THE IMPACT OF COMPANY-SPECIFIC AND EXTERNAL FACTORS ON CORPORATE RISK TAKING: THE CASE OF EGYPTIAN INSURANCE COMPANIES

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Abstract

Using a two-way panel regression analysis with fixed and random effects and the generalized method of moment(GMM), we investigate the impact of both firm-specific and external factors on the risk taking of Egyptian insurance companies. We use hand-collected data of Egyptian insurance companies over the period from 2006 to 2011 to estimate the relationship between total and systematic risks as risk measures and the independent variables. Following Eling and Mark (2011) the extent of risk taking is quantified through variations in stock prices and these are explained by firm-specific and external factors. We find that differences in company size, interest rate level and economic development affect variations in stock prices. The analysis also highlights differences between the life and non-life insurers, with the non-life insurers exhibiting a higher level of risk (market and premium) and board independence. The pattern of results are qualitatively the same for non-life insurers but different for life insurers when we use GMM method.

Keywords: Risk Management, Corporate Risk Taking, Corporate Governance, Insurance Industry, Egypt

JEL Classification: G34, D21, D23

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Introduction

Corporate governance and measuring corporate risk taking are an important effort to ensure accountability and responsibility of every part of the organization and has been identified to mean different things to different people. It can be broadly classified into internal and external mechanisms (Denis and McConnell, 2003; Sarkar et al., 2008). Internal mechanisms or firm-specific factors are those related to board structure, management and executive compensation and ownership structure. These mechanisms are the core of corporate governance, in particular the efficiency of board, which has played a significant role in this regard due to its characteristics. External mechanisms relate to the market for corporate control and disclosure requirements, are chosen to proxy the environment in which insurers operate, i.e. the takeover market and the shareholder protection offered by the legal system in which the business operates.

The importance of the factors associated with corporate risk taking in general and insurance companies in particular has attracted considerable attention in both the economic and financial literature and is widely believed to play an important role in corporate governance, particularly in monitoring top management. This influence of risk management and board of directors on corporate risk taking and firm performance has been discussed for a number of years, but mainly in the United States and European business context.

There are different ways to measure the insurance company risk taking, such as determination of risk-based capital via cash flow simulations (Cummins et al., 1999) or an analysis of factors explaining insurance company financial health (Chen and Wong, 2004). A number of methodologies have been adopted in this context, including multiple discriminant analysis (Carson

and Hoyt, 1995), neural networks (Brockett et al., 1994), and cascaded logistic regressions (Baranoff et al., 1999). Regulatory authorities assess insurer risk taking by performing stress tests or deriving solvency ratios. It is worth noting that a significant body of research involves identifying the parameters relevant for company failure (see, BarNiv and McDonald, 1992; Ohlson, 1980; Trieschmann and Pinches, 1973).

As most of the empirical evidence concerns developed markets such as the UK and US stock markets, it is necessary to investigate this issue for other markets to check the robustness of the US and UK results. Also, academics and policy makers in both developed and emerging markets are increasingly grappling with this issue as they seek to avoid or reduce the relevant level of risk which in turn will reform their governance mechanisms.

Despite the importance of corporate risk taking in emerging countries, a very few studies (see Adenikinju and Ayorinde (2001) and Sanda et al. (2005)) have been made on the emerging insurance business environment. This is because, firstly, developing countries have mainly chosen a state-sponsored route of development with a relatively insignificant role of the private corporate sector which made corporate finance not an interesting area of research for many decades. Secondly, developing countries suffer from the lack of data, since data on relevant variables are often not available. Thirdly, the analysis of the Egyptian market is of particular interest for three main reasons:(i) this market has been the focus of little research despite its importance (one of the largest markets in Africa); (ii) the Egyptian economy is a small open economy and it is likely that international factors play an important role in explaining risk taking decisions and variations in stock prices; and (iii) given the great Egyptian revolution, it is now the appropriate time for Egyptian companies seeking to reduce the level of risk and reform their governance mechanisms. The Egyptian insurance industry undoubtedly faced the most difficult period during the Egyptian revolution of 2011, as reflected in the number of individual policies seen in Table 1. These developments raise many questions concerning the nature of risk taking and the way of quantifying this type of risk in Egyptian insurance companies.

Table 1. Number of policies and sums assured (in thousands) in Egyptian Insurance Companies

	2006	*2007*	*2008*	*2009*	*2010*	*2011*
Number of policies:						
Individual	147032	176165	157464	158146	180363	158883
Group	515	536	528	431	482	485
Sums Assured:						
Individual	5883542	10139158	9744821	11106490	13598856	11131402
Group	23619430	27740740	44594760	49741142	45969718	62443244

Source: (Egyptian Financial Supervisory Authority EFSA, 2011)

This controversy, besides the lack of research in developing countries in general and Egypt in particular, motivates this study on the financing practices of the Egyptian insurance companies, where answers for many questions are still not clearly developed. Hence, the study intends to reduce the knowledge gap by investigating the corporate risk taking in large Egyptian insurance firms and analyse whether firm-specific and external factors have an impact on the level of risk, as measured by total and systematic risks.

Equipped with the previous analysis, this paper aims to examine the Egyptian evidence on the relationship between the firm-specific and external factors and corporate risk taking using data of Egyptian insurance companies between 2006 and 2011. Company-specific characteristics are credit risk, market risk, liquidity risk, premium risk, reserve risk, leverage and firm size, while external factors are growth rate of the gross domestic product (GDP growth) and an average short-term (three month) interest rate. Further, we extend our analysis to examine the relationship between the board characteristics and firm risk taking of Egyptian insurance companies. In essence, we are asking whether board characteristics, namely board independence and board meetings, are better able to explain the data of corporate risk taking. The idea is to identify the amount of risk taking through variations in stock prices.

The analysis in this paper is innovative in several ways. It is, to our knowledge, the first attempt to analyze a set of different internal and external risk drivers and their relationship to corporate risk taking in emerging markets. Furthermore, this is one of the first papers that use a dataset of Egyptian insurers to evaluate firm and environmental factors at an international level.

The remainder of the paper is set out as follows. Section 2 is a brief literature review on corporate risk drivers. Section 3 provides details of the methodology and models. Section 4 presents the data and empirical results and section 5 concludes.

Literature Review

The extent of risk taking is quantified through variations in stock prices and these are explained by firm-specific and external factors that proxy the environment in which the insurers are active. Indeed, there is a great deal of research that documents the correlation between risk drivers and corporate risk taking.

One strand of research on risk taking and variations in asset pricing (see, *inter alia* Hermalin and Weisbach (1991); Goodstein et al. (1994); Weir and Laing (1999); Adenikinju and Ayorinde (2001); Ferris et al. (2003); Sanda et al. (2005)) has investigated the internal factors discussed in academia and practice as potential drivers of risk associated with insurance companies. Internal factors include the company's management, organization, and business policy. Here, Ashby et al. (2003) emphasize that insurance company failures result from a combination of different causes and effects. Yet, the root of most failures is poor management. It is not clear whether skillful managers engage in more or less risk taking and do have a sense of responsibility with a long-term orientation toward business success (in contrast to a short-term bonus orientation). Skills would then be a combination of entrepreneurial competence and managerial responsibility, which is difficult to quantify. In this line Baranoff and Sager (2002) investigate the relation between capital and risk in the Life insurance industry in the period after the adoption of life risk-based capital (RBC) regulation over the period from 1993 to 1997 using Autoregressive two-stage least squares. They find that for life insurers the relation between capital and asset risk is positive and significant, while the relation between capital and product risk is negative. The contrast between the positive relation of capital to asset risk and the negative relation of capital to product risk underscore the importance of distinguishing these two components of risk.

Using the longitudinal factor analysis, Baranoff et al. (2007) examine the capital structure in the life insurance industry over the period from 1994 through 2000 and compare the effects of two different perspectives of asset risk represented by two different proxies and two size segments of the industry in two separate periods. They find that regulatory asset risk (RAR) and opportunity asset risk (OAR) are not equivalent proxies for asset risks and the large life insurers and small life insurers differ substantially in the importance of the two asset risks exert strongly positive and approximately equal effects on the capital ratio. But for the smaller life insurers, the RAR faddist is insignificant, whereas the OAR remains strong and positive as important in the prebull market period as for large insurers.

Low (2009) investigates the impact of equity-based compensation on managerial risk-taking behavior using both the abnormal returns and univariate analyses over the period from 1990 to 2000. He finds strong empirical evidence on the impact of equity-based compensation on managerial risk-taking, which are listed as (i) equity-based compensation affects managers' risk-taking behavior, this risk reduction is concentrated among firms with low managerial equity-based incentives, in particular firms with low chief executive officer portfolio sensitivity to stock return volatility. Further, the risk reduction is value-destroying; (ii) firms respond to the increased protection accorded by the regime shift by providing managers with greater incentives for risk-taking. In the same vein, Lee et al. (1997) examine the change in property-liability insurers' risk taking around enactments of state guaranty fund laws using t-test and Wilcoxon signed-ranks test in addition to the two-sample t-test and the mann-whitney test. They find an evidence supportive that the risk of insurer' asset portfolios increases following enactment, but this increase in risk is significant only for stock insurers. Their evidence of increased risk-taking following guaranty-fund adoptions suggests that the way these funds are organized creates counter productive investment incentives, while the evidence on changes in risk-taking helps resolve statistical problems that have been troublesome for studies of bank deposit insurance.

In the same line, Cummins and Sommer (1996) investigate the capital and portfolio risk decisions of property-liability insurance firms using OLS over the period from 1979 to 1990. They find supportive evidence that managerial incentives play a role in determining capital and risk in insurance markets, implying significant implications for insurance solvency regulation.

Another factor thought to have an influence on risk taking in insurance companies is financial distress and insolvency. Here, Sharpe and Stadnik (2007) test a statistical model to identify Australian general insurers experiencing financial distress using multiple discriminant analysis and logit and probit analysis over the period from 1998 to 2001. They find that insurers are more likely to be distressed. They are generally small and have low return on assets and cession ratios. Relative to holdings of liquid assets, they have high levels of property and reinsurance assets, they also write more overseas business, and less motor insurance and long-tailed insurance lines, relative to fire and household insurance.

Following Bar and McDonald (1992) and Trieschmann and Pinches (1973), Carson and Hoyt (1995) investigate the Life insurer financial distress. For insurance companies adopting three empirical models; namely recursive partitioning,

logistic regression, and multiple discriminant analysis, they find that surplus and leverage measures are strong indicators of insurer financial strength. However, no evidence is found for a strong relationship between state minimum capital requirements and insolvency.

Baranoff et al. (1999) investigate whether segmentation of the life/health insurance industry by product specially or size can improve solvency models. They find that segmentation improves upon whole industry models specialized by product line and by size are better than unitary models. Similarly, Eling et al. (2007) outline the specifics of solvency, to provide a basic understanding of solvency and also encourage additional research on best practices for successful risk-based capital standards. They indicate that insurance supervision in the EU is undergoing significant change as the European commission works toward harmonization across member countries as well as implementation of standards that are appropriate for a rapidly changing market place. Eling and Schumacher (2007) analyze the situation in which the fund under consideration represents the entire risky investment using the Hotelling-Pabst statistic. They compare the Sharpe ratio with twelve other performance measures. They find that despite significant deviations of hedge fund returns from a normal distribution, the comparison of the Sharpe ratio to the other performance measures results in virtually identical rank ordering across hedge funds.

Post et al. (2007) provide an overview and evaluation of the various international financial reporting standards (IFRS) arguments that concern the changes IFRS is likely to cause in the European insurance industry and indicate that the effects of IFRS are exaggerated and the main area of IFRS impact on the European insurance industry is likely to be on insurance product design. Also, Kim et al. (1995) employ dynamic statistical methodology, particularly event history analysis, to examine insurer insolvencies and factors associated with these insolvencies using multivariate discriminant analysis and binary response regression models. They indicate that examination of various factors associated with property-liability and life insurer insolvencies reveals several statistically significant relationships. For property-liability insurers, they find statistically significant factors with consistent signs in various versions of the exponential model including organizational age, premium growth, investment yields, underwriting results, expense ratios, loss reserve expousure, and realized and unrealized capital gains. For life insurers, statistically significant factors with consistent signs in various versions of the exponential model included organizational age, investment yields, expense ratios real estate holdings, income performance, and realized and unrealized capital gains. Klumpes (2004) investigates the performance benchmarking in the U.K life insurance industry using regressions analysis. He finds that performance benchmarking is applied to measure the profit and cost efficiency of UK life insurance products that are required by 'polarization' regulations to be distributed through either independent financial advisers.

Klumpes (2005) examines the economic and organizational factors affecting the level of risk taking and managerial propensity using three alternative measures: traditional accounting-based measures, economic value added(EVA) and multi period, actuarial cash flow based measures such as embedded value(EV) using univariate and multivariate tests and logistic regression. He indicates that life insurance CEOs are more likely to use EV for strategic management planning and control purposes, and that this preference is strongly conditioned by the firm's ownership structure. These results support the managerial incentive hypothesis, after controlling for the effects of other organizational structural and behavioral variables that potentially influence the level of risk and choice of financial performance measure.

Harrington et al. (2008) analyze whether the 1994-1999 'soft' market in medical malpractice insurance led some firms to underprice, grow rapidly, and subsequently experience upward revisions in loss forecasts 'loss development' which could have aggravated subsequent market 'crises'. The results indicate a positive relation between loss development and premium growth among growing firms. Underpricing was likely more prevalent among non-specialist malpractice insurers. Elston and Goldberg (2003) examine the factors affecting the level of executive compensation in Germany, with particular emphasis on the agency problem created by the separation of management and ownership using OLS. They find that, similar to US firms, German firms also have agency problems caused by the separation of ownership from control, with ownership dispersion leading to higher compensation.

Eling and Schmeiser (2010) investigate the impact of crisis on insurance companies and to derive consequences for risk management and insurance regulation. They indicate that the importance of outlining potential consequences seen from the crisis and the consequences derived believed to have sufficient evidence on the level of risk taking. Chen and Wong (2004) test the solvency status of individual insurers in the four Asian economies and to assess the effect of Asian financial crisis on the financial health of the insurance companies. They find that the factors that significantly affect general insurers, financial health in Asian economic are firm size, investment performance, liquidity ratio, surplus growth, combine ratio, and operating margin. While the

factors that significantly affect life insurers, financial health are firm size, change in product mix, but the last three factors are more applicable to Japan. Moreover, the financial health of insurance companies in Singapore seems to be significantly weakened by the Asian financial crisis.

Chen et al. (2006) examine the impact of option-based compensation on several market-based measures of bank risk: total, systematic, idiosyncratic and interest rate risks. They find a robust across alternative risk measures, statistical methodologies, and model specifications. Overall, the results support a management risk-taking hypothesis over a managerial risk aversion hypothesis . The results also have important implications for regulators in monitoring the risk levels of banks. In the same vein, Grace (2004) examines several hypotheses about the structure and level of compensation for property-liability chief executive officers (CEOs) using OLS. He finds that corporate governance structures, managers' stock ownership, and regulatory attention are not adequate to prevent CEOs from receiving compensation levels in excess of what economic factors predict. Contrary to findings in prior studies, there is little evidence that use of incentive compensation paid increases with insurer investment opportunities, as traditional measured.

Another strand has investigated external factors of risk taking, which are those cannot be influenced by the company. These are divided into general economic conditions, institutional intervention, and other risk factors. Factors for economic conditions and institutional intervention can be taken from the underwriting cycle literature (see, Cummins and Outreville, 1987; Lamm-Tennant and Weiss, 1997). In this regards, variations in interest rates should play an important role in determining insurer business risk, as premiums are calculated as discounted future claims or benefits. This argument is especially relevant for life insurers and long-tail casualty business. Here, Grace and Hotchkiss (1995) and Chen et al. (1999) analyse underwriting cycles and find that prices and underwriting profits are related to changes in the economic environment as measured by changes in real prices (inflation) or real GDP. Catastrophes are accompanied by an unusual and massive impact on claims and these might affect the business risk of insurance companies. With regard to corporate governance, the degree of regulation and disclosure requirements are two important external risk drivers. The higher the degree of regulation (such as price, product, or capital regulation), the lower is the competition in an industry. A low degree of competition without differentiation in products and prices might lower risk, but it also has a dampening effect on innovation. It is worth noting that higher disclosure requirements reduce information asymmetries between stockholders and managers, leading to more accurate estimates of future earnings and firm value. The switch from local generally accepted accounting principles (GAAP) to international financial reporting standards (IFRS) is an aspect in this context. The IFRS introduce more and standardized disclosure requirements, which should enhance the transparency and comparability of international insurers.

Following on from the seminal work of Fama and Jensen (1983), it has been argued that boards can be effective mechanisms to monitor top management on behalf of dispersed shareholders. Boards effectuate management appointment, dismissal, suspension and reward. Board characteristics, therefore, are relevant to corporate performance. A natural variable of interest in this case is board composition. The empirical evidence on this count is, however, mixed. Weisbach (1988) was one of the earliest to report an association of board turnover, risk taking, firm performance and the presence of outside directors. Fama (1980) argued that the viability of the board as a market-induced mechanism for low-cost internal transfer of control might be enhanced by the inclusion of outside directors. Echoing this view, Cadbury (1992) argued for more non-executive director representation on the boards of firms and the separation of the chairman and chief executive and their reflections on the level of risk taking.

In the same vein, Weisbach (1988) found that risk taking and performance measures are more highly correlated with CEO turnover for firms in which outsiders dominate the boards of directors than for those in which insiders dominate. Bhagat and Black (1999) provide evidence for a positive impact of the number of outsiders, while Hermalin and Weisbach (1991) did not uncover any robust relationship. A second variable of focus is CEO remuneration. Two important considerations assume relevance in this context. The first is the participation constraint which suggests that compensation of the CEO must be higher than the income available from alternative sources. The second is the incentive constraint, which indicates that aligning the incentives of the CEO with those of the shareholders is the easiest way to circumvent moral hazard on the part of the CEO (Jensen and Meckling, 1976; Fama , 1980).

In this line, Chen et al. (2001) examine the relation between risk and managerial ownership for a sample of life insurance companies in the United States. They find that the level of life insurance company risk is dependent on the level of managerial ownership, specifically, as the level of managerial ownership increases, the level of risk increases supporting a wealth transfer hypothesis over a risk aversion hypothesis. The findings suggest that when compensation packages encourage higher levels of managerial ownership,

manager and stockholder interest converge with regulators can control the risk-taking activities of life insurers by requiring a separation between ownership and management. Also, Cheng et al. (2011) investigate the relationship between risk taking of life-health insurers and stability of their institutional ownership. The main three findings are: (i) stable institutional ownership is associated with lower total risk of life-health insurers, supporting the prudent-man law hypothesis; (ii) when investors are sorted in terms of stringency of the prudent-man restrictions, their negative effect on risk holds for all, except insurance companies, as owners of life health insurers; and (iii) large institutional owners do not raise the riskiness of the investee-firms as proposed by the large shareholder hypothesis.

Cole et al. (2011) test the alternative theories regarding the relation between separation of ownership and management and risk taking by examining the implications of ownership structure for firm's risk taking behavior in the U.S. property-liability insurance industry, to impact firm risk. They find that each ownership structure is significantly different from every other ownership structure in terms of risk. Also, Core et al. (1999) examine the association between executive pay and a comprehensive set of board and ownership structure variables and find that measures of board and ownership structure explain a significant amount of cross-sectional variation in CEO (chief executive officers) compensation, after controlling for standard economic determinants of pay. Moreover, the signs of the coefficients on the board and ownership structure variables suggest that CEOs earn greater compensation when governance structures are less effective. They also find that the predicted component of compensation arising from these characteristics of board and ownership structure has significant impact on firm performance.

Mayer et al. (1997) investigate the role of outside directors in the corporate-control process by exploiting variation in ownership structure within the insurance industry. They find that firms that switch between stock and mutual charters make corresponding changes in board composition and mutuals' by laws more frequently stipulate participation by outside directors.

For growth rate as an external factor, John et al.(2008) examine the relationship between investor protection and the risk choices in corporate investment and find that corporate risk-taking and firm growth rates are positively related to the quality of investor protection.

He and Sommer (2010) investigate the implications of separation of ownership and control for board composition over a spectrum of ownership structures present in the U.S. property-liability insurance industry. They find that agency costs associated with manager-owner conflicts increase with the degree of separation of ownership and control, as greater agency costs imply a greater need for monitoring by outside directors on the board. Therefore, use of outside directors is expected to increase as the separation of ownership and control gets larger. Further, they found evidence supportive of: (i)corporate board roles, which fulfil two roles: boards play an institutional role and providing a link between the organization and its environment; (ii) boards discharge a governance role, monitoring and disciplining of inefficient management; and (iii) the strategic role, chartering the future growth path of the firm in a competitive setup.

In this line, Monks and Minow (1995) argue that board monitoring can lead to an improvement in the quality of managerial decision-making. Yet, the root of most failures is poor management. It is not clear whether skillful managers engage in more or less risk taking and do have a sense of responsibility with a long-term orientation toward business success (in contrast to a short-term bonus orientation). Skill would then be a combination of entrepreneurial competence and managerial responsibility, which are difficult to quantify.

Methodology and Models

In the following section, the research methodology is set up to estimate different specifications associated with risk drivers and firm risk taking. Based on the above analysis, the following model is employed:

$$BETA/VOL = \int[MR, CR, LR, PR, RR, LEV, SIZ, SB, BM, GDP, IR] \quad (1)$$

where the *BETA* is measured by the covariance of stock return and market return (EGX30) divided by the variance of the market return; *VOL* is the logarithmic changes of the insurer's stock price; *MR* is market risk measured by ratio of equity and real estate investments to total assets; *CR* is credit risk measured by ratio of loans and fixed-income securities to total assets; *LR* is the liquidity risk measured by ratio of cash and near-cash items and marketable securities to total assets; *PR* is the premium risk measured by the yearly net insurance premium growth *RR* is reserve risk measured by ratio of total insurance reserves to total net premiums earned;*LEV* is Leverage measured by ratio of total liabilities to shareholders equity;*SIZ* is the firm size, measured by LN(total assets); *SB* is the supervisory board compensation and measured by percentage of independent

members of the supervisory board;*BM* is board meetings measured by number of meetings held by the supervisory board; *GDP* is GDP Growth measured by the yearly growth rate of gross domestic;*IR* is the interest rate, measured by the Short term interest rate based on 3-month offered interbank rate.

To examine the relationship between risk drivers (internal and external) and corporate risk taking (systematic (Beta) and total (VOL) risks), let the risk measure be the dependent variable and the risk drivers be explanatory variables. The systematic (Beta) and total (VOL) risks and relationship model for life insurance companies is then presented as follows:

$$LBeta = \alpha + \sum_{k=1}^{9} \beta_j LINT_i + \sum_{k=10}^{11} \beta_j LEXT_i + \varepsilon_i \quad (2)$$

$$LVOL = \alpha + \sum_{k=1}^{9} \beta_j LINT_i + \sum_{k=10}^{11} \beta_j LEXT_i + \varepsilon_i \quad (3)$$

where L is the life insurance companies; α is the intercept; INT_i and EXT_i are the internal and external drivers respectively.

To investigate the relation between risk measures of nonlife insurance companies and the same independent variables, the following models are adopted:

$$NLBeta = \alpha + \sum_{k=1}^{9} \beta_j NLINT_i + \sum_{k=10}^{11} \beta_j NLEXT_i + \varepsilon_i \quad (4)$$

$$NLVOL = \alpha + \sum_{k=1}^{9} \beta_j NLINT_i + \sum_{k=10}^{11} \beta_j NLEXT_i + \varepsilon_i \quad (5)$$

where NL is the non-life insurance companies; α is the intercept; INT_i and EXT_i are the internal and external drivers respectively.

To accomplish the above objectives, the study employs pooled and panel data analysis techniques where panel data analysis are usually estimated by fixed effects and random effects techniques. In pooled model, all observations are put together and the regression coefficients describe the overall influence with no specific time or individual aspects. It assumes that the error term captures the differences between the firms (across-sectional units) over the time.

The pooled model is simply be estimated by Ordinary Least Square (OLS). However, OLS will be appropriate if no individual firm or time-specific effects exist. If they are, the unobserved effects of unobserved individual and time specific factors on dependent variable can be accommodated by using one of the panel data techniques (Gujarati, 2003). A panel data technique helps researchers to substantially minimize the problems that arise when there is an omitted variables problems such as time and individual-specific variables and provide robust parameter estimates than time series and/or cross-sectional data. It is usually estimated by fixed effects model and random effects models. The fixed effect model allows control for unobserved heterogeneity which describes individual specific effects not capturing by observed variables. The term ``fixed effects'' is attributed to the idea that although the intercept may differ across individuals (firms), each individual's intercept does not vary over time; that is, it is time invariant.

Unlike fixed effects model, the unobserved effects in random effects model is captured by the error term (ε_{it}) consisting of an individual specific one (u_i) and an overall component (v_{it}) which is the combined time series and cross-section error. The random effects model will be estimated by the Generalized Least Squares (GLS) technique. This is because the GLS technique takes into account the different correlation structure of the error term in the random effects model (Gujarati, 2003).

Assume that Y_t and X_t are random variables so that every equation in the linear model can be written in the form:

$$Y_t = X_t\theta + u \quad (6)$$

According to equation (6), we can imply two sets of the relationships between the residual and the explanatory variables. Firstly, where there is no correlation between the explanatory variables and the residuals. In this case we say that the expectation of Y_t, given a set of information I, can be given by $E\ (Y_t\ |I_t = X_t\theta)$ and the orthogonality condition appears as $E\ (X_t\ \theta|I_t) = 0$. Calling at the second case, which is common in the practical world, there is a correlation between the residual and the explanatory variables. Therefore it is

important to find other variables that did not correlate with residuals but correlate with the original variables; these variables are called instrumental variables.

Suppose that we have n observations on K variables, denoted as $Z_t = 1, \ldots\ldots, n$ which are correlated with X_t where $E\,(X_t, Z_t)$ is nonsingular but remains negatively correlated with the residual u_t, that is, $E\,(Z_t, u_t)$, so that $\rho \lim Z'\,u/n = 0$. Hence we include Z_t, as instrumental variables instead of the problematic regressors. Again, these instrumental variables are correlated with X_t (explanatory variable) but uncorrelated with the residual. Consider the following estimator:

$$\begin{aligned} \tilde{\tau} &= (Z'X)^{-1}Z'Y \\ &= \theta + (Z'X)^{-1}Z'u \\ &= \theta + (Z'x/n)^{-1}Z'u/n \end{aligned} \tag{7}$$

Then postulate that $\rho \lim Z'\,X/n$ is nonsingular, $\rho \lim Z'\,u/n = 0$, and $\rho \lim \tilde{\tau} = \theta$, where $\tilde{\tau}$ is called the simple instrumental variable estimator (IV). If the model contains a group of observations, then $U = Y_t - X_t\theta$ and $E(Z'u) = E(Z_t(Y_t - X_t\theta))$ which implies that the sample counterparts of the moment conditions can be given by:

$$\frac{1}{T}\sum_{t=1}^{T} Z(Y_t - L_t\theta) \tag{8}$$

Assume that the model is just-identified, then the sample version is set to be zero (orthogonality condition) and the GMM estimator (the standard instrumental variables estimator) can be evaluated as:

$$\hat{\theta}_T = \left\{\sum_{t=1}^{T} z'_x x_t\right\}\sum_{t=1}^{T} z_t y_t \tag{9}$$

However, if the matrix $Z'_t X_t$ is non singular and the model is over identified, we estimate the model as presented in equation (9). To estimate the variance of the standard instrumental variables estimator $\hat{\theta_T}$ for the sample version, we use:

$$\left[\frac{1}{T}\right]\acute{v}T = \left[\frac{1}{T}\right]\left\{\left[\left[\frac{1}{T}\right]\sum_{t=1}^{T} x_t z'_t\right] A\grave{}_T^{-1}\left[\left[\frac{1}{T}\right]\sum_{t=1}^{T} z_t x'_t\right]\right\}^{-1} \tag{10}$$

where $\hat{A_T}$ is an estimate of

$$A = \lim_{T\to\infty}[\frac{1}{T}]\sum_{t=1}^{T}\sum_{\nu=-\infty}^{\infty} E\{u_t u_{t-\nu} z_t z'_{t-\nu}\} \tag{11}$$

When the residuals u_t are serially uncorrelated and homoscedastic with a variance of σ^2, (A) can be obtained by:

$$\hat{A} = \grave{\sigma}_T^2 \sum_{t=1}^{T} z_t z'_t$$

where (12)

$$\grave{\sigma_T^2} = \left[\frac{1}{T}\right]\sum_{t=1}^{T} (y_t - X'_t\hat{\theta}_T)^2$$

Substituting into equation (9), the Variance of GMM (the standard instrumental variables estimator) is given by:

$$\grave{v}_t = \grave{\sigma}_T^2 \left\{\sum_{t=1}^{T} z_t X'_t\right\}^{-1}\left\{\sum_{t=1}^{T} z_t z'_t\right\}\left\{\sum_{t=1}^{T} X_t z_t\right\}^{-1} \tag{13}$$

Data and Empirical Results

Data

The data adopted in this study are annual data on Egyptian insurance companies and span the period from 2006 to 2011. Panel data are used as it observes multiple companies over multiple time periods. Hence, in this study we adopt panel data to examine a number of explanatory variables using the regression models discussed above. Hsiao (1986) in his book `analysis of panel data' highlighted the significant advantages from using panel data over cross-sectional and time-series data sets. Firstly, panel data provide a large number of data points, increasing the degrees of freedom and reducing the collinearity among explanatory variables. Secondly, longitudinal data allows certain questions to be addressed that cannot be done through using cross-sectional or time-series data sets. Finally, panel data while capable of testing more complicated behavioral models, can also resolve or reduce the problem of the certain

effects that occur due to omitted or mismeasured variables, which are correlated with the explanatory variables. Thus panel data are able to control better these effects (Hsiao,1986). The data has been collected from various sources. Data on stock prices are obtained from DataStream and Egyptian disclosure book.

To examine the effect of firm size on corporate risk taking, the variables of total assets and sales are gathered from the annual report of insurance companies issued by the Egyptian Financial Supervisory Authority, stock market index in the same periods, and price of shares of the insurance companies.

Empirical Findings

We begin our analysis with the descriptive analysis as in Table 2. The table presents the mean, standard deviation and correlations of two risk measures and Eleven risk drivers.

As we can see from Panel *A* and *B*, there is a wide spread in average and standard deviation across the risk measures and risk drivers. Data are separated by life and non-life, which includes reinsurance companies. The discussion is focused on differences between life and non-life insurers.

Comparing the different industries, the average beta is higher for non-life insurance (0.024) than for life insurers (0.008), a finding in agreement to that of Borde et al. (1994) who find that U.S. life insurers have a lower beta than non-life insurers. We believe that our finding is meaningful since non-life insurers in Egypt typically have significant savings processes, which result in large investment portfolios, and experience only a limited degree of uncertainty from the underwriting business. life insurers in Egypt have a smaller investment portfolio and are more prone to underwriting risk, especially in lines with catastrophes exposure. This situation should result in the returns of life insurers being more dominated by the investment result, whereas the returns of non-life insurers may be more dominated by underwriting results. One consequence of this difference between the two lines of business could be that non-life insurers are more correlated to stock market returns, as documented by a beta close to 1, while life insurers should have a lower beta.

The risk drivers in Panel *B* of Table 2 reveal some interesting cross-industry differences. On average credit risk and liquidity risk are higher in life insurers than nonlife. In contrast, premium risk and reserve risk are higher in nonlife insurers than life insurance. We believe that our finding is meaningful since non-life insurers in Egypt typically characterized by short-term contracts which reflect on the value of claims by insurers. On average we find differences for the control-related variables supervisory board independence and board meetings, which are both higher for the life insurers than non-life. This might reflect the fact that in life insurers industry the independence and control of executives can come under more public scrutiny (the publication of independent supervisory board members is mandatory in Egypt). In general, this highlights the distinct characteristics of the corporate governance environment in Egypt. Given the asset accumulation function of life insurers that leads to high reserves, it is reasonable to find a higher leverage and size compared to non-life insurance companies. Also, the higher market risk of non-life insurance companies seems plausible given the nonlife insurer business model. Further, we find no significant differences between GDP and interest rate in both life and non-life insurers.

Table 2 also presents Pearson's correlation coefficients between considered variables. As expected, the correlation between both risk measures for nonlife insurers is positive. Most of the correlations between internal risk and beta are positive and significant. The correlation between leverage and systematic risk is positive and significant with life insurers.

The correlation between size and the risk measures (systematic risk and total risk) is significant and positive in life and nonlife insurers for systematic risk indicating that with increasing size, the insurers become more aligned with the market and thus more prone to systematic risk. Interestingly, the correlation between corporate governance related variables (supervisory board independence and board meetings) and the insurers' beta is significant and positive for life insurers, while for volatility, this is only the case for board meetings but with a negative correlation.

With regard to external risk drivers, we find that GDP growth is positively correlated with total risk but uncorrelated with systematic risk. Also, GPD growth is negatively aligned with the short-term interest rate. To detect multi-collinearity, an ordinary least-squares regression of both risk measures against all other variables is conducted.

The results of the random and fixed effects regressions with beta and volatility as dependent variables are presented in Table 3 and Table 4. As specification tests we report the p-value of the Hausman statistic with the random effect models and the p-value of the f-test with the fixed effect models.

Table 2. Descriptive statistics and correlation between risk measures and risk drivers

	Beta	*Vol*	*MR*	*CR*	*LR*	*PR*	*RR*	*LEV*	*SIZ*	*SB*	*BM*	*GDP*	*IR*
Panel A:Life Insurance													
Mean	0.0075	0.6820	0.3222	0.1480	0.2971	1.937	3.475	10.60	12.69	0.8726	6.354	0.0247	0.0944
Std.Dev.	0.0261	0.1070	0.3375	0.1334	0.2374	6.688	3.119	11.73	1.871	0.0308	3.609	0.0331	0.0110
Panel A:Non-Life Insurance													
Mean	0.0239	0.4744	0.4027	0.1354	0.2397	39.18	4.585	1.945	12.59	0.8522	6.167	0.0245	0.0946
Std.Dev.	0.0125	0.2240	0.2712	0.0975	0.1648	6.1326	16.02	1.536	1.698	0.0396	3.515	0.0329	0.0113
Panel B: Pearson Correlation Matrix-Life Insurance													
Beta	1.0000												
Vol	-0.08	1.0000											
MR	-0.31	-0.14	1.0000										
CR	0.32	0.23	-0.09	1.0000									
LR	0.23	-0.08	-0.38	-0.13	1.0000								
PR	-0.17	0.13	0.48	-0.23	-0.26	1.0000							
RR	0.21	0.14	-0.60	0.19	0.39	-0.22	1.0000						
LEV	0.21	0.18	-0.66	0.04	0.10	-0.27	0.46	1.0000					
SIZ	0.28	0.11	-0.76	0.24	0.28	-0.37	0.74	0.46	1.0000				
SB	0.15	0.11	-0.30	0.21	0.15	-0.12	0.35	0.19	0.53	1.0000			
BM	0.15	-0.02	-0.43	-0.13	0.15	-0.24	0.09	0.34	0.18	0.35	1.0000		
GDP	0.17	0.42	-0.03	0.28	-0.02	-0.17	-0.04	0.09	-0.14	-0.04	-0.07	1.0000	
IR	0.09	0.42	0.04	-0.25	0.17	-0.01	0.07	-0.14	0.16	-0.01	0.05	-0.63	1.0000
Panel B: Pearson Correlation Matrix-Non-Life Insurance													
Beta	1.0000												
Vol	0.46	1.0000											
MR	0.13	0.17	1.0000										
CR	-0.02	-0.13	-0.05	1.0000									
LR	-0.10	-0.08	-0.37	-0.16	1.0000								
PR	0.30	0.26	0.30	-0.19	-0.32	1.0000							
RR	0.08	0.09	-0.01	-0.08	-0.19	-0.05	1.0000						
LEV	-0.01	-0.03	-0.40	0.12	0.37	-0.27	-0.01	1.0000					
SIZ	0.01	-0.12	-0.42	0.01	0.42	-0.38	0.01	0.43	1.0000				
SB	0.08	-0.08	-0.27	-0.07	0.28	-0.36	-0.06	0.27	0.58	1.0000			
BM	-0.01	-0.12	-0.27	0.17	0.11	-0.49	0.05	0.20	0.02	0.36	1.0000		
GDP	0.23	0.71	0.10	-0.03	-0.16	0.34	0.09	0.03	-0.20	-0.10	-0.12	1.0000	
IR	-0.04	-0.69	-0.04	0.07	0.02	-0.15	-0.04	-0.05	0.17	0.12	0.10	-0.64	1.0000

Starting from the random effects regressions, Table 3 shows results for two types of insurers (life and non-life). With beta, we focus on the co-movement of the individual insurer's stock price with the overall market movement, i.e., systematic risk. With volatility, we analyze total risk, i.e., we consider both systematic and unsystematic (firm-specific) effects. The variables are grouped into three categories as seen in Table 2: (i) internal risk drivers; (ii) internal risk drivers related to corporate governance; and (iii) external risk drivers. For each explanatory variable we present coefficient and significance estimates. In terms of sign estimates, the results are generally robust as most variables have either an entirely positive or negative impact on beta or volatility.

Table 3. Regression results for random effects models

Random Effects Regression				
	Beta		***Volatility***	
	Life	*Nonlife*	*Life*	*Nonlife*
MR	-0.0081 (0.0142)	0.0073 (0.0045)	-0.1282 (0.0684)*	0.1233 (0.0546)**
CR	0.0250 (0.0194)	0.0066 (0.0115)	0.0690 (0.0937)**	-0.1523 (0.1391)
LR	0.0025 (0.0117)	0.0011 (0.0078)	-0.0304 (0.0562)	0.0425 (0.0938)
PR	-0.0018 (0.0005)***	0.0000 (0.0000)***	0.0096 (0.0026)***	0.0001 (0.0001)
RR	0.0011 (0.0013)	0.0001 (0.0001)	-0.0049 (0.0064)	0.0006 (0.0008)
LEV	-0.0001 (0.0002)	0.0001 (0.0008)	-0.0003 (0.0012)	-0.0088 (0.0097)
SIZ	0.0004 (0.0025)	0.0014 (0.0009)	0.0147 (0.0121)	0.0198 (0.0114)*
SB	0.0036 (0.0018)***	0.0366 (0.0360)	-0.0044 (0.0085)	-0.1271 (0.4344)
BM	-0.0028 (0.0027)	0.0007 (0.0004)*	0.0059 (0.0130)	0.0047 (0.0047)
GDP	-0.0125 (3.918)	0.0723 (0.0438)*	1.3162 (0.3766)*	2.963 (0.5289)***
IR	-0.1688 (0.1321)	0.0989 (0.1206)	1.2118 (0.6343)*	-8.446 (1.4556)***
R^2	0.3347	0.2057	0.4786	0.6398
Hausman	37.58 (0.0001)	1.86 (0.9973)	-12.59 (0.0001)	1.04 (0.9998)

Note: (*:10%,**:5%,***:1% significance)

Next is the internal risk drivers. The most relevant internal risk drivers for beta life-supervisory board independence and premium risk are discussed, while for the most relevant internal risk drivers for beta non-life insurers are premium risk, and board meetings. For volatility, life-market risk, premium risk and interest rate are the most relevant internal risk drivers, while volatility non-life-market risk and firm size are the most relevant drivers. We find strong evidence that larger firms are associated with a higher premium risk.

That size affecting risk taking is also in line with the literature (Cheng et al., 2011). The positive sign for beta implies that with increasing size the analyzed insurers tend to become more aligned with the market. Smaller insurers, which tend to be less diversified, might be able to decouple from overall market movements. But also the estimates for the volatility are positive, which is contrary to our expectation that larger firms exhibit lower total risk, e.g., due to diversification of risks. However, the implications may be different when risk is not considered as an aggregate measure, such as our total risk proxy.

Table 4. Regression results for fixed effects models

Fixed Effects Regression				
	Beta		***Volatility***	
	Life	*Nonlife*	*Life*	*Nonlife*
MR	-0.0127 (0.0151)	0.0088 (0.0053)*	-0.1503 (0.0778)*	0.1496 (0.0651)**
CR	0.0405 (0.0208)*	0.0055 (0.0137)	0.0002 (0.1068)	-0.1990 (0.1670)
LR	-0.0025 (0.0125)	-0.0032 (0.0098)	-0.0079 (0.0644)	0.0757 (0.1193)
PR	-0.0016 (0.0006)***	0.0000 (0.0000)***	0.0113 (0.0032)***	0.0001 (0.0001)
RR	0.0016 (0.0013)	0.0001 (0.0001)	-0.0103 (0.0069)	0.0007 (0.0009)
LEV	0.0000 (0.0003)	0.0000 (0.0009)	-0.0014 (0.0014)	-0.0095 (0.0114)
SIZ	-0.0005 (0.0026)	0.0017 (0.0011)	0.02344 (0.0135)*	0.0231 (0.0130)*
SB	0.0045 (0.0019)**	0.0456 (0.0426)	-0.0051 (0.0096)	-0.2882 (0.5185)
BM	-0.0054 (0.0030)*	0.0008 (0.0004)*	0.0099 (0.0153)	0.0058 (0.0054)
GDP	-0.1017 (0.0785)	0.0697 (0.0475)	1.7227 (0.4039)***	2.992 (0.5790)***
IR	-0.1508 (0.1389)	0.0999 (0.1299)	1.2584 (0.7142)*	-8.477 (1.583)***
R^2	0.2791	0.1998	0.4474	0.6381
F-test	3.90 [00007]	2.61 [0.0057]	5.01 [0.0001]	16.61 [0.0000]

We find Leverage is insignificant for both systematic risk and total risk, which is in contrast to the case in the U.S. sample of Borde et al. (1994), who find a positive and significantly influence of leverage on total risk and a mixed (positive for life insurance companies and negative for non-life insurance companies) influence on systematic risk. However, Cummins and Sommer (1996) find a positive relation between capital and (total) risk for the property/casualty industry and Baranoff and Sager (2002) find a positive relation for the life insurance industry with asset risk. Our findings generally confirm this relationship as, in our case, a higher leverage ratio can be considered as a proxy for lower capital. As insurers usually have little equity compared to their liabilities, the estimates for the regression coefficients are rather small.

Also, Liquidity risk is especially insignificant with volatility and exhibits a negative sign for life insurers. Holding more cash generally should reduce liquidity risk, but it also reduces asset returns, as cash does not earn interest, and therefore increases the risk for life insurers of not being able to fulfill guarantees. For the non-life insurers, the coefficient is positive for systematic risk. Borde et al. (1994) find for their U.S. sample a negative relation of liquidity with systematic risk and a positive relation with total risk. This difference might be explained by the different reactions U.S. and Egyptian insurers have to a changing risk situation.

For the corporate governance-related risk drivers, the significant estimate of supervisory board independence is positive. in this line, John and Senbet (1998) discuss the role of the supervisory board in solving problems related to agency theory (and thus corporate governance), Core et al. (1999) relate weak board structures to agency problems and lower firm performance (as well as higher executive compensation). Boone et al. (2007) find indication that board independence is negatively related to executive influence. These results from previous work imply that increased control, e.g., through board outsiders, should be accompanied by less managerial discretion, resulting in better shareholder protection. This manifests in our case as higher risk taking, as shareholders may consider their investment as an

option. There is a positive effect of the number of board meetings on total risk for life and non-life insurers. The positive relation of board meetings and risk might be explained by firms with a higher (systematic and total) risk responding to this situation by increasing control efforts. The relation of the number of board meetings to risk is equal to the relation of board independence to risk, namely, positive, providing support for the idea that the board is indeed reacting to some high-risk situation.

Moving onto external risk drivers, GDP is the most relevant of the two external risk drivers and exhibits a negative relation with systematic risk and positive with total risk. The interest rate level is positively connected to total risk. This is in line with Chen and Wong (2004) who find for Asian property-liability insurers a positive relationship between the absolute level of interest rates and an "unhealthy rate". The authors interpret the interest rate not as a crediting, but as a financing cost rate. The short-term interest rate in our analysis may be interpreted similarly. Therefore, in our model, increasing the cost of short-term financing and liquidity is related to a higher probability of becoming insolvent and thus higher total risk. The fact that liquidity risk, i.e., the ratio of cash and near-cash items and other marketable securities to total assets, is negatively associated with total risk supports this hypothesis.

When we turn our attention to Dynamic Panel Data Analyses (considering endogeneity issues) we employ the GMM methodology to estimate the models. The results are presented in Table 5. GMM estimations of models

Table 5. Generalized Method of Moment-GMM

Generalized Method of Moment-GMM				
	Beta		***Volatility***	
	Life	*Nonlife*	*Life*	*Nonlife*
MR	-0.0173 (0.0230)	-0.0022 (0.0206)	0.0023 (0.1117)	0.0700 (2.82565)
CR	0.0377 (0.0388)	0.0365 (0.0383)	0.0137 (1496)	-0.0071 (0.2.4526)
LR	-0.0079 (0.0137)	-0.0066 (0.0151)	-0.0180 (0.0776)	-0.16329 (1.8722)
PR	-0.0036 (0.0014)	0.0000 (0.0000)***	-0.0006 (0.0055)	-0.0022 (0.0026)
RR	0.0010 (0.0011)*	-0.0005 (0.0005)	-0.0020 (0.0075)	0.0000 (0.0095)
LEV	-0.0004 (0.0006)	-0.0023 (0.0032)	0.0006 (0.0036)	-0.0089 (0.2834)
SIZ	-0.0023 (00025)	0.0036 (0.0026)	0.0181 (0.0102)*	0.1551 (0.1723)
SB	0.0109 (0.0636)	-0.0312 (0.0509)	0.4471 (0.2302)*	0.9949 (4.3167)
BM	0.0013 (0.0014)	0.0009 (0.0012)	0.0009 (0.0055)***	-0.4056 (0.1065)***
GDP	-0.0397 (0.1872)	0.1365 (0.0800)*	1.0506 (0.6147)*	24.197 (10.236)**
IR	0.0030 (0.0033)	-0.0087 (0.2687)	0.0060 (0.30136)	-7.5187 (24.518)
R^2	0.2791	0.1998	0.4474	0.6381
j-statistic	11.5730 (0.1155)	6.6734 (0.4637)	5.15320 (0.6413)	6.8857 (0.3315)

It is worth noting that significant differences in estimation results may indicate potential effects of the Endogeneity on risk taking. We do find slightly changes in sign estimates for the significant variables, but do find some interesting variations in significance for the internal risk drivers, external risk drives and corporate governance variables with the total risk measure across the insurers industry. The direction of the impact of risk drivers on the risk measures remains-on average- unchanged. We found strong positive significant influence to firm size, supervisory board independence and GDP growth on the total risk of the Egyptian insurance companies with life insurers, while the premium risk has a negative impact on the systematic risk. For the Egyptian non-life insurers, we find that the

premium risk and GDP have positive impact on the systematic risk, while board meeting and GDP have positive influence on the total risk.

In light of this additional test, we conclude that our results are robust with regard to model modifications. We observe changes of significance for some of the variables when we use instrumental variables. This is especially true for corporate governance related variables as well as for size and premium risk.

Conclusion

This article examines the effect of internal and external factors on firm risk taking. we adopt stock prices to clarify variations in risk across life and non-life insurance companies. Our analysis is based on a comprehensive sample of Egyptian life and non-life insurance firms over the period from 2006 to 2011. Our study reveals the need to be cautious when comparing the results of previous empirical work. As the review of the literature shows that many factors can alter the outcome of corporate risk taking analysis: alternative definitions of risk measures, different institutional environments, and methodologies. We confirmed some of these findings. First, we determined that alternative insurers may lead to varying results. In fact, our study shows that there is a difference between the level of risk associated with life and non-life insurers. Although, in general, we did not find a significant relationship between the most of internal factors associated with non-life insurers when we use the systematic risk as a measure of risk, we did find that the presence of the impact of the internal and external factors to hamper the results when we use the total level of risk as a measure of risk. Therefore, our article does not confer much importance on corporate risk taking per se but on the significance and effect of different measures of risk taking. It points to the necessity of further investigation into how life and non-life insurance firms should be controlled and managed to be successful by reducing the relative level of risk. Second, our study shows that different methodologies drive different results and that we should take into account a firm's unobservable heterogeneity and endogeneity issues when analyzing corporate risk taking. Third, interestingly, our research produced some contradictory results when compared with other insurance company multicountry studies. This suggests that the conclusions of multicountry studies that use mainly samples composed of large insurance firms may not apply to the whole universe of listed insurance firms.

Overall, our study suggests that although a priori it could seem that corporate risk taking might be an overstudied topic, we should explore it further. Recent studies have started to disentangle the separate effects of risk- based ownership and risk based control, as well as the influence of other measures of risk taking, but some questions have not been answered yet. For instance, why is it that the empirical results about the influence of types of risk measures on company performance may vary for different institutional settings and countries?

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