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# **Do CEOs Exercise Their Stock Options Earlier than Other Executives?**

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# Do CEOs Exercise Their Stock Options Earlier than Other Executives?\*

*Paul André<sup>†</sup>, M. Martin Boyer<sup>‡</sup>, Robert Gagné<sup>‡</sup>*

## Résumé / Abstract

Nous étudions dans cet article le moment choisi par le PDG d'une compagnie pour lever ses options ou vendre ses actions dans la compagnie comparativement au moment choisi par les autres hauts dirigeants de la compagnie. Nous présentons premièrement un modèle théorique de tournoi qui fait des prédictions quant au moment opportun pour le PDG et les autres dirigeants de lever leurs options et/ou de vendre leurs actions dans la compagnie. Nous montrons théoriquement dans un tel modèle de tournoi que les hauts dirigeants devraient lever leurs options après le PDG. Nous testons ce modèle en utilisant une base de données unique de compagnies canadiennes de 1993 à 1999. Nos résultats empiriques semblent supporter notre modèle théorique puisque les hauts dirigeants semblent lever leurs options un an plus tard que le PDG. De plus, les hauts dirigeants semblent plus enclins à lever leurs options lorsqu'un nouveau PDG vient d'être nommé, confirmant ainsi notre modèle de tournoi.

*This paper looks at the timing chosen by CEOs to exercise their stock options and to sell their shares of stock compared to the timing chosen by other top executives in the firm. We first present a model that predicts when CEOs should exercise their options and/or sell their shares, and when other top managers should. Using a tournament approach we find that other top executives should exercise their stock options later than the CEO. We test this model using a unique data set of Canadian companies from 1993 onward. Our results seem to support the theoretical model as non-CEO executives seem to exercise their stock options about a calendar year later than the CEO. Moreover, non-CEO executive are more likely to exercise when a new CEO has been appointed, confirming our tournament model results.*

**Mots clés :** Contributions volontaires , pertes publiques, risque, ambiguïté, données expérimentales.

**Keywords:** CEO and Executive Compensation, Options, Timing of Exercised Options.

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# 1 Introduction

## 1.1 Motivation

The growing popularity of performance based compensation has produced a huge literature on how and when should stock options and other long-term incentive plans be given to CEOs and other top executives. This has been true in both finance (Jensen and Meckling, 1976, and Smith and Watts, 1992) and accounting (Healy, 1985). Rappaport (1999) reports that stock options now account for more than half of total CEO compensation and about a third of top executive pay. Klassen and Mawani (2000) report that more than 67 percent of the largest Canadian public corporations granted stock options to their executives in 1995 (compared with 33 percent in 1991). Our data confirms this increasing trend. The recent study of Kole (1998) proposes, however, that the full complexity and richness of executive compensation has not been studied thoroughly yet.

Our paper fills a small gap in this literature. Our paper first attempts to develop a theory framework for understanding the differential timing of exercise by top executives based on signalling arguments and a tournament setting (see Lazear and Rosen, 1981, Chan, 1996, Tsoulouhas et al. (2000) and Agrawal et al., 2001). Second, using annual proxies and information circular of large Canadian corporations (excluding mining, prospecting and financial), we study empirically the timing of CEOs and other top executives in exercising their stock options. We find that CEOs appear to exercise their stock options a calendar year earlier than other top executives, consistent with our model.

The database we use is unique in its breath of information regarding executive compensation in Canada. The reason is that Canadian corporations listed on the Toronto Stock Exchange were not required to provide this information related to top-executive compensation until 1993. This information is published in the company's Management Proxy (or Information Circular) every year. Even if the average total pay of executives varies across countries (see Murphy, 1999), the difference between Canada and the U.S. is less so (see Helik, 1999).

The point of using Canadian data is not solely a question of testing existing managerial compensation theories with a different data base than previous studies that used U.S. data. The entire corporate governance of Canadian companies is very much different from that in the U.S., especially from a point of view of voting rights. In the U.S., very few stocks have multiple voting rights. And more often than not, those multiple voting rights are triggered only if a corporate raider launches a hostile takeover. These anti-takeover amendments are known as poison pills in the literature. In Canada, shares with multiple voting rights are much more frequent. They allow a company's founder to sell a huge portion of his future cash flows rights (dividends) while retaining control of

the corporation.

This brings us to the second important difference in corporate governance between the U.S. and Canada. The Berle and Means (1932) paradigm of diverse ownership of U.S. corporation does not apply in Canada. Many large Canadian companies are still owned in large part by its founder or by the founder's family. For example, Seagram's is owned by the Bronfmans, and Québecor by the Péladeau. Given that compensation policies and managerial share ownership are two important corporate governance mechanisms, it is not straightforward to expect U.S. corporate governance results to apply to Canada since the ownership and legal structure is not the same.

This paper does not address these issues directly. It is, however, important to keep those in mind when trying to compare results using American data and results using Canadian data. Our study focuses on the timing used by executives to exercise their stock options. More to the point, we want to compare when CEOs exercise their options compared to other top executives in the firm.

## 1.2 Relevant literature

The literature pertaining to CEO compensation packages is important (see Murphy, 1999). The compensation of other top executives has also been studied. What has not been studied in the literature is the timing of the total compensation of all executives. While research on CEO Stock-Based Compensation continues to debate the merits of such a compensation scheme (e.g., Bryan, Hwang and Lilien 2000) and its optimal structure (Hall and Murphy 2000), research on the motives for early exercise of employee stock options (ESO) is relatively sparse and fairly recent. In fact, research on the subject is almost non-existent prior to the ninety nineties since only few employees were compensated using options. The rise in the use of options but also issues related to the valuation of ESOs which have the particularity of not being traded has generated attention to this area.

A number of papers have examined the impact of agency, financial reporting and tax incentives of option grants (Matsunaga 1995, Yermack 1995 and Klassen and Mawani 2000). Recent, attempts by accounting standard setting bodies (e.g., FASB in the United States) to have companies recognize a compensation expense in their financial statement at the grant of the options has created an interesting controversy with respect to appropriate valuation techniques. A number of articles, even some in the financial press (e.g., Fox 1997) have shown that the restriction related to the sale of ESOs may create optimal conditions for early exercise. Optimal premature exercise of options modifies the concept of the term of the options and therefore their evaluation (Huddart 1994, Hemmer, Matsunaga and Shevlin 1994 and 1998).

In fact, motives for early exercise of ESOs can be structured in three groups: Macroeconomic-wide factors, Microeconomic-wide or firm related factors and Employee related or psychological factors. Among macro economic factors likely to have an impact on exercise, the most often cited are changes in interest rates and changes in tax laws. However, lack of longitudinal data in the area has not allowed significant testing of these hypotheses. Huddart (1998) does find that the frequency of exercise is greater for employees affected by a proposed tax rate increase. However, despite the greater frequency, less than one-third of the option holders who would benefit most from exercise for tax reasons chose to exercise earlier.

Firms play a role in the exercise decision of their employees. The characteristics they set on the stock option contracts (vesting schedule, expiration dates, share ownership targets) impose a first level of constraints and opportunities. The stock price movements and the predictability of prices (i.e, the volatility of the stock). Most studies show that employees exercise when the market to price ratios is high and when they is large uncertainty with respect to prices. Changes in dividend yield should have an impact on the value of the options but has not been captured empirically. Also, while their exist security laws with respect to insider trading, it is often suggested without empirical support that employees will exercise based on their private information. Firms can also buy back in-the-money options to be exercised with a tax deductible cash payment. Mawani (1998) examines the trade-offs between the opportunity cost of allowing options to be exercised and the cash cost of buying them back which trigger different financial reporting and tax consequences. Mawani finds evidence consistent with firms responding to financial reporting costs.

Employees are likely to exercise for risk diversification reasons and for liquidity reasons . Employees face a number of constraints such as firm-specific human capital, wealth limitations, security regulations regarding insider trading and non transferability provisions that do not apply to market participants in general. Hemmer, Matsunaga and Shevlin (1996) show that the decision of executives to exercise is positively related to the volatility of the stock but negatively related to the level of other compensation that serves to hedge against fluctuations and limits liquidity needs.

Other human factors also play a role. Heath, Huddart and Lang (1999) examined 50,000 exercise decisions at seven corporations and show, after controlling for economic factors, that psychological factors influence early exercise. More precisely, they show that employees exercise in response to stock price trends, i.e., exercise are positively related to stock returns during the preceding month and negatively related to returns over longer horizons. Their results are consistent with psychological models of values that include reference points, exercise being much greater in periods when stock prices exceed their maximum attained during the previous year. Cuny and Jorion (1995) argument that employees are more likely to stay with their employer if stock prices increases

and hence not exercise has not been validated in any study. Huddart and Lang (1996), using a similar database, find that the employee's level within the firm is a significant factors explaining early exercise by non executives (they do not examine the exercise behavior of CEO versus other executives). Beyond the effects of other compensation on risk and liquidity needs discussed above, top executives must publicly reveal the exercise of their ESOs, thus, creating a fir bit of attention on themselves.

Our paper explores another view of the choice to exercise based on the concept that maintaining ones options is a signaling mechanisms used by some executives under the setting of tournament theory (see the initial works by Lazear and Rosen 1981 and Rosen 1986 and a recent test of the theory in Scott and Thiessen 1999). Under tournament theory, the firm's hierarchical structure constitutes a tournament whereby incentives and signals by managers are generated through their desire to climb the organizational hierarchy.

### **1.3 Approach**

We know that CEOs would be inclined to exercise their stock options when they believe the stock to be over-valued, just as CEOs who own stocks will want to sell them when their price is high. Security bodies require the disclosure of these activities, thus this selling of call options and of stocks should send a message to the markets that the stock price is too high. We should therefore expect a reduction in the price of the stock following the public announcement that the CEO has sold the stock, or has exercised his call option. The same theory should apply to non-CEO top executives.

The intuition behind this hypothesis is that a company's top executives have more precise information related to the company's future cash flows. Therefore executives who expect future cash flows to be bad, and who expect the stock price to decline accordingly should sell off their stocks and call options. This information hypothesis could therefore explain negative abnormal returns on stocks for which an announcement has been made that some top executives have exercised their options.

This hypothesis does not explain, however, why some executives would exercise their stock options earlier than others. In fact, one could argue that all top-5 executives in a corporation have the same information, which means that they should all exercise at the same time. At least, we should not expect one type of executive to exercise systematically before all other four.

It is also possible that CEOs forbid through non-written contracts top executives to exercise stock options before the CEO does. A CEO would do that if he believes that the market would react too negatively to such an announcement. One possible negative signal would be that the non-CEO

executive is planning on leaving the company. Hayes and Schaefer (1999) show that corporations who lose a CEO or another top executive to another company have an abnormal return of -1,51% around the date where the announcement that the executive is leaving for a CEO position elsewhere is made. Therefore, if the market believes that an executive exercising his options is a signal that he is thinking of leaving, then the estimation of -1,51% of Hayes and Schaefer is an upper bound of the real negative abnormal return since the market reacted previously to the executive selling his stock or exercising his stock options.

CEOs may want to prevent such an event from occurring by forbidding other executives from exercising their options before he does. Given that other top-5 executives are more than five times as likely to depart than the CEO (and that they are less than five times the number), we have that a non-CEO executive who exercises his option is more likely to leave than a CEO who exercises his option.

## 2 Model

### 2.1 Setup

Let us take a very stylized model of executive behavior. Suppose there are three players, the CEO (agent 0), and two managers (agents 1 and 2) who live only two periods. The agent who is the CEO receives perquisite  $I_i \geq 0$ ,  $i \in \{0, 1, 2\}$ . An agent's perquisite of being a CEO is private information, and may thus be different for all agents. Let  $\lambda(I)$  represent the distribution of perk-types.

All these players are endowed with  $n_i$  options (at strike price  $K$ ) and  $m_i$  shares, and personal wealth  $Y_i$ ,  $i \in \{0, 1, 2\}$ . These endowments are common knowledge as they are made public in the management information circular or in the management proxy statements. The initial period's stock price is  $P$ . Period one's stock price is then  $P(1 + \mathbf{e})$ , where return  $\mathbf{e}$  is distributed with means  $R = E(\mathbf{e}) > 0$  and standard deviation  $\sigma = \sqrt{\text{Var}(\mathbf{e})}$ . This distribution of returns is the same for every period. We suppose that the three players cannot disrupt the stock return by their behavior. This is only done in order to simplify the model.<sup>1</sup>

In the first period, after observing period one's stock price, every agent must decide simultaneously whether to hold on to their stock and stock options or not (agents can only keep all of their endowed securities or sell all of their endowed securities).<sup>2</sup> This means that at the beginning of the

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<sup>1</sup>A more complete model would say that stock returns are more likely to be high when the CEO and the two managers have not sold any securities. We could then have that the behavior of the three agents influences the expected return, but not the variance of those returns. There are  $2^6 = 64$  possible combinations of behavior by the players. It would be possible to assign one expected return to each possible contingency. One contingency, denoted by 101001 would mean: CEO sells stock options, Manager 1 keeps stock options, Manager 2 sells stock options, CEO keeps stocks, Manager 1 keeps stocks, Manager 2 sells stocks.

<sup>2</sup>This approach does not take into account nesting periods and mandatory share ownership targets. We feel,



second period agent  $i \in \{0, 1, 2\}$  has  $\bar{n}_i$  options<sup>3</sup> and  $\bar{m}_i$  shares of the stock left in his portfolio, where  $\bar{n}_i \in \{0, n_i\}$  and  $\bar{m}_i \in \{0, m_i\}$ . The decision to sell or not is based on the known level of endowed securities, personal wealth and other financial parameters of the economy (stock price, distribution, etc...).

An agent who does not exercise his options or does not sell his stock in period one has to sell in period 2. Period 2 cash flows are discounted at rate  $d_i \geq 0$ ,  $i \in \{0, 1, 2\}$ , which may differ between agents (the discount factor is thus  $(1 + d_i)^{-1}$ ). This preference for time is private information for an agent. Let  $\delta(d)$  represent the distribution of discount-types.

Managers want to become the CEO. This may only occur when the incumbent CEO leaves the firm.<sup>4</sup> The incumbent CEO leaves the firm with exogenous probability  $s_n$  ( $s_m$ ) before period 2 if she exercised her option (sold her shares) in period 1. A CEO who leaves the firm receives outside income  $W \geq 0$ , which is known only to the incumbent CEO. Let  $\Omega(W)$  represent the distribution of outside income. We may view this outside income as another job or as the utility of leisure upon retirement.

In the case where the incumbent CEO has left the firm, a new CEO must be chosen. The new CEO may either be an inside manager or someone from the outside. A manager becomes the new CEO with some probability associated with the corporate citizenship he has shown toward the firm. Specifically, we will suppose that manager  $i$  becomes the CEO with probability  $\frac{1}{2} \frac{\bar{n}_i}{\bar{n}_i + \bar{n}_{-i} + \varepsilon_n} + \frac{\bar{m}_i}{\bar{m}_i + \bar{m}_{-i} + \varepsilon_m}$ . Variables  $\bar{n}_j$  and  $\bar{m}_j$  represent the number of stock options and the number of shares left in each manager's portfolio after the first period (that is, the number of each securities a manager did not sell in the first period).<sup>5</sup> The  $\varepsilon_n$  and  $\varepsilon_m$  terms represents the likelihood that an outsider is named CEO; this occurs with probability  $\frac{1}{2} \frac{\varepsilon_n}{\bar{n}_1 + \bar{n}_2 + \varepsilon_n} + \frac{\varepsilon_m}{\bar{m}_1 + \bar{m}_2 + \varepsilon_m}$ . Table 1 in the appendix illustrates the timing of events.

Each agent's payoff is given by the present value of each agent's final wealth. One must not forget that every agent must sell his shares or exercise his options by the end of the second period.

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however, that these concerns are not essential in our model; we can view  $m_i$  and  $n_i$  as the number of securities that are in play (i.e., that the manager or CEO is allowed to sell).

<sup>3</sup>Typical employee options have a much longer maturity than traded options. This means that there may be no market for these long term securities. We must then view the selling of options in our model as exercising the options at strike price  $K$ , and then selling of the stock itself at the market price.

<sup>4</sup>For a study on CEO turnover, see Agrawal et al. (2001) and Parrino (1997).

<sup>5</sup>It is clear that this stylized model can be generalized to  $A$  managers who fight for the CEO job, and by letting the weights on stock options and restricted shares that determine the next CEO not be  $\frac{1}{2}$ . We would then have that manager  $i$  becomes the next CEO with probability

$$\eta \mathbb{P}_A \frac{\bar{n}_i}{\sum_{j=1}^A \bar{n}_j + \varepsilon_n} + (1 - \eta) \mathbb{P}_A \frac{\bar{m}_i}{\sum_{j=1}^A \bar{m}_j + \varepsilon_m}$$

where  $\eta$  represents the weight assigned to stock options.

For ease of presentation let us separate the decision to exercise one's options from the decision to sell one's shares.

## 2.2 Payoff: Options

There are eight possible outcomes in the first period, given the observe performance of the stock in the first period. Suppose the observed price of the stock in period 1 is  $P(1+r)$ . The payoffs to each agent conditional on their first period action is given in the following tables. The only possible actions for every players is to sell all his stock options or to keep them all.

	Action	Payoff
Player 0	Sell	$Y_0 + n_0 \text{MAX} \{P(1+r) - K, 0\} + [s_n W + (1 - s_n) I_0] (1 + d_0)^{-1}$
Player 1	Sell	$Y_1 + n_1 \text{MAX} \{P(1+r) - K, 0\}$
Player 2	Sell	$Y_2 + n_2 \text{MAX} \{P(1+r) - K, 0\}$

	Action	Payoff
Player 0	Sell	$Y_0 + n_0 \text{MAX} \{P(1+r) - K, 0\} + [s_n W + (1 - s_n) I_0] (1 + d_0)^{-1}$
Player 1	Sell	$Y_1 + n_1 \text{MAX} \{P(1+r) - K, 0\}$
Player 2	Keep	$Y_2 + n_2 \text{MAX} \{P(1+r)(1+R) - K, 0\} (1 + d_2)^{-1} + s_n \frac{n_2}{n_2 + \varepsilon_n} I_2 (1 + d_2)^{-1}$

	Action	Payoff
Player 0	Sell	$Y_0 + n_0 \text{MAX} \{P(1+r) - K, 0\} + [s_n W + (1 - s_n) I_0] (1 + d_0)^{-1}$
Player 1	Keep	$Y_1 + n_1 \text{MAX} \{P(1+r)(1+R) - K, 0\} (1 + d_1)^{-1} + s_n \frac{n_1}{n_1 + \varepsilon_n} I_1 (1 + d_1)^{-1}$
Player 2	Sell	$Y_2 + n_2 \text{MAX} \{P(1+r) - K, 0\}$

	Action	Payoff
Player 0	Sell	$Y_0 + n_0 \text{MAX} \{P(1+r) - K, 0\} + [s_n W + (1 - s_n) I_0] (1 + d_0)^{-1}$
Player 1	Keep	$Y_1 + n_1 \text{MAX} \{P(1+r)(1+R) - K, 0\} (1 + d_1)^{-1} + s_n \frac{n_1}{n_1 + n_2 + \varepsilon_n} I_1 (1 + d_1)^{-1}$
Player 2	Keep	$Y_2 + n_2 \text{MAX} \{P(1+r)(1+R) - K, 0\} (1 + d_2)^{-1} + s_n \frac{n_2}{n_1 + n_2 + \varepsilon_n} I_2 (1 + d_2)^{-1}$

	Action	Payoff
Player 0	Keep	$Y_0 + n_0 \text{MAX} \{P(1+g)(1+R) - K, 0\} (1 + d_0)^{-1} + I_0 (1 + d_0)^{-1}$
Player 1	Sell	$Y_1 + n_1 \text{MAX} \{P(1+r) - K, 0\}$
Player 2	Sell	$Y_2 + n_2 \text{MAX} \{P(1+r) - K, 0\}$

	Action	Payoff
Player 0	Keep	$Y_0 + n_0 \text{MAX} \{P(1+r)(1+R) - K, 0\} (1 + d_0)^{-1} + I_0 (1 + d_0)^{-1}$
Player 1	Sell	$Y_1 + n_1 \text{MAX} \{P(1+r) - K, 0\}$
Player 2	Keep	$Y_2 + n_2 \text{MAX} \{P(1+r)(1+R) - K, 0\} (1 + d_2)^{-1}$

	Action	Payoff
Player 0	Keep	$Y_0 + n_0 \text{MAX} \{P(1+r)(1+R) - K, 0\} (1 + d_0)^{-1} + I_0 (1 + d_0)^{-1}$
Player 1	Keep	$Y_1 + n_1 \text{MAX} \{P(1+r)(1+R) - K, 0\} (1 + d_1)^{-1}$
Player 2	Sell	$Y_2 + n_2 \text{MAX} \{P(1+r) - K, 0\}$

	Action	Payoff
Player 0	Keep	$Y_0 + n_0 \text{MAX} \{P(1+r)(1+R) - K, 0\} (1+d_0)^{-1} + I_0 (1+d_0)^{-1}$
Player 1	Keep	$Y_1 + n_1 \text{MAX} \{P(1+r)(1+R) - K, 0\} (1+d_1)^{-1}$
Player 2	Keep	$Y_2 + n_2 \text{MAX} \{P(1+r)(1+R) - K, 0\} (1+d_2)^{-1}$

We can now analyze the optimal strategy of the three players contingent upon observing that the first period price of the stock is  $P(1+r)$ . Starting with the incumbent CEO (player 0), her decision to exercise her stock options or not does not depend on the behavior of the two other players. We have that she exercises her stock options when

$$\frac{1}{2} Y_0 + n_0 \text{MAX} \{P(1+r) - K, 0\} + [s_n W + (1-s_n) I_0] (1+d_0)^{-1} > \frac{3}{4} Y_0 + n_0 \text{MAX} \{P(1+r)(1+R) - K, 0\} (1+d_0)^{-1} + \frac{1}{4} I_0 (1+d_0)^{-1}$$

Which means that

$$\frac{1}{2} n_0 \text{MAX} \{P(1+r) - K, 0\} + s_n (W - I_0) (1+d_0)^{-1} > n_0 \text{MAX} \{P(1+r)(1+R) - K, 0\} (1+d_0)^{-1} \quad (1)$$

There are three possibilities here, depending on the strike price  $K$ . Note that the initial wealth of the manager (or his non-firm related income, whichever is best represented by  $Y_0$ ) does not enter the CEO's decision to exercise his stock options.

First, suppose  $P(1+r)(1+R) < K$  (recall that  $R > 0$ , which means that  $P(1+r) < P(1+r)(1+R)$ ) it follows that the player 0 exercises her stock options if and only if  $W - I_0 > 0$ . That is to say that player 0 exercises her stock options only if her outside opportunity is greater than the perquisites she gets from remaining the CEO.

Second, suppose that  $P(1+r) < K < P(1+r)(1+R)$ . We then have that player 0 exercises her stock options if and only if

$$s_n (W - I_0) > n_0 \{P(1+r)(1+R) - K\} \quad (2)$$

This means that  $W - I_0 > 0$  is necessary for player 0 to exercise her options.

Third, suppose that  $K < P(1+r) < P(1+r)(1+R)$ . We then have that player 0 exercises her stock options if and only if

$$n_0 \{P(1+r) - K\} + s_n (W - I_0) (1+d_0)^{-1} > n_0 \{P(1+r)(1+R) - K\} (1+d_0)^{-1}$$

This becomes

$$s_n (W - I_0) > n_0 P(1+r) [R - d_0] + n_0 K d_0 \quad (3)$$

or

$$s_n (W - I_0) > n_0 P(1+r) R - n_0 d_0 [P(1+r) - K]$$

Again,  $W - I_0 > 0$  is necessary for player 0 to exercise her options.

We can draw some conclusions when options are in the money ( $P(1+r) - K > 0$ ). The greater the outside opportunity  $W$ , the more likely a CEO will exercise his stock options. The higher the perquisites  $I_0$  related to the CEO position in the firm, the less likely. The greater the number of stock options  $n_0$ , the less will he exercise them. The greater the strike price  $K$ , the less likely. The greater the impatience  $d_0$  the more likely. The greater the expected return  $R$ , the less likely. Finally, the greater the probability of being ousted, the more (less) likely he will exercise if  $W < I_0$  ( $W > I_0$ ).

For the managers, the problem is slightly different since they must anticipate the CEO's decision and the other manager's behavior. Let  $\psi_i$ ,  $i \in \{0, 1, 2\}$  be the subjective probability assigned to player  $i$ 's exercising his stock options. We then have that player 1 exercises his options when

$$n_1 \text{MAX} \{P(1+r) - K, 0\} > \psi_0 \psi_2 \left( n_1 \text{MAX} \{P(1+r)(1+R) - K, 0\} (1+d_1)^{-1} + s_n \frac{n_1}{n_1 + \varepsilon_n} I_1 (1+d_1)^{-1} \right) + \psi_0 (1 - \psi_2) \left( n_1 \text{MAX} \{P(1+r)(1+R) - K, 0\} (1+d_1)^{-1} + s_n \frac{n_1}{n_1 + n_2 + \varepsilon_n} I_1 (1+d_1)^{-1} \right) + (1 - \psi_0) n_1 \text{MAX} \{P(1+r)(1+R) - K, 0\} (1+d_1)^{-1} \quad (4)$$

whereas player 2 exercises his options when

$$n_2 \text{MAX} \{P(1+r) - K, 0\} > \psi_0 \psi_1 \left( n_2 \text{MAX} \{P(1+r)(1+R) - K, 0\} (1+d_2)^{-1} + s_n \frac{n_2}{n_2 + \varepsilon_n} I_2 (1+d_2)^{-1} \right) + \psi_0 (1 - \psi_1) \left( n_2 \text{MAX} \{P(1+r)(1+R) - K, 0\} (1+d_2)^{-1} + s_n \frac{n_2}{n_1 + n_2 + \varepsilon_n} I_2 (1+d_2)^{-1} \right) + (1 - \psi_0) n_2 \text{MAX} \{P(1+r)(1+R) - K, 0\} (1+d_2)^{-1} \quad (5)$$

As for the CEO, it is interesting to note that the managers' initial wealth does not impact their decision to exercise their stock options. Not only does it not enter one manager's decision to exercise, but, as a ricochet, it does not enter the other managers' perception that the first manager will exercise.

The first result that is obvious is that a manager (player 1 and player 2) will not exercise his stock options if  $P(1+r) - K < 0$ . In other words, a manager will never exercise his option if it is out of the money. A necessary condition for a manager to exercise his option is then  $P(1+r)(1+R) > P(1+r) > K$ . We then have that player 1 exercises if and only if

$$I_1 \mu_1 + P(1+r)R - \{P(1+r) - K\}d_1 < 0 \quad (6)$$

whereas player 2 exercises if and only if

$$I_2\mu_2 + P(1+r)R - \{P(1+r) - K\}d_2 < 0 \quad (7)$$

The term  $\mu_1 = \psi_0 s_n \frac{\psi_2 n_2 + n_1 + \varepsilon_n}{(n_2 + \varepsilon_n)(n_1 + n_2 + \varepsilon_n)}$  (resp.  $\mu_2 = \psi_0 s_n \frac{\psi_1 n_1 + n_2 + \varepsilon_n}{(n_2 + \varepsilon_n)(n_1 + n_2 + \varepsilon_n)}$ ) represents the subjective probability that player 1 (resp. player 2) will become the CEO. Given these are subjective probabilities, it is quite normal that they do not sum to one.

General conclusions may be drawn here. The more impatient a manager  $d_i$ , the more likely he will exercise. The greater the strike price  $K$ , the less likely. The greater the expected return  $R$ , the less likely. The greater the probability the CEO will exercise ( $\psi_0$ ), the greater the probability he will be ousted ( $s_n$ ), the greater the prerequisite of becoming a CEO ( $I_i$ ), and the greater the probability the other manager will exercise his stock options ( $\psi_{-i}$ ) the less likely to exercise. The greater the number of stock options owned by each manager ( $n_{-i}$  and  $n_i$ ) (the greater the amount given to underlings), the more likely they are to exercise. Finally, the more noise in hiring the new CEO ( $\varepsilon_n$ ), the more likely.

It is clear that the importance of  $\psi_0$  and  $\psi_{-i}$  must be stressed. These variables are subjective probabilities assigned by the managers given that they know only the distribution of  $W$ ,  $I$  and  $d$ , but not the actual values of each variable (in other words,  $\psi_0 = g_0(\Omega(W), \lambda(I), \delta(d))$ ,  $\psi_{-i} = g_{-i}(\lambda(I), \delta(d))$ ).

### 2.3 Payoff: Shares

Again, given the observe performance of the stock in the first period there are eight possible outcomes. Suppose the observed price of the stock in period 1 is  $P(1+r)$ . The payoffs to each agent conditional on their first period action is given in the following tables. The only possible actions for every players is to sell all his shares or to keep them all.

	Action	Payoff
Player 0	Sell	$Y_0 + m_0 P(1+r) + [s_m W + (1 - s_m) I_0] (1 + d_0)^{-1}$
Player 1	Sell	$Y_1 + m_1 P(1+r)$
Player 2	Sell	$Y_2 + m_2 P(1+r)$

	Action	Payoff
Player 0	Sell	$Y_0 + m_0 P(1+r) + [s_m W + (1 - s_m) I_0] (1 + d_0)^{-1}$
Player 1	Sell	$Y_1 + m_1 P(1+r)$
Player 2	Keep	$Y_2 + m_2 P(1+r) (1 + R) (1 + d_2)^{-1} + s_m \frac{m_2}{m_2 + \varepsilon_m} I_2 (1 + d_2)^{-1}$

	Action	Payoff
Player 0	Sell	$Y_0 + m_0 P(1+r) + [s_m W + (1 - s_m) I_0] (1 + d_0)^{-1}$
Player 1	Keep	$Y_1 + m_1 P(1+r) (1 + R) (1 + d_1)^{-1} + s_m \frac{m_1}{m_1 + \varepsilon_m} I_1 (1 + d_1)^{-1}$
Player 2	Sell	$Y_2 + m_2 P(1+r)$

	Action	Payoff
Player 0	Sell	$Y_0 + m_0P(1+r) + [s_mW + (1-s_m)I_0](1+d_0)^{-1}$
Player 1	Keep	$Y_1 + m_1P(1+r)(1+R)(1+d_1)^{-1} + s_m \frac{m_1}{m_1+m_2+\varepsilon_m} I_1(1+d_1)^{-1}$
Player 2	Keep	$Y_2 + m_2P(1+r)(1+R)(1+d_2)^{-1} + s_m \frac{m_2}{m_1+m_2+\varepsilon_m} I_2(1+d_2)^{-1}$

	Action	Payoff
Player 0	Keep	$Y_0 + m_0P(1+g)(1+R)(1+d_0)^{-1} + I_0(1+d_0)^{-1}$
Player 1	Sell	$Y_1 + m_1P(1+r)$
Player 2	Sell	$Y_2 + m_2P(1+r)$

	Action	Payoff
Player 0	Keep	$Y_0 + m_0P(1+r)(1+R)(1+d_0)^{-1} + I_0(1+d_0)^{-1}$
Player 1	Sell	$Y_1 + m_1P(1+r)$
Player 2	Keep	$Y_2 + m_2P(1+r)(1+R)(1+d_2)^{-1}$

	Action	Payoff
Player 0	Keep	$Y_0 + m_0P(1+r)(1+R)(1+d_0)^{-1} + I_0(1+d_0)^{-1}$
Player 1	Keep	$Y_1 + m_1P(1+r)(1+R)(1+d_1)^{-1}$
Player 2	Sell	$Y_2 + m_2P(1+r)$

	Action	Payoff
Player 0	Keep	$Y_0 + m_0P(1+r)(1+R)(1+d_0)^{-1} + I_0(1+d_0)^{-1}$
Player 1	Keep	$Y_1 + m_1P(1+r)(1+R)(1+d_1)^{-1}$
Player 2	Keep	$Y_2 + m_2P(1+r)(1+R)(1+d_2)^{-1}$

We can now analyze the optimal strategy of the three players contingent upon observing that the first period price of the stock is  $P(1+r)$ . Starting with the incumbent CEO (player 0), her decision to sell her shares or not does not depend on the behavior of the two other players. We have that she sells her shares when

$$Y_0 + m_0P(1+r) + [s_mW + (1-s_m)I_0](1+d_0)^{-1} > Y_0 + m_0P(1+r)(1+R)(1+d_0)^{-1} + I_0(1+d_0)^{-1}$$

Which means that

$$s_m(W - I_0) - m_0P(1+r)[R - d_0] > 0 \quad (8)$$

We can draw some conclusions. First, the CEO's initial wealth has no impact on his decision to sell his shares. The greater the outside opportunity  $W$ , the more likely a CEO is to sell his stock. The higher the perquisites  $I_0$  related to the CEO position in the firm, the less likely will she sell. If the outside opportunity is greater (smaller) than the CEO's perquisite, then the greater the probability of being ousted  $s_m$  the greater (smaller) the likelihood of selling her shares. If the expected return is greater (lower) than the CEO's discount rate, then the greater the CEO's period one wealth  $m_0P(1+r)$ , the less (more) likely to sell. The greater the impatience  $d_0$  the more likely to sell, and the greater the expected return  $R$ , the less likely.

For the managers, the problem is slightly different since they must anticipate the CEO's decision and the other manager's behavior. Let  $\phi_i$ ,  $i \in \{0, 1, 2\}$  be the subjective probability assigned to player  $i$ 's selling his shares. We then have that player 1 sells his shares when

$$m_1 P(1+r) > \phi_0 \phi_2 \left( m_1 P(1+r)(1+R)(1+d_1)^{-1} + s_m \frac{m_1}{m_1 + \varepsilon_m} I_1 (1+d_1)^{-1} \right) + \phi_0(1-\phi_2) \left( m_1 P(1+r)(1+R)(1+d_1)^{-1} + s_m \frac{m_1}{m_1 + m_2 + \varepsilon_m} I_1 (1+d_1)^{-1} \right) + (1-\phi_0) m_1 P(1+r)(1+R)(1+d_1)^{-1} \quad (9)$$

whereas player 2 sells his shares when

$$m_2 P(1+r) > \phi_0 \phi_1 \left( m_2 P(1+r)(1+R)(1+d_2)^{-1} + s_m \frac{m_2}{m_2 + \varepsilon_m} I_2 (1+d_2)^{-1} \right) + \phi_0(1-\phi_1) \left( m_2 P(1+r)(1+R)(1+d_2)^{-1} + s_m \frac{m_2}{m_1 + m_2 + \varepsilon_m} I_2 (1+d_2)^{-1} \right) + (1-\phi_0) m_2 P(1+r)(1+R)(1+d_2)^{-1} \quad (10)$$

Simplifying, we have that player 1 sells his shares if and only if

$$\nu_1 I_1 + P(1+r)(R-d_1) < 0 \quad (11)$$

whereas player 2 sells his shares if and only if

$$\nu_2 I_2 + P(1+r)(R-d_2) < 0 \quad (12)$$

The term  $\nu_1 = \phi_0 s_m \frac{\phi_2 m_2 + m_1 + \varepsilon_m}{(m_1 + \varepsilon_m)(m_1 + m_2 + \varepsilon_m)}$  (resp.  $\nu_2 = \phi_0 s_m \frac{\phi_1 m_1 + m_2 + \varepsilon_m}{(m_1 + \varepsilon_m)(m_1 + m_2 + \varepsilon_m)}$ ) represents the subjective probability that player 1 (resp. player 2) will become the CEO. Given these are subjective probabilities, it is quite normal that they do not sum to one. As in the stock option case, a manager's decision to sell his shares does not depend on his initial wealth nor does it depend on his perception of the other manager's wealth. This, however, would no longer be the case when agents are risk averse.

The same general conclusions as in the case of stock options may be drawn here. A necessary condition for a manager to sell his shares early is for the expected stock return to be smaller than the manager's impatience rate ( $R < d_i$ ). So, given  $R < d_i$ , the more impatient a manager  $d_i$ , the more likely he will sell his shares. The greater the expected return  $R$ , the less likely. A manager is less likely to sell his shares early when the probability the CEO will exercise ( $\phi_0$ ) is larger, when the probability he will be ousted ( $s_m$ ) is larger, when the prerequisite of becoming a CEO ( $I_i$ ) is larger, and when the probability the other manager will exercise his stock options ( $\phi_{-i}$ ) is larger.

The greater the number of shares owned by each manager ( $m_{-i}$  and  $m_i$ ), the more likely - the greater the amount given to underlings, the more likely they are to sell their shares early. Finally, the more noise in hiring the new CEO ( $\varepsilon_m$ ), the more likely.

It is clear that the importance of  $\phi_0$  and  $\phi_{-i}$  must be stressed. These variables are subjective probabilities assigned by the managers given that they know only the distribution of  $W$ ,  $I$  and  $d$ , but not the actual values of each variable (in other words,  $\phi_0 = h_0(\Omega(W), \lambda(I), \delta(d))$ ,  $\phi_{-i} = \eta_{-i}(\lambda(I), \delta(d))$ ).

## 2.4 Exercising Stock Options vs. Selling Shares

What we want to do in this section is observe whether agents are more likely to exercise their stock options or to sell their shares. As previously stated, exercising one's options in this paper is the equivalent of cashing out. In other words, exercising one's options does not increase the share ownership of the agent. Starting with the incumbent CEO, he is more likely to exercise his stock options if<sup>6</sup>

$$s(W - I_0) > n_0P(1 + r)[R - d_0] + n_0d_0K$$

is more likely than

$$s(W - I_0) > m_0P(1 + r)[R - d_0]$$

This means that the CEO is more likely to exercise her stock options if and only if

$$m_0P(1 + r)[R - d_0] > n_0P(1 + r)[R - d_0] + n_0d_0K$$

and

$$(m_0 - n_0)P(1 + r)[R - d_0] > n_0d_0K$$

It is interesting to note that if the CEO is endowed with the no more shares of stock than as stock options ( $m_0 \leq n_0$ ), then he will always sell his shares before he exercises his stock options, provided  $R > d_0$ .

For a manager (say agent 2), he is more likely to exercise his stock options when

$$\mu_2I_2 + P(1 + r)[R - d_2] + Kd_2 < 0$$

is more likely than

$$\nu_2I_2 + P(1 + r)[R - d_2] < 0$$

This occurs when

$$Kd_2 - (\nu_2 - \mu_2)I_2 < 0$$

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<sup>6</sup>We only study the case where the options are in the money as of period one.



If  $\nu_2 \leq \mu_2$ , that is the manager assigns greater subjective probability that he will become the CEO because of stock options rather than shares, then the managers will sell his shares of stock before he exercises his stock options. If this is not the case, then it is interesting to note that the greater the perks of becoming a CEO ( $I_2$ ), the more likely a manager is to exercise his stock options before he sells his shares of stock. On the other hand, the higher the stock option's strike price ( $K$ ) and the higher the manager's discount rate ( $d_2$ ), the more likely he is to sell his shares of stock before he exercises his stock options.

Whether a manager believes that his ownership of shares is more or less important than his ownership of stock options depends on a multitude of factors, some being objective, other being subjective. A manager is more likely to sell his stock options before his shares of stock if  $\nu_2 - \mu_2 > 0$ . This occurs when

$$\phi_0 s_m \frac{\phi_1 m_1 + m_2 + \varepsilon_m}{(m_1 + \varepsilon_m)(m_1 + m_2 + \varepsilon_m)} - \psi_0 s_n \frac{\psi_1 n_1 + n_2 + \varepsilon_n}{(n_2 + \varepsilon_n)(n_1 + n_2 + \varepsilon_n)} > 0$$

This is more likely to occur the greater the subjective probability that the other two players sell their shares of stock ( $\phi_0$  and  $\phi_1$ ), and the greater the objective probability that the incumbent CEO will be ousted after he has sold his stock ( $s_m$ ). The opposite impact is true for the stock options.

### 3 Econometric Approach

The main test we want to conduct in this paper is whether other executives exercise their stock options at a later date than CEOs. Since a CEO's decision to exercise occurs at the same time as the other executive's decision, an executive's decision to exercise cannot depend directly on whether the CEO is exercising at the same time. What the executive can do, however, is evaluate the probability that the CEO will exercise at the same time that he is. In other words, the executive can try to predict whether the CEO will exercise. To reduce noise in the estimations, we aggregated all non-CEO executives into one.

The main testable equation of our paper is that a manager's decision to exercise depends on many factors, including the CEO's decision to exercise the previous period. The testable equation can thus be written as

$$ExerRatio_t = Cst + CeoEx_{t-1} + Cash_t + Unvested_t + Si ze_t \quad (13)$$

The dependent variable is constructed as the ratio of the value of exercised options to the value of all exercisable options. All exercisable options is calculated as the sum of exercised options and vested options:

$$ExerRatio_t = \frac{Exercised_t}{Exercised_t + Vested_t} \quad (14)$$

The  $CeoEx_{t-1}$  variables calculated the same way, but for the CEO: Ratio of exercised options to exercisable options. The  $Cash_t$  variable represents all other types of compensation received by the executive that year: Salary, bonuses, other payments, etc.  $Unvested_t$  is the value of remaining unexercisable options (that is, non-vested options) the manager is guaranteed to receive in the next few years.  $Cash$  and  $Unvested$  are given in millions of dollars.

Our theory predicts a positive sign on the  $CeoEx$  variable since we expect non-CEO executives to wait for the CEO to exercise their stock options before doing so themselves. The sign on the  $Cash$  variable would be negative for two reasons. First, poorer individuals should be willing to bear less risk than wealthier individuals. This means that wealthier managers should be more willing to keep their stock options instead of cashing them out. Another reason why wealthier managers should not want to exercise their stock options is that they are less likely to be faced with liquidity problems. As the  $Cash$  variable can be seen as a proxy for wealth, we expect its impact on  $ExerRatio$  to be negative. Similarly, managers that will have the right to exercise more options in the future should smooth their income by exercising more today. We therefore expect that the total value of unvested stock options ( $Unvested$ ) will have a positive impact on the proportion of exercised options to total options. Finally, we want to control for the size of the corporation ( $Size$ ). We proxy the size of the corporation as the log of the market value of the corporation. Size should have a positive impact on the exercising behavior exercise behavior of managers if incumbent CEOs extract more perks from being CEO of a large firm than CEO of a small firm. By receiving more perks from being a large-corporation CEO reduces the probability that the CEO will leave, which means that managers should exercise their options with greater probability. Another possibility is that size represents the number of possible appointees to the CEO position: The greater the size, the greater the competition. This means that with more managers competing for the job, managers may feel that their probability of being appointed is small, which means that they may (see Agrawal et al, 2001).

Following our tournament approach, we should expect that managers will exercise more often when a new CEO has been appointed than if the CEO has more tenure. There are two possible reasons to expect a positive impact of a new CEO appointment on option exercise. First, the CEO has, presumably, more years ahead of him when initially appointed than with a few years under his belt. This means that managers will need to wait a long time before being able to play the CEO tournament again. Second, spurned managers are likely to cash out their options and leave the firm: They do not want to serve in heaven. This means that the appointment of a new CEO ( $NewCeo$ ) should have a positive impact on  $ExerRatio$ .

Other variable used to control for the corporate governance are whether the CEO is also the

chairman of the board (*CeoCob*), whether the corporation has issued multiple classes of shares (*Multiple*), the CEO's percentage of ownership (*PcCeo*), the board member's percentage of ownership (*PcBoard*), the blockholder's percentage of ownership (*PcBlock*) and the ratio of firm unrelated board member to total board members (*UnrBoard*). Our theory predicts that managers are less likely to exercise when incumbent CEOs are more likely to leave (as a result of being fired or whatever). This means that corporate governance factors that increase the CEO's entrenchment in the company should reduce the likelihood of the CEO leaving, and thus increase the likelihood of the managers exercising their stock options.

The *NewCeo* variable takes the value 1 if a new CEO has been appointed that year and 0 otherwise. The *CeoCob* variable take the value 1 if the CEO is also the chairman of the board and 0 otherwise. *Multiple* equals 1 if the corporation has more than one class of shares outstanding, and 0 if there is only one class. The ownership variables (*PcCeo*, *PcBoard* and *PcBlock*) are constructed as the shares of each type of owner (CEO, board members and blockholders respectively) divided by the total number of shares in the corporation. We define a blockholder as a stockholder that owns more than 10 % of the outstanding shares of the stock. Finally, *UnrBoard* is constructed as the number of board directors that are unrelated to the corporation divided by the total number of directors on the board.

Our prediction is therefore that when the CEO is the chairman of the board (*CeoCob*), when the CEO has more stock (*PcCeo*) and the presence of multiple voting shares (*Multiple*) should increase the likelihood that managers exercise their options. These three factors increase, presumably, the CEOs control over the company. This means that CEO should be less likely to leave or be fired. Consequently, managers do not need to behave as good citizens of the corporation as they are not very likely to replace the current CEO.

On the other hand, the blockholder's percentage of ownership (*PcBlock*) and the presence of more unrelated directors on the board (*UnrBoard*) should reduce the managers' incentives to exercise their stock options early. It has been hypothesized (see Agrawal and Knoeber, 1996, and Schleifer and Vishny, 1997) that large blockholders and outsiders on the board are more likely to scrutinize the behavior of CEOs. Less entrenched CEOs are more likely to depart, whether they are fired or because of any other reason (loss of prestige). As their departure is more likely, managers should reduce their probability of exercising their options in the hope of becoming the next CEO.

### **3.1 Data Source**

We collected precise information regarding executive compensation of publicly traded Canadian companies listed on the Toronto Stock Exchange. Since 1993 every company traded on the TSE

must make public a lot more information that was required previously. They also needed to divulge information regarding 1991 and 1992 in order for the investor public to get an historical point of view. This information is made public once a year in the management proxy (information circular). The information contained in these proxies include 1) the name of the main stockholder; 2) the total compensation package (base salary, bonus, number of common shares and call options received) for the firm's top-5 executives; 3) the number of exercised options and their value, as well as the number and the value of vested and non-vested options; and 4) the board structure (name and position) and the number of shares owned by each member. Management proxies also gives us the details about the type of vesting rights the executives have, as well as the voting rights of each type of common shares.

Since 1996 all this information is available on the internet site of SEDAR (<http://www.sedar.com/>). Prior to this date the information must be collected from the companies directly (for free allegedly), or from Micromedia (at a price). The names of the 366 companies coded and the years used are listed at the end of this paper. The summary statistics are presented in table 1 in the appendix.

## 4 Results

In figures 1 and 2 we compared the salaries and bonuses of the CEO and of the other top executives. As we can see, it seems that the salary and bonus of CEOs and other top executives follow the same pattern. When we include exercised options (figures 3 and 4), we see that CEOs seem to receive a large lump-sum of money one year before other top executives. Since the only difference between figures 1 and 3 is the value of exercised options, and that salaries and bonuses seem to follow the same pattern, it has to be that CEOs exercise their options earlier than other top executives. Figures 5 and 6 present the trend in options granted for the two groups.

These aggregate results allow us to imagine that there is probably some game played between CEOs and managers who want to become managers. These results are not informative, however: The aggregation is too large. What we want to look at more closely is the behavior of managers in individual firms. These results appear in Table 2.

We present in Table 2 preliminary OLS regressions that explain the proportion of exercised options of the managers as a group. In model 1, we present the basic results where no corporate governance data is introduced. We see that all our initial hypotheses hold. The managers' ratio of exercised options to exercisable option is positively linked to the CEO's past ratio of exercised options to exercisable option ( $CeoEx_{t-1}$ ), the manager's cash income ( $Cash$ ) and the value of unvested options ( $Unvested$ ). The market value of equity variable ( $Size$ ) is also significant and positive, supporting the view that larger firms may offer CEOs perks that make CEOs less likely

to leave.

In model 2, we replace the manager’s compensation variables (*Cash* and *Unvested*) by corporate governance variables to see if the governance structure has any influence on the exercising behavior of managers. We see that only the appointment of a new CEO (*NewCeo*) and the presence of large blockholders (*PcBlock*) have an incidence on the exercising behavior of non-CEO executives. These impacts are of the correct sign. When a new CEO is appointed, managers start exercising their stock options as they have lost the CEO tournament; there is no longer any point in being a good citizen of the corporation. The presence of large blockholders reduce the likelihood that managers will exercise, in line with the hypothesis that blockholders oversee more carefully the CEO’s actions, which makes him less entrenched and therefore more likely to leave. Similarly, blockholders may put more emphasis on non-CEO managers for being good citizens of the corporation. None of the other corporate governance variables are significant, although some have to expected sign. The presence of a more entrenched CEO (those who are chairman of the board and/or who own more stock in the company) increases the likelihood that managers will exercise their options.

The last model presented in table 2 combines both the corporate governance variables and the manager’s compensation variables. The results do no change dramatically: The variables that were significant in the two other models remain significant, and the variables that were not significant remain non-significant.

## 5 Conclusion

This paper presents a model of managerial tournament where the big prize is to become CEO in the event where the current CEO retires, is fired or leaves for any other reason. Our empirical results suggest that, in accordance with tournament models, non-CEO managers wait to see if the incumbent CEO has exercised his stock options before exercising theirs. Moreover, as soon as a new CEO is appointed, other managers are more likely to exercise their options. This supports the perception that managers who were not appointed as the new CEO lost the tournament, and that they no longer need to behave as spotless citizens of the corporation.

It is clear that we will need to refine the analysis by incorporating stock market data to explain more precisely the timing of option exercise. Moreover, there is the need to account for the origin of the CEO (was he appointed from within or from the outside) and other factors that may have an impact on the manager’s decision to exercise.

An interesting future avenue of research would be to test the probability that any manager exercises his stock option. In the present paper, we aggregated all the managers into a single agent. Given the tournament setting presented it may be important to treat each manager

seperatly and observe how the behavior of each manager influences the behavior of the others. .

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## 7 Appendix

Table 1. Summary Statistics

Variable	Mean	Median	Standard Deviation
ExerRatio	0.1502	0.0000	0.2878
CeoEx <sub>t-1</sub>	0.0987	0.0000	0.2652
Size	8.8096	8.0828	9.3096
Cash	0.2708	0.1835	0.3655
Unvested	0.1809	0.0019	1.0104
NewCeo	0.1185	0.0000	0.3233
CeoCob	0.4166	0.0000	0.4932
PcCeo	0.1479	0.0143	0.2420
PcBoard	0.2893	0.1945	0.2891
PcBlock	0.4461	0.4535	0.2872
Multiple	0.1828	0.0000	0.3866
UnrBoard	0.6336	0.6667	0.1841

The number of usable observations is not the same for each variable due to missing values.

The number of observations goes from 1433 to 1510.

Table 2. The determinants of non-CEO managers option exercise  
 Dependent variable is  $ExerRatio = \frac{Exercised}{Exercised+Vested}$ .

Variable	Model 1	Model 2	Model 3
Intercept	-0.3428*** (0.0862)	-0.4202*** (0.0851)	-0.2924*** (0.0961)
ExCeo <sub>t-1</sub>	0.1140*** (0.0279)	0.1075*** (0.0281)	0.1072*** (0.0281)
Size	0.0248*** (0.0048)	0.0321*** (0.0042)	0.0243*** (0.0050)
Cash	0,0413* (0.0226)		0,0471** (0.0233)
Unvested	0.0326** (0.0163)		0.0293* (0.0164)
NewCeo		0.0456** (0.0233)	0.0423* (0.0233)
CeoCob		0.0207 (0.0165)	0.0210 (0.0165)
PcCeo		0.0258 (0.0442)	0.0301 (0.0442)
PcBoard		0.0005 (0.0396)	-0.0162 (0.0399)
PcBlock		-0.0834*** (0.0298)	-0.0826*** (0.0299)
Multiple		-0.0092 (0.0204)	-0.0079 (0.0204)
UnrBoard		-0.0350 (0.0427)	-0.0257 (0.0427)
$\bar{R}^2$	0.058	0.061	0.065
N	1416	1409	1409

The standard error is in parentheses.

\*, \*\*, \*\*\* are significant at the 10 %, 5 % and 1 % level respectively.

The differences in the sample size come from missing observations.

Initial period	Each agent $i \in \{0, 1, 2\}$ is endowed with initial stock options $n_i$ at strike price $K$ and shares $m_i$	The initial price of the stock is $P$	
Period 1		Nature chooses stock return $b < 0 < g$	Agents choose simultaneously to exercise their stock options and/or to sell their shares or not
Period 2 CEO retires with probability $s$ if he exercised his options or sold his shares in period 1	Agent $i \in \{1, 2\}$ becomes the new CEO with probability $\frac{1}{2} \frac{\bar{n}_i}{\bar{n}_i + \bar{n}_{-i} + \varepsilon_n} + \frac{\bar{m}_i}{\bar{m}_i + \bar{m}_{-i} + \varepsilon_m}$	Nature chooses stock return $b < 0 < g$	Agents exercise their remaining stock options and sell their remaining shares
Period 2 <div style="border: 1px solid black; padding: 5px; display: inline-block;"> <p>CEO stays if he did not exercise or sell anything in period 1</p> <p>CEO stays with probability <math>1 - s</math> if he exercised his options or sold his shares in period 1</p> </div>	No new CEO is appointed	Nature chooses stock return $b < 0 < g$	Agents exercise their remaining stock options and sell their remaining shares

FIGURE 1

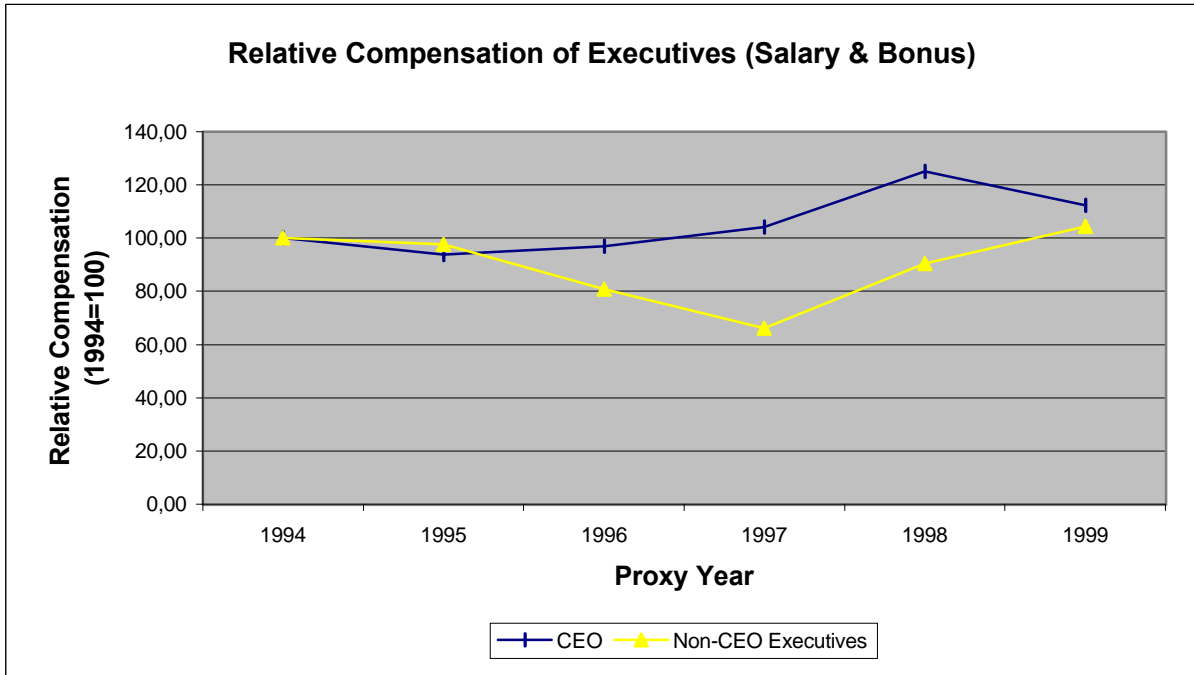


FIGURE 2

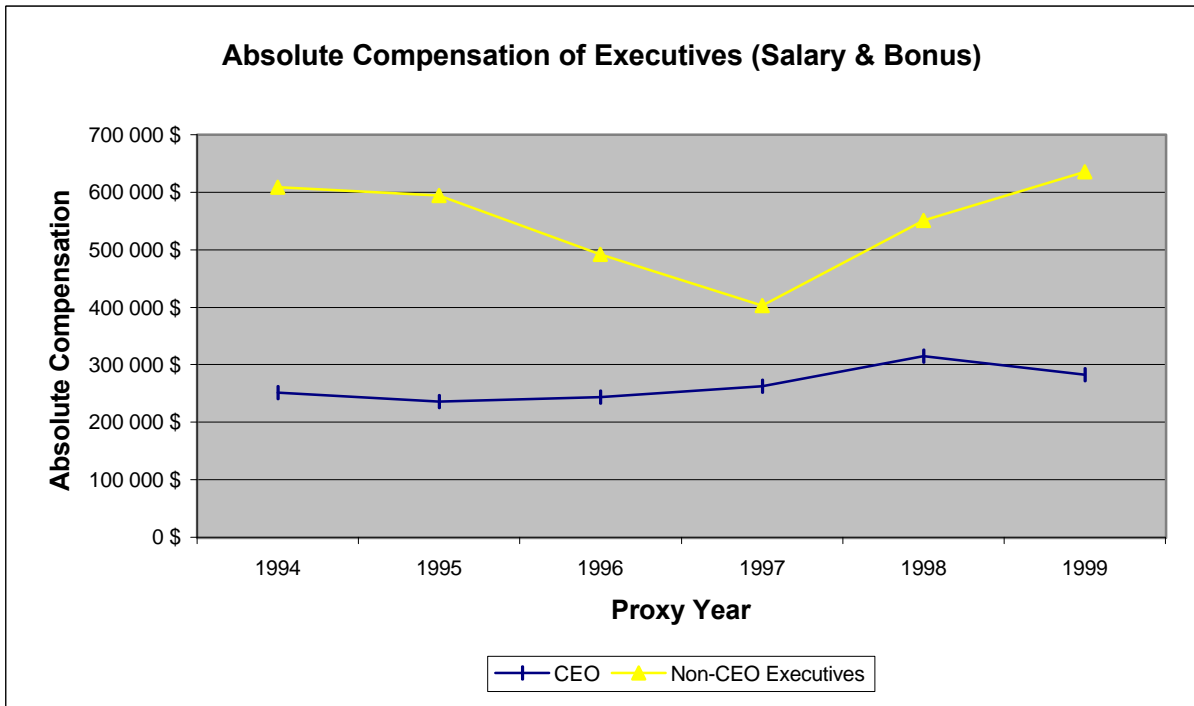


FIGURE 3

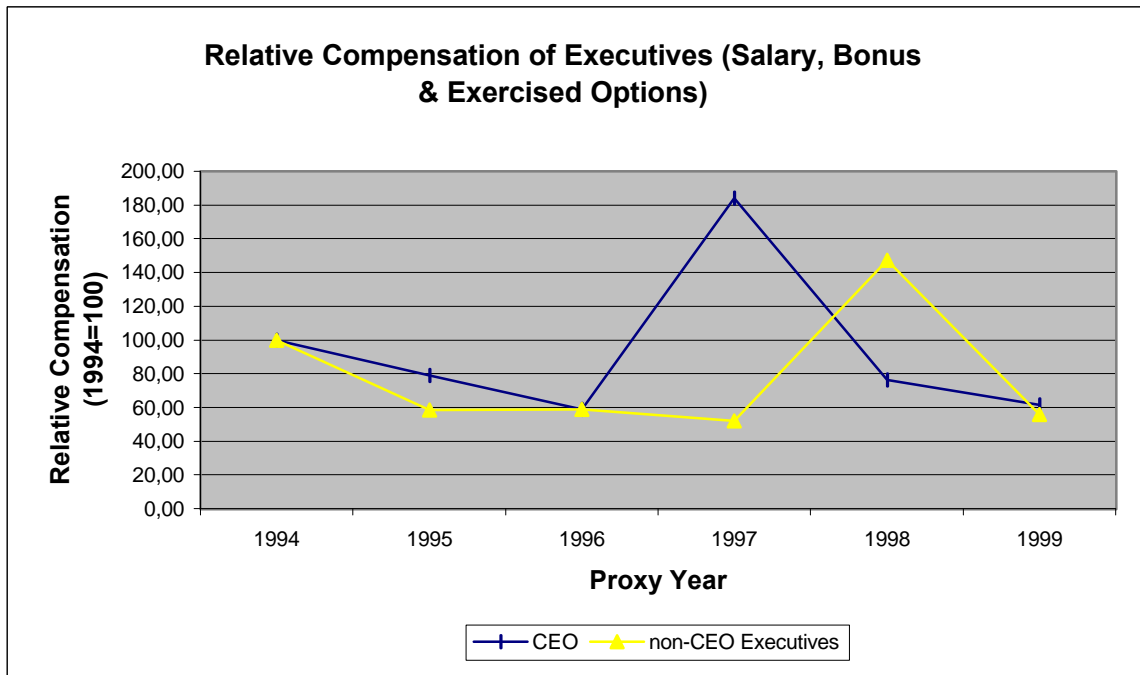


FIGURE 4

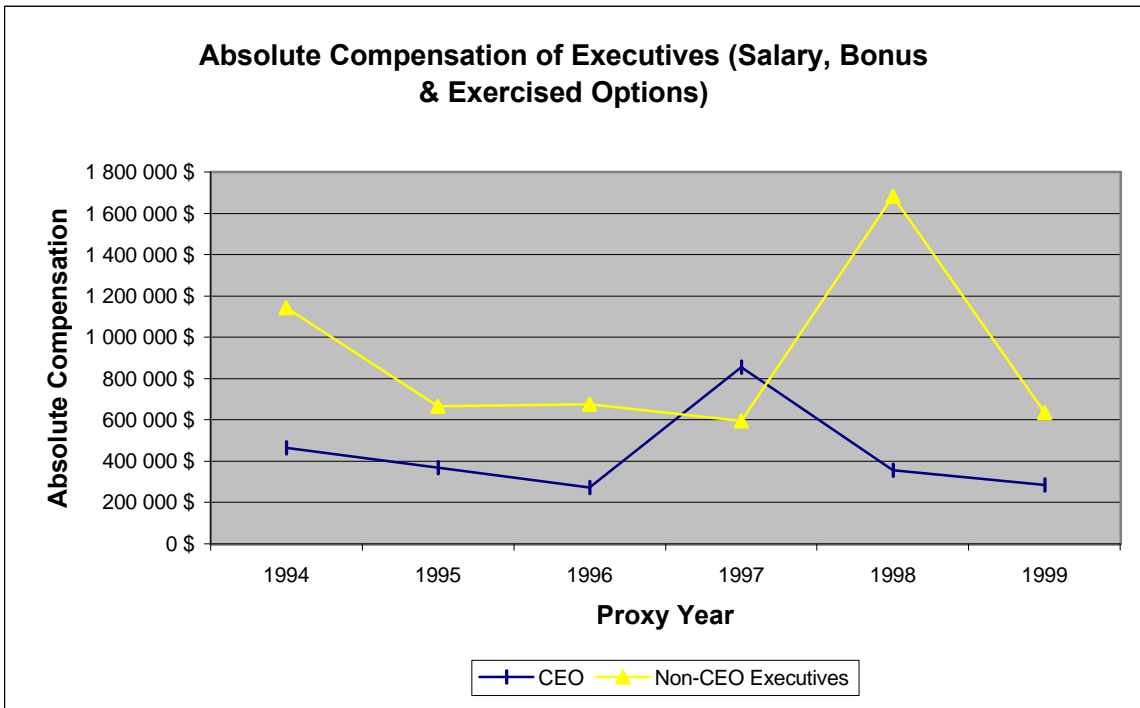


FIGURE 5

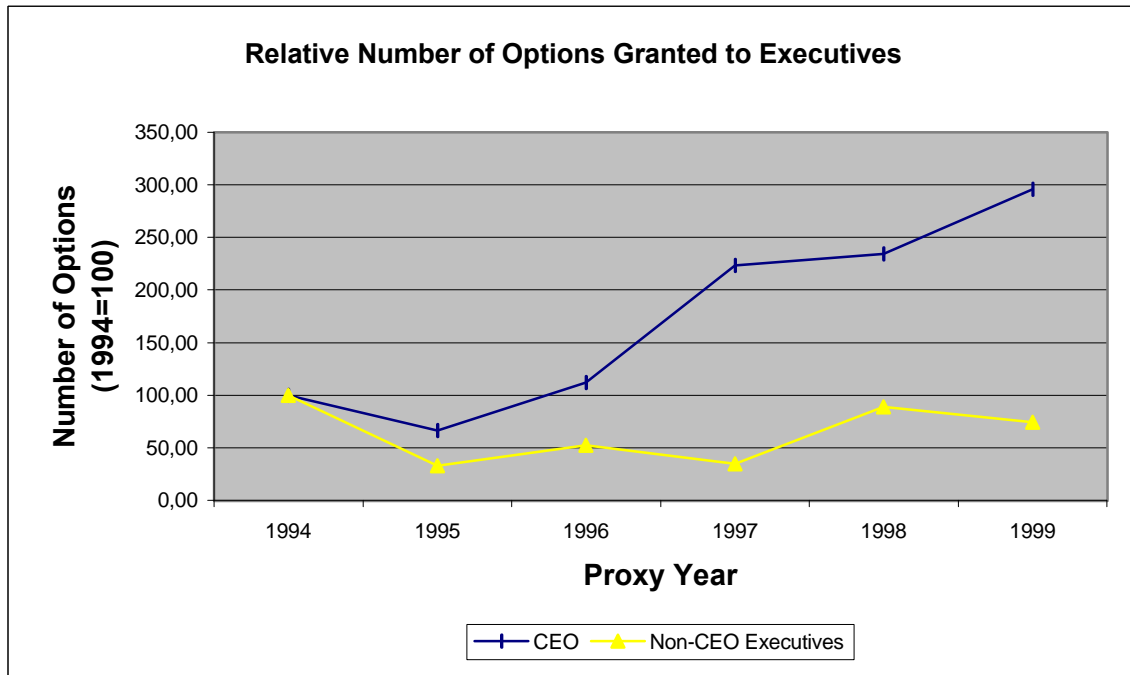
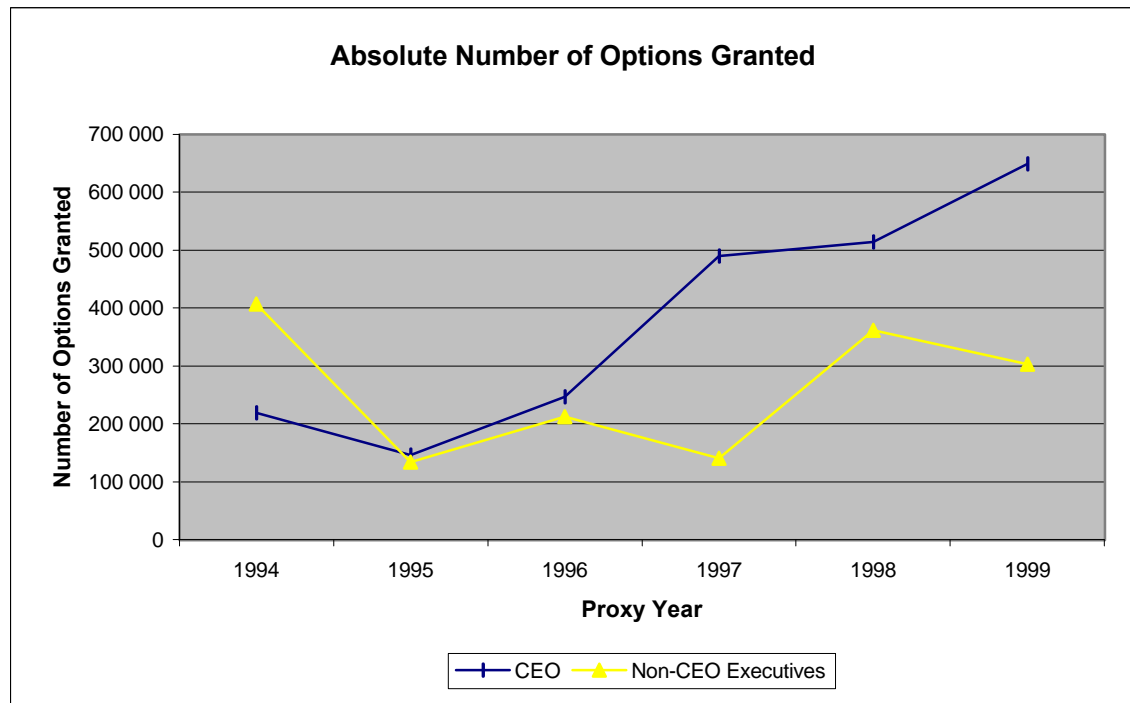


FIGURE 6



Company	ID	Years	Company	ID	Years
1 ALLELIX BIOPHARMACEUTICAL	1001	1992-1999	184 J D S FITEL INC	4020	1998-1999
2 ALTAREX CORP	1002	1996-1999	185 JETFORM CORP	4021	1997-1999
3 AXCAN PHARMA INC	1003	1996-1999	186 KASTEN CHASE APPLIED RSH LTD	4022	1997-1999
4 BIOCHEM PHARMA INC	1004	1992-1999	187 LG TECHNOLOGIES GROUP INC	4023	1997-1998
5 BIOMIRA INC	1005	1992-1999	188 LEITCH TECHNOLOGY CORP	4024	1994-1998
6 BIOVAIL CORP	1006	1993-1999	189 MDS INC	4025	1995-1997
7 CANGENE CORP	1007	1994-1999	190 MOSAID TECHNOLOGIES INC	4026	1993-1999
8 DRAXIS HEALTH INC	1008	1994-1999	191 MEMOTEC COMMUNICATIONS INC	4027	1993-1999
9 DRUG ROYALTY CORPORATION INC	1009	1992-1999	192 MITEL CORP	4028	1992-1999
10 HAEMACURE CORP	1010	1996-1999	193 NBS TECHNOLOGIES INC	4029	1994-1999
11 HEMOSOL INC	1011	1992-1999	194 NORBAT INTL INC	4030	1994-1999
12 HYAL PHARMACEUTICAL CP	1012	1992-1998	195 Nortel networks	4031	1994-1999
13 IBEX TECHNOLOGIES INC	1013	1992-1999	196 PERLE SYSTEMS LTD	4032	1994-1998
14 ID BIOMEDICAL CORP	1014	1994-1999	197 PROMIS SYSTEMS LIMITED	4033	1993-1995
15 LABOPHARM INC	1015	1996-1999	198 SIDUS SYSTEMS INC	4034	1993-1997
16 AETERNA LABORATORIES INC	1016	1996-1999	199 SPAR AEROSPACE LTD	4035	1993-1999
17 NU-LIFE CORPORATION	1017	1995-1999	200 SPECTRUM SIGNAL PROCESSING	4036	1996-1999
18 PATHEON INC	1018	1992-1999	201 SPEEDWARE CORP	4037	1996-1999
19 PHOENIX INTL. SCIENCES	1019	1995-1999	202 STRATOS GLOBAL CORP	4038	1997-1999
20 STRESSGEN BIOTECH CP -CL A	1020	1997-1999	203 TEKLOGIX INTERNATIONAL INC	4039	1995-1998
21 ORALIFE GROUP INC	1021	1996-1998	204 TROJAN TECHNOLOGIES INC	4040	1995-1999
22 ABITIBI CONSOLIDATED INC	2001	1997-1999	205 WESCAM INC	4041	1995-1999
23 ABITIBI-PRICE INC.	2002	1993-1996	206 I.S.G TECHNOLOGIES INC	4042	1993-1994
24 AINSWORTH LUMBER CO LTD	2003	1993-1999	207 S R TELECOM INC	4043	1993-1999
25 ALLIANCE FOREST PRODS INC	2004	1994-1999	208 ALGO GROUP INC -CL A	5001	1993-1999
26 BOWATER CANADA INC	2005	1993-1996	209 VAN HOUTTE LTEE A L	5002	1993-1998
27 CANFOR CORP	2006	1993-1999	210 ADVENTURE ELECTRONICS INC	5003	1994-1996
28 ST-LAURENT PAPERBOARD INC	2007	1994-1999	211 ANDRES WINES LTD	5004	1993-1998
29 CASCADES INC	2008	1993-1999	212 BC SUGAR REFINERY LIMITED	5005	1994-1996
30 C M L INDUSTRIES LTD	2009	1993-1999	213 BEAMSCOPE CANADA INC	5006	1993-1998
31 CONSOLIDATED RAMBLERS MINES LTD	2010	1993-1997	214 BIG ROCK BREWERY LTD	5007	1996-1999
32 CRESTBOOK FOREST INDUST. LTD	2011	1993-1997	215 CAMCO INC	5008	1993-1999
33 DOMAN INDUSTRIES -CL B	2012	1993-1999	216 CANADA BREAD LTD	5009	1993-1999
34 DOMTAR INC	2013	1993-1999	217 CANADIAN MANOIR INDS	5010	1994-1999
35 DONOHUE INC -CL A	2014	1993-1999	218 CANBRA FOODS LTD	5011	1993-1998
36 FLETCHER CHALLENGE CDA -CL A	2015	1992-1999	219 CASCADIA BRANDS INC	5012	1994-1997
37 NORANDA INC	2016	1993-1997	220 CFM MAJESTIC INC	5013	1996-1999
38 HARMAC PACIFIC INC	2017	1994-1998	221 CHAI NA TA CORP	5014	1993-1999
39 INTL FOREST PRODUCTS -CL A	2018	1993-1999	222 CINRAM INTERNATIONAL INC	5015	1995-1999
40 REPAP ENTERPRISES	2019	1993-1999	223 CLEARLY CDN BEVERAGE CP	5016	1994-1999
41 PERKINS PAPERS LTD	2020	1997-1999	224 CONSUMERS PACKAGING INC	5017	1993-1999
42 MACMILLAN BLOEDEL LIMITED	2021	1993-1998	225 CORBY (H.) DISTILLERY -CL A	5018	1996-1999
43 MALETTE QUEBEC INC	2022	1993-1998	226 COTT CORP QUE	5019	1993-1999
44 PACIFIC FOREST PRODUCTS LTD	2023	1993-1996	227 DOMCO TARKETT INC	5020	1996-1999
45 PAPERBOARD INDUSTRIES INTL	2024	1993-1999	228 DOREL INDUSTRIES -CL B	5021	1993-1999
46 PRIMEX FOREST PRODS LTD	2025	1993-1999	229 DOVER INDUSTRIES LTD	5022	1994-1999
47 RIVERSIDE FOREST PRODS LTD	2026	1993-1999	230 FANTOM TECHNOLOGIES INC	5023	1993-1999
48 ROLLAND INC	2027	1993-1999	231 FAR WEST INDUSTRIES INC	5024	1993-1999
49 ROMAN CORPORATION LTD	2028	1993-1999	232 FLETCHER CHALLENGE FIN CAN	5025	1996-1998
50 SINO-FOREST CORP -CL A	2029	1994-1999	233 FPI LTD	5026	1993-1999
51 SLOCAN FOREST PRODS LTD	2030	1993-1999	234 WESTON (GEORGE) LTD	5028	1993-1999
52 STELLA-JONES INC	2031	1993-1999	235 HOME PRODUCTS INC	5029	1993-1996
53 STONE-CONSOLIDATED CORP.	2032	1993-1996	236 IBEX TECHNOLOGIES INC	5030	1995-1999
54 TAIGA FOREST PRODUCTS LTD	2033	1993-1999	237 IMASCO LIMITED	5031	1993-1998
55 TEMBEC INC -CL A	2034	1993-1999	238 INTL COMFORT PRODUCTS CORP.	5032	1996-1998
56 TIMBERWEST FOREST CORPORATION	2035	1993-1995	239 INTL WALLCOVERINGS LTD	5033	1994-1997
57 UNIFORET INC -CL A	2036	1995-1999	240 IRWIN TOY LTD -NVTG	5034	1993-1999
58 WEST FRASER TIMBER CO	2037	1993-1999	241 LEF MCLEAN BROTHERS INTL. INC	5035	1995-1998
59 HJ FOREST PRODUCTS INC	2038	1994-1996	242 LINAMAR CORP	5036	1993-1999
60 SCOTT PAPER LIMITED	2039	1993-1994	243 MAGNA INTERNATIONAL -CL A	5037	1993-1999
61 ABL CANADA INC	3001	1993-1999	244 MAPLE LEAF FOODS INC	5038	1993-1999
62 ARC INTERNATIONAL CORP	3002	1998-1999	245 MICROTEC ENTERPRISES INC	5039	1996-1999
63 ACETEX CORP	3003	1995-1999	246 NATIONAL FIBRE TECH INC	5040	1993-1995

64	ALGOMA STEEL INC	3004	1993-1999	247	NATIONAL SEA PRODUCTS LTD	5041	1993-1997
65	ALPINE OIL SERVICES CORP	3005	1993-1999	248	NOBLE CHINA INC	5042	1993-1999
66	AMERICAN SENSORS INC	3006	1993-1995	249	NOMA INDUSTRIES LIMITED	5043	1993-1997
67	ANCHOR LAMINA INC	3007	1993-1996	250	NORWALL GROUP INC	5044	1993-1999
68	AT PLASTICS INC	3008	1993-1999	251	PEERLESS CARPET CORP.	5045	1993-1997
69	ATS AUTOMATION TOOLING SYS	3009	1993-1998	252	PREMDOR INC	5046	1993-1999
70	AUTREX INC	3010	1993-1995	253	QLT INC	5047	1993-1999
71	AVCORP INDUSTRIES INC	3011	1997-1999	254	ROTHMANS INC	5048	1993-1999
72	BALLARD POWER SYSTEMS INC	3012	1993-1999	255	SCHNEIDER CORP -CL A	5049	1994-1999
73	BEARING POWER (CANADA) LIMITED	3013	1994-1995	256	SEMI-TECH CORP -CL A	5050	1994-1997
74	BOMBARDIER INC -CL B	3014	1993-1999	257	SHERMAG INC	5051	1995-1999
75	BRAMPTON BRICK LTD -CL A	3015	1993-1999	258	SIGNATURE BRANDS LIMITED	5052	1993-1996
76	BUDD CANADA INC	3016	1994-1999	259	SLEEMAN BREWERIES LTD	5053	1996-1999
77	BUHLER INDUSTRIES INC	3017	1994-1996	260	SUN ICE LIMITED	5054	1993-1998
78	CO-STEEL	3018	1993-1999	261	SUN-RYPE PRODUCTS LTD	5055	1995-1998
79	CABLETEL COMMUNICATIONS CORP	3019	1994-1999	262	TECSYN INTERNATIONAL INC	5056	1993-1999
80	CELANESE CANADA INC	3020	1993-1997	263	TEE-COMM ELECTRONICS INC	5057	1993-1995
81	CFS GROUP INC	3021	1993-1999	264	MOLSON INC -CL A	5058	1993-1999
82	CHAMPION ROAD MACHINERY LTD	3022	1994-1995	265	NU-GRO CORPORATION	5059	1993-1999
83	CIRCUIT WORLD CORPORATION	3023	1995-1999	266	SEAGRAM CO LTD	5060	1994-1998
84	COGNOS INC	3024	1993-1999	267	VINCOR INTL INC	5061	1995-1998
85	COMPAS ELECTRONICS INC	3025	1993-1995	268	YOGEN FRUZ WORLD WIDE INC	5062	1994-1999
86	CONSOLTEX GROUP INC	3026	1993-1999	269	CCL INDUSTRIES -CL B	6001	1993-1999
87	DERLAN INDUSTRIES LTD	3027	1993-1997	270	COREL CORP	6002	1993-1999
88	DEVELCON ELECTRONICS LTD	3028	1997-1998	271	DOMINION TEXTILE INC	6003	1993-1996
89	DEVJO INDUSTRIES INC	3029	1993-1999	272	HARD SUITS INC	6004	1993-1996
90	DEVTEK CORP -SUB VTG	3030	1994-1999	273	OSF INC	6005	1996-1998
91	DOFASCO INC	3031	1993-1999	274	P F B CORPORATION	6006	1995-1999
92	DRECO ENERGY SERVICES LTD	3032	1994-1996	275	POLYAIR INTER PACK INC	6007	1996-1999
93	DUPONT CANADA -CL A	3033	1993-1999	276	SICO INC	6008	1993-1999
94	EAGLE PRECISION TECH INC	3034	1993-1999	277	SIMMONDS CAPITAL LTD	6009	1995-1999
95	EMCO LTD	3035	1993-1999	278	SMED INTERNATIONAL INC	6010	1996-1998
96	EXCO TECHNOLOGIES LTD	3036	1994-1999	279	W F I INDUSTRIES LTD	6011	1994-1999
97	FALVO CORPORATION	3037	1993-1996	280	ST CLAIR PAINT & WALLPAPER CORP.	6012	1993-1995
98	FOREMOST INDUSTRIES INC CDA	3038	1993-1999	281	ALIMENTN COUCHE-TARD -SVTG	7001	1996-1998
99	GANDALF TECHNOLOGIES INC	3039	1993-1995	282	AUTOSTOCK INC	7002	1993-1996
100	GEAC COMPUTER CORP LTD	3040	1993-1998	283	CANADIAN TIRE CORP -CL A	7003	1995-1999
101	THE VERSATECH GROUP INC	3041	1993-1997	284	CASSIDYS LTD	7004	1993-1998
102	GREAT PACIFIC ENTERPRISES INC	3042	1994-1996	285	CHAPTERS INC	7005	1996-1998
103	LAPERRIERE&VERREAULT -CL A	3043	1993-1998	286	CHATEAU STORES CDA -CL A	7006	1993-1999
104	GSW INC -CL B	3044	1996-1999	287	DENNINGHOUSE INC	7007	1995-1999
105	GWIL INDUSTRIES INC	3045	1993-1998	288	DYLEX LTD	7008	1993-1999
106	H.PAULIN & CO.LIMITED	3046	1996-1998	289	EMPIRE COMPANY LTD -CL A	7009	1993-1998
107	HALEY INDUSTRIES LTD	3047	1993-1999	290	FINNING INL INC	7010	1994-1999
108	HALLMARK TECHNOLOGIES INC	3048	1994-1999	291	FUTURE SHOP LTD	7011	1993-1998
109	HAMMOND MFG LTD -CL A	3049	1994-1999	292	GENDIS INC -CL A	7012	1993-1999
110	HARRIS STEEL GROUP -CL A	3050	1993-1999	293	GESCO INDUSTRIES INC	7013	1997-1999
111	HAWKER SIDDELEY CANADA	3051	1993-1999	294	GLENTEL INC	7014	1993-1999
112	INTERTAPE POLYMER GROUP INC	3052	1993-1999	295	HARTCO ENTERPRISES INC	7015	1993-1998
113	INVERPOWER CONTROLS LTD	3054	1995-1999	296	HUDSONS BAY CO	7016	1993-1999
114	IPSCO INC	3055	1993-1999	297	HY & ZELS INC	7017	1993-1999
115	IVACO INC -CL A	3056	1993-1999	298	JEWETT CAMERON TRADING LTD	7018	1996-1997
116	JANNOCK PPTYS LTD	3057	1993-1998	299	LEONS FURNITURE LTD	7019	1993-1999
117	KAUFEL GROUP LTD	3058	1994-1997	300	LIQUIDATION WORLD INC	7020	1996-1999
118	KIMPEX INTERNATIONAL INC	3059	1993-1997	301	LOBLAW COS LTD	7021	1993-1999
119	LAFARGE CDA INC -EX PREF	3060	1994-1999	302	MARKS WORK WEARHOUSE LTD	7022	1993-1999
120	LEROUX STEEL (ACIER) -CL B	3061	1995-1999	303	METRO INC -CL A	7023	1994-1999
121	GSI LUMONICS INC	3062	1995-1999	304	MOHAWK Canada LIMITED	7024	1996-1997
122	MAAX INC	3063	1993-1998	305	PANTORAMA INDUSTRIES INC	7025	1993-1998
123	MAGELLAN AEROSPACE	3064	1996-1999	306	PET VALU CANADA INC	7026	1996-1999
124	MERIDIAN TECHNOLOGIES INC	3065	1996-1997	307	PROVIGO INC	7027	1994-1997
125	METHANEX CORP	3066	1993-1999	308	REITMANS (CANADA) -CL A	7028	1993-1999
126	MILLTRONICS LTD	3067	1993-1998	309	RICHELIEU HARDWARE LTD	7029	1993-1999
127	NEEDLER GROUP LIMITED	3068	1993-1995	310	R T O ENTERPRISES INC	7030	1995-1999



128	NEWBRIDGE NETWORKS CORP.	3069	1993-1999	311	SEARS CDA INC	7031	1993-1999
129	NOVA CHEMICALS CORP	3070	1993-1999	312	SILCORP LIMITED	7032	1993-1995
130	NQL DRILLING TOOLS -CL A	3071	1993-1998	313	SUZY SHIER LTD	7034	1994-1999
131	PLAINTREE SYSTEMS INC	3072	1993-1999	314	FORZANI GROUP LTD -CL A	7035	1993-1999
132	PRUDENTIAL STEEL LTD	3073	1994-1999	315	JEAN COUTU GROUP	7036	1993-1998
133	RE-CON BUILDING PRODUCTS INC	3074	1996-1999	316	THE OSHAWA GROUP LIMITED	7037	1993-1997
134	REKO INTERNATIONAL GROUP INC	3075	1997-1999	317	SECOND CUP LTD	7038	1993-1998
135	ROYAL GROUP TECH LTD	3076	1997-1999	318	T S C SHANNOCK CORP -CL A	7040	1993-1997
136	SAMUEL MANU-TECH INC	3077	1993-1999	319	U A P INC	7041	1993-1997
137	SCINTREX LIMITED	3078	1993-1996	320	UNI SELECT INC	7042	1993-1999
138	SENVEST CAP INC	3079	1997-1999	321	WESTBURNE INC	7043	1993-1999
139	SHAW INDUSTRIES LTD -CL A	3080	1993-1999	322	WHITE ROSE CRFTS&NRSY	7044	1995-1999
140	SKYJACK INC	3081	1993-1999	323	ALLIANCE ATLANTS COMM -CL B	8001	1993-1996
141	SLATER STEEL INC	3082	1993-1999	324	AMTELECOM GROUP INC	8002	1993-1999
142	ST LAWRENCE CEM GRP -CL A	3083	1993-1999	325	ASTRAL MEDIA INC -CL A	8003	1993-1999
143	STACKPOLE LTD	3084	1993-1999	326	BATON BROADCASTING INC	8004	1994-1998
144	STELCO INC -CL A	3085	1993-1999	327	CANWEST GLOBAL COM -NVTG	8005	1993-1999
145	TARO INDUSTRIES LIMITED	3086	1993-1996	328	CFCF INC	8006	1995-1996
146	TELEGLOBE INC	3087	1993-1999	329	CHUM LTD -CL B	8007	1994-1999
147	TESCO CORP	3088	1993-1999	330	CINAR CORP -CL B	8008	1993-1995
148	TESMA INTERNATNAL INC -CL A	3089	1995-1999	331	CINEPLEX ODEON CORPORATION	8009	1993-1996
149	CANAM MANAC GROUP INC -CL A	3090	1993-1999	332	COGECO CABLE INC	8010	1995-1999
150	WESTAIM CORP	3091	1996-1999	333	COSCIENT GROUP INC	8011	1997-1998
151	TIMMINCO LTD	3092	1993-1999	334	ELECTROHOME LTD -CL Y	8012	1994-1997
152	TOROMONT INDUSTRIES LTD	3093	1993-1999	335	FUNDY CABLE LTD	8013	1994-1996
153	TRIAM AUTOMOTIVE INC	3094	1994-1996	336	GTC TRANSCONTINL GP -CL A	8014	1994-1999
154	TRIMIN ENTERPRISES INC	3095	1993-1999	337	HOLLINGER INC	8015	1993-1999
155	TRITECH PRECISION INC	3096	1994-1999	338	VIDEOTRN (LE GRPE) LTD	8016	1993-1999
156	UNICAN SECURITY SYS -CL B	3097	1996-1998	339	MDC CORP	8017	1996-1999
157	UNITED CANADIAN SHARES LIMITED	3098	1993-1995	340	MCGRRAW-HILL RYERSON LTD	8018	1993-1999
158	UNITED DOMINION INDUSTRIES	3099	1993-1999	341	MOFFAT COMMUNICATIONS	8019	1994-1999
159	VELAN INC -SVTG	3100	1996-1998	342	MOFFAT COMMUNICATIONS	8019	1994-1999
160	VENTRA GROUP INC	3101	1993-1999	343	OKANAGAN SKEENA GROUP LTD	8020	1994-1998
161	WESCAST INDUSTRIES -CL A	3102	1994-1999	344	OKANAGAN SKEENA GROUP LTD	8020	1994-1998
162	WESTERN STAR TRUCKS HLDGS LTD	3103	1994-1999	345	PARAGON ENTERTAINMENT CORP.	8021	1993-1996
163	WINPAK LTD	3104	1993-1999	346	PARAGON ENTERTAINMENT CORP.	8021	1993-1996
164	ZENON ENVIRONMENTAL INC	3105	1993-1999	347	QUEBECOR INC -CL B	8022	1993-1999
165	ATI TECHNOLOGIES INC	4001	1993-1999	348	QUEBECOR INC -CL B	8022	1993-1999
166	AIT ADVANCED INFO TECH CORP	4002	1994-1999	349	QUEBECOR WORLD INC -SUB VTG	8023	1993-1999
167	AZCAR TECHNOLOGIES INC	4003	1996-1999	350	QUEBECOR WORLD INC -SUB VTG	8023	1993-1999
168	ARCHITEL SYSTEMS CORP	4004	1996-1999	351	REGIONAL CABLESYSTEMS INC	8024	1996-1999
169	BATTERY TECHNOLOGIES INC	4005	1997-1999	352	REGIONAL CABLESYSTEMS INC	8024	1996-1999
170	CAE INC	4006	1993-1999	353	ROGERS COMMUNICATION -CL B	8025	1993-1999
171	C-MAC INDUSTRIES INC	4007	1994-1999	354	ROGERS COMMUNICATION -CL B	8025	1993-1999
172	CRS ROBOTICS CORP	4008	1995-1999	355	SHAW COMMUNICATN INC -CL B	8026	1994-1999
173	CALIAN TECHNOLOGY LTD	4009	1994-1999	356	SHAW COMMUNICATN INC -CL B	8026	1994-1999
174	BAE SYSTEMS CANADA INC	4010	1994-1999	357	SOUTHAM INC	8027	1993-1997
175	CANADIAN SATELLITE COMMUN	4011	1993-1999	358	SOUTHAM INC	8027	1993-1997
176	CORECO INC	4012	1996-1999	359	TELEMEDIA INC	8029	1994-1996
177	DALSA CORP	4013	1996-1999	360	TELEMEDIA INC	8029	1994-1996
178	DY 4 SYSTEMS INC	4014	1993-1999	361	THOMSON CORP	8030	1993-1998
179	DIGITAL PROCESSING SYS INC	4015	1996-1999	362	THOMSON CORP	8030	1993-1998
180	ELECTROHOME LTD -CL Y	4016	1993-1999	363	TORSTAR CORP -CL B	8031	1993-1999
181	EPIC DATA INTERNATIONAL INC	4017	1996-1999	364	TORSTAR CORP -CL B	8031	1993-1999
182	GENNUM CORP	4018	1997-1999	365	WIC WESTERN INTL COMM -CL B	8032	1994-1999
183	IITC HOLDINGS LTD	4019	1995-1999	366	WIC WESTERN INTL COMM -CL B	8032	1994-1999