

# Are U.S. CEOs Paid More Than U.K. CEOs? Inferences from Risk-adjusted Pay

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We compute and compare risk-adjusted CEO pay in the United States and United Kingdom, where the risk adjustment is based on estimated risk premiums stemming from the equity incentives borne by CEOs. Controlling for firm and industry characteristics, we find that U.S. CEOs have higher pay, but also bear much higher stock and option incentives than U.K. CEOs. Using reasonable estimates of risk premiums, we find that risk-adjusted U.S. CEO pay does not appear to be large compared to that of U.K. CEOs. We also examine differences in pay and equity incentives between a sample of non-U.K. European CEOs and a matched sample of U.S. CEOs, and find that risk-adjusting pay may explain about half of the apparent higher pay for U.S. CEOs. (*JEL* G31, G34, M41)

Since at least as early as the 1950s, the press and academic researchers have remarked on the high levels of CEO pay in the United States and questioned whether these levels are consistent with share value maximization (e.g., [Murphy 1999](#)). As these high levels have continued, there has been an increased willingness among academic researchers to suggest that U.S. CEO pay practices reflect managerial rent-extraction.<sup>1</sup> The purpose of this article is

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We would like to thank Mary Barth, Bill Beaver, Jim Brickley, Peter Cappelli, Alexander Dyck, George Foster, Alan Jagolinzer, Bjorn Jorgenson, Brian Main, Michael Orszag, Graham Sadler, Ross Watts, Joanna Wu, Jerry Zimmerman, an anonymous referee, and seminar participants at Baruch College, the 2005 Royal Economic Society meetings, Imperial College London, Manchester University, the 2005 NBER Summer Institute, New York University, Pennsylvania State University, Rutgers University, Singapore Management University, Stanford University, the University of New South Wales, the University of Pittsburgh, the University of Rochester, and the University of Utah 2006 Winter Conference for comments and suggestions. We thank Sophia Hamm for excellent research assistance. We are especially grateful to Richa Gulati, to Michael Orszag, to Watson Wyatt for their help with U.K. pay data, to Jie Cai and Anand Vijh for sharing their executive equity portfolio valuation software, and to Volkan Muslu for sharing his European CEO compensation and incentives data. John E. Core, MIT Sloan School of Management. E-mail: [jcore@MIT.edu](mailto:jcore@MIT.edu). Wayne R. Guay, Wharton School, University of Pennsylvania. E-mail: [guay@wharton.upenn.edu](mailto:guay@wharton.upenn.edu). Send correspondence to Martin J. Conyon, IE Business School; telephone: +34 91 745 1378. E-mail: [martin.conyon@ie.edu](mailto:martin.conyon@ie.edu)

<sup>1</sup> See [Core, Holthausen, and Larcker \(1999\)](#), [Bebchuk, Fried, and Walke \(2002\)](#), [Bebchuk and Fried \(2004\)](#), and [Jensen, Murphy, and Wruck \(2004\)](#).

to shed light on this issue by comparing CEO pay and incentives in the U.S. with CEO pay and incentives in the United Kingdom, the latter being a country with a similar economy, but where excessive pay is generally considered to be less problematic. Specifically, we examine whether, and to what extent, pay differences between U.S. and U.K. CEOs can be explained by differences in incentives and in risk premiums paid to CEOs for bearing incentive risk. Our results suggest that the commonly held view that U.S. CEO pay is high relative to U.K. CEO pay may not hold once one considers the risk premiums attributable to greater holdings of risky equity incentives.

The suitability of corporate governance in general, and of executive compensation and incentives in particular, continues to be of much interest to both academics and practitioners. The spate of corporate scandals in the United States over the last decade, as well as accusations about corporate largesse in the face of the current financial crisis, have once again focused attention on the pay received by those at the very top of organizations. Moreover, a growing body of academic research proposes that problems with U.S. governance and CEO pay are so profound that overpayment of CEOs is not limited to a few bad apples, but that all CEOs in the U.S. economy are overpaid (e.g., [Bebchuk and Fried 2004](#); [Jensen, Murphy, and Wruck 2004](#)). If this conjecture is correct, within-country benchmarking can provide an indication of how compensation practices vary with governance quality within the U.S., but tells us little about whether U.S. executive compensation practices as a whole suffer from systemic poor governance and excessive pay. Instead, it is necessary to compare U.S. practices with those of other countries where compensation practices *ex ante* are expected to suffer from these problems to a lesser extent (e.g., [Core, Guay, and Thomas 2005](#); [Holmstrom and Kaplan 2003](#)).

In this article, we use the U.K. as a benchmark against which to examine whether CEO pay in the U.S. appears unusually high. These two economies share important governance features (such as active takeover markets, unitary board structures, etc.). However, the U.K. is generally considered to be less afflicted by problems of excessive executive compensation. As we discuss below, and as is detailed in [Becht, Franks, Mayer, and Rossi \(2009\)](#), certain features of the U.K. governance environment may constrain pay. For example, unlike the U.S., U.K. CEOs are rarely also the board chair, shareholders vote annually on executive compensation packages, and disclosures about compensation consultants have been required for many years. Further, empirical evidence indicates that after controlling for standard economic determinants of pay, CEO compensation in the U.K. is systematically lower than it is in the U.S.<sup>2</sup>

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<sup>2</sup> Several studies have drawn the inference that U.S. CEOs earn more than British CEOs. [Conyon and Murphy \(2000\)](#) provide a detailed comparison illustrating that U.S. CEOs receive more pay than U.K. CEOs. [Abowd and Kaplan \(1999\)](#) also show that U.S. CEO pay is high compared to non-U.S. countries using survey data from Towers Perrin, and state: "U.S. CEOs receive compensation levels that appear out of line with the other OECD countries." In their data, U.S. CEOs earned about \$905,000, compared to \$494,000 for U.K. CEOs. Recently, [Fernandes, Ferreira, Matos, and Murphy \(2009\)](#) confirmed that U.S. CEOs receive more pay than U.K. CEOs.

Using U.S. and U.K. CEO pay and incentives data for 1997 and 2003, we show that U.S. CEOs have greater pay, but also hold substantially greater equity incentives than their U.K. counterparts. For example, after controlling for firm characteristics, the U.S. CEOs' 2003 pay was about 1.4 times the pay of U.K. CEOs. However, U.S. CEOs' 2003 equity incentives were about 5.5 times greater than those of U.K. CEOs (the 1997 differences in pay and incentives were even greater).

A central tenet of agency theory and contracting predicts that executives will require greater pay to bear greater incentive risk (e.g., Pratt 1964). The key research question in our article is whether some or all of the difference in pay between U.S. and U.K. CEOs can be explained by greater risk premiums paid to U.S. CEOs as compensation for their holdings of greater equity incentives. To examine this hypothesis, we first note that total pay to a risk-averse CEO is the sum of a risk premium for bearing incentive risk plus "risk-adjusted pay," which consists of compensation for CEO ability, compensation for CEO effort, and any rents the CEO obtains. For convenience, we term these two components of pay "risk premium" and "risk-adjusted pay." To partition pay into these components, we extend the method used in Cai and Vijh (2005), and estimate risk premiums for U.S. and U.K. CEOs using data on equity incentives and various assumptions about CEO risk-aversion and outside wealth. We then subtract these risk premiums from total pay to estimate the CEOs' risk-adjusted pay.

For a reasonable range of parameters, we find that after controlling for the risk premium, median risk-adjusted pay for U.S. CEOs is not consistently higher than that for U.K. CEOs (specifically, we find risk-adjusted pay to be higher for U.S. CEOs in 1997, but higher for U.K. CEOs in 2003). We conclude that critics of high U.S. executive pay should give greater consideration to the incentives borne by U.S. CEOs and the risk premiums that executives are likely to require for holding these incentives. We also note that while our risk premium estimates undoubtedly contain measurement errors, the main take-away from our analysis seems unlikely to be altered: that risk premiums in CEO pay must be considered to draw accurate inferences about the appropriateness of CEO pay levels. Further, we recognize that although risk premiums offer a potential economic explanation for why U.S. pay is higher than U.K. pay, it leaves open the question of why U.S. incentives are so much larger than U.K. incentives. In our main analysis, we assume that CEOs in both countries hold the same proportion of their wealth in firm incentives. The lower incentives held by U.K. CEOs imply that they have less wealth. We explore reasons why U.S. CEOs may accumulate more wealth, and we examine the sensitivity of our results to different assumptions about the proportion of wealth held in stock by U.S. and U.K. CEOs. Finally, we suggest that researchers should shift their efforts toward better understanding the reasons for differences in incentives between U.S. CEOs and CEOs in other parts of the world.

As a supplemental and exploratory analysis, we also examine pay and incentive differences between a sample of 40 non-U.K. European CEOs and a matched sample of U.S. CEOs. Similar to the U.K.–U.S. analysis, we find that European CEOs receive less pay and hold fewer equity incentives than U.S. CEOs. Using estimates of the risk premium to construct measures of risk-adjusted pay, we find that about half of the difference in U.S.–Europe CEO pay may be explained by differences in equity incentives. Although these findings provide an interesting perspective on U.S.–European CEO pay differences, we caveat these results by noting that there are likely to be greater differences in governance, institutional, and social structures between U.S. and non-U.K. European firms than there are between U.S. and U.K. firms. For example, as compared to the U.K., Europe has smaller, less liquid capital markets, a weaker market for corporate control, more concentrated ownership, greater monitoring from creditors, and two-tiered boards, and labor representation is required on some European boards.

In the next section, we motivate the article, review related literature, and describe our sample and data. In Section 2, we present univariate and multivariate comparisons of pay and incentives for the U.S. and U.K. over time. In Section 3, we estimate risk premiums related to incentive holdings and examine whether U.S. pay is high compared to U.K. pay once we control for differences in incentives. Section 5 provides an exploratory analysis of differences in risk-adjusted pay between non-U.K. European firms and U.S. firms. In the final section, we offer concluding remarks and caveats to our conclusions.

## 1. Executive Compensation in the U.S. and U.K.: Motivation and Data

### 1.1 Motivation and literature review

Recent research has suggested that U.S. pay is “too high” and that CEOs are able to exploit existing governance arrangements to extract rents (Bebchuk, Fried, and Walke 2002; Bebchuk and Fried 2004). The claim that U.S. CEO pay is “too high” raises the question: Too high compared to what? If the pay of every CEO within an economy is considered excessive, then there is no within-economy control group against which to evaluate the compensation package of any given CEO. In this article, we compare U.S. CEO pay to U.K. CEO pay. The U.S. and U.K. have very similar economies, but as we describe below, the U.K. is generally considered to be less afflicted by problems of excessive executive compensation. As such, the U.K. can be usefully considered as a control group with which to compare U.S. CEO compensation.

The extant research investigating the international differences in CEO pay arrangements is sparse. Indeed, the majority of executive compensation papers are single-country studies rather than research designed to probe cross-country differences in pay-setting strategies. An exception is Conyon and Murphy (2000), who find that after controlling for size, sector, and other firm and

executive characteristics, U.S. CEOs earned 45% higher cash compensation and 190% higher total compensation in 1997 than U.K. CEOs.<sup>3</sup>

What explains these pay differences? [Canyon and Murphy \(2000\)](#) argue that the differences could be largely attributed to greater stock option awards in the U.S. arising from institutional and cultural acceptance of equity pay in the U.S. vis-à-vis the U.K. Consistent with this explanation, [Abowd and Kaplan \(1999\)](#) examine survey pay estimates from Towers Perrin from 1984 to 1996 and find that stock options, expressed as a fraction of CEO pay, were increasing in the U.S. but not elsewhere. Using data from 27 countries in 2006, [Fernandes, Ferreira, Matos, and Murphy \(2009\)](#) also find that equity-based CEO compensation is much more prevalent in the U.S. than elsewhere. Consistent with options contributing to an excessive pay problem, several researchers, such as [Hall and Murphy \(2002\)](#) and [Jensen, Murphy, and Wruck \(2004\)](#), argue that U.S. compensation committees historically have under appreciated the full cost of options, and as a result, overpaid executives with option grants. Further supporting this conjecture, until recently, stock option disclosures were more detailed in the U.K. than in the U.S.

A second, and related, explanation is that pay-related governance problems are more severe in the U.S. By this explanation, U.S. firms overpay their executives using stock options because option pay is less visible to shareholders (e.g., [Bebchuk and Fried 2004](#)). Although the governance structures of the U.S. and U.K. are similar in many respects (e.g., both economies have active takeover markets, single-board internal control systems with remuneration committees, etc.), differences do exist.<sup>4</sup> For example, the roles of the CEO and chair positions are more often separated in the U.K. Further, since 2002, U.K. shareholders have voted annually on executive compensation packages, although there is no evidence that say-on-pay proposals change the level or growth of CEO pay (e.g., [Ferri and Maber 2008](#)). The outcome of this voting mechanism is frequently negative, and although the vote is not binding, companies often adhere to them.<sup>5</sup> Also, until very recently U.K. firms, but not U.S. firms, were required to disclose whether a compensation consultant was hired by management to design their pay packages and the name of the consulting firm. As a final point, if the U.K. populace has a lower tolerance of income inequality, this would constitute another cultural norm or governance mechanism that constrains executive pay.

A third possibility, which we explore in this article, is that there is no difference in the efficiency of pay outcomes in the two countries. Instead, differences

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<sup>3</sup> Other research examining international differences in pay and governance includes [Crystal, Main, and O'Reilly \(1994\)](#) and [Abowd and Kaplan \(1999\)](#) for the U.S. relative to the U.K.; [Kaplan \(1994a, b\)](#) for the U.S. relative to Japan and Germany; and [Canyon and Schwalbach \(1999\)](#) for differences in European pay.

<sup>4</sup> See, for example, "No excessive pay, we're British," *The Wall Street Journal*, February 8, 2006, page C1.

<sup>5</sup> Recent examples where a majority of shareholders have voted against management remuneration plans include Royal Dutch Shell PLC, Royal Bank of Scotland Group, Bellway PLC, and Provident Financial PLC.

in pay between the U.S. and U.K. may be explained by differences in risk premiums for bearing incentive risk. If the optimal contract requires a CEO to hold more incentives, the CEO will demand more pay. Prior research provides some descriptive support for this conjecture. [Canyon and Murphy \(2000\)](#) find that in 1997 U.S. CEOs had greater pay and held greater equity incentives than did U.K. CEOs. Canyon and Murphy briefly consider, but dismiss, the equilibrium explanation that U.S. executives have larger incentives and therefore larger pay.

## 1.2 Data description

While U.S. executive compensation data are readily available in machine-readable form, U.K. data require hand collection.<sup>6</sup> Because of the costs of hand collection, we limit ourselves to examining the year of the latest available data at the time we began this study, 2003, and the year of the earliest available U.K. data, 1997 (the basic points of the article, however, are not expected to be sensitive to particular years chosen for analysis).<sup>7</sup> Our U.K. data are hand-collected from annual reports and accounts of U.K. firms (broadly equivalent to U.S. DEF 14A proxy statements). These companies are drawn from the largest 250 U.K. publicly traded firms ranked by market capitalization in each of the years. We report results based on 177 U.K. CEOs in 1997 and 214 U.K. CEOs in 2003 for which we have complete data. As a supplemental analysis, in Section 4, we further explore the role of incentive risk by comparing U.S. CEO pay with CEO pay of firms in other non-U.K. European countries.

Our U.S. data come from the Compustat ExecuComp database, which includes firms in the S&P 500, the S&P MidCap 400, the S&P SmallCap 600, and the S&P supplemental indices. Our U.S. sample consists of 1,372 CEOs in 1997 and 1,511 CEOs in 2003. However, as shown in Panels A and B of Table 1, because we examine the largest 250 U.K. firms, the median U.S. firm in our sample tends to be smaller than the median U.K. firm. The median U.K. firm has sales of \$1.6 billion (\$1.8 billion) in 2003 (1997), compared to median sales for the U.S. firms of \$1.1 billion (\$1.0 billion) in 2003 (1997). Similar size differences are observed between the U.K. and U.S. firms based on market capitalization. To mitigate the concern that our findings are influenced by size differences across the U.S.–U.K. firms, in most of our tests, we focus on

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<sup>6</sup> Unfortunately, it is both labor- and time-intensive to collect U.K. executive compensation data. Although compensation disclosure in the U.K. was significantly expanded following the [Greenbury \(1995\)](#) and [Hampel \(1998\)](#) reports, the disclosed data are usually not available electronically and must be hand-collected. Moreover, the information is not reported in the same tabular form across different companies, making data collection more difficult. Currently, U.K. companies disclose information comparable to those available for U.S. executives, including exercise prices, maturity terms, options granted, and information on stock options outstanding.

<sup>7</sup> 1997 is the first year that U.K. companies were required to disclose data on stock option grants to top executives. For a similar reason, prior studies of U.S. pay often begin at 1992 because this is the first year that U.S. companies were required to disclose data on stock option grants to top executives.

**Table 1**  
**Descriptive statistics on full U.S. and U.K. samples: CEO total pay, incentives, sales, and market value in 1997 and 2003**

		Year	Average	Median	Change in the average	Change in the median
<b>Panel A: Sales</b>						
<i>Sales<sub>t-1</sub></i> ( <i>Millions</i> )	U.S.	1997	\$3,522	\$975 <sup>b</sup>		
	U.S.	2003	\$4,651	\$1,121 <sup>b</sup>	32.1%	15.0%
	U.K.	1997	\$4,295	\$1,779		
	U.K.	2003	\$5,155	\$1,555	20.0%	-12.6%
Ratio U.S. / U.K.		1997	0.82	0.55		
		2003	0.90	0.72		
<b>Panel B: Market value of equity</b>						
<i>Market Value of Equity<sub>t-1</sub></i> ( <i>Millions</i> )	U.S.	1997	\$4,273	\$1,072 <sup>b</sup>		
	U.S.	2003	\$5,791	\$1,168 <sup>b</sup>	35.5%	9.0%
	U.K.	1997	\$4,985	\$2,108		
	U.K.	2003	\$4,996	\$1,453	0.2%	-31.1%
Ratio U.S. / U.K.		1997	0.86	0.51		
		2003	1.16	0.80		
<b>Panel C: Total pay</b>						
<i>CEO total pay<sub>t</sub></i> ( <i>Thousands</i> )	U.S.	1997	\$3,739 <sup>a</sup>	\$1,959 <sup>a</sup>		
	U.S.	2003	\$4,439 <sup>a</sup>	\$2,521 <sup>a</sup>	18.7%	28.7%
	U.K.	1997	\$1,295	\$985		
	U.K.	2003	\$2,583	\$1,891	99.4%	92.0%
Ratio U.S. / U.K.		1997	2.89	1.99		
		2003	1.72	1.33		
<b>Panel D: Equity incentives</b>						
<i>CEO equity incentives<sub>t-1</sub></i> ( <i>Thousands</i> )	U.S.	1997	\$88,800	\$15,807 <sup>a</sup>		
	U.S.	2003	\$120,444	\$19,555 <sup>a</sup>	35.6%	23.7%
	U.K.	1997	\$7,238	\$2,409		
	U.K.	2003	\$22,051	\$3,806	204.7%	58.0%
Ratio U.S. / U.K.		1997	12.27	6.56		
		2003	5.46	5.14		

The U.S. (U.K.) sample is 1,372 (177) firms in 1997 and 1,511 (214) firms in 2003. Sales and Market Value of Equity are measured at the beginning of the respective year. Total Pay for the firm's CEO is defined as the sum of salaries, bonuses, benefits, stock options (valued on the date of the grant using the Black-Scholes formula), restricted stock grants (valued at 100% of performance contingent awards), and other compensation. CEO equity incentives are in equivalent stock value, and are defined as (share price)  $\times$  (the number of shares held) + (share price)  $\times$  (option delta)  $\times$  (the number of options held). U.K. pounds sterling denominated data are converted to U.S. dollars using the average  $\$/\pounds$  exchange rate during 1997 (=1.6386) and 2003 (1.6355). The superscript symbol <sup>a</sup> indicates that the U.S. value is significantly greater than the U.K. value at a 5% level. The superscript symbol <sup>b</sup> indicates that the U.S. value is significantly lower than the U.K. value at a 5% level.

a subsample of U.S. firms that are matched (within industry) to the U.K. firms using a propensity score procedure (discussed in more detail below).<sup>8</sup>

### 1.3 Measurement of CEO pay and incentives

Executive pay in the U.K. and the U.S. consists of the same basic elements. CEOs in both countries receive base salaries and are eligible to receive annual

<sup>8</sup> All of our inference holds when we conduct our tests using the full U.S. sample.

bonuses, usually based on accounting performance. CEOs in both countries frequently receive stock options, and can also receive restricted stock. In the U.S., restricted stock grants typically vest with the passage of time but not with performance criteria. In the U.K., by contrast, the vesting of restricted stock is typically tied to the attainment of performance objectives. In our empirical work, we define *total pay* for the firm's CEO as the sum of salary, bonus, benefits, stock option grant value, restricted stock grants (valued at 100% of performance contingent awards), and other compensation.<sup>9</sup> We estimate the value of options granted during the year using a modified version of the Black-Scholes (1973) model. Consistent with the findings of Hemmer, Matsunaga, and Shevlin (1996) and Huddart and Lang (1996) that employees exercise options prior to maturity, we assume the expected time-to-exercise is 70% of the option grant's stated maturity. Our inference, however, is unaffected if we value the option grant using the stated time-to-maturity.

Panel C of Table 1 provides descriptive statistics for CEO total pay for our full sample of U.S. and U.K. firms. We provide figures for the average and median values, as well as the percentage change in these values from 1997 to 2003. The total pay data illustrate that the broad sample of U.S. CEOs earn more than the sample of British CEOs. In 1997, the median U.S. CEO's pay was \$2.0 million, or 100% more than the median U.K. CEO's pay of \$1.0 million. In 2003, the median U.S. CEO's pay was \$2.5 million, or 30% more than the median U.K. CEO's pay of \$1.9 million. Note that the higher pay for U.S. CEOs is observed despite the fact that the U.S. firms in the full sample are somewhat smaller than the U.K. firms (we control for this size difference explicitly below). As a final point on Panel C, the pay differential between the U.S. and U.K. CEOs appears to have narrowed between 1997 and 2003.<sup>10</sup> There is a 92% increase in median U.K. CEO pay from 1997 to 2003, compared to a 29% increase in median U.S. CEO pay over this time period.<sup>11</sup>

We turn now to our measure of CEO equity incentives, which recognizes that incentives are greater when the CEO has more of his wealth invested in firm equity and less in other assets. The sensitivity of annual pay to stock returns captures only a small part of CEO equity incentives. Much greater incentives

<sup>9</sup> In the case of the U.S., we use variable item TDC1 from the ExecuComp database. For the U.K., we calculate total pay from information contained in the annual reports.

<sup>10</sup> Although the determinants of changes in pay and incentives for U.K. CEOs over time is an interesting research question, the objective of our study is to explore the implications of equity incentive risk premiums for cross-sectional differences in U.S. versus U.K. (and EU) CEO pay. That is, we seek to understand whether U.S. and U.K. pay appears to be different once pay is adjusted for the risk premium stemming from equity incentives.

<sup>11</sup> As a caveat to interpreting the changes in pay over time, we note that changes in business conditions over the six-year window from 1997 to 2003 have not been identical in the U.S. and U.K. For example, in Panel B of Table 1, we show that the median U.S. firm's market value fell by 2% from 1997 to 2003, compared to a decline of 27% for the U.K. sample firms. This relatively greater decline in market values for U.K. firms makes the relatively greater increase in U.K. pay more remarkable. Aggregate price inflation from 1997 to 2003 was 8.1% in the U.K. (1.3% per year), compared to 15.2% in the U.S. (2.4% per year), but these changes in general price levels seem unlikely to explain the observed pay changes. We also note that the average exchange rates were very similar in 1997 and 2003: In both years, one U.K. pound sterling was worth about 1.64 U.S. dollars.



are provided by the sensitivity of the CEO's holding of stock and options to changes in shareholder value. Stock and options directly link CEO wealth to shareholder value, and are the major component of total CEO equity incentives (Hall and Liebman 1998; Jensen and Murphy 1990).

We measure equity incentives as the equivalent stock value. For example, we refer to \$100 of stock as having \$100 of incentives. However, because options are equivalent to a leveraged investment in stock, \$100 of options has a greater sensitivity to stock returns, and greater incentives than \$100 of stock. To estimate the sensitivity of option value to stock price, i.e., the option portfolio delta, we use the method developed by Core and Guay (2002), with option maturities set to 70% of the Core and Guay assumed times-to-maturity to adjust for expected early exercise. We compute the total incentive measure as (share price)  $\times$  (the number of shares held) + (share price)  $\times$  (option delta)  $\times$  (the number of options held).<sup>12</sup> We note that our incentive measure is a scaled version (i.e., multiplied by 100) of a commonly used incentive measure: dollar change in the CEO's wealth from a 1% stock price increase (Baker and Hall 2004; Core and Guay 1999). We use the equivalent stock value incentive measure to facilitate our later discussions of the risk premium required for holding incentives.

In Panel D of Table 1, we provide descriptive evidence that U.S. CEO equity incentives are greater than those of U.K. CEOs. The median U.S. CEO in 2003 had incentives equal to about \$19.6 million in stock equivalent value. That is, for each 1% increase in the stock price, the median CEO would experience a \$196,000 increase in his equity value (=1%  $\times$  \$19.6 million). This compares to the median U.K. CEO incentives of about \$3.8 million in stock equivalent value, or a \$38,000 increase in equity value for a 1% change in stock price. The incentive data are positively skewed with mean values substantially greater than median values. This skewness is largely due to a small percentage of CEOs who hold very large amounts of equity. Between 1997 and 2003, the median U.K. CEO incentives increased by about 58%, compared to 24% for U.S. CEOs' incentives. Overall, the evidence in the bottom two panels of Table 1 shows that American CEOs have greater wealth and incentives in their firms compared with their British counterparts, but that U.K. CEOs' incentives have exhibited a greater relative increase from 1997 to 2003.

## 2. Analysis of Relative U.S. and U.K. CEO Pay and Incentives

We begin our analysis by showing that the U.S.–U.K. pay difference, which has previously been documented in the literature, holds within our data. Although the descriptive statistics in Table 1 suggest such a premium, a proper test should control for differences in firm characteristics known to vary with CEO pay.

<sup>12</sup> Shares held includes restricted stock and performance-vested restricted stock.

**Table 2**  
**Determinants of U.S. and U.K. CEO pay and incentives, and propensity-score-matching regression**

	Dependent Variable: OLS Regressions				Logit Regression (U.K. = 1) for Propensity-Score Matching	
	Log CEO Pay <sub>t</sub>		Log CEO Incentives <sub>t-1</sub>		(5) Year: 1997	(6) Year 2003
	(1) Year: 1997	(2) Year: 2003	(3) Year: 1997	(4) Year 2003		
<i>U.S. indicator</i>	0.69** (11.45)	0.32** (5.82)	2.15** (15.12)	1.87** (14.82)		
<i>Log(sales<sub>t-1</sub>)</i>	0.40** (18.41)	0.41** (21.65)	0.36** (10.90)	0.43** (15.71)	-0.20** (-2.67)	-0.01 (-0.18)
<i>Book to market<sub>t-1</sub></i>	-0.99** (-7.58)	-0.61** (-4.70)	-2.84** (-12.91)	-1.63** (-11.45)	0.02 (0.03)	1.48** (3.99)
<i>Log(Idio. Risk)<sub>t-1</sub></i>	0.20** (3.03)	-0.09 (-1.24)	0.15 (1.14)	-0.43** (-4.73)	-4.35** (-11.90)	-1.30** (-5.35)
<i>Log(Tenure)<sub>t-1</sub></i>	0.02 (1.10)	0.05* (2.33)	0.54** (13.37)	0.65** (17.15)	-0.07 (-0.79)	0.11 (1.39)
<i>Leverage<sub>t-1</sub></i>	0.31** (5.29)	0.18** (3.39)	0.25 (0.63)	-0.81** (-2.89)	-1.77 (-1.68)	0.72 (1.16)
<i>Shareholder return<sub>t</sub></i>	0.69** (11.45)	0.32** (5.82)			-1.32** (-3.87)	-0.65** (-2.91)
Industry Indicators	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,549	1,725	1,549	1,725	1,449	1,629
Adjusted R-squared	0.45	0.40	0.53	0.56		
U.S.-U.K. difference	99.4%	37.7%	758.5%	548.8%		

Total Pay for the firm's CEO is defined as the sum of salaries, bonuses, benefits, stock options (valued on the date of the grant using the Black-Scholes formula), restricted stock grants (valued at 100% of performance contingent awards), and other compensation. CEO equity incentives are in equivalent stock value, and are defined as (share price) × (the number of shares held) + (share price) × (option delta) × (the number of options held). Book-to-market is the ratio of book value of assets to the sum of book value of liabilities plus market value of equity. Idiosyncratic Risk is the standard deviation of the residuals from a market model estimated daily over year  $t-1$ . Tenure is the number of years the CEO has held that position. Leverage is the ratio of book value of liabilities to market value of assets. Shareholder Return is the one-year total return to shareholders. Industry indicator variables are computed at the two-digit SIC code level. U.K. pounds sterling denominated data are converted to U.S. dollars using the average \$/£ exchange rate during 1997 (1.6386) and 2003 (1.6355). The U.S.-U.K. CEO difference is calculated from the U.S. indicator variable as  $100 \times (e^{\text{coefficient estimate}} - 1)$ . The 1997 to 2003 change is calculated from the Year = 2003 variable as  $100 \times (e^{\text{coefficient estimate}} - 1)$ . The logit regressions in Columns (5)–(6) model the probability that a firm is a U.K. firm as a function of sales, book-to-market, tenure, CEO-chair indicator, leverage, and shareholder return. In the logit regressions, we include only U.S. observations for which we have a U.K. observation in the same industry (because our propensity-score-matching procedure matches within industry). The symbols \* and \*\* indicate statistical significance at the 5% and 1% levels, respectively. *T*-statistics are given in parentheses for Columns (1)–(4), and are based on Huber-White robust standard errors. Chi-Square statistics are given in parentheses in Columns (5)–(6).

Columns (1) and (2) of Table 2 report coefficient estimates of the U.S.–U.K. pay difference, using OLS regression methods and controlling for company size, growth opportunities, firm performance, stock idiosyncratic risk, leverage, and industry factors. Extant research on executive compensation has consistently hypothesized and found that larger firms with greater growth opportunities require more talented and more highly paid managers (e.g., Smith and Watts 1992). In addition, researchers often include controls for company performance, tenure, and firm risk (as proxies for ability or demand for ability). The models therefore include as controls the market value of the firm dated at  $t-1$ , the book-to-market assets ratio dated at  $t-1$ , the performance of the firm (measured as the one-year total return to shareholders), the idiosyncratic risk

of shareholder returns (as a proxy for risk), CEO tenure, and a set of industry dummy variables. We also include a proxy for leverage, measured as the ratio of book value of debt to the market value of assets. Regressions including both U.S. and U.K. CEOs are performed separately for 1997 and 2003 in Columns (1) and (2).

Consistent with prior research, Table 2 indicates that CEO pay increases with firm size, growth opportunities, and performance. However, the main coefficient of interest in Columns (1) and (2) is the variable “U.S. indicator,” which is equal to one if the firm is a U.S. firm and zero if it is a U.K. firm. The coefficient estimate on the U.S. indicator variable for 2003 in column (2) is a significantly positive 0.32, indicating that after controlling for various firm, CEO, and industry factors, CEOs in the U.S. earn approximately 38% more total compensation than their British counterparts in that year. An interesting feature of Table 2 is that it shows a narrowing of pay differences from 1997 to 2003. U.S. CEO total pay was about 99% higher than U.K. CEO pay in 1997, but this difference narrowed to 38% in 2003.<sup>13</sup>

Columns (3) and (4) of Table 2 report coefficient estimates of the difference between U.S. and U.K. incentives using a series of OLS regressions similar to those for total pay in Columns (1) and (2), and controlling for company size, growth opportunities, idiosyncratic risk, CEO tenure, leverage, and industry factors. The dependent variable in all columns is  $\log(\text{equity incentives})$ . As in the CEO pay regressions, the incentives regressions include both U.S. and U.K. CEOs, and are performed separately for 1997 and 2003. The coefficients on the control variables in the incentives regressions are consistent with prior literature: Larger firms with greater growth opportunities use more incentives, and CEOs with longer tenure hold more equity incentives. Consistent with prior mixed results on the association between risk and incentives, idiosyncratic risk does not show a consistent relation with incentives. Leverage is not associated with incentives in 1997, but shows a significant negative association in 2003.

In the 2003 regression, the coefficient estimate on the U.S. indicator is 1.87 and indicates that, after controlling for firm, CEO, and industry factors, CEOs in the U.S. hold about 549% more equity incentives than their U.K. counterparts in that year. This suggests that CEOs in the U.S. have much more wealth tied up in firm equity that is at risk to adverse price shocks.<sup>14</sup> As with the pay

<sup>13</sup> The cost of living in major metropolitan areas is roughly similar across the two countries. Mercer Human Resource Consulting (2009) conducts a Cost of Living Survey that covers 143 cities across six continents and measures the comparative cost of over 200 items in each location, including housing, transport, food, clothing, household goods, and entertainment. London is an expensive city in Europe and is ranked third globally in 2008, while New York City is the most expensive city in the U.S. and is ranked twenty-second globally in 2008. Further, it seems plausible that a greater percentage of U.K. CEOs reside in London, as compared to U.S. CEOs who reside in New York City. Outside of major metropolitan areas, the cost of living in the U.K. is generally lower than that of comparable U.S. cities.

<sup>14</sup> We note that differences in incentives borne through risk of CEO turnover are unlikely to alter this inference regarding differences in incentives between U.S. and U.K. CEOs. As we discuss in the Appendix, average U.K. CEO turnover is similar to, if not somewhat less frequent than, that of the U.S. Prior studies find similar results (e.g., Conyon and Murphy 2000; Dahya, McConnell, and Travlos 2002).

difference, the U.S.–U.K. incentive difference has declined somewhat from 1997 to 2003 (from 759% to 549%, respectively).

The regressions in Columns (1)–(4) in Table 2 indicate, not surprisingly, that CEO pay and incentives are influenced by many firm characteristics, such as size and growth. Because the U.S. and U.K. samples are likely to differ across some of these dimensions (for example, Table 1 shows that the samples differ on the firm size dimension), we facilitate clear comparisons by using a propensity-score-matching procedure to select a firm from the U.S. sample (which contains a much larger number of observations) for each U.K. firm. The propensity scores are computed based on the by-year logit regressions presented in Columns (5) and (6) of Table 2, which include all the control variables from Columns (1)–(4). The dependent variable is a “U.K. indicator,” which is equal to one if the firm is a U.K. firm and zero if it is a U.S. firm. The significant negative coefficients on idiosyncratic risk and on shareholder returns in both years suggest that U.K. firms tend to be less risky and had weaker stock price performance in both 1997 and 2003. We match each U.K. firm to the U.S. firm with the closest propensity score within a two-digit SIC code (the propensity-score regressions only include U.S. observations for which there is a U.K. observation in the same industry).

Table 3 presents mean and median descriptive statistics for the propensity-score-matched U.S. and U.K. samples separately for both 1997 and 2003, and shows differences between the samples in the far right columns. As expected and by construction, there are no significant differences in firm size (sales and market value) between the two samples. Further, among the variables included in the propensity-score regressions, idiosyncratic risk in 1997 is the only characteristic that exhibits a significant difference between the matched samples. Most importantly for our purposes, however, the direction and magnitude of differences in total pay and incentives between the U.S. and U.K. CEOs are quite similar to the descriptive statistics presented in Table 1. For the remainder of the article, we focus on the propensity-score-matched sample in our analyses.

Table 3 also presents descriptive statistics on some other governance and risk characteristics that may shed light on differences in pay or incentives between U.S. and U.K. CEOs. Specifically, we examine the incidence of CEOs who also serve as board chairs and the extent to which the firms are closely held. Brickley, Coles, and Jarrell (1997) argue that the prospect of becoming the board chair acts as an incentive mechanism for CEOs, suggesting that more successful and talented CEOs are likely to be awarded the chair. The combined roles may also carry greater responsibility. On the other hand, it is frequently argued that the dual CEO-chair position reflects CEO power and entrenchment (Core, Holthausen, and Larcker 1999). The previous finding that CEOs who serve this dual role are higher paid is consistent with both hypotheses. The dual position is rarely used in the U.K. compared to the U.S. (in 2003, the percentages of firms were 4.2% vs. 69.6%, respectively). This difference

**Table 3**  
**Descriptive statistics on propensity-score-matched U.S. and U.K. samples**

Variable	U.S.		U.K.		U.S.-U.K. Difference	
	Mean	Median	Mean	Median	Mean	Median
<b>1997 (N = 177)</b>						
<i>Sales<sub>t-1</sub></i> (\$Millions)	\$4,041	\$1,896	\$4,295	\$1,779	-\$254	\$325
<i>Market value of equity<sub>t-1</sub></i> (\$Millions)	\$5,965	\$2,082	\$4,985	\$2,108	\$980	-\$75
<i>Book to market<sub>t-1</sub></i>	0.64	0.65	0.62	0.61	0.02	-0.01
<i>Idiosyncratic risk<sub>t-1</sub></i>	22.2%	20.3%	19.6%	18.2%	2.6%**	1.5%**
<i>Tenure<sub>t-1</sub></i>	7.91	5.67	6.86	5.64	1.05	0.60
<i>Leverage<sub>t-1</sub></i>	16.4%	12.8%	14.7%	10.8%	1.7%	1.7%
<i>Shareholder return<sub>t</sub></i>	28.1%	24.6%	22.3%	20.6%	5.8%	3.6%
<i>Total pay<sub>t</sub></i> (\$Thousands)	\$3,411	\$2,245	\$1,295	\$985	\$2,116**	\$1,101**
<i>CEO equity incentives<sub>t-1</sub></i> (\$Thousands)	\$70,643	\$16,905	\$7,238	\$2,409	\$63,405**	\$13,632**
<i>CEO-Chair indicator<sub>t</sub></i>	74.6%	100.0%	16.4%	0.0%	58.2%**	100.0%**
<i>%Closely held shares<sub>t-1</sub></i>	15.9%	10.7%	17.3%	11.6%	-1.4%	0.4%
<i>%Closely held shares<sub>t-1</sub> excluding CEO</i>	13.7%	7.7%	17.0%	11.6%	-3.3%	0.3%
<b>2003 (N = 214)</b>						
<i>Sales<sub>t-1</sub></i> (\$Millions)	\$6,097	\$1,727	\$5,155	\$1,555	\$942	\$52
<i>Market value<sub>t-1</sub></i> (\$Millions)	\$6,630	\$1,627	\$4,996	\$1,453	\$1,634	-\$82
<i>Book to market<sub>t-1</sub></i>	0.80	0.83	0.82	0.83	-0.02	-0.02
<i>Idio. Risk<sub>t-1</sub></i>	37.2%	33.8%	35.5%	31.0%	1.7%	0.9%
<i>Tenure<sub>t-1</sub></i>	7.56	5.63	7.34	6.42	0.22	-0.43
<i>Leverage<sub>t-1</sub></i>	21.5%	19.7%	22.5%	20.4%	-1.1%	0.4%
<i>Shareholder return<sub>t</sub></i>	33.9%	27.8%	32.0%	27.5%	1.9%	0.2%
<i>Total pay<sub>t</sub></i> (\$Thousands)	\$4,964	\$2,744	\$2,583	\$1,891	\$2,381**	\$514**
<i>CEO equity incentives<sub>t-1</sub></i> (\$Thousands)	\$93,186	\$21,407	\$22,051	\$3,806	\$71,135**	\$13,119**
<i>CEO-Chair indicator<sub>t</sub></i>	69.6%	100.0%	4.2%	0.0%	65.4%**	100.0%**
<i>%Closely held shares<sub>t-1</sub></i>	17.3%	12.6%	16.6%	11.4%	0.7%	1.6%
<i>%Closely held shares<sub>t-1</sub> excluding CEO</i>	14.7%	11.3%	15.7%	11.2%	-1.0%	1.2%

Sales and Market value of equity are measured at the beginning of the respective year. Book-to-market is the ratio of book value of assets to the sum of book value of liabilities plus market value of equity. Idiosyncratic risk is the standard deviation of the residuals from a market model estimated daily over year  $t-1$ . Tenure is the number of years the CEO has held that position. Leverage is the ratio of book value of debt to market value of assets. Shareholder return is the one-year total return to shareholders. Total Pay for the firm's CEO is defined as the sum of salaries, bonuses, benefits, stock options (valued on the date of the grant using the Black-Scholes formula), restricted stock grants (valued at 100% of performance contingent awards), and other compensation. CEO equity incentives are in equivalent stock value, and are defined as (share price)  $\times$  (the number of shares held) + (share price)  $\times$  (option delta)  $\times$  (the number of options held). U.K. pounds sterling denominated data are converted to U.S. dollars using the average  $\$/\pounds$  exchange rate during 1997 (1.6386) and 2003 (1.6355). CEO-Chair indicator takes the value of 1 if the CEO is also board chair, and zero otherwise. %Closely held shares <sub>$t-1$</sub>  is the percentage of shares held by outside 5% holders and shares held by officers and directors (source: Worldscope). %Closely held shares <sub>$t-1$</sub>  excluding CEO is Closely held shares less shares held by the CEO. The symbols \* and \*\* indicate statistical significance at the 5% and 1% levels, respectively.

potentially provides a non-risk explanation for some of the differences in pay between the U.S. and U.K. CEOs. We examine the relation between the dual position of CEO and chair and CEO pay and incentives in a regression setting in Section 3.2 below.

Finally, we report the proportion of shares held by insiders and large shareholders (“%Closely held shares”), where large shareholders are defined as those holding more than five percent of outstanding shares (we report this variable with, and without, the CEO's shareholdings included). Jensen (1993) argues that active investors have the financial interest and independence to help correct governance problems. Thus, if differences in pay between U.S. and

**Table 4**  
**Illustration of incremental pay for incremental incentives for the median CEO**

	<i>Median Pay and Incentives (\$thousands)</i>		
	U.S. (1)	U.K. (2)	Difference: U.S. – U.K. (3)
<b>1997</b>			
CEO Pay in 1997	\$2,245	\$985	\$1,260
CEO Equity Incentives at beginning of 1997	\$16,905	\$2,409	\$14,496
Incremental pay per unit of incremental incentive (%)			8.69%
<b>2003</b>			
CEO Pay in 2003	\$2,744	\$1,891	\$853
CEO Equity Incentives at beginning of 2003	\$21,407	\$3,806	\$17,601
Incremental pay per unit of incremental incentive (%)			4.85%

Incremental pay per unit of incremental incentive in the last column is computed as the difference in pay divided by the difference in incentives, and is expressed as a percentage. The U.K. sample consists of 177 firms in 1997 and 214 firms in 2003. The U.S. sample consists of 177 firms in 1997 and 214 firms in 2003, selected using the propensity-score-matching procedure described in Tables 2 and 3. CEO pay is defined as the sum of salaries, bonuses, benefits, stock options (valued on the date of the grant using the Black-Scholes formula), restricted stock grants (valued at 100% of performance contingent awards), and other compensation. CEO equity incentives are in equivalent stock value, and are defined as (share price)  $\times$  (the number of shares held) + (share price)  $\times$  (option delta)  $\times$  (the number of options held). U.K. pounds sterling denominated data are converted to U.S. dollars using the average \$/£ exchange rate during each of the years 1997 (1.6386) and 2003 (1.6355).

U.K. CEOs reflect differences in agency conflicts, this may be due to a greater prevalence of active investors in the U.K. vis-à-vis the U.S. The data, however, do not show a significant difference in shares held by insiders and large shareholders. Excluding ownership by the CEO, in 1997, the U.K. firms have insignificantly higher median ownership by insiders and large shareholders than U.S. firms (11.6% vs. 7.7%, respectively), and in 2003, the U.K. and U.S. firms have nearly identical median ownership by insiders and large shareholders (11.2% vs. 11.3%, respectively).

### 3. Results on the Relation between Pay and Incentives

To this point, we have illustrated that the level of CEO compensation is higher for U.S. CEOs compared to U.K. CEOs. Further, we have shown that U.S. CEOs have more wealth at risk in their companies' stock and stock options relative to U.K. CEOs. There are economic benefits and costs to imposing incentives. The benefits of incentives are that they align the CEO's interests with those of shareholders and encourage the CEO to make decisions that increase shareholder value. However, the cost of these incentives is that a CEO will not work unless he is adequately compensated, and a risk-averse CEO will demand more compensation as the amount of incentives imposed is increased. All agency models predict that the greater the number of incentives imposed on an agent, the more he will be paid. Recent research emphasizes that risk-averse and undiversified CEOs discount the value of their firm-specific equity (e.g., Hall and Murphy 2002). This occurs because CEOs would prefer to invest their wealth in a more diversified portfolio and therefore do not value \$1 in firm stock as much as \$1 invested in this more diversified portfolio. The more

incentives the CEO holds, the less his wealth is diversified, and the greater the risk premium he requires.

Table 4 shows a descriptive calculation of the ratio of extra pay received by the median U.S. CEO to the extra incentives held by this median U.S. CEO. Columns (1) and (2) show median CEO total pay and beginning-of-year CEO portfolio incentives for 1997 and 2003, respectively. Recall that this incentive measure is defined as the change in the value of CEO equity holdings for a percentage change in the stock price, and equates \$100 in stock to \$100 in incentives. Column (3) shows that in 1997 (2003) the median U.S. CEO received \$1,260,000 (\$853,000) more pay and held \$14,496,000 (\$17,601,000) more incentives. In the final row of each panel, we compute the ratio of incremental pay received by the median U.S. CEO for incremental incentives held. This incremental pay is 8.69% per unit of incentives in 1997, and 4.85% per unit of incentives in 2003. In other words, our matched sample of U.S. CEOs receive between \$4.85 and \$8.69 in extra annual pay for holding an undiversified position equivalent to \$100 in firm stock. In the next section, we explore whether the magnitude of this premium appears reasonable given various assumptions about CEO risk-aversion, wealth, and firm characteristics.

### 3.1 Estimating the risk premium for holding incentives

That CEOs who hold greater incentives should receive greater pay seems reasonable. The key question is what magnitude of extra pay would we expect the U.S. CEOs to receive given the extra incentives they hold? In other words, is a range of \$4.85 to \$8.69 in extra pay per \$100 of extra incentives reasonable? Some light can be shed by extending the work of [Hall and Murphy \(2002\)](#) and [Cai and Vijh \(2005\)](#) on the risk premium a CEO will require for accepting an equity grant in lieu of cash pay. Hall and Murphy and Cai and Vijh show that the magnitude of the risk premium associated with the equity grant increases with the proportion of the manager's wealth that is invested in firm equity (as opposed to diversified assets) and with the CEO's risk-aversion. Both outside wealth (money not held in firm equity) and risk-aversion are unobservable to the researcher. However, prior literature typically assumes that outside wealth ranges between 50% and 100% of the CEO's inside wealth. For example, if the CEO owns \$10 million in firm equity, the literature assumes that his outside diversified holdings range from \$5 million to \$10 million. In addition, the literature typically assumes that the CEO exhibits relative risk-aversion, and that his relative risk-aversion parameter is in a range between two to three (e.g., [Hall and Murphy 2002](#); [Cai and Vijh 2005](#)).

Part of pay can be thought of as compensation for the CEO holding firm equity instead of selling the equity and diversifying (holding aside the component of pay related to the CEO's skill and cost of effort, and any rents that he may extract, which we refer to as "risk-adjusted pay"). In other words, one can think of a portion of annual pay as the risk premium paid to the CEO for holding an undiversified position in firm equity for the next year. Another way

to think of this risk premium is: How much less pay would the CEO accept if he were released from the restriction that he hold a substantial fraction of his wealth in firm stock? We solve for the risk premium the CEO requires to be indifferent between (1) receiving the risk premium and holding the firm equity position *for one year*; and (2) not receiving the risk premium, selling his firm equity, and holding a diversified portfolio instead.

We derive the risk premium by numerically solving the following equation:

$$\begin{aligned}
 & E[U(\textit{wealth unconstrained})] \\
 & = E[U(\textit{wealth constrained to firm equity, outside wealth, risk premium})].
 \end{aligned}
 \tag{1}$$

Wealth constrained to firm equity (inside wealth) is the CEO's beginning-of-year portfolio of stock and options. We assume that: (1) the CEO's outside wealth is either 50% or 100% of the CEO's inside wealth; (2) the CEO has a power utility with relative risk-aversion of either 2 or 3; and (3) the CEO may invest his outside wealth in long positions in both the market portfolio and the risk-free asset (but may not sell short).<sup>15</sup> The expression on the left side is the utility the CEO would receive if he could invest his total wealth in a utility-maximizing combination of the risk-free asset and the market portfolio. We assume that this unconstrained wealth is equal to the market value of the CEO's stock and options, plus his outside wealth.<sup>16</sup> The expression on the right side is the utility the CEO receives when he is constrained to hold the assumed fraction of his wealth in firm stock and options for one year, but may sell the securities at market value at the end of the year. We assume that the CEO invests the remainder of his wealth in a utility-maximizing combination of the risk-free asset and the market portfolio, and that he holds these positions for one year.<sup>17</sup> We assume a one-year holding period to match the period over which annual compensation is paid.<sup>18</sup> The risk premium is the dollar amount

<sup>15</sup> Our assumption that the CEO chooses between the market portfolio and the risk-free asset is consistent with the literature, but is an abstraction of people's real-world portfolio choices that may include large investments in other assets such as homes and other real estate. To the extent that portfolio choice varies by country, it may indicate differences in risk-aversion or in proportions of outside wealth across the countries. In Section 3.3, we provide a sensitivity analysis, and discuss how our inference would vary if U.K. CEOs differed from U.S. CEOs in risk-aversion or in proportions of outside wealth.

<sup>16</sup> To the extent that the CEO owns options or restricted stock, he will not be able to invest the market value of firm equity in a diversified portfolio. However, the objective of our method is to make comparisons of CEOs with different types of firm equity by asking the question: How much less pay would the CEO accept if he were released from the explicit or implicit restriction that he hold a portion of his wealth in firm stock?

<sup>17</sup> Because the CEO is able to choose a utility-maximizing combination of the market portfolio and the risk-free asset, this allows him to minimize the risk of his incentive holdings and minimize the risk premium (relative to a situation in which he held a fixed position in these assets [see Cai and Vijh 2005]).

<sup>18</sup> Clearly some forms of compensation are restricted for multiple years, and options (if the executive wishes to obtain their full value) are implicitly restricted beyond vesting. On the other hand, CEOs typically also own unrestricted stock and fully vested options. However, as noted above, the objective of our method is to make comparisons of CEOs with different types of firm equity by asking the question: How much less pay would the CEO accept if he were released from the explicit or implicit restriction that he hold a significant portion of his wealth in firm stock?



**Table 5**  
**Risk premium for holding firm equity**

Relative risk-aversion	% of wealth in firm equity	
	50%	67%
2	5.8%	7.6%
3	8.5%	11.0%

This table shows the risk premium as a % of incentives for various levels of risk-aversion and % of wealth in firm stock. The risk premium is derived by solving:

$$E[U(\text{wealth unconstrained})] = E[U(\text{wealth constrained to firm equity, outside wealth, risk premium})]. \quad (1)$$

The expression on the left side is the utility the executive receives from investing his wealth in a utility-maximizing combination of the risk-free asset and the market portfolio. The expression on the right side is the utility the executive receives when he is constrained to invest some proportion of his starting wealth in firm equity, and the remainder in a utility-maximizing combination of the risk-free asset and the market portfolio. The executive holds the positions for one year. The risk premium is assumed to be paid at the end of the year, and is the amount that sets the two sides equal. A percentage risk premium of 5.8%, for example, means that, if the CEO had \$1 million in firm equity, he would need to receive \$58,000 in extra pay to compensate for the additional risk. The executive is assumed to hold all stock (no options). Returns on the stock and on the market portfolio are assumed to be jointly lognormal, and to follow the capital asset pricing model. The market is assumed to have an 11% expected return and 20% volatility, and the risk-free rate is assumed to be 5%. The stock is assumed to have a beta of 1, an 11% expected return, and 40% volatility.

that sets the two sides equal, and is assumed to be paid by the firm to the CEO at the end of the year.

As an illustration of this method, in Table 5, we show the estimated risk premium for holding incentives for a hypothetical CEO. For convenience, we express this risk premium as a percentage of the CEO's incentives.<sup>19</sup> The table shows that the CEO requires a greater risk premium when he is more risk-averse and when more of his wealth is concentrated in firm stock. For our hypothetical CEO, when relative risk-aversion is two (three) and 50% of his wealth is in firm stock, he requires a risk premium of 5.8% (8.5%). If the CEO is less diversified and holds 67% of his wealth in firm stock, he requires a risk premium of 7.6% (11.0%) for a risk-aversion parameter of two (three). An estimated risk premium of 7.6% means that if the CEO has incentives of \$1,000,000, he will require an annual risk premium of \$76,000 to compensate for his lack of diversification. Another way to consider the risk premium is to suppose that a completely diversified shareholder requires a return of 10.0% on the firm's stock. Then the CEO, because he is undiversified, requires a return of 17.6%, 7.6% in extra annual pay on top of the 10% expected return. The estimated risk premiums in Table 5 appear comparable to the incremental U.S. pay per unit of incentives shown in Table 4. In 2003, the median U.S. CEO received \$853,000 more pay for holding about \$17.6 million more incentives, or an incremental-pay-to-incremental-incentive ratio of 4.85% (in 1997, the incremental-pay-to-incremental incentive ratio was 8.69%). This 4.85%

<sup>19</sup> Under our assumption that the CEO has constant relative risk-aversion, the risk premium is proportional to the magnitude of the incentives. For example, if the CEO's inside and outside wealth both increase by a factor of 10, the risk premium also increases by a factor of 10. This makes it convenient to scale the computed risk premium, and in the table, we express the risk premium as a percentage of incentives.

to 8.69% range of incremental-pay-to-incremental incentive ratios is slightly lower than, but roughly consistent with, the range of 5.8% to 11.0% shown in Table 5.

It is important to note that, although we use similar numerical methods to Cai and Vijh (2005), the risk premium we estimate is different than the risk premium Hall and Murphy (2002) and Cai and Vijh (2005) estimate. This prior work focuses on determining the executive's value of a *new* option grant by solving the following equation:

$$\begin{aligned} E[U(\text{wealth constrained to firm equity, outside wealth, option})] \\ = E[U(\text{wealth constrained to firm equity, outside wealth,} \\ \text{executive's value})]. \end{aligned} \quad (2)$$

The difference between the market value of the option (left-hand side) and the executive's value (right-hand side) is the risk premium associated with the option grant. Because of its interest in determining the executive's value for a new option grant, this work holds constant the risk premium for holding the existing equity portfolio, and solves for the incremental risk premium for holding a new option grant until maturity. In contrast, our objective is to estimate the risk premium required by the executive to hold his *entire* existing equity portfolio for a single year. Thus, the key difference between our objective and that of Hall and Murphy (2002) and Cai and Vijh (2005) is that we solve for the risk premium stemming from the CEO's entire equity portfolio, whereas they solve for the risk premium stemming from a single equity grant.

### 3.2 Estimating risk-adjusted pay

As described above, we conceive of total pay as compensation for ability and effort, plus a risk premium. Therefore, given an executive's incentives, one can estimate the risk premium and subtract it from total pay to obtain an estimate of "risk-adjusted pay." We note that this calculation requires one to make an assumption about the CEO's wealth and risk-aversion, and we assume that U.S. and U.K. CEOs have a relative risk-aversion of 2, and have 50% of their wealth outside the firm. From Table 5, these assumptions about risk-aversion and wealth outside the firm imply a risk premium of 5.8% of incentives.<sup>20</sup> In Table 6, we use the median data shown in Table 4 to obtain an estimate of the median risk-adjusted pay received by these CEOs. We compute the median risk-adjusted pay by subtracting 5.8 times the CEO's beginning-of-year incentives from his total pay. The analysis in Table 6 suggests that controlling for the risk premium substantially reduces the pay differences between U.S. CEOs and U.K. CEOs. In 1997, the median matched U.S. CEO received 128% more pay than the median U.K. CEO and held about 602% more equity incentives. After deducting the risk premium compensation for holding the median level of

<sup>20</sup> We note that 5.8% is approximately the midpoint of the observed incremental pay per unit of incentives reported in Table 4 for 1997 and 2003, and is the smallest of the estimated risk premium percentages presented in Table 5.

**Table 6**  
**Implied risk-adjusted pay for the median CEO**

	Median Pay and Incentives (\$thousands)		
	U.S.	U.K.	U.S./U.K.
Relative risk-aversion	2	2	1.00
Wealth in firm (%)	50%	50%	1.00
<b>1997</b>			
CEO Pay in 1997	\$2,245	\$985	2.28
CEO Equity Incentives at beginning of 1997	\$16,905	\$2,409	7.02
Implied CEO Total Wealth	\$33,809	\$4,818	7.02
Risk premium (5.8% of incentives)	\$980	\$140	7.02
Implied risk-adjusted pay	\$1,264	\$845	1.50
<b>2003</b>			
CEO Pay in 2003	\$2,744	\$1,891	1.45
CEO Equity Incentives at beginning of 2003	\$21,407	\$3,806	5.62
Implied CEO Total Wealth	\$42,814	\$7,612	5.62
Risk premium (5.8% of incentives)	\$1,242	\$221	5.62
Implied risk-adjusted pay	\$1,503	\$1,670	0.90

Implied risk-adjusted pay is computed as pay minus the risk premium. The risk premium is assumed to be 5.8% of incentives (assuming relative risk-aversion of 2.0 and 50% of wealth in firm equity, and using the calculations shown in Table 5). Implied CEO total wealth, under the assumption of 50% of wealth in firm equity, and the simplifying assumption that all incentives come from stock, is (equity incentives)/.50. The U.K. sample consists of 177 firms in 1997 and 214 firms in 2003. The U.K. sample consists of 177 firms in 1997 and 214 firms in 2003. The U.S. sample consists of 177 firms in 1997 and 214 firms in 2003, selected using the propensity-score-matching procedure described in Tables 2 and 3. CEO pay is defined as the sum of salaries, bonuses, benefits, stock options (valued on the date of the grant using the Black-Scholes formula), restricted stock grants (valued at 100% of performance contingent awards), and other compensation. CEO equity incentives are in equivalent stock value, and are defined as (share price)  $\times$  (the number of shares held) + (share price)  $\times$  (option delta)  $\times$  (the number of options held), measured at the beginning of the year. U.K. pounds sterling denominated data are converted to U.S. dollars using the average \$/£ exchange rate during 1997 (1.6386) and 2003 (1.6355).

incentives, the median risk-adjusted pay in 1997 is 50% greater for U.S. CEOs than for U.K. CEOs, still a substantial difference but much smaller than the 128% difference in unadjusted pay. In 2003, we observe an even more striking result. The median matched U.S. CEO received 45% more pay in 2003 than the median U.K. CEO and held 462% more equity incentives. After deducting the U.S. and U.K. CEOs' expected compensation for holding incentives, the median risk-adjusted pay in 2003 is 11% *greater in the U.K.* (\$1,503,000 for the median U.S. CEO vs. \$1,670,000 for the median U.K. CEO).<sup>21</sup> The results in Table 6 suggest that risk premium compensation may account for a large proportion of the observed differences in pay between U.S. and U.K. CEOs.

In Table 7, we examine whether these median results hold when the risk premium adjustment is applied on a CEO-by-CEO basis (as opposed to simply

<sup>21</sup> The U.K., to a much greater extent than the U.S., makes the vesting of options (and restricted stock) contingent upon the achievement of performance targets (e.g., Main 2005). To the extent that these targets are non-trivial, performance-based vesting will lower the value of an option or restricted share and decrease the incentives provided by the equity (e.g., Johnson and Tian 2000). We do not have data to feasibly incorporate these effects into our analysis. As a result, our calculated numbers may somewhat overstate U.K. pay, and also overstate U.K. incentives and the risk premium associated with these incentives. However, because the overstatement of pay will tend to be offset by the overstatement of the risk premium, it is not clear whether our measure of risk-adjusted pay for U.K. CEOs is somewhat overstated or understated.

**Table 7**  
**Implied CEO-specific risk-adjusted pay**

Panel A: Risk premium as a % of incentives

	Country	N	Average	25 <sup>th</sup> percentile	Median	75 <sup>th</sup> percentile
1997	U.K.	177	4.01%	2.69%	3.86%	5.05%
	U.S.	177	3.88%	2.53%	3.30%	4.75%
2003	U.K.	214	8.37%	5.05%	7.21%	8.98%
	U.S.	214	8.38%	4.78%	6.86%	9.85%

Panel B: Implied risk-adjusted pay (\$thousands)

	Country	N	Average (All values) (1)	Average (Negative Values set to 0) (2)	25 <sup>th</sup> percentile (3)	Median (4)	75 <sup>th</sup> percentile (5)
1997	U.K.	177	\$1,008	\$1,087	\$481	\$808	\$1,334
	U.S.	177	\$893	\$2,360	\$317	\$1,364	\$2,728
	U.S.-U.K.	177	-\$115	-	-\$805	\$463 <sup>a</sup>	\$2,047
	%(U.S.>U.K.)		60.5%				
2003	U.K.	214	\$936	\$2,086	\$905	\$1,564	\$2,728
	U.S.	214	-\$485	\$2,930	-\$246	\$938	\$3,339
	U.S.-U.K.	214	-\$1,421	-	-\$3,157	-\$393	\$2,251
	%(U.S.>U.K.)		44.3%				

The U.K. sample consists of 177 firms in 1997 and 214 firms in 2003. The U.S. sample consists of 177 firms in 1997 and 214 firms in 2003, selected using the propensity-score-matching procedure described in Tables 2 and 3. Implied risk-adjusted pay (expressed in thousands of dollars) is computed as total pay minus the risk premium. The risk premium as a % of incentives is estimated using Equation (1) above assuming that the CEO has a relative risk-aversion of 2 and 50% of his wealth outside the firm. Inputs into the calculation are the CEO's beginning-of-year stock and option portfolio, the firm's beta and volatility, an assumed market volatility of 20%, a risk-free rate of 5%, and a market risk premium of 6%. U.K. pounds sterling denominated data are converted to U.S. dollars using the average \$/£ exchange rate during 1997 (1.6386) and 2003 (1.6355). The superscript symbol <sup>a</sup> indicates that the U.S. value is significantly greater than the U.K. value at a 5% level. The superscript symbol <sup>b</sup> indicates that the U.S. value is significantly lower than the U.K. value at a 5% level.

illustrating results using the median CEO). To compute a risk premium for each CEO, we use Equation (1) above with an assumption that CEOs have a relative risk-aversion of 2 and 50% of their wealth outside the firm. Inputs into the calculation are each CEO's beginning-of-year stock and option portfolio, the firm's beta and volatility, an assumed market volatility of 20%, a risk-free rate of 5%, and a market risk premium of 6%. We then compute each CEO's risk-adjusted pay by subtracting the computed risk premium from his total pay. In Panel A, we present the computed risk premiums as a percentage of incentives, which average 3.9% in 1997 and 8.4% in 2003. The greater risk premiums in 2003 are the result of higher estimates of stock-return volatility for the U.S. and U.K. firms in that year. Because our propensity-score-matching procedure matches on idiosyncratic risk, the beta and stock volatility of the matched firms tend to be similar, and as a consequence there is no difference in risk premiums between the U.S. and U.K. firms.

Panel B of Table 7 shows that the *average* risk-adjusted pay is \$893,000 for the matched U.S. CEOs in 1997 and -\$485,000 for 2003, compared to \$1,008,000 for the U.K. CEOs in 1997 and \$936,000 in 2003. The negative average value for U.S. CEOs in 2003 is due to a small number of U.S.

CEOs who hold very large amounts of equity.<sup>22</sup> Setting negative values of risk-adjusted pay to zero (see Column (2)), the adjusted averages show that mean U.S. risk-adjusted pay is larger than risk-adjusted pay in the U.K. (\$2,360,000 vs. \$1,087,000 in 1997 and \$2,930,000 vs. \$2,086,000 in 2003).

However, because the averages in both samples are influenced by some extreme observations, as noted above, we interpret the median values as being more representative of the samples. The median risk-adjusted pay for the U.S. CEOs is about 69% greater than for the U.K. CEOs in 1997, \$1,364,000 versus \$808,000, respectively. The median paired difference is significantly greater than 0. From 1997 to 2003, risk-adjusted pay for the U.K. CEOs increased, largely due to growth in U.K. CEO pay over that period. At the same time, U.S. CEO risk-adjusted pay declined from 1997 to 2003, largely due to an increase in the estimated risk premium per unit of incentives (see Panel A of Table 7). As a result, the 2003 ordering of risk-adjusted pay is reversed, with the median U.K. CEO receiving more risk-adjusted pay than the median U.S. CEO, \$1,564,000 versus \$938,000, respectively. Now, the median paired difference is not significantly different from 0. Abstracting away from the magnitude, in 1997, 60.5% of U.S. CEOs had greater risk-adjusted pay, but this figure drops to 44.3% in 2003. Overall, the results in Table 7 (and in Table 6) suggest that the commonly held view that U.S. CEO pay is high relative to U.K. CEO pay may not hold once one considers the risk premium attributable to greater holdings of risky equity incentives.

Our results in Tables 3 and 7 indicate that U.S. pay is higher than U.K. pay, that risk adjustments narrow these differences, and that risk-adjusted U.S. pay is higher in 1997, but (insignificantly) lower in 2003. These results are based on propensity-score-matched differences that control for industry, size, and other determinants of compensation and incentives. In Table 8, we examine whether our findings are robust to controlling for additional CEO and labor market characteristics that may affect differences in pay and/or incentives between the U.S. and U.K.

As motivation for our first two additional explanatory variables, we expect that when a U.K. firm has greater exposure to the U.S., it is likely to participate in a more global CEO labor market, have a more global shareholder base, and be more likely to pay its CEO (and provide incentives) at levels comparable

<sup>22</sup> The 5% of CEOs who have the most negative risk-adjusted pay in 2003 have an average risk-adjusted pay of -45 million, an average tenure of 17.5 years, and an average stock ownership of 21.1% of shares outstanding, compared to the remaining 95% of CEOs who have an average risk-adjusted pay of \$1.7 million, an average tenure of 5.4 years, and an average stock ownership of 1.7% of shares outstanding. We acknowledge that a straightforward risk-adjusted pay framework is unlikely to capture important aspects of the compensatory relationship between the CEO and the firm when the CEO holds extremely large amounts of equity. Such CEOs are likely to be founders or long-standing executives who have successfully led the firm over a substantial period of time. These CEOs may reach a point where it is difficult for them to sell much of their equity (e.g., because shareholders expect them to show confidence in their continued leadership of the firm) and where it is also not feasible to expect the firm to fully compensate them for the risk borne through their equity holdings. The retention of these CEOs may be more closely tied to their motivation in maintaining the value of their equity holdings rather than in receiving annual pay (e.g., consider the compensation arrangements for well-known founding CEOs, such as Bill Gates at Microsoft Corp.).

**Table 8**  
**Differences in U.S.–U.K. CEO pay and incentives: Relations to competition and globalization**

Column	Median Regressions: Dependent Variable (000's)		
	U.S.–U.K. Difference in CEO Pay <sub><i>t</i></sub> (1)	U.S.–U.K. Difference in CEO Incentives <sub><i>t-1</i></sub> (2)	U.S.–U.K. Difference in CEO Risk-Adjusted Pay <sub><i>t</i></sub> (3)
<i>U.K. CEO is from U.S.</i>	-1,476* (-2.33)	7,457 (0.50)	-1,325 (-1.30)
<i>U.K. firm is listed in U.S.</i>	-1,189* (-2.21)	-4,595 (0.74)	-770 (-1.52)
<i>U.S.–U.K. Difference in CEO is chair indicator</i>	559* (1.86)	13,234** (4.45)	-322 (-0.94)
<i>Hirschman-Herfindahl Index</i>	3,294 (-0.61)	70,623 (0.71)	-2,653 (-0.33)
<i>Year 2003 Indicator</i>	-436 (-1.46)	48 (0.02)	-954** (-3.02)
<i>Intercept</i>	808** (2.74)	4,562 (1.38)	923* (2.48)
Pseudo R-squared	0.02	0.01	0.01

The U.K. sample consists of 391 firm-years (177 firm-years in 1997 and 214 firm-years in 2003). The U.S. sample also consists of 391 firm-years, selected using propensity scores developed from the logit regressions reported in Columns (5)–(6) of Table 2. Each U.K. firm is matched within industry to the U.S. firm with the closest propensity score. “U.S.–U.K. Difference in” is the difference between the relevant variable for its U.S. firm match and its U.K. firm. CEO pay is defined as the sum of salaries, bonuses, benefits, stock options (valued on the date of the grant using the Black-Scholes formula), restricted stock grants (valued at 100% of performance contingent awards), and other compensation. CEO equity incentives are in equivalent stock value, and are defined as (share price) × (the number of shares held) + (share price) × (option delta) × (the number of options held), measured at the beginning of the year. Implied risk-adjusted pay (expressed in thousands of dollars) is computed as total pay minus the risk premium. U.K. CEO is from U.S. is an indicator variable for whether the U.K. CEO is originally from the U.S. U.K. firm is listed in U.S. is an indicator variable for whether the U.K. firm is listed on any U.S. exchange. The Hirschman-Herfindahl Index is the sum of squared market shares within a 2-digit SIC industry. The market share is firm sales as a fraction of total industry sales. CEO is chair indicator takes the value of 1 if the CEO is also board chair, and zero otherwise. The symbols \* and \*\* indicate statistical significance at the 5% and 1% levels, respectively. *T*-statistics are given in parentheses, and are based on bootstrap standard errors.

to those of U.S. CEOs. Our first proxy for a U.K. firm’s degree of exposure to U.S. labor markets is an indicator variable for whether the U.K. firm employs an American CEO.<sup>23</sup> If the U.K. firm must pay U.S. wages to move an American CEO, we expect higher pay for this CEO. Following Gerakos, Piotroski, and Srinivasan (2010), who find higher pay for U.S.-listed U.K. firms, we also construct an indicator variable for whether the U.K. firm is listed on a U.S. exchange. In untabulated descriptive analysis, we find a small, but increasing, number of American CEOs at U.K. firms (4.0% in 1997 and 6.5% in 2003), as well as a small, but increasing, number of U.S. listings by U.K. firms (10.7% in 1997 and 14.0% in 2003). Although these factors are unlikely to explain a substantial proportion of the cross-sectional differences in pay between U.S. and U.K. CEOs, the change in these factors over time suggests a growing exposure of U.K. firms to U.S. markets, and could help explain some of the time-series narrowing of pay differences.

<sup>23</sup> We were not able to identify the nationality of 56 (14%) of our U.K. CEOs. If we drop these observations from the analysis in Table 8, our inference is qualitatively identical.

We also explore whether U.S.–U.K. differences in the prevalence of CEOs who also serve as board chair might explain some of the pay differences. As noted above, we expect CEO-board chairs to receive higher pay (the board chair indicates greater ability and/or greater entrenchment), and as shown in Table 3, a much greater proportion of U.S. CEOs are board chairs. We construct an indicator variable for whether a CEO is board chair, and include the difference between the indicator variables for the U.S. and U.K. matched CEOs as a variable in the regression. Finally, we consider that the degree of industry product market competition could potentially influence observed differences in pay between U.S.–U.K. CEOs. If the higher observed compensation for U.S. CEOs reflects excessive pay, we expect that the ability of U.S. firms to excessively pay their CEOs would be reduced in very competitive industries (likewise, CEO incentives in competitive industries should converge). Competitive pressure is expected to produce a similar result (i.e., the convergence of pay) if the lower pay in the U.K. is the result of social norms. As an inverse measure of the degree of market competition, we use the Hirschman-Herfindahl Index of industry product market concentration, calculated using Compustat Global as the sum of squared market shares. Market shares are based on firm sales as a fraction of worldwide industry sales, where industry is based on 2-digit SIC codes. This measure is often used as a proxy of market power in the industrial organization literature since higher values are associated with oligopoly, and in the limit monopoly, power.

In Table 8, we present median regression models of the difference in U.S.–U.K. CEO pay, incentives, and risk-adjusted pay, where the dependent variable is the difference between each U.S.–U.K. propensity-score-matched pair. The results indicate that the pay difference between the U.S. and U.K. matched CEO is smaller when the U.K. CEO is an American, and when the U.K. firm is listed in the U.S., consistent with Gerakos, Piotroski, and Srinivasan (2010) findings that U.K. firms with more U.S. exposure have greater pay. The difference in U.S.–U.K. incentive levels (Column 2), however, is not significantly related to whether a U.K. firm has an American CEO or a U.S. exchange listing. The results also indicate that CEOs who are board chairs have both greater pay and greater incentives. Product market competition, as measured by the Hirschman-Herfindahl Index, does not have explanatory power for either the difference in U.S.–U.K. pay or incentives.<sup>24</sup>

Importantly, the positive and significant intercepts in the total pay and risk-adjusted pay regressions (Columns 1 and 3) are consistent with our earlier findings that pay and risk-adjusted pay are higher in the U.S. in 1997. Further, the Year 2003 Indicator is significantly negative in the risk-adjusted pay regression, indicating that differences in risk-adjusted pay narrowed between

<sup>24</sup> If we add a control for the presence of large shareholders in Table 8, this variable is insignificant in all specifications and does not affect our inference. This is consistent with the descriptive statistics in Table 3 showing an insignificant difference in shares held by non-CEO insiders between our matched U.S. and U.K. samples.

1997 and 2003. We also find that F-tests on the sum of the intercept and the Year 2003 Indicator are insignificant, suggesting that there is no difference in 2003 in either pay or risk-adjusted pay. This is consistent with our earlier findings on risk-adjusted pay, but contrasts with our earlier finding of a significant difference in unadjusted pay. Overall, however, we find that the inclusion of the additional control variables in Table 8 do not change our earlier finding that U.S. CEOs' risk-adjusted pay is higher than that of U.K. CEOs in 1997 but about the same as that of U.K. CEOs in 2003.

### **3.3 Sensitivity analysis and interpretation**

We interpret our findings as being consistent with U.S. and U.K. CEOs receiving similar risk-adjusted pay, or at least that neither country's CEOs appear to receive consistently higher risk-adjusted pay. However, given perceptions by many that U.S. CEOs are overpaid relative to U.K. CEOs, we now consider a set of necessary conditions for our results instead to be interpreted as U.S. CEOs receiving greater risk-adjusted pay relative to U.K. CEOs. Not surprisingly, such a conclusion requires that either our analysis excludes an important determinant of differences in U.S.–U.K. pay levels, or our risk premium estimates or the assumptions we use to develop them are incorrect.

**3.3.1 Differences in unreported compensation.** In the above analysis, we focus on pay reported in U.S. and U.K. proxy statements. Although the types of pay reported are similar in both countries, some forms of compensation are not disclosed in numeric form in the proxy statement and are not included in our measures of total annual pay. These forms of compensation include value that may be received from backdated stock options, the expected value of pension and termination payments, and expected decreases in CEO pay due to early turnover.

As discussed in detail in the Appendix, our estimate of the difference between U.S. and U.K. CEO pay is not greatly affected by these unreported forms of compensation. This inference is due, in part, because unreported pay is expected to be a relatively small fraction of pay (at least on average), as well as because some forms of unreported pay are expected to be greater in the U.S. whereas other forms are expected to be greater in the U.K. For example, unreported pay due to option backdating in the U.S. slightly increases our estimate of the difference between U.S. CEO risk-adjusted pay and U.K. CEO risk-adjusted pay (option backdating was not, to our knowledge, prevalent in the U.K.). Pensions, on the other hand, appear to accrue at a higher rate in the U.K. than in the U.S. (15% vs. 10%, respectively), thereby slightly reducing our estimate of the difference between U.S. CEO pay and U.K. CEO pay. With respect to executive turnover, U.S. CEOs have at least as much turnover probability as U.K. CEOs and have about the same severance protection. As a result, since U.S. CEOs have higher total pay, they tend to lose more income



conditional on turnover, and incorporating a risk premium related to turnover would slightly reduce our estimate of the difference between U.S. CEO pay and U.K. CEO pay.

**3.3.2 Different assumptions about risk-aversion and wealth.** Our analysis to this point has assumed that U.S. and U.K. CEOs have the same relative risk-aversion (2), and hold the same proportion of their wealth in equity incentives (50%). Combined with our empirical finding that U.S. CEOs hold more equity incentives than U.K. CEOs, this latter assumption implies that, *ceteris paribus*, U.S. CEOs are wealthier than U.K. CEOs (i.e., if CEOs are assumed to hold 50% of their wealth in incentives, more incentives implies more wealth). In this section, we consider how different assumptions about U.S.–U.K. CEO risk-aversion and/or wealth would change our inferences about U.S.–U.K. CEO pay differences.<sup>25</sup>

We begin by supposing that CEOs in both the U.S. and U.K. have much lower risk-aversion than is assumed in the literature. In this case, the risk premium shown in Panel A of Table 7 would drop substantially for both countries, and U.S. pay would again appear high compared to U.K. pay. In the extreme, if all CEOs were risk neutral and required no risk premiums for holding incentives, the comparison of risk-adjusted pay across the two countries would become identical to the comparison shown in Table 6 in which U.S. CEOs receive 128% (45%) more pay than their U.K. counterparts in 1997 (2003).

On the other hand, assuming that the literature's assumptions of relative risk-aversion between two and three are correct, one might consider the possibility that U.S. and U.K. CEOs have somewhat different risk-aversion, on average.<sup>26</sup> Specifically, a claim that U.S. CEOs are overpaid relative to U.K. CEOs would require that U.K. CEOs are *more* risk-averse than U.S. CEOs and therefore require a greater risk premium per unit of incentives (if U.K. CEOs were instead less risk-averse than U.S. CEOs, this would imply a greater risk premium per unit of incentives for U.S. CEOs and would further lower the U.S. CEOs' relative risk-adjusted pay). In addition, due to country-specific differences in monitoring, perhaps it is optimal for U.S. CEOs to hold a different proportion of their wealth in equity incentives than U.K. CEOs. Specifically, a claim that U.S. CEOs are overpaid relative to U.K. CEOs would require that U.K. CEOs

<sup>25</sup> We also make the implicit assumption that the cost of CEO effort, along with the compensation for CEO effort, is the same for each pair of CEOs. Edmans, Gabaix, and Landier (2009) use an alternative assumption that is common in macroeconomic models: The cost of effort is proportional to wealth. Intuitively, wealthier persons have greater opportunity costs. If this assumption is correct, and if U.S. CEOs in fact tend to be wealthier, the differences in risk-adjusted pay shown in Table 7 would *overstate* the true pay premium received by U.S. CEOs: The positive pay premium for U.S. CEOs in 1997 would be less positive, and the slightly negative pay premium for U.S. CEOs in 2003 would become more negative.

<sup>26</sup> Graham, Harvey, and Puri (2009) provide survey evidence that U.S. CEOs tend to be more risk tolerant than non-U.S. CEOs. Although the survey compares U.S. CEOs (and CFOs) to European and Asian CEOs (and CFOs) as a group, and so does not speak specifically to the relative characteristics of U.K. CEOs, the results are at least suggestive that U.S. CEOs might be somewhat less risk-averse.

**Table 9**  
**Implied risk-adjusted pay for the median CEO—Sensitivity analysis U.K. CEOs assumed more risk-averse and less diversified than U.S. CEOs**

	<i>Median Pay and Incentives (\$thousands)</i>		
	U.S.	U.K.	U.S./U.K.
Relative risk-aversion	2	3	0.67
Wealth in firm (%)	50%	67%	0.67
<b>1997</b>			
CEO Pay in 1997	\$2,245	\$985	2.28
CEO Equity Incentives at beginning of 1997	\$16,905	\$2,409	7.02
Implied CEO Total Wealth	\$33,809	\$3,596	9.40
Risk premium (5.8% for U.S. and 11.0% for U.K.)	\$980	\$265	3.70
Implied risk-adjusted pay	\$1,264	\$720	1.76
<b>2003</b>			
CEO Pay in 2003	\$2,744	\$1,891	1.45
CEO Equity Incentives at beginning of 2003	\$21,407	\$3,806	5.62
Implied CEO Total Wealth	\$42,814	\$5,681	7.54
Risk premium (5.8% for U.S. and 11.0% for U.K.)	\$1,242	\$419	2.96
Implied risk-adjusted pay	\$1,503	\$1,472	1.02

The U.K. sample consists of 177 firms in 1997 and 214 firms in 2003. The U.S. sample consists of 177 firms in 1997 and 214 firms in 2003, selected using the propensity-score-matching procedure described in Tables 2 and 3. Implied risk-adjusted pay is computed as pay minus the risk premium. The risk premium is assumed to be 5.8% of incentives for U.S. CEOs (assuming relative risk-aversion of 2.0 and 50% of wealth in firm equity and using the calculations shown in Table 5), and is assumed to be 11.0% of incentives for the U.K. CEOs (assuming a relative risk-aversion of 3.0 and 67% of wealth in firm equity and using the calculations shown in Table 5). Implied CEO total wealth for U.S. CEOs, under the assumption of 50% of wealth in firm equity, and the simplifying assumption that all incentives come from stock, is (equity incentives)/.50, and for U.K. CEOs, under the assumption of 67% of wealth in firm equity, and the simplifying assumption that all incentives come from stock, is (equity incentives)/.67. CEO pay is defined as the sum of salaries, bonuses, benefits, stock options (valued on the date of the grant using the Black-Scholes formula), restricted stock grants (valued at 100% of performance contingent awards), and other compensation. CEO equity incentives are in equivalent stock value, and are defined as (share price) × (the number of shares held) + (share price) × (option delta) × (the number of options held), measured at the beginning of the year. U.K. pounds sterling denominated data are converted to U.S. dollars using the average \$/£ exchange rate during 1997 (1.6386) and 2003 (1.6355).

hold a greater proportion of their wealth in equity incentives (if U.K. CEOs were instead required to hold a lesser proportion of wealth in equity incentives than U.S. CEOs, this would imply a greater risk premium for U.S. CEOs and would further lower the U.S. CEOs' relative risk-adjusted pay).

To explore how our results would change under the assumptions that U.K. CEOs are more risk-averse and hold more of their wealth in firm incentives, Table 9 revises the analysis in Table 6 to show the effect of assuming that the median U.K. CEO has a relative risk-aversion of three and has 67% of his wealth in incentives, while maintaining the assumptions in Table 6 for the median U.S. CEO (i.e., a relative risk-aversion of two and 50% of wealth in incentives). From Table 5, these assumptions imply that the U.K. CEO would require a risk premium of 11.0% of incentives held, and the U.S. CEO would require a risk premium of 5.8% of incentives held. Under these alternative assumptions, the analysis in Table 9 shows that the median U.S. CEO received 76% more risk-adjusted pay than his median U.K. counterpart in 1997. However, by 2003 there is essentially no difference: The median U.S. CEO received only 2% more risk-adjusted pay than his median U.K. counterpart.

In reality, it seems unlikely that U.K. CEOs hold a greater fraction of their wealth in the firm than U.S. CEOs. If this were true, it suggests implausibly large wealth differences between the two countries' CEOs. As shown in Table 9, because the median U.S. CEO in 1997 held 7.0 times the incentives of the median U.K. CEO, an assumption that the U.S. CEO held 50% of his wealth in the firm, compared to 67% for the U.K. CEO, would imply that the U.S. CEO had 9.4 times the wealth of the median U.K. CEO (assuming for simplicity that all of the incentives were held in stock, for which \$100 in stock = \$100 in incentives).

A more plausible assumption might be more similar wealth levels between the two countries' CEOs, with the observed incentive differences caused by U.S. CEOs holding a greater portion of their wealth in the firm. For example, suppose that in 1997 U.S. CEOs had twice the wealth of their U.K. counterparts. Then, if the median U.S. CEO holds 50% of his wealth in the firm, the observed incentive differences imply that the median U.K. CEO holds only 14% of his wealth in the firm.<sup>27</sup> But this then raises the question of how U.K. firms are able to resolve agency conflicts with CEOs with this small amount of their wealth in firm equity. On one hand, institutional, regulatory, and societal differences between the U.S. and U.K. may allow U.K. firms to resolve governance problems without resorting to costly incentive structures tied to stock price performance. On the other hand, a lower tolerance for high pay in the U.K. may result in inefficiently low incentives because of constraints on paying risk premiums. To shed light on these alternative explanations, future research is needed to quantify the risk-aversion and wealth levels of top executives.

A final objection to our analysis might be as follows: Does not the apparently greater wealth of U.S. CEOs constitute prima facie evidence that they are overpaid? If U.S. CEOs are not overpaid relative to U.K. CEOs, how do they have so much more wealth? Although an investigation of this issue is beyond the scope of this article, we note a few potential explanations for why U.S. CEOs might be wealthier than U.K. CEOs. First, CEOs accumulate wealth through both risk-adjusted pay and pay for risk. To the extent that U.S. CEOs bear more incentive risk throughout their careers, they will be paid more and accumulate greater wealth (albeit with greater variance), all else being equal. Second, compared to U.K. executives, U.S. executive income is likely taxed at lower average rates over the individual's career. Although the top marginal tax rate is similar across the U.S. and U.K., this rate is applicable at lower income levels in the U.K. than in the U.S. For example, in 2003, the top U.K. income tax rate of 40% affected incomes above approximately \$50,000, whereas

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<sup>27</sup> Note that if U.K. CEOs hold less than 50% of their wealth in the firm, our risk premium estimates for U.K. CEOs will be upwardly biased, suggesting greater risk-adjusted pay for U.K. CEOs than our estimates in Tables 6, 7, and 9.

the top U.S. income tax rate of 35% affected incomes above approximately \$310,000. Thus, future executives in the U.K. pay greater taxes earlier in their careers and are expected to accumulate less wealth. Further, capital gains of U.S. executives are likely taxed at lower average rates. The capital gains tax rate on gains from equity sales is the same as the income tax rate in the U.K. In the U.S., the top capital gains tax rate has generally been lower than the top marginal tax rate. In comparison to low U.S. capital gains tax rates of 20% or below throughout our sample period, the U.K. capital gains rate has been 40%. Finally, we note that retirement ages are not mandatory in the U.K. The normal retirement age in the U.K. is 65, which is similar to the U.S. Overall, it seems conceivable that U.S. executives are wealthier because they receive higher risk premiums throughout their careers and are taxed at lower income and capital gains rates.

An alternative argument for why U.S. CEOs appear to accumulate more wealth is that U.S. CEOs are systematically overpaid relative to U.K. CEOs due to systemic corporate governance weaknesses at U.S. firms relative to U.K. firms. However, while it is obvious how excess pay leads to greater wealth, it is more difficult to see why this leads to greater incentives. In particular, why would a CEO who has considerable influence over the magnitude of his excess pay choose to bear excessive risk in the form of firm equity? The majority of stock and options held by U.S. CEOs is vested and saleable, and it is difficult to see why CEOs with sufficient clout to ensure excessive pay would not also have the flexibility to liquidate their vested stock and option holdings for the purposes of holding a better-diversified portfolio of assets.

#### **4. Analysis of U.S. versus Other European CEO Pay and Incentives**

In this section, we analyze CEO pay and incentives at other non-U.K. European firms. Although we believe this analysis provides some interesting additional insights on the potential importance of the risk premium in U.S. versus European CEO pay, we recognize that this comparison gives rise to a substantially longer list of caveats and concerns. Specifically, unlike the U.S.–U.K. comparisons, there are significant differences in corporate governance systems and practices between continental European firms and the U.S. (e.g., Becht, Franks, Mayer, and Rossi 2002). For example, as compared to the U.S. and U.K., European capital markets tend to be smaller and less liquid, and there is a significantly weaker market for corporate control (e.g., takeovers are relatively infrequent). Ownership of European firms tends to be more concentrated, and dominant family shareholdings are more prevalent, as in the case of France. Further, bank finance and monitoring is especially important in some countries, such as Germany. Two-tier boards, where the management and supervisory boards are separate entities, are common (e.g., in Germany, Holland, and France). Moreover, the governance of continental European firms often reflects a wider implicit social contract (e.g., in Germany, co-determination

rules require half of the supervisory board members to represent labor). At the same time, because executive compensation disclosures tend to be of less uniform quality in many European countries, our European sample (which consists of companies providing sufficiently transparent disclosure to compute our pay and incentives variables) may be more heavily populated by firms with good corporate governance. Because of these differences, we are limited in our ability to draw inferences about potential reasons for any observed differences in risk-adjusted pay levels between Europe and the U.S.

We hand-collect CEO compensation and equity incentives data from annual reports and firm accounts for a sample of 40 European firms for 2003. We select companies from the main European exchanges where complete CEO compensation and option information is available. The small number of firms in the European sample stems largely from limited disclosure of executive compensation in continental Europe compared to the U.S., especially stock options and other forms of equity compensation. Because of this, our sample over-represents firms with good disclosures about executive compensation. If firms with better disclosure have superior governance attributes, pay may be relatively lower, and incentives may be relatively higher, compared to non-disclosure firms. Also, because larger firms tend to have more detailed disclosures, our European sample comprises very large firms, considerably larger than the typical firm in our U.S. sample. Our results should be interpreted with the aforementioned caveats in mind. To allow for better comparisons to the U.S., we use the size and industry propensity-score-matching procedure (described above in Tables 2 and 3) to select a sample of 40 U.S. firms that we use to conduct our U.S. versus Europe comparisons.<sup>28</sup>

Descriptive statistics are provided in Table 10. The median European firm is somewhat larger than the median matched U.S. firm, but the differences are not statistically significant. The samples are quite similar across the other reported characteristics, except for CEO tenure and the incidence of the CEO serving the dual role of board chair. The median U.S. CEO has been in that position somewhat longer than the median CEO in the European sample, and is also more likely to serve as board chair. Most importantly for our analysis (and despite the somewhat larger size of the European firms), the U.S. CEOs have substantially higher median total pay than the European CEOs (\$5,921,000 vs. \$3,284,000, respectively). At the same time, the U.S. CEOs also hold much greater equity incentives than the European CEOs. The median U.S. CEOs held stock equivalent value of \$30.7 million, compared to \$3.2 million in stock equivalent value for the European CEOs.

In Tables 11 and 12, we provide U.S.–Europe risk-adjusted pay analyses analogous to those in Tables 6 and 7. As in Table 6, controlling for the risk

<sup>28</sup> Our propensity-score logit regression model indicates that, in addition to being larger, our EU firms have greater book-to-market ratios, lower recent stock returns, and shorter CEO tenure.

**Table 10**  
**Descriptive statistics on propensity-score-matched U.S. and European samples**

Variable	U.S.		Europe		U.S.-Europe Difference	
	Mean	Median	Mean	Median	Mean	Median
<b>2003 (N = 40)</b>						
<i>Sales<sub>t-1</sub></i> (\$Millions)	\$19,674	\$14,623	\$24,979	\$18,589	-\$5,305	-\$6,209
<i>Market value of equity<sub>t-1</sub></i> (\$Millions)	\$19,000	\$9,029	\$18,512	\$12,163	\$488	-\$1,547
<i>Book to market<sub>t-1</sub></i>	0.86	0.88	0.90	0.96	-0.04	-0.02
<i>Idiosyncratic risk<sub>t-1</sub></i>	36.0%	29.8%	35.2%	30.5%	0.7%	-1.6%
<i>Tenure<sub>t-1</sub></i>	4.33	3.63	3.05	2.00	1.28	1.00
<i>Leverage<sub>t-1</sub></i>	21.3%	20.6%	22.3%	22.2%	-1.1%	1.0%
<i>Shareholder return<sub>t</sub></i>	15.4%	20.5%	21.1%	19.2%	-5.7%	-7.7%
<i>Total pay<sub>t</sub></i> (\$Thousands)	\$8,745	\$5,921	\$4,982	\$3,284	\$3,762**	\$3,295**
<i>CEO equity incentives<sub>t-1</sub></i> (\$Thousands)	\$62,266	\$30,662	\$5,858	\$3,213	\$56,408**	\$24,287**
<i>CEO-Chair indicator<sub>t-1</sub></i>	67.5%	100.0%	40.0%	0.0%	27.5%**	0.0%**
<i>%Closely held shares<sub>t-1</sub></i>	14.9%	8.6%	16.1%	9.7%	-1.2%	0.8%
<i>%Closely held shares<sub>t-1</sub> excluding CEO</i>	14.5%	8.5%	16.0%	9.7%	-1.5%	0.0%

The European sample consists of 40 firms in 2003. The U.S. sample also consists of 40 firms in 2003, selected using propensity scores developed from a logit regression similar to those reported in Columns (5)–(6) of Table 2. Each European firm is matched within industry to the U.S. firm with the closest propensity score. Sales and Market value of equity are measured at the beginning of the respective year. Book-to-market is the ratio of book value of assets to the sum of book value of liabilities plus market value of equity. Idiosyncratic risk is the standard deviation of the residuals from a market model estimated daily over year  $t-1$ . Tenure is the number of years the CEO has held that position. Leverage is the ratio of book value of debt to market value of assets. Shareholder Return is the one-year total return to shareholders. Total Pay for the firm's CEO is defined as the sum of salaries, bonuses, benefits, stock options (valued on the date of the grant using the Black-Scholes formula), restricted stock grants (valued at 100% of performance contingent awards), and other compensation. CEO equity incentives are in equivalent stock value, and are defined as (share price)  $\times$  (the number of shares held) + (share price)  $\times$  (option delta)  $\times$  (the number of options held). European currency denominated data are converted to U.S. dollars using the average exchange rate during 2003. CEO-Chair indicator takes the value of 1 if the CEO is also board chair, and zero otherwise. %Closely held shares <sub>$t-1$</sub>  is the percentage of shares held by outside 5% holders and shares held by officers and directors (source: Worldscope). %Closely held shares <sub>$t-1$</sub>  excluding CEO is Closely held shares less shares held by the CEO. The symbols \* and \*\* indicate statistical significance at the 5% and 1% levels, respectively.

premium substantially reduces the pay differences between U.S. CEOs and European CEOs. In 2003, the median U.S. CEO received 80% more pay than the median European CEO and held about 854% more equity incentives. Table 11 shows that after deducting our estimate of the expected compensation for holding the median level of incentives, the median risk-adjusted pay is 34% greater for U.S. CEOs than European CEOs (\$4,142,000 vs. \$3,098,000). Or, alternatively stated, the \$1,044,000 difference in median risk-adjusted pay is much less than the \$2,637,000 difference in observed median total pay.

In Table 12, we examine risk-adjusted pay differences when the risk premium adjustment is applied on a CEO-by-CEO basis. In Panel A, we present the computed risk premium as a percentage of incentives. The lower risk premium for the median U.S. CEO as compared to the median European CEO (5.39% to 7.17%) stems from the fact that our European sample firms generally have higher stock-return volatility than the matched U.S. sample firms. Panel B of Table 12 shows that the median risk-adjusted pay in 2003 is \$4,323,000

**Table 11**  
**European and U.S. propensity score-matched sample**

Panel A: Incremental pay for incremental incentive for the median CEO

	<i>Median Pay and Incentives (\$thousands)</i>		
	U.S.	Europe	Difference: U.S.–Europe
CEO Pay in 2003	\$5,921	\$3,284	\$2,637
CEO Equity Incentives at beginning of 2003	\$30,662	\$3,213	\$27,449
Incremental pay per unit of incremental incentive			9.61%

Panel B: Implied risk-adjusted pay for the median CEO

	<i>Median Pay and Incentives (\$thousands)</i>		
	U.S.	Europe	U.S./Europe
CEO Pay in 2003	\$5,921	\$3,284	1.80
CEO Equity Incentives at beginning of 2003	\$30,662	\$3,213	9.54
Implied CEO Total Wealth	\$61,324	\$6,425	9.54
Risk premium (5.8% of incentives)	\$1,778	\$186	9.54
Implied risk-adjusted pay	\$4,142	\$3,098	1.34

Implied risk-adjusted pay is computed as pay minus the risk premium. The risk premium is assumed to be 5.8% of incentives (assuming relative risk-aversion of 2.0 and 50% of wealth in firm equity, and using the calculations shown in Table 5). Implied CEO total wealth, under the assumption of 50% of wealth in firm equity, and the simplifying assumption that all incentives come from stock, is (equity incentives)/.50. Total Pay for the firm’s CEO is defined as the sum of salaries, bonuses, benefits, stock options (valued on the date of the grant using the Black-Scholes formula), restricted stock grants (valued at 100% of performance contingent awards), and other compensation. CEO equity incentives are in equivalent stock value, and are defined as (share price) × (the number of shares held) + (share price) × (option delta) × (the number of options held). European currency denominated data are converted to U.S. dollars using the average exchange rate during 2003.

for the U.S. propensity-score-matched CEOs, compared to \$2,682,000 for the European CEOs. The median paired difference is not significantly different from 0. Abstracting away from the magnitude, 23 of 40 (57.5%) of U.S. CEOs had greater risk-adjusted pay. Thus, as with the U.S.–U.K. analysis, the results in Tables 11 and 12 suggest that the observed pay difference between the U.S. and European CEOs may be largely explained by the differences in risky equity incentives borne by these individuals.

### 5. Concluding Remarks

A growing body of academic research argues that the problems with U.S. CEO pay are systemic and that overpayment of CEOs is not limited to a few bad apples, but that all CEOs in the U.S. economy are overpaid. If this conjecture is correct, benchmarking within the U.S. tells us little about whether U.S. executive compensation practices, as a whole, suffer from systemic poor governance and excessive pay. Instead, it is necessary to compare U.S. practices with those of other countries where compensation practices ex ante are expected to suffer from these problems to a lesser extent. In this article, we use the U.K. as a benchmark against which to examine whether CEO pay in the U.S. appears unusually high. These two economies share important governance features, but the U.K. is generally considered to be less afflicted by problems of excessive executive compensation.

**Table 12**  
**Implied CEO-specific risk-adjusted pay European and U.S. propensity score-matched sample**

Panel A: Risk premium as a % of incentives							
	Region	N	Average	25 <sup>th</sup> percentile	Median	75 <sup>th</sup> percentile	
2003	U.S.	40	8.11%	3.73%	5.39%	8.74%	
	Europe	40	7.87%	4.44%	7.17%	9.48%	

  

Panel B: Implied risk-adjusted pay (\$thousands)							
	Region	N	Average (All values)	Average (Negative Values set to 0)	25 <sup>th</sup> percentile	Median	75 <sup>th</sup> percentile
2003	U.S.	40	\$4,239	\$6,024	\$1,428	\$4,323	\$10,479
	Europe	40	\$4,521	4,532	2,037	2,682	4,717
	U.S.-Europe	40	-\$282		-\$2,090	\$1,108	\$5,857
	%(U.S.>Europe)		57.50%				

The European sample consists of 40 firms in 2003. The U.S. sample consists of 40 firms in 2003, selected using propensity scores developed from logit regressions similar to those reported in Columns (5)–(6) of Table 2. Each European firm is matched within industry to the U.S. firm with the closest propensity score. Implied risk-adjusted pay (expressed in thousands of dollars) is computed as total pay minus the risk premium. The risk premium as a % of incentives is estimated using Equation (1) above, assuming that the CEO has a relative risk-aversion of 2 and 50% of his wealth outside the firm. Inputs into the calculation are the CEO’s beginning-of-year stock and option portfolio, the firm’s beta and volatility, an assumed market volatility of 20%, a risk-free rate of 5%, and a market risk premium of 6%. European currency denominated data are converted to U.S. dollars using the average exchange rate during 2003.

Using U.S. and U.K. data for 1997 and 2003, we compare U.S. and U.K. CEO annual pay and incentives. Pay is total annual pay (from cash, stock and option grants, and other pay), and incentives are measured in equivalent stock value (from holdings of stock and stock options). Controlling for firm characteristics, we find that U.S. CEOs have higher compensation and much higher incentives than U.K. CEOs. In 2003, median pay for a matched sample of U.S. CEOs was 45% higher than U.K. CEO pay and about 128% higher in 1997. At the same time, U.S. CEO incentives in 2003 were about 5.6 times higher than U.K. CEO incentives and 7.0 times higher in 1997.

When firms impose greater equity incentives on executives, one expects to observe greater risk premiums paid to those executives. Consequently, we expect that a portion of U.S. CEOs’ relatively greater pay is due to their relatively greater equity incentives. The key research question in our article is whether greater risk premiums can explain some or all of the difference in pay between U.S. and U.K. CEOs. To estimate risk premiums for U.S. and U.K. CEOs, we extend the methods in Cai and Vijh (2005) under various assumptions about CEO risk-aversion and outside wealth. We estimate risk-adjusted pay as total pay less the estimated risk premium CEOs receive for holding equity incentives.

For a reasonable range of parameters typical in prior literature, we find that the difference in risk premiums plausibly accounts for differences in pay between U.S. and U.K. CEOs. Specifically, we find that risk-adjusted pay for U.S. CEOs is not consistently higher than that for U.K. CEOs (U.S. CEOs have higher risk-adjusted pay in 1997, but U.K. CEOs have higher risk-adjusted pay



in 2003). Our analysis of European CEOs in 2003 offers a similar conclusion that U.S. CEOs, while they have significantly higher pay, do not have significantly higher risk-adjusted pay than their European counterparts.

We note, however, that while risk premiums offer a potential economic explanation for why U.S. pay is higher than U.K. and European pay, it leaves open the question of why U.S. incentives are so much larger than U.K. and European incentives. We discuss differences in wealth accumulation and constraints on pay as potential reasons for these differences, and suggest that researchers should shift their efforts toward better understanding the reasons for differences in incentives between U.S. and CEOs in the U.K. and in other parts of the world.

We conclude that critics of high U.S. executive pay should give greater consideration to the incentives borne by U.S. CEOs and the risk premiums that executives are likely to require to bear these incentives. Or, stated another way, if critics believe that the level of U.S. CEO pay is too high, they also might consider whether they would accept lower U.K.-style incentives as a trade-off for reductions in pay. However, particularly in recent years, many critics call for greater “pay-for-performance” and incentives for U.S. CEOs. Our findings suggest that calls for lower pay and greater pay-for-performance may be at odds and may be economically infeasible.

An important caveat is that our conclusions rely on the reasonableness of our risk premium estimates, and if our assumptions about risk-aversion and CEO lack of diversification are invalid, so too are our risk premium estimates. For example, if CEOs in both countries had much lower risk-aversion than is assumed in the literature, the estimated risk premium would decrease, and U.S. pay would again appear high compared to U.K. pay. However, for a fairly broad range of assumptions, risk premiums are likely to remain an important consideration in understanding differences in pay across groups of CEOs with differing levels of incentives. At the same time, quantifying the risk-aversion and wealth levels of top executives remains a crucial topic for future research in incentives and governance. A second important caveat is that our conclusions rely on the appropriateness of the choices of the U.K. and Europe as a benchmark. If U.K. and European CEOs are also overpaid, a finding that U.S. CEOs are not more overpaid may be of little comfort.

## **Appendix: Details on Unreported Compensation**

### **Option backdating**

Option backdating refers to a firm reporting in the proxy statement that an executive received an at-the-money option grant, but where, in fact, the executive received a more valuable in-the-money option grant. This is achieved by using hindsight to identify an earlier date when the stock price was lower than the actual date on which the options are awarded, and then disclosing that an at-the-money option was granted on this earlier date. For example, on the grant date the stock price might be \$10, but the firm looks back to a time when the price was \$9 and reports that an at-the-money option was granted on that earlier date; but, in effect, the executive is given an

option with a \$9 strike price on a day when the stock price is \$10. Because firms do not report backdated options in the proxy statement, reported executive option pay is too low for firms that engage in this practice. Heron and Lie (2009) estimate that 23.0% (10.0%) of U.S. option grants were backdated before (after) the SEC tightened reporting regulations on August 29, 2002. Heron and Lie (2007) find that for an average option grant before (after) August 29, 2002, there was a 3.7% (1.0%) discount to exercise price due to backdating. Combining these results suggests that, conditional on backdating, U.S. option grants had a 16.1% discount (3.7%/23%) before August 29, 2002, and a 10.0% discount (1.0%/10%) after. To our knowledge, there is no evidence that U.K. firms engaged in backdating.

When we apply these discounts using the Black-Scholes parameters of our sample firms that granted options, we find that a backdated option grant is worth on average 40% more than is calculated using reported grant dates in 1997, and 20% more in 2003. While these figures appear large, they do not translate into large differences in estimated mean or median total pay. In 1997, median estimated U.S. CEO pay increases 3.8% to \$2,330,000 (compared to \$2,245,000 in Table 3), and the median risk-adjusted pay for U.S. CEOs increases 4.3% to \$1,424,000.<sup>29</sup> The median paired difference in Table 7 increases to \$520,000 from \$463,000 in 1997. Changes are smaller in 2003, with median estimated pay increasing 0.8% to \$2,767,000 (compared to \$2,744,000 in Table 3), and median risk-adjusted pay for the U.S. CEOs increasing 2.6% to \$992,000. The median paired difference in Table 7 increases to -\$378,000 from -\$393,000.<sup>30</sup>

Note that we do not adjust our estimates of equity portfolio incentives for backdating. Although the computation of equity portfolio incentives at a point in time does depend on the exercise prices of the options in the portfolio, the computation does not depend on whether the options were, or were not, originally granted at-the-money. In other words, although a backdated option will convey greater annual compensation to the executive than is disclosed in the proxy statement, as long as the exercise prices of the executive's option portfolio are accurately reported at year-end, our portfolio incentives computations should not be affected by the backdating.

## Pension plans

Another source of pay in both countries at this time is the annual increase in the present value of an executive's company-sponsored pension plan. In the U.S., for a sample of 237 Fortune 500 companies in the 1996–2002 period, Sundaram and Yermack (2007) find that the mean annual pension accrual is 10% of total pay. In the U.K., for a sample of 181 firms from the FTSE350 in the period 2003 to 2006, Minhat (2009) finds that the mean annual pension increment for defined benefit plans is about 15% of total pay, or about 5% greater than the annual increment in the U.S.

## Severance payments

Although not a regular component of annual pay, a further source of compensation for CEOs in both countries is the separation payment that may be given to a CEO upon termination or retirement. Although severance agreements are the source of negative publicity in the U.S., Kaplan (2008, p. 16) gives the following perspective:

The average or median case is quite different from the extremes. Yermack (2006) looked at severance agreements in 179 instances of CEO turnover in Fortune 500 companies. The mean separation payment was \$5.4 million (compared to average

<sup>29</sup> To see the reason for this small conditional difference, consider that in 1997, while the conditional effect on an option grant is large (40%), only 23% of companies backdate, 72% of sample firms grant options, and options are about 39% of pay for firms that grant options. Thus, the product of the figures (the unconditional effect on pay) is only 2.6%.

<sup>30</sup> The above estimates are based on each firm engaging in an average amount of backdating. We also examine results if we instead assume that a subset of firms do all of the backdating. In other words, as the prior research suggests, we assume that 23% (10%) of our sample firms engaged in backdating in 1997 (2003). Further, we assume that the firms that backdate are the firms with the largest incentives. This alternative assumption generates qualitatively very similar median paired differences of \$504,000 in 1997 and -\$363,000 in 2003.

pay of \$8.1 million), while the median was \$0.7 million (compared to median pay of \$4.8 million). Most observers would be surprised that these numbers are not larger. The disparity between the mean and the median indicates that the mean is driven by a few large (and well-publicized) separation payments.

Rusticus (2006) also examines severance pay, but in contrast to the ex post payments examined by Yermack (2006), Rusticus examines expected severance payments based on ex ante agreements. For a sample of 305 newly hired CEOs from S&P 1500 firms between 1994 and 1999, he finds that half of the CEOs have some form of severance agreement. For these CEOs, the total expected severance pay (including estimated value vesting of unvested stock and options) is 1.1 times total pay at the mean, 0.8 times total pay at the median. Thus, the ex post analysis in Yermack suggests average severance of 0.67 times pay (i.e., \$5.4 million/\$8.1 million), and the ex ante analysis in Rusticus suggests average severance of 0.55 times pay (1.1 times pay x 50% of CEOs with a severance agreement).

In the U.K., to our knowledge, there is no academic research on severance agreements, and data are more difficult to obtain. Starting in 2002, the Directors Remuneration Report regulations require the firm to disclose its policy on (a) the duration of contracts with directors; and (b) termination payments under such contracts. Survey results by Deloitte (2004) suggest that at the FTSE 250 firms, the typical expected severance payment is about one times pay. This figure is confirmed by private survey data given to us by Manifest Information Services Ltd. (a European proxy governance and electronic voting agency). Further, severance payments have gotten less generous since the change in disclosure: The percentage of directors in FTSE 250 firms who would receive 24 months of severance fell from 25% in 2001 to 5% in 2004 (Deloitte 2004). We obtained some data on actual termination payments from Manifest for a sample of 60 executives in 2006 and 2007. For these, the median ratio of "loss of office payments" to total pay is approximately 1.1. Unfortunately, full disclosure on the percentage of U.K. CEOs with termination agreements and expected termination payments is incomplete (Deloitte 2004). However, it appears that at least as many U.K. CEOs receive severance agreements, and the ex post severance appears to be on average at least as generous as in the U.S.

## CEO turnover

Potential turnover imposes risk on CEOs, but also can generate severance pay. For our sample, we gather the incidence of CEO replacement in the year following the sample period (i.e., the years 1998 and 2004, for the 1997 and 2003 sample years, respectively). Note that the propensity-score-matching procedure controls for several likely firm-related determinants of turnover, such as performance, size, volatility, and industry, so the turnover differences across the samples can be interpreted as country differences. We compute turnover incidence excluding CEOs who are younger than 63 years of age, since older CEOs are more likely to have voluntarily retired. In 1998, the incidence of turnover for U.S. and U.K. CEOs is approximately the same (mean pre-63 years old turnover of 11.3% vs. 14.1% for the U.S. vs. U.K. CEOs, respectively), but in 2004, the incidence of U.S. turnover is significantly greater than that of the U.K. CEOs (mean pre-63 years old turnover of 14.0% vs. 9.3% for the U.S. vs. U.K. CEOs, respectively). Although we are reluctant to use these two years of data to draw strong inferences about the relative turnover risk in the U.S. versus U.K. samples, it appears that turnover risk for U.S. CEOs is at least as great as that for U.K. CEOs.

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