Can managerial superiority explain high executive pay in large firms?: Evidence supportive of Rosen's 'cloning' hypothesis*

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Version dated 19/08/2002

We present the first empirical evidence in support of Rosen's (1982) 'cloning' hypothesis, explaining the firm size-executive pay effect in terms of a predicted greater superiority in managerial talent the larger is the firm. We show that executives from better performing firms are more likely to join larger firms. Moreover, a misspecification arises if actual firm size is used in pay-performance sensitivity estimation. Correcting for specification bias results in a significantly smaller size effect on pay. Remarkably, the prior performance of the firm that previously employed the executive is a more significant determinant of the executive's pay with the current employer than is current firm performance.

Key words: executive pay, firm size, managerial ability, firm performance, cloning hypothesis

JEL Classification: J3, G3

* We wish to thank Gerald Garvey, Ed Lazear, Peter Moller, Eliza Wu, and Xianming Zhou for comments on an earlier draft. We also wish to thank the Australian Research Council and its Australian Professorial Fellowship and Discovery Grant schemes for generous financial support provided to Peter Swan. We gratefully acknowledge the programming assistance of Stuart Dennon.

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I. Introduction

The strong positive correlation between firm size and executive pay has become one of the most highly documented facts in the area of executive compensation over both many decades and numerous countries.[1] The main explanation for this strange but highly robust finding is Rosen's (1982) hypothesis: the positive correlation between firm size and pay is largely attributable to the higher level of talent possessed by executives in large firms. Despite innumerable studies and a fairly general acceptance of the thrust of Rosen's argument, to our knowledge no formal empirical tests of Rosen's hypothesis have been carried out. This lacuna is largely due to the difficulty faced by researchers in establishing and measuring managerial talent. In turn, this is due to the lack of appropriate data containing exogenous proxies for talent that are not contaminated by the firm's current performance and an accepted methodology for evaluating such talent.

At another level a sceptic could turn the Rosen proposition on its head and argue on the basis of the demonstrable fact that as larger firms pay more than smaller firms then of course better managers are going to gravitate towards larger firms. But such an approach would not explain why pay is higher in larger firms in the first place and nor is it so easy to be confident that larger firms do employ better managers. Managers in large firms may simply receive rents or there may be offsetting disadvantages. Moreover, how do we know that in fact these managers are superior even if they are paid more?

Furthermore, a sceptic might also pose the familiar 'so what' question: "the Rosen explanation is so transparently and obviously correct that there is no point in testing it empirically by trying to refute it". But is it correct? The explanation for pay

[1] See Rosen (1992) and the literature review below.

inequality for senior executives may be no different from the pay inequality for workers in general. The *size-wage differential* refers to the fact that larger employers typically utilizing larger plants pay considerably more for workers than do smaller employers employing workers with the same observable skills (see Brown and Medoff, 1989).[2] Clearly, the Rosen hypothesis should not be accepted without strong supportive evidence.

For decades, firm size has been documented as the most significant factor determining the level of compensation received by executives. This finding is disturbing, as it would appear to motivate executives to increase firm's size rather than performance. Thus, these findings seem to promote higher agency costs in large publicly traded corporations.[3] Adding to the ongoing concern, executives, especially in larger companies, are criticized in the popular press for 'excessive' pay that is not performance-related. The study by Jensen and Murphy (1990) finds that while the coefficient relating managerial pay and firm performance is statistically significant, the authors interpret the magnitude of the coefficient as economically insignificant. Putting these two findings together, the strong significance of size and the difficulty of establishing a major role for performance, seem to indicate a serious problem. These findings seem to be inconsistent with the foundations of fundamental neoclassical economics, as factor inputs such as executives should be paid their marginal product.

In a highly regarded and widely cited article, Rosen (1982) put forward a theory explaining the premium in pay received by executives of large firms. Through the '*cloning*' model, Rosen argues that the talent of CEOs is magnified the greater is

[2] For a theoretical product market explanation based on workers with identical skills see Shi (2002).

[3] The issue of agency problem is first introduced by Berle and Means (1932) and discussed thoroughly four decades later by Jensen and Meckling (1976).

the number of employees and the more hierarchical levels with the most capable managers assigned to positions at the top of the largest firms where their impact on subordinates is maximized. Since larger firms are more likely to have more hierarchical levels and more subordinates, a slight difference in CEO talent would affect a firm's performance considerably. As Rosen (1982, p.321) points out, the CEO's influence not only extends to a large number of people in the entire enterprise, but also the ability to make superior higher-level decisions can raise the productivity of all subordinates regardless of their ability at their own particular task. "The most capable foot soldier is not very effective if he is fighting the wrong war". Hence, larger firms are more likely to employ more talented executives than smaller firms. Thus, Rosen argues that the superior talent possessed by executives of larger firms is the main explanation for the positive correlation between firm size and pay.

Utilizing a comprehensive data set of executive movements within US companies, we offer the first empirical evidence in support of Rosen's theory. We partition our dataset into two components that capture information pertaining to the firm where the executive comes from and moves into, respectively. The executive movements data set allows us to proxy the executives' talent utilizing the performance of the firm where the executive comes from, a measure that is independent of the performance of the firm to which the executive moves and is thus exogenous.[4]

We recognize that our proxy for managerial ability captures only one aspect, admittedly an important aspect, of the *reputation* possessed by the executive. In the presence of incomplete information, firms are only able to proxy the level of true

[4] Clearly any attempt to test the Rosen hypothesis using the performance of the firm currently employing the executive as a proxy for executive talent runs into the problem that ultimately we wish to "explain" company performance (a proxy for marginal product) by the "effort" or "ability" of the

ability possessed by prospective executives. This view is similar to the moral hazard and observability argument put forward by Holmstrom (1979) and the *ex-post settling up* reputation model of Fama (1980). Hence, firms are expected to utilize some proxy measure of managerial ability, such as the one utilized in this study, the performance of the firm where the executive comes from. This proxy for managerial talent in turn influences the size of the firm to which the executive moves, the new firm's hiring decision and the executive's pay in the new job.[5]

Our results provide strong support for the *cloning* model of Rosen (1982, 1992).[6] Executives from better performing firms are more likely to move to larger firms. In essence, these managers from highly performing firms are more talented and they do tend to end up at larger firms, as Rosen's model predicts. In addition, we document a positive and significant link between the level of compensation received by executives in the firm that they move into and the performance of the firm from whence the executive came. While our results are both strong and robust, we are unable to eliminate size altogether as a determinant of senior executive pay. Thus we do not entirely close the door on models such as Shi (2002) that allow factor inputs of *equal* ability to receive higher compensation in larger organizations.

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agent in which case the argument becomes circular. Thus the need for an entirely exogenous proxy for talent becomes crucial before one can embark on testing the Rosen model.

[5] Here our purpose is not to test Fama's (1980) reputational model, although our findings do lend support, but rather to utilize performance in the previous job and firm as a proxy for the ability or talent of that executive in the current firm so as to provide refutable predictions arising from the Rosen model.

[6] While we believe our evidence to be strong and the most direct test that is feasible to be performed, we acknowledge that it is not 'direct' in the sense that we are able to place the internal decisions of the firm under a microscope and actually observe both the CEO's talent and the manner in which it is being cloned at each hierarchical level. Such tests are obviously impossible.

The outline is as follows: Section II provides an overview of the problem. Section III explains the unique nature of the executive movement data utilized in this study while Section IV documents the methodology and results and V concludes.

II. Literature Review

The demonstration of strong, positive and highly statistically significant correlation between firm size and pay can be traced back to the very early era of studies on executive compensation. Roberts (1956) and Lewellen and Huntsman (1970) carry out some of the pioneering work.[7] Baker, Jensen, and Murphy (1988) examine the relationship between CEO cash compensation and sales for the period of 1973 to 1983 and find a positive correlation between executive pay and firm size. Their findings suggest that a ten percent larger firm will pay its CEO about three percent more. Kostiuk (1989) obtains a similar finding. Examining 73 large U.S. corporations during 1968 to 1981, he concludes that the elasticity of the executive annual-salary-plus-bonus with respect to sales of the firm is in the 0.2 to 0.25 range.[8] Murphy (1985) uses a broader definition of pay, which includes deferred

[7] The early studies heavily rely on the accounting-based cash bonuses received by executives. However, the accounting-based cash bonuses are highly correlated with the absolute value of the accounting profit, which in turn is correlated with firm size. This persistent correlation introduces econometric problems in the form of multicollinearity in these early studies, (Ciscel and Carrol, 1980; Rosen, 1992; Dunlevy, 1985). While the issue of multicollinearity is difficult to be overcome, increasing the sample size and the utilization of the log transformation have been effective in reducing any biases.

[8] This finding is supported by a large number of studies such as Cosh (1975), Kokkelenberg (1988), Kostiuk (1989), and Barro and Barro (1990) who find a positive elasticity of executive pay and firm size (measured through both sales and assets). Even for studies where the elasticity cannot be computed (Mcguire *et al,* 1962; Winn and Shoenhair, 1988; Ciscel and Carroll, 1980), a positive correlated between executive pay and sales is documented.

compensation and stock options. Despite the different specification used, Murphy finds a similar result.

There has also been an enormous amount of international evidence that documents a highly significant positive relationship between CEO pay and firm size. Using a sample of 755 Canadian firms, Zhou (1999) finds a positive correlation between executive pay and firm size for Canadian firms (see also Zhou and Swan, 2002). Kaplan (1994a, 1997) and Kato (1997) find a similar result for Japanese firms; Cosh and Hughes (1997), Conyon (1997), and Conyon, Gregg, and Machin (1995) for British firms; Izan *et al* (1998) and Nixon *et al* (2002) for Australian firms. Studies by Brunello *et al* (1998) for Italian firms and Angel and Fumas (1997) for Spanish firms suggest a much lower elasticity than the others. Despite these two exceptions, international findings generally show that executive pay is positively related to firm size[9].

To date, no one has satisfactorily explained the cause of such high and persistent correlation, even though there is considerable agreement established by these prior studies showing the positive correlation between executive compensation and the size of their firm. Indeed, the dominant nature of this positive association is somewhat disturbing as it indicates that executive rewards are based on the size of the company where they are employed rather than their performance. Adding to the ongoing concern is the apparently low or negligible pay-performance sensitivity estimate made by Jensen and Murphy (1990) which further suggests that the true relationship is between pay and size and not pay and performance.

[9] Among the large number of international studies providing evidence are: Cosh (1975), Main, O'Reilly, and Crystal (1994), Conyon, Gregg, and Machin (1995) for UK, Brunello, Graziano, Parigi (1996) for Italy, Eriksson and Lausten (1996) for Denmark, Groves, Hong, McMillan, Naughton (1995) for China and Jones and Kato (1996) for Bulgaria and Kaplan (1994b) for Germany.

Through examining the different levels of control assigned to executives, Rosen (1982, 1992) provides the most widely accepted argument as to why larger firms tend to pay their executives more. He argues that the level of CEO talent is magnified by the number of hierarchical levels and hence the number of their subordinates. As a result, the output of a one-management-level firm is equal to:

$$s(k\delta_1+m\delta_0)\ , \tag{1}$$

where s is a hierarchy with a fixed span of control, δ is a worker's talent, and k and m are positive constants with k describing the direct productivity of the manager at her own supervisory level and m her productivity in terms of implementing and processing her superior's orders with $m + k < 1$ and $m < 1$ so that processing orders is costly. Therefore, a two-management-level firm's output is equal to:

$$s^2[k(k\delta_2+m\delta_1) + m\delta_0]\ . \tag{2}$$

Hence, an n-management-level firm's output is equal to:

$$Y_n = s^n(k^n\delta_n + k^{n-1}\, m\delta_{n-1} + \ldots + m\delta_o) \tag{3}$$

$$\equiv A^n\delta_n + \sum_{j=1}^{j=n-1} s^{n-j}A^j m\delta_j + s^n m\delta_0\ , \tag{4}$$

where $A = sk > 1$ is the net span of control.

(Rosen, 1992, pp. 183-184)

Hence, a CEO contributes $A^n\delta$ to output, while a $j < n$ level manager contributes $A^j m\delta$ and a production worker contributes $m\delta$. The CEO's talent is 'cloned' $(sk)^n\delta$ times over all hierarchical levels and the jth level manager, $(sk)^j m\delta$ where m < 1 over only j levels. Given the greater number of hierarchical levels in larger companies for a given span of control, the action taken by the their CEOs are *cloned* many times more than the action taken by the CEOs of smaller companies. Therefore, for a larger company, a small difference in the talent of their top executives will make a larger

impact on the whole company, which is attributable to the multiplier effect on the CEOs marginal product of the cloning process. Thus, according to Rosen's hypothesis, the positive correlation between firm size and executive pay is a result of more talented executives being hired by larger firms. In short, the CEOs of large firms are paid more because their marginal products are commensurately higher. This is due to greater talent or ability of executives employed by larger firms and is only circumstantially associated with larger size.

III. Data

The 'Swan' data set utilized in this study is extensive, covering the five highest paid executives (including the CEO) of 2,302 U.S. corporations for all stocks listed in the Standard and Poor's (S&P) 500, S&P MidCap 400 and S&P SmallCap 600 indices for the period between 1992 and 1999. It consists of 82,614 executive years representing 18,740 executives.[10] Information regarding accounting values and annual stock returns at the firm level is obtained from Standard and Poor's (S&Ps) COMPUSTAT *Research Insights* North American data while executive compensation data is obtained from S&Ps *ExecuComp* database.

Of the 18,740 executives observed in our data set, we identify 716 executives who were employed by more than one firm during the observation period.[11] Of these executives, we exclude those who have been employed by more than one firm simultaneously for more than two years, those who have been employed for less than

[10] The data set (the '*Swan*' data set) utilized in this study has been compiled by Peter L. Swan with programming undertaken by Stuart Dennon from the School of Banking and Finance, University of New South Wales. A full description of the database is contained in Garvey and Swan (2002).

[11] After excluding executives who have been employed by subsidiary companies and executives that have been employed by firms that changed their name.

one year in either Firm 1, the firm where the executives come from, or Firm 2, the firm where the executives move into, and any movements that are caused by takeovers and bankruptcy. The information regarding takeovers and bankruptcy is obtained through the Dow-Jones Interactive database. Our final sample consists of 605 executives that have moved once and an additional 29 executives who moved twice during the observation period.

Descriptive statistics are provided in Table 1. They indicate that both salary and total compensation tend to go up with the move from Firm 1 to Firm 2 and that firm size as measured by average total assets or market capitalization also tends to be greater. Market return is lower but the change is not statistically significant. Managers generally also receive more incentives, especially option grants, in their new positions.

PLACE TABLE 1 ABOUT HERE

The Swan data set provides a number of advantages. Firstly, it allows us to observe the careers of executives who move between firms. We are able to examine the change in the compensation received and the characteristics of the firms where the executives come from and move to. Secondly, it includes a great variety in the sizes of firms observed. Finally, it covers the five highest paid executives rather than being confined to CEOs.

In order to perform the proposed analyses, the ability to observe the executives' career both pre- and post the inter-firm move is crucial. We transform the observations on the 633 movement cases into a case-by-case cross-sectional format, which then allows us to uniquely identify each movement case, where each row contains information on the first, last, mean and the median value of the compensation received by the executive in Firm 1 and Firm 2 and information about both firms.

Hence, we are able to perform a comparison of the compensation received by the executives in Firm 1 with Firm 2 while at the same time being able to observe any differences between the two firms.

For each executive who has moved twice, we create two movement cases where the first case denotes the movement between Firm 1 and Firm 2 while the second case denotes the movement between Firm 2 and Firm 3. In the later case, Firm 2 is identified as Firm 1 while Firm 3 is identified as Firm 2. Our final data set contains 663 cases of executive movements representing 634 executives from 451 different Firm 1s' that move to 424 different Firm 2s'. Of the 663 executive movements, 154 represent outside CEO hires (23.23%). This figure is comparable to Fee and Hadlock (2001) who document that 214 of their 318 externally recruited CEOs have been previously employed in other U.S. public firms.

IV. Methodology and Results

The implication of Rosen's (1982) theory we test is that the positive correlation between firm size and pay depends on the superior talent, and hence higher marginal product, possessed by executives of larger firms. We perform our initial empirical analysis of the theory by examining the difference in the firm size, measured through total assets and sales, between Firm 1 and Firm 2. Should Rosen's hypothesis hold, we expect executives with a better past performance, and hence higher ability, to move to larger firms:

$$\Delta AT_{2\text{-}1} = \alpha + \beta_1 Perf_{1,t} + \beta_2 IDumChange + \beta_3 CEO\_non\text{-}CEO + \beta_4 non\text{-}CEO\_CEO + \beta_5 CEO\_CEO + \varepsilon_{time} \quad (5)$$

The dependent variable, $\Delta AT_{2\text{-}1}$, denotes the difference in size between the collection of Firm 1's and corresponding Firm 2's, proxied by the difference in the firms' total

assets. The first independent variable is a proxy for the executive's past performance in firm 1 ($Perf_{1,t}$), the second is a dummy variable which takes the value of 1 if the executive moves between industries and 0 otherwise (*Idum Change*), next there is a series of other dummy variables which quantify the position held by the executive in Firm 1 and after the move, in Firm 2 (*CEO_non-CEO, non-CEO_CEO, CEO_CEO*), and, finally, there is an *iid* error term.

Rosen's argument predicts a positive relationship between firm size and executive talent, which is proxied by the executive's past performance. Thus, based on Rosen's model, executives with superior talent are expected to move to larger firms. Therefore, the coefficient of $Perf_{1,\ t}$ is expected to be positive ($\beta_1 > 0$). The variable *IDum Change* is included in order to control for the possibility that executives who move within a given industry, move to larger firms due to their higher industry–specific experience and knowledge possessed where their marginal product will be higher. Consequently, executives who move from one industry to another may be less experienced in the new industry and thus the firm they move to should be smaller ($\beta_2 < 0$). Similarly, we expect that executives who move from a CEO to a non-CEO position to move to significantly larger firms ($\beta_3 > 0$), while those who move from non-CEO to CEO positions to move to significantly smaller firms ($\beta_4 < 0$).

The results reported in Table 2 generally support the proposition put forward by Rosen (1982), including the subsidiary hypotheses. The difference in size is found to be significantly and positively related to the stock return of Firm 1 during period *t* with $\beta_1 > 0$. We utilize two different proxies for the difference in firm size, the arithmetic and percentage difference in firm size. Market return is significant at the 5% level in both specifications. However, utilizing the *ROE* (Return on Equity) and *ROA* (Return on Asset) of Firm 1 as proxies for managerial talent provide

insignificant results. This is not surprising as Fee and Hadlock (2001) suggest that accounting returns can lack the ability to explain managerial ability and performance. In general, our findings suggest a positive association between past performance and the difference in size between Firm 1 and Firm 2. These findings indicate that executives from better performing firms are more likely to move to larger firms. The better is the market performance of the executive's initial firm during his tenure; the larger is the firm to which the executive moves. Since firm performance is the best proxy we have for executive ability, our results support Rosen's theory in which the positive correlation between firm size and executive pay is attributable to the superior talent possessed by executives of large firms and only indirectly to size.

PLACE TABLE 2 ABOUT HERE

Our findings also confirm several subsidiary hypotheses stemming from Rosen (1982): that executives who move from a CEO to a non-CEO position tend to move to a significantly larger firm and executives who move from a non-CEO to a CEO position tend to move to a significantly smaller firm. In addition, executives who switch industries tend to move to significantly smaller firms, possibly due to the lower industry specific ability possessed by these executives.

We extend our initial analysis by modifying the traditional pay performance sensitivity and size regression in light of the Rosen (1982) hypothesis. Two Stage Least Squares (2SLS) regression is utilized to analyse whether the hypothesised higher talent possessed by executives of larger firms influences the positive correlation between firm size and pay. The widely accepted semi-elasticity model (for example, Rosen, 1992, Nixon *et al,* 2002) is used to estimate the firm size elasticity of executive pay:

$$ln\ (TC_{t+1,\ 2}) \ = \ \alpha + \beta Perf_{t+1,2} + \beta(\hat{AT}_{t+1,2}) + \varepsilon_{time}, \qquad (6)$$

where the dependent variable $lnTC_{t+1,\ 2}$ is the log of total compensation received by the executive in Firm 2 in period $t+1$, $Perf_{t+1,\ 2}$ is the performance of Firm 2 in period $t + 1$, and $\hat{AT}_{t+1,2}$ is the predicted firm size at period $t + 1$ for firm 2, which is given by:

$$\hat{AT}_{t+1,2} = \alpha + \beta_2 Perf_{t,\ 1} + \beta_3 AT_{t,\ 1} + \beta_4 CEO\_non\text{-}CEO + \beta_5 non\text{-}CEO\_CEO + \beta_6 CEO\_CEO + \beta_7 IDumChange + \varepsilon_{time}\ . \quad (7)$$

The predicted size of Firm 2 is a function of the past performance of Firm 1 at time t ($Perf_{t,\ 1}$), the size of Firm 1 at that earlier time ($AT_{t,\ 1}$), a series of dummy variables which indicate the position held by the executive in Firm 1 and 2, and a dummy variable that takes the value of 1 if the executive moves between industries and 0 otherwise. Circularity is avoided because predicted size does not depend on the firm's current performance. Equation (7) is estimated using the observed firm size and then the predicted size of Firm 2 from this earlier estimation is utilized as an independent variable to replace the observed size of Firm 2 in the semi-elasticity model (6), where $Perf_{t+1,\ 2}$ denotes the performance of Firm 2 during period $t+1$. Thus it is inappropriate to use the observed firm size in equation (6) as is conventional in studies relating pay (total compensation) to both size and performance since observed size is not exogenous. Rather it is dependent on the size-talent relationship that is estimated from equation (7) using our proxy for performance given by the earlier performance of the firm where the executive was previously employed. The ability to utilize a 2SLS approach clearly depends on having a proxy for executive talent that is independent of current firm performance.

The results from the 2SLS estimation (as reported in Table 3 and columns 1 and 2 of Table 4) indicate that the elasticity of pay received by an executive is

positively related to their current performance as well as the log value of the predicted size of Firm 2, which is positively related to the performance of Firm 1 during period *t*. The results demonstrate a positive and significant association between past performance and the size of the firm that the executives move into, which in turn significantly affects the level of compensation received by the executives. Hence, we provide further evidence indicating that executives with superior ability are more likely to move to larger firms and thus receive higher compensation.

PLACE TABLE 3 ABOUT HERE

To further investigate Rosen's hypothesis, we estimate a model of executive pay in reduced form incorporating both the size and performance of the firm from which the executive came:

$$ln\,(TC_{t+1,\,2}) = \alpha + \beta_1 ln\,(AT_{t+1,\,2}) + \beta_2 ln\,(AT_{t,\,1}) + \beta_3 Perf_{t+1,\,2} + \beta_4 Perf_{t,\,1} + \varepsilon_{time}. \quad (8)$$

In this specification we incorporate observed rather than predicted asset capitalization, i.e., firm size. It recognizes that as a consequence of high performance in the previous job the employer raises pay in the current job without revealing the mechanism, the larger size of the current employer, which is made explicit in the two stage model set out in equations (6) and (7).

As reported in columns 3 and 4 of Table 4, with this model, the contemporaneous pay-size elasticity is reduced to 0.23 and 0.22 for our fiscal year and grant date estimates respectively from 0.268 and 0.269 for the conventional OLS estimation ignoring the size and performance of the company from which the executive came (as set out in columns 5 and 6).[12] The still considerable size of the scale coefficient indicates that either we are unable to capture the full superiority of managers in larger organizations or that, consistent with Brown and Medoff (1989),

there is still a role for scale alone to explain higher pay even with managers of the same ability. Our results are consistent for both specifications of total compensation, namely the total compensation including the value of options granted at the end of the financial year (*TC_fy*) and the total compensation including option holdings valued at the grant date (*TC_gd*).

PLACE TABLE 4 AOUT HERE

Most importantly, the level of total compensation received by executives during period *t+1* is found to be significantly and positively related to the performance of Firm 1 during period *t*. Indeed, we show that the performance coefficient of Firm 1 is the higher of the two performance coefficients, outshining even the performance of Firm 2 in the semi-elasticity model. This is true whether we measure total compensation at the end of the fiscal year for the company, valuing options granted at balance sheet date when they are typically 'in the money', or value options at the time of the option grant, typically when they are 'at the money'. However, utilizing the time of the option grant method, which is presumably closer to what the board intended in terms of the valuation of option grants, the coefficient of the performance of Firm 1 (0.66) is more than double the coefficient of Firm 2 (0.27). Both coefficients are highly statistically significant.

These remarkable findings are indeed consistent with the ex-post settling up model of Fama (1980), which suggests that in the presence of incomplete information, firms continuously adjust the executive compensation level according to their past performance. Up until now the evidence that past performance is crucial has been lacking. Hence, we conclude that the positive relationship between firm size and pay

[12] The executive pay and firm size elasticity documented by prior studies is in 0.25 to 0.28 range (Nixon, 2002).

found by prior studies is considerably influenced by the superior reputation and hence talent possessed by executives of larger firms.

As previously noted, analyses of the correlation between executive compensation and firm size often suffer from the presence of multicollinearity. Thus, we are obliged to ensure unbiasedness in our analyses. Tables A.1 and A.2 in the Appendix report the Condition Indices of all the regression analyses performed in this study. The Condition Indexes documented are in the 1 to 15.29 ranges, which are lower than the critical level, 30 (Gujarati, 1995, p. 338). Thus, we conclude that our results are not biased by the presence of multicollinearity.

V. Conclusion

This study provides the first substantial empirical evidence supportive of the cloning model of Rosen (1982). The higher level of ability possessed by executives of large firms explains some, but not all, the strong positive correlation between executive pay and firm size found in prior studies. Thus while our findings are remarkably supportive of the Rosen (1982) hypothesis, there is still a great deal more to be learned about the impact of scale on executive pay. Our new methodology, and proxy for talent based on the executive's performance in her job with the previous firm, produces significantly lower scale effects, after controlling for both the size and performance of the firm from which the executive came. However, we are unable to entirely eliminate scale impacts on pay utilizing our proxy for managerial ability. Surprisingly and strikingly, we find that the earlier performance of the firm which previously employed the executive has a greater impact on pay with the current firm

than does the current firm's performance. In terms of managerial pay at least, executives are living in the past.[13]

Our findings downplay the ongoing concern that the operation of the executive managerial labour market promotes higher agency costs via motivating executives to focus on expansion rather than performance. Not withstanding our finding, we cannot rule out the possibility that some executives are able to convince both boards and compensation consultants to use the crude pay-size relationship with increases in company size rather than a modified relationship between pay and talent or ability in which size plays a smaller role.

While this study has sought to provide the literature on executive compensation in general, and the studies on the relationship between executive compensation and firm size in particular, with a missing link that has been long sought, the matter is far from closed. There are a large number of potential improvements and related enquiries that need to be addressed. Future studies could, for example, utilize additional proxies for managerial talent, such as the level of executive reputation generated through the frequency of the executive being cited in business journals, and possibly further reduce the role of firm size in pay-performance regressions. Future studies could also address the applicability of alternative models based on identical worker abilities such as Shi (2002) to the question of managerial compensation.

[13] This long term aspect of executive reputation means that it is harder than it might appear for executives to falsely manipulate current or short-term performance in order to gain higher pay.

Appendix: Tests for Multicollinearity

Table A1. Test of Multicollinearity for Table 2

Condition Index	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7	Col. 8	Col. 9
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	1.51	1.40	1.38	1.51	1.40	1.38	1.48	1.61
3	1.51	1.42	1.41	1.51	1.42	1.41	1.49	1.62
4	1.74	1.43	1.46	1.74	1.43	1.46	1.70	1.93
5	1.88	1.73	1.74	1.89	1.73	1.74	1.82	2.22
6	2.77	2.51	2.51	2.77	2.51	2.51	2.60	4.45

Table A1 reports the Condition Indexes of the regressions reported in Table 2, the analyses on the correlation between the managerial ability and the difference in size of Firm 1 and Firm 2. The results reported document Condition Indexes that ranges from 1 to 4.45. They do not illustrate any significant presence of multicollinearity, as they are significantly lower than the critical level 30, which is suggested by Gujarati (1995). Thus, we are able to conclude that our results reported in Table 2 do not suffer from any biases caused by the presence of multicollinearity.

Table A2. Test of Multicollinearity for Tables 3 and Table 4

Condition Index	Table 3	Table 4					
		Col. 2	Col. 3	Col. 4	Col. 5	Col. 6	Col. 7
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	1.56	1.54	1.59	1.93	1.93	1.55	1.55
3	1.57	15.29	15.03	2.2	2.2	9.03	9.03
4	1.70	-	-	11.50	11.50	-	-
5	1.84	-	-	14.27	14.27	-	-
6	1.96	-	-	-	-	-	-
7	2.93	-	-	-	-	-	-

Table A2 reports the Condition Indexes of the regressions reported in Tables 3 and 4, as represented by equations (6) to (8) in the text, plus simple OLS estimation. The results reported document Condition Indexes that range from 1 to 15.29. While the documented Condition Indexes illustrate the presence of some multicollinearity, the results are not biased by the presence of severe multicollinearity because they are significantly lower than the critical level 30, that is suggested by Gujarati (1995). Thus, we conclude that our results reported in Tables 3 and 4 do not suffer from any biases caused by the presence of multicollinearity.

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Table 1 **Descriptive Statistics for the sample of 663 executive movement cases over the period 1992-1999 showing their details and that of the firm in their initial employment (Firm 1) and subsequent employment (Firm 2).**

	Firm 1		Firm 2		*t*-Value
	Mean	Median	Mean	Median	Firm 2 > Firm 1
Ttl Comp at grnt date; *TC_fy* ($000)	2,071.39	1,138.17	5,409.67	2,009.27	5.11***
Ttl Comp at fscl yr end; *TC_gd* ($000)	1,759.61	1,047.51	4,561.62	1,879.35	5.49***
Incent Prpn at fscl yr end*; IncPropn_fy*	0.61	0.62	0.70	0.75	9.17***
Mkr Del Ratio at grnt date; *MDR_fy*	0.37	0.35	0.47	0.47	7.29***
Mkr Del Ratio at fscl yr end; *MDR_gd*	0.35	0.32	0.46	0.46	8.61***
Salary('$000)	361.44	314.97	403.00	334.26	6.20***
Market Value of Equity; *MV*('$000)	4,757.15	1,942.80	8,551.57	2,384.55	5.78***
Firm's Market Return; *Mkrtx*	0.17	0.13	0.15	0.09	-0.61
Return on Equity; *ROE*	0.023	0.08	-0.63	0.07	-1.56
Total Assets; *AT*('$000)	9,454.45	2,368.38	17,527.74	2,208.10	4.40***
Number of Business Segments	1.32	1	2.15	1.33	12.38***

Table 1 presents the descriptive statistics. *TC_gd* and *TC_fy* denote the level of total compensation valued at grant date and end financial year respectively. *Inc_propn_fy* denotes the sum of all market-based pay inclusive of option and restricted stock grants plus bonus and Long Term Incentive Pay (LTIP) expressed as a proportion of total compensation as determined by the board (excluding privately held shareholdings). It has been analysed in Garvey and Swan (2002) and is related to Yermack's (1995) incentive proportion while *MDR_gd* and *MDR_fy* denote the Market Delegation Ratio (MDR) (see Garvey and Swan, 2002) valued at grant date and end financial year respectively. *MDR* is the proportion of board administered stock-based compensation (Black-Scholes value of options granted plus restricted stock) to total compensation inclusive of all compensation administered by the board. *MV* denotes the firm's market value of equity or market capitalization, *Mkrtx,* the firm's market return (dividend plus capital gain) expressed as a proportion while segments illustrate the number of business segments in the firm from S&Ps Research Insights North American data. The *t*-value reported document the difference between Firm 2 and Firm 1. *** denotes significant at 1% Level of Significance (LOS) under 2 tailed test ** denotes significant at 5% LOS under 2 tailed test. * denotes significant at 10% LOS under 2 tailed test.

Table 2 The Relationship between Firm Size and Past Performance

	ΔAT	ΔAT	ΔAT	Δ%AT	Δ%AT	Δ%AT
Intercept	9,880.53 (3.40)***	12,124 (4.43)***	12,144 (4.44)***	2.15 (4.29) ***	2.49 (5.27) ***	2.475 (5.26) ***
Mkrtx	16,772 (2.46)**	-	-	2.40 (2.05)**	-	-
ROE	-	168.899 (0.11)	-	-	0.012 (0.05)	-
ROA	-	-	-12,331 (-0.44)	-	-	9.166 (1.89)*
CEO_non-CEO	27,324 (4.18)***	27,970	28,016 (4.30) ***	4.15 (3.68) ***	4.23 (3.77) ***	-0.61 (-0.89)
Non- CEO_CEO	-13,777 (-2.61)***	-12,705 (-2.44)	-12,623 (-2.42) **	-2.68 (-2.95)***	-2.51 (-2.80)***	4.2 (3.75) ***
CEO_CEO	-6,504.94 (-0.82)	-5,800.94 (-0.74)	-5,533.74 (-0.70)	0.64 (0.46)	0.90 (0.67)	-2.58 (-2.88)***
IDUM Change	-10,424 (-2.59)***	-10,733 (-2.68)***	-10,764 (-2.69)***	-0.544 (-0.78)	-0.63 (-0.92)	0.714 (0.53)
R-Sqr adj F-Value	0.0568 8.77	0.0481 7.59	0.0484 7.63	0.0401 6.39	0.0343 5.63	0.0396 6.37

Table 2 documents regressions utilizing various measures of the difference between the size of *Firm 2* and *Firm 1*, i.e., size of 2 less size of 1, and as the dependent variable. We utilize both the absolute difference, ΔAT, and the percentage difference, Δ%AT, as a function of the managerial talent which is measured via the performance of *Firm 1* during period *t*. The three proxies for performance are *Mkrtx*, *ROE* and *ROA* which denote *Firm 1*'s Market Return, Return on Equity and Return on Assets, respectively. The dummy variables *CEO_non-CEO*, *non-CEO_CEO*, and *CEO_CEO* are included to capture the position held by the executives, whether they held a CEO or non-CEO position in both firms. The dummy variable *IDUM Change* takes the value of 1 if the executives switch industries during movement and 0 otherwise. *** denotes significant at 1% LOS under 2 tailed test ** denotes significant at 5% LOS under 2 tailed test. * denotes significant at 10% LOS under 2 tailed test.

Table 3 Predicting the Size of Firm 2 as Part of 2SLS Estimation

Dependent Variable, Firm Size Firm 2	$\widehat{AT}_{t+1,2}$
Intercept	42,165.40 (1.49)
Market Return of Firm 1*; Mkrtx*	11,079 (1.79)*
Total Assets, Firm 1*;* $AT_{t,1}$	1.61 (22.43) ***
CEO_non-CEO	27,765 (4.48) ***
Non-CEO_CEO	-14,583 (-2.91) ***
CEO_CEO	-2,249.69 (-0.30)
IDUM Change	-9,265.54 (-2.42) ***
R-Sqr adj	0.46
F-Value	94.02

Table 3 reports the estimation of equation (7) in the text given by $AT_{t+1,2} = \alpha + \beta_2 Perf_{t,1} + \beta_3 AT_{t,1} + \beta_4 CEO\_non\text{-}CEO + \beta_5 non\text{-}CEO\_CEO + \beta_6 CEO\_CEO + \beta_7 indus\ change + \varepsilon_{time}$ which estimates coefficients of variables utilized for the estimation of Firm 2's size against *mkrtx* which denotes the performance (market return) of Firm 1 during period *t*. The proxy for the size of Firm 1, $AT_{t,1}$, measured through the value of total asset of *Firm 1* during period *t*, is included in order to control for the higher ability possessed by executives of large firms, which in turn, positively affect the possibility of moving to another large or even larger firm. The dummy variables *CEO_non-CEO*, *non-CEO_CEO*, and *CEO_CEO* are included to capture the position held by the executives, whether they held a CEO or non-CEO position in both firms. These dummy variables are included in order to control for the higher likelihood of executives who move from a CEO to a non-CEO position to move to larger firm and vice versa. The dummy variable *IDUM Change* takes the value of 1 if the executives switch industries during movement and 0 otherwise. This dummy variable is included as executives who switch industries often move to smaller firms due to the lower industry specific abilities acquired. *** denotes significant at 1% LOS under 2 tailed test ** denotes significant at 5% LOS under 2 tailed test. * denotes significant at 10% LOS under 2 tailed test.

Table 4 **2SLS Estimation, Estimation of the Full Model in Reduced Form and Conventional OLS Estimation of Firm Size, Executive Compensation and Managerial Talent**

	2SLS Estimation		Estimation of Full Relationship		OLS Estimation	
Dependent Variable	Ln(TC_gd)	Ln(TC_fy)	Ln(TC_fy)	Ln(TC_gd)	Ln(TC_fy)	Ln(TC_gd)
Intercept	5.06 (13.16)***	5.05 (13.62)***	5.37 (23.90)***	5.30 (24.52)***	5.60 (29.27)***	5.55 (30.14)***
Ln($\hat{AT}_{t+1,2}$)	0.29 (7.18)***	0.29 (7.37)***	-	-	-	-
Market Return Firm 2; *Mkrtx_(t+1, 2)*	0.59 (5.74)***	0.28 (2.88)***	0.55 (6.67)***	0.27 (3.44)***	0.56 (6.65)***	0.28 (3.48)***
Observed Size; $Ln\,(\,AT_{t+1,2}\,)$	-	-	0.23 (7.79)***	0.22 (7.98)***	0.268 (11.52)***	0.269 (12.04)***
Observed Size; $Ln\left(AT_{t,1}\right)$	-	-	0.57 (1.70)*	0.06 (2.01)**	-	-
Market return Firm 1; *Mkrtx_(t, 1)*	-	-	0.66 (4.20)***	0.66 (4.38)***	-	-
R-Sqr adj	0.15	0.116	0.258	0.24	0.2177	0.199
F-Value	41.86	31.13	52.60	48.45	86.87	77.63

The first and the second columns show the results from the 2SLS where the log value of the predicted value of the size of Firm 2 is inserted into the conventional semi-elasticity model of performance and pay equation (6) in the text, given by $ln\,(TC_{t+1,2}) = \alpha + Perf_{t+1,2} + \beta_1 ln\,(AT_{t+1,2}) + \varepsilon_{time}$, and the third and forth columns illustrate the outcome of the regression where variables determining the size of Firm 2 are directly inserted into the regression to yield the reduced form regression equation (8) of the full model given by $ln\,(TC_{t+1,\,2}) = \alpha + \beta_1 ln\,(AT_{t+1,\,2}) + \beta_2 ln\,(AT_{t,\,1}) + \beta_3 Perf_{t+1,\,2} + \beta_4 Perf_{t,\,1} + \varepsilon_{time}$, while the conventional OLS regressions ignoring the endogeneity of firm size are shown in columns 5 and 6. As shown in Table 3, the performance of Firm 1 is a significant factor affecting the size of Firm 2. In turn, in the first and second columns, we find evidence suggesting that the predicted value of the size of Firm 2 is positively and significantly associated with the total compensation received. As before, *TC_gd* and *TC_fy* denote the level of total compensation valued at grant date and end financial year respectively. The variable *mkrtx_(t, 1)* captures the annual stock return of Firm 1 during period *t* while *mkrtx_(t+1, 2)* captures the annual stock return of Firm 2 during period *t+1*. Both of these variables are utilized as the proxy of firm performance. The result document a significant and positive correlation between the performance of Firm 1 and the level of compensation received by executives in Firm 2, even after controlling for the performance of Firm 2 during period *t*. In addition, the log value of the size of Firm 1, measured through the value of total asset held by Firm 1 during period *t*, positively and

significantly related to the log value of total compensation received by the executives in Firm 2. *** denotes significant at 1% LOS under 2 tailed test ** denotes significant at 5% LOS under 2 tailed test. * denotes significant at 10% LOS under 2 tailed test.