MAKING IT PERSONAL:
THE IMPACT OF CEO RETIREMENT PLAN ON FIRM RISK

The study explores the argument that the structure of CEO retirement plan affects CEO risk-taking behavior and therefore firm risk. Analytical and empirical results provide strong support of the argument, thereby making an important contribution to the literature on the impact of executive compensation on firm risk.

Introduction

In most developed countries, payouts from regular defined benefit and defined contribution retirement plans are limited by income tax regulations. Supplemental Executive Retirement Plans (hereafter, SERPs) are non-contributory pension plans offered by companies to executives as a top-up to regular pension benefits. In essence, SERP benefits are similar to post-retirement salaries. SERP benefits represent a widespread and economically significant form of executive compensation, with most U.S. and Canadian firms offering SERPs to their CEOs and lower-level executives (Sundaram and Yermack, 2007; Kalyta and Magnan, 2008).

The non-contributory nature of SERPs means that SERP benefits are entirely sponsored by the employer. In other words, an executive does not have to save for his or her SERP benefits: shareholders will bear all the costs. For this reason, SERPs are conceptually different from regular defined benefit and defined contribution retirement plans, in which both the employer and the employee contribute to the retirement fund. There is, however, a downside effect for executives. Since SERP benefits are entirely sponsored by the firm, in most cases accumulated SERP benefits may not be transferred from one employer to another. Consequently, in case of employment termination prior to the normal retirement age, an executive loses up to 100% (depending on terms of the SERP) of accumulated SERP benefits.

Sundaram and Yermack (2007) suggest, inter alia, that CEO SERP arrangements should impact CEO’s risk-taking behavior. The rationale is as follows: if CEO has not reached the age when he or she is entitled to receiving SERP benefits, a positive association between the value of accumulated CEO SERP benefits and CEO’s risk aversion is expected. A CEO will avoid undertaking risky decisions to decrease the probability of job termination (in case of unfavorable outcome of the decision) and preserve accumulated SERP benefits. However, Sundaram and Yermack (2007) fail to provide empirical support of the argument. The study finds no significant impact of the value of accumulated CEO SERP on firm capital expenditures and frequency of debt rating upgrades – two proxies for firm riskiness.

The results in Sundaram and Yermack (2007) are inconclusive due to several major conceptual and methodological limitations. First, the authors implicitly assume that SERPs are homogeneous, whereas in reality SERPs vary significantly from one executive to another. One important source of variation which is expected to have a key impact on CEO’s risk tolerance is the contingency of SERP benefits on firm performance. Second, Sundaram and Yermack (2007) do not account for the probability of early employment termination. For instance, the probability of early termination is likely to be low when the CEO approaches the age of normal retirement, i.e., the age at which the CEO is entitled to receiving
SERP benefits – as the payouts from golden parachutes are likely to be significantly more costly for the employer than keeping the CEO in the office until he or she retires.

I develop an explicit analytical model according to which the relationship between CEO’s risk-tolerance and CEO’s SERP benefits varies according to the performance-contingency of SERP benefits and the probability of early employment termination. To verify the predicted relationships, several hypotheses are tested. In general, the results provide empirical support of the analytical predictions. Specifically, CEOs whose SERP benefits are contingent on performance appear to be more risk-tolerant than CEOs whose SERP benefits are not contingent on performance. Also, CEO’s risk tolerance is negatively associated with the size of accumulated SERP benefits when SERP benefits are not contingent on performance. The results are substantially different from those reported in Sundaram and Yermack (2007) who suggest that a relationship between CEO SERP benefits and risk tolerance is possible but fail to provide empirical support for such relationship. The results provide an important contribution to the literature on the impact of executive compensation on executive risk tolerance and, ultimately, firm decisions.

The rest of the paper is organized as follows. Section 2 provides an overview of SERPs. Section 3 develops analytical predictions. Section 4 describes research methodology. Results are reported in Section 5. Section 6 concludes.

SERP

Supplemental retirement arrangements exist due to governmental regulations that limit the retirement income under regular pension schemes. In Canada, the Income Tax Act sets the limit on the annual income from Registered Pension Plans (RPP) at $2,333 per year of pension plan membership, which leaves generously-paid executives with but a modest fraction of their pre-retirement income. Kalyta and Magnan (2008) investigate a sample of CEOs of S&P/TSX60 firms and find that RPP benefits do not, on average, exceed five percent of CEO’s pre-retirement cash compensation – due to the Income Tax Act limitations. Similar limitations are in place in the U.S. According to the Internal Revenue Code, the limit on pensionable earnings under a qualified plan is set at $225,000. Consider a CEO who retires in 2007 with a $1,000,000 pre-retirement base salary, 35 years of pensionable service and the pension plan that calls for 2% of the last base salary multiplied by the number of years of service to be paid to CEO annually upon retirement. Under a regular pension scheme, CEO’s retirement benefits are limited to $157,500 per annum (35 * 2% * $225,000) because of the cap.

A SERP is a non-contributory pension plan (i.e., it is completely funded by the employer) that permits to increase executive’s post-retirement income beyond the regular pension limit. In essence, SERP benefits are similar to a post-retirement salary. Under a SERP, a firm enters into a long-term contractual obligation with an executive to make ongoing retirement payments in excess of the regular pension cap until the death of the executive, or sometimes until the death of the surviving spouse. If there is a reasonable expectation that a firm may not honor the contract – e.g., in case of a hostile takeover or bankruptcy – it can be guaranteed by a letter of credit.

Most often, the design of a SERP reflects the design of a regular pension plan: a certain percentage (multiplier) of pensionable earnings for each year of pensionable service to be paid annually to a retiree upon reaching the retirement age. In some cases, retirement benefits under SERPs are not associated with the number of years of pensionable service and are determined by pensionable earnings and multiplier only. However, while the general design of a SERP formula is straightforward, the way its components are determined and valued differ significantly from one executive to another. For instance, in some cases, pensionable earnings are limited to the base salary. In other cases, performance bonuses are also taken
into account. The design of other SERP components is also subject to alternatives: whether to provide retirees with survivor benefits, whether to limit the size of SERP benefits, whether to adjust SERP benefits to inflation, whether to allow early retirement, whether to impose tenure requirements, whether to fund retirement benefits, etc.

**Development of Research Hypotheses**

SERPs came to the attention of academic researchers in the last several years due to persistent anecdotes on excessive SERP benefits in individual cases and due to extremely limited disclosure of SERPs in publicly available corporate statements (prior to 2007, the companies were not required to disclose the value of actual or expected SERP benefits of top executives). Due to the lack of SERP disclosure, Murphy (1999) referred to SERP benefits as “stealth”, or hidden, compensation. Bebchuk and Fried (2004) suggested that SERPs were used to increase executive compensation off the radar screen of shareholders. The “stealth” nature of SERP benefits made them an attractive choice for managers with power to extract rents (i.e., receive compensation above the level that would have been received under optimal contracting), as the opposition from shareholders was likely to be minimal. Kalyta and Magnan (2008) investigated a sample of CEOs of S&P/TSX60 firms and provided empirical support of the latter arguments. The study found strong positive associations between the incidence and magnitude of CEO SERP benefits on one side and CEO power over the board on the other, consistent with the rent extraction hypothesis.

Sundaram and Yermack (2007) provide a comprehensive but largely descriptive study on SERPs, their determinants, consequences, and relationship with other forms of executive compensation such as stock option grants. The authors suggest, inter alia, that CEO SERP arrangements impact CEO’s risk-taking behavior. In case of employment termination prior to the normal retirement age, a CEO loses a certain percentage (up to 100%, depending on terms of the SERP) of accumulated SERP benefits. Consequently, the more significant is the value of accumulated CEO SERP benefits, the more risk-averse the CEO should be – if the CEO has not reached the age in which he or she is entitled to receiving SERP benefits yet. Sundaram and Yermack (2007) provide some graphical and statistical analysis on the association of the value of CEO’s SERP with firm’s risk. One graph shows that capital investments appear to decline as the value of CEO’s SERP increases. Another graph shows that increased SERP benefits also lead to a greater frequency of debt rating upgrades. However, using multivariate regressions, Sundaram and Yermack (2007) fail to find significant support of these relationships.

The analysis in Sundaram and Yermack (2007) is limited for several reasons. First, it implicitly assumes that SERPs are homogeneous. In reality, SERPs significantly differ from one CEO to another. A critical characteristic is the performance-contingency of SERP benefits. While some SERP benefits are contingent on firm performance, others are not. Second, the study ignores that the probability of early employment termination and, consequently, a loss of accumulated SERP benefits due to the termination is different at different points of CEO career. For instance, the probability of early termination is likely to be low when the CEO approaches the age of normal retirement, i.e., the age at which he or she is entitled to receiving SERP benefits – as the payouts from golden parachutes are likely to be significantly more costly for the employer than having the CEO in the office for another year or so.

The models below demonstrate that the performance-contingency of SERP benefits and the probability of losing accumulated SERP benefits in case of early employment termination should have a key impact on CEO’s risk-taking behavior. According to the nature of pension arrangements in place in a given year, CEOs can be classified into three groups: (1) \textit{NOSERP}, which includes CEOs without SERP arrangements; (2) \textit{SERPSAL}, which includes CEOs with SERP arrangements in which SERP benefits are determined based on salary only, and are therefore not contingent on CEO performance; and (3)
SERPBON, which includes CEOs with SERP arrangements in which SERP benefits are determined based on salary and bonus, and are therefore contingent on CEO performance. Suppose that the present value of expected CEO’s SERP benefits is \( v \) at the beginning of a given year. Hence, \( v = 0 \) for NO SERP, and \( v \geq 0 \) for SERPSAL and SERPBON.\(^1\) Also, suppose that CEO performance in this year can be either good (denoted by superscript +) or poor (denoted by superscript –). Then, expected values of CEO SERP benefits at the end of the year are:

\[
\begin{align*}
E(v_{\text{NO SERP}}) &= 0 \tag{1a} \\
E(v_{\text{NO SERP}}) &= 0 \tag{1b} \\
E(v_{\text{SERPSAL}}) &= v(1 - \Pi) + pv\Pi = v - v\Pi(1 - p) \tag{1c} \\
E(v_{\text{SERPSAL}}) &= v \tag{1d} \\
E(v_{\text{SERPBON}}) &= v(1 - \Pi) + pv\Pi = v - v\Pi(1 - p) \tag{1e} \\
E(v_{\text{SERPBON}}) &= v + bv \tag{1f}
\end{align*}
\]

where:

- \( \Pi \) = probability of being fired or forced to retire due to poor performance
- \( P \) = percentage of SERP benefits received due to early retirement; \( 0 \leq p < 1 \)
- \( B \) = percentage increase in the present value of SERP benefits due to good performance and increase in the bonus compensation

As such, in a given year, accumulated SERP benefits of SERPSAL increase by \( 0 \) in case of good performance, and decrease by \( v\Pi(1 - p) \) when the performance is poor:\(^2\)

\[
E(v_{\text{SERPSAL}} - v_{\text{SERPSAL}}) = [- v\Pi(1 - p); 0] \tag{2}
\]

Similarly, in a given year, accumulated SERP benefits of SERPBON increase by \( bv \) in case of good performance, and decrease by \( v\Pi(1 - p) \) in case of poor performance:

\[
E(v_{\text{SERPBON}} - v_{\text{SERPBON}}) = [- v\Pi(1 - p); bv] \tag{3}
\]

Finally, regardless of the performance, the change in the value of accumulated SERP benefits of NO SERP is zero:

\[
E(v_{\text{NO SERP}} - v_{\text{NO SERP}}) = [0; 0] \tag{4}
\]

According to Equations (2) and (3), when the performance is poor, the expected loss of the CEO whose SERP benefits are performance-contingent equals the expected loss of the CEO whose SERP benefits are based on the base salary only. However, the expected gain of the former CEO is higher (by the amount \( bv \), when the performance is good. Ceteris paribus, higher reward incites risk-taking. Therefore, CEOs with performance-contingent SERPs are expected to be more risk-tolerant than CEOs whose SERPs are not contingent on performance.\(^3\) The following prediction is tested empirically:

\(^1\) \( v = 0 \) for SERPSAL and SERPBON at the beginning of Year 1 of executive’s employment.

\(^2\) For brevity, I ignore normal increases in the present value of SERP benefits - i.e. technical increases due to the accumulation of the additional year of credited service. The value of these technical increases is marginal; besides, their values are equal for SERPSAL and SERPBON (a certain proportion of \( v \)) and therefore do not affect most model predictions. For similar reasons, changes in base salary due to good (poor) performance are ignored.

\(^3\) The relationship between CEO’s risk-tolerance and the performance-contingency of CEO’s SERP is not expected to be endogenous. The reason is grounded in the design of existing SERP arrangements: in all cases, performance-contingent SERP benefits are calculated based on bonuses in addition to base salaries, not on bonuses instead of...
**H1:** CEOs whose SERP benefits are contingent on firm performance are more risk-tolerant than CEOs whose SERP benefits are not contingent on firm performance.

The comparison of CEOs whose SERP benefits are performance-contingent with CEOs who have no SERP arrangements is not that straightforward. According to Equation (4), the expected payoff (loss) is zero for NOSERP regardless of performance. According to Equation (3), the expected payoff of SERPBON is bv when the performance is good, while the expected loss is \( v \Pi(1 - p) \) when the performance is poor. This means that no general prediction with respect to the relative risk-aversion of the two groups of CEOs can be made. On the one hand, contrary to CEOs with no SERP arrangements, CEOs with performance-contingent SERPs have something \( v \Pi(1 - p) \) to lose in case of poor performance, and thus should be relatively more risk averse. On the other hand, contrary to CEOs with no SERP arrangements, CEOs with performance-contingent SERPs have something to gain (bv) in case of good performance, and thus are incited to take additional risk. Clearly, the risk-tolerance of CEOs with performance-contingent SERPs would differ according to values attached to \( bv \) and \( v \Pi(1 - p) \).

However, while it appears unfeasible to construct a justifiable general hypothesis that would compare CEOs with no SERP benefits and CEOs whose SERP benefits are contingent on performance, it is possible to make relative risk-aversion comparisons in a specific setting: during the final year prior to the expected CEO retirement, when the probability \( \Pi \) of early termination approaches zero. The expected loss of all three groups of CEOs is equal (and equals zero) if the performance is poor in the final year as the CEO will retire at the end of that year anyway. At the same time, if the performance is good, CEOs with performance-contingent SERPs face higher expected payoffs (bv) than CEOs with no retirement arrangements and CEOs whose SERP benefits are determined based on the base salary only (zero). Since, ceteris paribus, higher reward incites risk-taking, the following hypothesis is examined:

**H2:** In the final year prior to expected retirement, CEOs whose SERP benefits are contingent on firm performance are more risk-tolerant than CEOs with no SERP benefits.

One would also expect CEO risk-tolerance to vary according to the size of already accumulated SERP benefits. However, the relationship is not that straightforward as in Sundaram and Yermack (2007), who hypothesize that a direct positive association between the two exists. Specifically, the association between risk preferences and the value of SERP should vary according to the performance-contingency of SERP benefits and the probability of early retirement, as showed by the examples that follow.

Suppose, that the present value of SERP benefits of two CEOs at the beginning of a year is \( v_1 \) and \( v_2 \) respectively, such that \( v_1 > v_2 \). Also, suppose that SERP benefits of the two CEOs are determined based on salary only, and both CEOs face same \( \Pi \) and \( p \). According to Equation (2), expected annual changes in accumulated SERP benefits at the end of the year for the two CEOs are, respectively:

\[
E(v_1)_{SERPSAL} - v_1_{SERPSAL} = [\cdot v_1\Pi(1 - p); 0]
\]

base salaries. Consequently, regardless of his risk preferences, a CEO would prefer a performance-contingent SERP in which pensionable earnings are based on salary and bonus to a SERP in which pensionable earnings are based on the salary only. SERP benefits are at least as high in the first case (if the performance is poor and the bonus is zero throughout the determination period) and likely to be higher (if the bonus is higher than zero in at least one determination year), but can never be lower. In other words, there is no downside effect or risk involved. As such, CEO’s initial risk preferences are not expected to impact the performance-contingency of SERP benefits.

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\(^4\) The key point is that the expected loss of all CEOs is equal, and not that it equals zero. Certainly, the true expected loss due to the poor performance is higher than zero for all CEOs. For example, a CEO faces costs related to the loss of reputation. However, such losses are assumed to be homogeneous across the three groups of CEOs.
The gain of the two CEOs when the performance is good is the same. However, since $v_1 > v_2$, the loss of the CEO with more accumulated SERP benefits is higher in case of poor performance than the loss of the CEO with less accumulated SERP benefits. Risk-aversion is therefore expected to be positively associated with the size of accumulated SERP benefits when SERP benefits are not contingent on performance. The only exception is the last year prior to CEO expected retirement when – as discussed above – the expected loss of both CEOs in case of poor performance is the same since $\Pi$ approaches zero. The following hypothesis is tested empirically:

**H3**: Except in the final year prior to expected retirement, the risk-tolerance of CEOs whose SERP benefits are not contingent on firm performance is negatively associated with the size of accumulated SERP benefits.

If SERP benefits are contingent on performance, the risk behavior of two CEOs with different values of accumulated SERP benefits is not that straightforward. Consider the abovementioned example for the two CEOs whose SERP benefits are performance-contingent. According to Equation (3), expected annual changes in accumulated SERP benefits at the end of the year for these two CEOs are, respectively:

$$E(v_{1\text{SERP}BON}) - v_{1\text{SERP}BON} = [- v_1\Pi(1 - p); b v_1]$$

$$E(v_{2\text{SERP}BON}) - v_{2\text{SERP}BON} = [- v_2\Pi(1 - p); b v_2]$$

On one hand, the CEO with more accumulated SERP benefits loses more in case of poor performance, and thus is expected to be more risk-averse than the CEO with less accumulated SERP benefits. On the other hand, when the outcome is positive, the CEO with more accumulated SERP benefits gains more $(b v_1)$ than the CEO with less accumulated benefits $(b v_2)$, and thus is more incited to take risks. The risk-tolerance of the two CEOs would differ according to specific values attached to $b$, $\Pi$ and $p$. Consequently, justifying a *general* prediction about the impact of accumulated SERP benefits on CEO risk-tolerance when SERP benefits are performance-contingent appears problematic. However, during the final year prior to expected retirement, a CEO with accumulated SERP benefits $v_1$ is expected to be more risk-tolerant than the CEO with $v_2$. If the performance is poor in that year, both CEOs face the same consequences, due to $\Pi$ approaching zero. If the performance is good, the CEO with higher accumulated SERP benefits enjoys higher returns, and thus is incited to take additional risks. Therefore, the following hypothesis is examined:

**H4**: In the final year prior to expected retirement, the risk-tolerance of CEOs whose SERP benefits are contingent on firm performance is positively associated with the size of accumulated SERP benefits.

Table 1 summarizes research hypotheses on the relative association between CEO risk preferences and SERP benefits (i.e., Hypotheses 1 to 4). To the best of my knowledge, none of the hypotheses has been examined in the literature. Investigating the links between CEO SERP benefits on one side and CEO risk preferences on the other makes important analytical and empirical contributions to the stream of research on the impact of executive compensation on business practices. The only existing study on the impact of CEO SERP benefits on CEO risk preferences, Sundaram and Yermack (2007), finds no significant association between the two concepts. I extend the research by Sundaram and Yermack (2007) by developing an explicit analytical model to study the relationship between SERP benefits and risk preferences and relaxing some critical assumptions of SERP homogeneity.
Table 1

Summary of research hypotheses

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Expected risk-tolerance relationship in a given year</th>
<th>Hypothesis</th>
</tr>
</thead>
<tbody>
<tr>
<td>SERPBON vs. SERPSAL</td>
<td>&gt;</td>
<td>H1</td>
</tr>
<tr>
<td>SERPBON vs. NO SERP</td>
<td>?</td>
<td>H2</td>
</tr>
<tr>
<td>SERPSAL_{HIGH} vs. SERPSAL_{LOW}</td>
<td>&lt;</td>
<td>=</td>
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<tr>
<td>SERPBON_{HIGH} vs. SERPBON_{LOW}</td>
<td>?</td>
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</table>

The table above summarizes research hypotheses on the association between CEO risk-tolerance and SERP benefits (Hypotheses 1 to 4). SERPBON are observations when CEO SERP benefits are contingent on firm performance. SERPSAL are observations when CEO SERP benefits are not contingent on performance. NO SERP are observations when CEO’s have no SERP arrangements. Subscripts HIGH and LOW refer to the size of accumulated SERP benefits.

Methodology

Econometric Models

Four separate multivariate models that control for fixed firm- and CEO-level effects are estimated to investigate Hypotheses 1 to 4. The main limitation of the models is common to most empirical studies on risk preferences: it is difficult to estimate a reliable measure of risk tolerance. The study alleviates the problem by employing two alternative publicly-available proxies for CEO risk tolerance: firm’s distance-to-default, and firm’s capital and R&D expenditures. The distance-to-default is defined as the number of standard deviations of decline in a firm’s asset value that would push it into default.\(^5\) Capital and R&D expenditures are deflated by the beginning of period total assets to control for firm size.\(^6\) Separate multivariate regressions are run for each proxy. Since no measure represents a perfect estimation of CEO risk-tolerance, using several proxies that have been justified and employed in prior studies (e.g., Hamada, 1972; Bowman, 1979; Ross, 2004; Sundaram and Yermack, 2007) is beneficial for the reliability of results.

Specifically, to test Hypothesis 1, the following model is estimated (firm and period subscripts are omitted for brevity):

\[
RISKTOL = \gamma_0 + \delta_1 BONSAL + \gamma_1 SIZE + \gamma_2 LEV + \gamma_3 PERF + \gamma_4 AGE + \varepsilon \tag{7}
\]

where SIZE, LEV, and PERF are as identified previously and:
- \(RISKTOL\) = proxy for CEO’s risk-tolerance, either of the following variables:
  - \(DTD\): firm’s distance-to-default
  - \(CAPEXP\): firm’s capital and R&D expenditures deflated by lagged total assets
- \(BONSAL\) = dummy variable equal to one if CEO’s SERP benefits are performance-contingent, and zero if CEO’s SERP benefits are not contingent on performance
- \(AGE\) = natural log of CEO’s age

\(^5\) The default point and the distance-to-default are estimated using standard procedures found in the literature (among others, Crouhy et al., 2001; Sundaram and Yermack, 2007).

\(^6\) The results are not affected if log capital and R&D expenditures is used as a risk-tolerance proxy, instead of capital and R&D expenditures deflated by total assets.
Hypothesis 2 is tested using the following model:

\[
RISKTOL = \gamma_0 + \delta_2 \text{BONNO} + \delta_3 \text{BONNO*LAST} + \gamma_1 \text{SIZE} + \gamma_2 \text{LEV} + \gamma_3 \text{PERF} + \gamma_4 \text{AGE} + \varepsilon
\]  

(8)

where:
- \text{BONNO} = \text{dummy variable equal to one when CEO’s SERP benefits are performance-contingent, and zero when CEO has no SERP benefits}
- \text{LAST} = \text{dummy variable equal to one if the year is the last year prior to retirement, zero otherwise}

Hypothesis 3 is examined using the following model:

\[
RISKTOL = \gamma_0 + \delta_4 \text{PVSAL} + \delta_5 \text{PVSAL*NOTLAST} + \gamma_1 \text{SIZE} + \gamma_2 \text{LEV} + \gamma_3 \text{PERF} + \gamma_4 \text{AGE} + \varepsilon
\]  

(9)

where:
- \text{PVSAL} = \text{present value of accumulated SERP benefits of a CEO whose SERP is not contingent on performance}
- \text{NOTLAST} = \text{dummy variable equal to one if the year is not the last year prior to retirement, zero otherwise}

Finally, Hypothesis 4 is tested by running the following regression:

\[
RISKTOL = \gamma_0 + \delta_6 \text{PVBON} + \delta_7 \text{PVBON*LAST} + \gamma_1 \text{SIZE} + \gamma_2 \text{LEV} + \gamma_3 \text{PERF} + \gamma_4 \text{AGE} + \varepsilon
\]  

(10)

where:
- \text{PVBON} = \text{present value of accumulated SERP benefits of a CEO whose SERP is performance-contingent}

If predicted associations between SERP benefits and CEO risk preferences are supported, coefficients on \( \delta_1 \) (Hypothesis 1), \( \delta_3 \) (Hypothesis 2), and \( \delta_7 \) (Hypothesis 4) are expected to be positive and significant, while the coefficient on \( \delta_5 \) (Hypothesis 3) is expected to be negative and significant. Regressions are controlled for common firm-level factors that potentially impact managerial propensity to undertake risky projects: size, leverage, and past performance (proxied, respectively, by log total assets, debt-assets ratio, and ROA). Specifically, the influence of firm size on capital and R&D spending is well-documented in the literature. Larger firms are expected to have greater resources to exploit innovations and develop sustained R&D programs (Schumpeter, 1942). A number of empirical studies support the prediction by confirming a positive association between capital and R&D expenditures with firm size (e.g., Baysinger and Hoskisson, 1989; Baysinger et al., 1991). In contrast, the relationship between capital and R&D expenditures and firm leverage is expected to be negative. High leverage prioritizes current cash-flows for debt service, thereby discouraging managers from investments into riskier long-term projects. In general, empirical studies support the negative association between firm’s leverage and capital and R&D expenditures (e.g., Long and Ravenscraft, 1993; Barker and Mueller, 2002), however this relationship is not always statistically or economically significant (Hitt et al., 1991). Finally, the evidence on the association between past performance and capital and R&D expenditures is somewhat mixed. Cyert and March (1963) suggest that poor past performance incites experimenting with innovative activities. Hitt et al. (1991) support this perspective empirically by confirming a negative association between past financial performance and R&D spending. The majority of later studies, however, find a positive relationship between the two variables (e.g., Hundley et al., 1996; Barker and Mueller, 2002). A possible

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7 Using alternative proxies for firm size (log assets, revenue, log revenue), leverage (debt-equity ratio), and accounting performance (net income, ROE) does not qualitatively affect the results.
explanation is that past profitability justifies managerial actions, gives managers confidence and encourages undertaking even riskier long-term projects.

The age of the CEO is included in regressions as another control variable. However, the evidence on the link between CEO’s age and risk-tolerance proxies is mixed. Some prior research suggests that younger CEOs are concerned about being disciplined by the managerial labor market in case of poor results, whereas for CEOs approaching retirement such career concerns are less relevant (e.g., Fama, 1980; Gibbons and Murphy, 1992). In addition, older CEOs are likely to possess more personal wealth that younger CEOs and may therefore be less risk-averse (Lewellen et al., 1987). However, CEOs approaching retirement may prioritize short-term performance and reduce capital and R&D expenditures (Dechow and Sloan, 1991). According to Lundstrum (2002) and Barker and Mueller (2002), CEO age has a negative association with R&D spending.

Data

The sample of 60 firms that comprised the S&P/TSX60 index in 1997 is used for the analysis. The S&P/TSX60 Index is comprised of Canada’s largest publicly traded firms listed on the Toronto Stock Exchange and more than 60% of which are cross-listed in the USA. The proportion of CEO SERP benefits to cash compensation in larger firms is expected to be more pronounced due to a greater disproportion between pensionable earnings and post-retirement income from the RPP. Since any form of executive compensation is positively associated with firm size (among others, Lambert et al., 1991; Core et al., 1999; Craighead et al., 2004; Kalyta and Magnan, 2008), CEOs in larger firms are better remunerated. Higher pre-retirement cash compensation translates into greater disproportion between pensionable earnings and RPP benefits and – therefore – a greater role of a supplemental pension plan in preserving pre-retirement cash-inflows for a CEO. Since supplemental retirement plans are most important for better-compensated CEOs, associations of SERP benefits with CEO risk preferences are expected to be especially pronounced in larger firms.

The sample encompasses the seven-year period between 1997 and 2003 and includes 60 firms, 116 CEOs, and 395 observations. Descriptions of SERPs are retrieved directly from annual proxy statements. When CEO’s age is not disclosed in the proxy statement, it is retrieved via Lexis-Nexis databases and Internet search engines. Death probability tables are retrieved from the Statistics Canada publications. Financial data is collected from Compustat. Missing observations are retrieved from Report on Business Top 1000 publications and corporate financial statements. To account for inflation, all monetary values are converted into 2003 dollars using historic CPIs.

SERP Estimation

Following prior studies (Masson, 1971; Sundaram and Yermack, 2007; Kalyta and Magnan, 2008), I use a two-step procedure to estimate the present value of accumulated retirement benefits. In the first step, the value of the annual pension already accumulated by the CEO is calculated. SERP formula, multiplier and years of pensionable service accumulated are disclosed in the proxy statement and do not have to be estimated. Pensionable earnings are typically not disclosed. Instead, a firm discloses information on

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8 See Kalyta and Magnan (2008) for the list of firms.

9 Consider two retiring CEOs with SERPs, with 35 years of credited service, whose annual pension is to be determined by the product of pre-retirement cash compensation, years of credited service and a multiplier of 2%. Pre-retirement cash compensation of CEO A is $200,000. Pre-retirement cash compensation of CEO B is $1,000,000. In that case, CEO A is entitled to annual pension of $140,000, of which 52.8% ($73,885) is from the RPP, and 47.2% ($700,000 - $73,885) is from the SERP. CEO B is entitled to annual pension of $700,000, of which only 10.6% ($73,885) is from the RPP, and 89.4% is from the SERP.
components of pensionable earnings (i.e., base salary or some combination of base salary and other incentives) and the period over which pensionable earnings should be estimated (i.e., annual pensionable earnings immediately prior to retirement or the average of highest annual pensionable earnings over a longer period). Thus, in most cases, to estimate pensionable earnings in year $t$, the information on CEO’s compensation in prior years must be collected from earlier proxy statements. For any given CEO at any given year $t$, compensation data for at least three prior years, $t-1$ to $t-3$, is available. For any prior year in which the information on CEO compensation is unavailable, I assume that the salary is equal to the salary in the earliest year for which the compensation information is available, while the bonus is equal to the average bonus in years for which the compensation information is available.

In the second step, the annual pension already accumulated by the CEO and death probability tables published by Statistics Canada are used to estimate the present value of the SERP. For simplicity, it is assumed that pension benefits are paid annually at the end of a year. When the age of the CEO is not disclosed in the proxy statement, it is retrieved via the Blue Book of Canadian Business, Who’s Who in Canadian Business, LexisNexis or Google. Any survivorship benefits are conservatively ignored as I am unable to gather information on the marital status of CEOs and the age of their spouses. I assume that current CEOs with SERPs will retire upon reaching the age at which they qualify for unreduced SERP benefits, which in most cases is the age of normal retirement specified in proxy statements. In one case, in which the CEO has already reached the age of normal retirement but continues serving in his position in 2003 (the last year in the sample), a retirement in 2004 is assumed.

**Results**

**Univariate Analysis**

The univariate analysis indicates that three of the four hypotheses on the association between CEO’s risk preferences and SERP benefits are supported. Table 2 compares mean distances-to-default and capital and R&D expenditures across observations of interest. The only hypothesized relationship rejected by univariate analysis is the predicted link between the value of performance-contingent SERP benefits and risk preferences in the last year prior to CEO’s retirement (Hypothesis 4). The comparison between SERPBON observations with the highest value of accumulated SERP benefits (top 50%) and SERPBON observations with the lowest value of accumulated SERP benefits (bottom 50%) displays no significant difference in either risk-tolerance proxy.

All other results provide evidence in favor of predicted links. On average, CEOs whose SERP benefits are performance-contingent display higher risk tolerance than CEOs whose SERP benefits are not contingent on performance (Hypothesis 1). Mean $DTD$ and $CAPEXP$ are significantly higher in the former subsample. Similarly, CEOs with performance contingent SERPs appear to be more risk-tolerant

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10 The first year of observations is 1997 but I also have access the 1996 proxy statements. Since a proxy statement contains information on executive’s compensation during last three years, for any 1997 observation there are three years of prior remuneration data.

11 In two cases in the sample, firms reported the projected value of CEO’s annual pension. However, as actuarial and other assumptions were never made transparent, I ignored that information and estimated the value of the annual pension already accumulated by the CEO in the manner described in the text. This ensures uniformity of assumptions across all observations. In addition, a robustness test shows that using the reported values of projected CEO’s annual pensions in these two cases does not affect any results qualitatively.

12 Descriptive statistics and correlation coefficients are not reported due to brevity and value-added considerations. The reader is referred to Kalyta and Magnan (2008) for detailed information.
than CEOs with no supplemental retirement arrangements in the last year prior to retirement. Both proxies for risk-tolerance display the expected relationship. The difference in capital and R&D expenditures is especially pronounced: $841.9 million vs. $444.7 million. Finally, Hypothesis 3 is also supported by univariate results. Risk-tolerance appears to be associated with the size of SERP benefits that are not contingent on performance in the years preceding the last year prior to CEO’s retirement. The comparison between SERPSAL observations with the highest value of accumulated SERP benefits (top 50%) and SERPSAL observations with the lowest value of accumulated SERP benefits (bottom 50%) reveals that the distance-to-default in the later group is on average higher. Capital expenditures are marginally higher in the bottom 50% observations as well.

Table 2
Risk tolerance by CEO’s SERP structure

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Period</th>
<th>Observations</th>
<th>Predicted Sign</th>
<th>DTD</th>
<th>CAEXP</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1</td>
<td>NOTLAST and LAST</td>
<td>SERPBON, SERPSAL</td>
<td>&gt;</td>
<td>2.94</td>
<td>939.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2.35 **</td>
<td>745.4 **</td>
</tr>
<tr>
<td>H2</td>
<td>LAST</td>
<td>SERPBON, NOSERP</td>
<td>&gt;</td>
<td>2.80</td>
<td>841.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2.12 **</td>
<td>444.7 ***</td>
</tr>
<tr>
<td>H3</td>
<td>NOTLAST</td>
<td>SERPSAL,&lt;SUB&gt;UPER&lt;/SUB&gt;, SERPSAL,&lt;SUB&gt;LOWER&lt;/SUB&gt;</td>
<td>&lt;</td>
<td>2.02</td>
<td>705.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2.76 ***</td>
<td>855.0 *</td>
</tr>
<tr>
<td>H4</td>
<td>LAST</td>
<td>SERPBON,&lt;SUB&gt;UPER&lt;/SUB&gt;, SERPBON,&lt;SUB&gt;LOWER&lt;/SUB&gt;</td>
<td>&gt;</td>
<td>2.97</td>
<td>865.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2.68</td>
<td>814.9</td>
</tr>
</tbody>
</table>

*** Significant at the 1% level; ** Significant at the 5% level; * Significant at the 10% level

The table reports means for observations grouped according to CEO SERP structure in the sample of TSX/S&P60 firms for the 1999-2003 period. Significance levels are for one-tailed t-tests for differences in means. Monetary values are in 2003 dollars. DTD is firm’s distance-to-default. CAEXP is firm’s capital and R&D expenditures. NOTLAST are observations that correspond to years that precede the final year prior to CEO’s termination. LAST are observations that correspond to the final year prior to CEO’s termination. SERPBON are observations that correspond to CEO’s with performance-contingent SERPs. SERPSAL are observations that correspond to CEO’s with SERPs that are not contingent on performance. NOSERP are observations that correspond to CEO’s with no SERP. Subscripts <SUB>UPER</SUB> and <SUB>LOWER</SUB> correspond to top (bottom) 50% of observations divided according to the value of accumulated SERP benefits.

Multivariate Analysis

Four separate models (Equations 7 to 10) are run to test the hypotheses concerning associations between risk-tolerance proxies and CEO’s SERP benefits. The results of the regressions are presented in Table 3. The adjusted R-squared values range from 0.198 to 0.454 for models in which the independent variable is firm’s capital expenditures, and from 0.360 to 0.545 for models in which the independent variable is firm’s distance to default. Most control variables display expected relationships with dependent variables. Risk-tolerance proxies are negatively associated with firm’s leverage and CEO’s age, and positively – with size. The association with past performance is positive as well - a result in line with the proposition that profitability justifies past actions, gives managers confidence and encourages undertaking riskier projects. In general, the relationships hold across the models.

The test of Hypothesis 1 reveals that the explanatory variable BONSAL which partitions the sample of CEOs with SERP according to performance-contingency of their SERP benefits has positive and significant associations with distance-to-default (0.240; p<0.05) and capital and R&D expenditures (0.020; p<0.05). As such, CEOs whose SERP benefits are contingent on performance appear to be more risk-tolerant than CEOs whose SERP benefits are not contingent on performance. A broader implication
Table 3
Determinants of CEO risk tolerance

<table>
<thead>
<tr>
<th>Variable</th>
<th>DTD H1</th>
<th>CAEXP H1</th>
<th>DTD H2</th>
<th>CAEXP H2</th>
<th>DTD H3</th>
<th>CAEXP H3</th>
<th>DTD H4</th>
<th>CAEXP H4</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIZE</td>
<td>0.249 **</td>
<td>0.021 ***</td>
<td>0.447 *</td>
<td>0.009 ***</td>
<td>0.163 *</td>
<td>0.025 ***</td>
<td>0.308 **</td>
<td>0.015 ***</td>
</tr>
<tr>
<td>LEV</td>
<td>-0.498 ***</td>
<td>-0.012</td>
<td>-0.581 ***</td>
<td>-0.007</td>
<td>-0.694 ***</td>
<td>-0.016</td>
<td>-0.470 **</td>
<td>0.013</td>
</tr>
<tr>
<td>PERF</td>
<td>0.233 *</td>
<td>0.073 ***</td>
<td>0.407 *</td>
<td>0.041 **</td>
<td>0.590 *</td>
<td>0.463 ***</td>
<td>0.501 *</td>
<td>0.026 *</td>
</tr>
<tr>
<td>AGE</td>
<td>-0.785 *</td>
<td>-0.113 ***</td>
<td>-1.003</td>
<td>-0.026</td>
<td>-0.816 *</td>
<td>-1.123 **</td>
<td>-0.763</td>
<td>-0.091 **</td>
</tr>
<tr>
<td>BONSAL</td>
<td>0.240 **</td>
<td>0.020 **</td>
<td>0.026</td>
<td>0.012</td>
<td>0.097</td>
<td>-0.002</td>
<td>0.085</td>
<td>0.001</td>
</tr>
<tr>
<td>BONNO</td>
<td>0.212 **</td>
<td>0.008 **</td>
<td>-0.328 ***</td>
<td>-0.111 *</td>
<td>0.126 *</td>
<td>-0.001</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BONNO*LAST</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PVSAL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PVSAL*NOTLAST</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PVBON</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PVBON*LAST</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjusted R²</td>
<td>0.463</td>
<td>0.371</td>
<td>0.360</td>
<td>0.198</td>
<td>0.545</td>
<td>0.454</td>
<td>0.529</td>
<td>0.396</td>
</tr>
</tbody>
</table>

*** Significant at the 1% level; ** Significant at the 5% level; * Significant at the 10% level

The table displays parameter estimates of the determinants of risk tolerance proxies for the sample of TSX/S&P60 firms for the 1999-2003 period. Models are estimated using OLS with robust Huber-White standard errors. Dependent variables are firm’s distance-to-default (DTD) and capital and R&D expenditures deflated by lagged total assets (CAPEXP). SIZE is the natural log of total assets, LEV is the ratio of debt to total assets, PERF is the return on assets, AGE is the natural log of CEO’s age. BONSAL is a dummy variable equal to one for observations when CEO’s SERP is performance-contingent, and zero for observations when CEO’s SERP is not contingent on performance. BONNO is a dummy variable equal to one for observations when CEO’s SERP is performance-contingent, and zero for observations when CEO’s SERP is not contingent on performance. PVBON is the value of accumulated SERP benefits of the CEO whose SERP benefits are performance-contingent. LAST are observations that correspond to the final year prior to CEO’s termination. NOTLAST are observations that correspond to years that precede the final year prior to CEO’s termination. To mitigate any influence from outliers all variables are winsorized at the 1% level.
is that SERPs are indeed not homogenous and their structure significantly impacts risk preferences.

The results also provide empirical support for Hypothesis 2. Coefficient on the $BONNO^{*}LAST$ interaction is positive and significant when either risk-tolerance proxy is used. In isolation, the explanatory variable $BONNO$ displays no significant association with either distance-to-default or capital and R&D expenditures. In other words, CEOs whose SERP benefits are contingent on performance appear to be more risk-tolerant than CEOs with no SERP benefits, but only in the final year prior to expected retirement.

Similarly, the analysis provides with evidence in favor of Hypothesis 3. As predicted, the coefficient on the $PVSAL^{*}NOTLAST$ interaction is negative. The association is weakly significant (-0.011; p<0.10) when capital and R&D expenditures are used as the dependent variable, but strongly significant (-0.328; p<0.01) when distance-to-default is used as a proxy for risk preferences. When the time frame is ignored, the association between accumulated SERP benefits and risk-tolerance proxies is marginally significant in one model and not significant in the other. As such, the risk-tolerance of CEOs whose SERP benefits are not contingent on performance appears to be negatively associated with the size of accumulated SERP benefits specifically in the years preceding the final year prior to CEO’s retirement, but not in the final year. In other words, on average, a CEO with higher accumulated SERP benefits is more risk-averse than a CEO with lower accumulated SERP benefits, when SERPs are not contingent on performance and when CEOs are not about to retire.

Finally, the support of Hypothesis 4 is limited. The association between capital and R&D expenditures on one side and the interaction of interest ($PVNON^{*}LAST$) on the other is statistically insignificant. When distance-to-default is used as an alternative risk-tolerance proxy, the association is only weakly significant, albeit positive, as predicted (0.126; p<0.10). As such, the results fail to support the proposition that the risk-tolerance of CEOs whose SERP benefits are contingent on performance is positively associated with the size of accumulated SERP benefits in the last year prior to CEO’s retirement. In years other than the last year, the size of accumulated performance-contingent SERP benefits does not appear to be linked to risk-tolerance proxies as well: coefficients on $PVNON$ are statistically insignificant.

To summarize, the results support three of the four hypotheses on links between SERP benefits and risk preferences. First, CEOs whose SERP benefits are contingent on performance appear to be more risk-tolerant than CEOs whose SERP benefits are not contingent on performance. Second, CEOs whose SERP benefits are contingent on performance are more risk-tolerant than CEOs with no SERP benefits but only in the last year prior to retirement. Otherwise, no significant difference in risk preferences of the two groups exists. Third, risk-tolerance is negatively associated with the size of accumulated SERP benefits when SERP benefits are not contingent on performance. The only exception is the last year prior to CEO’s retirement when the size of SERP benefits does not affect risk preferences. In general, the results provide a strong support to the assertion that the relationship between CEO’s SERP and risk preferences exists, it is not homogenous and varies according to the performance-contingency of SERP benefits.

**Research Limitations**

The study is subject to several limitations that are not expected to have substantial impact on the results. First, SERP estimation methodology does not account for survivor benefits, which may or may not be significant depending on CEO’s marital status and the age of the spouse. Clearly, *ceteris paribus*, the expected value of a SERP of a single CEO would be substantially lower than the expected value of a SERP of a married CEO whose spouse is 30 years younger. However, being unable to find out the marital status of CEOs using publicly available sources, I assume - conservatively - no survivor benefits. Another possibility is to assume that all CEOs are married to persons of opposite sex and that spouses are
of the same age as CEOs. As expected, redoing the analysis using this assumption yields very similar – univariate and multivariate – results. According to most SERPs, survivor benefits are limited to about 60% of executive’s pension and the life expectancy of females at age 60 is longer than that of males by about four years only. As a result, the actuarial value of the incremental pension benefit due to survivor benefits is insignificant when the abovementioned assumption is used. In addition, survivor benefits would be partially cancelled out if the probability of divorce was also accounted for.

Including the dummy variable for financial institutions in all models does not qualitatively affect any results. However, the lack of control for industry effects is a potential limitation of the study and an interesting opportunity for future research. For example, it is possible that the impact of SERP benefits on CEO risk tolerance differs across sectors (e.g., due to heterogeneous demand for and supply of qualified CEOs and hence different probability of early employment termination). In addition, the results of this study should not be generalized to the population of public firms, as the analysis concentrates on larger firms. SERP benefits are expected to be more prevalent and sizable in larger firms due to a greater disproportion between CEO’s pre-retirement cash pay and regular pension. Kalyta and Magnan (2008) confirm that the presence and magnitude of SERP benefits is related – among other factors – to firm size. Also, caution should be exercised when extending results to firm’s officers other than the CEO. The impact of SERP benefits of lower level officers on firm’s riskiness may not be as strong as the impact of CEO SERP benefits. A study on SERPs of lower-level officers would constitute an interesting research extension.

Conclusions

The study investigates the impact of CEO SERP benefits on CEO’s risk preferences. Existing evidence in this area is limited. Prior literature investigates the impact of SERP’s value on risk preferences but suffers from important conceptual and methodological limitations and fails to capture statistically significant associations (Sundaram and Yermack, 2007). I develop an explicit analytical model according to which the relationship between CEO’s risk-tolerance and CEO’s SERP benefits varies according to the performance-contingency of SERP benefits and the probability of early employment termination. To verify the predicted relationships, four hypotheses are tested empirically. Controlling for commonly-used explanatory factors, proxies for risk-tolerance are regressed on variables that partition the sample according to the nature of CEO’s retirement arrangements and the period with respect to CEO’s retirement date. Since it is difficult to estimate the reliable measure of CEO’s risk tolerance (the main limitation of most empirical studies on risk preferences), two alternative and conceptually different proxies are used to alleviate the problem: firm’s distance-to-default and capital and R&D expenditures deflated by total assets. Higher values in the dependent variables correspond to more risk tolerance and lower values correspond to more risk aversion. All empirical models are run separately for each proxy. In general, the results confirm analytical predictions. Specifically, CEOs whose SERP benefits are contingent on performance appear to be more risk-tolerant than CEOs whose SERP benefits are not contingent on performance. Also, CEO’s risk tolerance is negatively associated with the size of accumulated SERP benefits when SERP benefits are not contingent on performance. To summarize, empirical findings suggest that the relationship between CEO SERP benefits and risk preferences does exist and varies according to the performance-contingency of SERP benefits. The result is important in light of the study by Sundaram and Yermack (2007) that does not take into account the heterogeneity of SERPs with respect to their performance-contingency and finds no association of CEO SERP benefits and risk preferences. More generally, the result provides important analytical and empirical contribution to the academic literature on associations between executive compensation arrangements and firm’s decisions.
References


