Executive compensation has been a popular topic in the media recently; newspapers and magazines are criticizing executives who have profited despite the decline of their companies after the stock market boom of the late 1990s. In this paper, I examine the underlying problem of executive compensation—the agency problem—and trace the history of its study. I then review a famous study by Michel Jensen and Kevin Murphy on how executives are paid, rather than how much. Finally, I perform my own experiment to see if Jensen and Murphy's conclusion that executives are paid independent of performance still holds.
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The history of the agency problem

"Annus horribilis" read the headline of the San Francisco Chronicle 2002 year-in-review business section. The year had been bad because of a lingering recession, but "horrible" because of corporate scandals. "During the past 12 months, honesty was shown to be an orphan in some of the nation's board rooms," wrote Verne Kopytoff in the lead story. "Dozens of executives resigned under fire to spend more time not with their families, but with their attorneys" (Kopytoff 2002, G1). Executives at such major corporations as Adelphia, Enron, Rite Aid, and Tyco were mired in scandals (Kopytoff 2002).

In its September 2002 issue, Fortune magazine also criticized executives. "Over the past months, the public has been treated to an ever-lengthening parade of corporate villains, each seemingly more rapacious that the last," wrote Mark Gimein, in an article titled "You Bought. They Sold" (Gimein 2002, 64). Gimein analyzed the behavior of top executives shortly after the stock market bubble of the late 1990s, noting that "even as investors were losing 70%, 90%, or even in some cases all of their holdings, top officials of many of the companies that have crashed the hardest were getting immensely, extraordinarily, obscenely wealthy" (Gimein 2002, 65). Fortune had studied companies that had had a market cap of at least $400 million and then lost at least seventy-five percent of their highest value when the stock market crashed. Including stock sold only by top executives and board members from 1999 onward, the magazine concluded that the 1,035 corporations in their sample had made $66 billion on the stock sales, $23 billion of which went to 466 insiders at twenty-five corporations (Gimein 2002).
Citing these staggering numbers, *Fortune* questioned executives' ethics and morals and criticized corporate greed. But the magazine and other media that were critical of executives neglected to examine the reason for their behavior: the executives had not been motivated to act in their companies' best interests rather than their own.

Motivating executives to do what is best for their company when they themselves do not own the company is a classic problem in corporate governance—the agency problem. It develops when a company's ownership and management is separated, either because the original owner-managers hire professional managers or because they sell part of their company to investors. As a result, the owners are not directly involved in the management of the company, yet want the company to do well so that they will maximize the return on their investment. The company's managers, however, do not have the same financial stake in the company's success. They can maximize their return by, for example, increasing their own wages, improving their work environment, or even stealing from the company. Although they usually do not walk out of the building with large bags with dollar signs on them, the articles cited earlier make it seem like they were doing exactly that.

Even though corporate governance and its underlying agency problem have been popular in the media recently because of corporate scandals, they have in fact been studied for many years. In their 1976 paper on the theory of the firm, Michael Jensen and William Meckling trace the study of the problem all the way to Adam Smith and his 1776 book *The Wealth of Nations*, which created economics as an independent subject and established free-market theory. So, the agency problem may be as old as economics itself!
Smith wrote that the agency problem exists because "the directors of such [joint-stock] companies, however, being the managers of other people's money than of their own, it cannot be well expected, that they should watch over it with the same anxious vigilance with which the partners in a private company watch over their own" (cited in Jensen and Meckling 1976).

Adolf Berle and Gardiner Means were the first to examine the agency problem in the twentieth century; the topic was part of their 1932 book *The Modern Corporation and Private Property*. By the 1930s, such recognizable companies as Ford, Goodyear, General Electric, National Biscuit Company (Nabisco), Warner Brothers, and Eastman Kodak were already well-established and controlled a large part of corporate wealth. In fact, nearly half of all wealth owned by corporations was controlled by only 200 of the 300,000 non-financial companies that existed at the time. Together, these 200 companies also had twenty-two percent of all national wealth. And while some, like Ford, were still owned and run by their founders, many others were already owned by numerous investors and run by professional managers (Berle and Means 1932).

The American Telephone and Telegraph Company (AT&T), highlighted by Berle and Means as "perhaps the most advanced development of the corporate system" at the time, had almost $5 billion in assets (equivalent to about $55 billion today, which would place it in the top Fortune 15 companies). AT&T controlled more wealth than twenty-one states, employed 454,000 people, and was owned by 567,694 shareholders. But in contrast to Ford, its largest shareholder owned less than one percent of the company (Berle and Means 1932).
AT&T's size and growth created the need for separation of ownership and management. Because of its size, the company could be financed by only a large number of investors; the number was so large, however, that it was impossible for all the investors to maintain control over how the company spent their money. In fact, investors may have had to completely cede control when investing in a company as large as AT&T, according to Berle and Means: "The property owner who invests in a modern corporation so far surrenders his wealth to those in control of the corporation that he has exchanged the position of independent owner for one in which he may become merely recipient of the wages of capital" (Berle and Means 1932, 3).

While describing the incredible and unexpected changes in the structure and role of corporations during their time, Berle and Means did not underestimate how much corporations would evolve. They predicted that "the system will move forward to proportions which would stagger the imagination today" (Berle and Means 1932, 2).

The agency problem studied by Berle and Means was formalized by Michael Jensen and William Meckling in 1976 (Murphy 1999). They defined the agency problem as a "contract under which one or more persons (the principal(s)) engage another person (the agent) to perform some service on their behalf which involves delegating some decision making authority to the agent" (Jensen and Meckling 1976, 5). According to them, the agency problem was not unique to corporations, but existed in all organizations and cooperatives, including universities, mutual companies, and unions (Jensen and Meckling 1976).
Jensen continued to pursue the agency problem with Eugene Fama, (Fama and Jensen 1983), and later tested agency theories in the executive labor market with Kevin Murphy (Jensen and Murphy 1990a, b, c).

More recently, the agency problem was summarized by Andrei Shleifer and Robert Vishny in their 1996 survey of corporate governance. They defined the problem in corporations as "the difficulties financiers have in assuring that their funds are not expropriated or wasted on unattractive projects" (Shleifer and Vishny 1996, 7).

**How the agency problem is created**

The agency problem can develop at any company that is not owned by its manager; for example, at a company where the founder-manager has sold a share of the company to raise capital or at a company started by a group of investors that have hired a professional manager. As long as the manager owns one hundred percent of the company, he receives the full benefits and incurs the full costs of both pecuniary and non-pecuniary returns. He can maximize his utility from pecuniary returns by making money from the company and maximize his utility from non-pecuniary returns by improving his work environment. For example, if he has $100 to invest in the company and can either use the money to make $200 or to buy a fancy desk chair, he will choose whatever gives him greater marginal utility: a $100 profit or a chair that will make his time at work more enjoyable. He may choose either one, but in each case he will feel the full weight of his decision because he owns all of the company.

However, if the manager does not own the company entirely, he no longer receives the full pecuniary returns, but can still receive the full non-pecuniary returns. So,
in the previous example, if the manager makes a $100 profit for the company, it will be split among the company's shareholders rather than all going to the manager; if he buys the chair, however, he will be the only one to use it. So, the manager may prefer to buy the chair rather than receive a small amount of money (much smaller than $100—or even nothing), even though the company's investors may prefer that he make a profit so that they can receive their share.

Thus as the manager's share of the company decreases, he loses incentive to think of new business ideas, run the company efficiently, and generally work hard because he receives only a fraction of the financial rewards. On the other hand, he gains incentive to spend money to gain non-pecuniary returns, which he does not have to share with non-management shareholders (Jensen and Meckling 1976).

Anticipating the agency problem, company investors may try to specify how the manager should act in various situations so that his actions are in their best interest, but they may not be able to accurately predict the business climate and do not always know the best actions for their manager to take; otherwise, they would not need to hire him in the first place (Shleifer and Vishny 1996).

Because of the difficulty of writing a detailed contract, contracts signed between shareholders and managers are usually general, specifying broad goals and the division of profits, but not how managers should behave in specific business situations. Because oversight is difficult and impractical, investors grant managers control in most situations—control that the managers may take advantage of to further their own interests (Shleifer and Vishny 1996).
While extreme mismanagement of company funds, such as transfer pricing (selling the output of the company to management-owned firms below market price), is relatively rare in the United States because of strong court regulations, misallocation of funds for managers' personal benefit is more common. Managers may spend money on company perquisites, or "perks," such as airplanes, limousine rides, and massages (Shleifer and Vishny 1996). Some perks, however, are usually standard in executive compensation packages (Ellig 1982).

Why the agency problem persists

Despite the agency problem, investors continue to fund companies and hire professional managers. They believe that the problem can be mitigated in various ways or may simply not consider it.

Shleifer and Vishny argue that investors are willing to provide funding because they assume managers will need funds in the future and can raise them only if they build a good reputation by paying back the current investment. This theory unravels, however, if managers are borrowing for the last time. Then, they will have an incentive to default, and investors, anticipating this, will not have an incentive to lend (Shleifer and Vishny 1996).

Investors may also provide funding because they receive various rights in return. They may be allowed vote on certain company actions, such as mergers and acquisitions, and elect a board of directors, which is responsible for selecting and overseeing the managers. They may also sue the company if they believe the managers are not fulfilling their duties, according to Shleifer and Vishny. Courts are unlikely, however, "to interfere
in cases of excessive pay, especially if it takes the complex form of option contracts, and very unlikely to second guess managers' business decisions, including the decisions that hurt shareholders" (Shleifer and Vishny 1996, 24).

In addition, investors may provide funding because of irrational exuberance. As happened during the Internet-technology boom of the late 1990s, they may not consider the viability of a company or if the company's managers are acting in the company's best interest. In fact, their strategy may be to invest in the company for a short time, until they can sell their share to another investor (Shleifer and Vishny 1996).

Jensen and Meckling believe the agency problem may be mitigated with equity financing, which limits investors' liability for the company, but not their returns. Unlike owners of fixed claims, such as bonds, notes, and mortgages, equity investors are not liable for a company's debt. So, if the company is sued or goes bankrupt because of the managers' actions, equity shareholders can only lose their original investment. On the other hand, if the managers act in the investors' best interest and improve the company, equity holders can receive an unlimited return because their return is based on the growth of the company's value. In contrast, fixed-claims investors receive a limited return—an interest payment on their investment (Jensen and Meckling 1976).

Equity investing further relieves the agency problem by allowing monitoring costs to be included in the cost of investment. As Jensen and Meckling explain, the principal in an agency relationship can force the agent to act in the principal's best interest by providing the appropriate incentives and monitoring the agent's activities, which requires some monitoring costs. These costs increase as the agent's share of the company decreases and he gains greater incentive to waste company resources. If equity is
efficiently priced, its price includes these monitoring costs, and it sells for less than if the costs were not included. As a result, financing becomes more expensive for the company as the original owner's or professional manager's stake decreases because it must sell shares for increasingly lower prices. This decrease in prices and corresponding increase in the cost of financing forces managers to consider investment opportunities more carefully, making it less likely that they will waste company resources (Jensen and Meckling 1976).

In practice, the agency problem may not be as serious as it seems in theory. For example, shareholders in companies funded by a few large investors or creditors (those controlling either a majority or substantial minority of company equity, such as ten or twenty percent) can have much greater control over managers than shareholders in companies funded by many small investors (those controlling a small minority of equity). Their votes on certain decisions or their ability to remove the managers can induce the managers to act in the shareholders' best interest (Shleifer and Vishny 1996). In an extreme example of this situation, however, large investors may ignore the interests of small investors or unfairly distribute company cash flows (Shleifer and Vishny 1996).

The California Public Employees' Retirement System (CalPERS), the state employee pension fund, is one example of an influential investor. With assets of $131 billion and investments in over 1,800 American companies, CalPERS uses its financial clout to change corporate governance policies. The fund annually publishes a list of companies whose policies it disagrees with, most recently targeting JDS Uniphase, Xerox, and four others (Baker 2003).
Like all the companies, JDS Uniphase made the list after its stock price dropped significantly. CalPERS criticized the company's capital allocation and management structure, among other things (Baker 2003).
Even though corporate governance and the agency problem have been studied for many years, research in executive compensation in particular has grown during the last twenty years. Kevin Murphy traces the spike to a 1984 University of Rochester conference on "Managerial Compensation and the Managerial Labor Market" (Murphy 1999). Murphy himself has done a lot of work on the subject, beginning with his and Michael Jensen's study on the relation between CEO pay and company performance.

In their study, Murphy and Jensen were the first to quantify how much the earnings of chief executives officers—the top company executives—were correlated with changes in shareholder wealth, thus showing whether CEOs had an incentive to act in the shareholders' best interest of maximizing company value. Although the media and public officials had denounced rising pay levels prior to Murphy and Jensen's work, no one had calculated how serious the problem was. More importantly, no one had asked the pertinent question: not whether executives were being paid too much, but whether they were being paid independent of performance.

Murphy and Jensen's work is actually a serious of two related papers: "Performance Pay and Top-Management Incentives," written in June 1989, and published in the *Journal of Political Economy* in April 1990; and "CEO Incentives—It's Not How Much You Pay, But How," published in the May-June 1990 *Harvard Business Review*. As can be inferred from the publications in which they appeared, and thus their intended audiences, the two papers mostly differ in their presentation. In "Performance Pay and Top-Management Incentives," Jensen and Murphy explain their research in mathematical detail, refer to agency theory at length, and provide rigorous hypotheses to explain their
results. In "CEO Incentives—It's Not How Much You Pay, But How," on the other hand, they are opinionated and openly critical of the state of executive compensation.

Although "Performance Pay" is more commonly referenced and more rigorous, I used "CEO Incentives" when updating Jensen and Murphy's work because it has a more explicit explanation of their methodology, making it easier to emulate in my own study, which is included later in this paper. I also used "CEO Incentives" because Kevin Murphy provided an appendix to the paper that listed all the companies included in the research sample and further explained the methodology. Such information was not available for "Performance Pay."

In addition to being easier to emulate, "CEO Incentives" directly addresses the popular criticism and common misperceptions of executive compensation that initially attracted me to the topic and proposes ways to fix some of compensation's problems. For example, within the first page of the paper, Jensen and Murphy challenge the typical criticism of executive pay being excessive. "The critics have it wrong," they write.

"There are serious problems with CEO compensation, but 'excessive' pay is not the biggest issue. The relentless focus on how much CEOs are paid diverts public attention from the real problem—how CEOs are paid. In most publicly held companies, the compensation of top executives is virtually independent of performance" (Jensen and Murphy 1990b, 1).
Jensen and Murphy's methodology

Because my own work, included later in this paper, was based on Jensen and Murphy's methodology, I will explain their study in detail. I will also present their results and conclusions and show how they have evolved by presenting my own.

For their statistical analysis, Jensen and Murphy compiled data from *Forbes* magazine's annual executive compensation surveys and Standard & Poor's Compustat file. The *Forbes* surveys are usually published in late spring and contain broad information about executives' pay for the previous year, such as their salaries and bonuses, as well as *Forbes's* own best-paid rankings. The Compustat file is an extensive database of statistical, financial, and marketing information for public companies that is updated quarterly.

Jensen and Murphy limited their study to *Forbes* surveys published from 1975 to 1989, and thus compensation data from 1974 to 1988 (because the surveys reflect the previous year's information). Their original sample consisted of 2,505 CEOs from 1,400 companies; however, they eliminated the 740 companies that were not listed for at least eight years, and thus did not have seven years of pay-change data, as well as companies whose information was incomplete in some way. (In the appendix to their paper, however, the authors say that they required eight years of pay-change data from 1975 to 1988, so the true criterion is unclear). They also subtracted the 230 companies that were no longer in the sample in 1988 and eliminated pay information for CEOs that did not serve more than one year and therefore did not have their pay changed.

Overall, 430 companies remained and for each one, Jensen and Murphy estimated the answer to the same question: For each element of the CEO's compensation, "how
does that compensation element change in response to a $1,000 change in corporate
value, as measured by annual share price appreciation and dividends?” (Jensen and
Murphy 1990b, 22)

Jensen and Murphy separated an executive's compensation into five components:
yearly salary plus bonus, pay-related wealth, stock options, stock, and threat of dismissal.
Then, based on their estimates of each component, they computed how much the CEO's
compensation from that component would change if shareholder wealth changed by
$1,000. They define the change in shareholder wealth as \( r_t V_{t-1} \), where \( r_t \) is the inflation-
adjusted rate of return on the company's common stock in fiscal year \( t \), including
dividends, and \( V_{t-1} \) is the company's market value at the end of the previous year, year \( t-1 \).

The authors' calculations of each compensation component and its effect on
shareholder wealth is best understood by going through an example for one of the
companies presented in their study—Castle & Cooke, Inc., a real estate development firm
(Jensen and Murphy 1990b, 22-26; this reference applies for the entire example). To
calculate the relation between the change in salary plus bonus and the change in
shareholder wealth, Jensen and Murphy use the following least squares regression
equation:

\[
\Delta(\text{CEO Salary + Bonus})_t = a + b_1 \Delta(\text{Shareholder Wealth})_t + b_2 \Delta(\text{Shareholder Wealth})_{t-1}
\]

As explained earlier, \( \Delta(\text{Shareholder Wealth})_t \) is defined as \( r_t V_{t-1} \); the annual change in
salary and bonus is computed using the salary and bonus information reported in the
Forbes surveys. The equation includes the effect on salary and bonus of not only the
current year's change in shareholder wealth, measured by the coefficient $b_1$, but also the previous year's change, measured by the coefficient $b_2$. This adjustment in the equation is made for several reasons: bonus decisions may be made before the final fiscal-year earnings are known and thus may not accurately reflect the company's performance until the next year; even if the final earnings and stock-price changes are known, they may not accurately reflect the CEO's actions during that year if there is a lag in the effect of his actions on company value; finally, a bonus paid for performance in one year may actually be reported in a proxy statement the next year.

Jensen and Murphy define the salary plus bonus sensitivity to a change in shareholder wealth as the sum of the estimated coefficients $b_1$ and $b_2$. The coefficient $a$ is a constant denoting the base level from which the salary and bonus vary depending on the change in shareholder wealth.

For Castle & Cooke, Jensen and Murphy use pay change data for CEOs David H. Murdock, who was CEO during the last four years of their study, and Donald J. Kirchhoff, who served during the first four. Three other CEOs served from 1982 to 1984, but because they each worked for only a year, their pay data is not included in the calculations, as explained earlier. So, eight years of pay change data are entered into the regression equation for Castle & Cooke, producing the following result:

(1a) \[ \text{(change in CEO salary and bonus)} = 
\]
\[ $32,300 + 0.000986 \text{ (change in this year's shareholder wealth)} 
+ (-0.000219) \text{ (change in last year's shareholder wealth)} 
\]

Adding $b_1$ and $b_2$, the salary plus bonus sensitivity is estimated to be: $0.000986 +$
(–0.000219) = 0.000767; then, multiplying by 1,000 gives the effect of a $1,000 increase in shareholder wealth: 0.000767 * 1,000 = 0.767 or $0.77. Thus, a $1,000 increase in shareholder wealth increases Castle & Cooke's CEO's salary and bonus by seventy-seven cents over two years. Jensen and Murphy estimate regressions for the other 429 companies in the study in the same way and then rank the sensitivities to find a median. Their results are statistically significant at confidence levels above ninety-nine percent according to the t-statistics.

Although the effect of a change in shareholder wealth on the salary plus bonus component of executive compensation is a good estimate of the short-run link between shareholder wealth and CEO compensation, it underestimates the true change in the CEO's wealth. The change is underestimated because the CEO will continue to receive at least some of the higher salary and bonus in future years, and he may receive some additional pay in the current year that is not classified as either salary or bonus (nor is it in the form of stock awards or options). To measure the effect of the long-run change and the effect of the unclassified pay, Jensen and Murphy define the pay-related wealth component of executive compensation. This component is the sum of transitory compensation and the discounted present value of the permanent change in salary plus bonus. Jensen and Murphy then replace the original salary plus bonus component with this new pay-related wealth component when computing the total change in executive compensation.

Estimating the discounted present value of the permanent change in current pay is difficult in practice, for several reasons. First, the change in salary plus bonus may not
necessarily be permanent, especially the change in bonus; however, differentiating between the salary and bonus is difficult because they are not always reported separately. Second, the number of years over which to discount the salary and bonus payments is difficult to estimate because a CEO may not leave the firm at a mandatory retirement age and may receive pension payments for many years after retirement that are based on his current salary. Finally, the interest rate to use for discounting cannot be known for certain and may fluctuate unexpectedly.

To mitigate these problems in their work, Jensen and Murphy assume that all changes in salary and bonus are permanent, but changes in other forms of pay are temporary; that the CEO receives the change in salary and bonus only until age sixty-six (so the number of years that the CEO will receive the change in salary and bonus is the number of years left until he's sixty-six; if the CEO is already sixty-six, the change is not discounted); and that three percent should be the real interest rate used for discounting. They then define the change in CEO wealth as:

\[ \Delta(\text{CEO Wealth}) = \text{Other Pay} + \text{PV}(\Delta(\text{Salary + Bonus})) \]

The change in CEO wealth is then regressed on shareholder wealth using the same reasoning as for equation (1), producing the following least squares regression equation for the sensitivity of CEO wealth to changes in shareholder wealth:

\[ \Delta(\text{CEO Wealth})_t = c + d_1\Delta(\text{Shareholder Wealth})_t + d_2\Delta(\text{Shareholder Wealth})_{t-1} \]
In this equation, the sum of the coefficients \( d_1 \) and \( d_2 \) gives the effect of a change in shareholder wealth on the CEO's pay-related wealth; \( c \) is a constant, serving the same purpose as \( a \) in equation (1).

For Castle & Cooke, the estimated regression equation is:

\[(3a) \quad (\text{other pay} + \text{present value of change in CEO's salary and bonus}) = \\
\quad $150,000 + 0.00310(\text{change in this year's shareholder wealth}) \\
\quad + 0.00060(\text{change in last year's shareholder wealth})\]

According to this equation, Castle & Cooke's CEO's pay-related wealth will change $0.0037 (= 0.00310 + 0.00060) over two years for every $1 change in shareholder wealth or $3.70 (= 0.0037 * 1,000) for every $1,000 change.

The next component of executive compensation studied by Jensen and Murphy is stock options. Options have become an important component of compensation in recent years. They are difficult to value, however, because their value is different from regular stock; options do not pay dividends, for example, nor fluctuate in value by as much as the stock for which they are issued.

In "Performance Pay," Jensen and Murphy explain how the value of a CEO's options is calculated using the Black-Scholes (1973) formula, but in "CEO Incentives," (the paper I emulated) they gloss over the valuation methodology, saying that how much option value fluctuates with a $1 change in stock price depends on "factors such as interest rates, dividend yields, and whether the option is in or out of the money [i.e. whether the stock price is above or below the option's strike price—the price for which an option holder can buy a share of stock]" (Jensen and Murphy 1990b, 24). Using the
Black-Scholes option valuation method, they estimate that for an average company in their sample, a $1 change in stock price corresponds to approximately a $0.60 change in option value. This estimate is for an at-the-money option (i.e. an option whose strike price is equal to the current purchase price) and accounts for reasonable fluctuations in the option's maturity date, the variance of the return on the stock, and the general interest rate, all of which affect the value of the option. Although Jensen and Murphy's valuation may underestimate the value of in-the-money options, it overestimates the value of out-of-the-money options, and thus probably breaks even in the end.

Jensen and Murphy use company proxy statements issued before the companies' 1989 annual meetings for information on the CEOs' option holdings; when these are not available or do not provide complete data, they estimate outstanding options as those granted in 1988 plus those exercisable (meaning they can be used to purchase stock) within 60 days. The number of a CEO's options is understated using this technique, however, because options granted prior to 1988 that are not exercisable within 60 days are not included. So, the contribution of options to executive compensation may actually be greater than Jensen and Murphy estimate.

Because the change in value of a CEO's options is directly correlated with a change in shareholder wealth, Jensen and Murphy do not need to estimate a regression equation to see how the two are related. Instead, they compute how much a change in stock price will affect the value of a CEO's option holdings. Given that they had previously calculated that a $1 change in stock price corresponds to approximately a $0.60 change in option value, they can calculate the change in option value corresponding to a $1,000 change in shareholder wealth using the following formula:
In Castle & Cooke's case, CEO David Murdock is estimated to hold 50,000 options granted in 1988, plus 300,000 exercisable within 60 days, while the company has 59.3 million stock shares outstanding. Thus, Murdock's option value increases by $3.54 in response to a $1,000 change in shareholder wealth:

\[
(4a) \quad \left( \frac{\text{$0.60 \text{ change in value of option}}}{\text{$1 \text{ change in stock price}}} \right) \times \left( \frac{350,000 \text{ options}}{59,250,000 \text{ shares outstanding}} \right) \times 1,000 = 3.54
\]

Even though data on option holdings may be difficult to collect and the value of options difficult to measure, information on the fourth component of executive compensation—stock—is readily available and easily interpretable. In a CEO's stock holdings, Jensen and Murphy include shares that he directly owns and shares held by family members and in trusts in which he or his family have a "beneficial interest" (Jensen and Murphy 1990c, 35). To estimate the effect of a $1,000 change in shareholder wealth on the stock component of executive compensation, a simple formula can once again be used. After all, if the CEO is a shareholder in the company, the change in his wealth is proportional to the change in shareholder wealth. The change is given by the following formula:

\[
(5) \quad \left( \frac{\text{Shares Held by CEO}}{\text{Total Shares Outstanding}} \right) \times 1,000
\]
For Castle & Cooke's David Murdock, who owns 22.42 percent of company stock (as of March 1989, he owned 13,203,932 shares directly and his children held 80,870 shares in a trust), a $1,000 change in shareholder wealth corresponds to a $224.24 change in the stock component of his compensation.

The final component of executive compensation calculated by Jensen and Murphy is threat of dismissal; it is also the most complicated to measure and contributes the least to a CEO's overall compensation. This component is based on the idea that a CEO is more likely to be fired or resign if shareholder wealth decreases and that this threat of dismissal can be expressed quantitatively. Because this component's contribution is very small relative to the others, and its definition requires a subjective, four-step process, I did not include it in my own study. For David Murdock, a $1,000 loss by shareholders translates to a loss of just 3.8 cents in compensation because of the threat of dismissal.

So, in summary, for a change of $1,000 in shareholder wealth, David Murdock's pay-related wealth, which is the sum of transitory pay and the discounted present value of the change in salary and bonus, changes by $3.70; his options' value changes by $3.54; his stocks' value by $224.24, and his dismissal incentive by $0.038. In total, his pay changes by $231.52 for every $1,000 change in shareholder wealth.

**Jensen and Murphy's results and conclusions**

Although $231.52 is a large change in compensation for a $1,000 change in shareholder wealth, indicating a strong correlation between shareholder wealth and executive compensation, it is a highly unusual value. In fact, it makes Murdock the CEO
with the best incentive to act in the shareholders' interest among the 250 largest companies (as ranked by sales) in Jensen and Murphy's sample of 430. (Jensen and Murphy only report results for these 250 largest companies). For the median CEO among these 250 companies, a $1,000 change in shareholder wealth corresponds to just a $2.59 change in total compensation. The median salary plus bonus sensitivity, for a $1,000 change in shareholder wealth, is $0.067; the median pay-related wealth sensitivity is $0.44; the median change in the value of stock options is $0.58; the median change in the value of stock is $1.29; and the median threat of dismissal sensitivity is $0.05. (The median components do not add to the median change in total CEO compensation because the median of the sums is not generally equal to the sum of the medians) (Jensen and Murphy 1990b, 6).

In their study, Jensen and Murphy also analyze Works Project Administration pay data from the 1930s and discover that real executive pay levels are becoming lower, less variable, and less sensitive to corporate performance than in the 1930s (Jensen and Murphy 1990b, 14). And, because a $2.59 change in executive pay for a $1,000 change in shareholder wealth seems like a poor correlation to Jensen and Murphy, even without being compared to the correlation in prior decades, the authors conclude that CEOs are paid like bureaucrats—they receive steady compensation regardless of performance.

Jensen and Murphy believe that there are two main reasons for the poor link between company performance and executive compensation: public disclosure and a corporate brain drain. Because compensation committees, usually composed of outside directors, have to publicly disclose executive salaries, the salaries are open to public scrutiny; and the public more often criticizes absolute pay levels rather than the efficacy
of pay packages. As Jensen and Murphy write, "How often do shareholder activists or union leaders denounce a corporate board for underpaying the CEO?"

"Not very often—and that's precisely the problem. Most critics of executive pay want it both ways. They want companies to link pay to performance, yet they also want to limit compensation to arbitrary amounts or some fuzzy sense of 'what's fair.' That won't work" (Jensen and Murphy 1990b, 15).

Compensation committees usually yield to public pressure, whether coming from unions, the government, special interest groups, or the media, and cap executive compensation at artificial levels. These caps make the committees or company boards of directors reluctant to punish poor performance, thus limiting the range of pay and hurting the correlation between executive pay and company performance.

Jensen and Murphy cite several situations of previously private compensation being reduced because of scrutiny when it became public and of companies choosing not to become public for fear of criticism of their pay structure. The authors stress that they are not simply in favor of arbitrarily higher pay levels. They want a stronger correlation between executive pay and company performance—a correlation that would probably lead to higher pay levels. If the two were better correlated, executives would have more incentive to perform better, thus benefiting their companies. The executives' salaries would then rise along with their performance. Poorly performing executives, though, would be paid less and dismissed more promptly (Jensen and Murphy 1990b, 4).

Jensen and Murphy recognize that salary disclosure is important and do not advocate abolishing it; indeed, it has allowed them to perform their study. However, they want corporate boards and compensation committees to make pay decisions based on
what is best for their companies and not based on public pressure (Jensen and Murphy 1990b, 17).

The poor link between company performance and executive compensation is further weakened by a corporate brain drain, according to Jensen and Murphy. They believe that the best people are discouraged from pursuing CEO jobs because of the relatively low levels of pay and the lack of rewards for performance. The most talented and confident are instead attracted to law, investment banking, and consulting—industries in which there is less limit to their rewards (Jensen and Murphy 1990b, 18).

Jensen and Murphy find that the average levels of compensation for top investment bankers and corporate lawyers are actually higher than those for top executives. The average executive may still make more than the average lawyer, but the best lawyers and bankers earn more than the best executives (Jensen and Murphy 1990b, 19). Ten years after Jensen and Murphy's study, this conclusion seems no longer to apply because of the many recent reports of exorbitant executive salaries, such as the one by Fortune, but it may still hold. Because salaries for lawyers, consultants, and bankers are not publicly disclosed, they may be high without receiving any media scrutiny. I could not test in my own study how high they are because, as Jensen and Murphy write, "these numbers [the salaries for lawyers, consultants, and bankers] are closely guarded secrets" (Jensen and Murphy 1990b, 19).

Even though Jensen and Murphy focus on money as the most important motivator of executives, they recognize that to make money is not the only reason to run a company. Non-monetary rewards such as company perks, power, and making a difference in the community, may motivate CEOs as well. But, these rewards must be
positively correlated with shareholder wealth and balanced by monetary rewards if CEOs are to act in the shareholders' best interest (Jensen and Murphy 1990b, 21).

For example, a CEO may try to merge with or acquire another company to expand his power and influence, even if the merger is detrimental to his company and thus to shareholder wealth. If his compensation substantially decreases along with shareholder wealth, the CEO will be discouraged from pursuing the merger simply for non-monetary rewards. If, on the other hand, the monetary penalty is meager, he is more likely to engage in the unfavorable transaction. Jensen and Murphy believe the CEO's and shareholders' interests can be best aligned using monetary and stock compensation (Jensen and Murphy 1990b, 21).

Along with describing the reasons for the poor correlation between shareholder wealth and executive compensation, Jensen and Murphy propose several ways to improve it. The first policy they advocate is making the CEO a substantial shareholder in the company. Although they do not propose a specific percentage of company stock that a CEO should own, they do stress that the "feedback effect" of the CEO's actions becomes stronger as he owns more of the company. For example, Warren Buffett, the CEO of Berkshire Hathaway, who at the time of their study owned forty-five percent of the company's stock, is unlikely to buy some jets for the corporate fleet that reduce the company's market value by $10 million if his personal wealth is reduced by $4.5 million as a result (Jensen and Murphy 1990b, 7).

Jensen and Murphy criticize the focus on the dollar value of a CEO's stock holdings or on the value of those holdings as a percentage of annual compensation. What
is important, they stress, is the percentage of outstanding shares that the CEO owns. In their study, they find that nine out of ten CEOs own less than one percent of their company's stock, while only one in twenty owns more than five percent (Jensen and Murphy 1990b, 8).

The authors acknowledge that it is impossible to own a significant portion of giant public companies such IBM and GE, which are valued at hundreds of billions of dollars. Therefore, they argue, these types of companies must recognize that their size limits the incentives they can create for a CEO (Jensen and Murphy 1990b, 8).

Jensen and Murphy next advocate that cash compensation, in the form of salary, bonus, and transitory pay, be well-correlated with company performance, as measured by the change in shareholder wealth. Executives should meaningfully profit if the company does well, and vice versa. The authors note that cash compensation can effectively complement stock holdings because it does not fluctuate according to general market conditions. It can therefore counteract any bad years in the stock market. The authors, however, find no correlation between stock ownership and salary plus bonus sensitivity in their study, and cite this as yet another example of the many problems with executive compensation.

The final policy that Jensen and Murphy propose to improve the poor correlation between executive pay and company performance is making the threat of dismissal real. Not being fired can be a powerful incentive for an executive who may have spent most of his working life at the company he runs. Because his skills may not transfer easily to other industries or companies, the CEO may have trouble finding a similarly lucrative, high-paying position, and thus be spurred to work better.
The authors recognize that there is a lag between executive action and company performance and do not feel that executives should be judged on a yearly basis, like baseball managers. But even with infrequent evaluation, executives' chances of being fired should not be as small as they are currently.

Jensen and Murphy discover that the correlation between the threat of dismissal and company performance is weak even when performance is measured by metrics other than long-run market value, although these metrics are only important to the extent that they are correlated with shareholder wealth. The authors check how well dismissal is linked with sales growth, accounting profits, and other metrics, but find that it is not significantly correlated with any of these measures (Jensen and Murphy 1990b, 12).
An update of Jensen and Murphy's work

Intrigued by the growing media attention on executive compensation and inspired by Jensen and Murphy's work, I conducted my own study to estimate the correlation between executive pay and company performance, from 1992 to 2001. The work was valuable because it incorporated the years of the late 1990s stock market boom and corporate scandals—years during which the corporate climate changed significantly and which had not been included in other updates of Jensen and Murphy's work. (In their original study, Jensen and Murphy listed the infamous Enron CEO, Kenneth L. Lay, as the twenty-first best-paid CEO of a large company, not accounting for stock holdings).

Although I initially intended to reproduce Jensen and Murphy's work completely, I could not find a lot of the type of data they had used, nor emulate their methodology exactly. The problem was not that their work was complicated, but that I could not obtain a detailed enough description of what they had done. In the process of describing their study in a way that was easy to understand, they had omitted some of the details of their work. So, I focused on just one component of executive compensation from their study—salary plus bonus—and tried to find how it was correlated with shareholder wealth. My work was finding the $b_1$ and $b_2$ coefficients in Jensen and Murphy's first regression equation, reproduced below:

\[
\Delta(\text{CEO Salary + Bonus})_t = a + b_1\Delta(\text{Shareholder Wealth})_t + b_2\Delta(\text{Shareholder Wealth})_{t-1}
\]

I obtained salary, bonus, and shareholder wealth data from Standard & Poor's ExecuComp database, which is more comprehensive than the Forbes surveys and includes some of the same information as Standards & Poor's Compustat. ExecuComp
Nisenzoun covers the years 1992 to 2001 and has compensation and financial information for 22,568 executives (including non-CEOs) from over 2,500 companies.

So I could meaningfully compare my results with Jensen and Murphy's, I focused on the 430 companies that they had included in their sample, which were listed in the appendix to their paper. I found information in the ExecuComp database for approximately 250 of those 430 companies. In cases where a company had changed its name, been bought, or merged, the new, related company was included. Following Jensen and Murphy's example, companies that did not have eight years of pay data, and thus seven years of pay-change data, were excluded, as were companies with incomplete or missing information, or whose recent history could not be tracked. Unlike Jensen and Murphy, I included companies for whom data from the last year of my study was not available, but who still had eight years of pay data. The authors' approach of eliminating these companies could have introduced survivor bias. That is, excluding companies that went out of business before the last year of the sample, possibly because of their poor compensation practices, may have increased the number of companies in the sample who had a strong correlation between executive compensation and shareholder wealth.

Once I had selected the companies for my study, I prepared their data for the regression in several ways. First, I adjusted all the data for inflation, using the inflation calculator available from the Bureau of Labor Statistics through its website (www.bls.gov/cpi), so that I would only work with real dollars. Next, I computed the dependant variable, the change in salary plus bonus. To do this, I took the difference of the sums of a CEO's salary and bonus in consecutive years. So, for example, if salary and bonus data was available for 1992, 1993, and 1994, I calculated the change for 1993 by
subtracting the total pay in 1992 from the total pay in 1993; and the change for 1994 by subtracting the total pay in 1993 from the total pay in 1994.

The change in salary and bonus was computed separately for each CEO within a company. So, for example, if one CEO left the company in 1994 and another started in 1995, I did not calculate the difference in total pay between those two years. If a CEO had not stayed at least two years, and thus could not have had his compensation changed, his pay data was deleted from the sample, just like in Jensen and Murphy's study.

Finally, I computed the independent variable, the change in shareholder wealth, in several steps. First, I defined the change in shareholder wealth as $r_t V_{t-1}$, as Jensen and Murphy had done, where $r_t$ is the inflation-adjusted rate of return, including dividends, on the company's common stock in fiscal year $t$ and $V_{t-1}$ is the company's market value at the end of the previous year, year $t-1$. Starting with the first year for which data was available, 1992 for example, I calculated $V_{1992}$ as the close price of the company's common stock in fiscal year 1992 multiplied by the common shares outstanding for that year. To get the change in shareholder wealth in 1993, I then multiplied $V_{1992}$ by $r_{1993}$—the return on the company's common stock, including dividends, in fiscal year 1993. Once I had the change in shareholder wealth for 1993, I could calculate the firm's market value for 1993 ($V_{1993}$) by summing $V_{1992}$ and the change in shareholder wealth for 1993. This market value for 1993 could then be used to calculate the change in shareholder wealth in the next year.

The regression equation required two years of shareholder wealth-change data, and thus three years of total data, for each year of pay-change data. Because of this constraint and because my data set covered the years 1992-2001, the first year for which
an equation could be written was 1994. An equation could not be written for 1993, for example, because it required the change in shareholder wealth in 1993 and 1992, which would have required information for 1991-1993. So, a company that appeared in ExecuComp in all ten years would have had nine years of change data and eight sets of data points. A company that had eight years of pay data, the minimum for my study, would have had six sets of data points. However, because pay-change data was computed separately for each CEO within a company, companies with multiple CEOs during the years of the study could have had eight years of pay data, but less than seven years of change data, and thus less than six sets of points. These companies were eliminated from the sample, leaving 142 for which regression (1) was estimated.

Results

For the 142 companies, the mean value of the $b_1$ coefficient was 0.000112 and the median value was 0.000029. The mean value of $b_2$ was 0.000012 and the median value was 0.000010. The mean value of $a$, the intercept, was 74,603, while the median was 62,814. The mean of the sum of the estimated coefficients, $b_1 + b_2$, was 0.000123; the median of the sum was 0.000050. So, the median change in a CEO’s salary and bonus over two years for a $1,000 change in shareholder wealth was $0.050 (=0.000050*1000), which is slightly less than the $0.067 value found by Jensen and Murphy. Unlike in Jensen and Murphy’s study, however, the means and medians for both coefficients and the intercept were not significant at ninety-nine percent or even ninety-five percent confidence levels, according to the t-statistics. For $b_1$, the mean t-statistic was 0.67, and
the median t-statistic was 0.52. For $b_2$, the mean t-statistic was 0.32, and the median t-statistic was 0.08; for $a$, the mean t-statistic was 0.73, and the median t-statistic was 0.54.

The histogram below shows the frequency of the sensitivity of the salary plus bonus component of executive compensation to a $1,000 change in shareholder wealth.

As can be seen from the chart, the most frequent correlation between shareholder wealth and CEO salary and bonus is 0.1. So, the most common reward for an executive that creates $1,000 of shareholder wealth is only a dime.

**Analysis and conclusion**

Even though the results of my study are not statistically significant at a valid confidence level, perhaps because not enough companies were included in the sample,
they indicate that the correlation between executive compensation and shareholder wealth has not improved in the last ten years. In fact, it may have become worse.

The media is justified in criticizing executive compensation if CEOs' pay is poorly correlated with shareholder wealth. If the link is indeed poor, executive compensation should be investigated further and then reformed. How the reform will occur, however, is unclear.

Reform of executive compensation may actually be hindered by the media and government scrutiny needed to spark it. In a recent issue, *Fortune* again publicized the problems with executive pay (Useem 2003), but did not examine the link between pay and shareholder wealth. The magazine relied on a small sample of companies and anecdotal evidence to come to the arbitrary conclusion that compensation is too high and in need of reform. *Fortune* did not, however, look at the issues objectively, nor interview any major economists who have studied the subject. The same subjective approach is taken by other publications, which present executive pay ranges without explanation or in the proper context and wait for the public to become outraged; the ranges predictably appear exorbitant when compared to those for the average worker.

The focus has still not shifted from *how much* executives are paid to *how*, as Jensen and Murphy had wanted. And as for David Murdock, Castle & Cooke's CEO? He is still at the company, and, perhaps heeding Jensen and Murphy's advice on the problem of public disclosure, has recently taken the company private.
Works Cited


