

Analysis of Financial Crisis in UAE Financial Markets

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Abstract

This paper provides empirical evidence on the causes and timing of the recent 2007-2008 UAE financial crisis. A persistent weakness in the economic fundamentals throughout much of the pre-crisis period created necessary conditions for the financial crisis. However, the timing of the financial crisis was determined by a unique combination of an increase in leverage risk faced by the banking system and a decrease in foreign exchange reserves (FXRES) that forced the government to bail out the troubles financial institutions. A Vector Auto-Regressive (VAR) analysis identified UAE Foreign Liabilities, Central Bank's Quasi-money, Government intervention activity through increasing FEX Reserves, Improved corporate earnings, Leverage risk of the banking system (that serve as a proxy for the market value of banking system) and the ratio of quasi money (M_2) to foreign exchange reserves (FXRES) that measures the government's access to reserve for initiating bailout policies to explain the cause and timing of UAE economic crisis.

Keywords: UAE Financial Crisis; Macro-economic indicators; Leverage risk; M_2 to FX reserves; Bailout; Vector auto-regressive models (VAR)

JEL Classification Codes: G01, G18, G28, G35

Introduction

A recent study by the International Monetary Fund (IMF) indicated that, worldwide growth, which slackened from 5% in 2007 to about 3% in late 2008, was moving towards 4% in the course of 2009. Owing to globalization and the role of the US in the global economy, the US recession had a strong negative impact on the global economy. In the case of the ongoing financial crisis, the emerging

markets have melted down by 30% since 2007 (IMF WP/10/2008). One third of the loss to the developing markets occurred during the first half of 2008 alone.

Although emerging market (EM) countries in the Middle East and North Africa (MENA) region (which includes UAE and other GCC countries) were relatively insulated from the impact of the crisis at the outset, given their limited exposure to structured financial products and low levels of financial integration, the global slowdown has begun to affect their economic activity (IMF's Spring 2008 and Fall 2009 *World Economic Outlook (WEO)*). With foreign investors withdrawing from the Gulf Cooperation Council (GCC) markets, the real estate industry in the region also felt the brunt of the crisis. Saudi Arabia, the biggest capital market in the region, lost the largest with YTD (year-to-date) losses of 36% on its market capitalization, followed by Dubai at -32% and Abu Dhabi at -18%. The Kuwait market too registered a loss of 13% while Qatar lost 15% during 2008 (GCC Economic Monthly, NCB Capital, and August 2009).

Table 1 shows the types of interventions (including bailouts) made by various Policy Authorities in both developed and developing economies, to reduce the severity of the crisis and restore public confidence by lowering borrowing costs, encouraging investments, and improving liquidity in the economies.

Table 1: Types of Policy Intervention in the wake of Global Crisis

Countries	Policy Authority	Type of Policy Intervention in 2007-09
Developed economies		
United States	Federal Reserve System	Bailed out financial firms by buying US1 trillion \$ of their troubled assets (mostly mortgage-related)
EU	Europe Central Bank	Injected US\$ 99.8 billion in a 1-day money market auction
United Kingdom	Bank of England	Injected US\$ 36 billion
Japan	Bank of Japan	Injected US\$ 29.3 billion into its financial system
Australia	Reserve Bank of Australia	Injected US 1.5 billion (3 times more than the estimated market requirement)
Developing Economies		
China	Central Bank of China	Reduced interest rate for the first time since 2002
India	Reserve Bank of India	Injected US 1.32 billion through refinance operations
Taiwan	Central bank of Taiwan	Reduced required reserve ratio for the first time in 8 years
Indonesia	Central Bank of Indonesia	Reduced overnight repo-rate by 2% to a level of 10.25%
MENA Region		
United Arab Emirates	UAE Government	Guaranteed that all depositors and all banks will be protected
	UAE Central Bank	Tightened capital adequacy ratio of financial institutions from 10% to 11% by June 2009, and 12% by June 2010. ¹
	Government of Abu Dhabi	Recapitalized 5 domestic banks by injecting AED 12 billion (1 US\$ = 3.675 AED)
	UAE Central Bank + Federal Government	Supported domestic banks by injecting AED 120 billion as capital since September 2008
	Dubai Government	Launched a US\$20 billion support fund to manage the proceeds of the US\$20bn bond program launched earlier in 2009-10. ²

Source: Compiled from GCC Economic Monthly, NCB Capital, August 2009

¹ Unlike other developed economies, bond market in UAE is still not well developed; there are no open market operations to control interest rates due to relatively small size of the economy. Further, the local currency is pegged to US\$ giving less scope to the use of interest rates and the bond market as tools to regulate the banking system. So to strengthen the banking system, the central bank used capital adequacy norms as the tool to control (??) monitor and regulate the severe losses caused by banks' exposure to the nation's real estate and construction sectors after the onset of the credit crunch.

² The proposed fund managers are accountable to Dubai's Supreme Fiscal Committee (SFC). The fund provides support to the failing government and quasi-government owned entities in the form of commercial loans. These entities will repay the loan once the external market conditions improve. This initiative comes after the government-owned Nakheel PJSC, the Dubai-based property developer revised the redemption terms for its US\$750 million Sukuks (Sukuks are Islamic bonds issued by Islamic financial institutions after complying with Sharia Law) maturing in 2011 amid rising concerns over the company's ability to repay its debt obligations. The company has already acknowledged that it has received emergency support from the Dubai government to complete projects and repay outstanding obligations. Nakheel also used Government bailout initiative to payback US\$3.5bn worth of Islamic bonds (Sukuks) that matured in December 2009 (GCC Economic Monthly, NCB Capital, August 2009, pp 19-23).

Thus, the UAE regulators resorted to cautious and conservative policy intervention strategies such as guaranteeing depositors, supporting affected banks through re-capitalization and bond programs.

While there have been several analyses of the causes and timing of the crisis in the developed countries, to our knowledge, there has been no such study in the GCC countries in general and the UAE in particular. In the light of the important policy implications of the impact of the UAE crisis on the region, this paper looks at the following two interrelated research issues:

- a. Identify the determinants that explain the financial turmoil in the UAE financial markets.
- b. Evaluate the impact of the bailouts (i.e., intervention by the UAE Government) on the UAE economy in the short run and long run.

The research findings will, hopefully help policy makers to take pro-active steps in controlling future such crises. This paper is organized in five sections. Section 2 discusses the 1997 Asian currency crisis as the conceptual framework since it is widely researched and cited in the crisis literature. Section 3 states the hypothesis and discusses the vector auto regression (VAR) methodology to address the research issues. Section 4 discusses the results from VAR analysis. Section 5 summarizes and concludes the research findings.

2. Conceptual Framework

Several alternative explanations have been advanced ex-post for explaining the 1997 currency crisis in Korea and other countries affected by the Asian contagion of which, two have gained prominence in the research literature on crisis. One explanation proposed and popularized by Krugman (1998a, 1998b) is that, the Asian crisis was an inevitable consequence of an unsustainable deterioration of macroeconomic fundamentals and inappropriate government policies that provided incentives for moral hazard in the banking and corporate sectors. The second explanation advocated by Sachs (1997) holds that “self-fulfilling expectations” or “financial panic” was the main reason behind the development of the financial crisis and its regional contagion. Because of the similarity between the Asian contagion and UAE financial turmoil, we can relate below these two alternative explanations to analyze the determinants of UAE economic crisis and the impact of UAE Policy interventions.

2.1. Declining Fundamentals as the Cause of Crisis

Declining fundamentals refer to deterioration in quality of investments by undertaking risky-projects with the hope that the firms are not affected if the investments go bad since the Government will protect their losses. For example, in the case of Korea and other Asian countries, the investments made were highly questionable (Puri et al 2002).

This explanation rests on the premise that, in the absence of technological progress, high investment rates will be unable to sustain economic growth. Given a production function, high investment rates will mostly replenish the depreciated capital leading to diminished growth. Some economists tend to think that the “Asian Miracle” was largely an investment-led boom. In spite of the asymmetric information about investments in Korea, foreign investors were ready to supply their capital under the implicit bailout guarantee by the government. Thus, foreign investors had an incentive not to discriminate bad investments from good ones, a classic problem of adverse selection. According to the moral hazard argument³, corporations undertook risky projects, as they had nothing to lose if the investment was poor. When investors realized that the government was unable to rescue their investments, they started withdrawing their capital. Consistent with this view, Corsetti et al.

³ Moral hazard and adverse selection are associated with asymmetric information. Moral hazard occurs when one party (corporations and banks) has incentive and ability to shift the costs to the other party (government). Adverse selection refers to a situation, in which creditors are unable to judge the quality of the creditworthiness of borrowers. Therefore, they pay a price that reflects only average quality. As a result, noncompetitive projects may be selected.

(1999) conclude that, low foreign exchange reserves and financial deficiencies resulted in high proportion of non-performance loans which caused the Asian crisis. For several years before the financial crisis, economic fundamentals in UAE started showing signs of weakness⁴ as can be seen from Table 2.

Table 2: Major UAE macroeconomic indicators

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008
Real GDP growth rate	4.98	7.97	2.6	11.9	9.7	8.5	9.4	6.2	7.4
Inflation rate (%) based on CPI	3.09	2.8	2.91	3.1	4.96	6.2	10	10.6	12.8
Foreign Exchange Reserve (Billion US\$)	3.62	3.79	4.06	4.01	4.96	5.68	7.49	21.01	8.59
Foreign Liabilities (Billion US\$)	14.13	8.14	8.14	8.25	11.54	23.20	48.38	87.40	76.95
Bank Capital to Asset Ratio (%)	12.9	11.9	11.8	11.4	11.1	11.9	12.6	13	13.3

(Source: UAE Central Bank Annual Reports)

Real GDP growth rates in 2007-08 were (6.2% and 7.4%) well below those registered during 2003 to 2006 (11.9% and 9.4%). Inflation increased from around 5% in 2004 to 12.8% during 2008. Foreign exchange reserves (FXRES) declined during 2008 to US\$ 8.59 billion compared to a steep increase of US\$ 21.01 billion in 2007⁵. Foreign liability almost doubled annually during 2005-07 (US\$ 23.2 billion and \$87.40 billion) with a marginal decline in 2008 (\$76.95 billion). Although not reported in Table 2, large capital outflows, a surge in imports and lower investment income have already resulted in the UAE recording its first balance of payments (BoP) deficit of AED172.4bn in 2008.

2.2. Self-Fulfilling Expectations

The protagonists of the self-fulfilling expectations assertion (for example Radelit and Sachs, 1998) do not question the strength of economic fundamentals and accordingly do not hold them responsible for the severity of the crisis. They believe that the cause of the crisis is purely financial panic. In other words, the cause and the timing of the crisis have nothing to do with the underlying correlation among economic-fundamental variables. The main reason for the crisis is the change in the market information forces investors to radically revise their expectations⁶.

Relating this hypothesis to the UAE economy, we find that several key economic fundamentals as tabulated below could explain their possible role in the financial crisis.

Variable code	Variables (Monthly Percentage Change)	Represents
X ₁	FOREIGN LIABILITIES of Commercial Banks (FLIAB)	Macroeconomic indicator
X ₂	DOMESTIC CREDIT	Assets of the banking system
X ₃	CLAIMS ON GOVT (Negative)	Government intervention through bailout
X ₄	QUASI-MONEY	Monetary intervention activity
X ₆	FXRES	Government economic activity
X ₇	MSCI-Barra capital market Return index	Corporate profitability
X ₉	DEPOSIT TO ASSET RATIO	Leverage risk measure of the banking system
X ₁₀	M ₂ TO FXRES	Reserve adequacy (Liquidity) of UAE economy

The analysis in Table 2 presents preliminary evidence that weakness in several macroeconomic variables created necessary conditions leading to a financial turmoil in UAE. Since the banking system

⁴ Krugman (1994) argues that the deteriorating fundamentals and bad policies created preconditions for the financial (1997) crisis in Asia in the years leading to the Asian crisis.

⁵ Several studies have indicated that FXRES play an important role in determining the financial crisis e.g., Corsetti et al. (1998), Edwards (2001), and Frankel (2000).

⁶ Radelet and Sachs (1998) explained the Asian market behavior in terms of major shifts in expectations that led the economies into "bad equilibrium."

serves as the first firewall against the financial crisis, it is expected that the economic system could run smoothly if the market value of the banking system is sizeable to absorb the internal and external economic shocks. However, if shocks are severe and government does not have enough resources to rescue the banks, then the foreign exchange markets will collapse. Thus our general presumption is that the UAE economic crisis was triggered by weakness in fundamentals in both the macro-economy and the banking system. We test this presumption through the following set of hypotheses and variables.

2.3. Hypotheses

The market value of banking system is modeled in this paper through banking variables; namely: Assets of the banking system (predominantly domestic credit), Corporate profitability (expressed through MSCI capital market return index), and Leverage risk of the banking system (expressed through Deposit to Asset Ratio).

1. It is expected that an increase in domestic credit of the banking system together with increased corporate profitability accompanied by lower leverage risk of the banking systems should improve the market value of the banking system. Thus, higher the market value of the banking system, lower is the probability occurrence of economic crisis. This hypothesized negative relation is consistent with the self-fulfilling expectation proposition discussed in section 2 i.e., investors need not panic about their investments as they are safe since the banking system is sound.

Government intervention by provision of enough resources to the banks will reduce crisis of financial markets. The Government intervention is modeled in this paper through macroeconomic indicators such as: Foreign liability, Sovereign risk (expressed as a ratio of Foreign exchange reserve to Foreign Liability), Liquidity risk in the economy (expressed as a ratio of quasi money to foreign exchange reserve), government intervention through bailout (expressed as claims on government) and monetary intervention activity (expressed as quasi-money).

2. It is expected that an increase in sovereign and liquidity risks, decrease in foreign liability (a measure of foreign investments in to UAE), aggravates the economic fundamentals of UAE with the resultant increased claims on governments (implying increased government interventions through bailouts) and increased quasi-money supply (implying increased monetary intervention). This hypothesized negative relation is consistent with the declining economic fundamental theoretical concept discussed in section 2, i.e., if the quality of investments in the economy is weak it may result in increased government and monetary interventions to protect the investors and reduce impact of economic crisis.

3. VAR Methodology

Both banking and government financial systems are interdependent on each other for smooth functioning of economic system. In order to test our two inter-dependent research hypotheses we model the time series of macroeconomic, banking and private (corporate) sector data before the crisis in 2007-2008 and during the crisis (2008-2009) through a VAR (Vector Auto Regression) system of equations. Each VAR equation represents macroeconomic, banking and private sector variables identified in Section 2. VAR is a commonly used methodology⁷ for analyzing dynamic impact of random disturbances on the systems of interrelated time series variables.

⁷ Contrary to the VAR methodology, if we had used linear regression (OLS) methodology to test our hypotheses, then the mere introduction of several macroeconomic, banking and corporate variables in a system of linear regression equations might have violated some assumptions (i.e., independence of regressors) of a classical OLS as these variables are interrelated, and cause-effect relation of economic crisis cannot be established. In such cases, a VAR system is a useful tool to represent the dynamic relationship or causal relationship among variables of the system (Liu and Hudak, 1995, The SCA statistical system: vector ARMA modeling of multiple time series). We concur with Hamilton (1994)'s observation that while a VAR system is a statistical description of the dynamic interrelations among different variables,

Table 3 shows the set of 10 endogenous variables used in the UAE crisis analysis together with its association with the research hypothesis being tested and linkage with the conceptual framework.

Table 3: List of variables used in the UAE crisis analysis

Variable code in Vector Z	Variables (Monthly Percentage Change)	Represents	Relation of the variables to signify to which concept/hypothesis they are related	
			Concept	Hypothesis
X _{1t}	FOREIGN LIABILITIES (FLIAB)	Macroeconomic indicator	1	2
X _{2t}	DOMESTIC CREDIT CLAIMS ON GOVT	Assets of the banking system	2	1
X _{3t}	(Negative)	Government intervention through bailout	1	2
X _{4t}	QUASI-MONEY	Monetary intervention activity	1	2
X _{5t}	TOTAL RES	Government economic activity	1	2
X _{6t}	FXRES	Government economic activity	1	2
X _{7t}	MSCI-Barra Capital Market Return index	Corporate profitability	2	1
X _{8t}	FXRES to FLIAB	UAE Sovereign risk	1	2
X _{9t}	DEPOSIT TO ASSET RATIO	Leverage risk measure of the banking system	2	1
X _{10t}	M ₂ TO FXRES	Reserve adequacy (Liquidity risk) of UAE economy	2	1

Accordingly, we estimate the following VAR system:

$$Z_t = C + \Phi_1 Z_{t-1} + \dots + \Phi_p Z_{t-p} + \epsilon_t \tag{1}^8$$

In equation 1,

Z: is (10 x 1) vector of endogenous variables representing macroeconomic activity, C: (10 x 1) vector of intercepts,

Φ: is (10 x 10) estimated coefficient matrix representing own and cross-relationships among set of n variables (n=10 here), and

ε_t: is (10 x 1) residual vector matrix.

The diagnostic tools for model selection with appropriate lag lengths in VAR are the two information criteria: Akaike Information Criteria (AIC)⁹ and Schwartz Criteria (SC). These information criteria can be used for model selection with smaller values of the information criteria being preferred for determining the lag length of VAR.

The vector Z includes percentage changes on ten variables that characterize the UAE economy and its private (corporate), banking, and government sectors as indicated in third column in Table 3¹⁰. The choice of variables in the above VAR specification is consistent with economic intuition and the analysis presented earlier. For instance, if FXRES (X_{6t}) is autoregressive, the past international liquidity can impact future international liquidity. If domestic credit (X_{2t}) is autoregressive, the bank assets in the past can impact future assets depending on its quality. Similarly X_{9t} captures leverage risk

VAR system measures complete correlation among all the relevant variables and explain short- and long-term impact of VAR variables.

⁸ Equation 1 is a n-equation, n-variable linear model in which each variable is in turn explained by its own lagged values plus current and past values of the remaining n-1 variables. On the other hand it is different from a univariate autoregression, which is a single-equation, single-variable liner model in which the current value of a variable is explained by its own lagged values. The VAR system provides a systematic way to capture rich dynamics cross relationships in multiple time series.

⁹ L = log likelihood = -0.5T{k(1=log2Π) + log |Ω| }
 AIC = -2 L/T + 2n/T
 SC = -2L/T + n log T/T

¹⁰ It is not unusual to have a large number of variables. For example, Edwards (2001) and Frankel and Rose (1996) employ 16 regressors each. Park and Rhee (1998) use eight regressors in their probit model.

in the banking system. Stock market (X_{7t}) is often a leading indicator of strong market return fundamentals, and a decline in the stock market may indicate an impending financial and economic crisis. Increased foreign liability (X_{1t}) a macroeconomic indicator is often significant to destabilize the UAE economy. Analogously, government policies on fiscal expansion, money supply, total reserves and FXRES are captured by the monthly changes in X_{3t} , X_{4t} , X_{5t} and X_{6t} respectively. Sovereign and liquidity reserves of the UAE are captured by X_{8t} and X_{10t} .

The ratio of Deposit to Asset (X_{9t}) serves as a link between the private (corporate) sector and the banking sector. High X_{9t} (i.e., internal shocks) implies that the banking system deviates from the role of a profit maximizer and absorbs loan losses from the private sector through loss reserves on loans (assets). It also implies that the market value of the banking system is decreasing due to mismatching (as deposits are of shorter maturity and assets are of longer maturity in a scenario of rising interest rates). As a result, the ability of banks to borrow domestically (through deposits) and abroad (through foreign direct investments) becomes limited and the borrowing rate increases (external shocks). When the internal and/or external shocks are large enough to wipe out the market value of the entire banking system, it is the government's responsibility to bail out the troubled banks. At this point, FXRES (X_{6t}) becomes the link between the banking sector and the government. Low level of FXRES means that the government owns less of resources for the rescue.

The use of percentage changes (growth rates) in variables is especially helpful in establishing not only the causes but the timing of the crisis also¹¹. An example illustrates this point. Suppose foreign liability has reached a certain unsustainable level and stays there for some time. Even though the foreign liability per period may not further worsen (implying zero percentage change per period), *ceteris paribus*, FXRES would eventually deplete causing the UAE economy to destabilize. Thus, the use of growth rates should provide important evidence on the dynamic relationship among variables and explains the timing issue relatively well

3.1. Data

The data used in this research is obtained from two sources. Annual data were collected from annual reports of the UAE Central Bank. The monthly data were collected from International Financial Statistics (IFS) database. The sample covers a period from January 2000 to March 2009. We selected this sample period for two reasons. First, this period represents the increasing economic activity in the years (2000 to 2006) running up to the turmoil (2007 to 2009). Second, this period is selected to avoid any structural change in the UAE economy. The historical economic developments in UAE can be divided into two stages. Stage 1 involved UAE Government's launch of economic development plan and industrialization, promotion of infrastructure & cluster industries, and emergence as a newly reformed economy together with strengthening of economic stabilization efforts resulting in current surplus during 2000–2006. Stage 2 showed a weakness in the economic fundamentals during 2007–2009. It is, therefore, reasonable to choose the period 2000–early 2009 for the present empirical study. Time series on monthly percentage changes in all the variables included in the VAR model are computed from monthly observations.

4. Empirical Results from VAR Method

4.1. Descriptive Statistics

Table 4 provides the summary statistics on VAR variables during January 2000 to March 2009. The description of X_1, \dots, X_{10} variables are given in Table 3. Table 4 also provides diagnostic tests for

¹¹ Many a time researchers use growth rates if time series is non-stationary. In the current research, use of growth rate helped in spotting the timing of crisis as illustrated in the example in addition to correcting the non-stationary series.

existence of non-normality in UAE economic-fundamental variables¹². Long-term trend coefficients of UAE foreign liability (X_{1t}) and domestic credit (X_{2t}) were positive (increasing trend) and highly significant, while that of UAE FEX reserve (X_{7t}) and UAE sovereign risk (X_{8t}) were negative (marginally declining) and significant.

Table 4: Summary statistics of monthly changes in the VAR variables, sample period: January 2000–March 2009.

	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}
Trend coefficient	0.3441	0.03412	-0.054	0.0068	-0.002	-0.002	-0.089	-0.0682	-0.0109	0.0231
(t-value)	(6.50)	(3.27)	(-0.88)	(0.82)	(-0.06)	(-0.06)	(-2.59)	(-1.69)	(-1.23)	(0.89)
Mean	-55.07	1.96	3.45	1.71	1.37	1.40	2.16	0.26	0.30	0.96
Median	-59.06	2.15	0.38	1.35	1.27	1.27	2.51	-1.29	0.00	0.72
Maximum	-13.92	11.58	102.66	17.23	49.84	49.91	52.60	105.10	20.14	38.67
Minimum	-82.10	-12.97	-40.76	-3.99	-23.30	-23.62	-33.36	-22.25	-5.96	-31.53
Std. Dev.	20.71	3.63	20.24	2.75	8.55	8.62	11.86	13.53	2.96	8.55
Skewness	0.25	-0.77	1.56	1.68	2.12	2.10	0.75	4.28	2.81	0.27
Kurtosis	1.56	6.44	7.99	10.85	14.53	14.41	6.83	34.08	19.93	8.50
Jarque-Bera (JB)	10.65	65.23	158.77	334.53	691.90	677.42	77.61	4762.77	1457.30	140.20
Probability of error sig. of JB	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sum Sq. Dev.	46734	1435	44655	823	7968	8108	15327	19948	958	7971
Observations	110	110	110	110	110	110	110	110	110	110

The trend coefficients of other variables were less significant when trends were developed independently, but are needed in the VAR context to capture dynamics of cross-relationships among vector of variables.

4.2. VAR Estimation Results

Full estimates of the VAR model are presented in Appendix-1. Akaike Information Criteria (AIC) and lower Schwartz Criteria (SC) was lower in the VAR model with lag length of 2 compared to 4 period lag lengths. Hence as discussed in the methodology section, VAR model with lower AIC and SC was preferred i.e., 2 period lag length for analysis¹³. The VAR model identifies eight variables (factors) that have statistically significant direct correlation with the monthly changes in UAE macroeconomic variables. They are lagged changes of UAE foreign liability (X_{1t}), Quasi-money (X_{4t}), UAE Total Reserve (X_{5t}) and Foreign Exchange Reserves (X_{6t}), Growth in Corporate profitability (X_{7t}), UAE reserve adequacy (X_{8t}), Ratio of Deposit to Asset growth rate (X_{9t}), and UAE liquidity risk (X_{10t}). They are discussed below:

4.2.1. Result 1: Foreign Liability (X_{1t}) Equation in the VAR System

Foreign liability (FLIAB) in time t has positive relations with 1-period lagged X_1 , and 2-period lagged Quasi-money (X_{4t}). The relation between these two variables was direct and significant. A possible reason for this direct relationship is that the UAE Central Bank intervened in the banking market by

¹² Jarque-Bera statistic a measure of non-normality is highly significant indicating that error distributions of the vector of economic-fundamental variables are not normally distributed and hence ordinary regression analysis is not appropriate.

¹³ AIC and SC are high for these lag lengths compared to lag length of 1 & 2. Although not reported here, higher lag lengths of 5-6 indicated higher values of AIC and SC. Hence lag lengths beyond 3 were not considered in model specification

Lag length	2	3	4
AIC	51.24956	51.85352	52.1764
SC	56.46481	59.59723	62.4784

monetary expansion to avoid large swings in the asset and liabilities of the banks. This relationship implies the direct effect of bailout of the program (as reserve funds) for increased liquidity by the banking system in the future periods. For example, as shown in Table 1, UAE Central Bank injected 120 billion as capital since September 2008; government of Abu Dhabi recapitalized 5 domestic banks by injecting AED 12 billion. This increased money supply in the economy and helped in maintaining confidence of the market participants (both domestically and internationally) in the banking system thus maintaining the level of foreign liability. This result is consistent with the first theoretical concept discussed in the conceptual framework in section 2 i.e., the government interventions through bailouts reduced the severity of crisis to financial markets.

4.2.2. Result 2: Quasi-Money (X_{4t}) Equation in the VAR System

X_{4t} Quasi-money in time t has negative relation with 1-period lagged Total Reserves (X_{5t}), and positive relation with 1-period lagged Foreign exchange reserves (X_{6t}). Total reserves declined due to increased panic by public drawing down total reserves. These behavior by market participants resulted in decreased rate of total reserves [X_5 (-1)] and foreign exchange reserves [X_6 (-1)] of the commercial banks in the previous period. To overcome these declining fundamentals, the government intervened subsequently through increased quasi-money growth rates in the banking system in the next period. This relationship also implies the direct effect of bailout of the program (as reserve funds) for increased liquidity in the banking system due to sudden withdrawals (and the resultant decline in total liabilities of bank and reserves) in the future periods. The interpretation of the result is that declining fundamentals in UAE economy triggered economic crisis in UAE and is consistent with first theoretical concept stated in 2.1 i.e., declining fundamentals as the cause of financial crisis and the crisis was averted by the bailout programs of the government and the monetary authorities.

4.2.3. Result 3: Growth in Total Reserve (X_{5t}) and Foreign Exchange Reserves (X_{6t}) Equations in the VAR system

Total Reserves in time t has positive relations with 1-period lagged Quasi-money (X_{4t}), and 1-period lagged Capital Market Return (X_{7t}). Similarly, FXRES in time t has the same relations as in Total Reserves (X_{5t}) i.e., positive relations with 1-period lagged Quasi-money (X_{4t}), and 1-period lagged Capital Market Return (X_{7t})¹⁴. These relations imply that the increased quasi money growth rates and the corporate profitability in the previous period positively impacted growth of total and foreign exchange reserves of the UAE in the next period. These results are consistent with those discussed under Result 4.2.1 i.e., on the risk-return front: investors perceived the measures of the government as favorable which reduced their risk perception caused by the global financial crisis. This supports our research hypothesis-2 wherein the banking system being the first line of defense is propped by the government through bailout programs to maintain the confidence of investors.

4.2.4. Result 4: Growth in Corporate Profitability (X_{7t}) Equation in the VAR System

Capital Market Return in time t has positive relation with 2-period lagged Capital Market Return (X_{7t}). This result implies that during the study period there was growth in corporate profitability implying higher degree of confidence of the private sector in the economy in the coming periods. There was no

¹⁴ Efficient market hypothesis (EMH) implies that stock market return index should be a leading indicator of the financial strength in economy. Consistent with the EMH, the coefficients of one-period lagged changes in X_{7t} are significant and positive for variables (X_{5t} , X_{6t}) but negative for variables (X_{9t} market is positively related to X_{5t} , and X_{6t} , and negatively related to X_{9t} (banking system's leverage risk) and X_{10t} (Country's Liquidity risk). These mixed results raise the possibility that the stock market return index may not be a leading indicator, a notion contrary to market efficiency. In the case of UAE, the presence of market imperfections due to bailout programs, to assert that stock prices reflect all the information may not be justified. Perhaps, that is the reason our data exhibit an exception that the stock market is positively related to X_5 , and X_6 , and negatively related to X_9 (banking system's leverage risk) and X_{10} (Country's Liquidity risk).

other significant relation of this variable with other macroeconomic variables. Interestingly this result suggests that the cause and timing of crisis had nothing to do with the underlying correlation among macroeconomic variables which is consistent with second theoretical concept of self-fulfilling expectations i.e., private (corporate) sector believed that the crisis is purely triggered by financial panic of investors. This also validates our first research hypothesis that increased corporate profitability improved the market sentiment and market value of the banking system and is therefore negatively related to the UAE economic crisis.

4.2.5. Result 5: Growth in Reserve Adequacy (X_{8t}) Equation in the VAR System

Reserve adequacy measures the degree of sovereign risk of the UAE Government and is a ratio of FXRES to Foreign Liabilities in time t . Higher ratio is preferred by the market participants to signify lower sovereign risk. This risk measure in time t has positive relation with 2-period lagged Total Reserve (X_{5t}), and negative relation with 2-period lagged FEX Reserves (X_{6t}). It is to be noted that FXRES is an indicator of the ability of the government to intervene in the foreign exchange market and rescue the banking system. As the VAR estimates show, the FXRES (-2) is significant and negatively correlated with sovereign risk (X_{8t}). Hence, any current depletion in foreign exchange reserves is expected to cause sovereign risk and the financial crisis about 3 months later. These results are plausible since government bailout program by borrowing from foreign sources increased foreign liabilities, while at the same time depleted foreign exchange reserve since these reserve funds are provided to banking system by UAE government and central banks (Table 1). Both actions increased reserve adequacy and helped in reducing the sovereign risk of the UAE economy. These results further validate our research hypothesis 2 and are consistent with first theoretical concept. Earlier studies on Asian Crisis also confirm our results. For instance, Corsetti et al. (1998) found that low FXRES resulted in high proportion of nonperformance loans lowering the quality of assets during Asian crisis.

4.2.6. Result 6: Ratio of Deposit to Asset Growth Rate (X_{9t}) Equation in the VAR system

The ratio of Deposit to Asset is a leverage measure¹⁵ in the banking system. Leverage ratio in time t has negative relation with 2-period lagged Capital Market Return. A high leverage ratio can adversely influence the value of the banking system in the long run as well as in the short runs. The long-term effect entails accumulation of bad quality assets (high default rate) overtime with accumulated internal loan losses that adversely affect the value of the banking system. A high leverage ratio implies that the domestic and foreign depositors (or lenders to the banks) would require a higher default premium from the UAE commercial banks. Thus, a high ratio of leverage risk will be negatively correlated with the value of the banking system and investors' market rate of return.

Our empirical results (in Appendix-1) further indicate the important role of X_{9t} through other channels, such as X_{2t} (domestic credit), with $[X_9 (-1)]$ and $[X_9 (-2)]$ which are positively related although statistically less significant. This is another indication of the problem of moral hazard in banking as unprofitable companies borrowed new debt to pay off the old bad debt. This is suggested by increase in domestic credit before the financial crisis.

These results suggest an unambiguous role of the ratio of X_{9t} in reducing the market value of the banks and in triggering the financial crisis in 2007. It was then the government's responsibility to bail out the troubled banking system. This validates our first research hypothesis and is consistent with second theoretical concept of self-fulfilling expectations.

4.2.7. Result 7: Growth Rate in Country's Liquidity risk (X_{10t}) Equation in the VAR System

This variable measures the liquidity risk of the banking system. Reserve adequacy ratio (M2 to FXRES) in time t has **positive** relation with:

- 1-period lagged FXRES (X_{6t})

¹⁵ Deposits (of customers) are considered short- and intermediate term debt liabilities by the banking system used to invest in banking assets. To that extent deposit to asset ratio can be considered as leverage measure.

- 1-period lagged reserve adequacy ratio (X_{10t}) and has **negative** relation with fiscal and monetary variables:
- both 1-period and 2-period lagged quasi money (X_{4t})
- 1-period lagged total reserves (X_{5t})
- 1-period lagged capital market return (X_{7t})

The results indicate increasing trend of existence of liquidity risk ~~trend (bad style)~~ in the later half 2007 and 2008. In later part of 2007 and entire 2008, the UAE government reduced a substantial part of its foreign exchange reserves for market intervention.

Based on the analysis of above 7 set of results, it is reasonable to conclude that signs of an imminent financial crisis may be noticed in the declining UAE financial market in 2007-08 and other deteriorating economic fundamentals. As far as the timing of the crisis is concerned, the most important factors that triggered the crisis were the vulnerable banking sector and low level of reserves in 2007-08. Immediately before the 2007 financial crisis, there prevailed declining FXRES, with the result the foreign investor perceived the insufficiency of the bank equity. As a result the declining FXRES prompted the government to intervene in the banking market through bailouts. These results are consistent with earlier studies on Asian Crisis. For example, Frankel (2000) concluded that Taiwan and China, which had high reserves, successfully weathered the East Asia crisis. On the contrary, Thailand and South Korea, whose reserves had dwindled considerably by late 1997, succumbed to the crisis. Thus, our results are consistent with the earlier studies of similar crisis event and validate our first research hypothesis and second theoretical concept of self-fulfilling expectations.

5. Summary and Conclusion

This paper presents an analytical evaluation of the economic fundamentals of UAE prior to the 2007-08 financial crisis and attempts to identify the factors that played a decisive role in triggering the crisis. While most of the economic fundamentals deteriorated in 2003-06 creating necessary conditions for a crisis, it was weakness in the banking sector that triggered the financial crisis and without the government's bailout programs; the crisis would have been deeper. The foregoing conclusion is derived through a VAR model that estimates the relationship between several lagged variables that represent the weakness in macroeconomic fundamentals drawn from private, banking and government sectors of the economy. Following is the summary of the results discussed in section 4 that shows the importance of macroeconomic and financial sector variables in explaining the trigger of UAE economic crisis and our research hypotheses:

Variable code in Vector Z	Variables (Monthly Percentage Change)	Represents	Is Consistent with Theoretical concepts	Validates Research Hypothesis
X_{1t}	FOREIGN LIABILITIES (FLIAB)	Macroeconomic indicator	1	2
X_{4t}	QUASI-MONEY	Monetary intervention activity	1	2
X_{5t}	TOTAL RES	Government economic activity	1	2
X_{6t}	FXRES	Government economic activity	1	2
X_{7t}	MSCI-Barra Capital Market Return index	Corporate profitability	2	1
X_{8t}	FXRES to FLIAB	UAE Sovereign risk	1	2
X_{9t}	DEPOSIT TO ASSET RATIO	Leverage risk measure of the banking system	2	1
X_{10t}	M ₂ TO FXRES	Reserve adequacy (Liquidity risk) of UAE economy	2	1

Thus, the government timely saved the troubled banks through bailouts and drawing down FXRES. The timing of the increase in the ratio of X_{9t} and X_{10t} is consistent with the model's prediction that the government's bailouts and foreign reserve policy played crucial role in reducing the adverse reaction of financial crisis in 2007-08. These developments significantly contributed to the positive

expectations in the market. The result was survival of the banking sector with the confidence of the market participants intact.

6. Limitations of this Research

The analysis focused exclusively on the UAE, which is a relatively small economy in the Middle East and Northern African (MENA) region. Availability of relevant data for other economies in the MENA region would have made the analysis more region-specific since the regional economies in MENA are similar in culture and business operations. This is the first limitation.

The second limitation is similar to the first but is more related to the comparative analysis that could not be carried out with a developed economy data set. This is the first systematic research that we have embarked on. To that extent, the paper's result may not be generalizable to other economies due to small sample.

The third limitation is about the aggregation of data at the macro-level used in this research. The micro-level firm specific data could have captured the risk and return of different size banks in the UAE using a panel methodology.

The fourth limitation could be that-although the UAE is an oil-rich we did not explicitly include oil prices during the study period in the analysis. Nevertheless, we feel that this may not be a major limitation. Oil-revenue effects have been, to some extent, captured by including the corporate profitability.

Appendix 1. Coefficients of the VAR (Sample period 2000.01 to 2009.03)

	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10
X1(-1)	0.945	0.126	1.828	0.164	0.229	0.231	-0.901	0.475	-0.058	-0.257
Std. error	-0.280	-0.250	-1.374	-0.180	-0.528	-0.532	-0.721	-0.902	-0.203	-0.515
t-values	[3.374]**	[0.50544]	[1.33070]	[0.91232]	[0.43330]	[0.43408]	[-1.24904]	[0.52658]	[-0.28489]	[-0.49912]
X1(-2)	0.037	-0.126	-1.664	-0.129	-0.207	-0.209	0.805	-0.404	0.075	0.285
	-0.279	-0.249	-1.369	-0.179	-0.526	-0.530	-0.718	-0.899	-0.202	-0.513
	[0.13325]	[-0.50704]	[-1.21601]	[-0.72172]	[-0.39367]	[-0.39449]	[1.12041]	[-0.44969]	[0.37000]	[0.55431]
X2(-1)	0.229	0.020	-0.606	0.148	-0.062	-0.065	0.248	-0.574	-0.030	0.211
	-0.216	-0.193	-1.058	-0.138	-0.407	-0.410	-0.555	-0.695	-0.156	-0.397
	[1.06204]	[0.10271]	[-0.57255]	[1.07039]	[-0.15340]	[-0.15879]	[0.44617]	[-0.82642]	[-0.19404]	[0.53194]
X2(-2)	0.129	-0.060	-0.689	0.077	-0.040	-0.038	0.383	-0.407	0.013	0.191
	-0.202	-0.180	-0.988	-0.129	-0.380	-0.383	-0.519	-0.649	-0.146	-0.371
	[0.63869]	[-0.33307]	[-0.69758]	[0.59399]	[-0.10457]	[-0.09951]	[0.73752]	[-0.62650]	[0.09228]	[0.51387]
X3(-1)	-0.029	-0.017	-0.024	0.014	-0.054	-0.054	-0.086	-0.015	0.008	0.057
	-0.029	-0.025	-0.140	-0.018	-0.054	-0.054	-0.073	-0.092	-0.021	-0.052
	[-1.00251]	[-0.68427]	[-0.17221]	[0.76918]	[-0.99928]	[-0.99119]	[-1.16815]	[-0.16278]	[0.38655]	[1.08631]
X3(-2)	0.050	0.000	-0.135	0.014	-0.022	-0.022	-0.005	-0.165	0.005	0.051
	-0.028	-0.025	-0.138	-0.018	-0.053	-0.053	-0.072	-0.090	-0.020	-0.052
	[1.77616]	[0.01377]	[-0.97885]	[0.75593]	[-0.42134]	[-0.42013]	[-0.06407]	[-1.82349]	[0.24322]	[0.99390]
X4(-1)	-0.669	0.075	0.995	-0.166	1.534	1.555	-0.030	2.013	0.135	-1.889
	-0.354	-0.316	-1.737	-0.227	-0.668	-0.673	-0.912	-1.141	-0.256	-0.651
	[-1.89006]	[0.23798]	[0.57307]	[-0.72890]	[2.2972]*	[2.31032]*	[-0.03251]	[1.76501]	[0.52665]	[-2.89966]*
X4(-2)	0.836	-0.024	1.981	-0.215	1.132	1.147	0.043	-0.422	-0.178	-1.532
	-0.379	-0.339	-1.860	-0.243	-0.715	-0.720	-0.976	-1.221	-0.275	-0.698
	[2.205]*	[-0.07148]	[1.06548]	[-0.88513]	[1.58345]	[1.59157]	[0.04364]	[-0.34584]	[-0.64670]	[-2.19675]*
X5(-1)	3.597	-2.123	-18.638	-5.651	7.567	7.636	4.202	-4.919	-2.284	-15.256
	-3.917	-3.496	-19.205	-2.513	-7.385	-7.440	-10.082	-12.614	-2.835	-7.204
	[0.91829]	[-0.60711]	[-0.97045]	[-2.24828]*	[1.02465]	[1.02624]	[0.41673]	[-0.38992]	[-0.80559]	[-2.11776]*
X5(-2)	-5.763	-1.886	15.251	3.056	6.794	6.851	-12.145	26.190	4.591	-2.026
	-3.872	-3.456	-18.986	-2.485	-7.300	-7.355	-9.967	-12.470	-2.802	-7.121
	[-1.48831]	[-0.54561]	[0.80328]	[1.23005]	[-0.93059]	[-0.93140]	[-1.21858]	[2.10026]*	[1.63826]	[-0.28453]
X6(-1)	-3.557	2.137	18.086	5.561	-8.229	-8.306	-3.775	4.187	2.290	16.132
	-3.872	-3.457	-18.986	-2.485	-7.300	-7.356	-9.967	-12.470	-2.803	-7.122
	[-0.91859]	[0.61835]	[0.95260]	[2.23802]*	[-1.12724]	[-1.12922]	[-0.37872]	[0.33575]	[0.81712]	[2.26532]*
X6(-2)	5.401	2.069	-16.174	-3.049	-7.326	-7.390	11.669	-26.203	-4.625	2.521
	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10
	-3.867	-3.452	-18.961	-2.481	-7.291	-7.346	-9.954	-12.454	-2.799	-7.112
	[1.39671]	[0.59931]	[-0.85301]	[-1.22877]	[-1.00484]	[-1.00605]	[1.17234]	[-2.10406]*	[-1.65239]	[0.35443]

Appendix 1. Coefficients of the VAR (Sample period 2000.01 to 2009.03) - continued

X7(-1)	0.040 -0.038 [1.04516]	-0.045 -0.034 [-1.31911]	0.144 -0.185 [0.77680]	0.020 -0.024 [0.80542]	0.273 -0.071 [3.825]**	0.276 -0.072 [3.848]**	0.031 -0.097 [0.31859]	0.173 -0.122 [1.42221]	0.041 -0.027 [1.49658]	-0.203 -0.070 [-2.92155]*
X7(-2)	0.013 -0.039 [0.33717]	0.057 -0.035 [1.63162]	-0.092 -0.193 [-0.47517]	-0.010 -0.025 [-0.38790]	-0.112 -0.074 [-1.50189]	-0.112 -0.075 [-1.50153]	0.389 -0.101 [3.832]**	-0.140 -0.127 [-1.10108]	-0.060 -0.029 [-2.10035]*	0.091 -0.072 [1.24849]
X8(-1)	0.025 -0.099 [0.25076]	-0.072 -0.089 [-0.80801]	0.803 -0.487 [1.64998]	0.076 -0.064 [1.19139]	-0.095 -0.187 [-0.50842]	-0.099 -0.189 [-0.52288]	-0.098 -0.256 [-0.38330]	-0.080 -0.320 [-0.25157]	0.022 -0.072 [0.30304]	0.120 -0.183 [0.65501]
X8(-2)	-0.080 -0.061 [-1.30840]	-0.036 -0.055 [-0.66505]	0.318 -0.299 [1.06312]	0.014 -0.039 [0.35479]	-0.109 -0.115 [-0.94521]	-0.111 -0.116 [-0.95351]	-0.105 -0.157 [-0.66619]	0.126 -0.197 [0.64067]	0.022 -0.044 [0.49357]	0.126 -0.112 [1.12258]
X9(-1)	0.367 -0.386 [0.95013]	0.357 -0.344 [1.03687]	-3.011 -1.892 [-1.59148]	-0.086 -0.248 [-0.34591]	0.408 -0.728 [0.56075]	0.409 -0.733 [0.55862]	-0.055 -0.993 [-0.05525]	-0.295 -1.243 [-0.23750]	-0.298 -0.279 [-1.06620]	-0.530 -0.710 [-0.74737]
X9(-2)	-0.017 -0.379 [-0.04409]	0.163 -0.338 [0.48386]	-2.414 -1.856 [-1.30055]	0.144 -0.243 [0.59478]	0.105 -0.714 [0.14687]	0.109 -0.719 [0.15110]	0.848 -0.974 [0.87055]	-0.030 -1.219 [-0.02442]	-0.029 -0.274 [-0.10521]	0.131 -0.696 [0.18825]
X10(-1)	0.063 -0.250 [0.25397]	0.045 -0.223 [0.20201]	-0.140 -1.225 [-0.11395]	-0.028 -0.160 [-0.17239]	-0.864 -0.471 [-1.83397]	-0.873 -0.475 [-1.83955]	0.136 -0.643 [0.21140]	-0.883 -0.805 [-1.09756]	-0.036 -0.181 [-0.19726]	1.081 -0.460 [2.35108]*
X10(-2)	-0.426 -0.259 [-1.64575]	0.217 -0.231 [0.94020]	-0.954 -1.268 [-0.75256]	-0.032 -0.166 [-0.19476]	-0.721 -0.488 [-1.47867]	-0.728 -0.491 [-1.48203]	-0.783 -0.666 [-1.17679]	-0.156 -0.833 [-0.18733]	-0.095 -0.187 [-0.50485]	0.667 -0.476 [1.40247]
C	-1.588 -1.786 [-0.88902]	1.233 -1.594 [0.77328]	15.014 -8.757 [1.71444]	3.787 -1.146 [3.30389]**	1.690 -3.367 [0.50202]	1.700 -3.393 [0.50117]	-4.750 -4.597 [-1.03332]	6.776 -5.752 [1.17798]	1.650 -1.293 [1.27616]	3.314 -3.285 [1.00904]
R-squared	0.97	0.17	0.19	0.25	0.34	0.34	0.36	0.23	0.19	0.37
Adj. R-squared	0.96	-0.02	0.01	0.08	0.18	0.19	0.21	0.05	0.00	0.22
Sum sq. resids	1483	1182	35655	611	5272	5351	9826	15381	777	5016
S.E. equation	4.13	3.69	20.24	2.65	7.78	7.84	10.63	13.30	2.99	7.59
F-statistic	130.45	0.90	1.05	1.48	2.21	2.23	2.42	1.29	0.99	2.55
Log likelihood	-295	-282	-466	-247	-363	-364	-397	-421	-260	-361
AIC	5.85	5.62	9.03	4.96	7.11	7.13	7.74	8.19	5.20	7.07
SC	6.37	6.14	9.55	5.48	7.64	7.65	8.26	8.71	5.72	7.59

** Indicates significance at 1% level; * indicates significance at 5% level.; Standard errors in () & t-statistics in [

Based on lower AIC and SC, lag length of 2 is preferred¹⁶

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¹⁶ Lag length	2	3	4
AIC	51.24956	51.85352	52.1764
SC	56.46481	59.59723	62.4784

Lower values of AIC and SIC information criteria are preferred.

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