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Wealth and Executive Compensation

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ABSTRACT

Using new data on the wealth of Swedish CEOs, I show that higher wealth CEOs receive stronger incentives. Since high wealth (excluding own-firm holdings) implies low absolute risk aversion, this is consistent with a risk aversion explanation. To examine whether wealth is likely to proxy for power, I use lagged wealth (typically measured before the CEO was hired), and the results remain for one of two incentive measures. Also, the wealth–incentive result is not stronger for CEOs likely to face limited owner oversight. Finally, wealth is unrelated to pay levels, and is hence unlikely to proxy for skill.

THE COMPENSATION OF CHIEF EXECUTIVES of large listed companies is often largely in the form of risky instruments such as shares and options. Since share prices are affected by many factors outside management control, this exposes CEOs to risk. According to standard agency theory, the risk inherent in incentive compensation should reduce optimal incentives. Looking across firms, the evidence that volatile stock prices reduce incentives in actual compensation has been mixed (see, e.g., Aggarwal and Samwick (1999), Core and Guay (2001), and Prendergast (2002) for different views). The importance of risk for incentives is thus in dispute.[1]

This paper takes another look at CEO incentives, exploiting variation in risk aversion rather than risk. Decreasing absolute risk aversion implies that a wealthy CEO is less risk-averse than a similar (same coefficient of relative risk aversion), but less wealthy, CEO. Wealth should therefore proxy for risk aversion. Wealth may also be related to CEO skill and power.

Obviously, using wealth variation empirically hinges on having adequate data on individual wealth. I use Swedish tax filings to construct a proxy of wealth. In Sweden, tax authorities provide data on aggregate yearly income

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[1] CEO compensation in listed firms is a natural area for studying risk and incentives. The value of a company is generally affected by CEO actions, but is also subject to substantial variation unrelated to CEO behavior. The former implies that providing incentives is important, the latter that it is costly.

and aggregate taxable wealth for all tax-paying residents and citizens. Some assets are counted at market value (e.g., stockholdings) whereas other assets (which may lack obvious market values) are assigned values according to accounting rules or rules of thumb (e.g., art or real estate). The filings may be subject to distortions and manipulation, but fiscal wealth is probably a reasonable proxy for actual wealth, in the sense that it contains information about true wealth. A panel data set of the Swedish firms listed on the main list of the Stockholm Stock Exchange over the 1993 to 1999 period is used (the 1999 cross section is most useful).

In the Swedish sample, wealth has a positive relation with the strength of incentives (computed from stock and option holdings). This is certainly consistent with a risk aversion explanation, but also with several alternative explanations. First, if CEOs with high incentive contracts accumulate more wealth, some unobserved variables such as CEO power that influences the compensation contract might explain the coincidence of high wealth and strong incentives. My measure of wealth excludes the value of stock and option holdings in the firm, and thus only consists of "nonfirm wealth," which is less likely to be endogenous in this sense. Also, I use 1993 wealth as an alternative to 1999 wealth. The relatively long lag means that most CEOs were not in their CEO position at the start of the sample. The lagged results confirm the positive relationship between wealth and incentives.

Second, a more general endogeneity of wealth could drive the regression results. Wealth may be higher for CEOs with high skill, that is, those CEOs that have accumulated savings from high earnings early in the career. If it is also optimal to give high skill CEOs stronger incentives, the wealth–incentive relation could pick up skill variation. Without more detailed measures of skill, this is difficult to rule out in the present sample. It is worth pointing out that the relation between income and wealth is exceptionally weak in Sweden (see Domeij and Klein (1998)) due to high marginal tax rates and a very flat wage structure. On the other hand, large family firms are very common and their owners have usually inherited their wealth. Accordingly, wealth is likely to be less strongly related to skill than in other countries. Also, the wealth measure is unrelated to pay levels, which would be surprising if it were capturing skill.

Given these important caveats, the results give some support to the importance of risk aversion for executive compensation. To assess whether the numerical values seem consistent with standard principal–agent models, I calibrate a model based on Haubrich (1994). It turns out that the variation in wealth is plausibly large enough to explain the observed amount of variation in incentive strength.

The rest of the paper is organized as follows: Section I discusses the relevant theoretical and empirical literature. Section II describes the data on Swedish CEO compensation. Section III presents regression results for incentive strength, Section IV presents robustness tests, Section V the calibration, and Section VI concludes.

I. Executive Compensation and Risk Aversion

Agency theory predicts a negative relation between risk and incentives, or alternatively, a positive relation between risk aversion and incentives. Holmström (1979) describes the optimal incentive contracts in a principal–agent setting in which the agent's action is unobservable but there are one or more measures of output. Unknown effort leads to moral hazard and the agent exerts too little effort relative to first best. In the one-measure setting considered by Holmström and Milgrom (1991), the optimal wage contract induces first-best effort by giving the agent full incentives if the agent is risk-neutral or there is no risk. Normally, the optimal contract provides weaker incentives and does not induce first-best effort due to risk aversion of the agent. This theory thus predicts that incentive strength should depend on risk and risk aversion.

A. Evidence on CEO Incentives

In an influential paper, Jensen and Murphy (1990) estimate the average elasticity of executive wealth to firm value for the period 1969 to 1983 (in the United States) as \$3.25/\$1,000. They claim that this is too low, indeed "the compensation of top executives is virtually independent of performance." This conclusion hinges on whether CEOs are risk-averse enough that such low incentives can be optimal. Haubrich (1994) points out that under reasonable assumptions, observed pay sensitivities do provide adequate incentives. In a specific model, using combinations of parameters that seem reasonable, Haubrich finds a range of optimal sensitivity from \$4 to \$59 CEO income per \$1,000 change in firm value.

While average incentive levels may be consistent with optimal contracts, tests across firms of the relation between risk and incentives have had very mixed results. A positive result is from Aggarwal and Samwick (1999) who test in a cross section of U.S. firms whether risk affects incentives. They find that the strength of incentives is declining in stock price volatility, as predicted but contrary to many previous findings. Prendergast (1999) surveys the empirical literature on principal–agent models and finds that "... while agents appear to respond to incentives ... it would not appear that on the margin, the risk measures that have been considered are the true constraining factors on the provision of incentives."

There have been few tests based on variation in risk aversion instead of risk, most likely for lack of data.[2] While risk aversion is not observable, wealth data may provide a good proxy for the level of absolute risk aversion. This requires the weak (and plausible) assumption that risk aversion decreases with wealth. Baker and Hall (2002) claim that it is unlikely that wealth dispersion is large enough to generate nontrivial cross-sectional variation, in particular, compared to other (firm-specific) parameters. This is an empirical matter, however,

[2] Moers and Peek (2004) use a measure based on trailing pay volatility, and argue that it is related to CEO risk aversion.

and it is conceivable that different CEOs have very different levels of absolute risk aversion. In the pooled Swedish sample (1993 to 1999), the 25th, 50th, and 75th percentiles wealth are approximately \$140,000, \$620,000, and \$1,670,000, respectively.[3] Kennickell (2003) reports that 45% of U.S. households had a net worth of at least \$100,000 and almost 5% of at least \$1,000,000 (based on the Survey of Consumer Finances). The 25th percentile is about \$10,000, the 50th a little above \$50,000, and the 75th percentile almost \$250,000.[4] While not rich by American standards, some of the CEOs are clearly much more wealthy than others. Section V provides an approximate calibration to assess the economic plausibility of the observed wealth–incentive relationship.

B. Outside the United States

Outside the United States, there is limited evidence on CEO pay. Kaplan (1994) compares Japanese and U.S. incentives, including those provided by termination probabilities, and finds that incentives are broadly similar. Abowd and Kaplan (1999) study a representative sample of pay levels in 1984 and 1996 across 12 OECD countries, including Sweden. There is considerable variation among countries, but a clear increase in the level of pay, over time, in every country. Swedish CEOs are among the lowest paid. Abowd and Kaplan present no data on incentives.

II. A Swedish Executive Compensation Sample

A. Panel Data Sample

The data set contains all companies (48) that are listed on the A-list of the Stockholm Stock Exchange each year from 1993 to 1999. To expand the cross section, from where most of the information comes, all companies on the A-list in 1999 are also added for that year (104 firms are on the A-list that year). The A-list consists of those firms with the highest market value. A few companies that have been delisted or that are incorporated abroad are excluded for lack of data. The age, tenure, and cash compensation for the CEO is reported in footnotes to annual reports. When CEOs change during a year, the new CEO is used in the sample. Exceptional severance payments are excluded from pay. For a few companies wealth data could not be collected (the CEOs may be foreign residents/nationals or have nonpublic tax reports). The full sample contains around 80 companies and 7 years, but it is unbalanced and data points may be missing for specific regressions.

[3] These raw wealth data are not reported in detail later. Table I presents data on nonfirm wealth, which excludes the value of any claims on the company for which the CEO works. This is the variable used in regressions.

[4] The Swedish numbers are not exactly comparable, since valuations under tax rules are generally somewhat below market value. Nevertheless, Swedish CEOs must be considered remarkably poor compared to Americans. Their wealth levels are 5 to 10 times higher than that of the U.S. population as a whole, and hence in all likelihood far below that of U.S. CEOs.

The year-end number of shares and share price for each firm are from a financial database. Median market capitalization at year-end in 1999 was USD 1.4 billion and the mean was USD 7.8 billion. Return volatilities (annualized) are calculated from 12 months of daily return data. Accounting information is collected from annual reports.

B. CEO Wealth

Swedish tax authorities provide numbers for fiscal wealth. This information is public in Sweden, by law.[5] To protect individuals and to conform to Swedish law, all data is anonymous, that is, firm and CEO names were removed from the data set. Wealth data is available from 1993 and I collect wealth data for each CEO[6] each year he or she was employed, as well as 1993 data for the CEOs in 1999 (for instrumental variables regressions). Much reporting to the tax authorities is done automatically. Authorities receive monthly or yearly information from all Swedish employers (wages), banks and brokers (all account balances at year-end and all trading profits and losses, mortgages, and interest income), and similar sources. Many classes of assets are included in the authorities' wealth calculations, but precision and comprehensiveness vary by type of asset. Financial instruments held through Swedish institutions are automatically reported, as are bank account balances and loans such as mortgages (which are deducted). Shares of companies on the A-list of the Stockholm Stock Exchange (such as the companies involved in this study) are valued at 70% of year-end market value. Real estate directly owned (homes, summer homes) is valued according to elaborate rules assigning values that are related to, but usually lower than, market values. Other assets, such as art and collectibles, are probably undervalued in many cases. Tax evasion probably occurs and assets held abroad might be underreported.

One factor that may limit the usefulness of our wealth data concerns the sources of wealth that are not included at all by tax authorities. Future earnings potential (human capital), expected bequests, and termination bonuses are not part of tax wealth but can be substantial. Such future income should be contained in a proper measure of lifetime wealth. However, while tax wealth is clearly a noisy measure of economic wealth, it probably contains a lot of information nonetheless, given that tax authorities do a scrupulous job of collecting data on many types of wealth and valuing it relatively close to market value.

Rather than raw wealth numbers, I use nonfirm wealth, calculated as total wealth minus the value of share and option holdings in the CEO's own firm (see Table I, Panel B). Translated to U.S. currency, raw wealth levels (including all assets) average about USD 2.5 million with a median of USD 0.6 million. The

[5] Some CEOs are not in the database, typically because they were not Swedish residents for tax purposes. A few more observations are unavailable for other reasons (the data was not public for special reasons, or not yet finally settled, perhaps pending a tax court decision).

[6] Wealth data includes the spouse if the total household wealth exceeds SEK 0.9 million (approximately USD 110,000).

Table I
Sample Overview

Summary statistics for sample used in tests. The panel data used include, for 1993 to 1998, all companies that are on the Stockholm Stock Exchange's A-list for all 6 years, and for 1999 all companies on the list. Companies without wealth data are excluded. Panel A presents summary statistics for the independent variables, pooled from the whole data set. *Volatility* is the standard deviation of daily stock price changes, rescaled to a year. *Sales* and *Market Value of Equity* are measured in million SEK (SEK 1 million ≈ USD 125,000) and refer to the firm's reported annual total sales and equity (market value). *Age* is the highest age of the CEO during the year, and is based on year of birth (e.g., a CEO born in 1944 is assigned age 51 in 1995). *Tenure* is the number of years the CEO will have been employed at the end of the year, including all of her first year (if she started work in August 1992, tenure will be 2 for 1993, 3 for 1994, etc). *Pay* is annual compensation. *Wealth* is fiscal wealth as reported by Swedish tax authorities. Panel B reports *Nonfirm wealth*, that is, total wealth minus the value of any holding of claims on the employing firm. Panel C presents a measure of the derivative of CEO wealth with respect to the share price, *Money at Stake.* This is the CEO's shareholdings times the end-of-year share price plus the number of options times the delta (0.6 is used) times the end-of-year share price. Panel D presents a measure of the derivative of CEO wealth with respect to a fixed change in company value, *Share of Company,* and is equal to *Money at Stake* divided by total firm market value. Means and medians are presented for each year 1993 to 1999. Panel E reports cash compensation. Panel F reports correlations between variables in the pooled 1993 to 1999 sample. A * denotes significance at the 10% level, and ** at the 5% level (unadjusted).

Panel A: Summary Statistics of Independent Variables (Pooled)

	Mean	Median
Volatility (annual)	0.33	0.32
Sales (million SEK)	25,831.00	11,564.00
Market Value of Equity (million SEK)	62,364.00	11,050.00
Age	50.90	51.00
Tenure	6.80	5.50
Pay (million SEK)	3.40	4.00
Wealth (million SEK)	12.70	4.70

Panel B: Nonfirm Wealth

(Million SEK)	1993	1994	1995	1996	1997	1998	1999
Min.	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25^{th} percentile	0.5	0.0	0.0	1.1	0.0	0.0	0.0
Median	4.0	3.1	3.0	5.4	2.4	1.9	2.7
Mean	19.9	13.2	18.1	24.3	9.9	9.5	13.4
75^{th} percentile	8.9	11.4	12.7	11.3	6.7	5.6	7.5
Max.	273.0	227.0	369.0	99.0	45.0	36.0	144.0
Observations	32.0	33.0	33.0	33.0	32.0	31.0	70.0

Panel C: Incentives—Money at Stake

(Million SEK)	1993	1994	1995	1996	1997	1998	1999
Mean	5.1	5.8	7.1	8.0	16.1	18.2	13.0
Median	1.9	2.5	2.5	2.8	4.0	4.4	5.4
Observations	31.0	32.0	32.0	33.0	31.0	31.0	68.0

(*continued*)

Table I—*Continued*

Panel D: Incentives—Share of Company (×100)

(Million SEK)	1993	1994	1995	1996	1997	1998	1999
Mean	0.265	0.260	0.333	0.309	0.530	0.627	0.380
Median	0.027	0.032	0.023	0.014	0.028	0.047	0.047
Observations	31.000	32.000	32.000	33.000	32.000	31.000	69.000

Panel E: Cash Pay Levels

(Million SEK)	1993	1994	1995	1996	1997	1998	1999
Mean	2.83	3.33	3.59	4.00	4.60	4.69	4.54
Min.	0.38	0.81	0.89	0.70	1.52	0.79	1.11
25% percentile	1.46	1.68	1.87	1.95	2.43	2.55	2.55
Median	2.56	2.80	3.04	3.36	3.8	3.63	3.76
75% percentile	4.10	4.72	4.88	5.00	5.45	5.97	6.14
Max.	6.00	11.02	11.00	16.14	15.06	21.70	14.99
Observations	35.00	35.00	35.00	35.00	36.00	36.00	73.00

Panel F: Variable Correlations

	Money at Stake	Share of Company	Volatility	Sales (log)	Age	Tenure	Nonfirm Wealth
Money at Stake	1						
Share of Company	0.79**	1					
Volatility	−0.03	0.03	1				
Log Sales	−0.09	−0.19**	−0.23**	1			
Age	−0.14**	−0.14**	−0.08	0.27**	1		
Tenure	0.04	0.07	0.04	−0.29**	0.34**	1	
Log Nonfirm wealth	0.31**	0.28**	−0.23**	0.23**	0.09	−0.16**	1

90th percentile is about USD 3.8 million. These can be compared to the Swedish overall net wealth distribution, where the 90th percentile is USD 0.5M (Domeij and Klein (1998)). The median CEO wealth thus corresponds roughly to the 90th percentile overall (although the Domeij and Klein method, using survey data, may give slightly higher values). The CEOs are close to the overall distribution and poorer than might be expected (the same conclusion drawn from comparisons to U.S. wealth levels).

C. Net Compensation and Incentive Strength

In theory, all perks are taxable income and should be reported by the company. Pay data is therefore likely to be at least as comprehensive and accurate as for U.S. samples. Annual reports often specify a CEO's car benefits as an element of aggregate pay. We cannot rule out the possibility that some perks are not reported.

The amount of stocks and options held by each CEO in his/her company is collected from the Swedish Financial Supervisory Authority (Finansinspektionen). This institution performs duties similar to some of the functions of the U.S. SEC (Securities and Exchange Commission), and collects information on trading by every person with special access to sensitive information regarding a listed company, that is, insiders, including spouses and other close family members. The relevant individuals have a statutory reporting requirement and hence the data is essentially complete. Companies provide similar data (for year-end) in annual reports. Where discrepancies are found, the information in annual reports is used.

Murphy (1999) reports that in a sample of 1,000 large U.S. companies, 627 granted options to the CEO in 1992. Swedish CEOs held options less frequently in the early 1990s. In this sample, the share of CEOs holding options on their company's stock is only 44% in 1993 (including options granted in any year), rising to 71% in 1999. For tax reasons, it is not common in Sweden to give options to CEOs—instead, options are typically sold at fair value; if options are given away or sold at below fair value, social security fees and income tax are paid.

Options add incentives according to their delta. Hall and Liebman (1998) claim that the median delta for executive options in the United States is around 0.6, that is, an option reacts in value to a change in stock price about as much as 0.6 shares of stock. I use the same number, confirmed by informal input from Swedish companies (the details of option packages are not public but, according to industry sources, are standardized). With low diversification, high volatility, and managerial risk-aversion, the awarded options are worth much less to the manager than their market price (see Prendergast (1999), Hall and Murphy (2002)), but for present purposes their value is not the most important aspect; rather their incentive effect is the object of study.

III. Empirical Tests: Basic Specifications

A. Variables

A.1. Incentive Strength

Several measures have been used in the executive compensation literature for the strength of monetary incentives provided to the CEO. These include income-to-firm value elasticity (Jensen and Murphy (1990)), and income-to-stock return elasticity. In terms of derivatives of CEO net wealth, these measures are $\frac{\partial \text{wealth}}{\partial \text{MV}}$ (value-sensitivity) and $\frac{\partial \text{wealth}}{\partial R}$ (return-sensitivity). Baker and Hall (2002) point out that both measures may be appropriate depending on the type of decisions faced by the CEO. If CEO actions have similar dollar impact on different firms (buy a corporate jet, steal money), the first measure is more relevant. If, instead, actions have an impact proportional to firm size (implement new strategy), the second measure is more useful. Baker and Hall estimate the marginal product of CEO effort and find that it increases with size with an elasticity of 0.4. They

"interpret this as evidence that CEOs do a range of activities, the marginal product of which scales with size in varying degrees." Because of the ambiguity regarding the correct measure of incentive strength, it is computed in two ways for the Swedish sample. The first is "money at stake," the sum of stock owned by the CEO times share price and the number of options held times the estimated delta times the share price. If all incentives came through stock, this would be the value of the stake ($\frac{\partial \text{wealth}}{\partial R}$). The second measure is "share of the company," computed as number of shares plus number of options times delta, divided by the total number of shares outstanding. This measure captures $\frac{\partial \text{wealth}}{\partial \text{MV}}$. Based on the elasticity found by Baker and Hall, money at stake is a slightly more appropriate measure, but both are used. Table I reports the mean and median levels of both incentive measures for each year in the sample. The median share of the company varies from 0.03% to 0.05% over the sample period, which is considerably lower than U.S. numbers. Murphy (1999) reports values for S&P 500 companies (1992 to 1996) in the range of 0.34–0.7% (for mining and manufacturing, financial, and other industries, while utilities have much lower levels). Smaller companies have stronger incentives when measured this way, and Murphy reports 1.20–1.53% for S&P Midcap Industrials over the period. From 1993 to 1999, the median money at stake rises from SEK 1.9 to 5.4 million, or approximately USD 0.2 to 0.7 million. As a comparison, Murphy (1999) reports that for Mining and Manufacturing firms in the S&P 500, the value of stock held (i.e., excluding options) rises from above USD 4 million to above USD 6 million from 1992 to 1996, and in financial services firms from above 5 to above 10 million, USD. Clearly, the value of incentives in Sweden tends to be much lower than in U.S. companies, by either measure.

Volatility. Because higher volatility implies more noise and more risk for the undiversified owner, firms with higher volatility are expected to provide weaker incentives in the typical agency model. Previous studies have disagreed about how stock price volatility is related to incentive strength.

Firm Size. Previous research has found systematic variation of pay levels with firm size. The *log of sales* and *market value of equity* are included in the regressions.[7]

CEO Age and Tenure. As standard controls, age, and tenure are included in all regressions. Yermack (1995) finds that older CEOs and CEOs with longer tenure receive more option awards.

A.2. Log of Wealth

The log of taxable wealth, net of the value of the CEO's stake in her own company (as measured by the tax authorities), is included as a proxy for absolute

[7] Book return on equity is included as well, but has little measurable effect. Since it reduces the number of observations, it is excluded.

risk aversion. I use contemporaneous wealth. Since the wealth in stocks and options is part of a potentially dynamic pay schedule, it may not be endogenous in relation to parameters of the firm and the CEO. It is possible to partially control for this endogeneity problem, by looking only at nonfirm wealth. Therefore, $0.7 *$ value of shares is deducted (0.7 is the factor used for tax wealth calculations). After this procedure, 22 observations have negative wealth, perhaps because loans were larger than the tax value of assets. A dummy is introduced for those observations that had negative nonfirm wealth, and wealth was set to equal zero. The variable nonfirm wealth is highly correlated with raw wealth, but has a lower mean. I use nonfirm wealth in all regressions and refer to it simply as wealth subsequently.

A.3. Large Owner Dummy

I construct a variable based on the share of votes controlled by large private owners (at least 5% of votes). This variable excludes ownership by institutions, the government, and management. The data is from Cronqvist and Nilsson (2001) and refers to 1997 and onwards. As in Bertrand and Mullainathan (2001), the presence of a large owner with the power to intervene is taken to indicate better governance and closer monitoring of the CEO.[8]

Correlations of some variables (in the pooled 1993 to 1999 sample) are presented in Table I, Panel F. Both incentive measures are positively correlated with the *log of wealth* (and each other).[9] Share of company is also negatively correlated with *volatility*, and with *age* (i.e., older CEOs have weaker incentives). For other variables, univariate correlations with incentives are not significant. Nonfirm wealth is negatively correlated with volatility and positively with sales. The positive correlation could be interpreted as mixed evidence for CEO selection (i.e., larger companies have wealthier CEOs but high risk companies do not). All these correlations are univariate, so do not present real tests.

B. Pay and Wealth

The first test examines whether CEOs with higher wealth receive higher pay levels. Wealth could matter for pay for many reasons, including affecting the marginal cost of effort and the value of leisure, and as a proxy for skill or power. These factors all point toward a positive link between wealth and pay (i.e., higher wealth CEOs receive higher pay). What happens if wealth matters primarily through risk aversion? Notice that decreasing absolute risk aversion is equivalent to a negative second derivative of utility. It is thus true that wealthier CEOs, if less risk averse, will have lower marginal value of wealth; indeed, in a perfect information world, they would have to be given higher pay

[8] Including instead the ownership of the largest private owner (a continuous variable) gives similar results in terms of significance but is harder to interpret.

[9] The significance is inflated because some CEO–firm couples reappear multiple years.

Table II
Regressions of Pay Level on Log Wealth (1993 to 1999)

Two measures of incentives, *Money at Stake* and *Share of Company*, are regressed on explanatory variables. *Money at Stake* is the CEO's shareholdings times the end-of-year share price plus the number of options times the delta (0.6 is used) times the end-of-year share price. *Share of Company* is equal to *Money at Stake* divided by total firm market value. *Volatility* is the standard deviation of daily stock price changes, rescaled to a year. *Sales* and *Market Value of Equity* refer to the firm's reported annual total sales and equity (market value). *Age* is the highest age of the CEO during the year, and is based on year of birth (e.g., a CEO born in 1944 is assigned age 51 in 1995). *Tenure* is the number of years the CEO will have been employed at the end of the year, including all of her first year (if she started work in August 1992, tenure will be 2 for 1993, 3 for 1994, etc). *Log Wealth* is the logarithm of fiscal wealth as reported by Swedish tax authorities minus the value of any holding of claims on the employing firm. The panel data used include approximately 45 companies for 6 years (1993 to 1998) and approximately 90 for the last year (1999), but actual observations are fewer due to missing data on some variables. Year dummies are included in both regressions. A * denotes significance at the 10% level, and ** at the 5% level. Robust standard errors allowing clustering by firm are reported in parentheses.

Variable	Log of Pay	Log of Pay
Log Sales	0.23**	0.23**
	(0.029)	(0.028)
Log market value of equity	0.03	0.03
	(0.05)	(0.05)
Volatility	0.25	0.22
	(0.24)	(0.25)
Age	−0.006	−0.004
	(0.006)	(0.006)
Tenure	0.004	0.003
	(0.008)	(0.007)
Log wealth	−0.023	0.022
	(0.025)	(0.031)
Negative wealth dummy		0.205**
		(0.092)
R^2	0.47	0.49
No. of observations	248.00	248.00

to induce a desired action. Whether CEOs receive higher pay when pay is based on noisy signals is not clear. With higher wealth, the whole compensation package will include stronger incentives, but this has no unambiguous implication for the pay level. Hence, if wealth matters primarily by way of affecting risk aversion, the impact on pay levels is ambiguous. As an example, consider a situation in which a given level of very strong incentives is always optimal, regardless of CEO wealth. A poor CEO may then require very high pay levels to compensate for the risk. In another case, a poorer CEO may optimally be given weaker incentives and receive lower pay.

The first column of Table II presents the pooled (1993 to 1999) regression of (the log of) *cash pay* on *sales*, *market value of equity*, *volatility*, *age*, *tenure*, year dummies, and *wealth*. *Sales* has a strong positive effect on pay, with an

elasticity of 0.23. This is somewhat lower than the 0.3 estimates reported for the United States (see, e.g., Murphy (1985)). Notably, *wealth* has no significant effect on the level of pay (when controlling for sales). Column two reports the same regression, but also including a dummy for CEOs with zero or negative wealth. This specification verifies the result that wealthier CEOs do not receive higher pay. However, a CEO with no wealth earns 20% more than a CEO with positive wealth. This finding suggests that wealth is perhaps not a strong proxy for skill, power, or the value of leisure.

C. Incentives and Wealth

We now turn to the main question of whether wealthier CEOs receive stronger incentives. The basic regression specification is[10]

$$Incentives_{it} = \alpha + \beta' controls_{it} + \gamma \log Wealth_{it} + \delta' time\_dummies. \quad (1)$$

Incentives are measured as either money at stake or share of company. Table III presents regression results for both dependent variables. Most variables are insignificant. *Age* has a negative effect (age squared is dropped from all regressions because it is not significant), and *tenure* a positive effect of equal magnitude (implying that there is only weak evidence that CEOs accumulate stronger incentives as they stay in a firm). *Volatility* is insignificant and switches sign between regressions.

Importantly, *log of wealth* is significant with a positive coefficient in both regressions. High wealth CEOs have stronger incentives by either measure. The magnitude of the coefficients is similar. A one-standard deviation change in *log of wealth* (1.33) increases both *money at stake* and *share owned* by half a standard deviation (*SD* are 33.0 and 0.02). Moreover, the coefficient magnitudes seem important relative to typical incentive levels (for both incentive measures, medians are lower than standard deviations), so the effect of wealth on incentives is economically important. These results are consistent with the wealth-as-risk aversion argument, but also with alternative explanations (e.g., wealth as skill, wealth as skimming ability). These alternative explanations are examined below.

IV. Alternative Explanations and Wealth Endogeneity

As mentioned above, an important issue is whether wealth captures features other than risk aversion. One such alternative is corporate power: If the CEO is

[10] The regression specification does not include any firm fixed effects. Doing so would throw out between-firm variation and exploit only variation over years for a given firm. This would reduce power considerably (the cross-sectional variation in wealth far exceeds the time-series variation). More importantly, the results would be very sensitive to endogeneity issues. For example, a CEO who has had a good year and receives associated monetary compensation is wealthier than before and may receive stronger incentives going forward. Focusing on year-to-year changes is thus unsuitable. Unfortunately, firm characteristics have to be controlled for in the absence of fixed effects. If the wrong set of controls has been used, this might induce an omitted variable bias.

Table III

Regressions of Incentive Strength on Log Wealth (1993 to 1999)

Two measures of incentives, *Money at Stake* and *Share of Company*, are regressed on explanatory variables. *Money at Stake* is the CEO's shareholdings times the end-of-year share price plus the number of options times the delta (0.6 is used) times the end-of-year share price. *Share of Company* is equal to *Money at Stake* divided by total firm market value. *Volatility* is the standard deviation of daily stock price changes, rescaled to a year. *Sales* and *Market Value of Equity* refer to the firm's reported annual total sales and equity (market value). *Age* is the highest age of the CEO during the year, and is based on year of birth (e.g., a CEO born in 1944 is assigned age 51 in 1995). *Tenure* is the number of years the CEO will have been employed at the end of the year, including all of her first year (if she started work in August 1992, tenure will be 2 for 1993, 3 for 1994, etc). *Log Wealth* is the logarithm of fiscal wealth as reported by Swedish tax authorities minus the value of any holding of claims on the employing firm. The panel data used include approximately 45 companies for 6 years (1993 to 98) and approximately 90 for the last year (1999), but actual observations are fewer due to missing data on some variables. Year dummies are included in all regressions. A * denotes significance at the 10% level, and ** at the 5% level. Robust standard errors allowing clustering by firm are reported in parentheses.

Variable	Money at Stake	Share of Firm (×100)
Log Sales	−1.61	−0.036
	(2.28)	0.08
Log Market Value of Equity	−0.48	−0.28
	(2.20)	(0.19)
Volatility	−7.52	0.38
	(19.2)	(0.88)
Age	−0.87**	−0.038
	(0.43)	(0.023)
Tenure	0.95*	0.039
	(0.55)	(0.031)
Log Wealth	13.6*	0.84*
	(7.6)	(0.43)
Negative wealth Dummy	16.8*	1.00*
	(9.5)	(0.57)
R^2	0.16	0.11
No. of observations	250.00	251.00

continuously given strong incentives due to power, and those incentives result in accumulation of stock and options, wealth and incentive strength could be related because of the omitted variable (power).[11] A second possibility is that relatively high skill CEOs are rich and receive strong incentives. Two further tests are used to address these issues.

A. Corporate Governance

To tackle the wealth as power hypothesis, a control variable reflecting corporate governance is introduced and interacted with wealth. This variable is

[11] Notice, however that option grants in Sweden tend to be charged to the CEO at some estimated fair market price, and thus do not in themselves represent transfers from the firm to the CEO.

Table IV

Regressions on Corporate Governance and Wealth (1997 to 1999)

Two measures of incentives, *Money at Stake* and *Share of Company*, are regressed on explanatory variables. *Money at Stake* is the CEO's shareholdings times the end-of-year share price plus the number of options times the delta (0.6 is used) times the end-of-year share price. *Share of Company* is equal to *Money at Stake* divided by total firm market value. *Volatility* is the standard deviation of daily stock price changes, rescaled to a year. *Sales* and *Market Value of Equity* refer to the firm's reported annual total sales and equity (market value). *Age* is the highest age of the CEO during the year, and is based on year of birth (e.g., a CEO born in 1944 is assigned age 51 in 1995). *Tenure* is the number of years the CEO will have been employed at the end of the year, including all of her first year (if she started work in August 1992, tenure will be 2 for 1993, 3 for 1994, etc). *Log Wealth* is the logarithm of fiscal wealth as reported by Swedish tax authorities minus the value of any holding of claims on the employing firm. *Large Owner Dummy* is equal to one if private owners own at least 5% of the equity capital and zero otherwise. A * denotes significance at the 10% level, and ** at the 5% level. Robust standard errors allowing clustering by firm are reported in parentheses.

Variable	Money at Stake	Share of Firm (×100)
Log Sales	2.76	−0.077
	(2.43)	(0.052)
Log Market Value of Equity	1.40	−0.062
	(4.26)	(0.88)
Volatility	41.99	0.94
	(36.3)	(0.63)
Age	−0.79	0.0059
	(0.56)	(0.0094)
Tenure	1.30**	0.013
	(0.57)	(0.12)
Log Wealth	5.44**	0.140*
	(2.14)	(0.073)
Log Wealth × Large owner dummy	−2.33	−0.029
	(2.81)	(0.08)
Large owner dummy	12.5	0.23*
	(8.0)	(0.13)
Negative wealth dummy	6.21	0.28
	(6.71)	(0.21)
R^2	0.18	0.10
No. of observations	40.00	40.00

a dummy which is equal to one for firms with some private owner holding at least 5% of the share capital. I hypothesize that if wealth reflects CEO power, wealth should be more strongly related to incentives in firms without powerful owners, and thus the interaction should have a positive sign.

Table IV presents evidence on how corporate governance affects the incentive–wealth relationship. While wealth remains significantly related to incentives, the interaction with the owner dummy is insignificant. Firms that are more poorly governed (presumably) do not exhibit a stronger relationship between incentives and wealth. This suggests that wealth is not simply a measure of CEO power. On the other hand, incentives are somewhat stronger on

average for firms with a stronger owner (since the dummy enters significantly in one case). This finding would also be surprising if incentives represent skimming of corporate resources by CEOs.

B. Lagged Data on Wealth

The second issue is whether wealth proxies for skill. The Swedish wage structure (flat) and marginal tax rates (high) reduce the ability of well-paid employees to accumulate wealth. Using a large Swedish household survey, Domeij and Klein (1998) report a correlation between wealth and earnings of merely 0.11 to 0.17 (depending on the year). Wealthy individuals in Sweden are likely to have accumulated wealth in ways not directly linked to their wage earnings, making it less likely that CEO wealth is a proxy for professional skill. Nevertheless, I replace wealth with a lagged wealth variable to reduce the likelihood that the wealth–incentive relationship is driven by skill.

The oldest wealth data still publicly available at the time of data collection is for the tax year 1993. Most of the 1999 CEOs were not CEOs in 1993 (median tenure is 5.5 years in the full sample, but it falls with time, so by 1999 median tenure is only 4.0). To maximize the lag, wealth in 1993 is collected for all CEOs in 1999. The log of wealth in 1993 is used as the wealth variable in a regression with the 1999 subsample only. The early wealth is more likely to comprise inheritances (which probably do not reflect skill) than accumulated earnings (which are more likely to reflect skill). The correlation between the two measures of wealth is 0.47 and is significant. Using lagged wealth reduces the number of observations (out of the firms in 1999, only a little more than 60 had CEOs for which wealth data is available for 1993).

The results are reported in Table V. The coefficients on *log of wealth* are lower than in the ordinary least squares (OLS) regression (Table III), and the coefficient for the *share owned* regression is no longer significant. Because the sample size is so much reduced, it is difficult to decide what this lower significance means. The R^2 is very high for the share owned regression, indeed higher than for the OLS regression, while t-statistics are similar or lower. This may indicate a subsample with slightly different properties than the overall sample used for the OLS specification, perhaps with high collinearity. Indeed, the basic specification in the same subsample (not reported) gives similarly high R^2 and low t-stats. Most importantly, the wealth coefficient for share owned is comparably low (but significant at the 10% level).

V. Economic Plausibility: A Rough Calibration

To assess whether the effect of wealth on incentives is economically plausible, this section presents a simple calibration of a one-period model of a CEO with utility over wealth and effort that optimally chooses an action based on the incentive structure set by owners. I follow Haubrich (1994) in making the following assumptions in a one-period setting: The standard deviation of firm value is about $200 million, reflected in two firm value outcomes, $300 million

Table V
Regressions of Incentives on Lagged Wealth (1999)

Two measures of incentives, *Money at Stake* and *Share of Company*, are regressed on explanatory variables. *Money at Stake* is the CEO's shareholdings times the end-of-year share price plus the number of options times the delta (0.6 is used) times the end-of-year share price. *Share of Company* is equal to *Money at Stake* divided by total firm market value. *Volatility* is the standard deviation of daily stock price changes, rescaled to a year. *Sales* and *Market Value of Equity* refer to the firm's reported annual total sales and equity (market value). *Age* is the highest age of the CEO during the year, and is based on year of birth (e.g., a CEO born in 1944 is assigned age 51 in 1995). *Tenure* is the number of years the CEO will have been employed at the end of the year, including all of her first year (if she started work in August 1992, tenure will be 2 for 1993, 3 for 1994, etc). *Log Wealth 1993* is CEO fiscal wealth as reported for 1993 by Swedish tax authorities. A * denotes significance at the 10% level, and ** at the 5% level. Robust standard errors are reported in parentheses.

Variable	Money at Stake	Share of Firm ($\times 100$)
Log Sales	2.3	0.12
	(1.5)	(0.08)
Log Market Value of Equity	0.53	−0.65**
	(2.9)	(0.21)
Volatility	33.6	5.81**
	(21.6)	(1.91)
Age	−0.53	−0.001
	(0.37)	(0.017)
Tenure	0.94**	0.000
	(0.39)	(0.03)
Log wealth 1993	3.42**	0.08
	(1.24)	(0.07)
R^2	0.30	0.48
No. of observations	62.00	62.00

and \$700 million (the particular levels are not important, but their difference is). The outcomes have probabilities 0.55 and 0.45 if the CEO exerts low effort and 0.45 and 0.55 if she exerts high effort. The marginal value of CEO effort is thus $(0.55 - 0.45) * (\$700 \text{ million} - \$300 \text{ million}) = \$40$ million. Haubrich disregards wealth effects (assuming exponential utility), so I depart from his model as follows. I assume that the CEO has a power utility with a coefficient of relative risk aversion of $\gamma = 2$ or $\gamma = 3$, and that the CEO makes a binary effort choice (effort/no effort). The cost of effort is equivalent to a utility loss of 0.01 (in units of the utility function). I compare the optimal contract for a CEO at approximately the 25^{th}, 50^{th}, and 75^{th} percentiles of the 1999 empirical distribution of nonfirm wealth (these are approximately \$0, \$0.3 million, and \$1 million, respectively), assuming that wealth of other types, such as future earnings, is worth \$0.5 million for each CEO. Given the assumptions, the higher wealth CEOs have lower absolute risk aversion (because the second derivative of utility with respect to wealth is lower in absolute terms) and will accept more risk, as well as require a larger pay gain to exert effort.

I assume that the contract is constrained to yield a positive payoff in both states, the contract has to generate at least a reservation utility corresponding to earning \$0.3 million with no risk and no effort, and the contract can only be contingent on the outcome (i.e., effort is unobservable). As it turns out, the optimal contract induces the CEO to exert effort for all utility functions and wealth levels. With $\gamma = 2$, optimal pay (low outcome, high outcome) is (0.27, 0.34), (0.25, 0.37), and (0.17, 0.50) for low/median/high wealth CEOs, respectively (with $\gamma = 3$, the optimal pay is (0.28, 0.33), (0.24, 0.38) and (0.08, 0.70)). In terms of sensitivities (i.e., the change in CEO payoff as a share of the difference in outcomes \$700 million − \$300 million = \$400 million) optimal incentives for $\gamma = 2$ are 0.016%, 0.031%, and 0.080%, respectively (and for $\gamma = 3$ they are 0.013%, 0.034%, and 0.160%). How do these numbers compare to the empirical results? Based on the regression presented in Table III (second column), and assuming all other variables are at their median values except equity market value, which is set to \$500M to match the calibration, the three wealth levels correspond to incentive strengths of 0.010%, 0.012%, and 0.018%. This variation is lower than what the model predicts, but of comparable magnitude.

As far as it goes, the calibration suggests that the observed magnitudes are theoretically plausible. The simple model used here, with only two effort levels, does not capture what may be the most important aspect of wealth and risk aversion: In a world of multiple actions, a less risk-averse CEO may in optimum face stronger incentives because the optimal effort level is higher. A richer model would include this dimension. On the other hand, such a model would have even more free parameters (and calibration would be even more indeterminate) than here. With the small sample at hand, structural estimation is not feasible.

VI. Conclusions

I test whether risk aversion can explain cross-sectional patterns of executive compensation in a Swedish sample of large corporations. My results confirm that pay patterns for Swedish CEOs are similar to established U.S. patterns in some ways, for example, increasingly strong incentives during the 1990s and an uncertain effect of volatility on incentive strength. Tenure may have a positive effect on incentive strength. In this small sample, the effects of CEO age and firm size cannot be reliably established.

Most important, CEO nonfirm wealth has a strong positive effect on incentive strength. This is consistent with traditional principal–agent theory of risk aversion, but also with alternatives that interpret wealth as a proxy for either skill or power. However, wealthy individuals in Sweden are unusually likely to have accumulated wealth in ways not linked to their wage earnings, making it unlikely that CEO wealth is a proxy for skill. The wealth–incentive regression result holds uniformly in firms with and without large owners, suggesting that wealth is not a measure of power (if wealth captured the ability of powerful

CEOs to skim corporate resources, the wealth–incentive relationship should be stronger in firms with less owner oversight and without a large owner). The wealth–incentive relationship also holds for one incentive measure when lagged wealth is used in the cross-sectional regression. Lagged wealth seems even less likely to proxy for power than the contemporaneous measure (the 6-year lag means that most CEOs were not in their job at the point at which wealth is measured). Finally, pay levels are not related to wealth, a surprising finding if wealth proxies for skill.

Both the skill and CEO power explanations may have some validity and contribute to the strong empirical effects documented. Nevertheless, the principal–agent explanation for these findings must be considered the most plausible. Thus, the wealth–incentive relationship could be taken as mildly supportive of Aggarwal and Samwick's (1999) conclusion: "principal–agent considerations are incorporated into executive compensation contracts."

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