Impacts of Tax Incentive Programs on Mineral Exploration Expenditures in Canada: An Empirical Analysis

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From a government perspective, exploration investment is important for future global competitiveness in mineral industries. Canada provides an example of a nation that promotes exploration and is a major target of companies' exploration budgets. This paper analyzes impacts of the government policies and tax incentive programs on exploration spending by mining companies in Canada. The study is performed using econometric modeling of the Canadian exploration expenditures over the period of 1969-2008. Our analysis confirms that the tax incentive programs were effective in increase of exploration spending by the junior mining companies.

INTRODUCTION

From a government perspective, exploration investment is important for future global competitiveness in mineral industries. Canada provides an example of a nation that promotes exploration and is a major target of companies' exploration budgets. In 1997, the Canadian share of global exploration funds was 12%. It increased to 18% (USD3.1 billion) in 2011 according to the Metals Economics Group (MEG) estimates (MEG, 2012a and 2012b). Canada held the first place among nations in attracting exploration investments for the last 10 years, 2002-2011 (MEG, 2012a). In 2011, 781 mining companies budgeted funds for exploration in Canada. About 91% of these companies had the Canadian headquarters. The local companies' share of the total projected Canadian nonferrous exploration investments was almost 82%. MEG points that "exploration-focused tax incentives" are one of factors of Canada's non-ferrous exploration surge (MEG, 2012b). Given its success in attracting exploration investment, the example of Canada was selected for this study.

The objectives of this paper are to facilitate understanding of how the Canadian mineral exploration expenditures evolved over time and to highlight impacts of the government policies and tax incentive programs on exploration spending by senior and junior mining companies. These objectives are investigated using qualitative examination and econometric modeling of time dynamics of exploration expenditures.

This study conducts separate analysis of the Canadian exploration spending by senior and junior mining companies because of their differences in exploration behavior. "Senior" companies are those companies, which obtain incomes from mining or other business activities. In contrast, "junior" companies do not produce minerals, do not receive substantial incomes from business ventures, and mostly raise exploration money by issuing shares (Natural Resources Canada - NRCan, 2009). Junior companies are mainly involved in the grassroots exploration. Many, but not all, senior companies avoid grassroots exploration and concentrate their efforts later in the exploration process: for example, ore body

delineation and feasibility studies. Recent data show an increasing role of junior exploration companies. For example, in 2004, the juniors' exploration spending in Canada exceeded the seniors' exploration spending. From 2005, the juniors' exploration budgets constituted about half of the worldwide exploration expenditures (Goulden, 2006, and MEG, 2012b).

An analysis of exploration expenditures by seniors and juniors is performed in two steps: (i) qualitative examination and (ii) econometric modeling. The qualitative examination helps detect trends, peaks, and troughs of the Canadian exploration spending. It also helps associate movements of the exploration funds with possible underlying factors. The econometric modeling step quantifies impacts of factors affecting exploration expenditures. The models regress growth rates of exploration expenditures on the continuous growth rates in gold prices, dummy variables for government policies and discoveries. The data series of exploration expenditures are from the 2009 annual report "Overview of Trends in Canadian Mineral Exploration" by Natural Resources Canada (NRCan, 2009). The series include exploration plus deposit appraisal expenditures (on-mine-site plus off-mine-site activities), field work plus overhead. The gold price series is from the World Gold Council (2012).

Previous to this study, there have been several other studies that use econometric methods to understand mining exploration expenditures. A study by Eggert (1988) examines how corporate exploration expenditures depend on a mineral price index lagged one year. The author also tested whether exploration expenditures of seven mining companies correspond to their net incomes, indicators of availability of internal finds. The Canadian Intergovernmental Working Group has reported results of statistical estimations of exploration and deposit appraisal spending for Canada in successive issues of "Overview of trends in Canadian mineral exploration". The dependent variable was "exploration and deposit appraisal spending (field and overhead expenditures only)" with prices and expenditures in the previous year as regressors. The built models were used for forecasting exploration expenditures. The Group also provided results of econometric modeling of exploration expenditures in British Columbia by relating it to the British Columbia's mineral price index.

Our study differs from these works by: (i) use of more general econometric models, (ii) separate analysis of exploration expenditures by senior and junior companies; (iii) accounting for impacts of government policies and periods of important discoveries. Findings of our study will be useful for analyzing impacts of prices, government policies, and other factors on exploration spending.

The paper is organized as follows. The first section provides an introduction to the study. The second section examines the progression of exploration expenditures by senior and junior companies over the period of 1969-2008 and discusses factors influencing exploration expenditures. The third section describes an econometric analysis of exploration expenditures by junior and senior companies. The last section summarizes conclusions.

## TIME DYNAMICS OF EXPLORATION EXPENDITURES BY SENIOR AND JUNIOR COMPANIES IN CANADA

This section provides a qualitative examination of time dynamics of mineral exploration expenditures by senior and junior companies in Canada. It describes and compares trends, peaks and troughs, and volatilities in the evolution of exploration spending by these two investor types. The section also discusses impacts of factors influencing exploration expenditures. The qualitative examination sets the foundation for the quantitative analysis of exploration expenditures in the third section.

The evolution of the Canadian exploration expenditures by senior mining companies between 1969 and 2008 has been cyclical and volatile (Figure 1). It appears that seniors' exploration spending experienced a trend change in the late 1970s. A significant growth during the 1970s was altered by a declining trend with cycles around it afterwards (Figure 1). The seniors' exploration expenditures had three peaks and three troughs over the 1980s and the beginning 2000s. The majors' decreasing trend is indicated by a decline in the bottom levels of cycles (CAD374 million[1] in 1986, CAD 305 million in 1992, and CAD302 million in 2001) and by an overall decline in the top levels of cycles (CAD651.2 million in 1981, CAD681.8 million in 1988, and CAD 580.0 million in 1996).

The juniors' exploration expenditures were small during the 1970s, began to increase in the early 1980s, had a substantial but temporary spike in the late 1980s, later oscillated with cycles, somewhat parallel to seniors' cycles (Figure 1), and surpassed the seniors' exploration expenditures in 2004. The bottom levels of juniors' cycles point to an increasing trend: CAD79.9 million in 1992 and CAD123.3 million in 1999. Volatility of exploration spending by majors seems to be constant between 1979 and 2005, while volatility of juniors' spending varies over time.

The significant growth of seniors' exploration expenditures during the 1970s - the beginning of 1980s with a peak in 1981 and a following decline till 1986 might be associated with a surge in gold prices to a peak of $614.61 per ounce in 1980 and a drop to $317.18 per ounce in 1985 (Figure 1). Juniors' spending did not experience the same growth in the 1970s due to limited financing funds because of strict regulations on stock exchanges in Canada (Crowson, 2003).

FIGURE 1
CANADIAN EXPLORATION EXPENDITURES AND GOLD PRICES
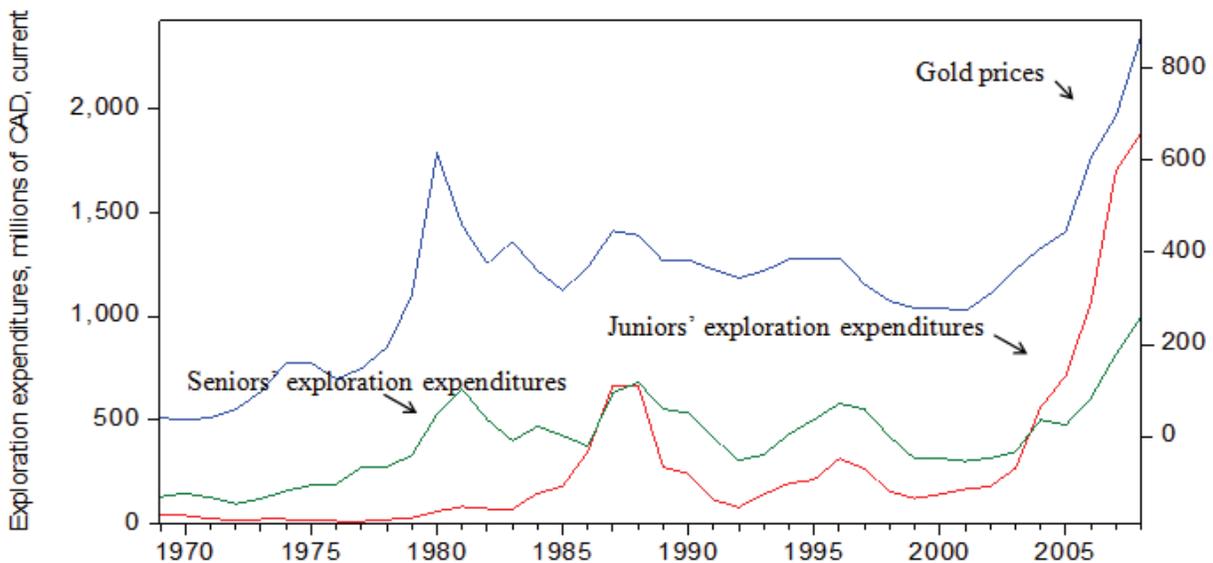
Source: Natural Resources Canada, 2009

The 1984-1888 increase in exploration expenditures by both types of companies is mainly attributed to the Canadian government's tax incentive measures: Flow-Through Shares (FTS) and Mining Exploration Depletion Allowance (MEDA) (Bouchard, 2004; Crowson, 2003; Eggert, 1992). The FTS and MEDA programs were implemented in 1983. The FTS program allows junior mining companies "flow through" exploration expenditures to shareholders in exchange for shares of the company. Shareholders apply the "passed" expenses for tax deduction. Under the MEDA program, investors in flow-through shares had a significant tax write-off opportunity. For every $1 investment in qualified shares, investors could use a $1.33 tax deduction. MEDA was phased out in 1988, FTS is still continuing. It seems that the impact of MEDA was augmented by a favorable price environment - increasing gold prices in 1986-1988. In contrast, the implementation of the Canadian Exploration Incentive Program (CEIP) during the 1989-1990 period of falling metal prices could only temporarily reduce the decline rate of both seniors' and juniors' spending. The growth of exploration spending by both juniors and seniors between 1992 and 1996 and the following decline between 1997- 2000 appear to track changes in gold prices. Though, discoveries of gold and diamond deposits could contribute to the 1992-1996 increase in exploration expenditures as well. During the period 1992-1997, mining companies made major discoveries of diamonds, nickel, and gold in Canada: 1992 – Ekati (diamond), Boston (gold), Meliadine

West and East (gold); 1994 – Voisey's Bay (nickel), Diavik (diamond), Meadowbank (gold); 1995 – Gahcho Kue (diamond); 1996 – Snap Lake (diamond); 1997 – Victor (diamond).[2] The 1997-2000 decrease in exploration expenditures was also affected by the Bre-X case in 1997. After the news that the Bre-X company falsified its estimates of ore reserves in Indonesia, investors lost interest in equity financing of junior mining companies. Another adverse factor was a tech-shares bubble of the late 1990s. Investments funds were diverted to financing dot.com companies. Juniors' exploration spending rebounded back in 2001, while seniors' spending rebounded with a lag of one year – in 2002. These increases in exploration spending could be influenced by growing metal prices and by the 15% Investment Tax Credit for Exploration, implemented since October 2000 (Bouchard, 2004).

EMPIRICAL ANALYSIS OF EXPLORATION EXPENDITURES

As we observe, gold prices, tax incentive programs, and discoveries influence exploration expenditures. This section models the continuous growth rate of exploration spending by junior and senior mining companies as a function of gold prices, tax measures, and discoveries:

$$dlog(juniorexplr)_t = c + a_1 d\,log(goldprice)_t + a_2 dfts + a_3 ddiscov + \varepsilon_t \tag{1}$$

$$dlog(seniorexplr)_t = c + a_1 d\,log(goldprice)_t + a_2 dfts + a_3 ddiscov + \varepsilon_t \tag{2}$$

$$dlog(juniorexplr_t) = log(juniorexplr)_t - log(juniorexplr)_{t-1}$$

$$dlog(seniorexplr_t) = log(seniorexplr)_t - log(seniorexplr)_{t-1}$$

$$dlog(goldprice_t) = log(goldprice)_t - log(goldprice)_{t-1},$$

where *juniorexplr* is the juniors' exploration expenditures, *seniorexplr* is the seniors' exploration expenditures, *goldprice* is the average annual gold price, *dfts* is a dummy variable for the FTS-MEDA programs in the 1983-1987 period, *ddiscov* is a dummy variable for discoveries in the 1993-1996 period. The dummy variable *dfts* equals one for the years 1983-1987 and zero in other years. The dummy variable *ddiscov* has values of one in the years 1993-1996 and zero in other years. The estimation results for models (1) and (2) are displayed in Table 1. The *t*-statistics are provided in parentheses below corresponding coefficients. The Breusch-Pagan-Godfrey heteroskedasticity test for model (1) indicates that the residuals are homoskedastic. Correlograms of residuals and the Breusch-Goldfrey Serial Correlation tests show that the residuals exhibit no serial correlation. Correlograms of squared residuals point to no conditional heteroskedasticity. The *t*-statistics for the gold price, *dfts* and *ddiscov* coefficients in model (1) for the juniors' exploration speding are above two, what implies that the coefficients are statistically significant. Model (1) shows that, holding everything else constant, if the growth rate in gold prices increases by 1 percent, then the growth rate of juniors' exploration investments increases by about 0.78% percent. The coefficients of dummy variables indicate that: (i) increases in exploration expenditures of the Canadian junior mining companies in the years 1983-1987 were significantly higher than would have been expected, given increases in gold prices; (ii) increases of juniors' exploration expenditures in the 1993-1996 period were significantly higher than would have been expected, given increases in gold prices and impacts of the FTS-MEDA program. Model (2) for the growth rate of seniors' exploration spending did not fit data well (adjusted R^2 is 0.177). Another model for seniors' exploration expenditures was considered:

$$log(seniorexplr)_t = c + a_1 log(goldprice)_t + a_2 dfts + a_3 ddiscov \\ + a_4 log(seniorexplr)_{t-1} + \varepsilon_t \tag{3}$$

The estimation results for model (3) are reported in Table 2.

TABLE 1
MODEL (1) AND MODEL (2) ESTIMATION RESULTS

Explanatory Variables	Dependent Variables	
	dlog(juniorexplr (Model 1)	*dlog(seniorexplr) (Model 2)*
dlog(goldprice)	0.7803 [3.0681]	0.4674 [3.1408]
dfts	0.4798 [2.9021]	0.0338 [0.3494]
ddiscov	0.3855 [2.1161]	0.1505 [1.4120]
C	-0.0662 [-0.9956]	-0.0042 [-0.1079]
Adjusted R-squared	0.293	0.177

TABLE 2
MODEL (3) ESTIMATION RESULTS

Explanatory Variables	*log(seniorexplr) (Model 3)*
log(goldprice)	0.6886 [6.5864]
dfts	-0.1240 [-0.8993]
ddiscov	-0.0003 [-0.0022]
C	2.0267 [3.3376]
AR(1)	0.6075 [4.2171]
Adjusted R-squared	0.878

The *t*-statistics are provided in parentheses below corresponding coefficients. The Breusch-Pagan-Godfrey heteroskedasticity test indicates that the residuals are homoskedastic. Correlograms of residuals and the Breusch-Goldfrey Serial Correlation tests show that the residuals exhibit no serial correlation.

Correlograms of squared residuals point to no conditional heteroskedasticity. The *t*-statistics for the gold price and one lag of the seniors' exploration expenditures coefficients in model (3) are above two, what implies that the coefficients are statistically significant. Results of model (3) show that: (i) if the current gold prices increase by 1 percent then the current seniors' exploration investments increase by 0.69 percent; (ii) the current seniors' exploration investments are strongly influenced by previous year exploration investments. The *t*-statistics of the estimated coefficients of the dummy variable for tax programs (*dfts*) and the dummy variable for the deposits discoveries (*ddiscov*) are below 2. This confirms that the seniors' exploration expenditures were not significantly affected by the FTS-MEDA programs in 1983-1987 and by discoveries in 1993-1996.

CONCLUSIONS

This paper examines and models mineral exploration spending by senior and junior mining companies in Canada. Models are built using the econometric techniques. There were only a few econometric studies of exploration expenditures: for example, those by Eggert (1988) and by the Canadian Intergovernmental Working Group in successive issues of "Overview of trends in Canadian mineral exploration". Our study differs from these earlier works by the use of more general models for exploration levels and the separate examination of the seniors' and juniors' exploration expenditures.

Results of models 1 and 2 demonstrate that increases in exploration expenditures of the Canadian junior mining companies in the years 1983-1987 (the tax incentives implementation period) were significantly higher than would have been expected, given increases in gold prices; (ii) increases of juniors' exploration expenditures in the 1993-1996 period (the major discoveries period) were significantly higher than would have been expected, given increases in gold prices and impacts of the FTS-MEDA program. The junior mining companies respond stronger to the gold price changes than the senior mining companies. Seniors' exploration spending is affected by the changes in gold prices and depends on the previous year's exploration spending. The analysis illustrates importance of discoveries for bolstering exploration expenditures by junior mining companies. Our models confirm that the tax incentive programs were effective in increase of exploration spending by the junior mining companies.

This study examines impacts of gold prices, government policies, and discoveries on exploration spending by the Canadian mining companies. In the follow-up papers I would like to analyze exploration costs and returns on exploration investments in Canada.

ENDNOTES

1. Levels of exploration expenditures are in the Canadian dollars.
2. The discoveries information is from (Bouchard, 2004).

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