Executive Compensation and Efficiency: A Study of Large and Medium Sized Bank Holding Companies

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I. INTRODUCTION

Evolution of the regulatory environment of the banking industry over the past fifteen years has provided significant opportunities for banks to merge, expand, acquire, and be acquired relative to the previous fifty years. Throughout the 1980s most states, including the District of Columbia, began permitting banks to operate across state lines on a reciprocal basis. By 1989, 46 states had done so. That year saw the passage of the Financial Institution Reform, Recovery, and Enforcement Act (FIRREA) that permitted healthy commercial banks to acquire healthy thrifts across state lines. By the end of 1994, 28 percent of U.S. banking assets were controlled by out-of-state banking organizations (Berger, Kashyap, and Scalise, 1994) and in that year the Riegle-Neal Interstate Banking and Branching Efficiency Act permitted banks to consolidate management of their interstate operations at a central location.

Increased opportunities, however, imply increased management monitoring costs because managers may be risk adverse (Jenson and Meckling, 1976), engage in firm-enlarging actions, or prefer "the quiet life" (Berger and Humphrey, 1997) and not act in the best interest of their shareholders. As a result, Bank Holding Company's (BHCs) must create compensation packages that entice managers to take advantage of the opportunities offered by deregulation. Very often bank efficiency and profitability are improved through expansion. Large asset size should exploit economies of scale, permit diversification of assets and liabilities, reduce vulnerability to competition from larger competitors, and create a market structure that gives management some control over pricing. Unfortunately, it is possible that these benefits do not materialize and that increased asset size merely ends up serving as a pretext for increased executive compensation (Jensen and Murphy, 1990, Hubbard and Palia, 1995, Bliss and Rosen, 2001). Increased asset size may lead to diseconomies of scale or insulate management from the need to seek the most efficient means of serving the bank's customers. It becomes imperative that compensation packages reward executives for bank efficiency and profitability and avoid compensation related to the "size" of the bank.

This paper uses Data Envelopment Analysis (DEA) to examine the relationship between executive compensation, asset size, profitability, and three measures of efficiency (Overall Technical, Pure Technical, and Scale) for the largest BHCs in the United States. Lebenstein (1966) introduced the notion that allocation is not the only dimension to efficiency and used the term "X-Efficiency" to refer to the extent that efficiently allocated resources approached their optimal benefit. The advantage of DEA over conventional accounting-based or market-based measures of BHC performance is that it assesses production/intermediation efficiency of BHCs and abstracts completely from price effects that may stem from different market structures. We find evidence that executive compensation is more sensitive to overall technical efficiency rela-

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tive to asset size for smaller BHCs in our sample while the opposite is true for larger BHCs. In particular, we document that executive compensation is positively related to pure technical efficiency for all BHCs sampled but that larger BHCs are operating at decreasing returns to scale. Our results are consistent with the hypothesis that executive compensation packages induce larger BHCs to expand beyond their optimal scale.

The rest of this paper is organized as follows. Section II is a review of the literature, Section III describes the data and methodology, Section IV discusses the DEA results, Section V discusses the relation between efficiency and executive compensation, and Section VI summarizes and concludes the paper.

II. REVIEW OF THE LITERATURE

The motivation for the gradual phasing out of the McFadden Act was the assumption that the prohibition from interstate banking had reduced competition, forced banks to operate at inefficient scales, and exposed them to otherwise diversifiable regional risk. The transition period has generated research interest in two related areas. A number of studies have focused on the scale economies of increased bank size. Some of the initial studies provide evidence that banks can achieve increasing returns to scale even when their asset size is in the low multibillion-dollar range (Shaffer, 1985, Hunter and Timme, 1986, Evanoff, Israilevich, and Merris, 1990, Noulas, Ray and Miller, 1990, Shaffer and David, 1991). However, more recent studies have been less fruitful in finding such evidence. For example, Bauer, Berger, and Humphrey (1993) report large banks are less efficient than small banks in a study that used 1986 data. Elyasiani and Mehdian (1995) find while large and medium sized banks in 1986 exhibited significant overall efficiency compared to very small (assets less than 50 million) banks, the difference was mainly a result of technical efficiency rather than scale efficiency. Miller and Noulas (1994), in a study of 201 of the largest commercial banks during the years 1984 to 1990, find scale efficiency varies little across their sample and is unrelated to profitability. Berger and Mester (1997) and Stiroh (2000) find that unexploited scale opportunities exist for banks of every size in general and for banks with assets in excess of $1 billion in particular. Thus the issue of scale economies is yet to be resolved.

The other line of research has focused on the effects of executive compensation on the performance of BHCs. Benston (1985), Coughlan and Schmidt (1985), and Murphy (1985) provide evidence that executive compensation is related to bank performance in terms of relative equity returns. Smith and Watts (1992) show that firms with more growth options tend to have higher executive compensation packages. They also report that firms in regulated industries have lower executive compensation packages. They reason that CEO's of firms with greater opportunity sets will have contracts that encourage risk taking. This reasoning would leave one to expect that as the investment opportunity set for banks expanded during the late 1980's and 1990's executive compensation would be adjusted to encourage executives to pursue opportunities. Crawford, Ezzell, and Miles (1995) find that there was, indeed, an increase in the sensitivity of executive compensation to stock returns during the period 1982 to 1988 relative to the period 1977 to 1981. They also present support that the increased sensitivity is due more to deregulation than the decline in bank capital. Houston and James (1995) report evidence consistent with Crawford, Ezzell, and Miles (1995) that bank executive compensation is indeed more sensitive to stock market performance than in other industries, but they find little evidence of pay-induced risk taking in the industry. Mishra and Neilsen (2000) find that the pay-performance relationship depends on the length of tenure of independent directors.

These studies focus on executive compensation and performance defined in terms of return on equity. Pi and Timme (1993), however, define performance in terms of cost efficiency calculated by using a stochastic cost frontier model. They show that both CEO equity participation and CEO compensation are positively related to efficiency when the CEO is not the chairman of the board but that this relation becomes negative or insignificant for banks where the CEO is also the chairman of the board. Asset size is used as a control variable (among others) but size is not significant in the regressions relating efficiency and executive compensation.

In the wake of the large restructurings of the 1990s it is appropriate to ask if asset size does play a role in determining executive compensation. This line of inquiry has its roots in Williamson (1963) and Marris (1963, 1971). These studies suggest that CEO's maximize across their own utility functions according to some shareholder satisficing constraint. Williamson concludes that the result is excessive administration costs. Marris concludes firms will grow too fast. Baumol (1962) comes to a similar conclusion. Penrose (1959) suggests that executive utility is maximized when gross profits, rather than profit margins, are maximized and that firms will maximize profits even as they are diluted over an ever growing capital base. Therefore, it is possible that the new-found opportunities to merge across state lines may cause a bias in favor of establishing BHCs that are larger than socially optimal.

The present study employs a non-parametric technique and a sample of the 136 largest BHCs to examine the relationship between efficiency and compensation using data from the 1998 Call Reports. In addition, we directly explore the relationship between size, economies of scales, and executive compensation. If the results suggest that the BHC executive compensation is more sensitive to asset size relative to efficiency then bank deregulation will not be as beneficial as originally hoped. That is because executive compensation schemes that encourage bank managers to exploit new opportunities for expansion through mergers and acquisitions with little regard for efficiency will not result in an operationally more efficient industry.

III. METHODOLOGY

To investigate the relationship between executive compensation and efficiency we employ the following model:

$$C_i = \beta_0 + \beta_1(Eff_i) + \beta_2(TA_i) + \beta_3(ROA_i) + \beta_4(TA_i{}^*Eff_i) + \varepsilon_i \quad (1)$$

where,

- C ≡ A measure of compensation,
- Eff ≡ A measure of efficiency,
- TA ≡ Total assets,
- ROA ≡ Return on assets,
- TA*Eff ≡ An interactive term, and

i refers to the i^{th} bank holding company.

Total assets and return on assets are included as control variables. The fifth term on the right is an interactive term that tests for parameter stability across asset size. Estimation of this model is a two-stage process. In stage 1, different efficiency indexes are computed and in stage 2 the parameters β_0, β_1, β_2, and β_3 are estimated using ordinary least squares.

We employ Data Envelopment Analysis (DEA), a non-parametric technique to compute several efficiency measures. Specifically, we calculate four measures of efficiency, overall technical efficiency (OTE), pure technical efficiency (PTE), scale efficiency (SE) and non-increasing returns to scale efficiency (NTE) for each bank included in the sample. To calculate these measures for the i^{th} bank holding company we follow Elyasiani and Mehdian (1995), Miller and Noulas (1996), and others by solving the following linear program.

$$\begin{aligned} &\text{Min } \tau_i \\ &\text{s.t.} \\ &\quad zX \le \tau_i x_i \qquad (2) \\ &\quad zY \ge y_i \\ &\quad z \in \Re_+^T \end{aligned}$$

where,

- X ≡ A matrix of inputs for all banks in the sample.
- Y ≡ A matrix of all outputs for all banks in the sample.
- τ_i ≡ Overall technical efficiency (OTE)
- z ≡ Intensity vector.
- y_i ≡ A vector of outputs produced by the i^{th} bank (i = 1, . . . , T).
- x_i ≡ A vector of inputs utilized by the i^{th} bank (i = 1, . . . , T).

i refers to the i^{th} bank holding company.

OTE calculated using the linear program (2) is an efficiency measure relative to a frontier that exhibits constant returns to scale. In order to calculate pure technical efficiency (PTE) we solve the same program for τ_i' but this time imposing the restriction $\Sigma z_i = 1$ so that τ_i' is PTE_i. Scale efficiency (SE) is equal to OTE/PTE. If $SE_i = 1$ then the bank is operating at constant returns to scale which is the socially optimal level. If $0 < SE \le 1$ then Bank i operates at an inappropriate scale: either increasing or decreasing returns to scale. We can determine the source of scale inefficiency by solving the program a third time for τ_i'' and imposing the restriction that $Sz_i \le 1$. Färe, Grosskopf and Lovell (1985) prove that if the $\tau_i' = \tau_i''$ then scale inefficiency is due to increasing returns to scale and due to decreasing returns to scale otherwise. Both cases are deviations from the socially optimal size.

IV. DATA

We use the "intermediary approach" to model bank activity. This approach considers sources of funds as inputs and uses of funds as outputs. Specifically, we assume BHCs employ four inputs: time deposits, transactions deposits, labor, and capital to produce four outputs: commercial and industrial loans, real estate loans, other loans, and investments.

Total costs include interest on deposits, employee and salary benefits, and expenses on premises and fixed assets. Components of executive compensation are taken from proxy statements and other sources available on EDGAR. In this study we focus on two separate measures of compensation; 1) salary and bonuses and 2) equity income. This second measure is designed to capture the compensation received by executives from the market and is computed by multiplying their aggregate holding of BHC common shares and options by the change in the stock price experienced in 1998. BHCs are identified using COMPUSTAT data and Dunn and Bradstreet's ***Directory of Corporate Families***. Data on inputs, outputs and costs were obtained from the December 1998 Call Reports. Three BHCs that had increased asset size through significant mergers during the year 1998 and one BHC that had significant non-bank operations were eliminated from the sample. In the end, data from 704 banks in the Call reports were consolidated into 136 holding companies. Table 1 displays the descriptive statistics of inputs, outputs, and compensation measures.

V. EMPIRICAL RESULTS

A. Efficiency

Table 2 shows that mean overall technical effi-

TABLE 1
Descriptive Statistics for Inputs, Outputs and Other Variables

Variable	Mean	Std. Dev.	Minimum	Maximum
Y_1	4,662,921	13,199,929	0	2,724,645
Y_2	6,599,841	13,758,402	0	115,649,476
Y_3	4,943,142	14,455183	6,448	120,833,743
Y_4	4,397,990	9,870,342	15,060	79,621,620
X_1	14,658,932	35,569,597	52,350	306,219,950
X_2	3,020,467	8,108,620	7,478	64,635,152
X_3	7,487	17,624	26	156,086
X_4	334,346	806,800	1,154	6,819,415
TC	1,065,294	2,567,527	3,149	21,547,140
Comp	1,136,069	1,002,328	103,846	6,228,686
TA	27,154,975	69,545,372	68,177	593,663,681
ROA	1.297	0.575	-1.430	5.076
EqInc	8,014,047	66,888,992	-84,683,950	698,627,728

Notation

Y_1	≡	C & I loans.
Y_2	≡	Real estate loans.
Y_3	≡	Other loans.
Y_4	≡	Total securities.
X_1	≡	Total time deposits.
X_2	≡	Total demand deposits.
X_3	≡	Labor.
X_4	≡	Premises.
TC	≡	Total costs.
TA	≡	Total assets.
Opt	≡	Intrinsic value of options
Comp	≡	Salary and Bonuses.
ROA	≡	Return on Assets
EqInc	≡	Equity induced changes in executive wealth

ciency of the BHCs is 0.786. This index is based on constant returns to scale technology and suggests that the "average" bank could generate the same output for 21.4% fewer inputs if it were on the best practice frontier. This estimate is lower than some of the more recent estimates (e.g. Miller and Noulas, 1996, or Elyasiani and Mehdian, 1995). However, as in most DEA studies, the largest contributor to excess input utilization was from pure technical inefficiency. Scale inefficiency, at 95.6%, was of relatively little consequence.

TABLE 2
Summary Statistics for Efficiency Measures of Entire Sample

Efficiency Measure	# of obs.	Mean	Std. Dev.	Min.	Max.
OE	136	0.727	0.176	0.239	1
OTE	136	0.786	0.146	0.505	1
PTE	136	0.823	0.149	0.516	1
SE	136	0.958	0.076	0.551	1
NTE	136	0.812	0.154	0.505	1

where,

OTE	=	Overall Technical Efficiency
PTE	=	Pure Technical Efficiency
SE	=	Scale Efficiency
NTE	=	Non-increasing returns to Scale Efficiency

In order to investigate the effect of size on efficiency we partition our sample into two equally sized subsamples based on assets with a threshold of $6.1 billion in total assets.

Statistically significant differences in both pure technical and overall technical efficiency measures emerge when the sample is decomposed into the largest and second largest BHCs. While Table 3 shows that large BHCs tend to be bunched very close to the efficient frontiers, Table 4 shows that there is greater dispersion among smaller BHCs. The larger BHCs appear to operate closer to the constant returns to scale technology than their smaller counterparts. Table 5 shows that this is indeed the case. The differences between large BHCs and small BHCs are significant at the 1% level by the Kruskall-Wallis and median chi-square criteria. Table 4 also shows that the greatest contributor to the relative inefficiency of the average small bank holding company is PTE with a difference in means of 8.4%. Again, according to Table 5, this is significant at the 1% level by both the Kruskall-Wallis and median chi square tests. This may be because of the ability of large BHCs to adopt non-scale technological advances more quickly or their greater ability to exploit economies of scope. While Mukherjee, Ray, and Miller (2001) find that larger asset size is associated with faster productivity growth, DEA cannot measure economies of scope

Small BHCs appear to be slightly more efficient than large BHCs in terms of scale efficiency according to Table 4 but we must reject this hypothesis by virtue of the results summarized in Table 5. Although Table

TABLE 3
Summary Statistics for Efficiency Measures of Larger BHC's

Efficiency Measure	# of obs.	Mean	Std. Dev.	Min.	Max.
OE	68	0.728	.0176	0.239	1
OTE	68	0.825	0.132	0.516	1
PTE	68	0.865	0.137	0.572	1
SE	68	0.945	0.077	0.719	1
NTE	68	0.865	0.138	0.571	1

TABLE 4
Summary Statistics for Efficiency Measure of Smaller BHC's

Efficiency Measure	# of obs.	Mean	Std. Dev.	Min.	Max.
OE	68	0.716	0.171	0.260	1
OTE	68	0.757	0.153	0.595	1
PTE	68	0.781	0.15	0.516	1
SE	68	0.971	0.074	0.551	1
NTE	68	0.758	0.153	0.505	1

TABLE 5
Statistical Tests of Differences Between Efficiency Measures of Smaller and Larger BHC's

Efficiency measures	ANOVA (F value)	K-W[1] Chi Sq	Median Chi-Sq
OE	0.57	1.44	1.05
OTE	5.54[b]	6.53[a]	5.72[a]
PTE	11.62[a]	10.26[a]	7.47[a]
SE	4.10[b]	1.85	0.12
NTE	18.15[a]	17.00[a]	9.46[a]

Notes:
[1] Kruskall-Wallis Chi-Square Value
[a] Significant at the 1% level.
[b] Significant at the 5% level.

5 shows that the difference was significant at the 5% level by the ANOVA F test, this test assumes normality of observations, which is clearly not the case.

Finally we note from Table 6 that while 63% of the larger banks are operating with decreasing returns to scale, 72% of the small banks are operating with increasing returns to scale.

TABLE 6
Number of BHC's in Different Classifications of Scale Economies

	Entire Sample	Smaller Banks	Larger Banks
CRS	24	11	13
DRS	51	8	43
IRS	61	49	12

List of symbols:

CRS = Constant return to scale.
DRS = Decreasing returns to scale.
IRS = Increasing returns to scale.

To summarize, consistent with recent DEA studies scale inefficiency is not a major issue for the largest BHCs during 1998. Large BHCs on average do enjoy significantly greater over all and pure technical efficiency than do smaller BHCs. This is consistent with the conjecture that either large BHCs are able to adopt new technologies more quickly.

B. Executive Compensation and Efficiency

In order to investigate whether executive compensation is associated with performance measured by the above efficient indices, we estimate Equation 1. Specifically, we regress salary and bonuses and equity income on the efficiency measures generated by the DEA. ***A priori*** one might expect that executives who manage efficient BHCs would be greatly rewarded. It is also possible that high level of compensation may be associated with inefficient operation. Compensation schemes tied to asset size, revenue growth, or merger activity may act to discourage resource-efficient operation. Entrenchment may lead to both high levels of compensation and sloppy management practices. Concentrated market structure may lead to high profits, high levels of executive compensation and poor efficiency. For these reasons all tests are two-tailed.

The overall technical efficiency (OTE) measure is, by construction, very much correlated to the other two. In effect, overall technical inefficiency is comprised of pure technical inefficiency and scale inefficiency. For this reason it is appropriate to take observations of executive compensation on each of the measures separately.

Asset size is included in the regressions as a control variable. It is possible that the relationship between executive compensation and efficiency is a function of asset size. Compensation at larger banks may give a higher weight to asset size relative to efficiency than smaller banks. For this reason we include an interactive term, efficiency measure times asset size. Finally, we would expect, a priori, that executive compensation should be related to profitability and for that reason we include return on assets as well.

As noted earlier, we use two measures of executive compensation. Salary and bonuses are compensation flows that reward performance for the immediate past. Wealth held in the form of common stock and stock options has been accumulated over the years, and serves as an incentive for long-term performance. Therefore we treat the two forms of compensation separately. Our results using salary and bonus as executive compensation are reported in Tables 7 through 10.

1. Salary and Bonus

The first column of Table 7 indicates that for the sample as a whole executive compensation is, indeed, associated with large asset size, profitability, and overall technical efficiency. However, the estimated coefficients are significant only at the 10% level and the interactive term is not significantly different from zero.

Chow (1960) suggests tests for parameter stability. One test is to partition the sample and compare the regression-squared errors of the two sub-samples to the regression squared errors of the whole. The results of this test are reported in the second two columns of Table 7. The interactive term is dropped and the sample is arbitrarily divided into two equal sub-samples by asset size. According to the Chow test, which is distributed $F_{4,128}$, the hypothesis of parameter instability can not be rejected. The second two columns of Table 7 also shed light on how executive compensation differs between BHCs of different asset sizes. For small BHCs the coefficient on overall technical is highly significant while the coefficient on assets is not. The opposite is true for large banks. Executives for larger BHCs tend to be rewarded more for size and profitability while executives of smaller BHCs tend to be rewarded for efficiency.

TABLE 7
Regression Results Dependent Variable: 98 Salary and Bonuses ($100,000)

	Whole Sample	Small BHC	Large BHC
Intercept	-4.313	-1.482	-0.090
	(1.147)	(1.673)	(0.014)
OTE	10.357[b]	7.488[a]	7.501
	(2.169)	(2.847)	(0.975)
TA	0.131	0.388	0.008[a]
	(1.275)	(1.56)	(7.359)
ROA	3.835[a]	0.361	4.868[a]
	(3.519)	(0.454)	(2.978)
TA*OTE	-0.044		
	(0.348)		
n	136	68	68
R^2_{Adj}	0.51	0.12	0.47
$F_{3,132}$	36.65[a]		
$F_{3,64}$		3.915[b]	20.601[a]
$F_{4,128}$		8.60[a]	8.60[a]

TA = Total Assets($billions), OTE = Overall Technical Efficiency, ROA = Return on Assets, n = sample size, $F_{4,128}$ is the Chow test for parameter instability, t-ratios are in parenthesis.

[a]significant at the 1% level.
[b]significant at the 5% level.
[c]significant at the 10% level.

The first column of Table 8 shows that executive compensation is a function of pure technical efficiency for the entire sample of 136 BHCs. All the coefficients are significant at the one-percent level including the interactive term. The second two columns of Table 8 explore these relations further. As before, the Chow tests reject the hypothesis of parameter stability. Executives at smaller BHCs tend to have their salary and bonuses tied more to asset size relative to larger BHCs and less to pure technical efficiency. One possible reason is that large banks may enjoy scale benefits of one-time transition costs of innovation that are not being picked up by the DEA analysis. If that is so, executives of larger BHCs who innovate more aggressively may enjoy a higher level of compensation. This conjecture is supported by the fact that profitability is significant in the larger bank holding company regression but not the small.

TABLE 8
Regression Results Dependent Variable: 98 Salary and Bonuses ($100,000)

	Whole Sample	Small BHC	Large BHC
Intercept	-17.124[a]	-3.298	-10.268
	(4.551)	(1.292)	(1.589)
PTE	21.144[a]	8.239[a]	20.597[a]
	(5.650)	(3.121)	(2.690)
TA	1.018[a]	0.515[b]	0.007[a]
	(4.413)	(2.027)	(6.168)
ROA	3.744[a]	0.906	4.208[a]
	(3.935)	(1.169)	(2.658)
TA*PTE	-0.936[a]		
	(4.040)		
n	136	68	68
R^2_{Adj}	0.60	0.14	0.51
$F_{3,132}$	51.82[a]		
$F_{3,64}$		4.488[a]	24.662[a]
$F_{4,128}$		8.67[a]	8.67[a]

TA = Total Assets($billions), PTE = Pure Technical Efficiency, ROA = Return on Assets, n = sample size, $F_{4,128}$ is the Chow test for parameter instability, t-ratios are in parenthesis.

[a]significant at the 1% level.
[b]significant at the 5% level.
[c]significant at the 10% level.

Table 9 shows that scale efficiency is inversely related to executive compensation. The coefficient is negative and significant at the 1% level. The interactive term is significant, however, indicating that size plays a role in the efficiency/compensation relationship. The second column indicates that there is no relationship between compensation and scale efficiency for the smaller BHCs. A low R^2 and an insignificant F statistic indicate that this is not an artifact of multicolinearity. For large banks, however, the story is very different. The negative and significant coefficient on the SE term indicates that executives for the larger BHCs are rewarded for scale inefficiency. This is consistent with the notion that executives of larger BHCs have incentive to operate their banks beyond the optimal scale. Hubbard and Palia, (1995), Bliss and Rosen, (2001) find evidence that Bank executive compensation is related to the size of the bank. These results are not necessarily inconsistent with those of Benston (1985) who finds that compensation packages did not cause managers to engage in firm-enlarging activities beyond the interests of the stock and bondholders. Here we are measuring bank efficiency, which affects bank clientele as well.

The suggestion that executives may have incentive to operate beyond scale inefficiency can be fur-

TABLE 9
Regression Results Dependent Variable: 98 Salary and Bonuses ($100,000)

	Whole Sample	Small BHC	Large BHC
Intercepte	3.116[a]	5.614	55.460[a]
	(4.656)	(0.901)	(3.723)
SE	-37.700[a]	-2.235	-49.767[a]
	(4.297)	(0.319)	(3.378)
TA	-0.203[b]	0.0441	0.0581[a]
	(2.08)	(1.498)	(4.736)
ROA	5.018[a]	0.935	3.965[b]
	(4.997)	(0.955)	(2.570)
TA*SE	0.351[a]		
	(2.949)		
n	136	68	68
R^2_{Adj}	0.56	0.01	0.54
$F_{3,132}$	44.68[a]		
$F_{3,64}$		1.112	27.358[a]
$F_{4,128}$		11.21[a]	11.21[a]

TA = Total Assets ($billions), SE = Scale Efficiency, ROA = Return on Assets, n = sample size, $F_{4,128}$ is the Chow test for parameter instability, t-ratios are in parenthesis.

[a]significant at the 1% level.
[b]significant at the 5% level.
[c]significant at the 10% level.

ther explored. If executives of BHCs that are operating at decreasing returns to scale have higher salary and bonuses, we can conclude that there is a tendency for compensation schemes to provide incentive to executives to operate in the decreasing returns to scale range. Table 10 shows that this is indeed the case. Three control variables, total assets, profitability, and pure technical efficiency, are included in a model where a dummy variable is equal to one for banks operating at decreasing returns to scale and zero otherwise to predict salaries and bonuses. All the coefficients have expected sign and are significant at the 1% level. Thus, we infer that executive compensation schemes do, indeed, provide incentives for executives to manage in the decreasing returns to scale range.

TABLE 10
Model: $S\&B_i = \beta_0 + \beta_1(TA_i) + \beta_2(PTE_i) + \beta_3(ROA) + \beta_4(Dummy_i) + \varepsilon_i$

β_0	β_1	β_2	β_3	β_4	R^2_{adj}	$F_{3,132}$
-10.36[b]	0.0711[a]	16.303[a]	3.626[a]	4.011[a]	0.586	48.72[a]
(3.088)	(8.755)	(4.154)	(3.732)	(3.311)		

[a] = Significant at the 1% level. [b] = Significant at the 5% level. S&B = Salary and Bonuses ($100,000), TA = Total Assets ($ billion), PTE = Pure Technical Efficiency, Dummy equals 1 for decreasing returns to scale, 0 otherwise, t- ratios in parentheses.

2. *Equity Income*

In order to align the interests of executives with those of the shareholders, virtually all BHCs have incorporated some form of equity exposure in their compensation packages. In most cases, executives are awarded stock options and restricted stock. Rosen and Bliss (2001) reason that equity-based compensation may mitigate against the size inducement of salary and bonus because the wealth of the executive would be more aligned with the wealth of the shareholders. While Rosen and Bliss (2001) and Hubbard and Palia (1995) consider only new awards of equity instruments, here we are concerned with efficiency which is a function of decisions taken over a long period of time. Therefore it is appropriate to use total equity income, which represents the change in equity wealth experienced during 1998. This measure of compensation is the number of shares of stock held plus the exercise rights of options held by the executive multiplied by the change in the stock price during the year. This calculation implicitly assumes that an option that is deeply out-of-the-money at the beginning of the year and is less so at the end of the year has the same impact as if it had been in-the-money during the year.

We repeat the same analysis as before only substituting equity changes in wealth for income. Details of this analysis are available from the authors upon request. As before we find that for large banks there is a significantly negative relationship between scale efficiency and changes in equity wealth consistent with the notion that equity-based compensation schemes provide incentive for large banks to operate beyond the efficient scale. Unlike the case of salary and bonuses, however, we cannot reject the null of no relationship when we examine whether executive compensation is higher for bank holding companies operating at decreasing returns to scale.

VI. SUMMARY AND CONCLUSIONS

In this paper we followed a two-stage procedure to determine whether executive compensation in BHC's induces efficient operation. We find that in spite of some indication that larger BHCs are operating at diseconomies of scale they were, on the whole, more efficient than the smaller ones. The difference is essentially due to the fact that the larger BHCs exhibit greater "pure" technical efficiency.

At the second stage of our investigation we regress 1998 salary and bonuses on the various measures of efficiency. We find that for both sub-samples, executive compensation is related to pure technical efficiency. We also show that executive compensation at larger BHCs is related to asset size and profitability rather than overall efficiency while the opposite is true for smaller banks. This observation is consistent with two other findings. First, for the largest BHCs, executive compensation is inversely related to scale efficiency. Secondly, when BHCs are operating at diseconomies to scale, executives tend to receive greater salary and bonuses and larger equity-based awards. It can be inferred that executive compensation schemes tend to encourage managers to expand their organizations beyond the optimal scale - particularly for the largest BHCs.

The overall implication of this study is that executives of BHCs have an incentive to expand the size of their organization beyond the scale efficient (i.e. constant returns) level. It follows that while there may be many benefits to deregulation as far scale of operation is concerned, unrestricted deregulation may lead to a socially sub-optimal outcome.

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