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Abstract

This paper examines the ability of stock market investors to monitor bank risk for a sample of listed banks in Tunisia and Morocco over the period 2003-2009. We construct various market-based risk measures derived from the market model as well as the distance-to-default derived from the structural model of credit risk. Using a panel data analysis, we show that market-based measures of risk are strongly associated to bank fundamental characteristics, especially capital and size. This finding has important implications for regulators as shareholders are able to assess a bank's financial condition and hence exert effective discipline on the bank's risk-taking behavior.

JEL Classification: G14, G21, G32

Keywords: Market discipline, Monitoring, Bank stock returns, Distance-to-default

ملخص

تبحث هذه الورقة في قدرة المستثمرين في سوق الأوراق المالية على مراقبة المخاطر المصرفية لعينة من البنوك المدرجة في تونس والمغرب خلال الفترة 2003-2009. نبني نماذج مختلفة عن مقاييس المخاطر على أساس مستمد من نموذج السوق، فضلا عن مقاييس مدى البعد عن المفترض المستمدة من النموذج الهيكلي من مخاطر الائتمان. باستخدام تحليل بيانات التتبعى، تبين لنا أن مقاييس المخاطر المعتمدة على أساس السوق ترتبط بقوة على الخصائص الأساسية البنك ، لا سيما رأس المال وحجمه. هذه النتيجة لها آثار هامة بالنسبة للمنظمين حيث أنها تساعد المساهمين على تقييم حالة البنك المالية وبالتالي ممارسة الانضباط الفعال على سلوك المخاطرة الخاص بالبنك.

1. Introduction

The stability of the banking system is an important concern for both regulatory authorities and bank stakeholders. To prevent crisis, the banking activity is heavily regulated all over the world. This involves monitoring of banks' risk-taking and ensuring compliance with prudential regulation such as capital adequacy rules, liquidity requirements and risk management tools.

Numerous studies provide evidence that market mechanisms can play a useful role in disciplining bank risk-taking. Herring (2004) argues that market discipline can enhance the effectiveness of bank capital regulation at a lower cost and eliminate regulatory arbitrage. According to Bliss and Flannery (2002), the concept of market discipline incorporates two components: monitoring and influence. Market monitoring refers to the ability of investors to evaluate bank financial condition. Market influence is defined as the responsiveness of bank managers to signals impounded in security prices.

In an efficient market, all available public information is impounded in stock prices. Thus, market data is supposed to convey signals about bank risk profile. As this is a first necessary condition for the existence of market discipline in the banking industry, we study to what extent the equity market monitoring hypothesis is consistent with empirical evidence in two emerging economies from the Maghreb region namely, Tunisia and Morocco[1]. To that end, we use a panel data set to investigate the relationships between stock market-based measures of risk and bank characteristics particularly, CAMEL ratings[2].

The empirical literature suggests three possible instruments for testing the presence of market discipline in the banking system: uninsured liabilities, subordinated debt and bank equity. Since bond markets are not developed in the Maghreb region and are dominated by government securities, we focus on markets for bank equity as a main source of market discipline.

The study of market discipline in Tunisia and Morocco based on the stock market is relevant since publicly traded banks accounted in 2009 for 79% and 55% of the total banking systems assets, respectively. The ownership structure, marked by the co-existence of state-owned, private and foreign banks also provides a good test of the extent and effectiveness of shareholders monitoring of bank risk in these two countries. While, previous studies related to the effectiveness of market monitoring are predominantly conducted in developed markets, this paper seeks for evidence from emerging economies.

This paper provides two main contributions. Firstly, we examine the ability of shareholders to assess bank risk profile relying on various market-based measures. In addition to classic measures derived from the market model (market beta, idiosyncratic risk and total volatility of returns), we use, as new proxy, the distance-to-default computed using the structural model of credit risk developed by Merton (1974). To the best of our knowledge, this study is the first to test the effectiveness of market monitoring in the context of the Maghreb region relying on bank equity. Secondly, we analyze a wide range of factors explaining bank risk including financial soundness indicators and various bank-specific characteristics.

Our findings suggest that market-based measures of bank risk are strongly associated to bank-specific characteristics. Since bank stock prices reveal important risk related information, shareholders are able to assess bank financial condition and exert discipline on bank risk-taking behavior in Tunisia and Morocco. The major determinants of bank risk are

1 The Maghreb region comprises Algeria, Libya, Mauritania, Morocco and Tunisia. This study is restricted to Tunisia and Morocco given the limited development of capital markets in the other countries.

2 CAMEL refers to five components of bank financial soundness assessment: C for capital adequacy, A for asset quality, M for management quality, E for earnings and L for liquidity.

capital adequacy ratio and size. While, capital has a mitigating effect on bank risk, larger banks are perceived as more risky than smaller institutions. Hence, higher capital adequacy requirements should be imposed to systemically important banks.

The reminder of the paper is organized as follows. Section 2 presents a literature review on bank risk and market discipline. Section 3 presents an overview of the banking systems in Tunisia and Morocco. Section 4 describes data and methodology. Section 5 discusses the empirical results. The last section concludes and draws implications.

2. Literature review

There is a large strand of literature that examines the presence of market discipline in the banking industry[3]. While many authors suggest to use subordinated debt as privileged instrument of market discipline among whom Flannery and Sorescu (1996) and Sironi (2003), an extensive literature has recently focused on equity market as source of market discipline (Berger et al. 2000; Krainer and Lopez 2004; Curry et al. 2007). Baele et al. (2007) argue that bank shareholders perceive bank risks differently. They show that while well diversified investors are primarily interested in the systematic risk exposure, large shareholders are more sensitive to idiosyncratic and total risk.

Compared to market monitoring, evidence related to the ability of market participants to influence bank management is relatively scarce. Bliss and Flannery (2002) do not find evidence supporting the presence of market influence on bank managerial decisions for US banks. The evidence on market discipline in emerging markets is also limited to monitoring. Bongini et al. (2002) find that CAMEL ratings are robustly correlated to distress for a sample of East Asian banks. Caprio and Honohan (2004) document the existence of a positive relationship between the effectiveness of market discipline and the share of total bank assets of listed banks in emerging markets.

Recent empirical studies point out that stock market prices can be helpful in predicting bank vulnerabilities. Berger et al. (2000) report that supervisors' assessments of bank soundness are less predictive of future changes than equity and bond market signals. Gunther et al. (2001) find that equity prices provide useful information on bank failure. Krainer and Lopez (2004) argue that both equity prices and bond yields explain rating changes well. Vassalou and Xing (2004) note that the increase in financial fragility around the globe, in recent years, led to development of early warning models based on both accounting and market information.

Gropp et al. (2006) use the distance-to-default and the spread of subordinated debt as leading indicators of bank fragility. They show that these indicators predict well bank fragility. While distance-to-default predicts bank distress at least 18 months in advance, spread could predict distress only 12 months in advance. They conclude that equity market information is more valuable to discriminate between solvent and troubled banks. More recently, Gapen (2009) has employed the distance-to-default to estimate the market value of public guarantees in the event of default. Igan and Pinheiro (2010) proposed a regression to identify the main determinants of the distance-to-default for a sample of US commercial banks. They find that large banks with high loan to deposit ratio and large share of real estate loans in their lending activities are more likely to face serious vulnerabilities in case of economic downturn. Moreover, banks with high net interest margins and cost-to-income ratios appear to be more sensitive to interest rate shocks both through the direct and indirect channels. Finally, banks experiencing rapid credit expansion tend to have higher non-performing loans and lower distance-to-default. Hence, the authors conclude that aggressive lending policies increase bank vulnerabilities.

3 For an excellent overview, see Flannery (1998).

Although they are forward-looking and highly liquid, equity markets may give ambiguous signals about bank soundness in presence of limited liability of shareholders and safety net. As in Gropp et al. (2006), we construct a more efficient indicator of bank distress combining both market and accounting data, the distance-to-default.

3. An Overview of Banking Systems in Tunisia and Morocco

The Tunisian banking system currently includes 21 banks: 11 private, 6 public and 4 joint-ventures. The ten biggest ones are listed on the Tunis stock exchange. The Moroccan banking system consists of 19 banks: 13 private and 6 state-owned. Six banks are listed on Casablanca stock exchange. Both in Tunisia and Morocco, banks play a major role in financing the economy. In fact, total credit to the economy represents 59.2 and 65.4 percent of GDP for Tunisia and Morocco, respectively. Banks also perform important functions in allocating resources, monitoring firms and promoting economic growth.

Despite the significant heterogeneity among these two countries, their financial sectors have a number of common characteristics. These include bank dominance, large presence of majority state-owned banks with weak performance and a high level of non-performing loans. While public banks still hold a large share of total banking assets in Tunisia, the role of state-owned banks in Morocco is less important.

As shown by figure 1, in Morocco, credit to the economy in percent of GDP has increased faster than in Tunisia during the period 2003-2009.

The financial systems in Tunisia and Morocco have developed substantially in the last decade. Both in Morocco and Tunisia the bond markets are dominated by government securities. As clearly shown by figure 2, the market capitalization in percent of GDP in Morocco is larger than in Tunisia.

In Tunisia as well as in Morocco, central banks enact management rules and prudential norms. These norms concern capital adequacy, risk concentration and division, credit classification and provisioning and liquidity. While, Morocco implemented Basel II pillar 1 as of June 2007, the Tunisian supervisory framework is mostly consistent with the Basel I accord. Financial soundness indicators, especially those related to credit quality, have generally improved in recent years, despite substantial differences between the two countries and in comparison with average levels in the Middle East and North Africa (MENA) region.

4. Methodology

4.1 Model specification

Our study uses four alternative market-based indicators of bank risk as dependent variables and CAMEL ratings as independent variables controlling for various bank-specific characteristics.

We examine the ability of shareholders to monitor bank risk profile using panel data analysis. The general form of the model used, with market-based measures of bank risk on the left-hand side and accounting ratios representing bank financial condition and other control variables on the right-hand side, allows examining the effects of including alternative variables as well as estimation methods. Thus, we estimate the following specification:

$$Y_{ijt} = \gamma + \sum_{k=1}^{K} \lambda_k X_{kijt} + \sum_{h=1}^{H} \theta_h Z_{hijt} + \varepsilon_{ijt} \quad (1)$$

where, i, j and t index banks, countries and months, respectively. Y_{ijt} is either systematic risk, idiosyncratic risk, total risk or default risk measured by the distance-to-default. The vector X_{kijt} contains bank CAMEL ratings. As control variables Z_{hijt}, we include size, charter value, income diversification, off-balance sheet activity and turnover. We also include bank fixed effects to account for individual heterogeneity.

4.2 Market-based risk measures

Decomposing bank total risk

As a measure of bank total risk, we use the variance of monthly stock returns σ_i^2 given by the following formula:

$$\sigma_i^2 = \frac{1}{N-1}\sum_{t=1}^{N}(r_{it} - \bar{r}_i)^2 \qquad (2)$$

where i and t index banks and months, respectively. r_{it} is the monthly return on stock i and N represents the number of observations.

Relying on the market model, we decompose the total variance of returns into systematic and idiosyncratic components. As systematic risk, we estimate the market beta β_i for each bank from the market model regression over sixty month moving window:

$$r_{it} = \alpha_i + \beta_i r_{mt} + \varepsilon_{it} \qquad (3)$$

where i and t index banks and months, respectively. r_{it} is the monthly return on stock i; r_{mt} is the monthly return on market portfolio; α_i and β_i are constant coefficients and ε_{it} is the residual. As market portfolio, we use TUNINDEX and MASI for Tunisian and Morocco's stock markets, respectively.

The analysis is based on arithmetic monthly returns using the following formula:

$$r_{it} = \frac{P_{it} - P_{it-1}}{P_{it-1}} \qquad (4)$$

where P_{it} is the adjusted closing price of stock i on month t.

The bank-specific risk is calculated as the difference between total and systematic variance:

$$\sigma_{ei}^2 = \sigma_i^2 - \beta^2\sigma_m^2 \qquad (5)$$

Stock prices are adjusted for dividends, split and rights offering. All market-based measures of risk are annualized.

Bank distance-to-default

Pioneered by Merton (1974), the distance-to-default is an application of the option pricing theory to credit risk assessment based on information incorporated in equity prices. The default point is reached when the book value of liabilities is just equal to the market value of assets. The distance-to-default is the number of standard deviations that the bank is away from default. Thus, the smaller the distance-to-default, the higher is the default risk.

As demonstrated by Vassalou and Xing (2004), the distance-to-default DD_t is given by:

$$DD_t = \frac{\ln(V_t / D) + (r - \sigma_V^2/2)(T-t)}{\sigma_V\sqrt{T-t}} = \frac{\ln(1/L) + (r - \sigma_V^2/2)(T-t)}{\sigma_V\sqrt{T-t}} \qquad (6)$$

where at time t, V_t is the market value of the bank assets; D is the book value of total liabilities; L is the leverage defined as the book value of debt over the market value of assets; r is the risk free rate; T is the maturity of debt commonly set to one year and σ_V is the volatility of assets.

Gropp et al. (2006) show that the negative of distance-to-default $(-DD)$ is the complete and unbiased indicator of bank fragility for $V > De^{-(r+1/2\ \sigma_V^2)\ (T-t)}$. $(-DD)$ is complete because it obviously reflects, V, L and σ_V. As demonstrated by the authors, this indicator is unbiased since $\partial(-DD)/\partial V < 0$; $\partial(-DD)/\partial L > 0$ and $\partial(-DD)/\partial\sigma_V > 0$. In order to implement the model, the market value of bank assets and the volatility parameter have to be estimated. Ronn and Verma (1986) suggest two identifying restrictions. The first restriction is the formula giving the value of the equity E_t as a European call option on the bank assets with a strike price equal to the face value of debt:

$$E_t = V_t N(d_t) - De^{-r(T-t)} N(d_t - \sigma_V \sqrt{T-t}) \qquad (7)$$

The second restriction is the relationship between volatilities of bank equity and assets obtained by applying the Ito's Lemma to the equation (7):

$$\sigma_E = \sigma_V (V_t / E_t)\ \ N(d_t) \qquad (8)$$

where,

E_t : the market value of equity,

σ_E : the standard deviation of equity returns,

V_t : the market value of assets,

D : the book value of total liabilities,

σ_V : the standard deviation of assets returns,

$N(\cdot)$: the cumulative standard normal distribution function,

r : the risk-free rate,

T : the time until maturity of debt,

$$d_t = \frac{\ln(V_t / D) + (r + \sigma_V^2 / 2)(T - t)}{\sigma_V \sqrt{T - t}}$$

Since the market value of equity is directly observable and the equity volatility can be estimated, these two non-linear equations can be solved by an iterative method. Then, we also calculate the distance-to-default year by year for all sample banks. The higher the distance-to-default, the lower is the default risk and vice versa. Note that assuming normal distribution, the implied probability of default PD, defined as the probability that the market value of assets is less or equal to the book value of debt, can be computed directly as $PD = N(-DD)$ .When formulating hypotheses and discussing results, we rely on the negative distance-to-default $(-DD)$ given that this measure is positively related to default risk.

4.3. Factors determining bank risk

We now present the key factors determining bank risk and formulate testable hypotheses related to the link between market-based risk measures and CAMEL ratings as well as various control variables.

Capital adequacy

The literature dealing with the impact of capital requirements on bank risk-taking provides mixed evidence. Relying on contingent claim pricing, Keeley and Furlong (1990) find that capital requirements reduce risk and contribute to the stability of the banking system.

However, Koehn and Santomero (1980), Kim and Santomero (1988), Gennotte and Pyle (1991), Rochet (1992), Blum (1999), among others, advocate that, in order to offset its negative effect on leverage and on profitability, a more stringent capital rule could lead to excessive risk-taking strategies.

Adopting a dynamic framework, Calem and Rob (1999) develop a model that allows banks to adjust their capital position. They show that a bank may either decrease or increase its portfolio risk as it moves toward compliance with the regulatory capital ratio. The measure used in this study is the book value of equity divided by total assets. To allow for non-linearity in the capital-risk relationship, we include the square of the capital ratio. This leads us to hypothesize:

Hypothesis 1: Market-based risk measures and bank capital adequacy ratio exhibit a negative relationship.

Asset quality

Brewer and Lee (1986) argue that high ratio of non-performing loans increases default likelihood. In addition, a decline in asset quality needs more provisioning and can lead to write-offs and hence reduce bank earnings. As proxies of asset quality, we consider two alternative measures: the ratio of non-performing loans to total loans (NPL) and the ratio of loan loss provisions to total loans (LLP). Bank stock investors are confronted with asymmetric information when they want to assess the quality of a bank's loan portfolio. The amount of loan loss provisions to cover unexpected losses is an observable signal about loans quality.

Hypothesis 2: the association between market-based measures of bank risk and asset quality proxies is expected to be positive.

Management efficiency

Economic theory assumes that managers will seek to reduce operating expenses in order to maximize profit. However, the expense preference model developed initially by Williamson (1963) predicts that managers can choose to maximize utility rather than profitability. As proxy of management efficiency, we use cost-to-income ratio that corresponds to the ratio of total operating expenses to net income. According to Baele et al. (2007), efficient banks are expected to have a higher franchise value while no particular effect on bank risk is expected. Building on economic intuition, we formulate our third hypothesis as follows:

Hypothesis 3: Cost-to-income ratio is expected to have a positive effect on market-based measures of bank risk.

Earnings

Many authors, among whom Brewer and Lee (1986) and Goodhart (2010) argue that profitability is negatively related to market-based measures of risk since large profit increases equity base as a buffer to shocks. Nevertheless, higher profitability may result from higher risk-taking practices. Thus, we can also expect a positive relationship between risk and earnings. As proxies of bank profitability, we employ either return on assets or return on equity. These measures are expected to be positively associated with bank market-based risk measures.

Hypothesis 4: Market-based risk measures and bank profitability proxies are positively related.

Liquidity

According to Brewer and Lee (1986), liquidity risk arises when a bank has to pay a premium over market value in order to fund its assets. While, holding substantial amounts of current assets reduce liquidity risk, greater levels of short-term liabilities expose banks to liquidity problems. As suggested by Beaver et al. (1970), Jahankhani and Lynge (1980) and Cihak and Poghosyan (2009), liquidity can be approximated by the ratio of liquid assets to total assets. We further consider the interbank ratio as alternative proxy of liquidity. The higher the liquidity ratio, the more a bank is able to repay its short-term liabilities.

Hypothesis 5: The relationship between market-based measures of bank risk and liquidity is expected to be negative.

Size

Saunders, Strock and Travlos (1990) report that large banks are more able to diversify risk. However, Demsetz and Strahan (1997) find that large banks do not translate this advantage into less total risk. Moreover, the too big to fail doctrine emphasizes the excessive risk-taking incentives induced by a generous scheme of deposit insurance (Duan et al. 1992; Hovakimian and Kane 2000). We expect that larger banks will have higher market betas. The idiosyncratic risk could be lower if systemic banks are perceived to be too big to fail (Penas and Unal 2004). Building on the diversification advantage, we hypothesize:

Hypothesis 6: Bank size is expected to be positively related to systematic risk but negatively related to idiosyncratic risk, total risk and default risk.

Charter value

Demsetz et al. (1996) define charter value as the present value of the future profits that a bank is expected to earn as a going concern. The main sources of bank charter value are efficiency, access to protected markets and valuable lending relationships. Demsetz et al. (1996), Anderson and Fraser (2000), Konishi and Yasuda (2004), among others, report that charter value mitigates the moral hazard problem associated with safety net by aligning the incentives of bank owners with those of regulatory authorities. Since charter value captures growth opportunities, many authors document a positive relationship between charter value and bank risk. In this regard, Keeley (1990), Matutes and Vives (2000), Hellmann, Murdock and Stiglitz (2000), Salas and Saurina (2003), Gropp and Vesala (2004) and Staikouras and Fillipaki (2006) attribute the erosion of charter value to increased competition coupled with financial liberalization. We consider charter value as a bank disciplinary mechanism. Thus, we formulate our next hypothesis as follows:

Hypothesis 7: Market-based risk indicators and bank charter value are negatively associated.

Off-balance sheet activities

There are many loan commitments and contingencies that generate income and/or hedge risks. While, some off-balance sheet instruments lead to risk mitigating, others increase the risk exposure of commercial banks. For this reason, we account for risk related to off-balance sheet items. Yildirim and Philippatos (2007) show that banks with higher levels of off-balance sheet items are more cost and profit efficient. Boot and Thakor (1991), Angbazo (1997) note that off-balance sheet items, as contingent liabilities, impose market discipline on bank management. However, Wagster (1996) argues that off-balance sheet items increase bank risk and create a moral hazard problem. We measure off-balance activities by the ratio of off-balance sheet items (loan commitments, standby letters of credit, and other guarantees) to total assets. Our next hypothesis is as follows:

Hypothesis 8: Market-based measures of bank risk are negatively related to the ratio of off-balance sheet items to total assets.

Income diversification

The effects of diversification on bank performance and risk have been extensively addressed by previous research. Baele et al. (2007) find that higher share of non-interest income in total income affects bank franchise value positively. From the risk side, Delong (2001) show that both activity and geographical diversification for a sample of US banks fail to create value. More recently, Deng and Elyasiani (2005) find that geographical diversification reduces systematic, idiosyncratic and total risk for US bank holding companies (BHCs). Furthermore, DeYoung and Roland (2001) note that fee-based activities are associated with higher revenue volatility and risk. Stiroh (2006) finds that non-interest diversification is negatively linked with performance. In accordance with Baele et al. (2007), as measure of bank functional diversification, we use non-interest income to total operating income. This measure captures all sources of non-interest income generated by a broad range of financial services.

Hypothesis 9: Income diversification is expected to be negatively correlated with market-based measures of bank risk.

Trading volume

Schwert (1990), Gallant et al. (1992) and Caner et al. (2007), among others, document the existence of a positive relation between trading volume and market risks. Following previous research, we expect that banks with higher stock turnover exhibit higher values of market-based risk indicators.

Hypothesis 10: Bank market-based risk measures and turnover are positively associated.

4.4 Data

This study uses data on 15 publicly traded commercial banks from Tunisia and Morocco over the period 2003-2009. Thus, the panel dataset contains 105 observations[4].

We collect annual accounting data from yearly financial reports of respective banks. Market data is obtained from Tunis stock exchange and Casablanca stock exchange for Tunisian and Morocco's listed banks, respectively. We use monthly returns of TUNINDEX and MASI as proxies for the returns on market portfolios. All returns are adjusted for dividends, splits and rights offering. As risk-free rate, we employ central bank key rates. For comparability, we convert the total assets for Morocco's banks into Tunisian Dinars. The descriptive statistics for our sample are reported in Table 2.

The mean value of market beta is 0.788 implying that banks have a return risk close to the market. In average terms, the total risk and the idiosyncratic risk of bank equity are 4.1% and 5.7%, respectively. The distance-to-default varies between a minimum level of 2.929 and a maximum level of 25.728 with a mean of 7.825. These low levels can be attributed to the low values of assets returns volatility and financial leverage which make default an unlikely event and hence lower implied default probability, especially for single period horizon. With regard to financial soundness indicators and other bank-specific factors like size, market-to-book, off-balance sheet activities, diversification and turnover, descriptive statistics show substantial heterogeneity between individuals. We control for this heterogeneity by including fixed effects in our model specifications.

5. Results

Overall, the variables representing CAMEL ratings and the control variables explain a large proportion of the variance for the alternative specifications of bank risk regressions.

Table 3 presents results for regressions using systematic risk as dependent variable. All specifications show a negative relationship between capital ratios and market betas. Hence, well capitalized banks have lower market betas. This is consistent with the finding of Kim

4 Our sample is composed by the following banks: Amen Bank (AB), Arab Tunisian Bank (ATB), Attijari Bank (ATTIJARI), Banque de Tunisie (BT), Banque Internationale Arabe de Tunisie (BIAT), Banque Nationale Agricole (BNA), Société Tunisienne des Banques (STB), Union Bancaire du Commerce et de l'Industrie (UBCI), Union Internationale des Banques (UIB), Banque de l'Habitat (BH), Attijariwafa Bank (ATW), Banque Marocaine du Commerce Extérieur (BMCE), Banque Marocaine pour le Commerce et l'Industrie (BMCI), Crédit du Maroc (CDM) and Banque Centrale Populaire (BCP).

and Santomero (1988) and Keeley and Furlong (1990). As suggested by Calem and Robb (1999), we also examine potential nonlinearities in the relation between systematic risk and bank capital. Since the coefficient on CAR^2 is positive and statistically significant, the empirical relation seems to be convex.

While the coefficient on non-performing loans is not statistically significant, the coefficient on loan loss provisions is negatively associated to systematic risk for two specifications. Higher loan loss provisions are hence perceived as buffer to adverse market shocks. Cost-to-income ratio, as a proxy of bank cost inefficiency, has a statistically negative and significant impact on market betas in all specifications. This implies that less cost efficient banks have lower exposure to systematic risk. Thus, banks facing a higher cost-to-income tend to have lower market betas. Neither the coefficient on the return on equity nor the coefficient on return to assets is statistically significant. The coefficients on liquidity measures are positive and significant for the majority of specifications. Therefore, higher degree of liquidity increases bank systematic risk.

Bank size is an important determinant of market betas. Larger banks are more exposed to systematic risk. This is consistent with previous empirical literature findings, in particular, Stiroh (2006) and Baele et al. (2007). The relationship between bank charter value and market beta is significantly positive in most specifications. While, this result is consistent with the findings of Saunders and Wilson (2001), it does not confirm those of Demsetz et al. (1996), Galloway, Lee and Roden (1997) and Konishi and Yasuda (2004). Neither the coefficient on off-balance sheet activities nor the coefficient on bank stock turnover is statistically significant. Contrary to Stiroh (2006) who find a significantly positive relationship between non-interest share and market betas for a sample of US bank holding companies, none of the specifications shows significant coefficients for the share of non-interest income as a measure of bank revenue diversification.

Table 4 reports results for idiosyncratic risk regressions. Bank capital to assets ratio has a significant negative impact on bank-specific risk only for the specification (6). The coefficient on off-balance sheet activities is negative and significant in all idiosyncratic risk specifications. Perceived as less risky, these activities are useful for imposing market discipline on bank management. The coefficient on size reveals that larger banks have higher specific risk. Thus, being big does not reduce bank idiosyncratic risk. For the other variables, our findings show similar results to the systematic risk regressions.

Table 5 provides results for regressions using total risk as the dependent variable. As for systematic risk regressions, capital adequacy ratio is negatively related to bank total risk in three specifications. Similar to specific-risk, off-balance sheet activities have a mitigating effect on total risk. For the other variables, results are in line with those provided by tables 3 and 4.

Table 6 contains estimation results of the distance-to-default regressions. Equity to assets ratio is positively and significantly related to distance-to-default for specifications (2) and (4). Return on assets is also positively and significantly associated with distance-to-default. Thus, the distance-to-default decreases with leverage and increase with return to assets as suggested by Gropp et al. (2006). Contrary to the three risk measures derived from bank stock returns model regressions, the coefficient on turnover is negative and statistically significant. Concerning the other bank characteristics, empirical results corroborate the effects obtained earlier.

We perform additional robustness checks that are more data and specification-related. Instead of using contemporaneous variables, we perform the analysis with one year lagged variables to alleviate endogeneity. Results are largely unaffected. We also modify the standard market model including other risk factors such as interest rate. Results do not change significantly.

We re-estimate the above regressions based on random-effects models. We also run pooled regressions using OLS and GLS. Our results are robust to these changes in methodology.

Contrary to Merton (1974), Crosbie and Bohn (2003) argue that the default point lies between total liabilities and short-term liabilities. For example, Moody's KMV uses the short-term liabilities plus half of long-term liabilities as face value of liabilities. We construct distance-to-default using the short-term liabilities plus half of long-term liabilities as default point. Results remain unchanged.

As pointed out by Duan (1994), the use of Ronn and Verma method to infer bank assets value and volatility has a major statistical problem. In fact, it relies on the sample standard deviation of stock returns as estimator for equity volatility. This estimator is not efficient since the theoretical model implies that the equity volatility should be stochastic. Therefore, Duan (1994) recommends the use of the maximum likelihood estimation method which is not only consistent with Merton’s theoretical model but also provides sound statistical inference. Alternatively, we use the maximum likelihood method to estimate both market value and volatility of bank assets. Our empirical results are not significantly modified.

Since market risk can vary with ownership, we include a dummy variable equal to one for state-owned banks and zero otherwise and re-estimate the model using pooled OLS. While, overall results do not change significantly, results show that private banks take less risk than public ones.

6. Conclusion

In order to assess whether the monitoring channel of market discipline is supported in Tunisia and Morocco, we analyze to what extent shareholders respond to changes in the financial condition for a sample of publicly traded commercial banks over the period 2003-2009. To that end, we estimate the link between market-based measures of bank risk and a set of balance-sheet risk indicators and control variables using a panel data analysis.

We find support to the hypothesis that bank stock prices reveal important risk related information. Shareholders pay close attention to bank equity base. Moreover, we find a non-linear relationship between risk and capital adequacy ratio similar to Calem and Robb (1999). Building-up loan loss provisions is perceived by investors as good news. Cost-to-income ratio is negatively linked to market-based indicators of bank risk. Larger banks are perceived to be more risky than smaller ones. Functional diversification gains are limited. Off-balance activities have a mitigating effect on bank risk. Charter value disciplining effect is not corroborated by our evidence. In line with Gropp et al. (2006), we show that distance-to-default is a suitable indicator of bank distress.

Our analysis has several policy implications. Building-up capital should be encouraged by supervisory authorities to enhance safety and soundness of the banking system in Tunisia and Morocco. However, larger banks are perceived as more risky than smaller ones implying that policies devoted to increasing bank size may not be desirable. Finally, our findings suggest complementarities between market and accounting information for assessing bank risk profile. Thus, regulators can rely on market information in assessing bank risk as a complement to accounting information.

References

Anderson, R. C. and D. R. Fraser. 2000. Corporate control, bank risk-taking and the health of the banking industry. *Journal of Banking and Finance* 24: 1383–98.

Angbazo, L. 1997. Commercial bank net interest margins, default risk, interest-rate risk, and off-balance sheet banking. *Journal of Banking and Finance*, 21: 55–87.

Baele, L., O. De Jonghe, and R. Vander Vennet. 2007. Does the stock market value bank diversification? *Journal of Banking and Finance* 31: 1999–2023.

Beaver, W., P. Kettler, and M. Scholes. 1970. The association between market-determined and accounting determined risk measures. *Accounting Review* 45: 654–82.

Berger, A. N., S. M. Davies, and M. J. Flannery. 2000. Comparing market and supervisory assessments of bank performance: Who knows what and when? *Journal of Money, Credit and Banking* 32: 641–70.

Black, F., and M. Scholes. 1973. The pricing of options and corporate liabilities, *Journal of Political Economy* 81: 637–54.

Bliss, R., and M. Flannery. 2002. Market discipline and the governance of US bank holding companies: Monitoring versus influencing. *European Finance Review* 6: 361–95.

Blum, J. 1999. Do capital adequacy requirements reduce risks in banking? *Journal of Banking and Finance* 23: 755–71.

Bongini, P., L. Laeven, and G. Majnoni. 2002. How good is the market at assessing bank fragility? A horse race between different indicators. *Journal of Banking and Finance* 26: 1011–28.

Boot, A. W. A., and A. V. Thakor. 1991. Off-balance sheet liabilities, deposit insurance and capital regulation, *Journal of Banking and Finance* 15: 825–46.

Brewer, E., and C. F. Lee. 1986. How the market judges bank risk. *Federal Reserve Bank of Chicago Economic Perspectives* 10: 25–31.

Calem, P., and R. Rob. 1999. The impact of capital based regulation on bank risk-taking, *Journal of Financial Intermediation* 8: 317–52.

Caner, S., S. Ozyildirim, and E. Ungan. 2007. How sensitive are shareholders to bank risk. SSRN: http://ssrn.com/abstract=1082791.

Caprio, G., and P. Honohan. 2004. Can the unsophisticated market provide discipline? World Bank Policy Research Working Paper No.3364.

Cihak, M., and T. Poghosyan. 2009. Distress in European banks: An analysis based on a new dataset. IMF Working Paper 09/9.

Crosbie, P., and J. Bohn. 2003. Modeling default risk. KMV Corporation. http://www.moodyskmv.com/research/files/wp/ModelingDefaultRisk.pdf

Curry, T. J., P. J. Elmer, and G. S. Fissel. 2007. Equity market data, bank failures and market efficiency. *Journal of Economics and Business* 59: 536–59.

DeLong, G.L. 2001. Stockholder gains from focusing versus diversifying bank mergers. *Journal of Financial Economics* 59: 221–52.

Demsetz, R. S., and P. E. Strahan. 1997. Diversification, size and risk at bank holding companies. *Journal of Money, Credit and Banking* 29: 300–13.

Demsetz, R., M. Saidenberg, and P. Strahan. 1996. Banks with something to lose: The disciplinary role of franchise value. *Federal Reserve Bank of New York Economic Policy Review* 2: 1–14.

Deng, S. and, E. Elyasiani. 2005. Geographic diversification, bank holding company value and risk. *Journal of Money, Credit and Banking*. 40: 1217–38.

DeYoung, R., and K.P. Roland. 2001. Product mix and earnings volatility at commercial banks: Evidence from a degree of total leverage model. *Journal of Financial Intermediation* 10: 54–84.

Duan, J.-C. 1994. Maximum likelihood estimation using price data of the derivative contract. *Mathematical Finance* 4: 155–67.

Duan, J.-C., A. Moreau, and C. Sealey. 1992. Fixed-rate deposit insurance and risk-shifting behavior at commercial banks. *Journal of Banking and Finance* 16: 715–42.

Flannery, M. J., and S. M. Sorescu. 1996. Evidence of bank market discipline in subordinated debenture yields: 1983–1991. *Journal of Finance* 51: 1347–78.

Flannery, M. J. 1998. Using market information in prudential bank supervision: A review of the US empirical evidence. *Journal of Money, Credit and Banking* 30: 273–305.

Gallant, R., P. Rossi, and G. Tauchen. 1992. Stock prices and volume. *Review of Financial Studies* 5: 199–242.

Galloway, T. M., W. B. Lee, and D. M. Roden. 1997. Banks' changing incentives and opportunities for risk-taking. *Journal of Banking and Finance* 21: 509–27.

Gapen, M. T. 2009. Evaluating the implicit guarantee to Fannie Mae and Freddie Mac using contingent claims. *International Finance Review* 10: 329–352.

Gennotte, G., and D. Pyle. 1991. Capital controls and bank risk. *Journal of Banking and Finance*, 15: 805–824.

Goodhart, C. A. E. 2010. Money, credit and bank behaviour, the need for a new approach. *National Institute Economic Review* 214: 73–82.

Gropp, R. and J. Vesala. 2004. Deposit insurance, moral hazard, and market monitoring. *Review of Finance* 8: 571–602.

Gropp, R., J. Vesala, and G. Vulpes. 2006. Equity and bond market signals as leading indicators of bank fragility. *Journal of Money, Credit and Banking* 38: 399–428.

Gunther, J. W., M. E. Levonian, and R. R. Moore. 2001. Can the stock market tell bank supervisors anything they don't already know? Federal Reserve Bank of Dallas Economic and Financial Review (2nd Quarter), 2–9.

Hall, J. R., T. B. King, A. P. Meyer, and M. D. Vaughan. 2002. What can bank supervisors learn from equity markets? A comparison of the factors affecting market-based risk measures and BOPEC scores. Federal Reserve Bank of Saint Louis Working Paper No.6.

Hellmann, T., K. Murdock, and J. Stiglitz. 2000. Liberalization, moral hazard in banking and prudential regulation: Are capital requirements enough? *American Economic Review* 90: 147–65.

Herring, R. J. 2004. The subordinated debt alternative to Basel II. *Journal of Financial Stability* 1: 137–55.

Hovakimian, A., and E. Kane. 2000. Effectiveness of capital regulation at US commercial banks, 1985 to 1994. *Journal of Finance* 55: 451–68.

Igan, D., and M. Pinheiro. 2010. Exposure to real estate in bank portfolios. *Journal of Real Estate Research* 32: 47–74.

Jahankhani, A., and M. J. Jr. Lynge. 1980. Commercial bank financial policies and their impact on market-determined measures of risk. *Journal of Bank Research*. 11: 169–78.

Keeley, M. C. 1990. Deposit insurance, risk and market power in banking. *American Economic Review* 80: 1183–200.

Keeley, M. C., and M. T. Furlong. 1990. A re-examination of the mean-variance analysis of bank capital regulation. *Journal of Banking and Finance* 14: 69–84.

Kim, D., and A. M. Santomero. 1988. Risk in banking and capital regulation. *Journal of Finance* 43: 1219–33.

Koehn, M., and A. M. Santomero. 1980. Regulation of bank capital and portfolio risk. *Journal of Finance*, 35: 1235–44.

Konishi, M., and Y. Yasuda. 2004. Factors affecting bank risk taking: Evidence from Japan. *Journal of Banking and Finance* 28: 215–32.

Krainer, J., and J. A. Lopez. 2004. Incorporating equity market information into supervisory monitoring models. *Journal of Money, Credit and Banking* 36: 1043–67.

Matutes, C., and X. Vives. 1995. Imperfect competition, risk taking, and regulation in banking *European Economic Review.* 44: 1–34.

Merton, R. C. 1974. On the pricing of corporate debt: The risk structure of interest rates. *Journal of Finance* 29: 449–70.

Penas, M.F., and H. Unal. 2004. Gains in bank mergers: Evidence from the bond market. *Journal of Financial Economics* 74: 149–79.

Rochet, J. C. 1992. Capital requirements and the behavior of commercial banks. *European Economic Review* 36: 1137–78.

Ronn, E., and A. Verma. 1986. Pricing risk-adjusted deposit insurance: An option-based model. *Journal of Finance* 41: 871–95.

Salas, V., and J. Saurina. 2003. Deregulation, market power and risk behavior in Spanish banks. *European Economic Review* 47: 1061–75.

Saunders, A., and B. Wilson. 2001. An analysis of bank charter value and its risk constraining incentives. *Journal of Financial Services Research* 192: 185–95.

Saunders, A., E. Strock, and N. Travlos. 1990. Ownership structure, deregulation and bank risk-taking. *Journal of Finance* 45: 643–54.

Schwert, G. W. 1990. Stock market volatility. *Financial Analysts Journal* 46: 23–34.

Sironi, A. 2003. Testing for market discipline in the European banking industry: Evidence from subordinated debt issues. *Journal of Money, Credit and Banking* 35: 443–72.

Staikouras, C. K., and A. Koustsomanoli-Fillipaki. 2006. Competition and concentration in the new European banking landscape. *European Financial Management* 12: 443–82.

Stiroh, K. J. 2006. New evidence on the determinants of bank risk. *Journal of Financial Services Research* 30: 237–63.

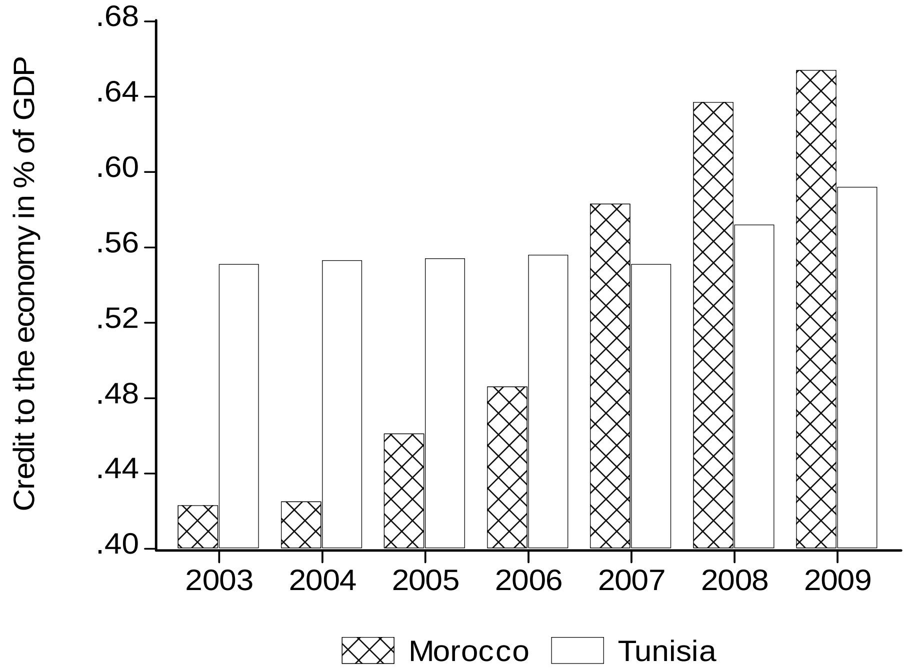
Vassalou, M., and Y. Xing. 2004. Default risk in equity return. *Journal of Finance* 59: 831–868.

Wagster, J. D. 1996. Impact of 1988 Basel Accord on international banks. *Journal of Finance* 514: 1321–46.

Williamson, O. 1963. Managerial discretion and business behavior. *American Economic Review* 53: 1032–57.

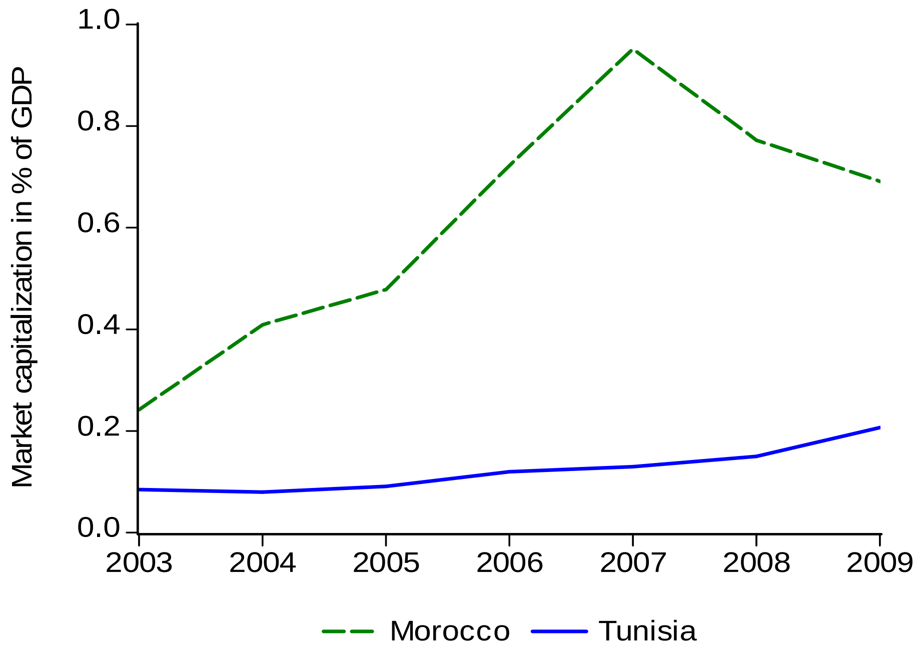
Yildirim, H. S., and G. S. Philippatos. 2003. Competition and contestability in central and Eastern European banking markets. *Managerial Finance* 33: 195–209.

Figure 1: Credit to the Economy in Percent of GDP, 2003-2009



Sources: International Financial Statistics and World Economic Outlook

Figure 2: Market Capitalization in Percent of GDP, 2003-2009



Sources: Central Bank of Tunisia and Bank Al-Maghrib

Table 1: Financial Soundness Indicators, Average Levels for the Period 2003-2009 (%)

	Tunisia	Morocco	MENA[5]
Regulatory capital to risk-weighted assets	11.54	11.06	15.77
Non-performing loans to total loans	19.19	12.01	10.10
Provisions to non-performing loans	50.47	68.16	83.13
Return on assets	0.74	0.89	1.60
Return on equity	7.90	12.41	15.93

Source: Global financial stability report of April 2010

Table 2: Descriptive Statistics, 2003-2009

	Mean	Median	Max.	Min.	Std. Dev.
Market-based risk measures					
Systematic risk, β	0.788	0.790	1.820	0.060	0.353
Idiosyncratic risk, σ_e^2	0.041	0.035	0.171	0.006	0.032
Total risk, σ^2	0.057	0.047	0.215	0.010	0.038
Distance-to-default, DD	7.825	7.180	25.728	2.929	3.794
CAMEL ratios					
Capital to assets ratio, CAR	0.087	0.085	0.174	-0.010	0.030
Non-performing loans to total loans, NPL	0.184	0.149	0.662	0.006	0.143
Provisions to non-performing loans, $PROV$	0.639	0.666	1.040	0.175	0.180
Cost-to-income ratio, CIR	0.539	0.520	1.141	0.253	0.165
Return on assets, ROA	0.007	0.009	0.029	-0.106	0.015
Return on equity, ROE	0.096	0.107	0.297	-0.106	0.062
Liquid assets to total assets, LIQ	0.291	0.215	0.935	0.025	0.223
Interbank position to total assets, INT	0.073	0.089	0.302	-0.634	0.183
Control variables					
Total assets in millions of Tunisian Dinars, TA	6261	3926	37456	1033	6685
Market-to-book of assets, MBA	1.061	1.045	1.385	0.927	0.090
Market-to-book of equity, MBE	1.682	1.460	6.009	-7.789	1.495
Off-balance sheet items to total assets, OBS	0.261	0.245	0.599	0.126	0.089
Share of non-interest income in total income, NIS	0.242	0.219	0.522	0.126	0.083
Turnover, TU	0.112	0.056	0.698	0.002	0.146

5 The countries included are: Saudi Arabia, Egypt, United Arab Emirates, Jordan, Kuwait, Lebanon, Morocco, Oman and Tunisia.

Table 3: Systematic Risk Regressions

This table presents fixed effects estimation of the model (1) using market beta as dependent variable and accounting ratios representing bank financial condition and other control variables as independent variables. The panel covers 105 bank-years in the sample period 2003-2009.

β is estimated from the market model. CAR is the capital to assets ratio. NPL is non-performing loans to total loans. $PROV$ is provisions to non-performing loans. CIR is cost-to-income ratio. ROA is return on assets. ROE is return on equity. LIQ is liquid assets to total assets. INT is interbank position to total assets. LTA is the log of total assets. MBA is the market-to-book of assets. MBE is the market-to-book of equity. OBS is off-balance sheet items to total assets. NIS is the share of non-interest income in total income. LTU is the log of bank stock turnover.

	***Market beta*, β**							
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
CAR	-8.348*	-13.670*	-7.956*	-11.490*	-10.407*	-16.858*	-9.780*	-14.274*
	(-2.904)	(-5.032)	(-2.950)	(-5.025)	(-2.797)	(-4.122)	(-2.882)	(-4.081)
CAR^2	78.388*	104.846*	72.390*	90.176*	85.480*	122.255*	78.197*	104.532*
	(3.927)	(5.169)	(4.267)	(5.748)	(3.796)	(4.695)	(4.032)	(4.908)
NPL	-0.543	-0.116	-0.508	-0.237				
	(-0.771)	(-0.186)	(-0.734)	(-0.366)				
$PROV$					-0.321***	-0.466***	-0.276	-0.392
					(-1.838)	(-1.846)	(-1.468)	(-1.539)
CIR	-0.796**	-0.842**	-0.744**	-0.773**	-1.067*	-0.994*	-0.986*	-0.944*
	(-2.295)	(-2.399)	(-2.300)	(-2.397)	(-3.849)	(-3.619)	(-3.640)	(-3.551)
ROA	-0.656		-0.151		0.252		0.697	
	(-0.432)		(-0.095)		(0.157)		(0.393)	
ROE		0.062		0.028		0.268		0.238
		(0.143)		(0.061)		(0.555)		(0.457)
LIQ	0.506	0.553***			0.617**	0.648**		
	(1.576)	(1.906)			(2.374)	(2.538)		
INT			0.898***	0.940***			0.937**	0.935**
			(1.774)	(1.988)			(2.055)	(2.259)
LTA	0.289***	0.359**	0.277***	0.324***	0.376*	0.416*	0.354*	0.381*
	(1.815)	(2.033)	(1.699)	(1.788)	(3.112)	(3.032)	(3.045)	(2.827)
MBA	0.745**		0.559		0.814**		0.608***	
	(2.152)		(1.503)		(2.379)		(1.668)	
MBE		0.033**		0.025***		0.042**		0.034***
		(2.578)		(1.886)		(2.229)		(1.919)
OBS	-0.303	-0.215	-0.465	-0.410	-0.246	-0.219	-0.445	-0.433
	(-0.697)	(-0.534)	(-1.281)	(-1.207)	(-0.507)	(-0.476)	(-1.101)	(-1.151)
NIS	0.020	-0.027	-0.319	-0.359	-0.093	-0.040	-0.433	-0.391
	(0.068)	(-0.089)	(-0.917)	(-1.004)	(-0.266)	(-0.113)	(-1.054)	(-0.942)
LTU	0.026	0.027	0.025	0.027	0.023	0.020	0.024	0.022
	(1.274)	(1.211)	(1.096)	(1.070)	(1.065)	(0.827)	(0.966)	(0.793)
R^2	0.736	0.734	0.746	0.745	0.738	0.741	0.747	0.749

Notes: *, ** and *** indicate values significantly different from zero at the 1, 5 and 10 percent levels, respectively.

Table 4: Idiosyncratic Risk Regressions

This table presents fixed effects estimation of the model (1) using idiosyncratic risk component as dependent variable and accounting ratios representing bank financial condition and other control variables as independent variables. The panel covers 105 bank-years in the sample period 2003-2009.

σ_e^2 is the variance of bank stock residual returns estimated from the market model. CAR is the capital to assets ratio. NPL is non-performing loans to total loans. $PROV$ is provisions to non-performing loans. CIR is cost-to-income ratio. ROA is return on assets. ROE is return on equity. LIQ is liquid assets to total assets. INT is interbank position to total assets. LTA is the log of total assets. MBA is the market-to-book of assets. MBE is the market-to-book of equity. OBS is off-balance sheet items to total assets. NIS is the share of non-interest income in total income. LTU is the log of bank stock turnover.

	Idiosyncratic risk, σ_e^2							
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
CAR	0.332	-0.129	0.365	0.079	-0.035	-0.621***	0.022	-0.367
	(1.154)	(-0.521)	(1.222)	(0.271)	(-0.131)	(-1.856)	(0.079)	(-0.984)
CAR^2	-0.374	1.582	-0.889	0.178	1.035	4.129***	0.334	2.367
	(-0.189)	(0.771)	(-0.438)	(0.080)	(0.543)	(1.803)	(0.166)	(0.955)
NPL	-0.076	-0.046	-0.076	-0.059				
	(-0.843)	(-0.509)	(-0.904)	(-0.721)				
$PROV$					-0.061**	-0.069*	-0.055**	-0.061**
					(-2.509)	(-2.781)	(-2.293)	(-2.395)
CIR	-0.075***	-0.075***	-0.069***	-0.067	-0.118*	-0.107*	-0.110*	-0.101*
	(-1.718)	(-1.658)	(-1.702)	(-1.603)	(-4.319)	(-4.568)	(-4.727)	(-4.912)
ROA	-0.282***		-0.244		-0.145		-0.108	
	(-1.760)		(-1.509)		(-1.097)		(-0.809)	
ROE		-0.020		-0.022		0.015		0.014
		(-0.659)		(-0.728)		(0.654)		(0.579)
LIQ	0.056**	0.060*			0.075*	0.076*		
	(2.213)	(2.815)			(3.683)	(3.853)		
INT			0.079*	0.089*			0.085*	0.089*
			(3.809)	(5.335)			(5.039)	(4.698)
LTA	0.039**	0.046*	0.037**	0.043*	0.053*	0.057*	0.050*	0.053*
	(2.290)	(2.993)	(2.276)	(2.836)	(4.721)	(5.822)	(4.740)	(5.564)
MBA	0.049**		0.031		0.061*		0.040***	
	(2.514)		(1.249)		(3.840)		(1.778)	
MBE		0.001		-0.000		0.002		0.001
		(0.388)		(-0.195)		(1.331)		(0.710)
OBS	-0.102**	-0.095**	-0.121*	-0.116*	-0.094*	-0.093*	-0.118*	-0.118*
	(-2.444)	(-2.469)	(-3.451)	(-3.527)	(-2.908)	(-3.157)	(-4.024)	(-4.321)
NIS	0.073	0.069	0.045	0.038	0.057	0.061***	0.028	0.028
	(1.363)	(1.316)	(0.923)	(0.845)	(1.644)	(1.938)	(0.938)	(1.063)
LTU	0.001	0.001	0.001	0.001	0.000	0.000	0.000	0.000
	(1.211)	(1.243)	(1.022)	(0.997)	(0.427)	(0.033)	(0.571)	(0.234)
$\mathbf{R^2}$	0.707	0.699	0.713	0.709	0.719	0.716	0.722	0.721

Notes: *, ** and *** indicate values significantly different from zero at the 1, 5 and 10 percent levels, respectively.

Table 5: Total Risk Regressions

This table presents fixed effects estimation of the model (1) using total risk as dependent variable and accounting ratios representing bank financial condition and other control variables as independent variables. The panel covers 105 bank-years in the sample period 2003-2009.

σ^2 is the variance of bank stock returns. CAR is the capital to assets ratio. NPL is non-performing loans to total loans. $PROV$ is provisions to non-performing loans. CIR is cost-to-income ratio. ROA is return on assets. ROE is return on equity. LIQ is liquid assets to total assets. INT is interbank position to total assets. LTA is the log of total assets. MBA is the market-to-book of assets. MBE is the market-to-book of equity. OBS is off-balance sheet items to total assets. NIS is the share of non-interest income in total income. LTU is the log of bank stock turnover.

	Total risk, σ^2							
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
CAR	-0.061	-0.643**	-0.027	-0.444	-0.478	-1.232*	0.423	-0.999**
	(-0.227)	(-2.490)	(-0.108)	(-1.595)	(-1.451)	(-2.918)	(-1.371)	(-2.275)
CAR^2	2.572***	5.218*	2.051	3.884**	4.239*	8.390*	3.600*	6.793*
	(1.668)	(3.002)	(1.497)	(2.236)	(2.785)	(3.853)	(2.661)	(3.078)
NPL	-0.076	-0.031	-0.069	-0.038				
	(-0.737)	(-0.301)	(-0.712)	(-0.400)				
$PROV$					-0.071**	-0.085**	-0.068**	-0.078**
					(-2.235)	(-2.363)	(-2.113)	(-2.147)
CIR	-0.104***	-0.109***	-0.101***	-0.104***	-0.150*	-0.140*	-0.143*	-0.136*
	(-1.840)	(-1.924)	(-1.835)	(-1.919)	(-4.506)	(-5.043)	(-4.571)	(-5.171)
ROA	-0.259		-0.211		-0.117		-0.078	
	(-1.430)		(-1.142)		(-0.689)		(-0.438)	
ROE		-0.020		-0.024		0.019		0.016
		(-0.589)		(-0.683)		(0.608)		(0.473)
LIQ	0.032	0.038			0.053**	0.057**		
	(1.226)	(1.552)			(2.613)	(2.600)		
INT			0.076*	0.086*			0.082*	0.084*
			(2.875)	(3.826)			(4.006)	(4.203)
LTA	0.059*	0.066*	0.058*	0.063*	0.075*	0.077*	0.073*	0.075*
	(3.196)	(3.514)	(3.320)	(3.447)	(6.132)	(6.434)	(6.451)	(6.284)
MBA	0.056**		0.041		0.069*		0.051***	
	(2.251)		(1.378)		(3.356)		(1.893)	
MBE		0.002		-0.001		0.004***		0.003
		(1.136)		(0.708)		(1.724)		(1.293)
OBS	-0.107**	-0.097***	-0.117**	-0.111**	-0.099**	-0.097**	-0.116*	-0.116*
	(-2.055)	(-1.971)	(-2.587)	(-2.553)	(-2.206)	(-2.314)	(-2.740)	(-2.949)
NIS	0.051	0.045	0.020	0.013	0.035	0.041	0.005	0.009
	(0.791)	(0.704)	(0.372)	(0.248)	(0.776)	(0.959)	(0.141)	(0.253)
LTU	0.001	0.001	0.001	0.001	0.000	0.000	0.000	0.000
	(1.136)	(1.039)	(0.852)	(0.835)	(0.368)	(0.013)	(0.341)	(0.083)
$\mathbf{R^2}$	0.700	0.696	0.707	0.705	0.712	0.714	0.718	0.720

Notes: *, ** and *** indicate values significantly different from zero at the 1, 5 and 10 percent levels, respectively.

Table 6: Distance-to-Default Regressions

This table presents fixed effects estimation of the model (1) using distance-to-default as dependent variable and accounting ratios representing bank financial condition and other control variables as independent variables. The panel covers 105 bank-years in the sample period 2003-2009.

DD is the distance-to-default calculated using the structural model of Merton (1974). CAR is the capital to assets ratio. NPL is non-performing loans to total loans. $PROV$ is provisions to non-performing loans. CIR is cost-to-income ratio. ROA is return on assets. ROE is return on equity. LIQ is liquid assets to total assets. INT is interbank position to total assets. LTA is the log of total assets. MBA is the market-to-book of assets. MBE is the market-to-book of equity. OBS is off-balance sheet items to total assets. NIS is the share of non-interest income in total income. LTU is the log of bank stock turnover.

	Distance-to-default, DD							
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
CAR	-12.929 (-0.454)	78.633* (3.516)	-13.804 (-0.445)	68.255** (2.209)	-13.104 (-0.371)	71.872 (1.628)	-15.464 (-0.408)	58.002 (1.212)
CAR^2	-202.459 (-1.403)	-618.355* (-3.919)	-187.445 (-1.136)	-547.455* (-2.734)	-152.454 (-1.167)	-582.010* (-2.937)	-120.792 (-0.795)	-483.493** (-2.192)
NPL	7.167 (1.044)	-0.361 (-0.054)	8.193 (1.350)	1.254 (0.208)				
$PROV$					-1.468 (-0.357)	-0.978 (-0.194)	-1.949 (-0.471)	-1.612 (-0.318)
CIR	13.439* (3.019)	14.242* (3.123)	12.872* (3.077)	13.450* (3.166)	15.291* (6.424)	13.885* (5.116)	14.877* (6.151)	13.486* (4.987)
ROA	41.685** (2.264)		42.014** (2.276)		32.848*** (1.833)		31.863*** (1.732)	
ROE		1.918 (0.423)		1.696 (0.375)		2.369 (0.398)		2.191 (0.362)
LIQ	-5.151*** (-1.958)	-6.117** (-2.223)			-5.469*** (-1.787)	-5.908*** (-1.977)		
INT			-2.813 (-0.794)	-4.474 (-1.164)			-3.223 (-0.851)	-4.519 (-1.193)
LTA	-3.676** (-2.501)	-4.818* (-3.200)	-3.495** (-2.378)	-4.521* (-2.927)	-4.108* (-3.304)	-4.691* (-3.909)	-3.946* (-3.139)	-4.449* (-3.756)
MBA	-8.252** (-2.600)		-7.423** (-2.121)		-8.402** (-2.401)		-7.469*** (-1.968)	
MBE		-0.287*** (-1.734)		-0.221 (-1.210)		-0.267 (-1.209)		-0.208 (-0.943)
OBS	-1.369 (-0.381)	-2.717 (-0.826)	0.467 (0.149)	-0.434 (-0.150)	-2.093 (-0.619)	-2.713 (-0.880)	-0.257 (-0.091)	-0.680 (-0.265)
NIS	-0.776 (-0.164)	0.216 (0.050)	-0.258 (-0.067)	1.324 (0.374)	0.770 (0.186)	0.164 (0.048)	1.656 (0.455)	1.659 (0.516)
LTU	-0.503*** (-1.916)	-0.519*** (-1.860)	-0.523*** (-1.815)	-0.531*** (-1.737)	-0.541*** (-1.814)	-0.535 (-1.509)	-0.569*** (-1.794)	-0.560 (-1.485)
R^2	0.632	0.621	0.629	0.619	0.631	0.622	0.628	0.620

Notes: *, ** and *** indicate values significantly different from zero at the 1, 5 and 10 percent levels, respectively.