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Guy, Frederick (2005) Earnings distribution,
corporate governance and CEO pay. *International
Review of Applied Economics*, **19** (1). pp. 51-65.

This is an author-produced version of a paper published in *International Review of Applied Economics* (ISSN 0269-2171). This version has been peer reviewed but does not include the final publisher proof corrections, published layout or pagination.

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Citation for this version:

Guy, Frederick (2005) Earnings distribution, corporate governance and CEO pay. *London: Birkbeck ePrints*. Available at:
<http://eprints.bbk.ac.uk/archive/00000477>

Citation for the publisher's version:

Guy, Frederick (2005) Earnings distribution, corporate governance and CEO pay. *International Review of Applied Economics*, **19** (1). pp. 51-65.

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Earnings distribution, corporate governance and CEO pay

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Published in *International Review of Applied Economics*, **19** (1): 51 – 65 (January 2005)

Abstract

We investigate the relationship between earnings differentials and the pay of CEOs of 190 British companies between 1970 and 1990. We find that (i) changes in the differential between the 90th and 50th weekly earnings percentiles for non-manual adult male workers [90:50] explain changes in the level of real CEO salary and bonus in our sample of companies; (ii) changes in this differential also account for changes in the elasticity of CEO pay to firm size; (iii) a broader measure of earnings inequality does far worse than 90:50 at explaining changes in both the level and the firm size elasticity of CEO pay; (iv) fitting the model on data for 1970-1983 and predicting pay levels for the period starting with the widespread adoption of executive share option schemes in 1984, we find a structural break in the relationship between lower management pay differentials and the pay of the CEO. We conclude first that top executive pay prior to 1984 was a stable function of both firm size and earnings differentials lower on the administrative ladder, consistent with a hypothesis advanced by Herbert Simon in 1957; and second that the use of share options from 1984 onward represents not simply a change in the mode of top executive compensation, but a de-linking of the pay of top executives and that of their subordinates.

Introduction

The pay of CEOs of companies in both the USA and the UK has risen significantly in real terms since 1980. Little in the vast academic literature on CEO pay has anything to say about why this increase has occurred. The basic model employed by economists treats the pay of CEOs as a function of firm size and financial performance. The size effect is regarded as important but stable, while the effect of financial performance on pay is seen as variable, and as providing information about the mode of corporate governance. Most research focuses on the pay-performance relationship, even though this accounts for a relatively small component of CEO pay.

This paper investigates *changes* in the relationship between CEO pay and firm size. We begin by establishing the fact that the firm size elasticity of pay for the CEOs of UK companies in fact changed considerably between 1970 and 1990, falling in the 1970s and rising in the 1980s. This fall and rise of firm-size elasticity of pay parallels the pattern in the mean pay level of CEOs in our sample, and also parallels the trend in earnings inequality in the UK.

Bok (1993) observes that when CEO pay is high, both overall income inequality and the incomes of other high-earners both tend to be high as well. It is possible that changes in CEO pay level are driven by broader changes in the distribution of earnings, which may or may not be connected with corporate governance. If this is so, the question would remain exactly *what* broader slice of the overall income distribution we should be looking at, and how we suppose it affects CEO pay. Bok associates high CEO pay with extremes in income inequality and does not offer a specific causal relationship. Simon (1957) proposes a sociological model in which the level of CEO pay is determined by pay differentials lower in the managerial and professional ranks. Simon's model was meant to explain the apparent *stability* of the elasticity of CEO pay to firm size, but we use it to predict *changes* in that elasticity and in pay levels. We use this approach to test Simon's hypothesis against Bok's. In keeping with Simon's model, we find that pay differences in the managerial and professional ranks do a far better job of predicting changes in CEO pay than do pay differences between the highest and lowest paid in the workforce generally. We also test whether a fitted empirical version of Simon's model continues to predict levels of CEO pay after the use of share options for CEO remuneration became widespread in the early 1980s. We find that lower managerial and professional differentials under-predict even the cash (salary and bonus) element of CEO remuneration, and seriously under-predict total remuneration (with the value of share options included). This is evidence that there was a governance-related structural change in the pay of British CEOs in the early 1980s.

Data

Our data are from the UK for the years 1970-1990. This period is well suited to our purposes, as the data display considerable variation in the relevant variables. The levels both of real executive pay and earnings inequality fell sharply in the mid 1970s, and then rose sharply throughout the 1980s. The use of share options as an important element in CEO pay packages was slight before the tax reform act of 1984, but from 1986 on it has been considerable.

We have data on CEO pay, number of employees, profit and assets for a balanced panel of 191 firms between 1970 and 1990. 'Pay' is what is listed in the company's annual report as 'total remuneration' of the highest paid director. This basically corresponds to the salary plus bonus listing in US annual reports. Our data set is an extract from the Cambridge/DTI Databank. All firms in question are private sector for-profit corporations. Finance, insurance, and property (real estate) concerns are not included, but other service firms are. The firms in this sample tend to be fairly large, for two reasons: first, large firms were more likely to have survived through the

entire period in question and, second, through the vicissitudes of sample selection for the original data set, data on large firms was more consistently collected than data on small firms. The mean number of employees in the sample is 13,732 (summary statistics appear in Table 1).

Table 1. Summary statistics

Variable	Mean	Std. Dev	Min	Max
CEO Pay	177,714	143,236	16,483	3,148,179
Ln CEO Pay	11.92	0.55	9.71	14.96
Employees	13,732	23,698	120	195,000
Ln Employees	8.52	1.43	4.79	12.18
Sales (× 1000)	12,638,89	2,260,356	6,979	21,090,650
LN Sales	12.97	1.51	8.85	16.86
Return on Capital Employed	0.17	0.13	- 0.71	1.02

Note: n = 3990, Prices in Pounds Sterling 2002.

We do not have data on executive share options for individual firms. We do have estimates, from Main *et al.* (1996), of the average value of share options (new options granted, plus change in value of existing options) relative to cash compensation. The Main *et al.* series starts in 1981, while share option grants did not become an important element in UK executive remuneration packages until after the tax reform act of 1984.

Figure 1 shows changes in the median real pay of CEOs in our panel. From 1981 onwards there are two curves: the lower curve indicates salary plus bonus, as before, while the upper curve also includes estimated share option grants and appreciation. Figures are deflated to 2002 values using the Retail Price Index (RPI). Figure 2 shows the same figures, but deflated in this case by median earnings of adult male full time worker.¹

The very sharp drop in the relative pay of CEOs in the two years from 1974 to 1976 (Figure 3) coincides with an active incomes policy that effectively prohibited raises for the high paid. Incomes policies soon went by the board but earnings compression did not: real CEO pay remained constant, and relative CEO pay continued to fall, until 1983. Then it rose sharply, by 1985 surpassing its 1973 peak in purchasing power. By 1989, CEO pay had reached eleven times the median full-time adult male wage before share options and seventeen times after share options had been included.

¹ The ratio is conservatively stated (and also ignores certain cyclical factors) in that the figure for median annual earnings of male workers is obtained by multiplying the weekly rate by 52, hence assuming year-round employment. The CEO figure is on an annual basis to begin with.

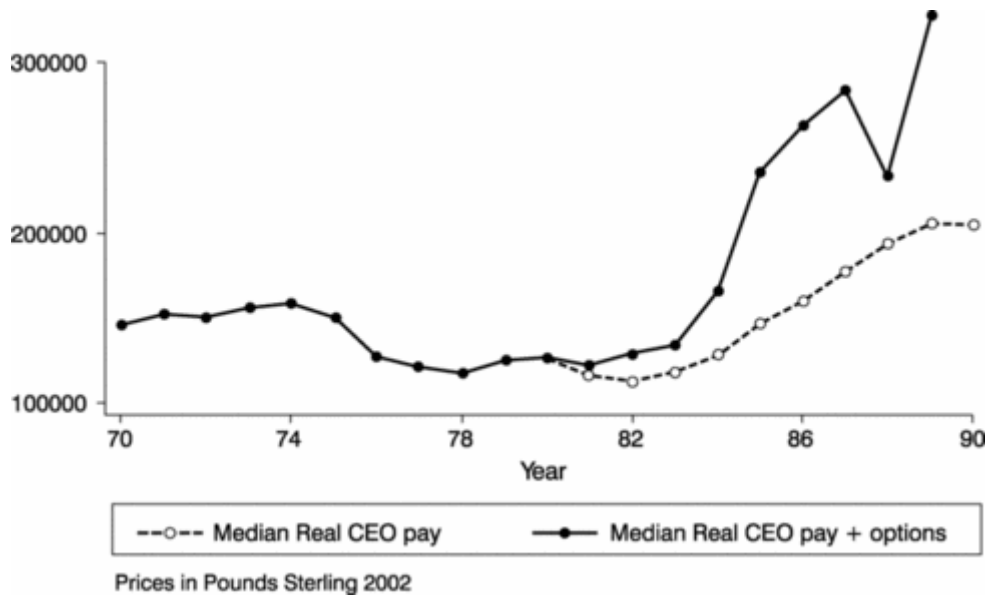


Figure 1. Median real CEO pay in sample

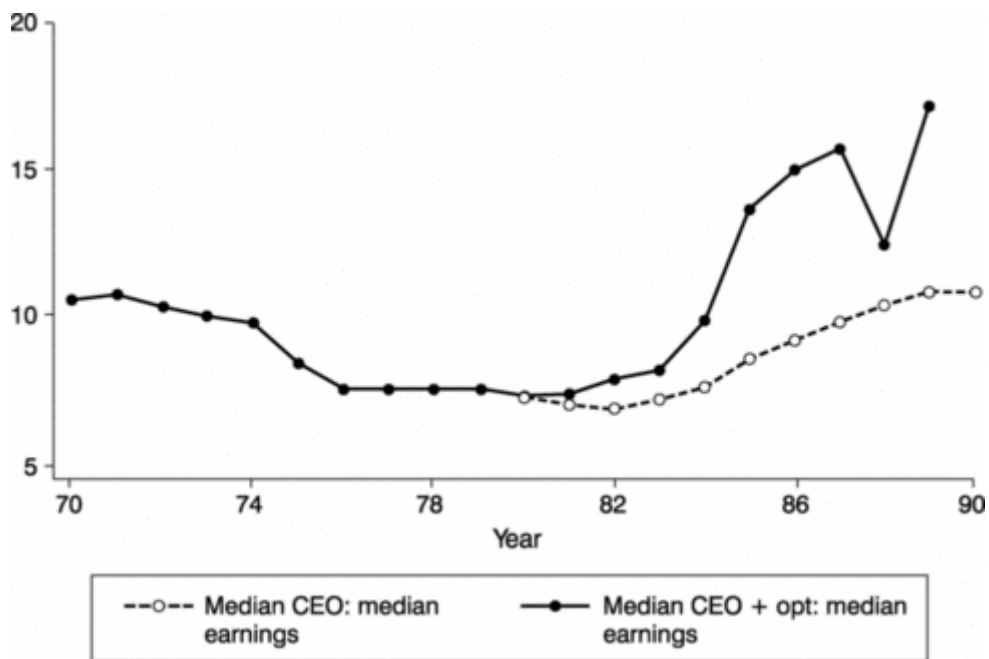


Figure 2. Median CEO pay to median earnings

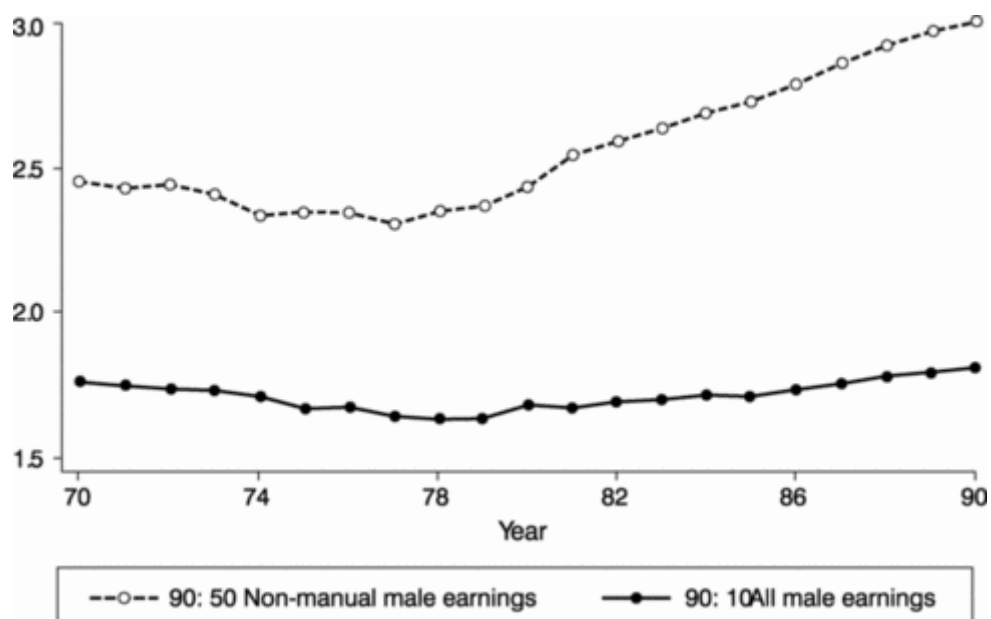


Figure 3. Changes in earnings inequality: two measures

Increased inequality of earnings and income, for both individuals and households, in both the UK and the USA, has been widely documented (Gottschalk & Smeeding, 1997). For the present study we use data from the New Earnings Survey (NES), which reports selected percentiles (10, 25, 50, 75, 90) of the distribution of weekly gross earnings for various categories of full-time adult workers in the UK from 1970 on. A common way of comparing changes in inequality using data of this sort is to take ratios of selected percentiles, such as 90:10 or 75:25. Figure 3 shows changes in two such ratios: that between the 90th and 10th percentile weekly wage for all adult males in full-time employment (90:10), and that between the 90th and 50th for adult males in full-time non-manual employment (90:50). We use ratios for male workers because, for most of the years studied here, the NES does not report consolidated figures for male and female workers; during the period studied, virtually all CEOs were male, as were most managers.

Notice that by both of these measures UK earnings inequality was falling during the early 1970s. It started rising in 1977 by the broader measure and 1979 for higher-earning non-manual male workers. The compression of earnings differentials in the mid-1970s had several causes. Trade union power was at its zenith and had the effect of boosting earnings at the lower end of the distribution. Progressive income taxation was also at its peak, which should reduce the use of high pay as an incentive (assuming diminishing marginal output from managers as after-tax pay increases). As previously noted, in much of the mid-1970s an active incomes policy capped increases in earnings to the extent in the mid-1970s of limiting pay rises to a flat £6 per week.

The models we estimate could have been run on either pre- or post-tax earnings. We have opted for pre-tax. We should note that the changes in pre-tax earnings inequality in the 1980s substantially understate increases in post-tax inequality, as the tax system became less progressive.

Theory

Earnings Distribution and the Level of CEO Pay

How are we to explain changes in the level of CEO pay? Although our interest is in the relationship between CEO pay and earnings distribution, we must start with the size of the firm. Virtually all studies of CEO pay levels find that most of the variation in cross-sections and short panels is due to differences in firm size. 'Size' is a general concept, but much the same results are obtained whether sales, assets or number of employees is used as a proxy for size. The basic model is: $CEO = \beta_0' SIZE_1^\beta u'$

taking logarithms, this becomes:

$$\ln(CEO) = \beta_0 + \beta_1 SIZE + u \quad (1)$$

The *invariance* of the elasticity of CEO pay to firm size is often treated as a stylized fact. Rosen (1992) says that this elasticity falls in a tight range between 0.20 and 0.24, while Baker *et al.* (1988) and Main *et al.* (1996) make similar assertions. Yet if we look at the studies cited by these authors, it is hard to discern the basis for any belief in the constancy of this coefficient. Cosh (1975), in a study of UK companies between 1969 and 1971, found pay: size (with size represented by net assets) elasticities in different industries ranging from 0.17 to 0.42. Even in broader (i.e. mixed industry) samples, the studies cited by Rosen in support of his claim actually found elasticities ranging from 0.19 to 0.35. Rosen points out that these studies used not only different samples, but different measures of size and pay, and different statistical methods, so that much of the difference in estimates might be put down to differences in measurement and estimator.

We checked the assumption that pay:size elasticities are stable in our data by estimating cross-sectional pay regressions for the CEOs of the same 190 firms over a 21-year period. Figure 4 shows OLS estimates for of β_1 for two versions of (1), using two different measures of firm size and augmented by a control for profitability, for each year from 1970 to 1990:

$$\ln CEO_{i,t} = \beta_{0t} + \beta_{1t} \ln EMPLOYEES_{i,t} + \beta_{2t} \text{PROFIT}_{i,t} + u_{i,t} \quad (1a)$$

$$\ln CEO_{i,t} = \beta_{0t} + \beta_{1t} \ln SALES_{i,t} + \beta_{2t} \text{PROFIT}_{i,t} + u_{i,t} \quad (1b)$$

where CEO is the salary plus bonus of the highest paid director and PROFIT is return on capital employed (ROCE). In any given year, there is not much difference between the estimated employment and sales elasticities, but the two vary over time, ranging from 0.20 to 0.32. Figure 4 shows changes in not only the size coefficient but also the intercept. The two coefficients appear as almost mirror images of each other.

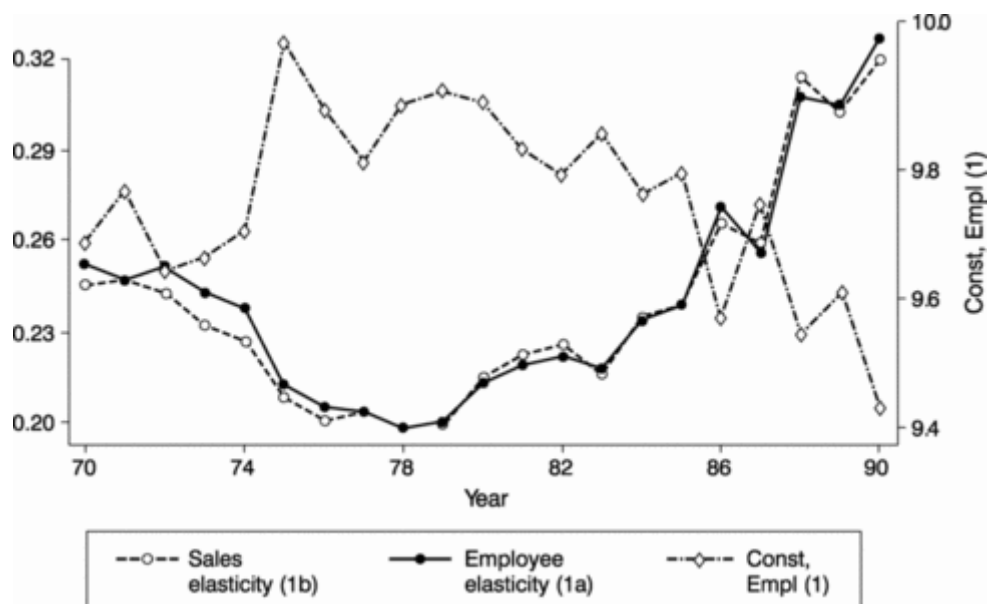


Figure 4. CEO pay: cross sectional coefficients

Note the similarity between the path of the size coefficient in Figure 4 and median real CEO pay in Figure 1. When CEO pay falls or rises, it is not simply a question of the overall *level* shifting, but of the relationship between pay and firm size changing. When the median level of CEO pay in our sample rises, the CEOs of large firms get a disproportionately large increase and those of small firms a disproportionately small increase. In other words, higher CEO pay is associated with greater inequality among CEOs.

Just as the size coefficient of CEO pay not only tracks the level of real CEO pay, the path of earnings inequality among lower-paid male workers (90:50 and 90:10 in Figure 3) is roughly the same. This is in keeping with a model of Simon (1957). Simon showed that β_1 in (1) could be expressed:

$$\beta_1 = \ln(d) / \ln(n) \quad (2)$$

where d is the percentage increase in pay from one level of the managerial hierarchy to the next and n is the span of control, or number of subordinates per supervisor. (Where it is needed for clarity, we will refer to d as the *hierarchical differential*, to distinguish it from earnings differentials in the workforce generally.) Simon assumed that earnings on the lowest rung of the management ladder were determined by the market, that the span of control was constrained by cognitive limits and that the differential between levels in a particular hierarchy was a matter of social convention, or fairness. On the last point, Simon contended that there is a *rule of proportionality*, whereby the proportional difference between a supervisor's pay and a subordinate's is approximately constant from the bottom of a managerial hierarchy to the top. Although many economists would view this invocation of fairness as *ad hoc*, recent experimental research has found that considerations of fairness can be quite important in earnings determination (Fehr & Gächter, 1998).

Simon presented his model not as an explanation for changes in executive pay levels, but for what appeared to be the stability, over time and samples, of the elasticity of pay to firm size (though for Simon that invariant elasticity fell between 0.33 and 0.37, not the 0.20-0.24 found by

Rosen). He showed that if both the span of control and the differential between supervisor and subordinate are constant, the elasticity of pay to firm size will be constant as well.²

Span of control of course varies a great deal between firms, depending on the management system and the production technology. This fact does not, however, contradict Simon's model. Simon is not claiming that proportionality keeps hierarchical differentials the same everywhere, but only that it keeps them the same within a particular set of career ladders in a particular organization. Simon's model can still be consistent with the stylized facts of the firm size elasticity of CEO pay, if a smaller span of control means smaller pay differentials between levels of hierarchy. This is quite plausible, since a smaller span of control means both smaller increments of responsibility between levels in a hierarchy, and more levels of hierarchy for a firm of a given size.

In recent decades, there appears to have been a de-layering of management, but an overall increase in earnings differentials. This would mean that increases in differentials from one level to the next had outstripped any earnings compression resulting from de-layering. Such increased earnings inequality lower in the managerial ranks would, according to Simon's theory, an increased firm-size elasticity of CEO pay.

Structural Change in the Determination of CEO Pay?

Let us say, hypothetically, that changes in lower management differentials do explain changes in the level of CEO pay over time. We are left with a second question, namely whether the relationship between lower management differentials and CEO pay in the UK subject to a structural break in the mid 1980s. At that time, share options became a major component in CEO remuneration packages and total CEO pay began a rise that has been sustained ever since. There are two ways of viewing the shift, which share options represent, in the composition of compensation. One is that the increased use of share options is entirely due to their favoured tax treatment after 1984: in other words, there was no structural change in the way executive pay is determined, but an exogenous change in UK tax rules led wealth-maximizing shareholders to change the composition of the CEO remuneration packages. The second way of viewing the change in the composition of CEO compensation is that it reflects a structural change in the way executive compensation is determined. Murphy (1997), for instance, sees share options as part of a revolution in corporate governance which has produced a more efficient allocation of resources, while Harrison (1997) tells the same story in terms of class conflict rather than efficiency, with the changing role of top management instrumental for restoring the profit share after a crisis in profitability in the late 1960s and 1970s. In this view, the changed tax treatment of share options is not exogenous, but a political manifestation of the change in corporate governance.

² Simon's theory was framed as an alternative to marginal productivity theories of executive pay, and incorporates assumptions which many economists find uncongenial: a career ladder which is internal to the firm, and pay differentials between hierarchical levels based on social norms. Various efforts have been made to reconcile the structure and conclusions of the model with marginal productivity theory: Calvo and Wellicz (1979) and Rosen (1982). Both motivate differentials within the hierarchy on the basis of sorting by ability, while in another paper Calvo and Wellicz (1978) show that the same conclusion can be reached with on the basis of monitoring costs and enforcement rents. All versions of the theory depend on some relationship being constant over the relevant range in the organization in question. For Simon this was the 'rule of proportionality', which is a social norm. In ability sorting and monitoring cost models, the constancy emerges from a chain of causation which includes an increase in marginal product of managerial ability (or effort) as one moves up an organizational hierarchy, and a distribution of ability (or functional form mapping pay into effort) which is such that marginal productivity generates the same proportional differential between levels from the bottom of the hierarchy to the top. Which of these stories you find more parsimonious may depend on the discipline in which you are trained.

If the first hypothesis is correct, then the tax code changes should be seen simply as encouraging a greater risk sharing element in CEO compensation, in the form of share options. A substantial risk-sharing element had actually been present in the UK CEO's cash pay prior to this, since it was highly responsive to company profitability (Guy, 2000); moreover, there is evidence from the US that CEOs manage to influence the timing of share option grants in order to enrich themselves while reducing market risk (Crystal, 1991; Yermack, 1997). Even so, changes in the value of share option holdings had become such a large part of CEO remuneration by the late 1980s (see Figure 2), that we should accept that CEOs had become more exposed to market risk. With greater risk we would expect the total level of compensation to rise but, *ceteris paribus*, the CEO's *cash* compensation should fall, partially offsetting the value of the options. We know, of course, that the cash compensation of CEOs actually rose throughout the 1980s, at the same time the grants of share options were increasing in volume and value. However, in this period the earnings differentials among lower-level managers were increasing as well, so that according to Simon's theory the level of CEO remuneration would have been increasing even if there were no additional risk-sharing. Therefore, the continued rise in cash pay even as the use of share options skyrockets could be consistent with a simple risk-sharing principal-agent contract (e.g. Jensen & Meckling, 1976), if the cash portion of compensation stayed below the total pay predicted by Simon's model.

What if the structural change hypothesis is correct? That is to say, what if the increased use of share options is just part of a broader shift in the way in which executive remuneration is determined, brought about by a revolution in corporate governance? Is there any prediction we can then make about the level of pay? Let us spell out more clearly the nature of the hypothesized structural change. Financial markets have increased their influence over companies, through both a threat of hostile takeover and a lure of leveraged buyouts. This has led to a transformation of the job of the CEO from one of running an ongoing organization, to managing a changing collection of operations as a portfolio of assets. This transformation of the job of the top management entails some distancing of it from the ongoing operational management team(s) of the organization. In Simon's theory, top management pay is determined according to a norm of proportionality that prevails throughout the managerial hierarchy. With top management jobs redefined in the way Murphy, Harrison and others describe, there is no reason to expect that top management pay would continue to be subject to these norms; indeed, it may be in the interest of shareholders to pay top managers more than the old norms would allow, simply to help separate them socially from the managers of the ongoing operations. In any event, if the structural change hypothesis is correct, there is no reason to expect that the increased use of share options would necessarily *displace* any amount of cash pay: the two might well rise together.

Estimating the Relationship between Earnings Inequality and CEO Salary plus Bonus

We have direct measures neither of the hierarchical earnings differentials within our firms, nor of the spans of control. However, differentials between levels of hierarchy and spans of control are, *together*, reflected in aggregate measures of earnings differentials for the relevant part of the workforce. Over time, changes in the typical organization of production may change the average span of control; changes in typical hierarchical differentials change as well. Such changes will be reflected both in changes in our cross-sectional estimates of Simon's β , and in aggregate measures of earnings inequality. From the data available to us, we choose the ratio of the 90th and 50th earnings percentiles for adult males in full-time non-manual employment (90:50) to approximate differentials between the bottom and middle of management hierarchies. So, we write: $90:50 = f(\ln(d) / \ln(n))$

Since, according to Simon's model (equation 2), $\beta_1 = \ln(d)/\ln(n)$,

$$\beta_1 = f^{-1}(90:50)$$

We do not know the functional form of $f(\cdot)$; our aim is to approximate it empirically. We begin with general specification:

$$\ln \text{CEO}_{i,t} = \alpha_0 + \alpha_1 \ln \text{SIZE}_{i,t} + \alpha_2 \text{INEQ}_t^{\alpha_3} \ln \text{SIZE}_{i,t} + \alpha_4 \text{INEQ}_t^{\alpha_5} + \alpha_6 \text{PROFIT}_{i,t} + u_{i,t} \quad (3)$$

where CEO is real cash pay, SIZE is number of employees and INEQ is either 90:50 or 90:10. This model provides a time-varying estimate of both the pay:size elasticity and the intercept, in keeping with what we observe in annual cross sections. The pay:size elasticity is:

$$\beta_1 = \alpha_1 + \alpha_2 \text{INEQ}_t^{\alpha_3} \quad (4)$$

If Simon's hypothesis is correct, and on the assumption that the ratio $\ln(d)/\ln(n)$ can be approximated by the quadratic (4) when INEQ is 90:50, then (4) gives us an estimate of Simon's β .

The regression intercept for an annual cross-section, as restricted by pooled estimation of (3), is:

$$\beta_0 = \alpha_0 + \alpha_4 \text{INEQ}_t^{\alpha_5} \quad (5)$$

Since we are using 90:50 as a measure of earnings dispersion in the lower and middle management ranks, it is of interest to know how earnings in this range compare with those of the CEOs in our sample. The relationship between the 90th percentile of non-manual male earnings and CEO earnings is shown in Figure 5. The former have been annualized by multiplying full-time weekly earnings by 52. The lower curve in Figure 5 is the ratio of the 10th percentile of the CEO sample with the 90th of the non-manual male sample. This ratio ranges between two and three for the entire period of the study. This is of the same order as the difference between the 90th and 10th percentiles of earnings for *all* adult males employed full time (see Figure 1). The upper curve in Figure 4 shows that the ratio of the median CEO to the 90th percentile non-manual male varies between about 3.5 and 5.25.

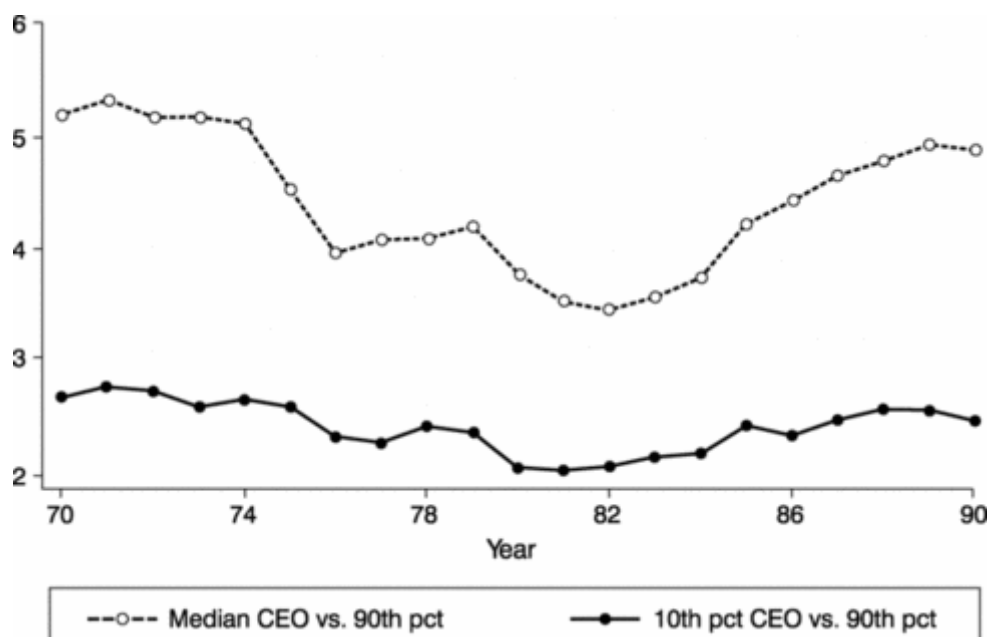


Figure 5. CEO 90th Pct non-manual male earnings

We were unable to estimate (3), as the model failed to converge. We searched for a restricted form by testing zero (or, in the case of exponents, unit) restrictions on each coefficient individually and on each pairwise combination of coefficients α_1 to α_5 , we find that the preferred model incorporates the restriction $\alpha_1 = 0$, $\alpha_5 = 1$, or:³

$$\ln \text{CEO}_{i,t} = \alpha_0 + \alpha_2 \text{INEQ}_t^{\alpha_3} \ln \text{SIZE}_{i,t} + \alpha_4 \text{INEQ}_t + \alpha_6 \text{PROFIT}_{i,t} + u_{i,t} \quad (3a)$$

For comparison, we estimate two models that do not depend on a measure of inequality, and one that uses a broader measure of earnings inequality. Model (3b) is a restricted OLS model that allows no change in either the size elasticity or the intercept:

$$\ln \text{CEO}_{i,t} = \alpha_0 + \alpha_1 \ln \text{SIZE}_{i,t} + \alpha_6 \text{PROFIT}_{i,t} + u_{i,t} \quad (3b)$$

Equation (3b) imposes the restriction $\alpha_1 = \alpha_3 = \alpha_4 = \alpha_5 = 0$ (as written, model (3b) looks almost identical to (1a): notice, however, that (1a) is the least restrictive model, estimating all coefficients separately for each year, while model (3c) restricts the coefficients to be the same for all years).

Model (3c) follows the conventional strategy of allowing for change over time with dummy variables, allowing the intercept but not the size elasticity to vary:

$$\ln \text{CEO}_{i,t} = \alpha_0 + [\text{20 year dummies}] + \alpha_1 \ln \text{SIZE}_{i,t} + \alpha_6 \text{PROFIT}_{i,t} + u_{i,t} \quad (3c)$$

Model (3d) uses both year dummies and interactions of these dummies with SIZE, allowing both the intercept and the size elasticity to vary freely. Model (3d) is the same as the 21 separate cross-sections estimated in (1a), except that (3d) constrains both the coefficient on PROFIT, and the variance, to be the same across years, in order to make the estimates comparable with (3a-c):

$$\ln \text{CEO}_{i,t} = \alpha_0 + [\text{20 year dummies}] + \alpha_1 \ln \text{SIZE}_{i,t} + [\text{20 interactions of year dummies with SIZE}] + \alpha_6 \text{PROFIT}_{i,t} + u_{i,t} \quad (3d)$$

Our rationale for using percentiles from the upper half of the non-manual adult male earnings distribution (90:50) has been that, given the limitations of our data, this is our best measure of inequality at the lower end of the executive career ladder. Use of this measure is consistent with Simon's theory, which dealt with a career ladder within an administrative hierarchy, not the work force as a whole. Are we right to follow Simon on this point, or is CEO pay in fact just as closely related to even broader changes in the distribution of earnings, as Bok's story suggests? To check this, we use the broadest inequality measure allowed by our data, the ratio 90th and 10th earnings percentiles for all (i.e. both manual and non-manual) adult males in full-time employment (90:10). Model (3e) is the same as (3a), except that 90:10 is substituted for 90:50.

Table 2 reports the estimates of models (3a-e), together with Schwartz's Bayesian Information Criterion (BIC) for each model. Smaller values of the BIC are preferred, and the smallest value here is that for (3a). Thus the use of 90:50 to model changes in CEO pay is not only supported by Simon's theory, but proves statistically preferable to the more flexible (but a-theoretical) use of dummy variables; it also dominates the use of the broader measure of inequality (90:10), providing support for Simon over Bok.

³ Coefficient selection was done using Schwartz Bayesian Criterion. See Table 2.

Table 2. Regression results

Coefficient (variable)	Model				
	3a (NLS using 90:50)	3b (simple OLS)	3c (OLS with year dummies)	3d (OLS, year dummies and interactions)	3e (NLS using 90:10)
α_0 (constant)	15.91 (0.85)	9.70 (0.04)	9.81 (0.05)	9.72 (0.16)	13.39 (0.37)
α_1 (SIZE)	-	0.24 (0.005)	0.24 (0.004)	0.25 (0.018)	-
α_2 (SIZE*INEQ, α_3)	0.01 (0.003)	-	-	-	0.02 (0.005)
α_3 (INEQ)	5.65 (0.41)	-	-	-	2.46 (0.16)
α_4 (INEQ)	- 3.58 (0.49)	-	-	-	- 1.39 (0.13)
α_6 (PROFIT)	0.62 (0.05)	0.81 (0.05)	0.62 (0.05)	0.58 (0.05)	0.64 (0.05)
Schwartz Bayesian Information Criterion	3461.5711	4246.5891	3623.4501	3715.6939	3731.1595

Note: Coefficient estimates for dummies and interactions not reported.

We compare models (3a) and (3e) visually in Figure 6, by plotting the annual firm-size elasticities from these models alongside the benchmark of the unrestricted annual estimates (1a) and constant linear model (3b). Model (3a), using 90:50, tracks the unrestricted estimate far more closely than (3e), providing visual confirmation of the statistical result.

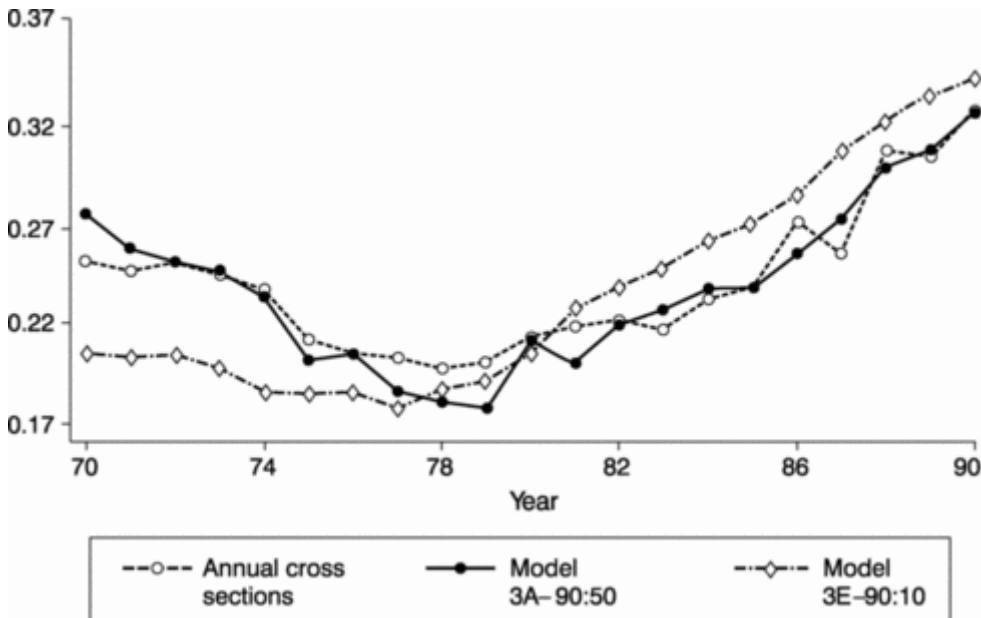


Figure 6. Employment elasticity of CEO pay

This specification is clearly inferior to those in which elasticity and the intercept both change over time. The preferred specification (3a) is exactly what Simon's theory would lead us to expect: the firm size elasticity (4) of CEO pay is a function of earnings dispersion lower in the managerial ranks, with elasticity inversely related to the intercept (5).

Model Stability and Share Options: Structural Break in the 1980s?

The results of the previous section show that major changes in both the level and the firm size elasticity of CEO pay can be accounted for by changes in the dispersion of earnings for high-earning male workers, but is this relationship really stable over time? In particular, do the parameters of the functional relationship between earnings differentials, firm size and CEO salary plus bonus change in 1984? In that year, the tax treatment of share options changed; from that year onward, changes in the value of share option holdings became a major element in the total compensation of CEOs in British companies. If these share options simply displace cash remuneration, we would expect a structural change in the determination of the level of salary plus bonus. If, on the other hand, there is no structural change in the determination of cash remuneration, we may paradoxically be able to infer a structural change in the determination of overall executive remuneration.

We do not have data on share option grants for individual executives. However, Main *et al.* obtained such information for 60 large UK companies from 1981 to 1989. In 1981, changes in the value of share options accounted for just 3% of total CEO remuneration in firms in their sample. This jumped to 12% in 1982 and 1983, 25% in 1984, and between 37% and 39% (but for a sharp one-year dip in 1988) for the remaining years of their study.

First we re-examine CEO pay without share options. We refit (3a) on data for 1970-1983 and then 1984-1990. An *F* test rejects structural homogeneity at the 5% level.⁴ We also used coefficients from the 1970-1983 period to predict CEO cash remuneration for 1984-1990 and plotted the results in Figure 7: the mean actual value of CEO cash remuneration from our sample is plotted alongside the mean fitted value for 1970-1983 and the median predicted value for 1984-1990. We also calculate total remuneration (salary + bonus + imputed change in value of share option holdings) for 1983-1989, on the basis of the Main *et al.* estimates.

Note that the 1970-1983 model not only under-predicts total remuneration, it even under-predicts *cash* remuneration. In other words, share options did not displace cash pay, but were a pure add-on to cash pay which was itself exceeding the levels predicted. This result provides support for the hypothesis that increased CEO pay from the late 1980s onwards was not simply the result of increased earnings inequality across the ranks of management, together with favourable tax treatment of share options: although both of these no doubt played a role, the evidence here supports the hypothesis of a structural change in the determination of CEO pay in the mid 1980s.

⁴ $F = 2.30$. With four restrictions and 3906 observations, the critical value at the 5% level is approximately 2.37.

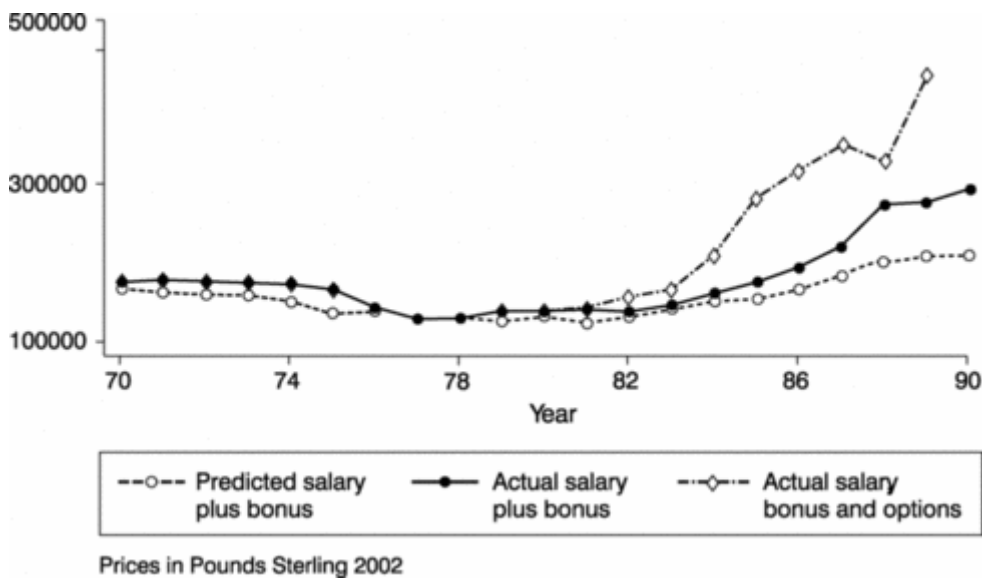


Figure 7. Predicted pay vs. actual. Sample means, cited 1970-83, predicted 84-90, model 3a

Conclusion

Changes in the level of CEO pay have attracted considerable public attention and concern. In both Britain and the USA, the pay of CEOs in publicly held firms is systematically reported, while that of other highly paid individuals is not. This makes it easy to think of high CEO pay as a phenomenon isolated from the broader distribution of earnings. The present study reconnects CEO pay with the earnings distribution. We show a relationship between CEO pay and upper-income male earnings differentials which is sufficiently consistent over time that it would be hard to argue that the two are determined independently of each other. Our finding is broadly consistent with Simon's theory that the pay of top executives can be explained by a rule of proportionality in the pay differences between ranks throughout the management hierarchy.

We find, however, that this proportionality was broken by a change in level and composition of CEO pay in the early-mid 1980s. This is consistent with a view that the heavy use of share options in top executive pay packages after 1984 was not simply a tax-driven fine-tuning of incentives, but part of a re-alignment of the interests of CEOs with those of shareholders as opposed to the ongoing management team. Simon's rule of proportionality has been broken: in the new context it is, at best, irrelevant. It is reasonable to ask whether financial markets would see the norm of a proportionality as an impediment to maximizing shareholder wealth. Insofar as the norm reflects a lasting non-market relationship between the CEOs and the people they manage, it would act as a barrier to various forms of corporate restructuring. The relationship between corporate governance and income distribution is, in any case, a complex one, and will require further study.

Data Sources

Cambridge/DTI/BSO Company Databank, Department of Applied Economics, Cambridge University. New Earnings Survey, HMSO, Various annual numbers, 1970-1990.

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