Testing the relationship between Free Cash Flow and Capital Expenditure in Canadian listed companies

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Abstract

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Abstract: This paper investigates the relationship between free cash flow and capital expenditure in Canadian listed companies for the period 2010 to 2015. The sample consists of 90 listed companies in Canada drawn from 10 different industries.

Firstly, this paper supports the hypothesis that there exists an autocorrelation in the relationship and therefore dynamic panel-data model should be selected. We use Arellano-Bond linear panel-data model to test which variables exhibit autocorrelations in the model. Finally, linear dynamic panel-date estimation would be used to obtain the relationship between free cash flow and capital expenditure.

Through the autocorrelation and regression analysis, this paper confirms autocorrelations in free cash flow and capital expenditure. We find a negative relationship between free cash flow and capital expenditure.

August 24, 2016

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Chapter 1 Introduction

1.1 Research Background

The main objective of an enterprise is to maximize shareholders wealth. Investment is one of the most significant means to gain shareholders wealth. We should focus on adding value to the shareholders wealth by taking advantage of investment opportunities which can generate positive NPVs. Good investments can lead a firm to grow and generate positive and stable free cash flows over a period of time. But the relationship between free cash flow and capital expenditure has always been a significant topic in corporate finance.

Capital expenditure are funds used by a company to acquire or upgrade physical assets such as property, industrial buildings or equipment or used to undertake new projects or investments by firms (Investopedia, 2012). Examples of such expenditures can include repairing a roof to building, purchasing a piece of equipment, or building a brand new factory.

Firms can use two different ways to finance capital expenditure: external financing and internal financing or retained earnings. If companies finance their capital expenditure by loans, they have to pay interest expense, which will decrease the net income of firms. Part of net income will be used to pay dividends to shareholders and the remainder is retained for investment activities. Firms prefer to finance their initial investment costs by retained earnings, because they do not need to pay the interest expense and it saves costs of borrowing for firms.

The Free Dictionary (2012) defines free cash flow as a measure of the firms' ability to generate cash flow to run the new projects and maintain operations. Free cash flow is more important than other measures for testing a firm's financial health because it shows how much cash a company can generate in each year. Stable and positive free cash flows indicate good operations of the firm and confirms that the firm has chosen good projects to invest in. Stable and positive cash flows will have a positive effect on stock price. Cash flow, focuses especially on the profitability of firm's actual business, is independent of outside factors such as debts and taxes, which reports the net movement of cash in and out of the company every year, and cash flow can make it easier for shareholders or analysts to check the current condition and predict future condition of the firm.

According to Modigliani (1958), investment decisions in perfect capital markets are independent of financing decisions and, hence, investment policies only depend on the availability of investment opportunities with a positive net present value. In the neoclassical model, companies have unlimited access to sources of finance and investment, so firms with opportunities for profitable investment that exceed their available cash flow would not be expected to invest any less than firms with the same opportunities and higher cash flow, because external funds provide a perfect substitute for internal resources.

Jensen (1986) defined free cash flow as a cash flow in excess of that required to fund all projects with positive net present value. When free cash flow is present and shareholder's monitoring is imperfect, the agency problem between executives and shareholders arises.

Modigliani and Miller (1958, 1961), referred to as MM, put forward theorems, more commonly known as the MM theorems, that form the foundation of modern corporate finance theory. The two main conclusions drawn from the MM theorems are that firm value is dependent on its current and future free cash flow. Secondly, the dividend policy does not affect firm value given that firms will use those dividends for investments purpose, and get a higher return from those investments.

Capital expenditure is strongly and positively associated to the level of free cash flow (the more free cash flows a firm has, the more investments the firm can engage in, also according to Vogt (1997), the more a firm has free cash flows, the more the profitable capital expenditure projects the firm can undertake), and free cash flow's influence on capital expenditure increases when firm size decreases, (in that small firms gear towards rampant growth thereby using most or all their free cash flows to invest in value adding projects) and as insider ownership increases.

Firms maximize their value through investing in projects and this therefore is a motivation to the managers who own shares of the company (as a measure to tame the agency problem) to invest in projects that add value to the firm, which has a long-term or future perspective unlike issuing dividends to shareholders which motivates for now but if invested in positive NPV projects can increase the value of the firm and the shareholders wealth.

1.2 Purpose of Study

In this paper, I develop an empirical test of how a company’s capital expenditure affects the free cash flow. This paper focuses on Canadian listed companies’ annual report data from 2010 to 2015, and conducts an empirical analysis of the relationship between free cash flow and capital expenditure.

1.3 statement of problem

Some researchers have pointed out that there exists a relationship between free cash flow and capital expenditure. Alti (2003) showed that the relationship between cash flow and investments is stronger in companies that are in growth stage. Growth company prefers to put more cash into investment, but the risk of losses from investments will increase. Moreover, more investments can reflect the company's growth opportunities.

In contrast to the above, Bo Becker (2006)'s research explained that in frictionless financial markets, investment does not depend on internal cash flows. In a large European data set, the researcher found that firms invest more on average when they have higher cash flow.

Free cash flow has always been a subject of great debate especially in the literature on the determinants of capital expenditures.

1.4 Structure of the Research

This Major Research Project has five chapters in total. Chapter 1 provides an introduction to the research background and the purpose of study.

Chapter 2 provides an idea of what kind of work has been published on the topic by accredited scholars and experts. It shows what relevant knowledge and ideas will be involved.

The methodology, sample selection, data analysis methods, and the way of picking suitable model will be covered in chapter 3.

Chapter 4 is for the analysis of the results calculated through chapter 3.

The last chapter, I will conclude the main results of this research, and offer some recommendations for future work in this area and some limitations for the method of this research.

Chapter 2 Literature Review

2.1 Introduction

This chapter discusses past researches conducted on the subject area. There are two parts: theories and empirical review. In the theoretical review, this paper outlines some important theories relevant to this research. In the empirical review, this paper shows some previous researches conducted on the relationship between free cash flow and capital expenditure. It will be helpful to understand the relationship between free cash flow and capital expenditure.

2.2 Theoretical Review

2.2.1 Dividend Policy Theory

This section analyzes the dividend policy theories including dividend irrelevance hypothesis and relevancy theories such as bird in hand, tax preference and agency costs.

Researchers identified three contradictory theories about dividend decisions by firms. Some believe raising the dividend payments to shareholders means less internal financing. For this reason, low payout would increase the firm value through increase in stock price (this is called the bird in hand theory). The second theory is that high dividend costs have a reverse effect on the value of the firm (tax preference theory). The third theory is known as dividend irrelevancy theory, which indicates that there is no relationship between dividend and firm value. All these theories will be discussed in the following sections.

2.2.1.1 Dividend Irrelevance Theory

Miller and Modigliani explain the dividend payment has no relationship with firm value based on certain conditions of perfect capital markets and rational behaviors (Miller & Modigliani, 1961). According to the M&M's model, share price of a firm and shareholder's wealth is not influenced by dividend policy in a perfect market because they believe the firm value is determined by its investment decisions which means the value of a firm is unrelated to what kind of dividend policies are enacted.

Assumptions of perfect capital market that Miller and Modigliani theory based on can be shown as follow:

1. No tax differences between dividends and capital gains.
2. Information is equally available to everyone with no cost (symmetrical information).
3. No agency cost.
4. No transaction cost.
5. All investors are price takers and cannot control the securities price.

M&M's model (1961) assumed the investment of a firm is fixed because all positive net present value projects are financed irrelevant of the firm's dividend strategies, accordingly dividends are firm's residual free cash flow. Conventional wisdom recommends that dividend payments are critical to the firm's value and an appropriate dividend policy is important to shareholders because it will affect their wealth as well as the share price. Usually investors faced with inaccurate information regarding a firm's performance consequently they use dividend payments as a signal (Frankfurter & Wood, 1997).

To summarize, in the perfect capital market, the only determinant of firm's value is the future cash flow from investment decisions.

2.2.1.2 Bird in Hand Theory

Myron Goldon (1959) and John Lintner (1962) developed the bird in hand theory and argued that there exists a relationship between dividend policy and the value of a firm. Investors believe that dividends are less risky than capital gains, firms should set a higher dividend payout ratio to maximize the share price (dividends can increase stock price) (Robinson, 2006).

In fact, the risk of a firm is determined by the risk of free cash flow, which is not changed by dividend policy. In other words, the risk of a firm cannot be decreased by an increase in the dividend payments (Bhattacharya, 1979). Therefore, most of financial literatures do not accept the explanation for dividend relevance in the bird in hand theory.

2.2.1.3 Agency Cost and Free Cash Flow Hypothesis

According to M&M's theory, there is no conflict between managers and shareholders. However, in practice, this assumption is not feasible since the interest of managers and shareholders is not exactly the same sometimes. Therefore, resulting from the potential disagreement between executives and equity owners, the equity owners may incur agency cost.

The agency explanation for dividends has been supported by previous studies such as (Rozeff, 1982). Additionally, Easterbrook (1984) illustrated that by paying dividends, managers may need to use other sources to raise funds, so it can reduce the free cash flow available for managers.

When a firm is in growth stage, the agency problem becomes more serious since there is free cash flow available for the managers, but the high level of dividends can decrease available funds. Thus, it is important to motivate the managers to return free cash rather than using it ineffectively (Jensen, 1986).

Jensen (1986) stated that when a firm's free cash flow is in excess of funds needed for the project with positive net present value, the managers would have the chance to benefit themselves. Jensen believed that when a firm has extra cash, the manager may accept projects with negative net present value because they can benefit from enlarging the scale of the firm. Thus, by rising dividend payments, free cash flow under manager's control can be alleviate and prevent them from investing unprofitable projects. Having a lower level of free cash flow can lead to lower agency costs.

2.3 Determinants of investments in listed companies

2.3.1 Exchange Rate

An appreciation of exchange rate has an effect on investments. Geng and N'diaye (2012) observed that a 10% percent appreciation would reduce total investment by around 1 percent of GDP.

2.3.2 Interest Rate

According to Rittenberg and Tregarthen (2014), there is a negative relationship between interest rate and capital expenditure. Higher interest rate can increase the cost of borrowing used to finance capital expenditure and can reduce the quantity of investments. Geng and N'diaye (2012) observed that at the aggregate level, a 100 basis points increase in real interest rates reduces corporate investment in Canada by about ½ percent of GDP. Interest rates have a big influence on big companies' free cash flow. Big firm can run several projects at the same time and involve in huge amount of debts. Once interest rate goes up, much extra interest expense will be deducted from free cash flow and some projects may be cancelled because the increase of the interest expenses may lead to a negative NPVs.

2.4 Empirical Review

I would like to discuss some previous studies which have been conducted internationally and show the relationship between free cash flows and capital expenditures.

Khan, Kaleem and Nazir (2012) they regarded free cash flows as a proxy for agency costs in their study. Their study observed that the firm leverage plays an important role in reducing the agency cost of free cash flow by reducing the free cash flow that is under the control of the manager. Jensen (1993) discussed such firms as the ones that have, further expensive internal control system. About small firms, Jalilvand and Harris (1986) commented that they are more vulnerable to experience cash flow restraint mainly because they have limited access to other capital markets, due to high transaction costs of public security issue and the information problems. Therefore, Vogt (1997) believed that small firms tend to have profitable and at the same time unexploited investment opportunities. The available cash flow should be the primary source of capital expenditure by these firms. Moreover, if cash flow is used by these firms to fund the capital expenditure, such an announcement must show a positive reaction in terms of appreciated stock prices.

Ding, Guariglia & Knight (2013) used a panel data of over 116,000 firms in China (2000-2007) to test the investment sensitivity among working capital, cash flow and fixed assets. They observed that the companies with higher working capital will have higher investment sensitivity in working capital to cash flow and low investment sensitivity in fixed capital to cash flow. Because working capital will be changing all the time throughout the whole life of the project. However, the fixed assets are not as volatile as working capital. It suggests that an active management of working capital may help firms to alleviate the effects of financial constraints on fixed investment.

Orsua, Herce and Bueno (2013) studied on the time series analysis of macroeconomic determinants of capital expenditure. They found that out of the seven macroeconomic indicators included in the study, only price inflation posed an inverse relationship with capital expenditure increase. Ilyas (2014) in his study on the impact of capital expenditure on the working capital management of listed firms concluded that a positive and highly significant relationship exists between the working capital requirements and capital expenditure.

Aslani and Noori (2014) conducted a study to conclude if a relationship exists free cash flows and dividends. Their results showed that a relationship does exist between the two; this relationship is evident throughout the organization’s growth, maturity and decline stage. Jamshidi, Lotfi and Mohseni (2014) in their study suggested that the directors must have regarded for the flow of economic benefits for financial reporting within the company and the optimal use of resources.

Hennessy, Levy, and Whited (2007), Almeida, Campello, and Galvao Jr. (2010), and Erickson and Whited (2012) estimated investment cash flow sensitivities of just 0.01–0.09, while Chen and Chen (2012) find that investment-cash flow sensitivities have completely disappeared in recent years. In short, while there remains disagreement about why investment and cash flow are related, much of the recent literature suggests that cash flow has, at most, a small impact on investment.

Chapter 3 Data and Methodology

3.1 Research Design

In this research we employ regression models to analyze the relationship between free cash flow and capital expenditure based on a sample of 90 listed companies in Canada. We examine all 240 listed companies on the Toronto Stock Exchange (TSX) from 2010 to 2015.

3.2 Sample Selection

Following Mugenda & Mugenda (2003), for a correlation test to be justified, at least 30 observations are required. We selected a sample of 90 companies from the population of 240 companies using the following criteria:

(1) We excluded the companies that went public no more than 3 years, because the data is not complete, and the data before 3 years cannot be collected.

(2) From the remainder, we selected companies randomly and giving each company the same probability to be selected.

(3) Exclude the companies without valid data. Only pick firms which have sufficient data for testing purpose.

The sampling data was classified by 10 sectors between 2010 and 2015 from Bloomberg: Health Care, Information Technology, Consumer Discretionary, Consumer Staples, Telecommunication Services, Financials, Industrials, Utilities, Energy and Materials.

This paper uses 6 time period's data from 2010 to 2015 for each variable of every companies.

3.3 Variable Selection

Dependent variable: Capital Expenditure

Main independent variable: Free Cash Flow

Other variables:

There are some other variables which have an effect on the capital expenditure of the firm. This paper selects dividends, working capital, depreciation, firm size (ln(total assets)) and interest expenses as other variables because according to the literature review these factors could have a significant influence on capital expenditure and are independent with free cash flow.

3.4 Unit Root Test

In this section, unit root test is used on variables to test the stationarity because only stationary variables can be used in panel data model.

We can run a panel data model under the condition that all the variables are stationary. For variables with missing observations (unbalanced), we use fisher-type unit-toot method at level and first-difference to test the stationarity.

In process of unit root test, the null hypothesis H_0 is all panels contain unit roots. Rejecting the null hypothesis means that the panels contain no unit-root. At level, that is shown by I(0), we accept the null hypothesis of series are non-stationary and then we move to the next level that is taking the first difference. There are four statistical tests in Fisher-type unit root test: Inverse Chi-squared, Inverse normal, Inverse logit and Modified inv. Chi-squared. Choi’s (2001) simulation results suggested that the inverse normal Z statistic offers the best trade-off between size and power. Therefore, we use inverse normal statistic to test the hypothesis.

3.5 Heteroscedasticity Test

Another common problem to affect the validity and efficiency of the regression model is heteroscedasticity. This problem usually occurs with cross-sectional data. Since our sample data is large and collected across various industries, heteroscedasticity is very widely to occur. For the dynamic panel data test, one of the necessities is that the method should be heteroscedastic.

In this paper, we use the Breusch-Pagan method to test the heteroscedasticity problem.

3.6 Regression Model

In this paper, we assume a liner regression relationship between the dependent variable (capital expenditure) and the independent variable (free cash flow) as well as other variables, dividends, depreciation, working capital, firm size (ln(total asset)) and interest expenses.

Construction of variables

In corporate finance, free cash flow can be calculated in variable ways depending on available data. According to this paper and some relevant variables, I will show two ways of calculating free cash flow:

Free Cash Flow = Operating Income + Depreciation – Income Taxes – Dividends

Or

Free Cash Flow = Operating Income × (1- Tax Rate) + Depreciation – Changes in Working Capital – Capital Expenditure

Capital expenditure is an expense where the benefit continues over a long period, and it is a payment for the fixed assets of initial investment. Capital expenditure will improve productivity.

Net Capital expenditure = Current Year Capital Expenditure – Previous Year capital Expenditure

The Dynamic Panel Data Model can be constructed as follow:

$$CAPEX_{i,t} = \alpha + \rho CAPEX_{i,t-1} + \beta_1 FCF_{i,t} + \beta_2 DIV_{i,t} + \beta_3 IE_{i,t} + \beta_4 D_{i,t} + \beta_5 WC_{i,t} + \beta_6 SIZE_{i,t} + u_{i,t,} \quad \text{……..Equation (3.1)}$$

In above Equation (3.1),

$CAPEX_{i,t}$: The Capital Expenditure of sector i in time t

$CAPEX_{i,t-1}$: The $CAPEX_{i,t}$'s lagged value

$FCF_{i,t}$: The Free Cash Flow of sector i in time t

$DIV_{i,t}$: A matrix of the components of dividends of sector i time t

$IE_{i,t}$: A matrix of the components of Interest Expense of sector i Time t

$D_{i,t:}$ The depreciation of sector i in time t

$WC_{i,t}$: Working capital of sector i in time t

$SIZE_{i,t}$: Ln(Total Asset) of sector I in time t

$u_{i,t}$: The error term. The $u_{i,t}$ consists of the unobserved sectors effects (v_i) and the observation errors (e_{it})

So: $u_{it} = v_i + e_{it}$ … Equation (3.2)

Combining the Equation 3.1 and equation 3.2, we arrive at the following:

$CAPEX_{i,t} = \alpha + \rho CAPEX_{i,t-1} + \beta_1 FCF_{i,t} + \beta_2 DIV_{i,t} + \beta_3 IE_{i,t} + \beta_4 D_{i,t} + \beta_5 WC_{i,t} + \beta_6 SIZE_{i,t} + v_i + e_{it}$

……….Equation (3.3)

Several econometric problems may arise from estimating equation (3.3):

1. $FCF_{i,t}$, $DIV_{i,t}$, $IE_{i,t}$, $D_{i,t}$, $SIZE_{i,t}$ and $WC_{i,t}$ are assumed to be endogenous, these regressors may be correlated with the error term.
2. The presence of the lagged dependent variable $CAPEX_{i,t-1}$ gives rise to autocorrelation.
3. The panel dataset has a short time dimension (T=6) and a larger industry sector (I=10).

To solve Problem 1, I decide to use the Arellano-Bond method to test autocorrelation in time period (T=6) and sectors (i=10) of these variables.

To cope with Problem 2 (fixed effects), the difference GMM uses first-differences to transform equation (3.4) into:

$\Delta CAPEX_{i,t} = \rho\Delta CAPEX_{i,t-1} + \beta_1\Delta FCF_{i,t} + \beta_2\Delta DIV_{i,t} + \beta_3\Delta IEi_{,t} + \beta_4\Delta D_{i,t} + \beta_5\Delta WC_{i,t} + \beta_6\Delta SIZE_{i,t} + \Delta e_{it}$ ……..Equation (3.4)

Finally, the Arellano-Bond estimator is designed for small T and Large I panels (Problem 4).

Sargan test and zero autocorrelation test will be used to test if over identifying restrictions are valid or not. Finally, I will run the linear dynamic panel data regression to obtain the relationship between free cash flow and capital expenditure.

For all the models, I will test them at 95% confidence level and 5% significant level. If the P value is less than 5% of significant level, the conclusion will be that the model is significant in explaining the relationship.

Chapter 4 Results

4.1 Scatter Plot

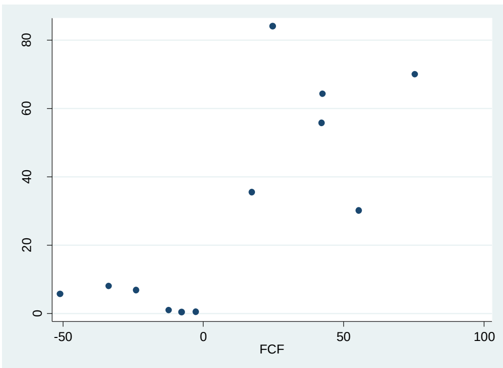
Before testing the relationship between Free Cash Flow and Capital Expenditure, we discuss briefly the relationship between these two factors via scatter plot graph.

From the graph, the relationship between free cash flow and capital expenditure is not clear without looking at each panel, because that graph shows a pooled scatter plot results and does not show time series and cross-section effects. Maybe some specific sectors have positive relationship between free cash flow and capital expenditure, while other sectors have negative relationship or no relationship.

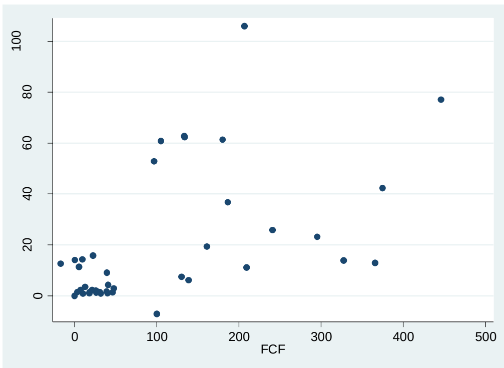
Figure 4.1: shows the relationship by industry sector:

Figure 4.1: Scatter plot of Free Cash Flow and Capital Expenditure by industry (2010-2015)

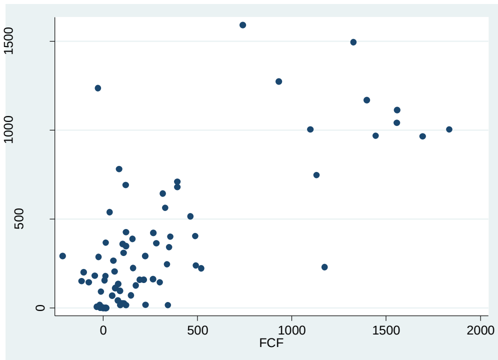
(a) Health Care



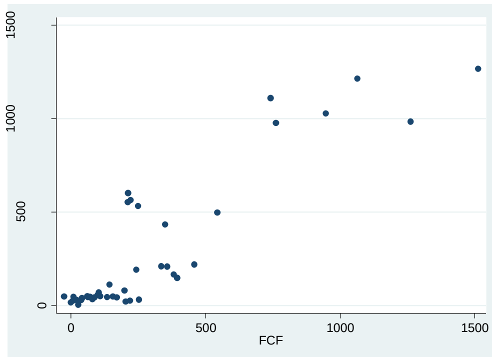
(b) Information Technology



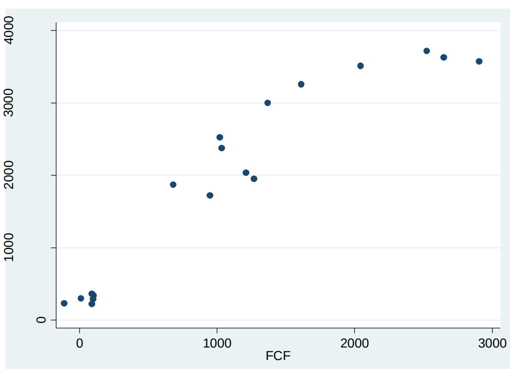
(c) Consumer Discretionary



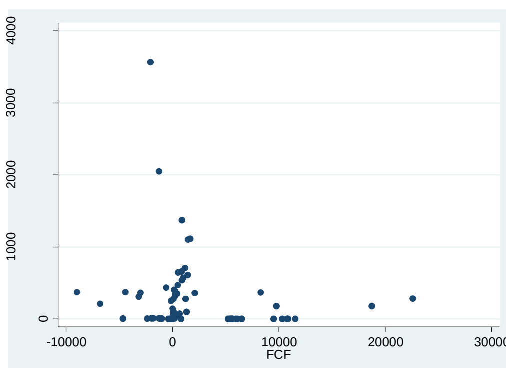
(d) Consumer Staples



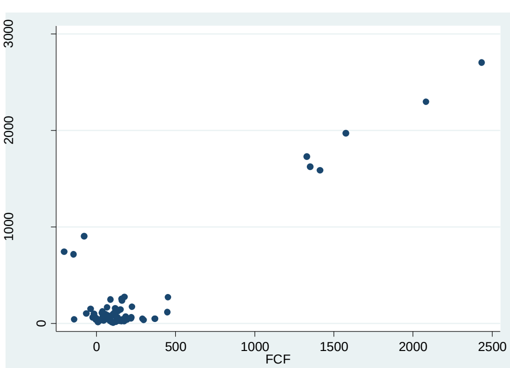
(e) Telecommunication Services



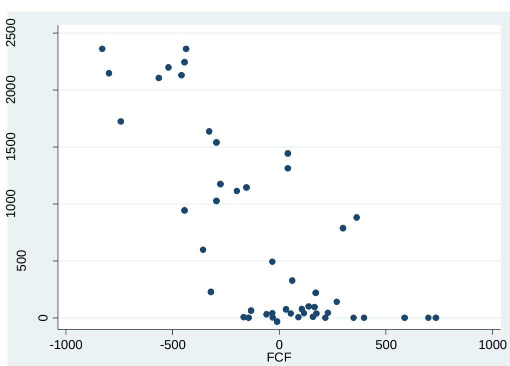
(f) Financials



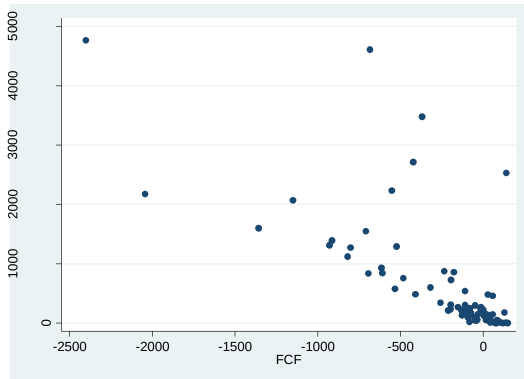
(g) Industrials



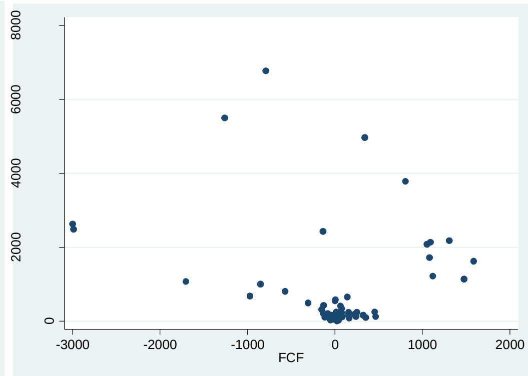
(h) Utilities



(i) Energy



(j) Materials



From Figure 4.1, we can see that there appears to be a positive relationship between free cash flow and capital expenditure in Health Care, Consumer Discretionary, Consumer Staples, Telecommunication Services, and Industrials. For the Information Technology, Financials, and Materials, there is no clear relationship between capital expenditure and free cash flow. That is because some companies in those industries have little or no fixed assets as investments. Utilities and Energy show a negative relationship between free cash flow and capital expenditure.

4.2 Unit Root Test

In this section, the results of unit roots test are presented. All variables are tested for unit roots both at their level and first differences. Results are shown in Table 4.1 to 4.5 below.

Table 4.1 Unit-root Test (free cash flow)

```
. xtunitroot fisher FCF, pperron trend demean lags(0)

Fisher-type unit-root test for FCF
Based on Phillips-Perron tests
------------------------------------------------------
Ho: All panels contain unit roots           Number of panels       =     90
Ha: At least one panel is stationary        Avg. number of periods =   5.94

AR parameter:     Panel-specific            Asymptotics: T -> Infinity
Panel means:      Included
Time trend:       Included                  Cross-sectional means removed
Newey-West lags: 0 lags
------------------------------------------------------------------------------
                                  Statistic       p-value
------------------------------------------------------------------------------
 Inverse chi-squared(180)   P       548.3562        0.0000
 Inverse normal             Z        -8.6405        0.0000
 Inverse logit t(444)       L*      -12.2977        0.0000
 Modified inv. chi-squared Pm        19.4141        0.0000
------------------------------------------------------------------------------
 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.
------------------------------------------------------------------------------

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```

```
. xtunitroot fisher FCF, pperron trend demean lags(1)

Fisher-type unit-root test for FCF
Based on Phillips-Perron tests
------------------------------------------------------
Ho: All panels contain unit roots           Number of panels       =     90
Ha: At least one panel is stationary        Avg. number of periods =   5.94

AR parameter:     Panel-specific            Asymptotics: T -> Infinity
Panel means:      Included
Time trend:       Included                  Cross-sectional means removed
Newey-West lags: 1 lag
------------------------------------------------------------------------------
                                  Statistic       p-value
------------------------------------------------------------------------------
 Inverse chi-squared(180)   P      1339.0525        0.0000
 Inverse normal             Z       -20.3646        0.0000
 Inverse logit t(439)       L*      -35.6645        0.0000
 Modified inv. chi-squared Pm        61.0874        0.0000
------------------------------------------------------------------------------
 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.
------------------------------------------------------------------------------

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Table 4.2 Unit-Root Test (net capital expenditure)

```
Fisher-type unit-root test for NetCapitalExpenditure
Based on Phillips-Perron tests
----------------------------------------------------
Ho: All panels contain unit roots           Number of panels       =     90
Ha: At least one panel is stationary        Avg. number of periods =   5.94

AR parameter:     Panel-specific            Asymptotics: T -> Infinity
Panel means:      Included
Time trend:       Included                  Cross-sectional means removed
Newey-West lags: 0 lags
------------------------------------------------------------------------------
                                  Statistic      p-value
------------------------------------------------------------------------------
 Inverse chi-squared(180)  P       200.7158       0.1384
 Inverse normal            Z         4.1388       1.0000
 Inverse logit t(439)      L*        2.6549       0.9959
 Modified inv. chi-squared Pm        1.0918       0.1375
------------------------------------------------------------------------------
 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.
------------------------------------------------------------------------------

. xtunitroot fisher NetCapitalExpenditure, pperron trend demean lags(1)

Fisher-type unit-root test for NetCapitalExpenditure
Based on Phillips-Perron tests
----------------------------------------------------
Ho: All panels contain unit roots           Number of panels       =     90
Ha: At least one panel is stationary        Avg. number of periods =   5.94

AR parameter:     Panel-specific            Asymptotics: T -> Infinity
Panel means:      Included
Time trend:       Included                  Cross-sectional means removed
Newey-West lags: 1 lag
------------------------------------------------------------------------------
                                  Statistic      p-value
------------------------------------------------------------------------------
 Inverse chi-squared(180)  P       501.8922       0.0000
 Inverse normal            Z        -5.2338       0.0000
 Inverse logit t(419)      L*       -9.2393       0.0000
 Modified inv. chi-squared Pm       16.9652       0.0000
------------------------------------------------------------------------------
 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.
------------------------------------------------------------------------------

.
```

Table 4.3 Unit root test (dividend)

```
Based on Phillips-Perron tests

Ho: All panels contain unit roots            Number of panels       =     90
Ha: At least one panel is stationary         Avg. number of periods =   5.90

AR parameter:     Panel-specific             Asymptotics: T -> Infinity
Panel means:      Included
Time trend:       Included                   Cross-sectional means removed
Newey-West lags: 0 lags

                                  Statistic      p-value

 Inverse chi-squared(178)  P       837.8883       0.0000
 Inverse normal            Z        -9.3104       0.0000
 Inverse logit t(419)      L*      -20.0858       0.0000
 Modified inv. chi-squared Pm       34.9740       0.0000

 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.

. xtunitroot fisher Dividends, pperron trend demean lags(1)
could not compute test for panel 29

Fisher-type unit-root test for Dividends
Based on Phillips-Perron tests

Ho: All panels contain unit roots            Number of panels       =     90
Ha: At least one panel is stationary         Avg. number of periods =   5.90

AR parameter:     Panel-specific             Asymptotics: T -> Infinity
Panel means:      Included
Time trend:       Included                   Cross-sectional means removed
Newey-West lags: 1 lag

                                  Statistic      p-value

 Inverse chi-squared(178)  P      1014.4116       0.0000
 Inverse normal            Z       -12.5959       0.0000
 Inverse logit t(419)      L*      -25.4237       0.0000
 Modified inv. chi-squared Pm       44.3297       0.0000

 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.
```

Table 4.4 Unit root test (interest expense)

```
Fisher-type unit-root test for InterestExpense
Based on Phillips-Perron tests

Ho: All panels contain unit roots           Number of panels       =     84
Ha: At least one panel is stationary        Avg. number of periods =   5.49

AR parameter:    Panel-specific             Asymptotics: T -> Infinity
Panel means:     Included
Time trend:      Included                   Cross-sectional means removed
Newey-West lags: 0 lags

                                  Statistic      p-value

 Inverse chi-squared(164)  P       576.4859       0.0000
 Inverse normal            Z        -1.0541       0.1459
 Inverse logit t(339)      L*      -10.2102       0.0000
 Modified inv. chi-squared Pm       22.7757       0.0000

 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.

.
```

```
Fisher-type unit-root test for InterestExpense
Based on Phillips-Perron tests

Ho: All panels contain unit roots           Number of panels       =     84
Ha: At least one panel is stationary        Avg. number of periods =   5.49

AR parameter:    Panel-specific             Asymptotics: T -> Infinity
Panel means:     Included
Time trend:      Included                   Cross-sectional means removed
Newey-West lags: 1 lag

                                  Statistic      p-value

 Inverse chi-squared(164)  P       753.8906       0.0000
 Inverse normal            Z        -2.8612       0.0021
 Inverse logit t(329)      L*      -16.0906       0.0000
 Modified inv. chi-squared Pm       32.5713       0.0000

 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.
```

Table 4.5 Unit root test (working capital)

```
Fisher-type unit-root test for workingcapital
Based on augmented Dickey-Fuller tests
--------------------------------------------------------------------------
Ho: All panels contain unit roots           Number of panels       =     79
Ha: At least one panel is stationary        Avg. number of periods =   5.87

AR parameter: Panel-specific                Asymptotics: T -> Infinity
Panel means:  Included
Time trend:   Not included                  Cross-sectional means removed
Drift term:   Included                      ADF regressions: 0 lags
------------------------------------------------------------------------------
                                  Statistic      p-value
------------------------------------------------------------------------------
 Inverse chi-squared(158)  P       365.8286       0.0000
 Inverse normal            Z       -10.4692       0.0000
 Inverse logit t(399)      L*      -10.2994       0.0000
 Modified inv. chi-squared Pm       11.6913       0.0000
------------------------------------------------------------------------------
 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.
------------------------------------------------------------------------------

. xtunitroot fisher workingcapital, dfuller drift demean lags(1)

Fisher-type unit-root test for workingcapital
Based on augmented Dickey-Fuller tests
--------------------------------------------------------------------------
Ho: All panels contain unit roots           Number of panels       =     79
Ha: At least one panel is stationary        Avg. number of periods =   5.87

AR parameter: Panel-specific                Asymptotics: T -> Infinity
Panel means:  Included
Time trend:   Not included                  Cross-sectional means removed
Drift term:   Included                      ADF regressions: 1 lag
------------------------------------------------------------------------------
                                  Statistic      p-value
------------------------------------------------------------------------------
 Inverse chi-squared(144)  P       261.9473       0.0000
 Inverse normal            Z        -6.7591       0.0000
 Inverse logit t(364)      L*       -6.7491       0.0000
 Modified inv. chi-squared Pm        6.9501       0.0000
------------------------------------------------------------------------------
 P statistic requires number of panels to be finite.
 Other statistics are suitable for finite or infinite number of panels.
------------------------------------------------------------------------------
```

Tables 4.1 to 4.5 show that except interest expense, all the variables are stationary at level. Unlike the results at level, all variables are stationary at first difference and the null hypothesis is rejected at 1% level of significance.

4.3 Heteroscedasticity Test

Table 4.6 Breusch-Pagan Test

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: Depreciation InterestExpense Dividends FCF workingcapital lnIR

         chi2(6)      =   547.06
         Prob > chi2  =   0.0000
```

From Table 4.6, the P value is 0.0%, which is less than 5%, so we can easily reject the null hypothesis of constant variance. There exists heteroscedasticity in the model. Therefore, dynamic panel data model is available for this data.

4.4 Dynamic Panel Data Analysis

Arellano-Bond linear dynamic panel-data estimation

The Arellano-Bond approach, and its extension to the ‘System GMM’ context, is an estimator designed for situations with:

“Small T, large N” panels: Few time periods and many individual units.

A linear functional relationship.

One left-hand variable that is dynamic, depending on its own past realisations.

Right-hand variables that are not strictly exogenous: correlated with past and possibly current realisations of the error.

Fixed individual effects, implying unobserved heterogeneity.

Heteroscedasticity and autocorrelation within individual units' errors, but not across them.

For the model in this paper, all the conditions above are fulfilled, I will run this model by using Arellano-Bond approach.

In this part, we focus on the dynamic panel data analysis to estimate the capital expenditure level as a function of one lagged level of free cash flow, capital expenditure, dividends, working capital, firm size and interest expenses. I will use three different ways to test the relationship in each variables and test the relationship between free cash flow and capital expenditure: one-step method, one-step with a robust and twostep with a robust test. I will use Sargan test to check if overidentifying restrictions are valid or invalid and zero autocorrelation test to find if there appears to be autocorrelated in this model.

Table 4.7: One-step results

```
Arellano-Bond dynamic panel-data estimation  Number of obs         =       198
Group variable: B                            Number of groups      =        59
Time variable: year
                                             Obs per group:    min =         1
                                                               avg =  3.355932
                                                               max =         4

Number of instruments =     17               Wald chi2(7)          =    569.51
                                             Prob > chi2           =    0.0000
One-step results
```

NetCapitalExpenditure	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
NetCapitalExpenditure						
L1.	.3862177	.0666338	5.80	0.000	.2556179	.5168176
FCF	-.4538833	.0621907	-7.30	0.000	-.5757748	-.3319919
Depreciation	1.046473	.2226833	4.70	0.000	.6100214	1.482924
LnTA	114.2206	51.53632	2.22	0.027	13.21131	215.23
InterestExpense	-3.933302	.2931114	-13.42	0.000	-4.50779	-3.358815
Dividends	.2034545	.1481305	1.37	0.170	-.086876	.4937849
workingcapital	-.0520899	.0398198	-1.31	0.191	-.1301352	.0259554
_cons	-383.9794	401.6875	-0.96	0.339	-1171.272	403.3136

```
Instruments for differenced equation
        GMM-type: L(2/.).NetCapitalExpenditure
        Standard: D.FCF D.Depreciation D.LnTA D.InterestExpense D.Dividends D.workingcapital
Instruments for level equation
        Standard: _cons
```

```
. estat sargan
Sargan test of overidentifying restrictions
        H0: overidentifying restrictions are valid

        chi2(9)      =  10.31233
        Prob > chi2  =    0.3258
```

In this test, the P value of Sargan Test is 32.58% which is greater than 5%, so we can accept the null hypothesis that the over-identifying restrictions are valid. The P value of free cash flow is 0.0%, we can conclude that there is a negative relationship between free cash flow and capital expenditure. Also, the P value of firm size is 2.7% (less than 5%), for companies with bigger sizes, they will spend more capital expenditures.

Table 4.8: One-step results (with robust test)

```
Arellano-Bond dynamic panel-data estimation  Number of obs         =       198
Group variable: B                            Number of groups      =        59
Time variable: year
                                             Obs per group:    min =         1
                                                               avg =  3.355932
                                                               max =         4

Number of instruments =     17               Wald chi2(7)          =    408.67
                                             Prob > chi2           =    0.0000
One-step results
                                   (Std. Err. adjusted for clustering on B)
```

NetCapitalExpenditure	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
NetCapitalExpenditure						
L1.	.3862177	.110872	3.48	0.000	.1689127	.6035228
FCF	-.4538833	.1410987	-3.22	0.001	-.7304318	-.1773349
Depreciation	1.046473	.4576753	2.29	0.022	.1494454	1.9435
LnTA	114.2206	36.18649	3.16	0.002	43.29643	185.1449
InterestExpense	-3.933302	1.299108	-3.03	0.002	-6.479507	-1.387098
Dividends	.2034545	.2971643	0.68	0.494	-.3789769	.7858858
workingcapital	-.0520899	.1211203	-0.43	0.667	-.2894814	.1853016
_cons	-383.9794	237.261	-1.62	0.106	-849.0024	81.04357

```
Instruments for differenced equation
        GMM-type: L(2/.).NetCapitalExpenditure
        Standard: D.FCF D.Depreciation D.LnTA D.InterestExpense D.Dividends D.workingcapital
Instruments for level equation
        Standard: _cons
```

Arellano-Bond test for zero autocorrelation in first-differenced errors

Order	z	Prob > z
1	-2.6527	0.0080
2	.90437	0.3658

H0: no autocorrelation

In the Table 4.8, I add a robust into this one-step model and test the relaitonship again. Now, we add a robust test to eliminate the effect of standard errors. As we can see from Table 4.8, the P value of one lagged capital expenditure is 0.0%, which is less than the significance level of 5%. It illustrates that the one lagged capital expenditure is significant in this model. The P value of free cash flow is less than 5% of significance level. So there is a negative relationship between free cash flow and capital expenditure.

The results illustrate that the standard errors have an influence on autocorrelation and heteroscedasticity. For the validity test, we cannot use Sargan test because only for a homoscedastic error term does the Sargan test have an asymptotic chi-squared distribution. In fact, Arellano and Bond (1991) show that the one-step Sargan test over-rejects in the presence of heteroscedasticity. Because its asymptotic distribution is not known under the assumptions of the robust model, Sargan test does not compute it when robust is specified. We can use Arellano-Bond for zero correlation test to test the autocorrelation in first-differenced errors. As we can see above, the P value of order 1 and order 2 are 0.8% and 36.58% respectively. Accepting the null hypothesis of no autocorrelation in the first-differenced errors at an order greater than one implies no model misspecification.

Finally, I use two-step estimation with a robust to test the relationship of dependent variable of capital expenditure and independent variable of free cash flow, dividends, depreciation, interest expense, firm value and working capital again.

Table 4.9: Two-step with robust test

```
Arellano-Bond dynamic panel-data estimation  Number of obs         =       198
Group variable: B                            Number of groups      =        59
Time variable: year
                                             Obs per group:    min =         1
                                                               avg =  3.355932
                                                               max =         4

Number of instruments =     17               Wald chi2(7)          =    224.83
                                             Prob > chi2           =    0.0000
Two-step results
                                   (Std. Err. adjusted for clustering on B)
```

NetCapitalExpenditure	Coef.	WC-Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
NetCapitalExpenditure						
L1.	.3486403	.1268728	2.75	0.006	.099974	.5973065
FCF	-.5455563	.1629892	-3.35	0.001	-.8650092	-.2261034
Depreciation	1.100638	.4411187	2.50	0.013	.2360615	1.965215
LnTA	95.59078	42.20752	2.26	0.024	12.86556	178.316
InterestExpense	-3.56891	1.437148	-2.48	0.013	-6.385669	-.7521511
Dividends	.1731495	.2694576	0.64	0.520	-.3549776	.7012766
workingcapital	-.000026	.140286	-0.00	1.000	-.2749814	.2749294
_cons	-455.2239	287.1018	-1.59	0.113	-1017.933	107.4853

```
Instruments for differenced equation
        GMM-type: L(2/.).NetCapitalExpenditure
        Standard: D.FCF D.Depreciation D.LnTA D.InterestExpense D.Dividends D.workingcapital
Instruments for level equation
        Standard: _cons
```

Arellano-Bond test for zero autocorrelation in first-differenced errors

Order	z	Prob > z
1	-.95925	0.3374
2	.0221	0.9824

H0: no autocorrelation

By using Arellano-Bond dynamic panel data estimation with two-step and robust test, this model is valid with P value (33.74%) over 5% at order one. We confirm that this model has no autocorrelation. Therefore, we obtain the same conclusion as the last model.

In conclusion, we can obtain the results that our model has no autocorrelation at first-difference, so it is a feasible model.

4.5 Regression Analysis

From above analysis, we know that the Equation (3.4) has no autocorrelation. We can get the relationships in variables from above estimations.

Table 4.7 to 4.9 show that at 5% significance level, the P value the free cash flow is 0.0% which is less than 5%. It proves that there is a negative relationship between net capital expenditure and free cash flow. The capital expenditure will decrease by approximately 0.5 with free cash flow increasing by 1. Companies with larger sizes will invest more in capital expenditures. We also can get the dividends and working capital have no relationship with capital expenditure in Canadian listed companies.

Chapter 5 Conclusions and recommendations

5.1 Conclusion

The objective of this paper is to determine the relationship between Free Cash Flow and Capital Expenditure of Canadian listed companies and how this will affect the future cash flow of the firms.

This research was carried out using a sample of 90 listed companies in Canadian from 2010 to 2015 to test the relationship between Free Cash Flow and Capital Expenditure. Dividends and depreciation are among the variables tested and found to affect capital expenditure. Capital expenditure have a positive relationship with firm size and depreciation. From the analysis, free cash flow has a negative relationship with capital expenditure.

From the companies considered, it is established that there is a negative relationship between free cash flows and capital expenditure. Canadian listed companies would like to decrease their investments although their free cash flows increase. Normally, firms with more free cash flow will make more investments. However, we get a reverse result in Canadian firms during last six years. We can confirm that a conservative investment method was used among Canadian listed companies during 2010 to 2015. For the growth firms, they still invest more projects than the companies in other stages. We can infer that the Canadian economy was not good between 2010 and 2015, many companies were not willing to invest aggressively at that time. According to the previous years' analysis, Canadian firms better be circumspect in investments next year.

5.2 Limitations

There are several limitations which are related to this study and which need to remind the researchers when planning for a research project. Some of these limitations are shown as below:

This paper only used three variables as the measure of relationship between free cash flow and capital expenditure, there is a need to run this model with other different factors to make sure if other variables will have effects on the relationship with free cash flow in Canadian quoted companies.

Another deficiency is that most of the data collected from Bloomberg begins with the year of 2010. If we add the data before year 2010, the results we get from dynamic panel-data model will be more accurate.

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Appendix A: The population of Canadian listed companies

Name	Name	Name
CNR CT	GIL CT	ACO/X CT
MG CT	CUF-U CT	GC CT
ABX CT	BPY-U CT	BTE CT
TD CT	L CT	NVU-U CT
RY CT	IPL CT	ECI CT
BNS CT	WFT CT	BNP CT
ENB CT	SNC CT	JE CT
CP CT	ARX CT	EFN CT
T CT	FCR CT	RUS CT
BAM/A CT	TCK/B CT	PJC/A CT
MFC CT	BB CT	HCG CT
CNQ CT	GIB/A CT	WTE CT
SLF CT	MX CT	EXE CT
G CT	EDV CT	CJR/B CT
TRP CT	NG CT	H CT
BMO CT	MRU CT	BIR CT
POT CT	FTS CT	DOO CT
PPL CT	AAV CT	FSV CT
WCN CT	QBR/B CT	KXS CT
AEM CT	TXG CT	CIX CT
ATD/B CT	NGD CT	TOG CT
QSR CT	CVE CT	IT CT
AGU CT	VRX CT	ENF CT
CM CT	RBA CT	NVA CT
BCE CT	HBC CT	BAD CT
DGC CT	FTT CT	KEL CT
TRI CT	GUY CT	CR CT
SU CT	SSO CT	AVO CT
K CT	CG CT	AX-U CT
OTC CT	PVG CT	BNE CT
FNV CT	DOL CT	BYD-U CT
SLW CT	SAP CT	PBH CT
THO CT	GWO CT	NFI CT
SJR/B CT	ECA CT	NPI CT
IAG CT	EFX CT	ITP CT
YRI CT	HR-U CT	RNW CT
BCB CT	VET CT	BBU-U CT
OGC CT	CCO CT	CMG CT
AGI CT	POW CT	PD CT
RCI/B CT	INE CT	TRQ CT
FFH CT	IMO CT	
SW CT	CTC/A CT	
CSU CT	PSK CT	
IMG CT	OCX CT	
PAA CT	WN CT	
FR CT	CLS CT	
LNR CT	PKI CT	
SMF CT	WSP CT	
NA CT	BBD/B CT	

Name	Name	Name	Name
VII CT	BEP-U CT	ERF CT	TIH CT
ASR CT	FM CT	GRT-U CT	BTO CT
AC CT	CIG CT	CSH-U CT	BEI-U CT
UNS CT	CCA CT	CEU CT	MIC CT
HSE CT	NWC CT	DSG CT	DHX/B CT
DH CT	SCL CT	KGI CT	D-U CT
MRE CT	CWB CT	IFC CT	LB CT
ALA CT	TFI CT	MFI CT	CU CT
EMP/A CT	AAR-U CT	MDA CT	PSI CT
CPG CT	REI-U CT	SJ CT	CPX CT
STN CT	MAG CT	RRX CT	SPB CT
TOU CT	LUN CT	WJA CT	GTE CT
ELD CT	PLI CT	CHE-U CT	MEG CT
X CT	LUC CT	WEF CT	MNW CT
EMA CT	ATA CT	AQN CT	TCN CT
KEY CT	WPK CT	MST-U CT	DRG-U CT
IFP CT	CRR-U CT	DDC CT	SGY CT
HBM CT	PEY CT	AYA CT	ESI CT
SRU-U CT	PXT CT	PWF CT	AIM CT
WCP CT	REF-U CT	TA CT	NSU CT
GEI CT	FRU CT	TCL/A CT	AP-U CT
CCL/B CT	MTL CT	CAE CT	SES CT
CXR CT	CAR-U CT	VSN CT	MBT CT
OSB CT	ARE CT	CFP CT	ESL CT
IGM CT	CGX CT	OR CT	AD CT
LIF CT	DII/B CT		

Appendix B: Companies by industries included in the sample

Health Care	Information Technology	Consumer Discretionary	Consumer Staples	Telecommunication Services
EXE	KXS	CTC/A	NWC	MBT
PLI	CMG	TRI	MRU	BCE
	OTC	MRE	EPM/A	T
	SW	CCA	BCB	
	ESL	QBR/B	WN	
	CLS	GC	PJC/A	
	CSU	MG	PBH	
		DHX/B		
		GIL		
		LNR		
		AYA		
		DOO		
		HBC		
Financials	Industrials	Utilities	Energy	Materials
BAM/A	TIH	CPX	AAV	DDC
OCX	WCN	CU	TOU	WFT
BNS	RBA	SPB	ECA	TRQ
POW	CNR	INE	PKI	WEF
IFC	TCL/A	JE	VII	ABX
PWF	BAD	BEP-U	PD	HBM
X	WJA	FTS	PXT	CFP
EFN	WTE	ACO/X	WCP	POT
HCG	ARE		NVA	MX
MFC	CAE		TOG	PAA
BMO	STN		EFX	SSO
REF-U			SES	
CRR-U			GEI	
AP-U			MEG	