MPRA
Munich Personal RePEc Archive

Does credit for equity investments feedback on stock market volatility? Evidence from an emerging stock market

Onour, Ibrahim

Arab Planning Institute

2 January 2011

Online at https://mpra.ub.uni-muenchen.de/28001/
MPRA Paper No. 28001, posted 11 Jan 2011 21:36 UTC

Does credit for equity investments feedback on stock market volatility?
Evidence from an emerging stock market

Ibrahim A. Onour
Arab Planning Institute
Kuwait

onour@api.org.kw
ibonour@hotmail.com

Does credit for equity investments feedback on stock market volatility? Evidence from an emerging stock market

Ibrahim A. Onour

abstracts
This paper investigates the causal relationships between volatility in Saudi stock market and banks credit for equity investments. Our finding indicate there is a bi-directional feedback effects between the stock price volatility and banks credit loans. In other words, volatility in private credit for equity investments influence volatility in stock price and vice versa. A policy implication of such result is that regulating private credit loans in banking sector could reduce the upnormal swings in Saudi Stock prices.

Keywords: Saudi stock market, Volatility, speculation, banks' credit

JEL classification: C10, C50

1-Introduction:

One powerful theme of the occasional upnormal swings in Saudi stock market has been an attempt at blaming a small group of manipulators as being primarily responsible for the events in the market. One way to justify such a characterization is the case of illiquid security initially trading among powerful manipulative traders, despite the lack of willingness of other investors to purchase the security. The manipulative cartel actively trades such an illiquid stock among them, to a point where naïve (or uninformed) investors feel the stock is liquid and valuable. This tempts the naive investors to step in (withdraw on their credit account) and buy the share. At this point the manipulative cartel has made profits, because the misguided investor has been persuaded to part with his money at a falsely elevated price. Based on such an argument, the pattern of information flows between volatility of Saudi stock market and banks credit for equity investors can be investigated through volatility and causality analysis. The transmission mechanism between private credit for equity investment and stock price volatility in an inefficient stock market can be viewed as follows. Information inadequacy on the part of the majority of market participants spurs price movements at the whims of a few powerful market manipulators. When price changes are controlled by a few manipulators, price changes influence changes in banks credit rather than the reverse. Put succinctly, information on stock price changes feedback on private credit for equity investments. Such phenomena of self-fulfilling expectations can give rise to so-called rational bubbles (systematic digression of asset price from its fundamental value) (Blanchard and Watson, 1982). A large number of investors reacting similarly to new information may create an overreaction in the aggregate, and thus creating herd behavior (Bikhchandani and Sharma, 2000).

Despite the lack of empirical research on the issue of causality between stock markets volatility and private credits for traders in GCC stock markets, this paper is motivated by the growing literature on the relationship of conditional variance a cross financial markets. A two step procedure proposed by Cheung and Ng (1996) is employed to characterize the pattern of information flows based on mean and variance causal relationships.

An advantage of the Cheung and Ng method is that it allows for conditional mean and variance dynamics in the testing procedure, beside the observation that, its' asymptotic behavior does not depend on the normality assumption, which is violated by the data included in this paper.

The relationship between banks credit and stock markets volatility in GCC countries in general worth special attention, since the beginning of 2006, most GCC markets, albeit Saudi market, have embarked on structural reforms aimed at sophistication of trading systems and transparency improvement by adopting new regulatory policy framework, trading rules, reporting, surveillance, settlements and clearance systems. All these efforts came in conjunction with the newly adopted agreement requiring GCC member states equal treatment of all GCC nationals in all investment activities, including stock ownership and establishment of new business and allowing free mobility of capital and labor of GCC nationals in member countries. The new agreement also calls for harmonization of all investment-related laws and regulations among GCC countries.

The article is divided into four sections. Section two, deals with basic data analysis; Section three demonstrates GARCH effects; Section four investigates mean-variance causality. The final section concludes the study.

2- Data Analysis:

The data used in this research includes monthly data on Saudi stock price index and banks' private loans for investment in securities, during the sample period from January 2000 to September 2008 (105 observations). The stock price series obtained from Arab Monetary Fund Data base, whereas data on private loans for securities obtained from monthly statistical reports published by Saudi Monetary Agency (SAMA). Table (1), presents some descriptive statistics for the two data series. All skewnwess and kurtosis coefficients are significantly different from those of a normal distribution. Correlation coefficient values for five lags indicate stock price index and private loans are extremely persistent. The unit root tests of Augmented Dickey-Fuller (ADF) and Phillip-Perron (PP) tests verify that the two variables are better modeled as an integrated series. The lag length parameter of ADF is determined using the Akaike information criteria (AIC). Results based on the levels of both variables are non-stationary, while their first differences are stationary. To investigate if there is a long term association linking the stock price index with the private credit loans we employed linear cointegration approach .Table(2) reports both the maximum eigen value and trace statistics and confirm there is only one cointegrating relationship between private credit loans and stock price index series, revealing a significant evidence of long-term association between the two variables.

Table (1):Summary Statistics

	Levels		First Difference	
	C	P	C	P
mean	9.14	5.25	0.43	0.28
Std.deviation	0.20	0.55	0.87	0.054
skewness	-1.44	-0.46	-1.66	0.07
kurtosis	9.71	0.37	9.97	0.62
ACF:				
r(1)	0.88	0.94	-0.04	0.20
r(2)	0.77	0.87	-0.008	0.16
r(3)	0.67	0.81	-0.03	0.14
r(4)	0.57	0.74	0.05	0.24
r(5)	0.48	0.68	-0.09	0.12
Unit roots:				
ADF test	1.57	5.23	12.47*	10.94*
PP test	1.67	8.78*	36.54*	31.25*

Note : Jarque-Bera test results for levels of credit and price series are respectively 244 and 2.5, whereas for the first differences are 263.8 for the credit and 0.73 for price index.
*Significant at 5% significant level.

Table(2):Cointegration

H_0	H_1	L_{max}	Critical Values (5%)	L_{trace}	Critical Values (5%)
$r=0$	$r=1$	31.4	14.16*	34.2	17.18*
$r\leq 1$	$r=2$	2.8	8.1	2.8	8.1

Critical values obtained from Johansen and Juselius (1990), table A2
*Statistics significant at the 5% level.

3-GARCH Effects:

Before discussing causal relationship between stock price changes and private loans for security investments, we present some formal evidence of conditional heteroskedasticity in the data. Generalized Autoregressive Conditional Heteroskedasticity (GARCH) process is used to model the heteroskedasticity process in the data.

Given a time series {y(t)}, t=1,2,….N, a non-augmented GARCH process is shown as:

$$\Delta c_t = a_0 + \sum_{i=1}^{k_1} a_i \Delta c_{t-i} + e_{1t} \qquad (1)$$

$$\Delta p_t = b_0 + \sum_{i=1}^{k_2} b_i \Delta p_{t-i} + e_{2t} \qquad (2)$$

$$where, \quad e_{t/t-1} \sim N(0, h_t)$$

$$and,$$

$$h_t = \beta_0 + \sum_{i=1}^{k_3} \beta_i e^2{}_{t-1} + \sum_{i=1}^{k_4} \alpha_i h_{t-i} \qquad (3)$$

To assess the degree of influence of each variable on the other variable, it is also useful to employ the augmented GARCH process:

$$\Delta c_t = \alpha_0 + \sum_{i=1}^{k} \overline{\alpha}_i \Delta c_{t-i} + \sum_{i=0}^{k} \alpha_i \Delta p_{t-i} + \lambda_1 E_{t-1} + e_{1t} \qquad (4)$$

$$where\ e_{1,t \backslash t-1} \sim N(0, h_{1,t})$$

$$h_{1,t} = \beta_0 \sum_{i=1}^{k1} \beta_i e^2{}_{1,t-i} \ + \sum_{i=1}^{k2} \delta_i h_{1,t-i} + \varepsilon_{1,t}$$

$$and,$$

$$\Delta p_t = \alpha_0 + \sum_{i=1}^{k} \overline{\alpha}_i \Delta p_{t-i} + \sum_{i=0}^{k} \alpha_i \Delta c_{t-i} + \lambda_2 E_{t-1} + e_{2t} \qquad (5)$$

$$where,\ e_{2t \backslash t-1} \sim N(0, h_{2,t})$$

$$h_{2,t} = \beta_0 \sum_{i=1}^{k1} \beta_i e^2{}_{2,t-i} \ + \sum_{i=1}^{k2} \delta_i h_{2,t-i} + \varepsilon_{2,t}$$

Where h_{it} is the conditional variance of the residuals.

The error terms in equations (1) and (2), describe the conditional mean dynamics, as depicted by the GARCH process postulated in equation (3), with conditional variance, h_t, where k_i , are lag parameters. Tables (3) and (4), include result of non-augmented and augmented GARCH models results. Both models indicate no evidence of Granger causality effects. Information criteria and diagnostic statistics are used to select the model specification. The Lagrange multiplier test results in both tables, confirm that data on stock price exhibit significant conditional hetroskedasticity, whereas the data on private loans do not show the hetroskedasticity condition.

Given the evidence of GARCH effects on stock price data, study of causality between stock price index, and private loans requires taking into account the GARCH effect when considering the dynamics of residuals in equation (5). It has been pointed-out (Engle, 1982) that presence of conditional hetroskedasticity may render inefficient the conventional Granger's (1982) causality test. Existence of GARCH effect justifies use of causality test proposed by Cheung and Ng (1996).

Table (3):GARCH Model

	Credit	P-values	Price	P-values
a_0	0.004	0.52	0.02	0.00*
a_1	-0.04	0.34	0.19	0.12
a_2	-0.01	0.93	0.15	0.08
b_1	-0.28	0.05*	0.04	0.50
b_2	0.53	0.00*	0.08	0.16
β_0	0.08	0.95	-0.10	0.59
β_1	0.007	0.56	0.00	0.33
β_2	-0.04	0.00*	0.14	0.36
α_1	0.00	1.00	-0.67	0.41
α_2	0.00	1.00	0.03	0.95
Log-likelihood	69.6		104.1	
LM test	0.48		37.62*	

***significant at 5% significance level.**

Table (4):Augmented GARCH Model

	Credit	P-values	Price	P-values
a_0	0.29	0.31	-0.17	0.00*
α_1	0.02	0.83	0.09	0.41
α_2	-0.07	0.43	-0.01	0.95
β_0	0.13	0.86	-0.04	0.80
β_1	0.00	0.03*	0.00	0.20
β_2	-0.04	0.17	0.24	0.02*
$\overline{\alpha}_1$	1.52	0.00*	-0.46	0.17
$\overline{\alpha}_2$	-0.51	0.03*	0.38	0.12
λ	-0.03	0.31	0.04	0.00*
Log-likelihood	83.03		110.5	
LM test	0.30		37.57*	

***significant at 5% significance level.**

4: Mean and Variance Causality Test:

More recently, Cheung and Ng (1996) developed a new procedure of causality in mean and variance, which test for causal relationships in the mean and in the variance, using standardized residuals and their squares estimated from GARCH models. Cheung and Ng (1996), approach based on cross correlation results of standardized residuals from equations (4) and (5).The standardized residuals defined as

$e_{it} / \sqrt{h_{it}}$ .Causality in mean is tested using cross-correlation coefficients between standardized residuals, whereas causality in variance is tested using the squares of standardized residuals. It should be noted that, there is no evidence of causality in mean (variance) when all cross correlation coefficients calculated from (squares of) standardized residuals, at all possible leads and lags, are not significantly different from zero. A causal relationship is indicated by significant cross-correlation values. Cross-correlations between squared standardized residuals can be defined by,

$$v_{1t} = \hat{e}_{1t}^{\ 2} / \sqrt{\hat{h}_{1t}} \qquad (6-a)$$

$$v_{2t} = \hat{e}_{2t}^{\ 2} / \sqrt{\hat{h}_{2t}} \qquad (6-b)$$

Where hats indicate estimates. The sample cross-correlation at lag k is,

$$r_{v_1v_2}(k) = d_{v_1v_2}(k) / \sqrt{d_{v_1v_1}(0) d_{v_2v_2}(0)} \qquad (7)$$

Where, $d_{v_1v_2}(k)$ is the sample cross-covariance,

$$d_{v_1v_2}(k) = \begin{cases} (1/N)\sum_{t=l+1}^{N}(v_{1t} - \bar{v}_1)(v_{2t} - \bar{v}_2) & if\, k \geq 0 \\ (1/N)\sum_{t=1}^{N-l}(v_1 - \bar{v}_1)(v_{2(t-l)} - \bar{v}_2) & if\, k < 0 \end{cases}$$

With N denotes sample size, $\bar{v}_i$, (i=1,2) are the sample means.

Denominator in equation (7) defined as:

$$d_{xx}(0) = (1/N)\sum_{t=1}^{N}(x_t - \bar{x})^2, where\ x = v_1,\ v_2$$

Cheung and Ng (1996) suggest testing the null-hypothesis that no causal relationships, using the statistic:

$z = N\sum_{k=1}^{K} r^2{}_{v_1v_2}(k)$,which has an asymptotic chi-square with k degrees of freedom (k denotes for lag parameters).The reverse hypothesis that c_t does not cause p_t, in variance can be tested analogously summing the squared cross-correlations $r^2{}_{v_1v_2}(k)$ from $k = -K \ to \ -1$.

Hong (2001) suggest weighting the cross-correlations to obtain more powerful tests as follows:

$$H = \frac{N\sum_{l=1}^{N-1} w^2(k,K) r^2{}_{v_1v_2}(k) - m(w)}{\sqrt{2n(w)}} \sim N(0,1) \qquad (8)$$

Where $w(k,K)$ is a weight function, for which we adopt the Bartlett kernel in this paper,

$$w(k,K) = \begin{cases} 1 - \left| k/(K+1) \right| & if \ k/(K+1) \le 1 \\ 0 & otherwise \end{cases}$$

And

$$m(w) = \sum_{l=1}^{N-1} (1 - k/N) w^2(k,K)$$

$$n(w) = \sum_{l}^{N-1} (1 - k/N)(1-(k+1)/N) w^4(k,K)$$

Are approximately the mean and variance, respectively, of

$$N\sum_{l=1}^{N-1} w^2(k/K) r^2{}_{v_1v_2}(k)$$

Table(5): Cross-correlation analysis for the levels and squares of standardized results of residuals for GARCH model.

	H_0:p_t does not cause c_t			H_0:c_t does not cause p_t	
Lag k	levels	squares	Lag k	levels	squares
1	-0.05	-0.92*	-5	-0.16*	0.49*
2	-0.07*	-0.07*	-4	-0.14*	0.73*
3	0.10*	-0.33*	-3	0.11*	1.09*
4	0.15*	-0.30*	-2	-0.07*	0.61*
5	-0.08*	-0.24*	-1	0.09*	0.59*

Note: K is the number of lag periods (months). A lead is given by a negative lag. Cross-correlations are calculated from the standardized residuals and their squares obtained from the equations (4) and (5).
*Significant at 5% significance level .

Compared with Granger causality test results reported in table (4), cross-correlation statistics in table (5), reveal a more complex and dynamic causation pattern. For instance, while there is no significant causation between the two sets of data in Granger causality test, there is evidence of bi-directional causation in variance. These results show that a proper account of conditional heteroskedasticity can have significant implication for the study of volatility spillovers.

5- Concluding Remarks

This paper investigates, the causal relationships between volatility in Saudi stock market and banks credit for equity investments.

The Cheung and Ng (1996) approach is utilized to test for causality in both the mean and the variance. The finding in this research indicate that there is a bi-directional feedback effects of volatility between stock price series and private loans. Volatility in private credit for equity investments influence volatility in stock price index and vice versa. Also indicated in the paper, there is a strong long term association between the two sets of variables. Results in tables (3) and (4) show incremental information does not come only from lagged changes in private credits and stock price data, it also derives from the lagged error terms.

A policy implication of this study is that regulating private credit loans in banking sector expected to have significant impact on volatility stablization in Saudi Stock market.

The quality of the data used in this research could be improved, and thereby more robust results could be concluded, if daily data series about the two sets of data is used instead of monthly data series.

References

Abraham A. and S. Fazal. 2006. Information transmission between the Gulf equity markets of Saudi Arabia and Bahrain. *Resrearch in International Business and Finance* Vol.20, Issue 3: 276-285.

Arab Monetary Fund. Various statistical reports. Abu Dhabi, United Arab Emirates.

Bauwens, L., S. Laurent and J. Rombouts. 2003. Multivariate GARCH models: A Survey. CORE discussion paper (2003/31), Department of Economics, Universite Catholique de Louvian, Belgium.

Bollerslev, T. 1990. Modelling the coherence in shortrun nominal exchange rates: A multivariate generalized ARCH approach. *Review of Economics and Statistics* 72:498-505.

__________, R. Engle. and J. Wooldridge. 1988. A capital asset pricing model with time-varying covariances. *Journal of Political Economy* 96:116- 131.

Brock W., W. Dechert and J. Scheinkman. 1996. A test for independence based on correlation dimension. *Econometric Reviews* Vol. 15, No.3: 197-235.

Cheung, Y. and L. Ng. 1996. A causality-in-variance test and its application to financial market prices. *Journal of Econometrics* 72:33-48.

Dicky, D.A; and Fuller W.A; (1981) "Liklihood Ratio Statistics For Autoregressive Time Series With a Unit Root", Econometrics, Vol 49, pp. 1057 1072.

Dicky, D.A; and Fuller W.A; (1979) "Distribution of the Estimators for Autoregressive Time Series With a Unit Root" Journal of American Statistical Association, 74, 427-431.

Engle, R. and K. Kroner. 1995. Multivariate simultaneous generalized ARCH. *Econometric Review* 11:122-150.

Eun C. and S. Shim. 1989. International transmission of stock market movements. *Journal of Financial and Quantitative Ana*lysis 24: 241-256.

Hamao, Y., R. Masulis, and V. Ng. 1990. Correlation in price changes and volatility: A cross international stock markets. *Review of Financial Studies* Vol. 3: 281-307.

Johansen, S., and Juseilus, K., (1990) "Maximum Liklihood Estimation and Inference On Cointegration – With Application to The Demand For Money, Oxford Bulletin of Economics and Statistics,52, 169-210.

King M. and S. Wadhwani . 1990. Transmission of volatility between stock markets*.* *Review of Financial Studies* 3:5-33.

Kocenda, E.and L. Briaka. 2005. Advancing the iid test based on integration acroos the correlation integral, ranges, and power. *Econometric Reviews* Vol.24, No. 3: .265-295.

Newey W. and D. Steigerwald. 2008. Consistency of quasi-maximum likelihood estimators for models with conditional heteroskedasticity. Social Science Research Network Electronic Library. Working Paper Series. Internet website: http://ssrn.com/abstract=6592.

Ng, S.; Perron, P.; (1993b), Unit Root Tests in ARMA Models with Data Dependent Methods for The Selection of the Truncation Lag, (Manuscript), C.R.D.E., University of Montreal, Quebec.

Saudi Arabian Monetary Agency, Statistical Monthly reports.
http://www.sama.gov.sa/sites/samaen/ReportsStatistics/statistics/Pages/Home.aspx