

Executive Compensation: Six Questions That Need Answering

John M. Abowd and David S. Kaplan

The big news this year isn't in the big numbers—it's in the fine print. Buried in the latest pay contracts chief executives are signing and the lists of stock-options they're salting away in the wall safe are the auguries and portents of things to come.

Business Week, April 24, 1995, p. 88.

There is a growing realization by the popular business press that a proper analysis of stock and option holdings is crucial to understanding U.S. executive compensation practices. The academic economics literature has also come to this conclusion, although only very recently. The economics literature on the effects of stock and options holdings is only in its infancy, but it has already yielded large dividends and has the potential for much more.

In this article, we focus on how these recent advances can be used to address the following six questions: How much does executive compensation cost the firm? How much is executive compensation worth to the recipient? How well does executive compensation work? What are the effects of executive compensation? How much executive compensation is enough? Could executive compensation be improved? Our discussion will focus on the role of agency theory, which predicts that stock-based compensation will align executive and shareholder interests by linking the executive's compensation directly to increases in the market value of the company.

Murphy (1999) reviews the extensive research on executive compensation. In this article, we consider instead some of the implications of that research and some important directions for future research.

We begin by noting how U.S. CEO compensation policies compare with other

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Table 1

Total Compensation of CEOs at Purchasing Power Parity For 12 OECD Countries, 1984 and 1996*(thousands of 1998 OECD PPP \$)*

<i>Country</i>	<i>Year</i>	<i>Base + Bonus</i>	<i>All Benefits and Perquisites</i>	<i>Long-Term Compensation</i>	<i>Total</i>
Belgium	1984	196	124	0	320
	1996	285	161	0	447
Canada	1984				
	1996	347	76	88	511
France	1984	175	70	34	279
	1996	274	122	68	464
Germany	1984	232	57	0	289
	1996	294	74	0	368
Italy	1984	223	62	0	285
	1996	328	139	19	486
Japan	1984				
	1996	202	91	0	292
Netherlands	1984	178	63	0	241
	1996	295	76	0	371
Spain	1984	208	60	0	268
	1996	314	89	0	403
Sweden	1984	107	72	0	179
	1996	147	94	0	241
Switzerland	1984	210	54	5	268
	1996	264	69	12	345
United Kingdom	1984	153	68	37	258
	1996	297	123	74	494
United States	1984	305	54	73	433
	1996	548	97	260	905

Sources: Authors' calculations using data from a variety of public sources and the methods of Abowd and Bognanno (1995).

OECD countries. Table 1 shows an international comparison of the importance of some of the major components of CEO compensation, based on 1984–96 data from 12 OECD countries. The data reflect 1998 U.S. dollars at purchasing power parity exchange rates. Table 2 shows the analogous comparison for human resource directors. The components are salary, annual bonus, benefits (including pension), and long-term compensation. The estimates shown are for the domestic national CEO of a company incorporated in the indicated country with \$200–500 million in annual sales (in 1990 dollars).¹ Salary is defined as cash compensation that is

¹ The methodology used to construct Tables 1 and 2 is the same as Abowd and Bognanno (1995), and relies on publicly available data from various governmental statistical agencies, Towers Perrin, a compensation consulting firm, and other private companies. Our comparative data come from a variety of sources, which target companies of different sizes in the individual countries. To make the sources comparable, Abowd and Bognanno regression-adjusted the compensation data so that the size of the

Table 2

Total Compensation of HRDs at Purchasing Power Parity For 12 OECD Countries 1984, 1996*(thousands of 1998 OECD PPP \$)*

<i>Country</i>	<i>Year</i>	<i>Base + Bonus</i>	<i>All Benefits and Perquisites</i>	<i>Long-Term Compensation</i>	<i>Total</i>
Belgium	1984	88	46	0	134
	1996	121	72	0	193
Canada	1984				
	1996	123	37	0	160
France	1984	86	47	17	149
	1996	112	63	18	192
Germany	1984	104	30	0	133
	1996	117	28	0	144
Italy	1984	85	30	0	115
	1996	147	80	0	227
Japan	1984				
	1996	106	36	0	143
Netherlands	1984	99	39	0	139
	1996	125	37	0	162
Spain	1984	87	34	0	121
	1996	157	41	0	199
Sweden	1984	58	39	0	98
	1996	75	43	0	118
Switzerland	1984	110	28	3	140
	1996	117	21	2	140
United Kingdom	1984	70	33	17	120
	1996	133	49	17	199
United States	1984	91	20	22	132
	1996	156	23	30	208

Sources: Authors' calculations using data from a variety of public sources and the methods of Abowd and Bognanno (1995).

determined at the beginning of an annual pay cycle. Annual bonus is defined as cash compensation that is determined at the end of an annual pay cycle and is based on only one year's worth of performance information. Benefits are the company's cost to provide retirement income, health care and other services, evaluated on an annualized basis. Long-term compensation is the annualized present value of any cash or cash-equivalent compensation that is based on outcomes measured over periods longer than one year. Long-term compensation includes stock options (the right to purchase company stock at a given price), restricted stock (stock that cannot be sold for some specified period of time),

reference company was \$200–500 million in 1990 U.S. dollars. We note that it is difficult to collect comparative data for native executives (not foreign nationals) when one looks at very large companies, because there are relatively few of them in most OECD countries.

performance share plans (formula-based stock compensation), and cash equivalents of all of the above.²

Not surprisingly, given the general tone of public comment on this issue, Table 1 shows that U.S. CEOs receive compensation levels that appear out of line with the other OECD countries, although Table 2 shows that this is not the case for human resource directors.³ We will see, however, that the high compensation received by U.S. CEOs is composed of several complex instruments that require a more detailed analysis.

Although Table 1 shows that U.S. CEOs receive higher levels of pay than those in other OECD countries, comparisons along other dimensions are also useful. In comparing Japanese management practices to those in the United States, Kaplan (1994) finds that the sensitivities of executive cash compensation and probability of executive turnover to market returns are not statistically different across the two countries. One difference is that financial institutions take a more active role in corporate governance in Japan, particularly following negative corporate earnings. Rather than relying on monitoring from the board of directors, the interests of U.S. CEOs and shareholders are aligned through higher stock ownership by the executives. Overall, however, Kaplan's conclusion is that the U.S. and Japanese systems are quite similar.

The Basic Structure of Contingent Executive Compensation

The system has doled out rich rewards—but it can and does impose hefty penalties on those who don't perform. More than ever, the boss is likely to lose his job and his perks when he doesn't deliver the profits shareholders expect.

Business Week, April 22, 1996, p. 102

Most of the early economics literature in this area focused on attempts to model the level and structure of compensation. However, data constraints prevented the detailed analyses of stock and option holdings that have recently proved so useful. The first puzzle for the literature was explaining why firm size appeared quite important in explaining cross-sectional variability in compensation, while firm profitability appeared insignificant. Ciscel (1974) noted this fact and Ciscel

² The data in Tables 1 and 2, and in subsequent tables and figures, have been updated for this paper and are available from the authors on request or on the website noted in the acknowledgements at the end of the article.

³ A complete set of figures showing the components of compensation for CEOs, human resource directors, and manufacturing operatives at purchasing power parity is available from the authors and on the website noted in the acknowledgements to this article. The figures show that U.S. manufacturing operatives receive compensation levels similar to those in other OECD countries. Figures that use real exchange rates rather than purchasing power parity rates are also available. Real exchange rates are useful to compare differences in employer costs across countries.

and Carroll (1980) hypothesized that the growth of firm size was an important method for the CEO to increase profitability, so rewards for increasing size might be consistent with neoclassical theory.

Using data from a panel of firms, Murphy (1985) made great strides in assessing the incentives provided to executives. He noted that compensation equations estimated on cross-sectional data look quite different from those that controlled for fixed firm effects. Large firms tend to exhibit lower rates of return, while paying their executives more than their smaller counterparts. However, Murphy also showed that firm performance, as measured by the realized shareholder return, is strongly and positively correlated with managerial remuneration in specifications that controlled for fixed firm effects. He noted that growth of firm sales is also strongly related to managerial remuneration. Coughlan and Schmidt (1985) showed that executive termination decisions are affected by the firm's stock market performance, while Deckop (1988) documented that CEO compensation is positively related to firm profits as a percentage of sales.

Having established the strong statistical link between executive compensation and firm performance, the literature attempted to assess the magnitude and importance of this link. The seminal article in this line of inquiry is Jensen and Murphy (1990a), which reported a weak alignment between shareholder interests and managerial incentives. They estimated that CEO wealth changes only \$3.25 for every \$1,000 change in shareholder wealth, primarily due to the fact that the median value for CEO stock holdings as a fraction of shares outstanding was 0.0025 in 1987, the only year for which they collected stock-holdings data from proxy statements. Stock held by family members and shares held as options exercisable within 60 days were treated identically to shares owned by the CEO. The remaining \$0.75 came from the sum of average pay for performance sensitivities arising from cash compensation, stock-option grants, and threat of dismissal, which were all estimated with data from the *Forbes* annual surveys of CEO compensation. They concluded that CEO compensation policies provided incentives that were too weak to be consistent with agency theory. Haubrich (1994), however, showed through calibrations of agency models that such low levels of alignment are reconcilable with agency theory given reasonable values for CEO risk-aversion parameters; that is, even low levels of alignment impose significant wealth risk on CEOs so it is not clear that efficiency would be enhanced by increasing alignment.

Recently, Hall and Liebman (1998) introduced a great technical innovation in the study of the sensitivity of executive compensation to changes in shareholder wealth. Using the entire portfolio of long-term compensation—new awards plus the change in the market value of options and stock already awarded—they found that CEO wealth changes are significantly larger than those reported by Jensen and Murphy (1990a). They estimate that, in 1994, the median sensitivity of CEO wealth to firm performance is about \$5.29 for every \$1,000 change in shareholder wealth. Changes in the value of stock-option holdings, which were not included in the

Jensen and Murphy estimate, account for \$2.15 of this figure.⁴ While Hall and Liebman note that their estimate of the slope of CEO compensation contracts is quite far from a benchmark of perfect alignment which would provide first-best incentives, they do show through simulations that their estimated level of incentive alignment imposes enormous lifetime consumption risk on CEOs. This is essentially the same argument Haubrich (1994) used to reconcile agency theory with the data, although Hall and Liebman make this point using a less structural approach.

As Hall and Liebman (1998) demonstrated, examining the annual surveys of executive pay in *Business Week* or *Forbes* cannot provide the information required for analyzing executive compensation policies. One needs to examine holdings of restricted stock and stock options, since recent empirical work has demonstrated that the vast majority of the link between shareholder and executive wealth comes from stock and stock option holdings. Since this is a relatively new innovation for the literature, it is helpful to review some basic facts about the sorts of options that are granted and to offer an intuitive sense of how such options can be valued. In turn, these insights will illuminate how to think about the connections between executive compensation and corporate performance.

Starting with the basics, a typical call option used in a compensation system allows an executive to purchase a specified number of shares of stock at a fixed exercise price. Typically, options granted to U.S. executives have maturity dates of five to ten years; that is, the right to purchase the stock at the fixed price expires five to ten years after the grant date. The option contracts are written to allow the executives the right to exercise before the option matures (“American-style calls”). Usually, there are some formal restrictions on early exercise during the first few years of the option’s life (“vesting restrictions”). Once the options are fully vested, less formal mechanisms discourage, but don’t eliminate, early exercise.

The basic insight of option pricing theory is straightforward: Consider what it would cost in the present to purchase a “hedge portfolio” that will replicate the payoff of the option in the future. As an extremely simple example, consider the case where an executive is given an option to purchase a share of stock at an exercise price of zero and where the stock pays no dividends; that is, at the executive’s time of choice, the executive will receive a share of stock. In this case, the option-hedge portfolio for the company is simply to buy one share at the time the option is granted, and then plan to hand it over when the executive exercises the option.

Of course, most options are not granted at an exercise price of zero, and many stocks do pay dividends, which an executive who has decided to postpone exercising an option does not receive, so the problem of creating a hedge portfolio is usually more complex than just buying stock. However, option pricing theory has

⁴ The mean sensitivity of CEO wealth to firm performance in the Hall and Liebman (1998) findings is somewhat higher, at \$25.11 for every \$1000 change in shareholder wealth, of which \$3.66 is accounted for by stock-option holdings.

demonstrated that the payoff of a call option on a stock can always be replicated with a portfolio that combines a purchase of Δ shares of stock, which is partially financed by borrowing β dollars at the riskless interest rate. Moreover, as the stock price changes over time, the investor need only adjust this hedge portfolio by moving funds between the stocks and bonds, without adding funds or taking funds out, to replicate the ultimate payoff of the option. The connection between the value of the call option to the appropriate hedge portfolio, using a binomial option-pricing model, is derived in the appendix.

The parameter Δ , which is commonly called the hedge ratio in the financial economics literature, is of central importance. The hedge ratio is the number of shares of the underlying stock held in the hedge portfolio per option; that is, it is the degree to which the option-holder's wealth is affected by changes in stock price.

The most important determinant of the link between an executive's lifetime wealth and firm performance, Δ , is more properly viewed as data than as a parameter to be estimated, as we show in the appendix. However, other links between lifetime wealth and performance, such as those arising from cash compensation and threat of dismissal, can only be estimated through statistical analysis. We show in the appendix how a researcher might analyze a compensation system, noting the interactions between Δ and the parameters that require estimation, and thus provide a general framework that can be used to evaluate nearly all studies of executive compensation.

Unfortunately, most companies do not keep track of Δ , even when they use hedge portfolio methods to compute the cost of their compensation systems. Companies do keep data on certain design features—eligibility for long-term compensation, ratio of long-term compensation to salary, size of options granted, and so on—but these factors are only crudely related to the slope of expected total compensation with respect to the stock price. Thus, the primary challenge in uncovering the true links between pay and performance, and the reason the Hall and Liebman (1998) data set on stock and option holdings is so valuable, lies in the problem of estimating the relationship between corporate performance and executive compensation using as much data on the determinants of executive wealth as possible. Core and Guay (1998) address this challenge by introducing an inexpensive algorithm for estimating the sensitivity of options to stock price, stock price volatility and dividend changes, using information available from individual proxies or from the data in Compustat's Execucomp. Their methodology could be a powerful tool for future research.

Before turning to our six questions, we note that risk aversion plays no role in option-pricing theory since the risk generated by an option can be eliminated with a hedge portfolio. Agency theory, however, predicts that the employer must prevent this hedging by the employee; otherwise, hedging unravels the incentive effects of the option. This wedge between the employer cost of options and their value to employees will raise various issues in the discussion that follows.

Question 1: How Much Does Executive Compensation Cost the Firm?

The staggering rise in pay for the good, the bad, and the indifferent has left even some advocates of pay for performance wondering whether the balance between the CEO and the shareholder is tilting the wrong way.

Business Week, April 21, 1997, p. 62

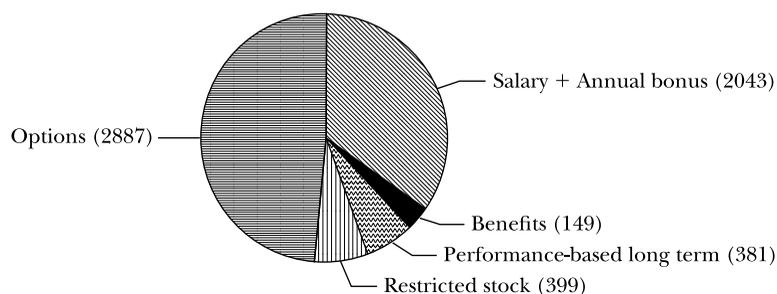
The analysis of the cost of executive compensation centers on the opportunity cost to the company of the stock and performance-based components. The cost to the company is the foregone resources represented by the compensation contract. To estimate the amount of these foregone resources we use the hedge portfolio: the cost of the call option to the firm cannot exceed the cost of creating the hedge portfolio that exactly offsets the cash flows of the executive's option portfolio.

Figure 1 shows estimates of the cost of the 1996 compensation for the CEOs of the Standard and Poor's 500 companies. Clearly, the values of the long-term components—options, restricted stock and performance plans—greatly exceed the other components. These estimates do not include the change in the value of the executive's previously awarded stock and stock options. Changes in the value of stock and option holdings are not relevant in this section since we are considering the cost of creating the hedge portfolio at the grant date.

There are some conventional problems associated with this method of determining the cost of executive options. One problem is that executives may exercise the options earlier than the wealth-maximizing date. In this case, the options will be worth less than the option pricing model would calculate. To see this, suppose that the firm, anticipating what it will be forced to pay the executive upon exercise of the stock options, decides to create the hedge portfolio prescribed by the option pricing model. This method requires an initial purchase of company stock, which is partially financed by selling (going short in) riskless bonds at the option grant date. Appropriate management of this fund, adjusting the stock holdings and riskless borrowing at frequent intervals, will result in the hedge portfolio having the exactly the same value as the executives' option holdings, assuming optimal exercise behavior by the executive. However, if the executive exercises the option prematurely, then the value of the hedge portfolio will exceed what the executive receives. The firm can therefore liquidate the hedge portfolio, pay the executive the amount due at early exercise, and have something left over. In this case, the hedge valuation procedure will produce an overestimate of employer cost.

Other conventional valuation problems can arise as well. The conventional hedge portfolio does not adjust itself according to the degree of variation in interest rates and dividend yields; it assumes constant interest rates and constant dividend yields. Also, the common restrictions on when options can be exercised and the rules for vesting of the stock-based compensation are not reflected in conventional hedge portfolio pricing models.

Figure 1

1996 CEO Compensation S&P 500*(thousands of 1998 U.S. dollars)*

Source: Compustat Execucomp, $N = 496$.

Some of these problems can be addressed. Statistically, we need information on the actual cash payoffs and exercise dates from a representative sample of executives. If the executives are exercising earlier than the wealth-maximizing date, then properly constructed hedge portfolios should accumulate cash, providing an estimate of the difference between actual employer cost and the cost of the hedge portfolio. If short-term volatility in dividend yields and risk-free interest rates is important, the error in the hedge portfolios should be significant relative to the cash flows on the options themselves, which would indicate that more complicated hedging strategies would be warranted.

Another problem is that the option pricing models typically assume that the grant of the option, the creation of the hedge portfolio and the exercise of the option have no effect on share price. In markets with many small players, this is a reasonable assumption. However, if one of these small players is a top executive in a company, the market might react to the incentive effects of the CEO's option holdings, resulting in a shift of the probability distribution of returns.

An area of compensation research that may grow in importance tries to refine methods for estimating the cost of executive stock options. A good example of this type of research is Cuny and Jorion (1995) who note that executive departure typically forces an early exercise of options. They show that accounting for the fact that departure is more likely following poor firm performance is important for obtaining reliable estimates of option costs. A related study by Saly (1994) uses a model where stock-option plans are renegotiated after market downturns. Saly's empirical results were consistent with the hypothesis that option plans were renegotiated after the market crash of 1987—that is, post-crash option grants were significantly larger than pre-crash option grants.

Question 2: How Much is Executive Compensation Worth to the Recipient?

The salaries, bonuses, perks and stock gains paid to the top 25 chief executives over the past five years amount to nearly \$1.9 billion. These individuals were smart and lucky enough to lead highly successful companies during a roaring bull market.

Forbes, May 20, 1996, p. 189

An executive with extensive stock options is suboptimally diversified; that is, the employing company constitutes too large a proportion of the executive's wealth portfolio. In general, such an executive would willingly exchange the option-based compensation for salary that is less than the current value of the hedge portfolio.

Estimates of the size of this compensating differential are not easy to find. Using as the risk measure the elasticity of total compensation with respect to the stock price (approximately the share of stock-based compensation in total compensation), proprietary executive compensation data for the 1980s show that for every 1 percent increase in the compensation risk measure, expected total compensation is 1.8 percent larger. The typical compensation package in that era, which consisted of about 20 percent stock-based compensation for all long-term eligible executives, is thus about 36 percent larger, on average, than total compensation packages with no stock-based compensation. Hall and Liebman (1998) also attempt to estimate this compensating differential and find that it is on the same order of magnitude for their CEO sample—increases in the executive's position in the employing company's stock or options have a certainty equivalent that is about half of the market value of the compensation. In the United States, the Financial Accounting Standards Board (FASB) and the Security and Exchange Commission (SEC), which jointly regulate stock-based compensation and the form of mandatory disclosures regarding this compensation, should recognize that executives should disagree with their employers and with each other over the value of the options in their personal portfolios because executives will vary in their attitudes toward risk. The difference between company cost and executive value is a critical feature of contingent compensation systems. It is one reason why executives receive the compensating differentials estimated above. Differences in ability and differences in bargaining power could also help to explain these differentials.

The employer cost of compensation and its value to the employee can differ for other reasons as well. Differences in purchasing power have important effects on the value of pay packages. The comparisons in Tables 1 and 2 were made with purchasing power parity exchange rates, rather than with real exchange rates.⁵ The

⁵ Interested readers can request figures comparable to the data shown in Tables 1 and 2 except that real exchange rates are used instead of purchasing power parity rates. These data are also available at the website listed in the acknowledgements note at the end of the article.

use of purchasing power parity exchange rates tends to inflate U.S. CEO compensation relative to compensation in most of the other OECD countries.

Tax and public benefits (pensions) also enter into the executive's valuation of the compensation package, with an effect that is especially significant outside the United States. Figure 2 shows a comparison of 1996 after-tax, purchasing power adjusted compensation of the CEO pay packages examined in Table 1.⁶ All tax payments, including income taxes and mandatory employer and employee public benefit contributions are shown as negative amounts. Private after-tax compensation is the white positive amount. The value of public benefits, primarily retirement income and health care, is shown as the black block at the top. Clearly, there is considerable variability in the proportion of the CEO pay package that comes as publicly-provided benefits, with France, Italy, and Sweden having the largest components. The tax payments due on the compensation vary much less than the after-tax compensation itself.

Question 3: How Well Does Executive Compensation Work?

You don't expect a neat correlation in any one year. A chief executive might be cashing in option gains he had accumulated in other years. But over five years? Shouldn't a fat paycheck be matched by shareholder results?

Forbes, May 18, 1998, p. 232

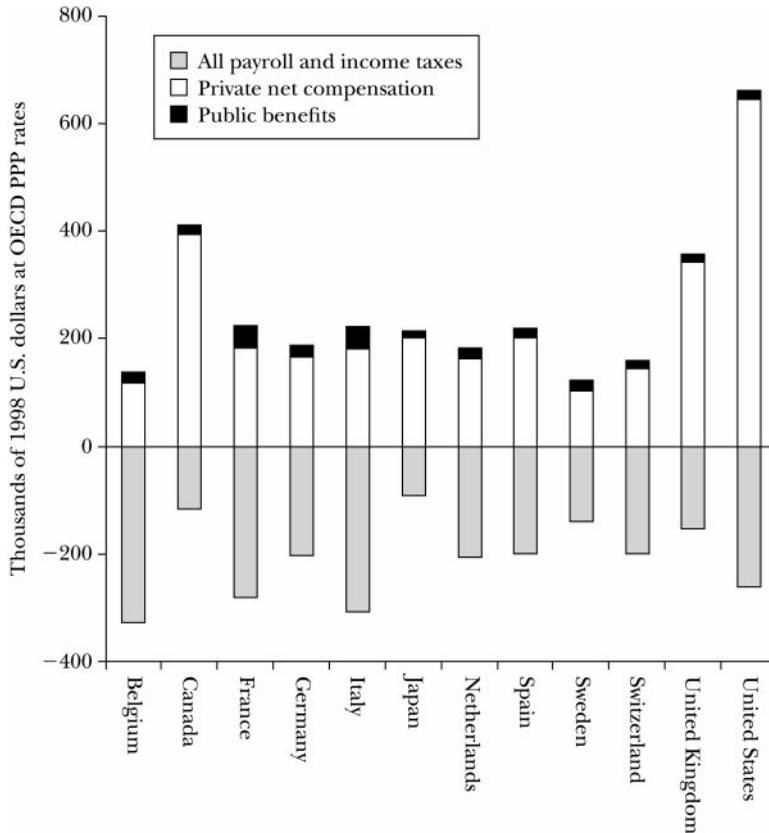
It is impossible to infer the slope of the compensation/stock price relation from looking at executive paychecks, as we have already argued. However, using stock and option holdings, Hall and Liebman (1998) show that the median elasticity of CEO wealth to firm value is 3.94 in 1994, which is more than three times the 1980 figure. The links between CEO wealth and performance have increased dramatically over time, perhaps in response to widespread criticism of CEO pay. At the same time as the business press advocated stronger links between pay and performance as a formula for improved profitability, the connection between stock price and executive wealth was increasing because of increased stock and stock option holdings. It is difficult to determine whether these increases in incentive compensation had the desired effect on stock market performance and profitability.

The availability of measures of both compensation and firm performance make executive compensation a good place to test agency-theoretic models. A simple and direct test of some of the most basic implications of agency theory is found in Garen (1994). His analysis relies on Jensen and Murphy's (1990b) analysis of 430 large firms for which they estimated the sensitivity of CEO wealth to changes

⁶ Figures with data for 1984–96 for CEOs, human resource directors, and manufacturing operatives are available from the authors on request or from the website noted in the acknowledgements.

Figure 2

Total Taxes, Private After-Tax Compensation, and Public Benefits for CEOs
(12 OECD countries 1996)



in shareholder wealth. Garen's main finding—variables that are related to greater variability of firm profitability are negatively related to the Jensen and Murphy estimates of the pay for performance sensitivities—is predicted by agency theory. When the best available measure of performance is noisy, a tight link between pay and performance imposes too much risk on the executive. More recently, Aggarwal and Samwick (1999) address these same issues with more complete data. Using Compustat-Execucomp, which has data on roughly the 1,500 largest publicly-traded U.S. firms, they also find that pay for performance sensitivity is negatively correlated with the variability of firm stock market performance, primarily because CEOs of high-variability firms tend to own a lower percentage of their firm's stock.

Many attempts have been made in the compensation literature to test the relative performance evaluation hypothesis. The basic idea behind relative performance evaluation is that some identifiable aspects of firm performance are outside the executive's control. A market-wide movement in stock returns is the classic

example. A compensation scheme that negatively links an executive's wealth to the performance of other firms can therefore reduce the risk necessary to achieve any level of incentive alignment. Antle and Smith (1986) was the first paper that tested this hypothesis. They found little evidence that industry returns (measured at the two-digit SIC level) affect executive cash compensation, although they did find some evidence that industry returns negatively affect broader definitions of compensation. Barro and Barro (1990) study relative performance evaluation for CEOs of banks. They found no evidence that the average stock market and accounting performance for other banks within a bank's region affects the cash compensation of CEOs, though higher average regional performance makes turnover more likely, as predicted by relative performance evaluation theory.

Using a broader sample of firms, Gibbons and Murphy (1990) found that the salary plus bonus of a CEO rises with a firm's own rate of return, but decreases with either industry- or market-wide return, exactly as relative performance theory predicts. They note, however, that industry measures of rate of return have little explanatory power over CEO pay or turnover compared to market returns, which seems surprising since industry returns should more accurately reflect the environment of the firm. Janakiraman, Lambert and Larcker (1992) estimated firm-specific compensation equations and found similar results. Bertrand and Mullainathan (1999) use annual cash compensation plus the value of stock options granted to test whether CEOs are rewarded for exogenous shocks in oil prices. They find very little evidence of relative performance evaluation and, to the extent that they do find it, it is stronger for negative shocks than for positive ones.

To our knowledge, the only paper that investigates the relative performance evaluation hypothesis with data on stock and option holdings is Aggarwal and Samwick (1999), which finds no evidence supporting relative performance evaluation. This is not surprising, since the instruments that primarily link performance outcomes to executive wealth, stock and option holdings have no relative components in them. We therefore conclude that, despite the obvious attractive features of relative performance evaluation, it is surprisingly absent from U.S. executive compensation practices. Why shareholders allow CEOs to ride bull markets to huge increases in their wealth is an open question.

Several explanations have been proposed for the weak evidence in support of relative performance evaluation. Gibbons and Murphy (1990) note that a negative link between CEO compensation and the performance of rival firms can encourage actions that lower the performance of rival firms, even at the expense of own-firm performance. Aggarwal and Samwick (forthcoming) take this argument a step further and argue that a positive link between CEO compensation and rival performance can create incentives that mimic collusive outcomes. Aggarwal and Samwick also present surprising evidence that, in some industries, CEO compensation is positively affected by the performance of rival firms. These two papers offer a useful starting point, but we view the weak evidence of relative performance evaluation as an important puzzle for executive compensation research.

Question 4: What Are the Effects of Executive Compensation?

Despite the soaring pay, many experts argue that the system is working better than ever. They see the bull market and healthy corporate sector as proof positive that companies get what they pay for.

Business Week, April 21, 1997, p. 60

One of the most fundamental questions for the early literature on CEO pay was whether incentive contracts actually motivate executives. In particular, the impact of incentives on stock market returns has been studied extensively. Before reviewing the literature on the effect of incentive plans on stock returns, we should stress how difficult it is to obtain guidance on this subject from economic theory. These difficulties arise for at least two reasons.

The first difficulty is that stock returns have shareholder expectations imbedded in them. As we mentioned earlier, an option grant might affect the distribution of stock returns for the company. The forward-looking nature of stock prices might allow this shift to occur prior to the executive taking any action. In fact, the shift in the distribution of prices and therefore a current return reflecting this shift, might occur when shareholders first begin to expect an incentive plan, which may occur well before the plan is announced and, even more likely, before it is fully implemented. This could explain why early exercise of options is discouraged, since early (and unanticipated) exercise could allow executives to reap the benefits of shareholder expectations without delivering on them.

The second difficulty arises because economic theory does not predict that increases in incentives necessarily lead to increases in profitability. If firms are already providing their executives with incentives that are close to their profit-maximizing levels, then a small increase in incentives should lead to almost no change in profitability.

Despite these theoretical difficulties, the effect of incentive plans on stock returns has been studied extensively. In the earliest of the studies linking financial incentives to subsequent performance, Masson (1971) found that firms that provided greater financial incentives for their CEOs exhibited better stock market performance over the postwar period, which he interpreted as evidence that firms systematically provided suboptimally low incentives. Larcker (1983) also found a positive stock market reaction when the adoption of a short-term compensation plan, a bonus plan based on single-year performance measures, was announced. However, Tehranian and Waagelein (1985) note that abnormal returns seem to precede the announcement of the adoption of a short-term compensation plan, making it difficult to interpret the Larcker result.

Leonard (1990) found that, in his sample of large firms from 1981–85, companies with long-term incentive plans exhibited greater increases in return on equity than those without these plans. Abowd (1990) found that the sensitivity of

managerial compensation in one year is positively related to corporate performance in the next year, although this relationship is much stronger for market measures of performance than for accounting measures. This result reflects the difficulty of testing for optimal compensation system design because of the problems, discussed above, of measuring performance expectations in an efficient capital market.

When outcomes other than profitability are examined, economic theory can provide clearer guidance. Economic theory certainly predicts that executives will work harder when given larger incentives to do so. Kahn and Sherer (1990) tested this prediction by examining longitudinal data from one firm. The firm had two types of incentive programs: bonuses that mainly targeted higher levels of management and merit payments available across all managerial levels. They showed that managers with high sensitivities of bonus payments to subjective performance evaluations tended to have higher subsequent evaluations, as compared to other managers at that firm, even after controlling for prior evaluations. They found no significant effects of merit pay on subsequent performance.

Another important area of research focuses on some unintended effects of incentive plans. One of the seminal articles in this field is Healy (1985), who studied the effects of nonlinear bonus schemes on managerial accrual and accounting procedures. He found that managers are more likely to choose income-decreasing accruals (decisions that lower reported profitability) when their bonus plan's upper or lower bound is binding—that is, when the pay for performance sensitivity is zero. Note that there is no profit-maximizing rationale for this behavior. It is simply a rational response by the managers to the incentives they face, even though this behavior might be harmful to long-term profitability.

Holthausen, Larcker and Sloan (1995) returned to this issue with a data set in which they can directly identify whether a manager is operating above the upper bound or below the lower bound of the bonus plan, instead of imputing this as in Healy's (1985) work. They found that managers do manipulate earnings downward when they are operating above the maximum of their bonus plan, but they found little evidence that such manipulation occurs when managers are below the minimum performance level that allows a bonus.

The results of perverse behavior in certain incentive compensation systems suggest an interesting direction for future research. Healy's (1985) work demonstrates the unfortunate or unintended effects of incentive plans that contain floors and ceilings. Many case studies also document unintended effects of high-powered incentives. Is there a downside to increased stock and option holdings of top executives? Might the increased incentives imposed on today's executives be motivating them to do more harm than good? One candidate for an unintended consequence of high levels of stock and option holdings is that they might encourage excessively cautious behavior. Since Hall and Liebman (1998) showed wealth fluctuations for CEOs can be quite high, projects that appear profitable but risky may seem unappealing to executives.

Question 5: How Much Executive Compensation is Enough?

Institutional investors, small shareholders, academics, employees, and even pay consultants are challenging the vast pay packages given to CEOs. Many of them express particular dismay that the average CEO paycheck continues to bulge even in a recession year, when CEOs are demanding sacrifices from their employees and laying off thousands of workers. The annual largess, many critics say, is out of step with the times—a hangover of the go-go 1980s that seems egregious in the frugal 1990s.

Business Week, May 6, 1991, p. 90

One of the most common complaints about U.S. CEO compensation policies is how much CEOs receive relative to others in the firm. Figure 3 shows the after-tax compensation plus benefits of CEOs as a multiple of the after-tax compensation plus benefits of manufacturing operatives across 12 OECD countries in 1996. This figure shows that U.S. CEOs do, in fact, have exceptionally high pay relative to manufacturing operatives. For comparison, Figure 4 shows that the ratio of compensation of human resource directors to manufacturing operatives is not exceptionally higher in the United States.⁷ The high U.S. CEO compensation is particularly striking when compared to the lower pay of German and Japanese CEOs, many of whom have equaled or outperformed their U.S. counterparts for substantial periods during the last few decades.

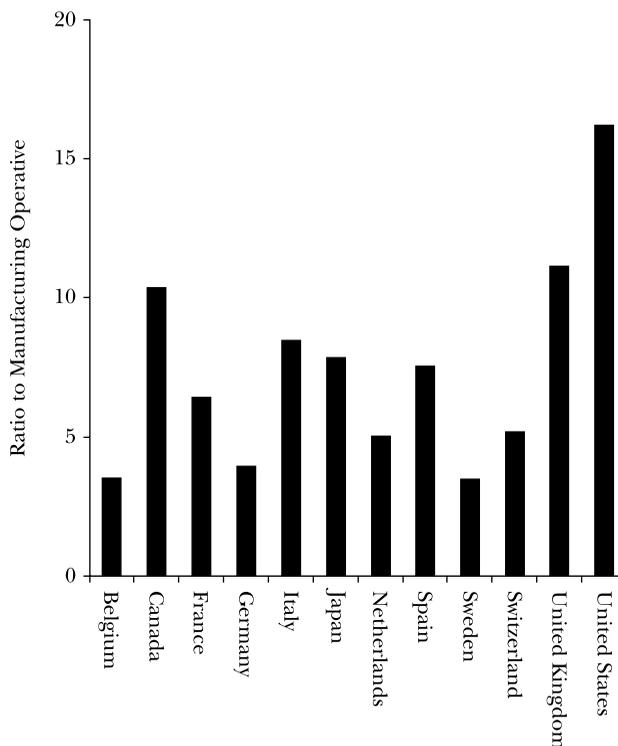
Hallock (1998) provides a small measure of comfort on the issue of “fairness” in the compensation of CEOs, given the welfare of other workers. Contrary to popular opinion, CEOs do not receive higher compensation when layoffs are announced. Since layoff announcements have small negative effects on share prices, CEOs are punished for layoffs. This punishment is, however, quite small and unlikely to be a significant deterrent to layoffs. Dial and Murphy (1995) use a case study to illustrate that a layoff can be a productivity-enhancing strategy, for which the CEO should be rewarded; that is, while CEOs should not be rewarded directly for layoffs, they should be rewarded if the layoffs generate increased profitability.

The question of “How much compensation is enough?” is inherently difficult. We have already mentioned estimates of the degree to which total compensation rises as compensation risk rises, but reliable estimates of risk-aversion parameters are necessary to determine if the high compensation levels in U.S. companies merely reflect a reasonable risk-return tradeoff. It is difficult to imagine how these estimates might be obtained.

Kole and Lehn (1996) provide some indirect insight into this issue in their study of airline deregulation. They found that, relative to CEOs in other industries, CEOs in the airline industry received increases in their compensation following

⁷ Analogs of Figures 3 and 4 that use total compensation, which reflects employer costs, are available on request or from the website noted in the acknowledgements. The available data for these comparisons covers the period from 1984 to 1996.

Figure 3

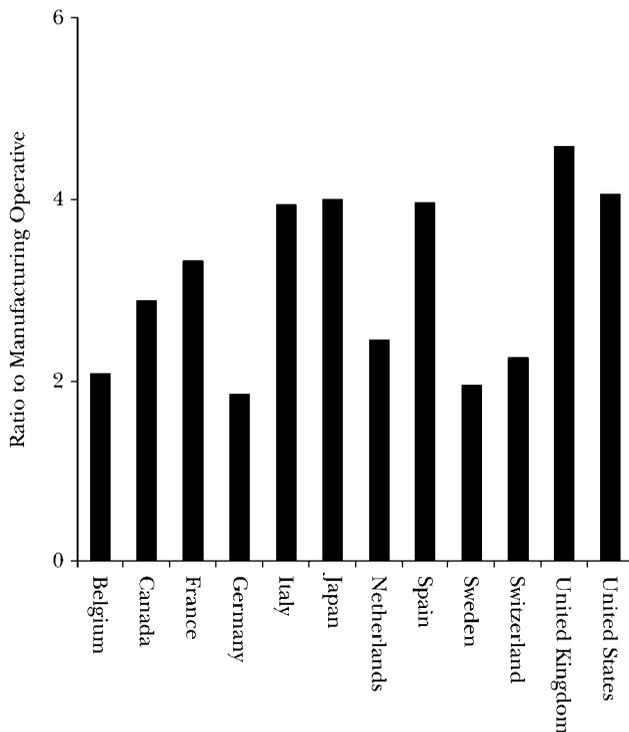
Ratio of CEO After-Tax Compensation and Benefits to that of Manufacturing Operatives (1996)

deregulation, primarily due to increased stock-option grants. Thus, Kole and Lehn provide one example of changes in compensation levels within U.S. firms in response to environmental changes. Whether observed differences between compensation levels in the United States and other OECD countries reflect responses to environmental differences or abuses in U.S. compensation systems is a difficult question.

Question 6: Could Executive Compensation Be Improved?

Inside every boardroom, the key issue is how best to link pay to performance. The standard solution is the stock option, but a number of more rigorous committees are beginning to wonder if it's the right answer. The reason harks back to the old Wall Street saw about not confusing brains with a bull market. Options, by rewarding CEOs whose stock rises with the tide, may be doing just that.

Business Week, April 26, 1993, pp. 64

*Figure 4***Ratio of Human Resource Director After-Tax Compensation and Benefits to that of Manufacturing Operatives (1996)**

Since Hall and Liebman (1998) demonstrated that CEOs face enormous wealth volatility, firms should find every possible method to reduce this volatility without reducing incentives. While this task may seem daunting, we mention two possibilities, which we do not claim as our own insights: relative performance evaluation and multiple payoff criteria.

Stock options reward stock price appreciation regardless of the performance of the economy or sector. Why should CEOs be rewarded for doing nothing more than riding the wave of a strong bull market? If the exercise price could be linked to measures like the S&P 500, or an index of close competitors, then executives would be rewarded for gains in stock price in excess of those explainable by broad market factors outside their control. If market-wide stock movements could be netted out of executive incentive schemes, then equivalent incentives could be provided while reducing the volatility of the executives' portfolios. An interesting research question would be to investigate the extent to which relative performance evaluation could reduce wealth volatility while maintaining executive incentives at their current levels. These estimates, combined with estimates of risk-aversion

parameters, would lend insight into the value of resources squandered by a failure to implement relative performance evaluation plans.

A second alternative approach to executive compensation might use multiple payoff criteria. A portfolio of stock options, some with constant exercise prices, some with exercise prices linked to external criteria (like the Standard and Poor's 500 stock market index), and some with exercise prices linked to internal criteria like division profits or specific executive goals would provide more dimensions along which to give direct share price incentives, relative performance incentives and individual incentives.

While linking executive wealth to stock market performance has obvious attractive features, stock market performance should not be the only measure used. Executives function as a team and stock-based compensation rewards team performance, but some adjustments should be made for individual performance to avoid the free rider problem. While the link between the expected total compensation and the degree of risk in the compensation system is conceptually well understood, a better calibration of how compensation is sensitive to different factors would permit better cost control. In particular, whenever an individual's contribution can be isolated, higher-powered incentives can be provided without imposing more compensation risk on the executive, thus reducing the cost of the compensation.

Conclusion

We have shown that there are good reasons why the answer to the question, "How much does executive compensation cost the firm?" is different from the answer to the question, "How much is executive compensation worth to the recipient?" Agency theory remains the only viable candidate for the answer to the question, "How well does executive compensation work?" but the empirical research to date cannot explain very much about the structure of the optimal contract. For this reason, it is also hard to answer the questions, "What are the effects of executive compensation?" and "How much executive compensation is enough?"—although it is clear that companies can provide both too little and too much contingent compensation. Finally, we have suggested two fertile areas for research regarding the question, "Could executive compensation be improved?"

One maxim seems clear: Whatever happens to CEO pay, the business press will always have a multitude of kudos and brickbats to hand out every April when they turn their attention to the recently released proxy statements. Mandatory disclosure of the specifics of American CEO compensation contracts distinguishes U.S. executives from their colleagues in other countries and provides the fuel for the empirical study of size and consequences of incentive compensation programs.

Appendix

The Binomial Pricing Methodology

While the Black-Scholes (1973) formula is the most famous tool used for valuing stock options, the formula is only accurate when the wealth-maximizing exercise strategy is to hold the options until the expiration date. Since it is well-known that the presence of dividends can make early exercise optimal, we choose to present the binomial pricing formula instead. This methodology does not yield a closed-form solution, although it can be understood using simple dynamic programming concepts. The binomial pricing methodology divides time into discrete components, and that the price of the stock can rise or fall in discrete amounts each period. If dividends were dropped from this exercise, we could derive the Black-Scholes pricing formula, which is based on a continuous-time model, as a limiting case of the binomial model as the distance between periods approaches zero. We follow Cox and Rubinstein (1985) quite closely, and examine a call option to purchase one share of stock at a fixed exercise price. Suppose that with one period remaining prior to expiration, the stock price has the following possibilities for the last period:

$$d(1 - \delta)^v P \quad \text{or} \quad u(1 - \delta)^v P,$$

where the down and up factors satisfy $0 < d < u$, δ is the constant dividend yield, $v = 1$ if the last period is an ex-dividend date and 0 otherwise, and P is the current stock price. When the expiration date arrives, the option will be worth

$$C_d = \max[0, d(1 - \delta)^v P - K] \quad \text{or} \quad C_u = \max[0, u(1 - \delta)^v P - K],$$

where K is the exercise price. As Black and Scholes noted when they discussed the riskless hedge that completed their option pricing model, in the binomial formulation there exist numbers Δ and B such that holding Δ shares of stock and borrowing B dollars using riskless bonds is a payoff-equivalent strategy to holding the option. That is

$$dP\Delta - rB = C_d \quad \text{and} \quad uP\Delta - rB = C_u,$$

which implies

$$\Delta = \frac{C_u - C_d}{(u - d)P} \quad \text{and} \quad B = \frac{dC_u - uC_d}{(u - d)r}.$$

The payoff from holding the option must be equivalent to the payoff of a portfolio with Δ shares of stock and B dollars borrowed using riskless bonds. For this reason, this portfolio is usually called the option hedge portfolio and the dynamic trading strategy associated with the binomial option pricing formula is called a riskless hedge. If the option is not exercised early, the value of the option (which we denote C) must equal the value of this portfolio, namely $P\Delta - B$. It is possible, however, that the value of exercising the option prior to the last period ($P - K$) exceeds $P\Delta - B$, in which case the option is exercised early.

The value of the option is, therefore,

$$(1) \quad C = \max[P - K, P\Delta - B].$$

More importantly for our purposes, Δ , which is commonly called the hedge ratio, measures the degree to which the option-holder's wealth is affected by dollar changes in stock price. The hedge ratio is the number of shares of the underlying stock held in the hedge portfolio per option. While the analysis thus far has focused on the period prior to expiration, we can apply dynamic programming techniques to derive the call option value for 2, 3, . . . , N periods prior to expiration. As the interval associated with a period tends toward zero, we can express the value of the call option as $C(P, K, T)$, where T is the amount of time until the option expires. Regardless of time to maturity, the hedge ratio can be expressed as a function of u , d , the current stock price, and the possible values for the option in the following trading period as shown above. Hence, the hedge ratio is the derivative of the call value with respect to the price of the underlying security

$$(2) \quad \frac{\partial C(P, K, T)}{\partial P} = \Delta(P, K, T).$$

Consider an executive currently employed at a given firm. Let period 0 denote the executive's initial compensation period. Let P_0 denote the value of the employing firm's stock at the end of period 0. The executive receives total compensation with a cost to the company given by

$$S_0 + F_0 + N_0 C(P_0, K_0, T)$$

where S_0 is salary, F_0 is the periodic cost of the benefit package, N_0 is the number of call options awarded, K_0 is the exercise price of these call options and T is the time to expiration of the call options. At the end of period 1, a new stock price P_1 is realized. The executive remains employed at this firm with probability $\pi(P_1)$. If separated the executive receives alternative compensation S_1^A , which does not depend upon P . At the end of period 1, the executive receives a new stock option grant of N_1 shares at exercise price K_1 expiring in T years. Salary and benefits

costing $S_1 + F_1$ are also paid at this time. A comparable exercise occurs at the beginning of period 2.

We now consider the realized and expected future compensation of a mid-career executive, which we will interpret as the values in the model above at the end of period 1. The executive's realized compensation at the end of period 1, assuming continued employment, is

$$V_1 = S_1 + F_1 + N_1 C(P_1, K_1, T) + N_0(C(P_1, K_0, T - 1) - C(P_0, K_0, T)),$$

where the first three terms are comparable to compensation awarded in the initial period and the final term represents the capital gain or loss on the stock options awarded in the first period. Viewed as a function of P_2 , the executive's expected future compensation at the end of period 2 is

$$E[V_2(P_2)|P_2] = \pi(P_2) \left(\begin{array}{l} S_2 + F_2 + N_2 C(P_2, K_2, T) \\ + N_1(C(P_2, K_1, T - 1) - C(P_1, K_1, T)) \\ + N_0(C(P_2, K_0, T - 2) - C(P_1, K_0, T - 1)) \end{array} \right) + (1 - \pi(P_2))S_2^A.$$

This equation provides the basis for interpreting the relation between the slope of the pay-for-performance and the hedge ratio. Taking the derivative with respect to P_2 yields

$$(3) \quad \frac{\partial E[V_2(P_2)|P_2]}{\partial P_2} = \pi(P_2) \left(\begin{array}{l} \frac{\partial S_2}{\partial P_2} + \frac{\partial F_2}{\partial P_2} + \frac{\partial N_2}{\partial P_2} C(P_2, K_2, T) \\ + N_2 \Delta(P_2, K_2, T) + N_1 \Delta(P_2, K_1, T - 1) \\ + N_0 \Delta(P_2, K_0, T - 2) \end{array} \right) + \frac{\partial \pi(P_2)}{\partial P_2} \left(\begin{array}{l} S_2 + F_2 + N_2 C(P_2, K_2, T) \\ + N_1(C(P_2, K_1, T - 1) - C(P_1, K_1, T)) \\ + N_0(C(P_2, K_0, T - 2) - C(P_1, K_1, T - 1)) \\ - S_2^A \end{array} \right).$$

Although most empirical studies of executive compensation have attempted to estimate the above derivative, none have analyzed all of its components. Recent improvements in data quality, however, make such a complete analysis possible.

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