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Does stock option-based executive compensation induce risk-taking? An analysis of the banking industry

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Abstract

We investigate the relation between option-based executive compensation and market measures of risk for a sample of commercial banks during the period of 1992–2000. We show that following deregulation, banks have increasingly employed stock option-based compensation. As a result, the structure of executive compensation induces risk-taking, and the stock of option-based wealth also induces risk-taking. The results are robust across alternative risk measures, statistical methodologies, and model specifications. Overall, our results support a management risk-taking hypothesis over a managerial risk aversion hypothesis. Our results have important implications for regulators in monitoring the risk levels of banks.

JEL classification: G21; J33

Keywords: Risk-taking; Executive compensation; Banking industry

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1. Introduction

The issue of risk-taking has been a central focus of the banking literature. While banks must operate within the constraints imposed by regulators, they have discretion in making decisions that can have a significant impact on the riskiness of the institution. One area in which banks exercise discretion is in their choice of executive compensation levels and structures. The compensation level and structure employed by each bank has implications for risk-taking and for the agency relation between managers and stockholders. John et al. (1995) note that managerial compensation affects the investment choices made by the firm, and the effects of these choices are magnified when moral hazard and managerial discretion are present. Thus, both regulators and stockholders have an interest in monitoring the executive compensation that is in place in the banking industry.

This paper examines the relation between risk-taking and option-based executive compensation in the banking industry. The issue of risk-taking and executive compensation has been previously studied for industrial firms by a number of researchers.[1] For example, Agrawal and Mandelker (1987) find that large stock and option holdings by a manager induce him/her to select variance-increasing investments. DeFusco et al. (1990) report that both implied volatility and stock return variance increase after the approval of executive stock option plans. The results for industrial firms, however, cannot necessarily be generalized to the banking industry for several reasons.

First, Houston and James (1995) find that the compensation structure in the banking industry differs significantly from the structure in other industries, both in terms of total compensation and in terms of the relative importance of the individual elements that comprise total compensation. Second, evidence presented by Smith and Watts (1992) and Mayers and Smith (1992) suggests that compensation is less responsive to firm performance in regulated industries than in unregulated industries. Since banks operate in a different business and regulatory environment than their nonbank counterparts, this may alter the incentives created by the compensation contract.

An impressive body of research examining executive compensation and performance has been formed in the banking literature.[2] However, few studies on the banking industry examine the relation between executive compensation and firm risk-taking. One such study by Houston and James (1995) reports that bank chief executive officers (CEOs) receive less cash compensation, are less likely to participate in stock option plans, and receive a smaller percentage of their total compensation in the form of stock options than do their counterparts in other industries. They conclude that the compensation structure in the banking industry does not promote risk-taking. However, their inquiry focuses on comparing the compensation structure of banks to the compensation structure of industrial firms rather than analyzing the impact of compensation on risk across banks.

More recently, John et al. (2000) make theoretical arguments highlighting the continuing viability and importance of an empirical investigation into the relation between exec-

[1] While our focus is the relation between risk-taking and executive compensation, a large number of studies have investigated the relation between compensation and performance. Studies in the non-banking sector include Jensen and Murphy (1990a,b), Mehran (1995), Coughlan and Schmidt (1985), Lewellen et al. (1987), Agrawal et al. (1991), Goldberg and Idson (1995), Aggarwal and Samwick (1999), and Core et al. (1999).

[2] The banking studies include Barro and Barro (1990), Crawford et al. (1995), Hubbard and Palia (1995), Collins et al. (1995), Houston and James (1995), Fields and Fraser (1999), and John et al. (2000).

utive compensation and risk. They contend that regulation of bank risk-taking based on imposing capital requirements and restricting asset choices has limited effectiveness. They propose and develop a model that explicitly incorporates bank management's compensation schedule into the risk-based pricing of deposit insurance. They demonstrate that, unlike capital and asset regulations that indirectly affect managerial decisions, altering the compensation structure provides a direct method of influencing managerial risk-taking incentives. Therefore, the issue of whether the compensation structure in the banking industry affects managerial risk-taking invites further inquiry.

Our study differs from previous studies in three important aspects. First, we explicitly examine the impact of option-based compensation on several market-based measures of bank risk: total, systematic, idiosyncratic, and interest rate risks. While a few studies (Saunders et al. (1990); Chen et al. (1998)) have examined the related issue of the relation between managerial stock ownership and bank risk, our analysis provides insight into the relation between various measures of option-based compensation and bank risk-taking.[3] Although both managerial stock ownership and option-based compensation are equity ownership, the former represents current ownership and the latter future ownership. While the current ownership may increase or decrease in value, the future ownership (stock options) can experience more dramatic outcomes with exercise values that may reasonably fluctuate from zero to several million dollars due to the leverage effect. This possibly makes stock options a more powerful variable for investigating risk related principal-agent problems in banking. Moreover, purely due to the substantial growth in the use of stock options in the banking sector, the relationship between bank risk-taking and stock options is an important investigation.

Second, we analyze a time period over which an expanded investment opportunity set exists in the banking industry because of regulatory changes. In 1990 the Federal Reserve Board first permitted a bank to sell stocks through a subsidiary. Initially the stock market operations were limited to 10% of the company's total revenue. This ceiling was lifted to 25% in 1996. In 1994, the Riegle-Neal Act permitted bank holding companies (BHCs) to operate in multiple states. Perhaps the ultimate regulatory change that has dramatically changed the opportunity set for banks is the passage of the Gramm-Leach-Bliley Act in 1999, allowing banks to fully expand into the securities and insurance businesses. These changes may have altered the level and structure of executive compensation in the banking industry, highlighting the importance of understanding the relation between compensation and risk-taking (Fields and Fraser, 1999).

Indeed, Crawford et al. (1995) and Hubbard and Palia (1995) find that deregulation has created a more competitive environment, and has resulted in an expansion of managerial discretion and the banking industry's investment opportunity set. Specifically, Hubbard and Palia (1995) have documented that the value of salary and bonus and the value of options granted increased significantly after deregulation. In a related study, Rajan (1998) finds increasing levels of off-balance sheet activities by BHCs.

[3] Saunders et al. (1990) form models based on market-based risk measures and find that banks with high managerial equity ownership exhibit greater risk-taking than do banks with low managerial equity ownership. In contrast, Chen et al. (1998), who use a similar methodology over a different time period, find a negative relation between managerial ownership and risk-taking, suggesting that as managerial ownership increases the level of risk-taking decreases.

Third, we analyze a time period (1992–2000) after which the Securities and Exchange Commission in 1992 required that all firms disclose detailed information on executive compensation in the proxy statement due to the prevalent use of incentive-based executive compensation. Using data from this period, our study is able to provide insights that are not available from prior studies.

To achieve the objectives of our study, we derive four market-based measures of risk: total, idiosyncratic, systematic, and interest rate risks. These risk measures are then modeled as a function of the accumulation and structure of CEO stock option-based compensation. Our pooled sample contains 68 banks involving 70 CEOs over the time period from 1992 to 2000, resulting in 591 bank-CEO-year observations.

Several important conclusions emerge from our analysis. First, in comparison to a sample of industrial firms, the use of stock option-based compensation has become more widespread in the banking industry in recent years, and the percentage of stock option-based compensation relative to total compensation has also increased. Second, the structure of executive compensation (proxied by stock options as a percentage of total compensation) induces risk-taking in the banking industry; risk also impacts compensation structure. Third, the stock of option-based wealth induces risk-taking in the banking industry. This relationship also holds in reverse. We reaffirm these findings using a relative option-based wealth measure. Our finding of a positive relation between option-based compensation and risk highlights the influence of the expanded investment opportunity set that the banking industry has gained through deregulation. Fourth, the results are robust across alternative risk measures and model specifications (both two- and three-equation simultaneous equation systems). Finally, we provide limited evidence that executive option-based wealth enhances shareholder wealth.

The remainder of this paper is organized as follows. Section 2 develops hypotheses regarding the impact of compensation on bank risk. Section 3 discusses the methodology and data. Section 4 presents descriptive statistics and empirical results. Section 5 summarizes the major findings of our study.

2. Hypotheses regarding executive compensation and bank risk

In this section we develop two hypotheses regarding the relation between option-based compensation and bank risk-taking. The arguments begin with the contention that as executive compensation in the form of stock options increases, the interests of executives and stockholders converge. It is well established in the corporate finance literature that stockholders have an incentive to increase the risk of the firm resulting in a wealth transfer from bondholders to stockholders.[4] In the context of the banking industry, Saunders et al. (1990) argue that since depositors (and deposit insurance funds) cannot perfectly monitor the actions of stockholders, bank depositors (and deposit insurance funds) are also susceptible to this wealth transfer effect. Thus, stockholders can increase the value of their call-option-like equity by increasing bank risk.

[4] As previously discussed, we do not include equity ownership in this study because: (1) the relation between risk-taking and managerial ownership has been studied (Saunders et al. (1990); Chen et al. (1998)), and (2) stock ownership is not a clean measurement of compensation since equity holdings can be bought by managers independent of the shares given by the compensation committee.

Consequently, as the option-based executive compensation increases and as the *stock* of option-based wealth grows, the executives face the same incentives as stockholders and, as such, will pursue strategies that increase bank risk. Indeed, this is the classic moral hazard problem that contributed to such phenomenal losses in the savings and loan (S&L) industry and the financial crisis in the emerging financial markets. Historically, this problem has been exacerbated for depositories because of the existence of fixed cost deposit insurance. Over the sample period covered by this study, however, risk-based insurance premia are in effect thereby reducing the incentive effects. Nonetheless, the desire for stockholders to maximize their equity call option value may lead to additional risk-taking. Moreover, in the wake of an expanded investment opportunity set following deregulation, bank executives may now have opportunities and incentives that are comparable to their industrial counterparts. Thus, we derive the risk-taking hypothesis as follows:[5]

> *Option-based compensation affects risk-taking. Bank risk increases as CEO's stock option-based compensation increases.*

In contrast to the risk-taking hypothesis, however, it is possible that option-based compensation may be negatively related to risk. This is based on the notion that as stock option-based executive compensation increases, the executive's personal portfolio becomes less diversified and the executive becomes more risk averse and more likely to pursue strategies aimed at mitigating the risk of the institution (Smith and Stulz, 1985). Because stock options are normally issued at-the-money, the managers are exposed to some downside risk in the value of the option in an ex-post sense.

Consider two extremes. In the first scenario, if executives choose a low risk approach then the stock price will increase to P_1 with wealth gain W_1. In a second scenario, if executives choose a high risk approach then there is a ρ percent chance that the stock will fall to P_0 with wealth gains from exercise of $W_0 = 0$ and a $(1 - \rho)$ percent chance the stock will rise to P_2 with wealth gains W_2, where $P_2 > P_1 > P_0$, and $W_2 > W_1 > W_0$. Clearly, the risk-averse executive may have an incentive to pursue a relatively low risk approach. Based on this counter argument, we formulate the risk aversion hypothesis as follows:

> *To mitigate their personal portfolio risk, bank risk decreases as CEOs' stock option-based compensation increases.*

3. Methodology and data

The primary method by which we examine the relation between executive compensation and risk-taking is by modeling four market-based risk measures as a function of two compensation measures and several control variables. The risk measures are obtained from the two-index market model and are estimated for each year using daily data from the relevant year obtained from the Center for Research in Security Prices (CRSP) tapes. The model is given as

$$R_j = \alpha + \beta_{mj}(R_m) + \beta_{Ij}(I) + u_j, \tag{1}$$

[5] The risk-taking hypothesis can alternatively be viewed as the interest alignment hypothesis. In this context, the use of option-based compensation aligns the interests of shareholders and executives resulting in greater risk-taking.

where R_j is the daily return on bank stock, R_m is the daily return on the CRSP equally-weighted index, I is the daily three-month T-bill yield obtained from the Federal Reserve Bank of St. Louis, and u_j is a random error term. Estimation of this equation results in two risk measures, β_{mj} and β_{Ij}, which are proxies for systematic and interest rate risks respectively.[6] Two additional risk measures are generated by calculating the standard deviation of the stock returns (σ_j) and the standard deviation of the residuals (σ_{uj}) from Eq. (1).

After generating the four risk measures, we then model each risk measure as a function of two measures of executive compensation: a *flow* measure – annual stock option-based compensation as a percentage of total compensation (a measure of compensation structure); and a *stock* measure – the value of accumulated stock options (a measure of option-based wealth). We also control for firm specific factors such as bank size, financial leverage, income diversification, and geographic diversification. A dummy variable controlling for year/interest rate effects is also included in each model to control for unobservable structural shifts.

The basic regression model can be specified as

$$\begin{aligned}\text{RISK} = f[&\text{COMP},\ \text{LN(TA)},\ \text{CAPITAL\_RATIO},\ \text{NON\_INT\_INCOME\%},\\ &\text{GEO\_DUMMY},\ \text{YEAR\_DUMMY}],\end{aligned} \tag{2}$$

where

$$\text{COMP} \in \{\text{OPTION/TOTAL\_COMP},\ \text{ACCUMULATED\_OPTION}\},$$
$$\text{RISK} \in \{\sigma_j, \sigma_{uj}, \beta_{m,}, \beta_I\}$$

and

RISK one of the four alternative measures of risk generated from the two-index model. σ_j is the total risk, σ_{uj} is the idiosyncratic risk, β_m is the systematic risk, and β_I is the interest rate risk;
ACCUMULATED_OPTION the Black-Scholes value of accumulated, in-the-money stock options paid and held to date;
OPTION/TOTAL_COMP the total value of annual stock options granted (based on Black–Scholes model) as a percentage of the total annual compensation of the CEO;
LN(TA) the natural logarithm of the total assets of the bank, a measure of bank size;
CAPITAL_RATIO the capital-to-assets ratio which is total equity capital divided by total assets, a measure of financial leverage;
GEO_DUMMY a dummy variable coded as one if the bank operates in more than one state, zero otherwise;
NON_INT_INCOME% a measure of income diversification calculated by dividing total non-interest income by the sum of interest income and non-interest income;

[6] We use the absolute value of the interest rate beta to conduct the analysis since both positive and negative interest rate betas suggest that the bank is exposed to interest rate risk. Consequently, the sign of interest rate beta is not of major concern. Rather, it is the magnitude of the interest rate beta that determines the interest rate exposure for the bank.

YEAR_DUMMY a binary variable coded as 1 or 0 for each year from 1992 to 2000 with 1995 being the excluded year.

In addition to these variables, three-year revenue growth rate (GROWTH), dividend yield (DIV_YLD), fiscal year-end stock price (STOCK_PRICE), and changes in shareholder wealth (ΔWEALTH) are also employed in other equations within simultaneous equation models.

The ExecuComp database contains variables such as the Black-Scholes value of annual stock options granted, total annual compensation, and Black-Scholes value of in-the-money options held to date.[7] Therefore, we use this database to generate the compensation variables (OPTION/TOTAL_COMP and ACCUMULATED_OPTION) for the commercial banks and BHCs which have complete market returns over the sample period. OPTION/TOTAL_COMP is a measure of compensation structure whereas ACCUMULATED_OPTION is a measure of the CEO's option-based wealth. Therefore, these two compensation variables do not necessarily measure the same thing. With respect to accumulated options the ExecuComp database reports the value of existing options only for in-the-money options. This reporting practice could potentially understate the total value of options held by bank CEOs.

This bias, however, is not likely to be significant. Stock options normally are issued to CEOs at the money. During the sampling period, the banking sector registered positive returns in each year except 2000. Therefore, out-of-the-money options will not have a significant impact.[8] A positive and significant coefficient on OPTION/TOTAL_COMP and/or ACCUMULATED_OPTION would support the risk-taking hypothesis. On the other hand, a negative and significant coefficient on OPTION/TOTAL_COMP and/or ACCUMULATED_OPTION would support the risk-aversion hypothesis. Finally, an insignificant coefficient on OPTION/TOTAL_COMP and ACCUMULATED_OPTION would mean the executive's option-based compensation does not have any measurable impact on risk-taking behavior in the banking industry.

Data for the control variables are also obtained from the ExecuComp database. LN(TA), measured as the natural logarithm of the bank's total assets, is expected to be negatively associated with bank risk. Typically, large banks have more diverse product lines and a broader customer base and, therefore, are more diversified and less risky. CAPITAL_RATIO is a measure of financial leverage that is expected to negatively influence bank risk. That is, the larger the equity capital, the lower the bank's risk. GEO_DUMMY is a measure of geographic diversification. Since a bank that operates in multiple states is less likely to be affected by state specific factors, GEO_DUMMY is expected to be negatively related to risk. NON_INT_INCOME%, a measure of income diversification, measures how much of a bank's income is derived from non-interest income sources, such as off-balance sheet activity. Therefore, we expect NON_INT_INCOME% to be positively associated with bank risk (Demsetz and Strahan, 1997).

Our final sample which includes all necessary data for the empirical analysis has a maximum of 68 commercial banks and BHCs (1995 and 1998), involving 70 CEOs over the

[7] ExecuComp uses 70% of the stated life of the option for the expiration date, a seven-year treasury bond yield as a proxy for the risk-free rate, and the standard deviation of the previous 60 monthly stock returns as a measure of volatility.

[8] Aggarwal and Samwick (1999) employed the same statistical measure using the same database.

Table 1
Descriptive statistics

Variable	N	Mean	Median	Standard deviation	Minimum	Maximum
ACCUMULATED_OPTION	591	8700.13	2900.56	18529.41	0.00	255,520
$OPTION	591	1146.76	406.33	2467.19	0.00	36,055
OPTION/TOTAL_COMP	591	25.88%	22.12%	21.58%	0.00%	94.77 %
σ_j	591	0.0184	0.0170	0.0065	0.0089	0.0643
σ_{uj}	591	0.0171	0.0157	0.0060	0.0082	0.0544
β_{mj}	591	0.9491	0.9072	0.4129	0.0352	2.8452
β_{ij}	591	0.2435	0.1595	0.2438	0.0002	1.3826
TA	591	36092.43	14084.8	67640.39	1254.01	642,191
LN(TA)	591	9.6405	9.5529	1.2636	7.1341	13.3726
CAPITAL_RATIO	591	0.0825	0.0789	0.0230	0.0301	0.2394
GEO_DUMMY	591	0.7902	1.0	0.4075	0.0	1.0
STOCK_PRICE	591	42.18	36.38	36.29	5.87	524.13
DIV_YLD	591	2.5874%	2.6090%	1.2213%	0%	6.9030%
GROWTH	591	13.622%	12.522%	15.522%	−25.74%	123.38%
NON_INT_INCOME%	591	21.24%	19.03%	12.04%	0.22%	99.3%
ΔWEALTH	591	905.58	223.26	2932.36	−25050.20	27543.36

This table provides basic descriptive statistics for the sample. ACCUMULATED_OPTION is the value of in-the-money stock options accumulated and held to date (in thousands of dollars); $OPTION is the value of the annual stock options granted (in thousands of dollars); OPTION/TOTAL_COMP is the ratio of the annual option value to the total annual compensation; σ_j is a measure of total risk; σ_{uj} is the idiosyncratic risk; β_{mj} is the systematic risk; β_{Ij} is the interest rate beta; TA is the total assets (in millions of dollars); LN(TA) is the natural logarithm of total assets (in millions of dollars); CAPITAL_RATIO is the capital-to-assets ratio; GEO_DUMMY is binary variable measuring geographic diversification, STOCK_PRICE is the stock price; DIV_YLD is the dividend yield; GROWTH is the sales growth rate over the past three years; NON_INT_INCOME% is the percentage of income that is from non-interest sources; and ΔWEALTH is the change in shareholder wealth.

time period from 1992 to 2000.[9] The sample contains 591 bank-CEO-year observations. We pool the observations over the sample period for estimation efficiency, and control for possible year-to-year changes in the structural relation due to unobservable variables using a series of dummy variables.[10]

4. Empirical results

4.1. Descriptive statistics

Table 1 reports descriptive statistics for the variables used in the study. The mean value of accumulated stock options (ACCUMULATED_OPTION) for the CEOs is $8,700,130 with a standard deviation of $18,529,410, a minimum of $0.00, and a maximum of $255,520,700. The relatively low median value ($2,900,560) compared to the mean suggests

[9] The sample period employed is dictated by the data contained in the ExecuComp database. Moreover, as indicated in Section 2, only after 1992 did the SEC require that firms fully disclose details of their executive compensation plans.

[10] The possible impact of the 1995 Russian banking crisis is an example of an event that is controlled for through the yearly dummy variables. In some simultaneous equations, we also use an interest rate dummy variable for a better model specification.

that a number of CEOs have very large accumulated options. The mean value of annual CEO option grants ($OPTION) is $1,146,760. The percentage of annual compensation that is derived from options (OPTION/TOTAL_COMP) has a mean value of 25.88%. While there are executives receiving no stock options in certain years (minimum value of OPTION/TOTAL_COMP is 0%) overall, 79.53% of the CEOs did receive stock options as part of their annual compensation during the sample period. Although not shown in the table, we also find that in 1999, 88.89% of the CEOs received options, while in 1992 only 68.85% of the CEOs received options, supporting the dramatic increase in the use of options in the banking industry.

Total risk (σ_j), measured by the standard deviation of daily stock returns for a given year, has a mean of 0.0184 with a standard deviation of 0.0065, whereas idiosyncratic risk (σ_{uj}) has a mean of 0.0171 with a standard deviation of 0.006. The average systematic risk (β_{mj}) is 0.949, while the average interest rate beta (β_{Ij}) is 0.2435. With respect to the control variables, total assets (TA) has an average value of $36,092 million, with a standard deviation of $67,640 million. The capital-to-assets ratio has a mean of 0.0825 whereas the stock price has a mean of $42.18 and standard deviation of $36.29. Average dividend yield is 2.5874% and the three-year revenue growth rate has an average value of 13.62%. The average bank derives 21.24% of its income from non-interest sources. Finally, the average annual change in shareholder wealth is $905.58 million with a standard deviation of $2932.36 million.[11]

Panel A of Table 2 provides average compensation measures across the nine-year sampling period for the banking firms. Average total compensation (AVG TOTAL_COMP) increases approximately three fold from $1,627,620 in 1992 to $4,695,750 in 2000. This rate of increase dramatically exceeds the inflation rate during these years. The average annual value of stock options granted (AVG $OPTION) varies considerably over time; nevertheless, a strong increasing trend is evident. AVG $OPTION was $282,400 in 1992 while in 2000 this value increased to $1,667,940, representing a nearly 500% increase. As a percentage of total compensation, AVG OPTION/TOTAL_COMP increases from 17.35% in 1992 to 35.52% in 2000.

The accumulation of stock options is equally impressive. In 1992, the average value of the accumulated stock options (AVG ACCUMULATED_OPTION) was $2,167,740. By 2000, this same measure was $17,108,880. This represents a nearly 700% increase. Only part of the increase in the value of the accumulated stock options reflects the increase in equity prices during the same period. The banking industry's stock returns increased approximately 120% during the sampling period.

In Panel B of Table 2, we report the same statistics for a group of industrial firms. Due to data constraints, we only have data for this group of firms from 1993 through 1998. For the banking industry, AVG $OPTION increases 363% (from $394,920 to $1,830,180) during the period from 1993 to 1998, while the same statistic is 213% for industrial firms. Options as a percentage of total compensation (AVG OPTION/TOTAL_COMP) for the banking industry experienced a 115% increase (from 1993 to 1998) as compared to

[11] In comparison to a bank sample obtained from the COMPUSTAT database, our sample banks obtained from the ExecuComp database have larger total assets ($36,092 million compared to $19,253 million) and slightly smaller capital-to-asset ratio (8.25% compared with 8.729%). COMPUSTAT, however, does not provide executive compensation data. Our conclusions, therefore, are based upon a sample of larger banks, and the conclusions may or may not apply to smaller banks.

Table 2
Compensation structure and stock of option-based compensation: A comparison of banks and industrial firms

Year	*N*	AVG TOTAL_COMP	AVG $OPTION	AVG OPTION/ TOTAL_COMP (%)	AVG ACCUMULATED_OPTION
Panel A: banking industry					
1992	61	1627.62	282.40	17.35	2167.74
1993	66	1928.21	394.92	20.48	2387.54
1994	73	2321.83	739.77	31.86	1840.30
1995	68	2239.65	433.18	19.34	4735.04
1996	67	3109.40	855.54	27.51	7932.49
1997	67	3946.67	1353.12	34.29	16898.72
1998	68	4151.22	1830.18	44.09	15478.48
1999	63	5863.85	2885.93	49.22	19906.31
2000	58	4695.75	1667.94	35.52	17108.88
Panel B: industrial firms					
1993	438	1854.14	684.54	36.92	3122.37
1994	461	2140.12	818.31	38.24	2947.48
1995	512	2467.81	967.27	39.20	5935.53
1996	591	2993.05	1394.42	46.59	6571.67
1997	639	3897.19	1813.73	46.54	10846.52
1998	674	5061.98	2143.66	42.35	13580.19

This table provides statistics on the executive compensation structure and accumulated option-based compensation over the period of 1992–2000. AVG TOTAL_COMP is the average annual total compensation (in thousands of dollars); AVG $OPTION is the average value of annual stock options granted (in thousands of dollars); AVG OPTION/TOTAL_COMP is the average of the ratio of the value of annual stock options to annual total compensation; and AVG ACCUMULATED_OPTION is the average value of in-the-money stock options accumulated and held to date.

a 14.71% increase for the industrial counterparts. The difference illustrates how the popularity of option-based compensation has increased in recent years in the banking industry. Finally, the accumulated option value for the banking industry increased 548% from 1993 to 1998, while the same statistic for industrial firms is 335%. Therefore, although options and the value of options have increased dramatically during the last decade for all firms, the banking industry has experienced a more dramatic increase, perhaps due to deregulation.

4.2. An OLS analysis of the relation between compensation and firm's risk

We report the results of OLS regression analyses based on Eq. (2) in this section of the paper. Table 3 presents regression results for four models in which we study the impact of accumulated option on the four risk measures. Accumulated option serves as a proxy for the CEO's *stock* of option-based wealth. The coefficient estimate on ACCUMULATED_OPTION is positive in every model and is statistically significant at the one percent level for the first three models, suggesting that the CEO's option-based wealth increases a firm's total, idiosyncratic, and market risks. The effect of CEO's option-based wealth, therefore, is not limited to enhancing the idiosyncratic risk, but also has a positive effect on the non-diversifiable market risk. This result has implications even for diversified shareholders. The significant impact of accumulated option on firm risk is consistent with the risk-taking or interest alignment hypothesis that

Table 3
Ordinary least squares (OLS) regression models showing the relation between alternative risk measures and the stock of option-based compensation

Models of:	σ_j	σ_{uj}	β_{mj}	β_{Ij}
ACCUMULATED_OPTION	0.00004	0.00004	0.0029	0.00033
	(3.51)***	(3.25)***	(3.30)***	(0.78)
LN(TA)	−0.0010	−0.0011	0.0458	−0.0153
	(5.43)***	(6.32)***	(3.37)***	(2.33)**
CAPITAL_RATIO	−0.0482	−0.0457	−2.7909	−1.2084
	(5.46)***	(5.47)***	(4.29)***	(3.84)***
NON_INT_INCOME%	0.0062	0.0060	0.3148	0.0310
	(3.43)***	(3.52)***	(2.35)***	(0.48)
GEO_DUMMY	−0.0001	−0.0002	0.0177	−0.0113
	(0.23)	(0.44)	(0.44)	(0.59)
Dum92	0.0040	0.0036	0.2347	0.2161
	(5.01)***	(4.78)***	(3.97)***	(7.55)***
Dum93	0.0030	0.0028	0.2356	0.1567
	(3.79)**	(3.75)***	(4.05)***	(5.58)***
Dum94	0.0003	−0.00003	0.0754	0.0136
	(0.34)	(0.04)	(1.34)	(0.50)
Dum96	−0.0002	−0.0004	−0.0673	0.0880
	(0.25)	(0.62)	(1.17)	(3.16)***
Dum97	0.0030	0.0018	0.3216	0.3328
	(3.80)***	(2.34)***	(5.51)***	(11.80)***
Dum98	0.0092	0.0057	0.4447	0.0984
	(11.71)***	(7.73)***	(7.68)***	(3.52)***
Dum99	0.0062	0.0056	0.2279	0.0702
	(7.76)***	(7.42)***	(3.88)***	(2.47)***
Dum00	0.0135	0.0130	−0.2648	0.6354
	(16.48)***	(16.72)***	(4.37)***	(21.69)***
R^2	52.06%	50.18%	36.14%	57.21%

This table shows the parameter estimates and t-statistics (in parentheses) for the four regression models in which each of the four alternative risk measures is the endogenous variable, and the accumulation of stock options and the firm specific variables are the exogenous variables. σ_j is a measure of total risk; σ_{uj} is the idiosyncratic risk; β_{mj} is the systematic risk; β_{Ij} is the interest rate beta; ACCUMULATED_OPTION is the value of accumulated in-the-money stock options; LN(TA) is the natural log of total assets; CAPITAL_RATIO is the capital-to-assets ratio; NON_INT_INCOME% is the percentage of income that is from non-interest sources; GEO_DUMMY is a binary variable measuring geographic diversification; and Dum92–Dum00 are dummy variables coded as 1 or 0 for each year from 1992 to 2000. 1995 is the excluded year.
***, **, * indicates significance at the 1%, 5%, and 10% levels, respectively.

asserts that as the CEO's option-based wealth increases, the interests of executives and shareholders converge resulting in greater risk-taking. This result, however, is not consistent with the risk-aversion hypothesis. Though not reported in Table 3, we also include a squared term of the variable ACCUMULATED_OPTION in the regression model to investigate the possibility of a risk-aversion effect at sufficiently high levels of option-based wealth. The insignificant parameter estimate, however, fails to provide support for a risk-aversion effect.

Among the control variables, LN(TA) serves as a measure of bank size. As previously argued, larger banks have more opportunities to diversify their product lines and operations and, therefore, reduce the risk of the bank. The negative and significant coefficient on LN(TA) in all models (except the market risk model) is supportive of this argument.[12] The capital-to-assets ratio (CAPITAL_RATIO) is a measure of financial leverage, and is anticipated to have a negative influence on risk. Our results are consistent with this expectation and the parameter estimate on this variable is significant at the 1% level in all models.

Non-interest income (NON_INT_INCOME%) carries a positive sign and is statistically significant at the one percent level in all models except the interest rate risk model, suggesting that bank risk increases when non-interest earning activity (e.g., off-balance sheet activity) increases. The fact that non-interest-income is not statistically significant in the interest rate risk model is expected since the more income generated from non-interest sources, the less risk the bank is exposed to from interest rate changes.

Geographic diversification (GEO_DUMMY) is not statistically significant although a negative sign is consistent with the prediction that a bank operating in multiple states is less risky. The yearly dummy variables (Dum92 through Dum00) control for the shift in risk not explained by other exogenous variables, with 1995 being the excluded year. Dummy variables for 1992, 1993, and 1997 through 2000 are positive and statistically significant indicating that risk (after controlling for the effects of compensation and the other exogenous variables) is higher during these years.

Table 4 presents results when compensation structure (OPTION/TOTAL_COMP) is the measure of compensation. The parameter estimate on this variable is positive in all models and is significant at the one percent level for systematic and interest rate risks. It is, however, not statistically significant in the model of total risk and idiosyncratic risk. The firm specific variables in this table (i.e., LN(TA), CAPITAL_RATIO, NON_INT_INCOME%, and GEO_DUMMY) all yield similar results as found in Table 3. Therefore, in Table 4 we find some evidence that compensation structure also impacts bank risk-taking although the results are not as strong as in the equation when the CEO's option-based wealth is used.

4.3. Endogeneity and joint determination of executive compensation and firm risk

While our regression models analyze the impact of executive compensation on firm risk-taking, what we have found could be merely an "association" between risk and compensation. One could argue that compensation is also endogenously determined. In effect, the principal-agent models suggest that firm risk may impact a firm's compensation contract design. To be sure, the principal-agent model would predict that the CEO's equity-based compensation is decreasing in the standard deviation of firm returns. In other words, the CEO of a more risky firm would prefer salary-based compensation rather than equity-based compensation. On the other hand, some would argue that firm risk serves as a measurement of the firm's information environment. As such, higher risk indicates better opportunity to profit from asymmetric information, and equity-based compensation maximizes such opportunity. The existing empirical results, however, are not definitive. For example, Garen (1994) finds that none of his regression models show a significant relation-

[12] The positive sign of LN(TA) in the systematic risk equation, however, suggests a different relation between systematic risk and bank size. While the ability to diversify lowers the total risk of a bank, the systematic component of the total risk may actually increase toward the risk level of a better-diversified portfolio (i.e., unity). This is very plausible judging from the fact that the median beta of our sample bank is less than one (0.907).

Table 4
Ordinary least squares (OLS) regression models showing the relation between alternative risk measures and the structure of executive compensation

Models of:	σ_j	σ_{uj}	β_{mj}	β_{Ij}
OPTION/TOTAL_COMP	0.00001	0.00001	0.0019	0.0009
	(1.34)	(1.18)	(2.64)***	(2.76)***
LN(TA)	−0.0009	−0.0010	0.0526	−0.0154
	(4.85)***	(5.80)***	(3.94)***	(2.40)**
CAPITAL_RATIO	−0.0398	−0.0383	−2.1684	−1.1075
	(4.61)***	(4.71)***	(3.43)***	(3.66)***
NON_INT_INCOME%	0.0080	0.0076	0.4163	0.0254
	(4.59)***	(4.63)***	(3.25)***	(0.41)
GEO_DUMMY	−0.0003	−0.0004	0.0024	−0.0142
	(0.60)	(0.78)	(0.06)	(0.74)
Dum92	0.0040	0.0036	0.2336	0.2184
	(4.89)***	(4.66)***	(3.93)***	(7.68)***
Dum93	0.0028	0.0026	0.2253	0.1567
	(3.55)***	(3.52)***	(3.87)***	(5.62)***
Dum94	0.00005	−0.0002	0.0557	0.0077
	(0.06)	(0.30)	(0.98)	(0.28)
Dum96	−0.0002	−0.0004	−0.0705	0.0829
	(0.19)	(0.55)	(1.22)	(2.99)***
Dum97	0.0033	0.0020	0.3348	0.3268
	(4.22)***	(2.74)***	(5.76)***	(11.74)***
Dum98	0.0094	0.0059	0.4430	0.0871
	(11.76)***	(7.85)***	(7.57)***	(3.11)***
Dum99	0.0061	0.0056	0.2027	0.0518
	(7.39)***	(7.09)***	(3.34)***	(1.78)*
Dum00	0.0138	0.0133	−0.2579	0.6261
	(16.69)***	(16.94)***	(4.24)***	(21.51)***
R^2	51.19%	49.39%	35.71%	57.72%

This table shows the parameter estimates and t-statistics (in parentheses) for the four regression models in which each of the four alternative risk measures is the endogenous variable, and the structure of executive compensation variable and firm specific variables are the exogenous variables. σ_j is a measure of total risk; σ_{uj} is the idiosyncratic risk; β_{mj} is the systematic risk; β_{Ij} is the interest rate beta; OPTION/TOTAL_COMP is the percentage of total compensation in the form of stock options; LN(TA) is the natural log of total assets; CAPITAL_RATIO is the capital-to-assets ratio; NON_INT_INCOME% is the percentage of income that is from non-interest sources; GEO_DUMMY is a binary variable measuring geographic diversification; and Dum92–Dum00 are dummy variables coded as 1 or 0 for each year from 1992 to 2000. 1995 is the excluded year.
***, **, * indicates significance at the 1%, 5%, and 10% levels, respectively.

ship. Despite these controversial results, the issue of the endogeneity of both the compensation and the risk variables should be analyzed.

In Table 5, we reassess the relation between executive compensation and total risk using a simultaneous equation model in which both executive compensation and firm risk are treated as endogenous variables and are jointly determined. When both compensation and risk are endogenous, OLS results presented in Tables 3 and 4 are not appropriate. This is because the othogonality assumption between compensation and the regression residuals is violated, and the use of OLS leads to biased and inconsistent parameter estimates. The usual t and F tests for these parameters are also no longer valid.

The risk equation is similar to the model we used in Tables 3 and 4, while the compensation equation, stated in Eq. (3), specifies executive compensation (COMP) as a function

Table 5
Simultaneous equation model showing the relation between total risk and option-based compensation estimated using two-stage least squares (2SLS)

Models equations	(1) σ_j & OPTION/TOTAL_COMP		(2) σ_j & ACCUMULATED_OPTION	
	σ_j	OPTION/TOTAL_COMP	σ_j	ACCUMULATED_OPTION
Variable	Eq. (1)	Eq. (2)	Eq. (1)	Eq. (2)
OPTION/TOTAL_COMP	0.00028	–	–	–
	(2.17)**	–	–	–
				ACCUMULATED_OPTION
	–	0.00021	–	
		–	(4.86)***	–
σ_j	–	1065.1	–	1877.65
	–	(3.13)***	–	(5.93)***
LN(TA)	−0.00123	2.191	−0.0015	2.5616
	(−3.73)***	(3.13)***	(−6.12)***	(3.93)***
CAPITAL_RATIO	−0.27	–	−0.08	–
	(−1.83)**	–	(−6.21)**	–
NON_INT_INCOME%	0.0012	–	−0.0025	–
	(0.27)	–	(−0.83)	–
GEO_DUMMY	−0.0009	–	0.0006	–
	(−0.99)	–	(0.85)	–
STOCK_PRICE	–	0.0758	–	0.157
	–	(2.69)***	–	(5.99)***
Dum92/Rate92	0.0059	−1.842	0.0055	−0.3406
	(3.8)***	(−1.88)*	(5.54)***	(−0.37)
Dum93/Rate93	0.0056	−1.054	0.0052	0.6085
	(3.15)***	(−0.89)	(4.98)***	(0.55)
Dum94/Rate94	0.0022	0.7567	0.0024	0.4149
	(1.42)	(0.88)	(2.37)***	(0.52)

Dum95/Rate95	0.00006	−1.1032	0.0003	−0.3342
	(0.05)	(−1.77)*	(0.36)	(−0.57)
Dum97/Rate97	0.0033	0.404	0.0029	1.0367
	(2.66)***	(0.57)	(3.11)***	(1.58)
Dum98/Rate98	0.0095	1.592	0.0093	1.0771
	(7.68)***	(2.3)*	(10.15)***	(1.67)*
Dum99/Rate99	0.0071	3.591	0.0071	0.981
	(5.47)***	(4.7)***	(7.55)***	(1.38)
Dum00/Rate00	0.0136	1.259	0.0139	1.4515
	(10.53)***	(2.0)**	(14.65)***	(2.47)***
R^2	30%	17%	45%	19%

This table shows the parameter estimates and t-statistics (in parentheses) for a simultaneous regression model explaining the relation between total risk and the two compensation measures. Total risk and OPTION/TOTAL_COMP are treated as endogenous, jointly determined variables in model 1 and total risk and ACCUMULATED_OPTION are treated as endogenous, jointly determined variables in model 2. σ_j is a measure of total risk; ACCUMULATED_OPTION is the value of the accumulated in-the-money stock options held to date; OPTION/TOTAL_COMP is the ratio of option-based compensation to total compensation; LN(TA) is the natural log of total assets; CAPITAL_RATIO is the capital-to-assets ratio; NON_INT_INCOME% is the percentage of income that is from non-interest sources; GEO_DUMMY is a binary variable measuring geographic diversification; STOCK_PRICE is the stock price; Dum92–Dum00 are dummy variables used in the risk equation and are coded as 1 or 0 for each year from 1992 to 2000; and Rate92–Rate00 are variables used in the compensation equation and are coded as the T-bill rate or 0 for each year from 1992 to 2000. 1996 is the excluded year.

***, **, * indicates significance at the 1%, 5% and 10% levels, respectively.

of firm risk (RISK), the firm's total assets (LN(TA)), underlying stock price (STOCK_-PRICE), and dummy variables (RATE_DUMMY) where the dummy variables are based on annual interest rates. For example, Rate92 is defined as the T-bill rate of 1992 if the data is from year 1992; otherwise, a value of 0 is assigned to Rate92. Interest rate dummies control for the impact of interest rates on option value. Eq. (3) is estimated as follows:

$$\text{COMP} = f[\text{RISK},\ \text{LN(TA)},\ \text{STOCK\_PRICE},\ \text{RATE\_DUMMY}] \tag{3}$$

where

$$\text{COMP} \in \{\text{OPTION/TOTAL\_COMP},\ \text{ACCUMULATED\_OPTION}\},$$
$$\text{RISK} \in \{\sigma_j, \sigma_{uj}, \beta_m, \beta_I\}.$$

The specification of the compensation equation takes into account two major factors suggested in prior literature. The principal-agent model suggests a negative effect of risk on compensation, while the information asymmetry model suggests a positive effect of risk on compensation. Furthermore, the pay-performance literature suggests a positive effect of firm value (proxied by stock price) on compensation. We estimate the two-equation simultaneous equation models using a two-stage-least-squares (2SLS) method. The 2SLS estimate has a smaller bias than the OLS estimate (Sawa, 1969), and provides asymptotically correct estimates of the standard errors.

Model 1 of Table 5 reports the relation between total risk and OPTION/TOTAL_COMP, a measure of a firm's compensation structure. In contrast to the results reported in prior tables using the OLS regressions, the results of the risk equation suggest that the compensation structure variable does affect a firm's total risk. Specifically, the parameter estimate on the OPTION/TOTAL_COMP variable is positive and statistically significant at the five percent level. LN(TA), and CAPITAL_RATIO are all significant with the expected signs.

In the compensation equation, risk (σ_j) is statistically significant suggesting that firm risk does impact compensation contract design. The positive sign, however, contradicts the suggestion of the principal-agent model in favor of the asymmetric information model. Garen's (1994) results also fail to support the principal-agent model. The positive and significant relation between risk and OPTION/TOTAL_COMP may be also consistent with the contention that higher growth firms, typically with higher risk, are more likely to offer executive option-based compensation due to liquidity constraints and the upside potential of their equity value. This explanation is particularly credible during the decade of 1990s which dominates our sample period. The STOCK_PRICE variable is statistically significant and carries a sign that is consistent with the argument that higher stock prices increase the incentives for the executives to lobby for more option-based compensation.

Model 2 in Table 5 reports the relation between total risk and the accumulated option variable, a measure of option-based wealth. As shown, the coefficient estimate of ACCUMULATED_OPTION is statistically significant at the 1% level with the expected positive sign in the risk (σ_j) equation.[13] LN(TA) and CAPITAL_RATIO are both negative and

[13] Since ACCUMULATED_OPTION is measured in millions, while σ_j is measured in percentage in the regression analysis, the estimated ACCUMULATED_OPTION coefficient in the σ_j equation implies an increase of 0.021% in σ_j for every $1 million increase in ACCUMULATED_OPTION. Because the mean σ_j reported in Table 1 is 1.84%, 0.021% represents a 1.14% increase in risk (0.021/1.84 = 1.14%). As reported in Table 2, since accumulated options increased 700% from 1992 to 2000, an average bank's risk thus increased by 8% (1.14% × 7) during the sampling period. This magnitude is not trivial and is both statistically and economically significant.

Table 6
Simultaneous equation model showing the relation between market beta and option-based compensation estimated using two-stage least squares (2SLS)

Models of: Equations of:	(1) β_{mj} & OPTION/TOTAL_COMP		(2) β_{mj} & ACCUMULATED_OPTION	
	β_{mj}	OPTION/TOTAL_COMP	β_{mj}	ACCUMULATED_OPTION
Variable				
OPTION/TOTAL_COMP	0.0122	–	–	–
	(1.72)*			
ACCUMULATED_OPTION	–	–	0.0122	–
	–	–	(4.03)***	–
β_{mj}	–	15.268	–	28.049
	–	(2.89)***	–	(5.73)***
LN(TA)	0.0386	0.685	0.0163	−0.2044
	(2.08)**	(0.8)	(0.93)	(−0.26)
CAPITAL_RATIO	−1.66	–	−4.53	–
	(−2.01)**	–	(−5.08)***	–
NON_INT_INCOME%	−0.1428	–	−0.1597	–
	(0.6)	–	(−0.77)	–
GEO_DUMMY	−0.02	–	0.0546	–
	(−0.4)	–	(1.21)	–
STOCK_PRICE	–	0.0566	–	0.1248
	–	(2.22)**	–	(5.28)***
Dum92/Rate92	0.3746	−3.0709	0.3733	−2.5653
	(4.24)***	(−3.13)***	(5.43)***	(−2.82)***
Dum93/Rate93	0.4031	−3.1506	0.4133	−3.165
	(4.03)***	(−2.7)***	(5.75)***	(−2.93)***
Dum94/Rate94	0.2113	0.0276	0.25	−0.865
	(2.48)**	(0.03)	(3.59)***	(−1.16)
Dum95/Rate95	0.0581	−0.8677	0.073	0.1009
	(0.84)	(−1.41)	(1.16)	(0.18)
Dum97/Rate97	0.4018	0.3142	0.3743	0.8534
	(5.78)***	(0.45)	(5.86)***	(1.33)
Dum98/Rate98	0.5228	1.5426	0.5089	0.9714
	(7.56)***	(2.28)**	(8.05)***	(1.55)
Dum99/Rate99	0.3271	3.2712	0.3378	0.4031
	(4.53)***	(4.37)***	(5.19)***	(0.58)

(*continued on next page*)

Table 6 (*continued*)

Models of: Equations of:	(1) β_{mj} & OPTION/TOTAL_COMP		(2) β_{mj} & ACCUMULATED_OPTION	
	β_{mj}	OPTION/TOTAL_COMP	β_{mj}	ACCUMULATED_OPTION
Dum00/Rate00	−0.1916	1.6142	−0.1829	2.0926
	(2.64)***	(2.61)***	(−2.79)***	(3.66)***
R^2	27.8%	17.5%	32%	19.5%

This table shows the parameter estimates and *t*-statistics (in parentheses) for a simultaneous regression model explaining the relation between market beta and the two compensation variables. Market beta and OPTION/TOTAL_COMP are treated as endogenous, jointly determined variables in model 1 and market beta and ACCUMULATED_OPTION are treated as endogenous, jointly determined variables in model 2. β_{mj} is a measure of systematic risk; OPTION/TOTAL_COMP is the ratio of option-based compensation to total compensation; ACCUMULATED_OPTION is the value of the accumulated in-the-money stock options held to date; LN(TA) is the natural log of total assets; CAPITAL_RATIO is the capital-to-assets ratio; NON_INT_INCOME% is the percentage of income that is from non-interest sources; GEO_DUMMY is a binary variable measuring geographic diversification; STOCK_PRICE is the stock price; Dum92–Dum00 are dummy variables used in the risk equation and are coded as 1 or 0 for each year from 1992 to 2000; and Rate92–Rate00 are variables used in the compensation equation and are coded as the T-bill rate or 0 for each year from 1992 to 2000. 1996 is the excluded year.

***, **, * indicates significance at the 1%, 5%, and 10% levels, respectively.

Table 7
Simultaneous equation model showing the relation between interest rate beta and option-based compensation estimated using two-stage least squares (2SLS)

Models of: Equations of:	(1) β_{Ij} & OPTION/TOTAL_COMP		(2) β_{Ij} & ACCUMULATED_OPTION	
	β_{Ij}	OPTION/TOTAL_COMP	β_{Ij}	ACCUMULATED_OPTION
Variable				
OPTION/TOTAL_COMP	0.0056	–	–	–
	(1.67)*			
ACCUMULATED_OPTION	–	–	0.0053	–
	–	–		–
	–		–	
	–	–	(3.55)***	–
β_{Ij}	–	30.4	–	38.937
	–	(2.32)**	–	(3.18)***
LN(TA)	−0.0217	2.34	−0.031	2.7551
CAPITAL_RATIO	(−2.48)**	(3.31)***	(−3.62)***	(4.18)***
	−0.878	–	−2.1357	–
	(−2.25)**	–	(−4.87)***	–
NON_INT_INCOME%	−0.098	–	−0.22	–
	(−0.87)	–	(−2.17)**	–
GEO_DUMMY	−0.024	–	0.0086	–
	(−1.04)	–	(0.39)	–
STOCK_PRICE	–	0.041	–	0.0932
	–	(1.62)*	–	(3.94)***
Dum92/Rate92	0.167	−1.8667	0.1642	−0.5922
	(4.02)***	(−1.88)**	(4.86)***	(−0.64)
Dum93/Rate93	0.1223	−1.0128	0.1236	0.1567
	(2.6)***	(−0.82)	(3.5)***	(0.14)
Dum94/Rate94	−0.0364	0.5775	−0.0218	−0.2006
	(−0.91)	(0.66)	(−0.64)	(−0.25)
Dum95/Rate95	−0.089	−1.2217	−0.0826	−0.5017
	(−2.74)***	(−1.94)**	(−2.67)***	(−0.85)
Dum97/Rate97	0.2426	0.50	0.231	1.2853
	(7.41)***	(0.71)	(7.36)***	(1.95)**
Dum98/Rate98	0.0092	1.7185	0.0034	1.3416
	(0.28)	(2.48)**	(0.11)	(2.07)**
Dum99/Rate99	−0.0052	3.7188	−0.0012	1.088
	(−0.15)	(4.79)***	(−0.04)	(0.13)

(*continued on next page*)

Table 7 (*continued*)

Models of: Equations of:	(1) β_{Ij} & OPTION/TOTAL_COMP		(2) β_{Ij} & ACCUMULATED_OPTION	
	β_{Ij}	OPTION/TOTAL_COMP	β_{Ij}	ACCUMULATED_OPTION
Dum00/Rate00	0.5419	1.2096	0.5461	1.4614
	(15.85)***	(1.89)**	(16.94)***	(2.45)***
R^2	49%	16%	52%	16%

This table shows the parameter estimates and *t*-statistics (in parentheses) for a simultaneous regression model explaining the relation between interest rate risk and the two compensation variables. Interest rate beta and OPTION/TOTAL_COMP are treated as endogenous, jointly determined variables in model 1 and interest rate beta and ACCUMULATED_OPTION are treated as endogenous, jointly determined variables in model 2. β_{Ij} is a measure of interest rate risk; OPTION/TOTAL_COMP is the ratio of option-based compensation to total compensation; ACCUMULATED_OPTION is the value of the accumulated in-the-money stock options held to date; LN(TA) is the natural log of total assets; CAPITAL_RATIO is the capital-to-assets ratio; NON_INT_INCOME% is the percentage of income that is from non-interest sources; GEO_DUMMY is a binary variable measuring geographic diversification; STOCK_PRICE is the stock price; Dum92–Dum00 are dummy variables used in the risk equation and are coded as 1 or 0 for each year from 1992 to 2000; and Rate92–Rate00 are variables used in the compensation equation and are coded as the T-bill rate or 0 for each year from 1992 to 2000. 1996 is the excluded year.

***, **, * indicates significance at the 1%, 5%, and 10% levels, respectively.

Table 8
Simultaneous equation model showing the relation between idiosyncratic risk and option-based compensation estimated using two-stage least squares (2SLS)

Models of: Equations of:	(1) σ_{uj} & OPTION/TOTAL_COMP		(2) σ_{ji} & ACCUMULATED_OPTION	
	σ_{uj}	OPTION/TOTAL_COMP	σ_{uj}	ACCUMULATED_OPTION
Variable				
OPTION/TOTAL_COMP	0.00026	–	–	–
	(2.15)**			
ACCUMULATED_OPTION	–	–	0.00019	–
	–	–	(4.75)***	–
σ_{ui}	–	1259.8	–	2073.89
	–	(3.21)***	–	(5.64)***
LN(TA)	−0.0013	2.42	−0.0016	2.9423
	(−4.28)***	(3.41)***	(−6.76)***	(4.43)***
CAPITAL_RATIO	−0.027	–	−0.075	–
	(−1.93)**	–	(−6.21)***	–
NON_INT_INCOME%	0.00128	–	−0.0021	–
	(0.32)	–	(−0.73)	–
GEO_DUMMY	−0.0009	–	0.00041	–
	(−1.09)	–	(0.67)	–
STOCK_PRICE	–	0.082	–	0.1623
	–	(2.81)***	–	(5.95)***
Dum92/Rate92	0.0057	−1.8879	0.00528	−0.470
	(3.89)***	(−1.91)**	(5.64)***	(−0.51)
Dum93/Rate93	0.0055	−1.086	0.0051	0.434
	(3.31)***	(−0.91)	(5.2)***	(0.39)
Dum94/Rate94	0.002	0.713	0.0022	0.2495
	(1.41)	(0.83)	(2.33)**	(0.31)
Dum95/Rate95	0.00034	−1.128	0.00058	−0.3785
	(0.29)	(−1.79)*	(0.67)	(−0.64)
Dum97/Rate97	0.0023	0.4085	0.0019	1.0751
	(1.97)**	(0.57)	(2.17)**	(1.62)*
Dum98/Rate98	0.0063	1.7185	0.0061	1.1131
	(5.44)***	(2.48)**	(7.07)***	(1.7)*
Dum99/Rate99	0.0067	3.5932	0.0067	0.9716
	(5.53)***	(4.65)***	(7.57)***	(1.34)

(*continued on next page*)

Table 8 (*continued*)

Models of: Equations of:	(1) σ_{uj} & OPTION/TOTAL_COMP		(2) σ_{ji} & ACCUMULATED_OPTION	
	σ_{uj}	OPTION/TOTAL_COMP	σ_{uj}	ACCUMULATED_OPTION
Dum00/Rate00	0.0134	1.2425	0.0136	1.442
	(11.04)***	(1.95)**	(15.21)***	(2.42)**
R^2	29%	17%	43%	18.3%

This table shows the parameter estimates and *t*-statistics (in parentheses) for a simultaneous regression model explaining the relation between idiosyncratic risk and the two compensation variables. Idiosyncratic risk and OPTION/TOTAL_COMP are treated as endogenous, jointly determined variables in model 1 and idiosyncratic risk and ACCUMULATED_OPTION are treated as endogenous, jointly determined variables in model 2. σ_{uj} is a measure of idiosyncratic risk; OPTION/TOTAL_COMP is the ratio of option compensation to total compensation; ACCUMULATED_OPTION is the value of the accumulated in-the-money stock options held to date; LN(TA) is the natural log of total assets; CAPITAL_RATIO is the capital-to-assets ratio; NON_INT_INCOME% is the percentage of income that is from non-interest sources; GEO_DUMMY is a binary variable measuring geographic diversification; STOCK_PRICE is the stock price; Dum92–Dum00 are dummy variables used in the risk equation and are coded as 1 or 0 for each year from 1992 to 2000; and Rate92–Rate00 are variables used in the compensation equation and are coded as the T-bill rate or 0 for each year from 1992 to 2000. 1996 is the excluded year.

***, **, * indicates significance at the 1%, 5%, and 10% levels, respectively.

statistically significant consistent with results reported in the previous tables. In the compensation equation, risk carries a positive sign and is statistically significant at the one-percent level suggesting that both risk and compensation are jointly determined. Firm value, proxied by the stock price, is statistically significant and carries the expected sign. These results reaffirm our findings that option-based wealth alters the incentives for risk-taking in the banking industry.

In addition to total risk, we also report the relation between compensation and other risk measures in a simultaneous equation setting. Studying the relationship between compensation and various risk measures serves two purposes. First, different managers may target different risk exposures. For example, managers who actively engage in hedging interest rate risk using derivatives will see smaller β_I; while managers who emphasize credit risk will see changes in total and idiosyncratic risks. Second, results obtained from alternative risk measures supporting the same hypotheses are important because these results mitigate the concern that total volatility of stock returns and the level of accumulated option-based wealth are mechanically correlated, since betas and idiosyncratic risk are not theoretical inputs for option value determination.

Tables 6–8 present results of the relation between COMP and market risk, interest rate beta, and idiosyncratic risk, respectively. Consistent with results reported in Table 5, we find that (1) both compensation structure (OPTION/TOTAL_COMP) and option-based wealth (ACCUMULATED_OPTION) induce risk-taking in all risk measures although the effect is generally stronger for the ACCUMULATED_OPTION variable; (2) firm risk affects compensation contract design. That is, more risky firms offer more equity-based compensation; and (3) risk and both compensation measures are jointly determined in a simultaneous equation system.

4.4. Executive compensation, firm risk, and firm value

While we analyze the relation between compensation and firm risk in the above sections, prior literature has focused on the relation between firm value and compensation. Therefore, it is possible to combine these two veins of research in a three-equation model that studies the relation among three variables; compensation, firm risk, and firm performance. Combining these three variables in a system of equations makes sense when compensation, firm performance, and firm risk are interrelated and are jointly determined.

In Table 9, we report the results of such a model estimated using 2SLS method. In Table 9, columns 2 and 3 represent the essence of our research, i.e., the relation between compensation (OPTION/TOTAL_COMP) and firm risk (σ_j). On the other hand, columns 3 and 4 represent the relation between compensation and shareholder wealth examined in many compensation studies. Change in shareholder wealth (ΔWEALTH) is measured by the product of the stock return and the bank's market value of equity in the last period. Specification of the risk equation and compensation equation is similar to that reported in the previous tables. Specification of the shareholder wealth equation follows prior literature in that it is a function of executive compensation and firm size. We also add revenue growth rate in the past three years (GROWTH) and dividend yield (DIV_YLD) as additional predetermined variables. Results of Eqs. (1) and (2) in Table 9 are consistent with the results reported in Table 5 that employs a two-equation system. That is, OPTION/TOTAL_COMP positively impacts risk-taking, and firm risk increases equity-based compensation. The result

Table 9
Simultaneous equation model showing the relation between total risk, market valuation, and the structure of compensation estimated using two-stage least squares (2SLS)

Models of:	σ_j	OPTION/TOTAL_COMP	ΔWEALTH
Variable	Eq. (1)	Eq. (2)	Eq. (3)
OPTION/TOTAL_COMP	0.00028	–	−0.98
	(2.17)**	–	(−0.03)
σ_j	–	1065.12	–
	–	(3.13)***	–
LN(TA)	−0.00123	2.1907	945.41
	(3.73)***	(3.13)***	(7.25)***
CAPITAL_RATIO	−0.027	–	–
	(−1.83)*	–	–
NON_INT_INCOME%	0.00115	–	–
	(0.27)		
GEO_DUMMY	−0.0009	–	–
	(−0.99)	–	–
STOCK_PRICE	–	0.0758	–
	–	(2.69)***	–
GROWTH	–	–	−9.499
	–	–	(−1.12)
DIV_YLD	–	–	−674.34
	–	–	(−6.14)***
Dum92/Rate92	0.006	−1.842	−1104.5
	(3.8)***	(−1.88)**	(−2.33)**
Dum93/Rate93	0.0056	−1.054	−1481.1
	(3.15)***	(−0.89)	(−3.02)***
Dum94/Rate94	0.0022	0.757	−1220.7
	(1.42)	(0.88)	(−2.72)***
Dum95/Rate95	0.00006	−1.103	25.41
	(0.05)	(−1.77)*	(0.06)
Dum97/Rate97	0.0033	0.4035	854.66
	(2.66)***	(0.57)	(2.01)**
Dum98/Rate98	0.0095	1.592	−1219.9
	(7.68)***	(2.3)**	(−2.9)***
Dum99/Rate99	0.0071	3.591	−2993.9
	(5.47)***	(4.7)***	(−7.01)***
Dum00/Rate00	0.0137	1.259	−173.35
	(10.53)***	(2.0)**	(−0.39)
R^2	33%	17%	33%

This table shows the parameter estimates and t-statistics (in parentheses) for a simultaneous regression model explaining the relation between total risk, option-based compensation as a percentage of total compensation, and changes in shareholder wealth. All three variables are treated as endogenous and jointly determined. σ_j is a measure of total risk; OPTION/TOTAL_COMP is a ratio of option-based compensation to total compensation; ΔWEALTH is the change in shareholder wealth; LN(TA) is the natural log of total assets; CAPITAL_RATIO is the capital-to-assets ratio; NON_INT_INCOME% is the percentage of income that is from non-interest sources; GEO_DUMMY is a binary variable measuring geographic diversification; STOCK_PRICE is the stock price; GROWTH is the three-year sales growth rate; DIV_YLD is the dividend yield; Dum92–Dum00 are dummy variables used in the σ_j and ΔWEALTH equations and are coded as 1 or 0 for each year from 1992 to 2000; and Rate92–Rate00 are variables used in the compensation equation and are coded as the T-bill rate or 0 for each year from 1992 to 2000. 1996 is the excluded year.

***, **, * indicates significance at the 1%, 5%, and 10% levels, respectively.

Table 10
Simultaneous equation model showing the relation between total risk, market valuation, and the stock of option-based compensation estimated using 2SLS method

Models of:	σ_j	ACCUMULATED_OPTION	ΔWEALTH
Variable	Eq. (1)	Eq. (2)	Eq. (3)
ACCUMULATED_OPTION	0.00021	–	40.665
	(4.86)***	–	(2.97)***
σ_j	–	1877.65	–
	–	(5.93)***	–
LN(TA)	−0.00154	2.5616	750.1
	(−6.12)***	(3.93)***	(7.35)***
CAPITAL_RATIO	−0.08	–	–
	(−6.21)***	–	–
NON_INT_INCOME%	−0.0025	–	–
	(−0.83)	–	–
GEO_DUMMY	0.00056	–	–
	(0.85)	–	–
STOCK_PRICE	–	0.1571	–
	–	(5.99)***	–
GROWTH	–	–	−10.878
	–	–	(−1.46)
DIV_YLD	–	–	−475.4
	–	–	(−4.32)***
Dum92/Rate92	0.0055	−0.3407	−824.8
	(5.54)***	(−0.37)	(−1.89)**
Dum93/Rate93	0.0052	0.6085	−1195.2
	(4.98)***	(0.55)	(−2.76)***
Dum94/Rate94	0.0024	0.4149	−1041.6
	(2.37)***	(0.52)	(−2.49)***
Dum95/Rate95	0.00033	−0.3342	−10.013
	(0.36)	(−0.57)	(−0.03)
Dum97/Rate97	0.0029	1.0367	854.1
	(3.11)***	(1.58)	(2.14)**
Dum98/Rate98	0.0093	1.0771	−1236.7
	(10.15)***	(1.67)*	(−3.12)***
Dum99/Rate99	0.0071	0.981	−2922.0
	(7.55)***	(1.38)	(7.27)***
Dum00/Rate00	0.0139	1.4515	−250.6
	(14.65)***	(2.47)***	(−0.61)
R^2	45%	19%	36%

This table shows the parameter estimates and *t*-statistics (in parentheses) for a simultaneous regression model explaining the relation between total risk, the accumulation of stock options, and the change in shareholder wealth. All three variables are treated as endogenous and jointly determined. σ_j is a measure of total risk; ACCUMULATED_OPTION is the value of the accumulated in-the-money stock options held to date; ΔWEALTH is the change in shareholder wealth; LN(TA) is the natural log of total assets; CAPITA_RATIO is the capital-to-assets ratio; NON_INT_INCOME% is the percentage of income that is from non-interest sources; GEO_DUMMY is a binary variable measuring geographic diversification; STOCK_PRICE is the stock price; GROWTH is the three-year sales growth rate; DIV_YLD is the dividend yield; Dum92–Dum00 are dummy variables used in the σ_j and ΔWEALTH equations and are coded as 1 or 0 for each year from 1992 to 2000; and Rate92–Rate00 are variables used in the compensation equation and are coded as the T-bill rate or 0 for each year from 1992 to 2000. 1996 is the excluded year.

***, **, * indicates significance at the 1%, 5%, and 10% levels, respectively.

in Eq. (3), however, is consistent with the hypothesis that compensation structure is endogenously designed and thus has no impact on shareholder wealth.

Table 10 reports the results when executive compensation is measured by accumulated options. Our main result suggests that, consistent with our previous findings in Table 6, executive compensation (ACCUMULATED_OPTION) impacts firm risk and vice versa. Results from the ΔWEALTH equation also suggest that accumulated option does enhance shareholder wealth. Since ACCUMULATED_OPTION has a more significant impact on risk than OPTION/TOTAL_COMP as reported in previous tables, this result does lend some support to the argument that executive's option-based wealth promotes risk-taking, which in turn enhances shareholder wealth.[14]

We also check the robustness of this finding by repeating the same model design of a three-equation simultaneous equation system for alternative risk measures. Though not reported here, all results come to the same conclusion and are consistent with those reported in Tables 9 and 10. That is, the CEO's option-based compensation induces risk-taking and there is some evidence that it also enhances shareholder wealth, thus aligning the interests of executives and shareholders.

4.5. Robustness checks

In Section 4.3, we stated that examining alternative risk measures mitigates the concern that total volatility of stock returns and the level of accumulated option-based wealth are mechanically correlated. However, one may argue that if all risk measures are correlated, using alternative risk measures does not resolve the concern entirely. In this section, we re-examine this issue by using a *relative* measure of executive's option-based wealth.

Relative option-based wealth is calculated by dividing the level of accumulated option-based wealth (ACCUMULATED_OPTION) by the level of executive's non-option based compensation.[15] The rationale for using this relative measurement is intuitively obvious. When the accumulated option-based wealth is large relative to the executive's non-option based compensation, the executive derives a proportionally larger part of his/her utility from option-based wealth, and the risk-taking decision will be more likely to be affected by such wealth. On the other hand, when the executive's option-based wealth is small relative to his/her non-option based compensation, the executive derives most of the utility from non-option based compensation, and the risk-taking decision is less likely to be affected by the option-based wealth. Since this *relative option-based wealth* is a "ratio" of two types of wealth, it is less likely to be *mechanically* correlated with stock return volatility.

Table 11 reports 2SLS results of the risk equation (σ_j) and the compensation equation (ACCUMULATED_OPTION% – a relative option-based wealth measure) in a two-equation simultaneous equation system. ACCUMULATED_OPTION% carries a posi-

[14] Arguments can be made questioning the true exogeneity of certain control variables used in the simultaneous equation system such as capital-to-asset ratio and dividend yield. Indeed, it is very difficult, if not impossible, to find economic variables that are purely exogenous. To further mitigate this concern, nonetheless, we also test models presented in Tables 5–10 using the lagged capital-to-asset ratio and the lagged dividend yield. Our conclusion that compensation positively impacts risk does not change. Using lagged variables, however, imposes constraints on the sample size.

[15] This new variable has a mean and standard deviation of 5.775 and 8.573, respectively.

Table 11
Simultaneous equation model showing the relation between total risk and the relative options wealth estimated using two-stage least squares (2SLS)

Models of:	σ_j	ACCUMULATED_OPTION %
Variable	Eq. (1)	Eq. (2)
ACCUMULATED_OPTION %	0.00013	–
	(2.03)**	–
σ_j	–	720.04
	–	(5.13)***
LN(TA)	−0.0009	−0.5623
	(−4.72)***	(−1.95)***
CAPITAL_RATIO	−0.045	–
	(−4.95)***	–
NON_INT_INCOME%	0.0066	–
	(3.41)***	–
GEO_DUMMY	−0.00012	–
	(−0.21)	–
STOCK_PRICE	–	0.0997
	–	(8.58)***
Dum92/Rate92	0.0045	−0.379
	(5.17)***	(−0.94)
Dum93/Rate93	0.0037	−0.039
	(4.04)***	(−0.08)
Dum94/Rate94	0.0009	−0.083
	(1.04)	(−0.23)
Dum95/Rate95	0.00016	−0.229
	(0.19)	(−0.89)
Dum97/Rate97	0.0033	0.782
	(4.07)***	(2.69)***
Dum98/Rate98	0.0096	0.631
	(11.9)***	(2.21)**
Dum99/Rate99	0.0067	0.313
	(8.08)***	(0.99)
Dum00/Rate00	0.0141	0.773
	(16.82)***	(2.97)***
R^2	50%	23%

This table shows the parameter estimates and *t*-statistics (in parentheses) for a simultaneous regression model explaining the relation between total risk and the relative accumulation of stock options. Total risk and ACCUMULATED_OPTION% are treated as endogenous, jointly determined variables in the system. σ_j is a measure of total risk; ACCUMULATED_OPTION% is the ratio of the value of the accumulated stock options held to date to the non-option based compensation; LN(TA) is the natural log of total assets; CAPITAL_RATIO is the capital-to-assets ratio; NON_INT_INCOME% is the percentage of income that is from non-interest sources; GEO_DUMMY is a binary variable measuring geographic diversification; STOCK_PRICE is the stock price; Dum92–Dum00 are dummy variables used in the risk equation and are coded as 1 or 0 for each year from 1992 to 2000; and Rate92–Rate00 are variables used in the compensation equation and are coded as the T-bill rate or 0 for each year from 1992 to 2000. 1996 is the excluded year.
***, **, * indicates significance at the 1%, 5%, and 10% levels, respectively.

tive sign and is statistically significant at the five percent level, consistent with the results reported when the level of option-based wealth is used. We also test the relationship between ACCUMULATED_OPTION% and alternative risk measures. Though not reported here, all significant relationships hold except for systematic risk. We also test the three-equation system using this relative option-based wealth measure. Table 12

Table 12
Simultaneous equation model showing the relation between total risk, market valuation, and the relative options wealth estimated using two-stage-least squares (2SLS)

Models of:	σ_j	ACCUMULATED_OPTION%	ΔWEALTH
Variable	Eq. (1)	Eq. (2)	Eq. (3)
ACCUMULATED_OPTION%	0.00013	–	88.97
	(2.03)***	–	(2.27)***
σ_j	–	720.04	–
	–	(5.13)***	–
LN(TA)	−0.0009	−0.562	879.14
	(−4.72)***	(−1.95)**	(9.73)***
CAPITAL_RATIO	−0.045	–	–
	(−4.95)***	–	–
NON_INT_INCOME%	0.0067	–	–
	(3.41)***	–	–
GEO_DUMMY	−0.0001	–	–
	(−0.21)	–	–
STOCK_PRICE	–	0.0997	–
	–	(8.58)***	–
GROWTH	–	–	−11.98
	–	–	(−1.47)
DIV_YLD	–	–	−472.73
	–	–	(−3.63)***
Dum92/Rate92	0.0045	−0.379	−770.3
	(5.17)***	(−0.94)	(1.58)
Dum93/Rate93	0.0036	−0.039	−1062
	(4.04)***	(0.08)	(−2.14)**
Dum94/Rate94	0.0009	−0.083	−959.8
	(1.04)	(−0.23)	(−2.06)**
Dum95/Rate95	0.00016	−0.229	0.3024
	(0.19)	(−0.89)	(0.0)
Dum97/Rate97	0.0033	0.782	832.2
	(4.07)***	(2.69)***	(1.91)*
Dum98/Rate98	0.0096	0.631	−1198.3
	(11.9)***	(2.21)**	(−2.78)***
Dum99/Rate99	0.0067	0.3129	−2854.0
	(8.08)***	(0.99)	(−6.47)***
Dum00/Rate00	0.0141	0.7728	−205.88
	(16.82)***	(2.97)***	(−0.46)
R^2	50%	23%	32%

This table shows the parameter estimates and *t*-statistics (in parentheses) for a simultaneous regression model explaining the relation between total risk, the relative accumulation of stock options, and the change in shareholder wealth. All three variables are treated as endogenous and jointly determined. σ_j is a measure of total risk; ACCUMULATED_OPTION% is the ratio of the value of the accumulated stock options held to date to the non-option based compensation; ΔWEALTH is the change in shareholder wealth; LN(TA) is the natural log of total assets; CAPITAL_RATIO is the capital-to-assets ratio; NON_INT_INCOME% is the percentage of income that is from non-interest sources; GEO_DUMMY is a binary variable measuring geographic diversification; STOCK_PRICE is the stock price; GROWTH is the three-year sales growth rate; DIV_YLD is the dividend yield; Dum92–Dum00 are dummy variables used in the σ_j and ΔWEALTH equations and are coded as 1 or 0 for each year from 1992 to 2000; and Rate 92–Rate 00 are variables used in the compensation equation and are coded as the T-bill rate or 0 for each year from 1992 to 2000. 1996 is the excluded year.
***, **, * indicates significance at the 1%, 5%, and 10% levels, respectively.

reports the results using the total risk measure (σ_j), relative option-based wealth (ACCUMULATED_OPTION%), and changes in shareholder wealth (ΔWEALTH) as the endogenous variables. These results are basically similar to those reported in Table 10 when the level of option-based wealth (ACCUMULATED_OPTION) is used as a measure of executive compensation.

Taken collectively, our results show that executive compensation impacts firm risk, and firm risk also affects executive compensation contract design. More importantly, we provide evidence that the use of stock option-based compensation in the banking industry increases executive's option-based wealth over time, which in turn induces firm risk-taking. We also find some limited evidence that option-based compensation creates an alignment effect in which the interests of executives and shareholders converge.

Our results provide an important extension to the findings of earlier studies. For example, using earlier period data, Houston and James (1995) conclude that the compensation structure in the banking industry does not promote risk-taking. Our results, based on more recent data following deregulation show that compensation structure and the accumulation of stock option-based wealth appear to induce risk-taking. Our finding of a positive relation between compensation and risk-taking may be due to the expanded investment opportunity set now available to banks, and our findings are inconsistent with the previous suggestion that the relatively limited opportunity set in the banking industry mitigates the risk incentive effects that are potentially inherent in executive compensation contracts.

5. Conclusions

We investigate the relation between stock option-based bank compensation and risk-taking. We use three different measures of compensation and four different market-based measures of risk to test this relation while employing several alternative estimation methodologies. Our pooled sample contains 68 banks involving 70 CEOs over the time period from 1992 to 2000, resulting in 591 bank-CEO-year observations.

Several important conclusions emerge from our analysis. First, in comparison to a sample of industrial firms, the use of stock option-based compensation has become more widespread in the banking industry, and the percentage of stock option-based compensation relative to total compensation has also increased. Second, the structure of executive compensation (proxied by stock options as a percentage of total compensation) induces risk-taking in the banking industry; risk also impacts compensation structure. Third, the *stock* of option-based wealth induces risk-taking in the banking industry. This relationship also holds in reverse (We reaffirm these findings using a relative option-based wealth measure). Fourth, the results are robust across alternative risk measures and model specifications (both two- and three-equation simultaneous equation systems). Finally, we provide limited evidence that option-based wealth enhances shareholder wealth.

These results should be interesting to regulators in their role as monitors of the banking system. Our findings suggest that regulatory oversight of the compensation structure employed in the banking industry is important. Indeed, our results are supportive of the theoretical arguments presented by John et al. (2000) who suggest that regulators need to consider a new paradigm that explicitly provides the appropriate incentives/disincentives for risk-taking within the compensation structure.

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