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Accounting and capital market measures of banks' risk: evidence from an emerging market

Abstract

Depending on the purpose, both accounting and market information can be used as appropriate measures to assess bank's risk. According to Bliss and Flannery (2001), the market is likely to provide supervisors with signals that can be used to improve control quality through bank supervision. In this context, the prudential supervision reforms proposed by Basel Committee (BIS 2003) are based on three pillars including one calling for greater use of market discipline. However, market discipline can lead to a safe and efficient bank only when the market is sufficiently developed and its participants are competent and motivated to monitor banks.

Several authors have focused on the banking systems of developed countries and found that there are significant relations between accounting and market risk measures. Nevertheless, given the significant role of banking systems in emerging countries and the need to promote their stability, these countries are also preparing the adoption of prudential regulation. Therefore, it seems very interesting to examine the market ability to reflect the risk taking by banks in an emerging country. By applying a panel data analysis on 10 listed Tunisian commercial banks during the period of 1998-2007, the results show that neither the capital measure of total risk nor the systematic risk are linked to the accounting measures of total risk, leverage risk and credit risk of banks. Therefore, we can conclude that capital market is not able to reflect accounting information; therefore, prudential Tunisian authorities have to focus on accounting measures to assess the risk-taking by banks.

Keywords: risk accounting measures, risk capital market, total return risk, systematic risk, specific risk.

JEL Classification: G21, G30, G32, M41.

Introduction

According to the objective, in order to choose a suitable measurement to evaluate the banks' risk taking, one can use accounting information as well as capital market measures of risk. If a banking regulator seeks to evaluate the financial health of a bank, a CAMEL rating, made up of accounting variables would be preferred. However, according to Bliss and Flannery (2001), the market is likely to provide to the prudential authorities signals which they can exploit to improve control quality and the banking supervision. In this context, the prudential reforms proposed by the Basel Committee (BIS 2003) rest on three pillars including one recommending the improvement of market discipline. Nevertheless, there are many conditions that encourage the success of market discipline. First of all, the market has to be competitive and to function satisfactorily. If the capital market is not sufficiently active and the investors are not informed properly, nor sufficiently qualified and reasonably encouraged to control the banks, the information existing on the market can never reflect the risk undertaken by the banks and the signals can not be exploited by the regulator. So, it is of major interest to evaluate the aptitude of the market to reflect the risk taking by banks and their quality of the credit.

Since the work of Pettway (1976), several other authors¹ were interested in establishing the relation

between risk accounting measures and those apprehended on the stock markets. These various studies made exclusively on the data of the developed countries' banks found that there are significant relations between the accounting and market measures of risk. Given the importance of the banking industries role within the emerging countries and the need for promoting their stability, the Official Authorities of these countries prepare, in their turn, the adoption of the Basel II prudential reforms.

For the reason of the recent reforms to stimulate and promote the market discipline and to improve the control quality of the Tunisian banks, we estimate that it is interesting to examine the aptitude of the Tunisian capital market to reflect the risk taking by the banks. In order to achieve this goal we will use the panel data analysis of the 10 listed commercial banks over the period of 1998-2007.

1. Relations between accounting and capital market measures of banks' risk: literature review

In a context of instability, such is the case of these last years, risk accounting measures can be differentially affected by economic environment and their relative importance can change over time (Agusman et al., 2008), so it becomes very important to use capital market measures. However, the data of the market can be exploited only if the

investors are properly informed and sufficiently qualified and incited to control the firms.

Several previous researches concerned with the problem of the relationship between the two various risk measures, namely accounting and capital market measures of risk. Treating this problem on the data of the American banks, Jahankhani and Lynge (1980), Lee and Brewer (1985), and Mansur et al. (1993) found significant relations between these two kinds of measures. Elyasiani and Mansur (2005) examined the Japanese banks using a GARCH model and also found a significant relation between accounting and capital market measures of risk.

In fact, the interest to this topic goes up for more than three decades. The pioneer was Pettway (1976) who explored the relation between these two kinds of risk measures. He studied the impact of the bank's capital level and other accounting variables on market beta and on the price to earning ratio. He noted that the amount of bank equity had an effect on market beta in 1974 and on the price to earning ratio in 1972 and 1974. Pettway and Sinkey (1980) developed an early warning system using, at the same time, the accounting and market information. Thereafter, Jahankhani and Lynge (1980) examined a sample of 95 commercial banks in the United States during the period of 1972-1976. They considered the market beta as a dependent variable, and noted that there were several factors which acted on the systematic risk such as the dividends yields and the coefficient of variation of the deposits. In the same way, they noted that accounting measures of risk explained 26% of systematic risk variability. Moreover, when the total risk is considered as a dependent variable, all the variables except for the ratio of loans/deposits prove statistically significant relations, and 43% of variability in the dependent variable are explained.

Also, Rosenberg and Perry (1981) examined 124 American banks between March 1969 and June 1977. The systematic and specific risks are used as dependent variables and a certain number of accounting ratios are used as independent variables. They noted that the most important predictive factors of beta are the size of the bank, the *dividend yield*, equity capitalization, and the asset to long-term liability ratio. In addition, the income variability, the leverage ratio and the accounting measure of beta are the most important predictive factors of the specific risk

In the same way, Karels et al. (1989) examined the relationship between the total risk, the systematic risk, and the specific risk and an accounting

measure of risk, namely, the capital ratio. They examined these relations using a sample of 24 American banks for the period exceeding 30 quarters between 1977 and 1984. They noted that, as predicted, the coefficients of correlation between the capital ratio and the systematic risk were negative in each of the thirty quarters. They also explained that higher capital adequacy ratios provided a greater buffer against default and, therefore, implied less risk.

Mansur et al. (1993), using also a sample of American banks, examined the data of 59 institutions, chosen randomly, during the period of 1986-1990. Using the market beta as a dependent variable, they announced that only the loan loss reserve to total loans ratio and the coefficient of variation of deposits were statistically significant. They found that the independent variables explained 35% of the variability of the systematic risk. Moreover, using the total risk as a dependent variable, only the liquidity ratio was found statistically significant, and it explained 24% of the variability of this risk. In a general way, these studies indicate that accounting measures and the capital market measures of risk are interdependent in the case of the American banks.

Finally, in their recent work, Agusman et al. (2008) were interested in this topic and concentrated particularly on the banks' data of certain emerging countries, especially the banks of the Asian countries. The sample consisted of 46 institutions observed over the period 1998-2003. By applying the panel data analysis, their results show that the standard deviation of the return on assets (ROA) and loan-loss-reserves-to-gross-loans are significantly related to total risk. Also, gross loans to total assets and loan loss reserves to gross loans are significantly related to specific risk. Agusman et al. (2008) specified, consequently, that in these countries the specific risk of the banking firms is more important than the systematic risk.

The question which arises in this case, is such a result can be generalized to the other emerging countries, where the banking environment is instable and where the insolvency risk is omnipresent, such as for Tunisia? The answer to this question is of a major interest, because these countries are preparing to adopt the fundamental principles of the Basel II agreement which rests primarily on the market discipline.

2. Data and empirical methodology

The aim of this section is to examine the aptitude of the capital market to reflect the risk undertaken by Tunisian listed commercial banks. This topic was the subject of several previous researches that often

use the prices of the subordinate obligations (Adrian Pop, 2005). Alternatively, there were few studies which treated this topic using the stock prices. The interest to use the stock prices rises from the weak liquidity of the other compartments of the financial markets or even from the inexistence of a market for the subordinate debts, such as the case of Tunisia. Among the studies which used the stock prices to evaluate the aptitude of market data to reflect the risk undertaken by banks is the study by Distinguin, Rous and Tarazi (2005) which relates to a sample of European banks for the period going from 1995 to 2002. The methodology used by these authors is in forecasting the deteriorations of the financial situation of banks which are identified using the rating deteriorations published by the three principal rating agencies (Fitch, Standard & Poors and Moody's). Gropp, Vesala and Vulpes (2005) also used the public information carried out by the agencies charged to evaluate the financial health of the borrowers. These authors justified the use of this kind of information by the insufficient number, in the case of Europe, of the officially declared banking bankruptcies, which does not make it possible to form a representative sample and also, by the difficulty of access to the internal notation systems of the banking supervision authorities used by the American studies (e.g., Curry, Elmer and Fissel, 2003; and Gunther, Levonian and Moore, 2001).

However, for the case of Tunisia, not all the listed commercial banks have a solicited notation, and if there are some banks which have it, this notation is available only for the few recent last years; therefore, it will not enable us to build a representative sample. So, to achieve our purpose, we are limited to check if there is a relation between the risk accounting measures and the capital market risk measures. Thus, we have chosen to use the stock prices to apprehend the total risk, the systematic risk and the specific risk of each bank. We will use these measures as dependent variables and we will examine the relation which can exist between these measures of risk and accounting measures of risk, namely, the total risk, the leverage risk, the credit risk and the liquidity risk.

2.1. Data and sample. In order to calculate the total risk, the systematic risk and the specific risk of the various banks, we obtained the data from the Web site of "La Bourse des Valeurs Mobilières de Tunis"¹. The accounting data are collected from the financial statements and the annual reports for each bank. Data concerning the nonperforming loans and

the loans loss reserves, which we will use as indicators of credit risk, are obtained from the services of the central bank of Tunisia. These data are rarely disclosed in the banks' annual reports. The collected data enabled us to have a sample composed by the ten listed commercial Tunisian banks over the period of 1998-2007. Because of the adoption of the new Tunisian accounting system in 1997 we could not take into account one longer period.

2.2. Specification of the empirical model. This study tests empirically the relations between capital market risk measures and accounting ratios using the following general model:

$$CMR = f(\text{Total Risk, Leverage Risk, Credit Risk, Liquidity Risk, Control Variables}) + \text{error}, \quad (1)$$

where, *CMR* represents the capital market risk measures including the total risk, the systematic risk and the specific risk.

The Capital market Total risk (σ_i) is the annualized standard deviation of the banks' daily stock returns.

The systematic and specific (idiosyncratic) risk measures are calculated using the following market model. This model is estimated for each year for each bank:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it}, \quad (2)$$

where *i* and *t* denote bank and time, respectively; *R* is the bank's equity return; *R_m* is the return on TUNINDEX market index; α is the intercept term; ε is the residuals. β_i is the systematic risk of bank *i*. Finally, the specific risk is calculated as the standard deviation of residuals of Eq (2) for each year and for each bank.

The three dependent variables, presented above, are regressed to several accounting measures of risk used to reflect the total risk (SDROA and Z-score), the leverage risk (EQTA and DEPEQ), the liquidity risk (LIQATA) and the credit risk (LLPGL, LLRGL and NPLGL).

The total risk accounting measure (SDROA) is the standard deviation of return on assets calculated estimated in a three-year moving window of annual observations. This variable is used by Brewer and Lee (1986), Shiers (1994) and Agusman et al. (2008). Moreover, we introduce in the regression function a second measure of bank's total risk, namely the Z-score². This measurement was not used by the previous researches which seek to

¹ www.bvmt.com.tn

² The Z-score appreciates the total insolvency risk of a bank. This measure was proposed by Par Roy (1952), Blair and Heggstad (1978), Boyd and Graham (1986) and used by Goyeau and Tarazi (1992). Z-score = $(ROA + K/A) / SDROA$, where ROA is the return on assets, SDROA is the standard deviation of ROA, and K/A is the capital on total assets ratio.

examine the relation between the risk calculated by the accounting ratios and capital market risk measures. The Z-score was introduced in the regression function as an inverse form, i.e. $1/Z$, so as to make the interpretation of the signs of coefficients comparable. Otherwise, a high Z-score means less insolvency risk whereas a high total risk, the systematic risk or the specific risk indicate more risk. We also introduced the inverse form of Z-score to alleviate the multicollinearity problem with the indicator of credit risk (EQTA).

We expect to have a positive sign between these accounting measures (SDROA, Z-score) of total risk and the capital market measures of risk.

The leverage risk measure (EQTA) is the ratio of book value equity to total assets, which is the proxy for the Cooke ratio. This measure was used by Pettway (1976), Jahankhani and Lynge (1980), Brewer and Lee (1986) and Karels et al. (1989). We expect to have a negative sign between this accounting measure of leverage risk and the capital market risk measures. The second measure (DEPEQ) that we propose to introduce in the regression function to appreciate the leverage risk is the total deposits held by the bank to the book value equity. This measurement was not used by the previous studies but we estimate that it is relevant to explain the leverage risk of the banks because the deposits are ensured by the organization of deposits insurance. Thus, the amount of the deposits is high; the incentive with moral hazard of the bank is high, contrary to the other uninsured loans. Consequently, a higher ratio of deposits on book value equity corresponds to a more important leverage risk. We expect that the correlation between this ratio and the capital risk measures is positive.

The liquidity risk (LIQTA) is apprehended by the ratio of liquid assets to gross loans. This measure was used by Jahankhani and Lynge (1980) and by Mansur et al. (1993). We expect to have a negative sign between this ratio and the capital market measures of risk of the market.

The accounting measure of credit risk (LLPGL) is the ratio of loan loss provisions to gross loans. This variable was used by Mansur et al. (1993) and by Hassan (1993). We expect to have a positive sign between this accounting measure of credit risk and the capital market risk measures. As alternative measures of credit risk we use the ratio of loan loss reserves to gross loans (LLRGL), used previously by Agusman et al. (2008) and the ratio of nonperforming loans to gross loans (NPLGL). This last ratio has not been already used in this context, but it represents a relevant measure of credit risk

largely used as an indicator of the asset quality of the banking firm.

In order to better determine the impact of accounting measures of risk on those of the capital market, we controlled for the effects of banks' size, of banks' ownership (private or public) and of the quantity of information disseminated by the banks on their risk profile in their annual reports.

In fact, it is very important to control for the effect bank size because the banking regulation exerts a discipline on the behavior of the risk taking by the banks. But this discipline is imperfect for the case of big banks. Indeed, the bankruptcy of a big bank could result in very important costs, and consequently, these establishments generally anticipate a non intervention of the regulator. Their anticipations of the non interventionism of the regulator rise from the problem of "*too big to fail*". Indeed, this behavior can generate incentives for the banks to engage in too risky activities. To apprehend the bank size we used the natural logarithm of total assets.

Moreover, the ownership of the bank can have a considerable effect on its level of the risk. In fact, the economic literature stipulates that the *raison d'être* of the public banks is due to the existence of insufficiencies on the financial and credit markets (Stiglitz and Weiss, 1981; Greenwald and Stiglitz, 1986). Indeed, the private banks which search, generally, to maximize their profits do not take into account the social returns in their projects financing decisions. Consequently, the aim of public banks is to enhance the economic development and to improve the social well-being (Stiglitz, 1993). According to this theory, the object of the public banks must be to direct the financial resources towards projects which are socially advantageous or to firms which do not have an access to other sources of financing, but have high risks. To take into account the bank ownership in the regression function we have created a dummy variable which equals 1 if the bank is private and 0 if the bank is public.

Finally, the interest to control the effect of the information quantity disseminated to the investors in the annual reports, is that the banks which reveal more information choose a lower level of risk (Cordella and Yeyati, 1998; Boot and Schmeits, 2000). The choice of a low level of risk by these banks is due to the fact that those are exposed to the market discipline, thus, they would be penalized by the investors if they choose a high level of risk. This effect is weak if the information given to the investors is limited and it is absent if the investors do not know the risk profile of the banks. To take

into account the impact of information quantity on capital market measures of risk we introduce in the regression function an index drawn on a previous study of Nier and Baumann (2006). It synthesizes disclosure based on annual reports information. In Table 3 of the Appendix we present a summary of 17 categories used to construct the composite disclosure index (named Index). It is defined as: $Index = \frac{1}{17} \sum_{i=1}^{17} S_i$, where

each sub-index S_i can be related to one or more sources of risk. For all subindices, we assign 0 if there is no information about the corresponding categories and 1 if there is at least one informed category. Then, the composite index will range between 0 and 1.

Finally, the general model (Eq1) presented above is detailed as follows:

$$CMR = \alpha_0 + \alpha_1(SDROA) + \alpha_2(z\text{-score}) + \alpha_3(EQTA) + \alpha_4(DEPEQ) + \alpha_5(LIQT A) + \alpha_6(LLRGL) + \alpha_7(NPLGL) + \alpha_8(LLPGL) + \alpha_9(Index) + \alpha_{10}(Size) + \alpha_{10}(PRIV) + error.$$

3. Empirical results

3.1. Descriptive analyses. Table 1 presents descriptive statistics of the various dependent and independent variables, and it shows that the data contain negative values. This table shows that the standard deviation is very high for the majority of the variables. Thus, we can conclude that the data are not homogeneous and they require additional tests so being able to choose the suitable estimator.

Table 1. Descriptive statistics of dependent and independent variables

Variables	Obs	Mean	Std. dev.	Min	Max
Total risk	100	1.453849	1.0603	.15194	10.66866
Systematic risk	100	63.79256	48.92614	-15.5772	208.7067
Specific risk	100	1.284687	1.039715	.14195	10.40687
SDROA	100	.5313885	1.355668	0	7.819807
Z-score	100	.0787105	.1742123	-.8003099	.8164958
EQTA	100	9.940542	6.18544	-39.22517	21.45947
DEPEQ	100	8.853683	2.587632	4.398857	16.15669
LIQTA	100	102.4385	20.61492	54.18894	146.8738
LLRGL	100	13.0655	9.250582	4.071816	86.15167
NPLGL	100	.2050848	.1278024	.0132722	.6644325
LLPGL	100	1.469797	1.529695	.1236853	11.77671
Index	100	.5622727	.2687695	0	1
Size	100	14.51537	.4965182	13.53922	15.44515
PRIV	100	.58	.496045	0	1

3.2. Regressions results. Baltagi (2001) and Hsiao (1986) indicate panel data methodology controls for individual heterogeneity, reduces problems associated with multicollinearity and estimation bias, and specifies the time-varying relation between dependent and independent variables. This study uses a panel data methodology and an F-test is used to determine whether the fixed-effects model outperforms the pooled OLS. The appropriateness of the random-effects model relative to the pooled OLS model is examined with the Breusch and Pagan Lagrange multiplier (LM) test. These tests indicate that there are no specific effects and the

Ordinary Least Squares (OLS) estimator is more suitable. However, the post regression analysis shows that the residuals are not independent and not identically distributed because of the presence of serial correlation, the contemporaneous (spatial) correlation and the panel-level heteroscedasticity.

We used the Feasible Generalized Least Squares estimator to overcome these problems and to provide consistent standard deviations.

Thus, the results of the regressions by Feasible Generalized Least Squares estimator are presented in Table 2.

Table 2. Estimated coefficients from regressing capital market risk measures on accounting risk measures (cross-sectional time-series FGLS regression)

Variables	Expected sign	Total risk	Systematic risk	Specific risk
SDROA	+	.0195 (.0408679)	-.8702043 (4.276143)	-.0072598 (.0062323)
Z-score	+	-.3638866 (.7282982)	-44.1514 (30.35564)	-.0219587 (.0641338)
EQTA	-	.001374 (.0164714)	.9230197 (.7432319)	-.0065388 ** (.0033232)

Table 2 (cont). Estimated coefficients from regressing capital market risk measures on accounting risk measures(cross-sectional time-series FGLS regression)

Variables	Expected sign	Total risk	Systematic risk	Specific risk
DEPEQ	+	-0.0159849	-2.42582	.0072943*
		(.0442512)	(1.610937)	(.0044024)
LIQTA	-	.0717036*	.0995611	-.0037532 ***
		(.0403473)	(.8176405)	(.000799)
LLRGL	+	-.0039946	.3946529	-.010381
		(.0058594)	(.5581496)	(.0231479)
NPLGL	+	-.0015885	.3188865	.0068833
		(.0074729)	(.3332159)	(.0919526)
LLPGL	+	-.0370227	-6.692531 **	-.003761
		(.088948)	(3.328934)	(.0092066)
Index	-	-.2908101	-70.36999 ***	-.2116866 ***
		(.5809237)	(27.34359)	(.0485822)
Size	+	.0252495	16.38068	.0856132
		(.2938481)	(15.83256)	(.0526936)
PRIV	-	-.0249681	-9.43554	-.0284768
		(.2146052)	(13.68288)	(.0320141)
_cons		.5069472	-116.0044	.462072
		(4.181979)	(224.8792)	(.7271301)
Wald chi2 (11) = Prob > chi2 =		551.10* (0.0945)	258.48*** (0.0000)	405.39*** (0.0000)
Wooldridge test for autocorrelation in panel data F (1, 9) = Prob > F =		5.421** (0.0449)	1.778 (0.2152)	7.204 (0.0250)
Breusch-Pagan LM test of independence: chi2 (45) = Pr =		53.642 (0.1768)	112.669 *** (0.0000)	59.453* (0.0730)
Modified Wald test for groupwise heteroskedasticity chi2 (10) = Prob > chi2 =		9860.33 *** (0.0000)	15.93 (0.1018)	4365.26 *** (0.0000)
Observations		100	100	100
Number of banks		10	10	10

Notes: *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively. Robust standard errors (to account for both heteroskedasticity and autocorrelation) are in parentheses.

Total return risk is the annualized standard deviation of the banks' daily stock returns. Systematic risk is the beta of the banks' stock returns. Specific risk is the annualized standard deviation of residual errors from the market model. SDROA is the standard deviation of return before taxes on assets estimated in a three-year moving window of annual observations. Z-score is the total insolvency risk. EQTA is the book value equity to total assets ratio. DEPEQ is the total deposits to the book to value equity ratio. LIQAT is the liquid assets to total assets ratio. GLTA is the gross loans to total assets ratio. LLRGL is the loan loss reserves to gross loans ratio. NPLGL is the non performing loans to gross loans ratio. LLPGL is the loan loss provisions to gross loans ratio. Index = $\frac{1}{17} \sum_{i=1}^{17} S_i$ as in Nier and Baumann (2006) and detailed in Table 3 in the appendix. Size is the natural logarithm of total assets. PRIV = 1 if the bank is private and 0 if the bank is public.

The results from the Feasible Generalized Least Squares specification indicate that when total return risk is used as the dependent variable, only LIQTA is significant but it has a negative relation with the total return risk, not as expected. When systematic risk is used as the dependent variable, only the LLPGL variable is significant but the sign is negative.

Finally, when the specific risk is used as the dependent variable, EQTA, DEPEQ and LIQTA show significant relations with the expected signs.

These results show that firm specific risk is more important in Tunisia than is systematic risk, like as for the listed Asian banks studied by Agusman et al. (2008).

However, the capital market neither reflects SDROA nor Z-score, which are the measures of both total and insolvency risks that are so high for Tunisian banks. In addition, in spite of the importance of Tunisian banks' credit risk, with a high level of nonperforming loans that are not sufficiently provisioned, the relations between LLPGL, LLRGL and NPLGL and the capital market risk measures are not significant and do not have the expected signs. So, we can conclude that the market is not able to reflect the most important source of risk of Tunisian banks. We can explain this result by the fact that the investors on Tunisian capital market have no information about asset quality of Tunisian banks because the latter, generally, do not disclose the information about their nonperforming loans.

Consequently, prudential Tunisian authorities have to focus on accounting measures to assess the risk-taking by banks until the information disclosed to investors will be of better quality. As we can observe in Table 2, the *Index* variable made up to apprehend the quantity of information disclosed to investors is significant and negatively related to systematic and specific capital market risks. So, prudential authorities have to encourage banks to be more transparent in the aim to reduce risk taking and to ameliorate the functioning of the market.

Conclusion

The relations between accounting and capital market measures of risk are examined for a sample of 10 listed Tunisian banks for the period of 1998-2007.

References

1. Agusman. A., Monroe. G.S., Gasbarro. D., Zumwalt. J.K. (2008). Accounting and capital market measures of risk: Evidence from Asian banks during 1998-2003, *Journal of Banking & Finance* 32, 480-488.
2. Arellano, M. (1987). Computing robust standard errors for within-groups estimators. *Oxford Bulletin of Economics and Statistics* 49, 431-434.
3. Arellano, M. (2003). Panel Data Econometrics. Oxford University Press, New York.
4. Baltagi, B.H. (2001). Econometric Analysis of Panel Data, second ed. John Wiley and Sons Ltd, Chichester.
5. Barth, J.R., Nolle, D.E., Rice, T.N. (1997). Commercial banking structure, regulation, and performance: An international comparison. OCC Working Paper 97-6.
6. Bertrand, M., Duflo, E., Mullainathan, S. (2004). How much should we trust differences-in-differences estimates. *Quarterly Journal of Economics*, 249-275.
7. Brewer Jr., E., Lee, C.F. (1986). How the market judges bank risk. Economic Perspectives. Federal Reserve Bank of Chicago, 25-31.
8. Chang, Y.T. (2004). East Asian banking restructuring: Regulation and industry policy, Working Paper, University of East Anglia, 1-34.
9. Cheng, C.S.A., Hopwood, W.S., McKeown, J.C. (1992). Non-linearity and specification problems in unexpected earnings response regression model. *Accounting Review* 67, 579-598.
10. Claessens, S., Djankov, S., Lang, L.H.P. (2000). The separation of ownership and control in East Asian corporations, *Journal of Financial Economics* 58, 81-112.
11. Cronan, T.P., Epley, D.R., Perry, L.G. (1986). The use of rank transformation and multiple regression analysis in estimating residential property values with a small sample, *Journal of Real Estate Research* 1, 19-31.
12. Elyasiani, E., Mansur, I. (2005). The Association between market and exchange rate risks and accounting variables: A GARCH model of the Japanese banking institutions, *Review of Quantitative Finance and Accounting* 25, 183-206.
13. Enoch, C., Baldwin, B., Fre'caut, O., Kovanen, A. (2001). Indonesia: Anatomy of a banking crisis: Two years of living dangerously 1997-99, IMF Working Paper, 1-139.
14. Goyal, A., Santa-Clara, P. (2003). Idiosyncratic risk matters, *Journal of Finance* 58, 975-1007.
15. Greene, W.H., 2003. Econometric Analysis, fifth ed. Prentice Hall, New Jersey.
16. Hassan, M.K. (1993). The off-balance sheet banking risk of large U.S. commercial banks, *Quarterly Review of Economics and Finance* 33, 51-69.
17. Hsiao, C. (1986). Analysis of Panel Data. Cambridge University Press, Cambridge, New York.
18. Iman, R.L., Conover, W.J. (1979). The use of the rank transform in regression. *Technometrics* 21, 499-509.
19. Jahankhani, A., Lynge Jr., M.J. (1980). Commercial bank financial policies and their impact on market-determined measures of risk, *Journal of Bank Research* 11, 169-178.
20. Kane, G.D., Meade, N.L. (1998). Ratio analysis using rank transformation, *Review of Quantitative Finance and Accounting* 10, 59-74.
21. Karels, G.V., Prakash, A.J., Roussakis, E. (1989). The Relationship between bank capital adequacy and market measures of risk, *Journal of Business Finance and Accounting* 16, 663-673.
22. Klingebiel, D., Kroszner, R., Laeven, L., Oijen, P.V. (2001). Stock market responses to bank restructuring policies during the East Asian crisis. Policy Research Working Paper No. 2571, Financial Sector Strategy and Policy Department, World Bank, 1-44.
23. Lee, C.-F., Brewer, E. (1985). The association between bank stock market based risk measures and the financial characteristics of the firm: A pooled cross-section time series approach. In: Proceedings of a Conference on Bank Structure and Competition. Federal Reserve Bank of Chicago, 285-315.
24. Mansur, I., Zangeneh, H., Zitz, M.S. (1993). The association between banks' performance ratios and market-determined measures of risk, *Applied Economics* 25, 1503-1510.

Using panel data analysis, the Feasible Generalized Least Squares model indicates that the capital market risk measures do not reflect accurately the risk taken by banks. In fact, almost all the coefficients are insignificant for the total and systematic risks. And for the systematic risk, only EQTA, DEPEQ and LIQTA are significant and have the expected signs; but the variables that apprehend the total risk and the credit risk are not significant and they don't have the expected signs. The results indicate that the bank specific risk is more important than the bank systematic risk and indicate also that the market is not able to reflect accurately the risk taken by banks. So, the prudential Tunisian authorities have to focus on accounting measures to better assess risk-taking of commercial banks.

25. McAnally, M.L. (1996). Banks, risk, and FAS105 disclosures, *Journal of Accounting, Auditing and Finance* 11, 453-490.
26. Neuberger, J.A. (1991). Risk and return in banking: Evidence from bank stock returns, *Economic Review* 4, Federal Reserve Bank of San Francisco, 18-30.
27. Pettway, R.H. (1976). Market tests of capital adequacy of large commercial banks, *Journal of Finance* 31, 865-875.
28. Pettway, R.H., Sinkey Jr., J.F. (1980). Establishing on-site bank examination priorities: An early-warning system using accounting and market information, *Journal of Finance* 35, 137-150.
29. Rosenberg, B., Perry, P. (1981). The fundamental determinants of risk in banking. In: Sherman J. Maisel (Ed.), *Risk and Capital Adequacy in Commercial Banks*, National Bureau of Economic Research.
30. Shiers, A.F. (1994). Deposit insurance and banking system risk: Some empirical evidence, *Quarterly Review of Economics and Finance* 34, 347-361.
31. Williams, J., Nguyen, N. (2005). Financial liberalization, crisis, and restructuring: A comparative study of bank performance and bank governance in South East Asia, *Journal of Banking and Finance* 29, 2119-2154.
32. Wooldridge, J.M. (2002). *Econometric Analysis of Cross Section and Panel Data*. MIT Press, Cambridge.
33. Wooldridge, J.M. (2003). Cluster-sample methods in applied econometrics, *American Economic Review* 93, 133-138.
34. Zou, H., Adams, M.B., Buckle, M.J. (2003). Corporate risks and property insurance: Evidence from the People's Republic of China, *Journal of Risk and Insurance* 70, 289-314.

Appendix

Table 3. Sub-indices used to make up a disclosure index based on annual reports information

Items	Sub-index	Categories
Assets		
Loans	S1: Loans by maturity	Loans and advances <3 months, loans and advances 3-12 months, Loans and advances) 1 year
	S2: Loans by counterparty	Loans to group companies, loans to other corporate, loans to banks
	S3: Problem loans	Total problem banks
	S4: Problem loans by type S5: risk weighted assets	Overdue/ restructured/ Other non-performing loans, total of risk weighted assets
Other earning assets	S6: Securities by type	Treasury bills, other bills, bonds, CDs, equity investments, other investments
	S7: Securities by holding purpose	Investment, trading
Liabilities		
Deposits	S8: Deposits by maturity	Demand, savings, sub 3 months, 3-6 months, 6 months-1 year, 1-5 years, + 1 year
	S9: Deposits by type of customer	Banks/customers/ municipal, government
Other funding	S10: Money market funding	Total money market funding
	S11: Long-term funding	Convertible bonds, mortgage bonds, other bonds, subordinated debt, hybrid capital
Income statement		
	S12: Non-interest income	Net commission income, net fee income, net trading income
	S13: Loan loss provisions	Total loan loss provisions
Memo lines		
	S14: Reserves	Loan loss reserves (memo)
	S15: Capital	Total capital ratio, Tier 1 ratio, total capital
	S16: Off-balance sheet (OBS) items S17: Liquid assets	OBS items, total liquid assets