate the capital needs for the whole banking sector and each group of banks whenever post-shock CAR ratio happen to fall below any of the two prescribed minimum ratios.

The remainder of the paper is organized as follows. Section 2 provides an overview of literature. Section 3 identifies features of Qatari banking sector performance. Section 4 gives an overview of risk exposure in the domestic banking sector. Section 5 explains the methodology. Section 6 analyses the results and finally section 7 concludes.

2. LITERATURE REVIEW

Despite advancement in banking activities, credit risk remains to be the most significant source of risk. For this reason, most of literature on stress testing has focused on examining the dynamic nature of credit risk. Besides, stress testing credit risk is also an essential element of the Basel II framework. However, details of frameworks used for macro stress testing for credit risk varied depending on country –specific circumstances, the complexity of banking system and data availability, and so on. In its 2009 consultation report on Qatar's economic developments and policies, IMF has performed a stress test on the resilience of the Qatari banking sector to credit risk. The stress test implies that the cumulative effect of macroeconomic shocks over a three-year horizon could be significant. A slowdown in real non-oil growth from 9 % to 4% has the potential to increase the NPLs ratio by 3%. Similarly, an increase in interest rates by 3% would worsen the non-performing loans (NPLs) ratio of Qatari banks by another 3%. The vulnerability of banks was estimated by monitoring the resilience of banks' Capital Adequacy Ratio (CAR) to the adverse economic conditions before and after the authorities' interventions in the banking sector on the back of the recent global financial crisis. The results reveal that before the intervention three banks would have suffered losses pulling their respective CAR ratio below regulatory requirement of 10% as soon as NPLs reached 10% and five banks out of 8 banks would have needed recapitalization in the worst case scenario (20 % increase in NPLs ratio) ranged between $.2 billion and $2.5 billion. In contrast, the authorities' intervention have helped to strengthen the resilience of the Qatari banking sector since only one bank reported CAR ratio below the required limit and the whole banking sector 's recapitalization needs dropped to below $1 billion in the worst case scenario.

Głogowski (2008) investigates the links between business cycle variables and loan losses of Polish commercial banks using the flow of loan loss provisions as a proxy for Loan losses and he finds a significant influence of real GDP growth, changes in real interest rate, and labor market variables such as changes in unemployment rate. He further points out that the differences in loan losses between banks can be attributed to differences in business profile as well as the structure of loan portfolio. Similarly, Kattai (2010) gives an overview of the credit risk model that has been developed for the Estonian banking system using non-performing loans and loan loss provisions of the banking sector, which have been modeled conditional on underlying economic conditions: economic growth, unemployment, interest rates, inflation, indebtedness and credit growth. The model highlights the importance of economic growth as the most influential factor behind the soundness of the banking sector in the latest downturn and that the expected fall in output volatility will probably decrease the relative importance

of output growth and increase the role of interest rates in the future. Likewise, Vazquez et al. (2010) employ disaggregated credit loans for business and consumer loans of the Brazilian banking sector and conduct macro stress test of credit risk based on scenario analysis. The results corroborate the presence of a strong procyclical behavior of credit quality, and show a robust negative relationship between (the logistic transformation of) NPLs and GDP growth, with a lag response up to three quarters. The models also indicate substantial variations in the cyclical behavior of NPLs across credit types.

Drehmann et al. (2008) measure the integrated impact of credit and interest rate risk on banks' portfolios. Their framework accounts for all sources of credit risk and interest rate risk by modeling the whole portfolio of a bank and by taking account of the reprising characteristics of all exposures as they assess the impact of credit and interest rate risk not only on the bank's economic value but also on its future earnings and capital adequacy. They apply their framework to a hypothetical bank in normal and stressed conditions. The simulation highlights that it is fundamental to measure the impact of interest rate and credit risk jointly. They also show that it is crucial to model the whole portfolio, including the reprising and maturity characteristics of assets, liabilities and off balance sheet items.

Misina M. et al (2006) investigate expected losses in the corporate loan portfolio of the Canadian banking sector resulting from changing circumstances in the different industries in which these loans reside. These circumstances are described by means of one summary measure, that is "sectoral probabilities of default "and this measure is then modeled using vector auto regression (VAR) model to assess the impact of macroeconomic variables on sectoral probabilities of default. The macroeconomic variables selected are Canada's GDP growth rate, Canada's real interest, the Bank of Canada commodity price index, the U.S. real GDP growth rate, and the U.S. real interest rate. A clear advantage of using VAR approach is that it offers two channels of impact of a macroeconomic shock on default probabilities: the direct impact of a change in the scenario variable on the default probabilities, and an indirect impact via the impact on other macroeconomic variables. For that reason using this model, the authors were able to assess the interrelationship between the macroeconomic environment and sectoral defaults and perform a series of tests under different possible scenarios. The scenarios selected reflect the sources of vulnerabilities that are commonly considered as typical for Canada, rather than a reflection of the concerns of the moment.

Rouabah A and Theal J (2010) used loan loss provisions to total loans over the period spanning 1995 until 2009 as an approximation for the aggregate probability of default to assess the vulnerability of the Luxembourg financial system to various adverse macroeconomic scenarios. In order to produce an estimate of the likely shift in the distribution of default rates under various adverse macroeconomic scenarios, they developed a multivariate macroeconomic model to estimate simultaneously via seemingly unrelated regression (SUR) values of the probability of default and the macroeconomic variables over a horizon of 10 quarters for both the baseline and adverse scenarios. They then gauge how the probability of default responded to exogenous shocks in the macroeconomic environment thereby linking the fundamental economic environment to the vulnerability of the banking sector as a whole. From the results of these simulations, stressed tier1 capital ratio was calculated and compared with their associated unstressed capitalization level. The macroeconomic model consists of a joint system of six linear equations for the probability of default, the growth rate of Luxembourg GDP, the euro area real GDP growth rate, the real interest rate, the change in real property prices, and returns on the SX5E[3]. The advantage of the model was its ability to account for interactions and feedback effects between the macroeconomic environment and the aggregate probability of default and to simulate a distribution of probabilities of default conditional on a given adverse scenario.

Otani A. et al (2009) pursue an alternative avenue and stress test Japanese banks' credit portfolio applying the framework for credit risk stress testing used at the Bank of Japan (BOJ), which takes account of changes in borrowers' creditworthiness over the business cycle to examine the robustness of loan portfolios for major banks against a severe economic downturn. In their application of this framework, the authors construct a quasi-transition matrix of Japanese banks' loan portfolios using two datasets: the banks' aggregated transition matrix data for borrower classifications and credit score data for Japanese firms. They then examine the relationship between the transition of borrowers between rating classes and macroeconomic variables using a model that has different sensitivity of transition probabilities across rating classes against business conditions under a baseline scenario and stressed scenario to produce a non-linearity in the fluctuations of credit risk over the business cycle. The model they have employed is vector auto regression (VAR) with five variables. These are real GDP,

[3] SX5E is The EURO STOXX 50 Index, Europe's leading Blue-chip index for the Euro zone that provides a Blue-chip representation of super sector leaders in the Euro zone. The index covers 50 stocks from 12 Euro zone countries.

The CPI, the amount outstanding of bank lending, the nominal effective exchange rate and the overnight call rate. In assessing the robustness of the banking sector against credit risk they employed two indicators: (1) excess credit risk – defined as the difference between the ratio of maximum losses to tier I capital for both the stress and baseline scenarios – and (2) excess credit loss- defined as the difference between the expected losses for both the stress and baseline scenarios.

Hoggarth G al et (2005) use the write-off to loan ratio as a proxy of banks' fragility to estimate the impact of changes in macroeconomic variables on the UK banking system's aggregate losses since the late 1980s and sectoral losses since the early 1990s. Applying the VAR approach, they find a significant negative relationship between changes in output and the write-off ratio for the aggregate banking sector and that the corporate sector write-off ratio was twice as sensitive to output shocks as the aggregate write-off ratio. Household write-offs, on the other hand, were found to be more sensitive to changes in income gearing than changes in economic activity. They also find that the bank write-off ratio tended to increase following shocks to nominal variables such as annual rate of retail price inflation and nominal interest rates though the impact was only significant at a longer time horizon, i.e. after four-six quarters.

3. OVERVIEW OF QATARI BANKING SECTOR PERFORMANCE

The Qatari banking sector encompasses seventeen banks, of which ten banks (including three Islamic banks) are national banks and seven are foreign banks operating. National banks remain to dominate the banking sector with a market share of 92.3 percent of total assets, 95.4 percent of total credit and 93 per cent of total deposits as of December 2010. Despite that the market capitalization of banking sector declined from 38.6 percent in 2008 to 34 percent in 2009 on the bank of the financial crisis in 2008, Qatar banking sector continued to report solid performance indicators and double-digit growth rate with total assets increased by 21.3 percent in 2010 compare to 16.42 percent in 2009 to stand at QR 567.5 billion in December 2010 compared to 468 billion in Dec. 2009. The sustainable growth was demonstrated as well by the significant growth in total domestic credit, which experienced a growth rate of 16.7 percent in 2010, compared to 14 percent in 2009 to stand at QR 294 billion in 2010 from QR 252 billion in 2009. Total deposits also increased by 23.2 in 2010 compared to 13.5 percent in 2009 to reach QR 277 billion in 2010 from QR 224.8 billion in 2009. Furthermore, the contribution of the financial services industry to GDP continued to record a rising trend over the four-year period from 2006 to 2009 as it increased from around 9 percent in 2006 to 12 percent in 2009. [4]

The Qatari banking system remains to be profitable and well capitalized. Profitability was 20 % higher in the first three quarters of 2010, compared to the same period in 2009. Banks are well capitalized with capital adequacy ratio of 15 %. In addition, asset quality indicators reveal a positive outlook. Nonperforming loans (NPLs) ratio and provision coverage ratio stand at 1.7 %, and 85 % at end of 2009 respectively.

IMF indicates that though the fundamentals of banking sector remain strong and the outlook is positive, the main risk to this outlook include maturity mismatch, limited sources of funding as aggregate deposit growth failing to keep pace with loan disbursements, credit concentration and excessive lending to the private sector, which might have an impact on the assets quality. However, apart from these potential challenges and constraints facing local Qatari banks, going forth opportunities, in light of the high level of government support, appear to be increasingly impressive given the size of the projects planned over the next years, which will provide banks with more business.[5]

4. OVERVIEW OF RISK EXPOSURE IN THE DEMOSTIC BANKING SECTOR

4.1 Credit Risk

An analysis of the composition of total assets of the domestic banks suggests that credit risk might be a significant risk as a majority of the domestic banks' assets is held in loans to customers (5-year average 62 per cent) as opposed to other assets that carry little or no credit risk (Table 1). Lending to the public sector, which is generally considered to pose less risk to the banking sector than lending to other sectors, has witnessed an increasingly upward trend since 2006 where is stood at 21 per cent of total loans as compared to 35 per cent in 2010. The overwhelming share of the aggregate customer loans on average (72 per cent) comprises loans to the

[4] Quarterly satirical Bulletin – table 13 and 14 , Dec. 2010 , QCB
[5] 2009 Article IV Consultation , IMF country report no. 10/41 , February 2010

private sector. Nevertheless, lending to private sector ratio has dropped significantly to 65 per cent in 2010 from 79 per cent in 2006.

Table 1: Customer Loans to Total Assets

Domestic banking sector	Dec-06	Dec-07	Dec-08	Dec-09	Dec-10	5-year Average
Total assets (QR m)	156,560	252,022	345,337	397,534	476,175	**325,526**
Gross customer loans (QR m)	98,010	148,667	222,385	250,775	294,529	**202,873**
Customer loans to total assets	**63%**	**59%**	**64%**	**63%**	**62%**	**62%**
of which (%)						
Public sector	**21%**	**25%**	**27%**	**30%**	**35%**	**28%**
Private sector	**79%**	**75%**	**73%**	**70%**	**65%**	**72%**

On average, approximately 82 per cent of the domestic banking sector's assets and 81% of the domestic banking sector's customer loans are held by conventional banks vis-à-vis Islamic banks. However, Islamic banks market share in terms of both total assets and customer loans has considerably increased over the last five years to stand in 2010 at 22% of total assets and 24% of customer loans up from 15% and 13% respectively in 2006.

The composition of customer loans in terms of sector exposure is also different for conventional banks as compared with Islamic banks. On average, there is a higher proportion of lending to the public sector in conventional banks (30 per cent) compared to Islamic banks (19 per cent). In 2010, around 40 per cent of conventional banks' lending was directed to the public sector as compared with only 22 per cent for Islamic banks (Table 2).

Loans to the private sector are made in three broad groups: corporate sector, real estate & construction and retail sector. The aggregate figures in 2010 indicate that lending to the corporate sector represents the largest single group for both conventional and Islamic banks, with 44 per cent and 41 per cent share respectively of the aggregate private-sector loans.

The corresponding shares for the real estate & construction and retail sector in conventional banks are 31 per cent and 26 per cent, respectively, as opposed to 38 per cent and 21 per cent for Islamic banks.

Table 2: Customer Loans to Total Assets

A. Conventional banks						5-year Average
Total assets (QR m)	133,274	210,543	282,183	318,616	371,473	263,218
Gross customer loans (QR m)	85,327	123,400	178,501	194,743	222,747	160,943
Customer loans to total assets	**64%**	**59%**	**63%**	**61%**	**60%**	**61%**
of which (%)						
Public sector	**23%**	**25%**	**27%**	**32%**	**40%**	**30%**
Private sector	**77%**	**75%**	**73%**	**68%**	**60%**	**70%**
B. Islamic banks						
Total assets (QR m)	23,286	41,478	63,155	78,917	104,702	62,308
Gross customer loans (QR m)	12,683	25,267	43,885	56,032	71,781	41,930
Customer loans to total assets	**54%**	**61%**	**69%**	**71%**	**69%**	**65%**
of which (%)						
Public sector	**9%**	**22%**	**23%**	**21%**	**22%**	**19%**
Private sector	**91%**	**78%**	**77%**	**79%**	**78%**	**81%**

Domestic banking sector maintains satisfactory level of asset quality as measured by nonperforming loans (NPLs) relative to total loans. On average, this ratio stands at 1.5% for both the banking sector as a whole and

the two groups of banks dominating the banking sector. (Table3). Provision adequacy ratio (coverage ratio), measuring the extent to which provisions cover NPLs indicate that conventional banks are more adequately providing for NPLs at 83 per cent in 2010 as compared with only 58 per cent coverage ratio for Islamic banks.

Table 3: Asset Quality

Domestic banking sector	Dec-06	Dec-07	Dec-08	Dec-09	Dec-10	5-year Average
NPLs of total loans	1.9%	1.2%	1.1%	1.4%	1.9%	1.50%
Coverage ratio	80%	90%	82%	92%	80%	85%
Conventional banks						
NPLs of total loans	1.7%	1.2%	1.1%	1.5%	2.2%	1.54%
Coverage ratio	80%	91%	85%	95%	83%	87%
Islamic banks						
NPLs of total loans	3.4%	1.5%	1.0%	0.8%	1.0%	1.55%
Coverage ratio	79%	86%	69%	74%	58%	73%

4.2 Interest Rate Risk

The vast majority of Qatari banks' assets and liabilities are interest rate sensitive. In 2010, approximately 86 per cent of aggregate balance sheet assets are interest earning and approximately 74 per cent of aggregate balance sheet liabilities are interest bearing. These shares though appear to have changed little in entirety since 2006; components items have changed significantly, which suggest shifts in the outlook of the banking sector's vulnerabilities sourcing from interest rate risk.

Interest-earning assets consist of balances with the central bank, loans to banks, loans to customers and short and long-term investments. The key interest-earning category is loans to customers, with loans to the private sector in 2010 accounting for approximately 39.4 per cent of all interest-earning assets as compared with 52.3 per cent in 2006 and 47.4 per cent on five year average since 2006 to 2010. Loans to the public sector account for 21.4 per cent of all interest-earning assets in 2010 compared to 14.3 per cent in 2006 and 18 per cent on five-year average. Loans to banks including the central bank make 25.3 per cent of total interest-earning assets in 2010 with central bank's loans coming to about 11 per cent. Correspondingly, the same ratio stood at 23 per cent in 2006 with central bank's loans at only 0.7 per cent and 4.3 percent on average. The investment portfolio accounts for the remainder (14 per cent) in 2010 as opposed to 11 per cent in 2006 and 11 per cent on average.

In 2010 almost 82 per cent of interest income is sourced from loans as compared to 76 per cent in 2006 and 80.6 per cent on average. Effective interest rate on gross customer loans has decreased to 5.4%, the lowest over the analysis period, from 6 per cent in 2006, and 5.7 per cent on average. Interest income derived from debt securities has significantly increased to a round 12 per cent in 2010 from 7.3 per cent in 2006 and 8 per cent on average. Inter banking lending including abroad loans and to the central bank has contributed 6 per cent of interest income in 2010 as compared with 16.5 per cent in 2006 and 11.5 per cent on average.

A decomposition of interest-bearing liabilities indicates that the banking sector continues to rely on customer deposits as a source of funding. In 2010, customer deposits account for 79 per cent of interest-bearing liabilities with 32 per cent of the total sources from public sector. Deposits by banks made 12 per cent with the remaining 9 per cent accounted for by other borrowings and liabilities. The largest share of interest expense (around 81 per cent) is paid on customer deposits with effective interest rate of 2.2 per cent, the lowest over the analysis period compared with a rate of 3.64 per cent in 2007, the highest over the analysis period, and the average rate of 3.1 per cent. This reflects an increasing ability of the banking sector to mobilize funds at lower rates, which implies lower potential risk sourcing from downward pressures on net interest income arising from increasing cost of funds. During stressful times, however, the situation is very likely to reverse as depositors turn to alternative savings or investment options, which would cause a run on banks' deposits driving up cost of funds rate paid by banks, which subsequently put downward pressure on net interest income.

One approach to measuring interest-rate risk is sensitivity gap analysis, which analyses the extent to which the maturity of assets and liabilities are mismatched in order to estimate potential increase or decrease in interest

income arising from changes in interest rates. In 2010, the available data on the assets and liabilities maturity analysis suggests that the domestic banking sector has a net long position in all maturity categories. This implies that the Qatari domestic banking sector is less exposed to interest rate risk arising from downward pressure on interest income sourcing from rising cost of funding.

4.3 Foreign Exchange Risk

Table 4: Banking Sector Total Assets and Laibilities Breakup (by Currency)

in QR million

	Dec-06	Dec-07	Dec-08	Dec-09	Dec-10
Total assets					
Qatari Riyal	72,204	120,634	182,345	272,313	333,695
USD	70,681	91,138	122,650	94,829	113,669
EURO	6,297	14,825	16,062	8,147	6,794
Pounds Sterling	3,705	14,621	7,535	4,046	2,059
Other Currencies	3,674	10,848	16,746	18,218	19,957
Total	**156,560**	**252,067**	**345,337**	**397,553**	**476,175**
Total Liabilities and Equity					
Qatari Riyal	92,323	135,328	182,734	261,133	320,668
USD	54,419	89,759	132,784	115,625	136,350
EURO	4,418	9,705	15,591	7,877	6,612
Pounds Sterling	4,148	14,461	7,904	3,750	2,092
Other Currencies	1,253	2,814	6,323	9,168	10,454
Total	**156,560**	**252,067**	**345,337**	**397,553**	**476,175**

In 2010, around 70 per cent of the banking sector's total assets are denominated in Qatari Riyal compared to 57 per cent on average for year-end 2006 through 2010. Out of the remaining 30 per cent, about 80 per cent represents assets maintained in US$. On the other hand, 67 per cent of banking sector's total liabilities is denominated in Qatari Riyal compared to an average of 60 per cent over the review period from 2006 to 2010. Liabilities in US$ make 88 per cent of the remaining 33 per cent.

the banking sector in general maintains a long position in almost all currencies except for the US$ currency which has been maintained in short positions since 2008. Though Qatari riyal is pegged to the US$, this implies that the banking sector is exposed to foreign exchange risks arising from a depreciation in the US$ and appreciation in all foreign currencies other than the US$.

The banking sector's net open foreign exchange position (including the US$) decreased considerably since 2006 from 87 per cent of total equity and 107 per cent of tier 1 capital to 18 percent and 25 percent respectively in 2010. Consequently capital requirement for FX risk calculated on the basis of the size of the net open position had considerably declined from 6.9 per cent of total equity and 8.6 per cent of tier 1 capital in 2006 to 1.5 per cent and 2 per cent respectively in 2010.

To control banks' exposure to foreign exchange risk, Qatar central bank (QCB) stipulates a minimum foreign currency ratio of 100 per cent calculated as total assets in foreign currency to total liabilities in foreign currencies. This ratio has dropped to below the 100 per cent limit to stand at 91.8 per cent and 91.6 per cent in 2009 and 2010 respectively.

5. ANALYSIS METHODOLOGY

The stress test is based on one sensitivity scenario combing three risk types namely, credit risk, interest rate risk, and exchange rate risk. The stress test assumes a potential deterioration in the quality of the loan portfolio, increase in interest rates, and exchange rate depreciation. Through the scenario encompasses a simultaneous move in the three identified risk types, the magnitude of shock given to risk types are all hypothetical and have been envisaged separately for each risk type. The analysis is carried out on a backward basis covering the last five years from year-end 2006 through 2010. The test is conducted using bottom-up approach under which the data of the individual banks in the sample was used. The impact of shocks on portfolios of individual banks was then aggregated to measure the impact on the banking sector as a whole. In our analysis we also divide the banks in the sample into two groups by business model (5 conventional banks, and 3 Islamic banks) and capture

the impact of the shocks on each groups of banks applying the same procedures as those followed for the whole banking sector.

The impact of shocks on the banking sector and the two groups of banks is expressed as post-shock capital adequacy (CAR) ratio (tier 1 capital relative to risk-weighted assets) compared to pre-shock scenario capital adequacy ratio. The difference between ratios is then calculated and further disintegrated into its component impact of each risk type to assess the size of impact of each risk type on the capital adequacy ratio. We as well compare stressed CAR with the minimum requirement of the local regulator; Qatar center bank (QCB), which stipulates 10% minimum capital adequacy ratio, and Basel II directives which, mandate a minimum capital adequacy ratio of 8 %. And then attempt to estimate the capital needs for the whole banking sector and each group of banks whenever the stressed CAR ratio happen to fall below any one of the two ratios.

Finally, we also calculate for the whole banking sector and for the two groups of banks the impact of the stress scenario on a number of banking ratios and banks' Z-score and compare them with same sets of ratios under the pre-shock scenario.

5.1 Credit Risk

The credit risk is the risk of loss of the loan principal amount and any potential return thereon arising from borrowers' failure to repay loans in full or in part according to the repayment terms agreed upon. Credit risk, therefore, affects a bank in two ways. One way is through the bank's income statement as the bank suffers a loss of interest income on defaulting loans. The other way is through the bank's balance sheet as the bank suffers a loss of the loan principal amount.

Our stress test for credit risk involves assessing the impact of deterioration in the quality of customer loans portfolio resulting from hypothetical adverse economic conditions as outlined in the scenario below[6]. The negative feedback effect on banks' financial outcomes is projected to materialize in two forms. First, in form of higher levels of nonperforming loans (NPLs) in proportion to the total stock of performing loans, and secondly in form of declining interest income to the extent of interest income suspended on these nonperforming loans. To this effect and in order to capture any sectoral or sector concentration risk we apply in our analysis different shocks to different economic sectors to find out which sectors represent the exposures with the biggest potential impact on the banking sector.

Accordingly, we summarize our stress test of credit risk as follows

- An overall decline in the disposable income to the consumption sector (retail sector) during the crisis, therefore the highest level of deterioration in credit quality will appear in the consumption sector.
- In light of declining real estate prices during the period 2008 – 2009, deterioration in the credit quality of the real estate sector becomes the second highest among all the other sectors.
- Default ratios (shock size) were scaled up between the sectors according to the following ratios:
  - Corporate sector, which includes industry, general trade, services, activities around the world and others were estimated to have experienced 5% default rate.
  - Contracting and Real Estate sector is estimated to have suffered from 10% default rate.
  - Consumption (retail) sector 's risk is anticipated to have gone up to reflect 15% default rate .
  - Public sector is not shocked in the stress test.
- New provisions are made for 75 percent of non-performing loans.
- No guarantees assumed for the non-performing loans (NPLs).
- Interest income declines to the extent of interest income suspended on nonperforming loans estimated using each bank's annual effective interest rate on customer loans portfolio calculated as total interest income from customer loans to gross loans minus NPLs.
- Capital is affected by 100% of amount of interest income suspended and 75% of the additional NPLs, (that is, to the extent of loan loss provisions).
- Risk weighted assets are affected to the extent of 50% of the additional NPLs.

[6] These hypothetical adverse economic conditions presented in form of different shocks to different economic sectors are the same as those used by QCB in its internal assessment of credit risk.

5.2 Interest Rate Risk

The interest rate risk is the risk that the bank's financial condition may be adversely affected by a change in the prevailing market interest rates. One way a change in market interest rates might affect banks is that the banks' earnings from net interest income and other interest sensitive income change as a result of a change in market interest rates. This risk can be quantified as the difference between the amounts of net interest income realized at unchanged interest rates as compared to realized net interest income given adverse movements in interest rates.

One method used to assess the impact of a change in interest rates on banks' earnings, which we have used in our analysis, is the interest sensitivity gap or (net open position) method. Interest rate sensitivity gap is defined as the difference between interest-earning assets and interest-bearing liabilities maturing or reprising within a given time period. Accordingly, under this method interest-sensitive assets and liabilities, are grouped according to their contractual maturity or the remaining time to interest rate reset into a number of time bands and the earnings effects are then calculated through subtracting liabilities from the corresponding assets in each time band to produce an interest rate "gap" for that band. This gap is then used to estimate the effects on earnings by multiplying the gap by the value of the anticipated change in interest rates. A gap is considered positive when the amount of interest rate sensitive assets exceeds interest rate sensitive liabilities. On the other hand, a gap is considered negative when the amount of interest rate sensitive liabilities exceeds interest rate sensitive assets. During a period of rising interest rates, a positive gap would tend to result in an increase in net interest income while a negative gap would tend to affect net interest income adversely.

The intensity of the impact of on net interest income, therefore, because of changes in market interest rates depends on the size of the gap or the net position in a given period.

In constructing our stress scenario for interest rate risk, we have laid out a number of assumptions as follows:

- Due to unavailability of data on interest rate sensitivity gap according to remaining time to profit rate reset for Islamic banks we have used profit sensitivity gap according to the contractual maturities of assets and liabilities.

- The interest rate sensitivity gap for conventional banks was calculated according to the remaining time to reprising.

- With the objective to analyze changes in earnings in the short-term period that are induced by interest rate fluctuations, we restrict gap analysis to a one-year horizon. That is the intensity of the change in net interest income because of changes in market interest rates is limited to the cumulative net position with residual maturity up to one year.

- We assume 150 basis point upward parallel shifts in the short-term yield curve.

- Banks' capital and risk-weighted assets are affected to the extent of 100% of the decrease / increase in the value of the change in net interest income.

5.3 Exchange Rate Risk

Exchange rate risk is the risk that a bank may suffer losses as a result of adverse exchange rate movements during a period in which it has an open position, either spot or forward, or a combination of the two, in an individual foreign currency (Basel, 1980). There are two sources of foreign exchange risk. First, direct exchange-rate risk which arises from banks' net open positions in foreign currency and second, indirect exchange-rate risk which arises from the impact of foreign exchange change on the borrowers' creditworthiness and ability to repay(C˘iha´k, 2004).In our analysis we focus of the first type of foreign-exchange risk.

One method used to assess the direct exchange rate risk is the net open position in foreign exchange. Accordingly, exchange rate risk arises where values of assets and liabilities in particular currency are mismatching. Therefore, the extent to which a bank is vulnerable to an exchange rate appreciation or depreciation will depend on whether that bank has a long or short net open position. A net long position occurs when assets in a particular currency exceed liabilities in that same currency, while a short position arises when liabilities in particular currency are in excess of assets in that same currency. Consequently, a long position in foreign currency which is depreciating will result in an exchange loss relative to the bank's book value.

Similarly, a net short position in a foreign currency that is depreciating represents an exchange gain relative to the bank's book value.

In our stress test for exchange rate risk, we have calibrated currency depreciation shock of 5%, 4 percent and 3percent to 3 net open positions of three groups of currencies, Euro, Pounds Sterling and other currencies respectively. Because Qatari Riyal is relatively pegged to the US Dollar, net open positions maintained in US Dollar were not shocked. Consequently, Banks' capital and risk-weighted assets are affected to the extent of 100% of the total impact of the respective shocks.

6. RESULTS ANALYSIS

3.1 The Banking Sector

The pre-test CAR for the banking sector increased by only 1.1 percentage point between 2006 and 2010 to stand at 16.4 per cent in 2010 as compared to 15.2 per cent in 2006. This slight increase can be attributed to the declining return on risk-weighted assets (RORWA) over the period since 2006. Year-on-year growth in profit has remained to fall behind the growth witnessed in RWAs. Return on RWAs has dropped from 4.2 per cent in 2006 to 3.9 percent in 2010. Over the same period, post –test CAR has increased by 1.52 percentage point to stand at 13.49 per cent in 2010 as compared to 11.96 per cent in 2006. The fact that this increase in the post-test scenario was higher than the increase in the pre-test CAR suggests that the overall pool of risks in the banking sector has declined (Table 5).

Table 5: Summary of Stress Testing Results for the Banking System, 2006-2010

	Dec-06	Dec-07	Dec-08	Dec-09	Dec-10
Pre-shock CAR*	***15.23%***	***16.9%***	***15.8%***	***16.1%***	***16.4%***
Conventional banks	13.8%	14.4%	14.4%	14.8%	15.4%
Islamic banks	22.3%	26.2%	20.9%	19.9%	19.0%
Stress test scenario					
Total impact of shocks	***-3.26%***	***-2.97%***	***-3.18%***	***-3.09%***	***-2.87%***
Credit shock	11.85%	13.68%	12.49%	12.95%	13.45%
Interest rate shock	15.24%	16.96%	15.79%	15.98%	16.32%
Exchange rate shock	15.34%	17.12%	15.87%	16.14%	16.43%
Post-shock CAR	***11.97%***	***13.94%***	***12.60%***	***12.96%***	***13.49%***
Conventional banks	10.39%	11.18%	11.23%	11.89%	12.97%
Islamic banks	19.59%	24.25%	17.62%	16.16%	14.94%
Number of banks					
with CAR < 10%	**2**	**3**	**2**	**2**	**2**
with CAR < 8%	**0**	**2**	**2**	**0**	**0**
Capital injection (QR m) **	446	2,442	1,540	1005	824
Market share of banks with CAR < 8% ***	-	18.1%	5.2%	-	-
Market share of banks with CAR < 10% ***	20.0%	36.1%	16.4%	16.2%	13.7%

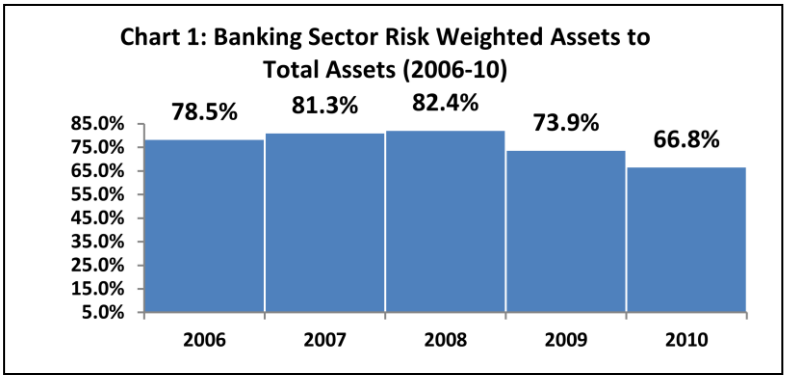
* CAR stands for capital adequacy, defined as per Basel II

** Capital needed for each bank in the system to have post-shock CAR of at least 10 percent.

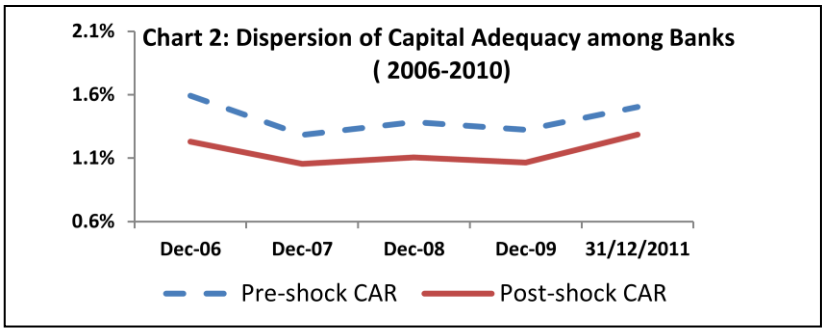
*** Market share of total assets before the shock

This is also evidenced by the intensity of the overall reduction in the CAR ratio in the post-test scenario over the analysis period. In 2010, the banking sector has suffered the least reduction in CAR ratio of 2.87 percent, as compared to, for instance, 3.27 per cent in 2006 and 3.08 on average. Much of this can be attributed to the intervention of the authorities, which included capital injection, and purchases of banks' troubled assets in the real estate and investment portfolios. Besides, risk weighted assets to total assets ratio indicates considerable changes in the structure and overall pool of risk of the banking sector. This ratio having been declined to 70%

on average post the crisis during 2009-10 from 80% on average before the crisis during 2006-07 means that the banking sector has become less vulnerable to economic downturn shocks than ever before (Chart 1).



Though the post-shock CAR for the banking sector remained above the 8% and 10 % regulatory minimum capital mandated by Basel II and Qatar central bank respectively, it had fallen below the regulatory minimum ratios for some banks in the sample (Table 5). In order to assess the financial stability of the banking sector we have calculated the dispersion of the capital adequacy prior to and after the shock (Chart 2). Lower dispersion indicates higher stability as it reflects a lower share of the banking sector that would experience problems during stressful times. The dispersion analysis of the Qatari banking sector though reveals that the performance of the banking sector has been volatile over the analysis period, which reflects instability, the difference in dispersion year-on year shows that the intensity of instability is within manageable limits. This is evidenced through the declining number of banks and their respective market shares that would have suffered from losses under the stress test scenario.



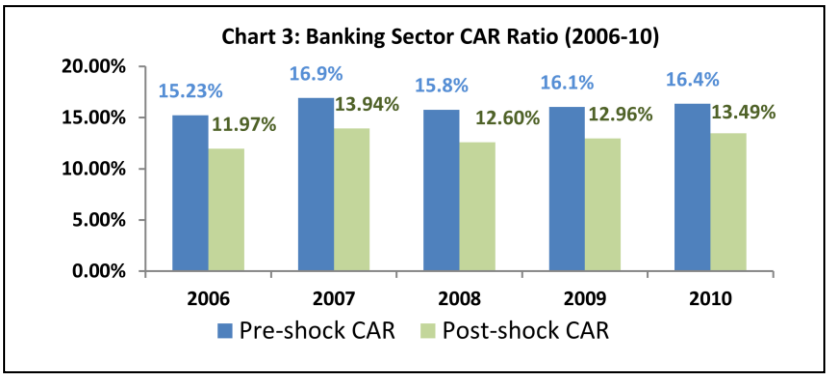
In 2006, the impact of the shock would have caused the capital adequacy ratio of two banks in the sample to fall below the minimum requirement of 10 percent but would have had no impact of all banks' ability to maintain the minimum ratio of 8 percent. The market share of these two banks makes around 20 percent of the domestic banking sector measured as a percentage share in the banking sector's total assets. The recapitalization needs for the overall banking system would have come to QR 446 m. The analysis shows that year 2007 would have been the worst affected by the same size of the shock as more banks would have maintained capital adequacy lower than 10 percent. Three banks with market share of 36 percent would have failed to maintain capital adequacy ratio above 10 percent with two of which failing to maintain the lower minimum floor of 8 percent. Consequently, the recapitalization needs for these three banks would have come to about QR 2,442 m.

The impact of the shock would have lessened in 2008 as the market share of banks, which would have suffered significantly from the shock, has reduced to only 16.4 percent. Two banks would have had their CAR ratio declining below the minimum ratio of 8 percent. Capital injection would have as well reduced to QR 1,540 m. The impact of the shock, though less significantly compared to previous years, would have continued to take its toll on the banking sector through 2009 and 2010. The market share of banks that are more exposed to the risks assumed in the stress test and had lower capital puffers compared to their peers has significantly shrunk to only 13.7 percent in 2010. Recapitalization needs have also declined to QR 1,005 m and QR 824 million in 2009 and 2010 respectively.

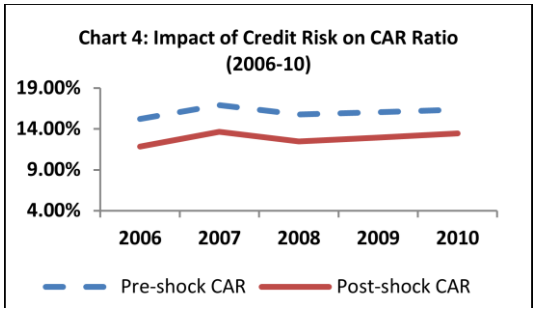
The stress test suggests that credit risk continues to remain a significant vulnerability for the banking sector as it continues to have the largest influence on capital ratio. In the aggregate scenario, in which all the three risk

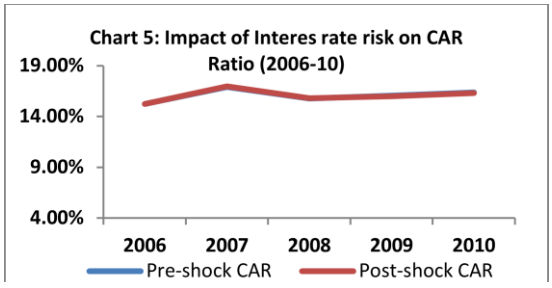
types materialize, the capital ratio drops by 2.87 percentage points in 2010 as compared to 3.26 percentage points in 2006 and 3.07 percentage points on average (Chart 3). This decline corresponds to 17.55 percent of CAR value in 2010 as compared to 21.42 percent in 2006. The negative impact on CAR ratio attributed to credit risk comes to 2.91 percentage points in 2010, as compared with 3.38 percentage points in 2006. This means that the actual negative impact of credit risk was alleviated, though slightly, by the positive impact of other risk types in the stress scenario. Of the two components of credit risk, i.e., deterioration in credit quality and decline in interest income by the amount of suspended interest income, this latter has very small impact in the range of 22 and 25 basis points over the 5-year analysis period.

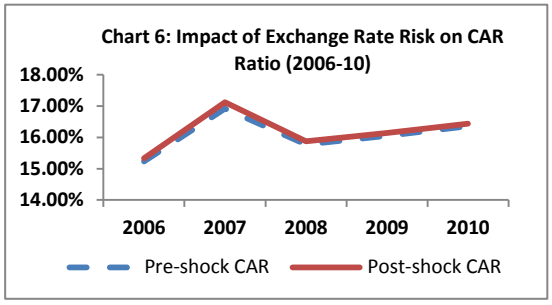
Credit stress test was carried on a sector-by-sector basis to find out which sectors represent the exposure with the biggest potential impact on the banking sector. The sectoral stress test suggests that the banking sector's exposure is quite dispersed across sectors, and, as a result, even such relatively drastic shocks as assumed in the stress scenario could mostly be absorbed by the system. At the same time, it is noticed that the risk profile of the banking system has changed. The impact of retail sector shock on capital ratio has declined drastically from 1.93 percent in 2006 to 1.18 percent in 2010, which reflects a shift in the banking system's risk appetite from consumer credit toward corporate credit. This is evident by the declining share of retail sector credit in the total private sector credit from 39 percent in 2006 to 25 percent in 2010. The impact of credit exposure to other sectors on banking sector's capital ratio increased reflecting their increasing share in the total private credit from 33 percent in 2006 to 42 percent in 2010 for corporate sector and from 28 percent in 2006 to 33 percent in 2010 for real estate sector.



The weight of individual risk types has remained unchanged in the period under analysis. In the context of the overall impact on capital adequacy, credit risk continues to have the biggest impact (chart 4), minimal impact arising from interest rate risk as a result of an increase in short term interest rates by 1.5% (chart 5). One reason for this is that most loans bear variable interest rates. Finally, exchange rate risk appears to have limited influence on the banking sector as only a minor share of banking sector's total assets (6 % in 2010) is held in foreign currencies excluding the US$ (chart 3).







6.2 Banking Sector Ratio Analysis

In this section we try to provide an analysis of the banking sector stability and performance during the assumed stress (post-shock) scenario and compare the results with the pre-shock scenario. We attempt to do this by measuring the banking sector performance in relation to three performance areas related to asset quality, profitability and solvency (Table 6).

Table 6: Banking Sector Ratio Analysis

	Asset Quality			Profitability		Solvency
	NPLs / Loans*	Provisions/NPLs	(NPLs-provisions)/capital	ROA	ROE	Z-score
	Summary of Pre-Shock Banking Ratios					
Dec-06	2.48%	79.6%	2.1%	3.3%	22.5%	23.39
Dec-07	1.64%	90.0%	0.5%	3.2%	19.1%	35.74
Dec-08	1.44%	82.3%	0.9%	2.9%	18.5%	44.52
Dec-09	1.92%	92.0%	0.6%	2.5%	15.6%	49.21
Dec-10	2.36%	95.4%	0.4%	2.2%	16.1%	55.89
	Summary of Post-Shock Banking Ratios					
Dec-06	10.3%	76.2%	9.5%	0.6%	4.5%	16.66
Dec-07	10.2%	79.7%	7.0%	0.5%	3.7%	26.87
Dec-08	9.8%	76.2%	7.9%	0.01%	0.1%	31.58
Dec-09	9.3%	73.7%	7.1%	-0.02%	-0.1%	36.76
Dec-10	9.1%	80.5%	5.9%	0.5%	3.8%	43.30

* Includes only private sector loans portfolio

Asset Quality Ratios:

In the pre-shock scenario, asset quality measured as nonperforming loans to total private loans seems to be rising since 2007. The banking sector, however, is more adequately providing for possible further losses in the future. Provision adequacy ratio measured as provisions to NPLs has increased in 2010 to 95.4 percent from 79.6 percent in 2006. This reflects lower potential impact of asset quality problems on banking sector's ability to absorb losses from impaired assets without impairing the capital. This is evident by the lower impact on capital in case all non-provided for NPLs was fully charged off. In 2010, the core capital of the banking sector would have been impaired by only 0.4 percent as compared to 2.1 percent in 2006.

In the stress scenario, asset quality would have deteriorated drastically arriving at almost 9 percent of total private credit. This is almost 3.85 times the ratio in the pre-shock scenario. Coverage ratio, however, improves to stand at 80.5 percent in 2010 as compared to 76.2 percent in 2006. This reflects more resilience in the banking sector in later years as compared to earlier years. This is evident by the declining impact on capital in case all non-provided for NPLs would have been fully charged off. In 2010, the core capital of the banking sector would have been impaired by 6 percent as compared to 9.5 percent in 2006.

Profitability Ratios:

In the pre-shock scenario, both profitability indicators show that the banking sector becomes less profitable since 2006. Return on Assets (ROA) drops from 3.3 percent in 2006 to 2.2 percent in 2010. Similarly return on equity (ROE) records a decline from 22.2 percent in 2006 to 16.1 percent in 2010. In the post-shock scenario both ratios indicate very fragile profitability for the banking sector as ROA and ROE drop to 0.5 percent and 3.8 percent in 2010 respectively. The whole banking sector would have stood to suffer a loss in 2008.

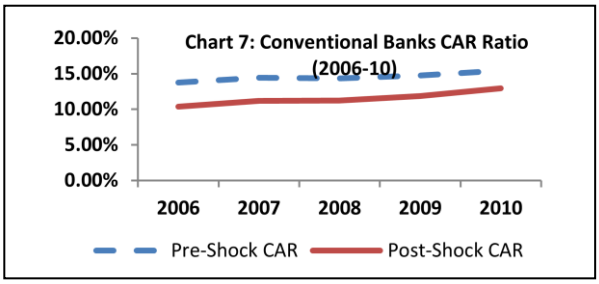
Solvency:

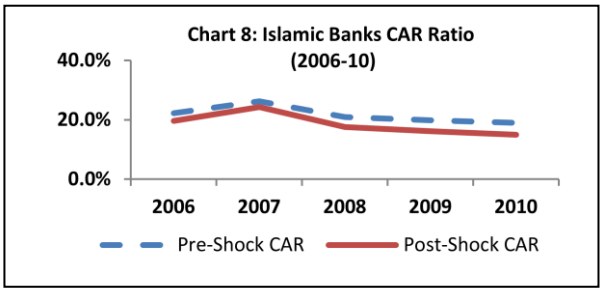
To measure the banking sector's probability of insolvency we have utilized z-score[7] measure that is an estimate of bank stability and an indicator of bank distance from insolvency. Under the assumption of normal return distributions of the banking sector, z value specifically indicates the number of standard deviation bank's return has to fall below its expected value before a bank's equity is depleted and hence the bank is declared insolvent. A higher z-score implies a lower probability of insolvency risk. Z-score shows that the banking sector's solvency remains very strong under both scenarios.

[7] Z value is calculated as (ROA+CaR)/SD (ROA) where CaR reflects capital-asset ratio.

6.3 Comparative Analysis of Stress Test Results between Islamic & Conventional Banks

Both groups of banks have maintained strong aggregate capital adequacy ratio in the post-shock scenario though the intensity in the change in the capital adequacy ratio was different for both groups of banks. Whereas CAR ratio has increased by 1.6 percentage point in 2010 from 13.78 per cent in 2006 for conventional banks, Islamic banks' CAR ratio has declined by 3.3 percentage point. This reflects more resilience shown by conventional banks though at least 17.6 per cent of conventional banks has reported capital ratio of less than 10 percent in 2010. This ratio, nevertheless, has improved considerably compared to earlier years in the period under review. This is also confirmed by the fact that conventional banks have assumed a rising trend in capital adequacy ratio in both scenarios as compared to a declining trend for Islamic banks (Charts 7& 8).





The fact that the increase in the CAR ratio in the post-shock scenario for conventional banks was higher than the increase in the pre-shock CAR suggests that the overall pool of risks in the conventional banking sector has declined. On the other hand, the decline in the CAR ratio in the post-shock scenario, which was higher than the decline in the pre-shock CAR for Islamic banks, suggests that the overall pool of risks in this banking sector has increased.

Furthermore, the total impact of shocks would have been different prior to the global crisis in 2008 as compared to post the crisis for the two groups of banks. Total impact would have been higher for conventional banks, on average, at 3.33 percentage point prior to the crisis during 2006-07 as compared to 2.66 percentage point post the crisis during 2009-10. In contrast, Islamic banks would have suffered from higher impact at 3.86 percentage point, on average, post the crisis as compared to 2.32 percentage point, on average, prior to the crisis. In 2008, the year of the crisis, Islamic banks would have experienced higher total shock impact of 3.29 percentage points as compared with 3.14 percentage point for conventional banks. This indicates again as explained above that the risk profile for both groups of banks have changed post the crisis as compared to prior to the crisis with Islamic banks tending to assume higher risk as compared to the conventional banks (see table 7 below).

Credit risk remains to represent the major source of vulnerability for both groups of banks. The impact of credit quality, however, would have been severer on Islamic banks as compared to conventional banks. In 2010, the influence of credit risk on capital ratio would have declined to 2.62 percentage point from 3.58 percentage points in 2006 for conventional banks, which reveals improvement in credit quality. In addition, the impact of credit shock would have been significantly worse prior to the crisis at 3.54 percentage point, on average, during 2006-07 compared to only 2.82 percentage point on average prior to the crisis. Most of this can be attributed to the fact that conventional banks have reduced their exposure to the retail sector from 38 percentage point, on average, during the crisis to 25 percentage point, on average, after the crisis. In contrast, the impact of credit risk exposure on capital ratio has increased for Islamic banks from 2.48 percentage points in 2006 to 3.69 percentage points is 2010. This reflects in part the disparity in credit concentration policies for Islamic banks relative to conventional banks. Around 37 percent of conventional banks' credit portfolio was not subject to stress due to being directed to the public sector compared to only 21 percent for Islamic banks. Islamic banks also have more exposure to real estate sector which was stressed at the second highest rate of 10 percent in the stress scenario (38 percent to total private sector in 2010) as compared to conventional banks (29 percent to total private sector in 2010). Islamic banks, however, have maintained lower exposure to retail sector compared to conventional banks, which provided Islamic banks some protection against the severe deterioration in this sector that was assumed to have been the worst in the event of an economic downturn.

In the short term, conventional banks seem to stand to profit from an increase in interest rate as compared to Islamic banks. In 2010, an increase in interest rate by 1.5 percent would have boosted the capital ratio of conventional banks by 7 basis points as compared to a negative impact of 32 basis point for Islamic banks. This positive verses negative impact experienced by conventional and Islamic banks respectively is observed throughout the period under review. This could be because conventional banks have most of their assets priced

at variable interest rates as compared to fixed rates for Islamic banks, which allowed conventional banks to adjust faster to changes in market rates than could Islamic banks. In Aggregate, both groups of banks maintained small net positions in the short term which helped limit any potential impact on capital ratio resulting from unexpected big changes in interest rates. Besides, The impact of interest rate change on capital ratio would have remained as minimal post the crisis as prior to the crisis for both groups of banks.

Exchange rate risk would have had a small positive impact on capital ratio of both groups of banks. This is because a small amount of both groups of banks total assets is maintained in foreign currencies other than the US$. In 2010, this ratio stood at 1.8 percent for Islamic banks as compared to 7.3 percent for conventional banks. Total assets in foreign currencies to total liabilities in foreign currencies ratio is 102 percent and 97 percent for Islamic and conventional banks respectively. Both groups of banks' net open foreign exchange position (including the US$) decreased considerably since 2006 from 104 of tier 1 capital to 42 per cent in 2010 for conventional banks and from 118 per cent in 2006 to 13 percent in 2010 for Islamic banks. Consequently, capital requirement for FX risk calculated based on the size of the net open position had considerably declined from 9 per cent of tier 1 capital in 2006 to 5 percent for conventional banks and from 9 per cent in 2006 to 1 percent in 2010 for Islamic banks.

Though the aggregate capital ratio of conventional banks have remained above the regulatory minimum limits , at least 23.4 percent of conventional banks in 2006 would have reported capital ratios of less than 10 percent which would have required a capital injection of around QR446 m. This market share would have declined to 17.6 percent in 2010 with capitalization needs of QR824 m. In contrast, all Islamic banks have reported capital ratios above the regulatory minimum limits throughout the period under review (Table7).

Table 7: Comparison of Stress Testing Results for Islamic & Conventional Banks, 2006-2010

	Dec-06	Dec-07	Dec-08	Dec-09	Dec-10
Conventional banks					
Pre-shock CAR*	***13.78%***	***14.4%***	***14.4%***	***14.8%***	***15.4%***
Stress test scenario					
Total impact of shocks	*-3.39%*	*-3.26%*	*-3.14%*	*-2.87%*	*-2.45%*
Credit shock	10.20%	10.94%	10.97%	11.75%	12.80%
Interest rate shock	13.88%	14.55%	14.50%	14.78%	15.49%
Exchange rate shock	13.86%	14.57%	14.48%	14.87%	15.52%
Post-shock CAR	***10.39%***	***11.18%***	***11.23%***	***11.89%***	***12.97%***
Number of banks					
with CAR < 10%	2	3	2	2	2
with CAR < 8%	0	2	2	0	0
Capital injection (QR m) **	**446**	**2,442**	**1,540**	**1,005**	**824**
Market share of banks with CAR < 8% ***	0.0%	21.7%	20.1%	20.2%	0.0%
Market share of banks with CAR < 10% ***	23.4%	43.2%	20.1%	20.2%	17.6%
Islamic Banks					
Pre-shock CAR*	***22.3%***	***26.2%***	***20.9%***	***19.9%***	***19.0%***
Stress test scenario					
Total impact of shocks	***-2.66%***	***-1.99%***	***-3.29%***	***-3.70%***	***-4.03%***
Credit shock	19.77%	23.91%	17.99%	16.51%	15.28%
Interest rate shock	21.88%	26.09%	20.53%	19.53%	18.65%
Exchange rate shock	22.45%	26.71%	20.94%	19.88%	18.97%
Post-shock CAR	***19.59%***	***24.25%***	***17.62%***	***16.16%***	***14.94%***
Number of banks	-	-	-	-	-
with CAR < 10%	-	-	-	-	-
with CAR < 8%	-	-	-	-	-
Capital injection (QR m) **	-	-	-	-	-
Market share of banks with CAR < 8% ***	-	-	-	-	-
Market share of banks with CAR < 10% ***	-	-	-	-	-

* CAR stands for capital adequacy, defined as per Basel II

** Capital needed for each bank in the system to have post-shock CAR of at least 10 percent.

*** Market share of total assets before the shock

6.4 Comparative Ratio Analysis between Islamic and Conventional Banks

In this section, we try to provide an analysis of the two groups of banks stability and performance during the assumed stress (post-shock) scenario and compare the results with a pre-shock scenario. We attempt to do this by measuring the performance in relation to three performance areas related to asset quality, profitability, and solvency (Table 8&9).

Table 8: Convetional Bansks Ratios Analysis

	Asset Quality			Profitability		Solvency
	NPLs / Loans*	Provisions/ NPLs	(NPLs-provisions)/ capital	ROA	ROE	Z-score
	Summary of Pre-Shock Banking Ratios					
Dec-06	2.39%	79.9%	2.1%	2.9%	21.9%	28
Dec-07	1.65%	91.0%	0.56%	2.5%	17.5%	35
Dec-08	1.60%	76.7%	0.89%	2.4%	18.2%	34
Dec-09	2.35%	80.0%	0.5%	2.2%	16.1%	63
Dec-10	2.55%	94.7%	0.5%	2.2%	16.1%	141
	Summary of Post-Shock Banking Ratios					
Dec-06	10.3%	76.1%	10.7%	0.1%	0.7%	19
Dec-07	10.3%	77.6%	8.6%	-0.2%	-2.0%	24
Dec-08	9.9%	76.7%	8.7%	-0.3%	-2.4%	23
Dec-09	9.3%	80.0%	7.3%	0.1%	0.8%	47
Dec-10	9.1%	83.7%	5.5%	0.8%	6.7%	115

* Includes only private sector loans portfolio.

Table 9: Islamic Bansks Ratios Analysis

	Asset Quality			Profitability		Solvency
	NPLs / Loans*	Provisions/ NPLs	(NPLs-provisions)/ capital	ROA	ROE	Z-score
	Summary of Pre-Shock Banking Ratios					
Dec-06	3.89%	78.7%	2.0%	6.0%	24.4%	15
Dec-07	2.06%	86.3%	0.48%	6.8%	23.0%	22
Dec-08	1.35%	68.8%	1.02%	4.8%	19.2%	36
Dec-09	1.09%	74.4%	0.8%	3.5%	14.4%	19
Dec-10	1.29%	58.5%	1.8%	3.0%	15.3%	13
	Summary of Post-Shock Banking Ratios					
Dec-06	10.4%	76.4%	5.9%	3.3%	14.7%	13
Dec-07	9.8%	77.4%	3.7%	4.5%	16.1%	19
Dec-08	9.5%	74.1%	6.0%	1.2%	5.5%	28
Dec-09	9.3%	74.9%	6.6%	-0.5%	-2.5%	14
Dec-10	9.2%	72.7%	8.5%	-0.7%	-4.1%	9

* Includes only private sector loans portfolio.

Asset Quality Ratios:

In the pre-shock scenario, asset quality measured as nonperforming loans to total private loans seems to be higher at 2.55 percent for conventional banks in 2010 as compared to 1.29 percent for Islamic banks. Conventional banks, however, are more adequately providing for possible further losses in the future than Islamic banks. Provision adequacy ratio measured as provisions to NPLs has increased for conventional banks in 2010 to 94.7 percent from 79.9 percent in 2006 as compared to 72.7 percent for Islamic banks in 2010 down from 78.7 percent in 2006. This reflects lower potential impact of asset quality problems on conventional banks ' ability (compared to Islamic banks) to absorb losses from impaired assets without impairing the capital. This is evident by the lower impact on capital in case all non-provided for NPLs were to be fully charged off. In 2010,

the core capital of conventional banks would have been impaired by only 0.5 percent as compared to 1.8 percent for Islamic banks.

In the stress scenario, asset quality would have deteriorated drastically arriving at almost 9 percent of total private credit for both groups of banks. This is almost 3.58 and 7.12 times the ratio in the pre-shock scenario for conventional and Islamic banks respectively. Coverage ratio, however, improves compared to the pre-shock scenario to stand at 72.7 percent in 2010 for Islamic banks while deteriorates for conventional banks to 83.7 percent for conventional banks. The impact on capital in case all non-provided for NPLs would have been fully charged off is smaller for conventional banks as compared to Islamic banks. In 2010, the core capital of conventional banks would have been impaired by 5.5 percent as compared to 8.5 percent in for Islamic banks.

Profitability Ratios:

In the pre-shock scenario, both profitability indicators show that both groups of banks become less profitable since 2006. Furthermore, profitability ratios show that profitability has deteriorated more drastically for Islamic banks as compared to conventional bank. In 2010, return on assets (ROA) drops from 2.9 percent to 2.2 percent in 2006 for conventional banks as compared to a decline from 6 percent in 2006 to 3 percent in 2010 for Islamic banks. Similarly return on equity (ROE) records a decline from 22 percent in 2006 to 16 percent in 2010 for conventional banks as compared to a decline from 24.4percent in 2006 to 15.3 percent in 2010 for Islamic banks. In the post-shock scenario, both ratios indicate very fragile profitability for both groups of banks. Conventional banks, however, demonstrated more resilience in later years as compared to Islamic banks. The conventional banking sector would have stood to suffer losses in 2007 and 2008 before it recovers in 2009 onwards, whereas Islamic banks would have reported losses in 2009 and 2010.

Solvency:

The Z score shows that conventional banks ' solvency remains very strong under both scenarios whereas it is quite low for Islamic banks. Most of this is maybe attributed to higher volatility in profitability for Islamic banks as compared to conventional banks.

7. CONCLUSION

The stress test suggests that credit risk continues to remain a significant vulnerability for the banking sector as it continues to have the largest influence on capital ratio. Besides, the sect oral stress test suggests that the banking sector's exposure is quite dispersed across sectors, and, as a result, even such relatively drastic shocks as assumed in the stress scenario could mostly be absorbed by the system. On the other hand, hardly any impact arising from interest rate risk was observed as a result from an increase in short term interest rates by 1.5%. This is because more assets of the banking sector are reprising faster than liabilities in the short run. One reason for this is that most loans bear variable interest rates. Exchange rate risk appears to have limited influence on the banking sector as only a minor share of banking sector's total assets (6 % in 2010) is held in foreign currencies excluding the US$.

Ratios analysis of the banking sector shows that asset quality would have deteriorated drastically to almost 3.85 times the ratio in the pre-shock scenario. Coverage ratio and impact on capital in case all non-provided for NPLs would have been fully charged off show, however, improving signs in later years as compared to earlier years in the period under review . In the pre-shock scenario, profitability indicators show that the banking sector becomes less profitable since 2006. In the post-shock scenario both ratios indicate very fragile profitability for the banking sector as ROA and ROE drop to 0.5 percent and 3.8 percent in 2010 respectively. The whole banking sector would have stood to suffer a loss in 2008. Lastly, the Z score shows that the banking sector's solvency remains very strong under both scenarios.

The comparative analysis between conventional and Islamic banks shows that both groups of banks have maintained strong aggregate CAR ratio in the post-shock scenario. The intensity in the change observed in the CAR ratio, however, was steeper for Islamic banks as compared to conventional banks. Furthermore, the fact that the increase in CAR ratio in the post-test scenario for conventional banks was higher than the increase in the pre-test CAR suggests that the overall pool of risks in the conventional banking sector has declined. On the other hand, the decline in CAR ratio in the post-test scenario which was higher than the decline in the pre-test CAR for Islamic banks suggests that the overall pool of risks in this banking sector has increased.

The impact of all risk types, namely, credit risk, interest rate risk and exchange rate risk, on the CAR ratio for both groups of banks resembled that of the whole banking sector. Credit risk remains to represent the major source of vulnerability for both groups of banks, whereas the impact of interest rate risk and exchange rate risk remained very low.

Ratios analysis of the groups of banks reveals that in the pre-shock scenario, asset quality measured as nonperforming loans to total private loans is higher at 2.55 percent for conventional banks in 2010 as compared to 1.29 percent for Islamic banks. Conventional banks are, however, more adequately providing for nonperforming loans and more likely to recoup faster than Islamic banks in the worst-case scenario under which the impact of the credit risk becomes severer. In the stress scenario, asset quality would have deteriorated drastically to become almost 9 percent of total private credit for both groups of banks. Coverage ratio, however, improves compared to pre-shock scenario for Islamic banks while deteriorates for conventional banks .The impact on capital in case all non-provided for NPLs were to be fully charged off is smaller for conventional banks as compared to Islamic banks.

Profitability indicators in the pre-shock scenario, show that both groups of banks become less profitable since 2006 and that profitability has deteriorated more drastically for Islamic banks as compared to conventional bank**.** In the post-shock scenario, profitability ratios indicate very fragile profitability for both groups of banks. Conventional banks, however, demonstrated more resilience in later years as compared to Islamic banks. The conventional banking sector would have stood to suffer losses in 2007 and 2008 before it recovers in 2009 onwards, whereas Islamic banks would have reported losses in 2009 and 2010. Lastly, Z score shows that conventional banks ' solvency remains very strong under both scenarios whereas it is quite low for Islamic banks. Most of this is maybe attributed to higher volatility in profitability for Islamic banks as compared to conventional banks.

REFERENCES

Alfaro, R and Drehmann M (2009)," Macro Stress Tests and Crises: What Can We Learn?", IBS.

Article IV Consultation(2009), IMF country report no. 10/41 , February 2010

Breuer T, Jandacka M , Rheinberger K , Summer M ,(2009) " How to find plausible ,and useful stress scenarios ", International Journal of Central Banking, Vol. 5, No.3.

Basel Committee on Banking Supervision-IBS, (2010) "The Basel Committee's response to the financial crisis: report to the G20 ".

Borio C, Drehmann M and Tsatsaronis (2012), "Stress-testing macro stress testing: does it live up to expectation", Monetary and Economic Department, BIS Working paper no. 369.

Buncic D and Melecky M (2011)," Macro-prudential Stress Testing of Credit Risk: A Practical Approach for Policy Maker", School of Economics and Political Science, Department of Economics, University of St. Gallen, Discussion Paper no. 2011-39

Committee on the Global Financial System - International Bank of settlement (2000) "Stress testing by large financial institutions: current practice and aggregation issues ".

Cihak M (2004a)," Designing Stress Tests for the Czech Banking System", CNB Internal Research and Policy Note /3/.

Cihak M (2004b), "Stress testing: A review of key concepts", Czech National Bank, Internal Research and Policy Note no. 2/2004.

Cihak M and Hermanek J (2005a)," Stress testing the Czech Banking System: Where Are We? Where Are We Going", Czech National Bank, Research and Policy Note no. 2.

Cihak, M (2005b), "Stress Testing of Banking Systems ", Czech Journal of Economics and Finance, 55- 2005, C 9-10.

De larosiere, J (2009), "The high-level group on financial supervision in the EU".

Drehmann M, Sorensen S and Stringa M (2008), "The integrated impact of credit and interest rate risk on banks: an economic value and capital adequacy perspective", Bank of England, Working paper no.339.

Foglia, A (2009), " Stress Testing Credit Risk: A survey of Authorities Approaches", Banking and Financial Supervision, Bank of Italy, International Journal of Central Banking, Vol. 5 No. 3

Głogowski A, (2008), "Macroeconomic determinants of Polish banks' loan losses – results of a panel data study", National bank of Poland, Working Paper no. 53.

Galati G. and Moessner R (2011), " Macro-prudential policy- A literature review", Bank for International Settlement, Working paper no. 337

Hoggarth G, Sorensen S, Zicchino L (2005), "Stress tests of UK banks using a VAR approach", Bank of England, working paper No. 282.

Haldane, A (2209), "Why banks failed the stress test".

Iman,v.D, Franka and Pr¨opper L (2008), Marc De Nederlandsche Bank, "Stress Testing Linkages between Banks in the Netherlands ", Munich Personal RePEc Archive (MPRA).

International Bank of settlement (2005), "Principles for sound stress testing practices and supervision ".

Jones M , Hilbers P, Slack G , "Stress Testing Financial Systems: What to Do When the Governor Calls " , IMF working paper no. 04/127

Jones M., Hilbers P and G Slack (2004), " Stress Testing Financial Systems: What to DO When the Governor Calls", IFM Working Paper no.127.

Kattai R (2010),"Credit risk model for the Estonian banking sector", Bank of Estonia, Working paper no. 1/2010.

Misina M , Tessier D , Dey S (2006)," Stress Testing the Corporate Loans Portfolio of the Canadian Banking Sector " , Bank of Canada , Working paper 2006-47.

Otani A , Shiratsuka S , Tsurui R , Yamada T (2009), " Macro Stress-Testing on Loan Portfolio of Japanese Banks " , Bank of Japan working paper series , No.09-E-1.

Pritsker M (2011)," Enhanced Stress Testing and Financial Stability".

Qatar National Bank (QNB) , Qatar Economic Review –July 2010

Quarterly Statistical Bulletins, Qatar Central Bank (2009), Financial Stability & Statistics Department ,Vol. 29 - Number 4

Rouabah A, Theal J (2010), "Stress testing: the impact of shocks on the capital needs of the Luxembourg banking sector "working paper No.47.

Sorge, M (2004)," Stress-testing financial systems: an overview of current methodologies", Bank for International Settlement, Monetary and Economic Department, Working paper no. 165.

Vazquez, F, Tabak, B, M and Souto M (2010)," Macro Stress Test Model of Credit Risk for the Brazilian Banking Sector", Central Bank of Brazil, Working Paper Series 226

Wiszniowski, E (2010), "Stress testing as a tool for simulating the effects of crisis in banks ", BEH.