

**THE IMPACT OF OIL PRICE ON BANK  
PROFITABILITY IN CANADA**

by

Chengcheng Xu

Bachelor of Management in Public Administration, Wuhan University, 2014

And

Bingqing Xie

Bachelor of Economics - Finance, Guangdong University of Foreign Studies, 2014

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# Approval

**Name:** Chengcheng Xu and Bingqing Xie

**Degree:** Master of Science in Finance

**Title of Project:** The Impact of Oil Price on Bank Profitability in Canada

**Supervisory Committee:**

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**Dr. Jijun Niu**  
Senior Supervisor  
Associate Professor, Beedie School of Business

---

**Dr. Andrey Pavlov**  
Second Reader  
Professor, Beedie School of Business

**Date Approved:** \_\_\_\_\_

## **Abstract**

Using the ordinary least squares estimation, this paper analyzes the impact of oil price on bank profitability in Canada. We use data on 10 public banks from 1995 to 2015. Our profitability determinants include bank-specific characteristics and macroeconomic factors. We separately consider how banks react to two dramatic drops during these 20 years. We find that there is a significantly positive relationship between the oil price and bank profitability in the early period, but no evidence shows that they have relationship in recent years. This evidence that Canadian banks have taken action to immunize from the risk of oil price drop.

**Keywords: Oil Price; Bank Profitability; Canadian Banks**

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# 1. Introduction

From 2010 to mid-2014, the global oil price had been fairly stable. Since mid-2014, the global oil price has been in a new downturn. The Brent crude oil has now down to below 50 USD a barrel. This drop is led by the oversupply of oil in the world market, the weak demand in many emerging countries as well as the increasing US oil production.

As a result, many oil-exporting countries experience revenue shortfalls, while the importing countries pay less to boost the local economy or power the individual car. For the oil-exporting country, the disadvantage of declining oil price is obvious. Not only the oil industry reduces revenue which leads to government revenues fallen, but other industries like retailing or banking may suffer revenue decline as well. These may lead to lower GDP growth and higher unemployment rate.

Canada is the fifth largest oil producing country in the world. The petroleum production is a major industry which is vital to Canadian economy, even to the economy of North America. In 2008 Canada produced an average of 438,000 cubic meters per day (2,750,000 barrels per day) of crude oil, bitumen and natural gas condensate.<sup>1</sup> The vast majority of Canadian crude oil is exported to the United States. Calgary, Alberta and Saskatchewan are the famous oil producing provinces. Depressed oil prices are taking a bite out of their exports. Their government lost billions of dollars in revenue.

The collapse in oil price is followed by some negative effect on Canadian banking system. In February, a report by Moody's claim that, if the oil price does not increase in the short term,

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<sup>1</sup> [https://en.wikipedia.org/wiki/Petroleum\\_production\\_in\\_Canada](https://en.wikipedia.org/wiki/Petroleum_production_in_Canada)

Canadian's banking sector would experience diminished profitability<sup>2</sup>. There is no doubt that the oil company would reduce their borrowing from the banks, which, in turn, would constrain revenues from banking.

Therefore, the relationship between oil price movement and bank profitability is worth investigation. Some potential questions might come up to people's mind: Do the oil price affect bank performance and if so, is the effect positive or negative? Do the banks perform the same during the 20 years? Do banks find methods to immunize the effect of oil price? Our paper is to provide empirical evidence for these issues.

To do this, we apply the multiple regression technique (Ordinary Least Squares) to identify the impact of oil price on profitability by introducing the quarterly data from ten Canadian banks over the second quarter of 1995 to the second quarter of 2015. We separate the time by 2007, just before the recent financial crisis. In order to run the linear regression, we add some bank specific factors and macroeconomic factors which are related to the bank profitability.

Our result suggest that there is a positive relation between oil price and bank profitability. However, the relation differs under different time period. Before 2008 financial crisis, the relation was positive and significant, and is robust to controlling for a number of time-varying bank characteristics. However, in recent years, the relation is not significant, which means that banks are more immune to oil crashes. Overall, our findings suggest that oil price, once the important determinant of bank profits, has less impact on bank performance after the crisis.

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<sup>2</sup> <http://internationalbanker.com/banking/how-are-canadian-banks-being-affected-by-the-slump-in-oil-prices/>

## **2. Literature Review**

In this paper, the goal is to explore whether the oil price has an impact on the bank profitability in Canada where is an oil-exporting country. The bank profitability is determined by different factors. There is a large amount of studies on this topic covered a wide range of countries or regions. For example, Osuagwu (2014) investigated the Nigerian banking industry, Trujillo-Ponce (2012) focused on the banks in Spain and Tan & Floros (2012) provided data analyses on China. Other studies discuss the bank profitability on a panel of countries. Goddard et al. (2004) examined the role of different factors in six European countries. Hesse & Poghosyan (2009) analyzed eleven oil-exporting MENA countries. It is not surprising that the studies mentioned above show various empirical results. Because they used different countries, time periods, regression methods and datasets.

Referring to bank profitability, return on assets (ROA) or return on equity (ROE) is widely employed. The ROA figure gives us an idea of what earnings were generated from assets. The higher the number, the better, because it means the company is more efficient in converting investment to net income. ROE measures what earnings were generated from shareholders' investments. Lower leverage (higher equity) will generate higher ROA, but lower ROE (Panayiotis et al., 2008).

### **2.1 The impact of bank-specific variables on bank profitability**

Based on the previous literatures, the variables determining the bank's profitability can be categorized into two groups. The first is variables specific to each bank. They include asset structure, capitalization, capital structure and the size.

Abreu & Mendes (2002), who examined banks in several European countries, finally draw a conclusion that loan-to-assets ratio, as a representative for asset structure, has a positive effect on the bank profitability. Zhang & Dong (2011) find that although higher number in loan-to-assets ratio will bring more credit risk to the banks for insufficient liquidity, the positive effect of lending specialization outperform the negative effect.

Previous research studies of the impact of capital have agreed that capital has a close connection with bank's profitability. The equity-to-total asset ratio is a positive variable in determining bank profitability. The positive impact may include less borrowing, lower cost of funding and better signal to the market. (Athanasoglou et al.,2006; Flamini, 2009). Similar result is shown by Trujillo-Ponce (2012) when he used ROA as a dependent. The negative influence of banks capital on ROE can be explain that ROE equals to the product of ROA and total assets-to-equity ratio.

A large share of deposits to liabilities seems to boost the bank profit, which is cited by García-Herrero et al. (2009). This result is supported by Trujillo-Ponce (2012) later.

When taking into accounts the previous papers, researchers have mixed conclusions on the relationship between size and bank profitability. , Martinez-Peria & Mody (2004) held the opinion that large banks may have high revenues and profits result from higher interest rate charge on loans. At the same time, the banks can reap economies of scale. Demirguc-Kunt & Huizinga (2000) explain that the size effect is indirect. There exist various factors (e.g. corruption) which are close linked to bank size can positively affect banks. Testing data in fifteen European countries over the period 1995-2001, Pasiouras & Kosmidou (2006) point out that larger banks tend to have lower profits. Goddard et al. (2004) concluded the result regressed

across six European countries. They cannot find evidence to support that the bank size is correlated to the banks' profit. Among the six countries, Germany is negative and significant while the banks from UK seem to benefit from scale or scope economics. The relationship from the other four countries appears to be neutral.

## 2.2 The impact of macro-economic variables on bank profitability

Besides, bank profitability may depend on the macroeconomic factors at the same time. They include economy growth, inflation and interest rate. In order to test the effect of oil price, in this paper, we add oil price as another macroeconomic factor.

There appears to be a consensus in the previous literature that the GDP growth and increase in interest rates may help the bank to perform better in terms of profitability (e.g., Molyneux & Thornton, 1992; Claeys & Vander Vennet, 2008; Demirgüç-Kunt & Huizinga, 1999). Poor economic conditions coupled with low interest rates could increase competition among banks and increase the credit loss. For example, the probability of loan default may increase for the existing borrowers and at the same time, in order to attract new borrowers, the quality of the loan portfolio may be worsened.

Significant and positive relationships between inflation and bank profitability have been proposed by Trujillo-Ponce (2012) and Molyneux & Thornton (1992). However, this opinion is challenged by some scholars. Perry (1992) concludes that the effect of inflation on bank profitability is dependent on whether the inflation is fully anticipated. If the inflation rate increases without being anticipated, the costs for the banks are rising faster than their incomes. Boyd & Champ (2006) further shows that inflation may decrease the loan lending and thus negatively influence the profit.

### 2.3 The impact of oil price on economic activities

There are many previous studies examined how the oil price movement affect the economic activities. Yoshizaki & Hamori (2013) extend Kilian's (2009) method, which studies the effect of oil price shocks on the GDP and CPI of the United States, to investigate the effect of oil price shocks on the exchange rate and real economic. They find that oil price shocks have no long-run effect in oil-abundant countries. Only the oil deficient countries will intentionally lower production level to save oil. The oil price movement also affects Asian countries. But the impact is limited to the short run and it is more significant when oil price is defined in local currency (Cunado & Gracia, 2004). Their result is similar to that written by Yoshizaki & Hamori. The oil-exporting country has less significant result. Applying a structural cointegrated VAR model, Cologni and Manera (2008) estimates the direct effects of oil price change and the level of economic activities. The majority countries' monetary variables are affected. And the oil price effect is transmitted by monetary policies to the economic system.

Oil price movements receive important consideration for Canadian economy. As a traditional oil exporting country, the relationship between oil price and economy is an important issue to be addressed. Using quarterly data from 1974 to 2010, Rahman & Serletis (2011) investigate how Canadian economic react to the oil price uncertainty. They state that the oil price movement does not synchronize with the economy movement because of the sharp rise in volatility. A lower average growth rate in economic activity in Canada is resulted from the increased volatility in oil price. This is consistent with what Bashar et al., (2013) report in their study. Instead of the oil price change level, it is the oil price uncertainty makes considerable contribution to the Canadian economy.

Nonetheless there is very limited researches academic literature on relation between oil price and bank performance. Said (2015) using data contained 32 Islamic banks from the MENA Region during the financial crisis 2007-2009 to explore the relationship between the oil price and the bank efficiency. Their result shows these two variables have no direct relationship. Further studies suggest that in MENA countries, the banking system is underdeveloped which result to the inefficiencies. Hesse and Poghosyan (2009) using data on 145 banks in 11 oil-exporting MENA countries show that the oil price shocks have effect on bank profitability in an indirect way, via macroeconomic channels. Because of the high correlations between the macroeconomic variables and the oil price, when regressing all the factors, the result suggests that the impact of oil prices is not significant. The oil income affect the government fiscal spending, which in return has an impact on the bank profitability. The main macro drivers seem to be inflation and the fiscal stance. They also find evidence that, compared with the commercial banks and Islamic banks, the investment banks appear to be affected the most. In addition, the global financial crisis distorted the relationship between oil price and bank performance. The multiple global shocks should be taken into account when analyze the oil price and bank profitability in oil export countries.

### **3. Sample and variables**

Our sample period goes from 1995:Q2 to 2015:Q2. The sample starts in 1995:Q2 because twenty-year data is enough for our empirical study, and several variables used in our analyses became available in that quarter.

We begin with a list of publicly-traded domestic bank holding companies (“banks”), including Bank of Montreal, Bank of Nova Scotia, Canadian Imperial Bank of Commerce, Canadian Western Bank, Equitable Bank, Laurentian Bank of Canada, National Bank of Canada, Pacific & Western Bank of Canada, Royal Bank of Canada, and Toronto-Dominion Bank.

As we mentioned in the literature review, it is widely accepted that ROA or ROE is the indicator of the bank profitability, so we use ROA or ROE as the independent variable.

Following Stever (2007), we use size as a variable in the study of banks. Size is measured as the natural logarithm of market capitalizations (historical shares outstanding multiple by stock price), in thousands of dollars.

Tong and Xu(2012) investigated the determinants of bank profitability in Canada. We use their empirical specifications to select control variables. First, we control for the ratio of equity to total assets. Second, we control for the ratio of total loans to total assets. Third, we control for the ratio of customer deposit to total liability. Fourth, we control for the ratio of total deposits to total liabilities. Fifthly, we control for inflation rate. As the interest rate has direct impact on the loan rate, changes in the interest rate have a noticeable impact on the profitability of banks.

Following the studies by Dietrich (2011) and Rumler (2015), we use the real GDP as an explanatory variable, to control for the level of the economic development in bank’s profitability.

Finally, we control for oil price. For the oil price, two major benchmarks for pricing crude oil are the West Texas Intermediate (WTI) and Western Canada Select (WCS). As WTI is more frequently used in the United States, Western Canada Select (WCS) - the price obtained for many Alberta producers for oil - is believed a better indicator of Canadian oil prices. However, as WCS was launched in December 2004, prior to that date, the prices of the WCS are not available. The benchmark before WCS is WTI. As both benchmarks reflect the demand and supply of the oil, WCS and WTI move in the same trend in the long run. Considering these factors, we use WTI price, which is more feasible and consistent, in our studies.

For the bank specific variables, we obtain the quarterly data from the Bloomberg. For the macro variables, GDP is gathered from the Organization for Economic Co-Operation and Development (OECD) website, while the inflation and interest rate are from Bank of Canada.

The monthly WTI price (in Canadian dollars) is gathered from Bloomberg, after that we take average of the every three month to get the quarterly oil price.

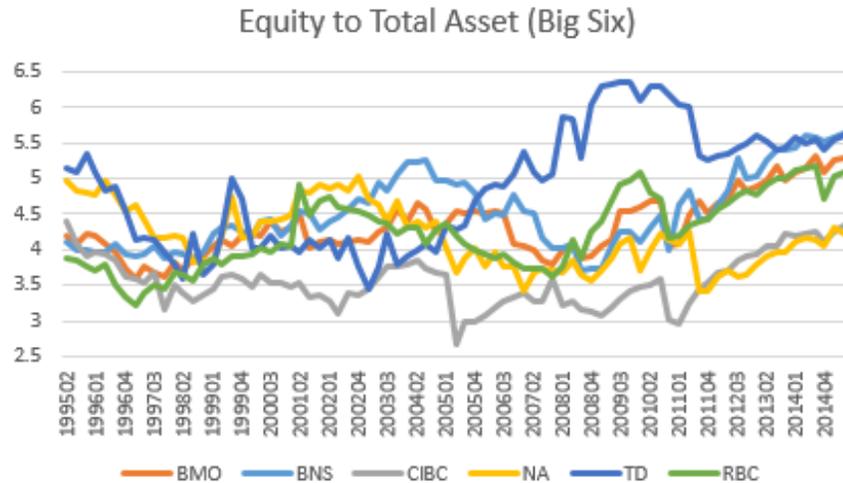
Table 1 lists the definition of each variable. To study the effect of extreme events, we do not winsorize all the variables, instead, we retain all the variables, and keep watch over the surprises, especially even the extreme values of ROA, ROE and Oil Price.

Table 2 presents summary statistics for the variables.

We take natural log of market capitalization to calculate size. Considering log is a concave function, the summary for size may be misleading, we include the summary statistics for the market capitalization in our summary statistics table. Size has a mean of 8.976129, in other words, for an average bank in our sample, the market value of the assets is 22864.27 million

dollars, which equals to 22.86 billion dollars. The number seems quite low, as the big five are perceived as billions of market capitalizations. The market value of many small banks (e.g. Equitable Bank, Laurentian Bank of Canada) are too low, dragging down the average. This guess is made a certainty by the low median - the median bank has the market value of 15.87 billion dollars - which is far below the average.

Equity is the ratio of equity to total assets, showing the leverage of the capital of the banks in balance sheet. The average of equity ratio is 4.64%, that is, the debt/equity ratio is 20.55. The most conservative bank is Pacific & Western Bank of Canada, with the minimum leverage of 7.90, from 2014 Q2 to 2015 Q2, (which tended more conservative as time goes on). Then comes the Equitable Group, with the equity ratio of 10.82 at 2009 Q4, 10.87 at 2009 Q3. The most aggressive bank is Canadian Imperial Bank of Commerce, with the minimum equity ratio 2.678809 – 32.58 leverage - at 2005 Q2. Over the whole time horizon, all the banks tend to be more conservative, except for the Equitable Group and Laurentian Bank of Canada. The increasing capital adequacy can be attributed to the Basel III, a framework that sets out global regulatory requirements for bank capital, leverage and liquidity. Canada implemented Basel III capital rules in January 2013, which explains why the leverage ratio of all the banks is above the 3% after 2013.



Loans plays an important part in a bank’s asset. We use loans to total assets ratio as a variable to test the impact of loans on bank’s profitability. As the banks make profit from the interest spread - the difference in borrowing and lending rates of the bank - the loans are considered to be the main earning assets for banks. On average, loans account for 59.16% of total assets. The loans to total assets ratio varies widely across banks and time, as indicated by the standard deviation of 15.65%.

On Average, deposits account for 74.25% of total liabilities. Usually deposits is considered cheap and stable for a bank to finance. Higher customer deposit in total liability indicates the banks have more stable sources of funds to meet loan obligations. Such stability can give rise to a high creditworthiness of banks. Surprisingly, when we calculate the deposit ratio for each bank, none of the big six banks (Bank of Montreal, Bank of Nova Scotia, Canadian Imperial Bank of Commerce, National Bank of Canada, Royal Bank of Canada, and Toronto-Dominion Bank) has more deposit than the average (74.25%). At the same time, some small banks has strikingly high deposit ratio, including Canadian Western Bank (93.57%), and Pacific & Western Bank of Canada (91.92%).

Over the 81 quarters, GDP has a mean of 0.50% with a standard deviation of 0.61%, suggesting that the quarterly GDP in our sample differ considerably, the inflation rate has a mean of 1.89%, and interest rate 3.06%. The average WTI oil price is 63.75 CAD.

For the independent variables, average ROA is 0.18%, much lower than the literature (e.g., Xu and Tong, 2012). Because we calculate ROA by the quarterly net income to total assets, whereas the previous literature uses annual net income to get ROA. This also applies to ROE, the average of which is 3.96. There is quite a bit of different between the maximum and minimum return. It could be a result of the 2001 oil crash and 2008 economic downturns (oil crisis). Under the assumption of the normal distribution, the 95% of the data would fall within two standard deviations, so if we calculate, the lower bound of ROA is  $0.1824455 - 2 * 0.0842649 = 0.0139157$ , and ROE is  $3.964036 - 2 * 2.001458 = -0.03888$ , we could conclude that most of the time, there is a positive return on both asset and equity. However, the minimum ROA is -0.6511777, ROE - 24.30848, this imply the distribution of ROA and ROE are skewness, the fat tail of ROE means over the past 20 years, the extreme events occur more frequently than expected. The smallest ROE (-24.30847674,-11.6741501,-10.05793953) come from Canadian Imperial Bank of Commerce in 2005 Q2, 2007 Q4, 2008 Q1. This finding is in line with the previous analysis, as CIBC has minimum equity, this overaggressive strategy gave rise to more risk.

WTI price is quite volatile. Three noticeable changes happened in 2001, 2007 and 2014. Spiking oil prices in 2001 and 2007 contributed to a greater or lesser degree to the worldwide economic recessions of 2001-2003 and 2007-08 that were painful for all financial institutions and investors.

<sup>3</sup>Falling oil price in 2014 December also hurt the Canadian banks. In 2014, the slowed demand in

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<sup>3</sup> <http://www.investopedia.com/ask/answers/030315/why-did-oil-prices-drop-so-much-2014.asp#ixzz3tb5108dk>

emerging economies such as China, Russia, Indian, Brazil, the discovery of US oil, production increase by the Organization of Petroleum Exporting Countries (OPEC) in the Middle East drove the price of oil to its record lows.

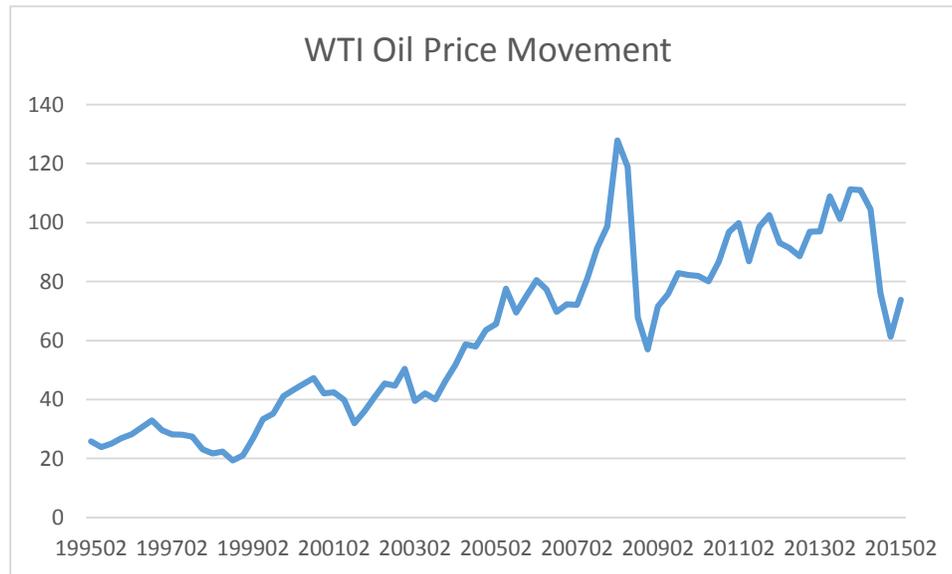


Table 3 presents the correlation matrix of the dependent variables. This table reveals several differences between small and large banks.

Firstly, the negative correlation between size and equity ratio indicates that small banks have higher equity ratios. For big six, most of the time the equity falls within 3.5% to 5.5%, whereas small banks, like the Canadian Western Bank, all the time stays above 6%, and Pacific & Western Bank of Canada has high equity ratio of 9%. The equity to total assets ratio is an important measure of capital adequacy. In general, the higher portion of equity, the banks will have safer buffer towards its funding risk. As clients and investors are less confident about small banks, they need more buffer to compete with big banks.

Secondly, the larger banks tend to have the lower loans ratio and deposits ratio. In the income statement, the net income of commercial banks is made up of two part: the interest income, and non-interest income. Now banks, especially big banks, are earning more from noninterest income. As they diversify their business to trading, investment banking and insurance, the traditional interest income relatively shrink, so the loans ratio and deposit ratio are lower. For Bank of Montreal, in 2014, non-interest income comprises 49.39% of the revenue, whereas, for Canadian Western Bank, only 18.10% of the revenue is from non-interest income.

Thirdly, the positive correlation between loans and deposit indicates that those who have more deposit are more inclined to launch more loans. This makes sense, as Basel III put more constraints to the liquidity, the banks those have more deposit are safer and more capable to issue loans.

The oil prices are negative correlated with the interest rate. This is different from what we learned from Economies. When the oil price hikes, the Canadian economy goes well, the interest rate will go higher, namely, in oil crisis, the economy goes down, the Bank of Canada cuts rate: so the oil price should be positive correlated with the interest rate. However, the data shows, when the oil price hikes, interest rate may still go down. As the oil price is only one of the many factors affecting interest rate, when oil price stays within the normal range, the interest rate is determined by other factors. Under extreme circumstances, like 2008 Q4 and 2014 Q4, for the short-term, the interest rate will go down when the oil price plunges.

## 4. Hypothesis

Before we run the regression, we calculate the correlation between oil price and bank profits.

The coefficient is positive (0.0483), but not significant. There maybe two reasons: over the twenty years, oil price may have no significant impact on banks performance; or it has different impact over different time period, in the combination, the positive impact offset the negative one.

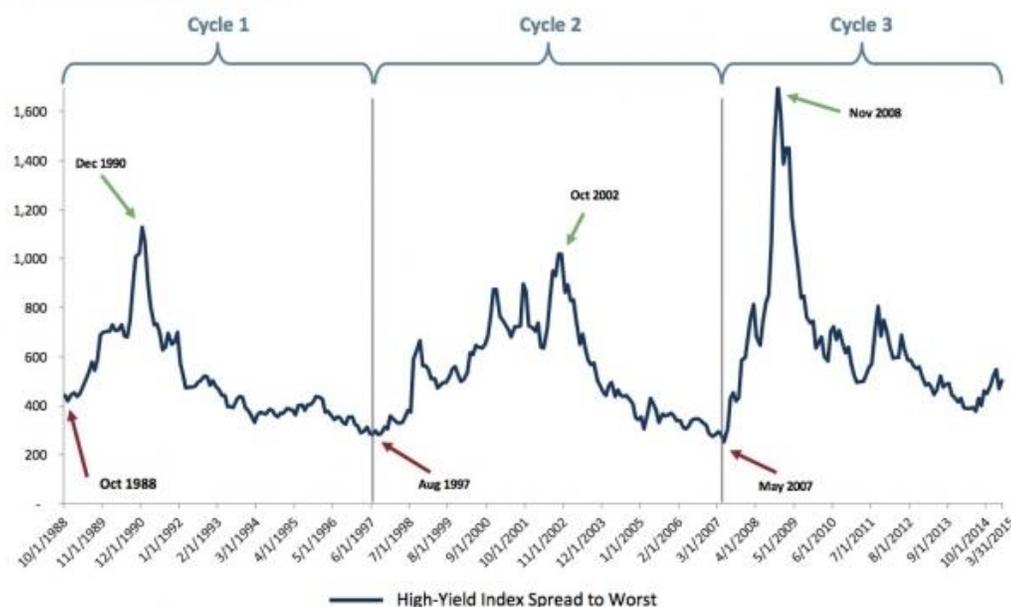
Previous scholars Hesse and Poghosyan (2009) have agreed that, the relationship between oil price and bank profitability changes over different time period. They find that the global financial crisis distorted the relationship between oil price and bank profitability.

Though the financial crisis happened in United States, the performance of Canadian big bank was also affected. The U.S. financial crisis may impede the Canadian bank profits through the following channels:

In the difficult capital markets conditions, investment management, wealth management and private banking tumbled due to the gloomy U.S. capital market and the correlated global capital market;

As Canadian economy largely depend on United States, exports declined in response to weak U.S. demand, business investment also slowed in response to uncertainty about the global credit crisis on the economy, the provision for credit losses increased, new impaired loans and acceptances surges, especially those exposures to the manufacturing, oil and gas and U.S. residential and commercial real estate sectors.

## A Tale of Three Credit Cycles



Source: Spread data from Citigroup High-Yield Index (Yield Book).

We take into account the impact of financial crisis and credit cycle, and divide the sample period into two periods: before the crisis (1995:Q2-2007:Q2), after the crisis (2007:Q3-2015:Q2).

Table 4 presents the correlation matrix of the independent variables (ROE) and oil price under different market conditions. Before the crisis, the bank profitability is significantly positively correlated with the oil price. After the crisis, the coefficient goes down and insignificant.

We hypothesis that, over the long time horizon, the relationship between oil price and bank profitability would be positive. Before the financial crisis, the oil had larger significant impact on bank profitability. After 2008 crisis, the oil would have less impact on bank. In other words, the banks are more immunized to oil crashes after the crisis.

## 5. Empirical results

To examine the relation between oil price and bank profitability, we regress ROE on oil price, a set of bank characteristics and macro economy factors. We estimate the regression using ordinary least squares (OLS).

The results of the full sample regression are presented in the first column of Table 5.

In control variables, we find that size is positively associated with bank profitability. As Martinez-Peria & Mody (2004) point out, size affects banks' profits through economies of scale.

Loans to assets ratio has a significant and positive impact on bank profits. This is consistent with the findings of Abreu & Mendes (2002), who studied banks profitability in several European countries. They drew a conclusion that loan-to-assets ratio, as a representative for asset structure, has a positive effect on the bank profitability.

Coefficient on deposits is negative and significant. Tong and Xu (2012) reported the similar result in their studies. The banks those earn more diversify their liabilities more. Apart from the deposits, now banks rely more on other sources, for example, derivative instruments, acceptances, securities sold but not yet purchased, securities lent or sold under repurchase agreements. As these liabilities increase more than deposits, the ratio goes down.

Among the macro economy variables, the coefficient of the GDP is significant and immense. A one percentage increase in GDP is associated with an increase in ROE of 2.94%. This result is consistent with Dietrich and Wanzenried (2014). They find the effect of GDP growth on bank profitability is statistically significant and positive in middle-income and high-income countries, which means that bank profits in these countries usually increase in prosperous economic times.

The coefficients on other control variables are insignificant.

The coefficient on oil price is positive but not significant. We run regressions separately for each period to find out whether oil price has no significant impact on banks performance, or it has different impact over different time period, in the combination, the relation become insignificant.

In column 2 and 3 we report the regression results for the periods before, and after the crisis, respectively.

Before the crisis, we report a significantly positive effect of oil price on bank profitability, however, after the global financial crisis, the relationship between oil price and bank performance is distorted.

Before the crisis, holding other factors constant, one dollar increase in oil price is associated with an increase of 0.01549 in ROE. In oil crashes, it is not uncommon that oil price drops by 50 Canadian dollars in one quarter. Holding other factors constant, ROE will erode by 0.7745, which equal to 19.54% of its mean. In reality, oil price turbulences have butterfly effect in GDP and interest rate, those differences together would result in extreme changes in ROE. In 2001 oil recession, for example, Bank of Montreal, in 2001 Q3, ROE dropped to 0.042 from 4.280; Bank of Nova Scotia, in 2001 Q4, ROE plunged to 0.413 from 4.411.

Before the crisis, in the control variables, size, capital, interest rate, loans and GDP growth are positively associated with profitability. Deposit and inflation rate are negatively associated with bank performance before the crisis.

After the crisis, the relation between oil price and ROE is not significant. Take the recent oil drop as an example. In 2014 Q3, Quarterly WTI oil price is 104.45, whereas the oil price fell to

76.123 in Q4. In 2015 Q1, CIBC, Canadian Western Bank, Bank of Canada, Toronto-Dominion Bank drop by 3.722%, 2.224%, 4.821%, and 8.203% respectively. Though other banks (Bank of Montreal, Bank of Nova Scotia, Royal Bank of Canada), performed well against the headwinds in 2015 Q1, their ROE reduced in different degree one quarter before or after. Bank of Montreal suffered the severest impact, as ROE decreased by 14.892% in 2014 Q4. Royal Bank of Canada dropped by 7.025% in 2015 Q2, Equitable Group declined by 6.361% in 2014 Q4, Bank of Nova Scotia is well immunized from this oil crisis, its ROE only went down by 1.955% in 2015 Q2. Though the bank profitability was still affected by oil price changes, in comparison with 2001 oil crashes, the Canadian performance better this time.

Other control variable and ROE remain unchanged, except that the impact of the deposit and interest rate reverse.

In the 2014 Q4 oil crashes, the banks are more immunized to oil changes, possible reasons are as follows:

Firstly, diversification the loan portfolio in industry. To reduce the oil market volatility, banks now issue less loans to oil and gas industry, and have more exposure to consumer sector. Take Bank of Montreal as an example. In 2009, oil and gas consist 5.64% of the net loans. This ratio decreased to 3.46% in 2013. At the same time, there is a significant increase of loans to retail, wholesale, and service industries.

Secondly, big banks are diversified in geography. For example, Toronto-Dominion Bank operates in United States and other international, 34.44% of its revenues are generated from the foreign segments. Bank of Montreal have operations in the United States, United Kingdom, Europe, the Caribbean and Asia, which consist 30.3% of total revenue.

Thirdly, the decline provision in soured oil and gas loans reflects better credit quality. Take Bank of Montreal as an example. For oil and gas industry, the shrinking net impaired loans and acceptance (from 2.02% in 2009 to 0.13% in 2014), and declining special allowances for credit losses (2.28% in 2010 to 0.93% in 2014) are signals for improving loan quality .

Fourthly, Basel III put more constraints on regulatory capital requirements. Since the first quarter of 2013, regulatory capital requirements for banks have been determined on a Basel III basis. With stricter Basel III capital ratios, banks have more capital to buffer against the oil shocks.

We also run regressions on ROA, and we report a similar outcome. In full sample, the relation between oil price and profits is not significant. Oil price, once positive and significant before the crisis, turned out insignificant after crisis. The slight difference in control variables is in equity and deposit. Equity, which is not significant in ROE in all scenarios, now positive and significant under all circumstances. Deposit, once, the negative and significant factor in ROE full sample regressions, now insignificant. Because in Return on Asset, as the denominator increase a lot, the small difference in deposit ratio are negligible.

As oil price exhibits persistency. As well, there might be a lag between a change in oil price and a change in bank profitability. Hence, we modify our model as follows:

Change in ROE (quarter on quarter) = Change in Oil Price (over the past 12 months) + Control Variables

The result is shown in the table 7. In the full sample, the coefficient of oil price is not significant.

We have to admit that there are some limitations in our studies:

Firstly, different bank react to oil crashes at different speed. For example, some banks are more sensitive to oil price changes and move at the same time, while some lag.

Secondly, banks' profits are sticky, so the bank's profits will not change right after the oil shocks, instead, it takes long time to show. But in the capital market, the stock price (indicator of future earnings) changes right after the oil shocks. The oil price do have impact on banks, but more obvious in stock price (future earnings) than ROE (past earnings).

Secondly, current bank profitability may impact the bank specific variables values in the next quarter. We did not find a solution to mitigate the reciprocal causation.

Thirdly, oil price may have different impact on large banks and small banks. As the data for the Canadian small banks are not adequate, we cannot separate the oil price impact on different size of banks.

## **6. Conclusion**

Motivated by the importance of oil for bank profits, we investigate the relation between oil price growth and bank profitability. Using quarterly observations on ten Canadian banks, we find a positive relation between oil price and Return of Equity. However, the relation differs under different time period. Then we divide time by the 2007 credit cycle. We report a significant and positive relation before the crisis, and is robust to controlling for a number of time-varying bank characteristics. However, the relation between oil price and bank performance is not significant after the crisis, in other words, banks are more immunized to oil crashes after global crisis. We come to a similar conclusion using Return of Asset as dependent variable. Overall, our findings suggest that oil price, once the important determinant of bank profits, shows less impact on bank performance after the crisis.

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## 8. Appendices

Table 1

Variable definitions

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Variable	Definition
Size	The natural log of market capitalizations (historical shares outstanding multiple by stock price). States dollars.
Equity	The ratio of equity to total assets.
Loans	The ratio of total loans to total assets.
Deposits	The ratio of total deposits to total liabilities.
ROA	The ratio of the quarterly net income to total assets.
ROE	The ratio of the quarterly net income available for common shareholders to total common equity.
GDP	Quarterly Growth Rates of real GDP, change over previous quarter.
Inflation	Quarterly total consumer price index. The indicator of changes in consumer prices.
Interest Rate	Quarterly overnight rate. The rate at which major financial institutions borrow and lend one-day.
Oil Price	Quarterly WTI crude oil price is the average of monthly oil price in CAD of three months.

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Table 2

## Summary Statistics

Variable	Mean	SToronto-Dominion Bank. Dev.	Min	25th Percentile	Median	75th Percentile	Max
Size	8.976	1.877	4.386	7.243	9.672	10.439	11.661
Market Capitalization	22864.27	25040.89	80.136	1397.736	15870.55	34165.61	115990.9
Equity	4.642	1.266	2.679	3.803	4.240	4.993	11.239
Loans	59.160	15.647	36.570	46.755	53.873	72.857	95.503
Deposits	74.254	11.052	43.851	67.791	72.114	80.841	97.009
ROA	0.182	0.084	-0.651	0.154	0.188	0.219	0.720
ROE	3.964	2.001	-24.308	3.374	4.079	4.738	15.705
GDP	0.594	0.612	-2.247	0.267	0.626	0.985	1.612
Inflation	1.889	0.848	-0.900	1.200	2.000	2.400	4.500
Interest Rate	3.061	1.761	0.500	1.250	3.000	4.500	7.593
Oil Price	63.754	28.714	19.310	39.462	65.628	86.673	127.903

Table 3

Correlation matrix

	Size	Equity	Loans	Deposits	GDP	Inflation	Interest Rate
Size	1.000						
Equity	-0.346***	1.000					
Loans	-0.855***	0.448***	1.000				
Deposits	-0.583***	0.619***	0.603***	1.000			
GDP	-0.019	-0.097**	0.022	-0.011	1.000		
Inflation	-0.017	-0.068	-0.029	0.011	0.084**	1.000	
Interest Rate	-0.150***	-0.193***	-0.002	0.203***	0.161***	0.296***	1.000
Oil Price	0.171***	0.178***	0.005	-0.162***	-0.168***	0.030	-0.631***

Note: \*\*\* indicates significance at the 1% level, \*\* indicates significance at the 5% level.

Table 4

Correlation matrix between ROE and Oil Price

	Full Sample	Before the Crisis	After the Crisis
Oil Price	0.048	0.089*	0.025

Note: \* indicates significance at the 10% level.

Table 5  
Regression Result

	(1) Full Sample	(2) Before the Crisis	(3) After the Crisis
Oil Price	0.003 (0.004)	0.016** (0.008)	-0.010 (0.007)
Size	0.336*** (0.082)	0.343** (0.151)	0.284*** (0.098)
Equity	0.075 (0.083)	0.227 (0.141)	-0.108 (0.098)
Loans	0.027*** (0.010)	0.011 (0.022)	0.028** (0.012)
Deposits	-0.023** (0.011)	-0.016 (0.031)	-0.009 (0.012)
GDP	0.294** (0.125)	0.258 (0.250)	0.544*** (0.156)
Inflation	-0.057 (0.096)	-0.081 (0.152)	-0.064 (0.133)
Interest Rate	0.113* (0.062)	0.287*** (0.096)	-0.055 (0.090)
Constant	0.048 (1.397)	-1.353 (2.960)	1.698 (1.585)
Observations	693	382	311
R-squared	0.058	0.081	0.094

Note: The dependent variable is ROE (return on equity). The sample period is from 1995:Q2 to 2015:Q2. It is divided into two periods: before the crisis (1995:Q2-2007:Q2) and after the crisis (2007:Q3-2015:Q2). Standard errors are reported in parentheses. \*\*\*, \*\*, and \* indicate significance at the 1%, 5%, and 10% level, respectively.

Table 6  
Regression Result

	(1) Full Sample	(2) Before the Crisis	(3) After the Crisis
Oil Price	0.000 (0.000)	0.001*** (0.000)	0.000 (0.000)
Size	0.018*** (0.003)	0.015*** (0.005)	0.017*** (0.004)
Equity	0.032*** (0.003)	0.042*** (0.005)	0.023*** (0.004)
Loans	0.001*** (0.000)	0.001 (0.001)	0.002*** (0.000)
Deposits	0.000 (0.000)	-0.001 (0.001)	0.000 (0.005)
GDP	0.012** (0.005)	0.010 (0.009)	0.021*** (0.007)
Inflation	-0.003 (0.004)	-0.004 (0.005)	-0.005 (0.006)
Interest Rate	0.005* (0.002)	0.011*** (0.003)	-0.001 (0.004)
Constant	-0.209*** (0.053)	-0.210** (0.102)	-0.171** (0.067)
Observations	693	382	311
R-squared	0.243	0.263	0.270

Note: The dependent variable is ROA (return on asset). The sample period is from 1995:Q2 to 2015:Q2. It is divided into two periods: before the crisis (1995:Q2-2007:Q2) and after the crisis (2007:Q3-2015:Q2). Standard errors are reported in parentheses. \*\*\*, \*\*, and \* indicate significance at the 1%, 5%, and 10% level, respectively.

Table 7  
Regression Result

	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
Size	2.155	0.905	2.38	0.018	0.378	3.933
Equity	0.834	0.440	1.90	0.058	-0.029	1.698
Loans	-0.028	0.041	-0.7	0.486	-0.108	0.052
Deposits	-0.047	0.040	-1.17	0.242	-0.126	0.032
GDP	-0.028	0.047	-0.59	0.558	-0.121	0.065
Inflation	0.093	0.187	0.5	0.619	-0.274	0.460
Interest Rate	0.532	0.269	1.98	0.048	0.004	1.059
Oil Price Change	-0.007	0.006	-1.11	0.269	-0.019	0.005
Constant	-0.005	0.110	-0.05	0.961	-0.222	0.211

Note: The dependent variable is ROE (return on equity). The sample period is from 1995:Q2 to 2015:Q2. The number of observations is 653. R-squared equals to 0.0237.