IDIOSYNCRATIC RISK AND SHORT INTEREST ANALYSIS
FOR CANADIAN LARGE CAP STOCKS

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Abstract

While previous studies have focused on the relation between idiosyncratic risk and short interest in US stock markets, we test whether the Canadian market shows the same symptoms in costs limiting arbitrage. In order to measure arbitrage cost, we use idiosyncratic risk and use it as a proxy to determine the cost level. To prevent any ambiguity and bias in our result, we use commonly recognized indexes to measure both transaction and holding costs. Consistent with the similar study conducted in U.S., we find that high Short Interest Canadian stocks appear to have higher idiosyncratic risk that is significant enough to affect investors' decisions.

Acknowledgements

Contents

Introduction

In the past few decades, tremendous amount of studies has been conducted to explain the relationship between short interests and stock returns in U.S. stock market. Famous articles as Dechow, Hutton, Meullbroek, and Sloan (2001), Desai, Ramesh, Thiagarajan and Balachandran (2002), Asquith and Meullbroek (1995) have all shown that stocks that are highly shorted tend to have relatively low returns in the period after. Although it makes sense intuitively, the fact that stock prices move away from fundamental value is not consistent with the traditional Capital Asset Pricing Theory introduced by Treynor (1961, 1962), William Sharpe (1964). In the paper by Gang, Ying and McLean (2009), two important problems have been identified to further analyze the anomaly, they are: (1) the cause of this anomaly (2) the barrier that prevents investors to arbitrage away the mispricing.

Much effort has been spend on the first idea. Supported by papers from Boehme, Danielsen, Kumar; and Sorescu (2008); Diether Malloy, and Scherbina (2002); Asquith, Pathak, and Ritter (2005), Miller (1977) used unexplained volume to capture information on investors' private valuation, and thus have come to the conclusion that the abnormal high stock price is the product of investors opinion divergence and short sale cost. Alternatively saying, unexplained volume and short sales cost would together create an upward price bias.

There has been a great controversy in the explanation of the second problem.

The problem arises as: Since people are willing to put effort to identify any mispriced stocks, why don't they completely hedge/arbitrage this security and make profit? While many people believe that high lending fee is the major barrier that prevents investor from doing so, papers from Danilsen, Boehme, Sorescu (2006), DAvolio (2002) analyzed the market for borrowing and lending securities, and concluded that the loan fees for highly shorted stocks are less than the stock market average and shouldn't be considered as a main factor. Based on this idea, Gang, Ying and McLean (2009) tested the effect of idiosyncratic risk on arbitrage activities, and ultimately come to the conclusion that idiosyncratic risk is the main reason that prevents rational investor to arbitrage the mispricing. Our paper contributes the literature by extending the evidence to Canada

While studies has focused on explaining anomaly and problems for the U.S. security market, it has come to our attention that there is no similar study conducted in Canadian security market. In order to fully test the theory above, we perform our regression analysis on large cap Canadian stocks from 2002 to 2011. To have a conservative measure, we decided to use idiosyncratic risk as the primary proxy to estimate the holding cost. The reason behind is that Pontiff (2006) recognized the idiosyncratic risk as the primary holding cost. Shleifer and Vishny (1997) also pointed out that the larger the weight of a single security, the higher the risk for the entire portfolio. This concept is similar to that in Arrow (1965), which implied a risk averse

investor will take a larger position in a low idiosyncratic risk security. Based on the above, both Pontiff (2006) and Treynor (1973) agreed that a high short interest and idiosyncratic risk stock would have a larger alpha among other stocks. In this case, we believe idiosyncratic risk is a fair measure compares to other methods.

According to our result, we find that idiosyncratic risk is positively correlated with short interest for Canadian large cap stocks, and the difference between high and low idiosyncratic risk is as much as 0.391% per month. We also find that there is a positive relationship between idiosyncratic risk and the size of the company. We show that in Canadian stock market, the short seller's alpha is positively correlated with idiosyncratic risk, which corresponds to the result acquired in Gang, Ying and McLean (2009).

The structure of the paper is as follow. Part II of the paper discussed why we recognize idiosyncratic risk as an arbitrage cost. Part III shows the data we used to conduct our test and gives an explanation of our result. Part IV contains the conclusion.

Arbitrage costs

a. Definition of arbitrage

Arbitrage is the transaction where a rational agent tries to profit from mispricing and idiosyncratic risk is a typically arbitrage cost. Since arbitrageur couldn't diversify

way the idiosyncratic risk, it will affect arbitrage activity. As Pontiff (1996) states, each arbitrage cost can be categorized as either a holding cost or a transaction cost, which can prevent rational traders from eliminating mispricing completely.

b. Holding cost

Holding costs occur in every period that a position is kept open. They include opportunity cost of capital, the opportunity cost of not receiving full interest on short-sale proceeds, and idiosyncratic risk exposure.

Tuckman and Vila (1992) point out that holding and transaction costs make riskless arbitrage risky. For example, in an efficient market Stock A has intrinsic value of $ 100. Without holding and transaction costs, the investor will short Stock A and wait until for the price drops to the fair value to cover his/her position if the price of A is over $100.

In practice, holding and transaction cost exit. Assume that holding cost for Stock A in each period is $10. If the mispricing dissipates within multiple periods, the arbitrageur can gain profit. Or else he or she will lose. On the other hand, assume that transaction cost for shorting Stock A is $1 for one time and the arbitrageur enters the short position at $10. Therefore the arbitrageur can gain profit only if the price below $9 after that period ends. Or else he or she will lose.
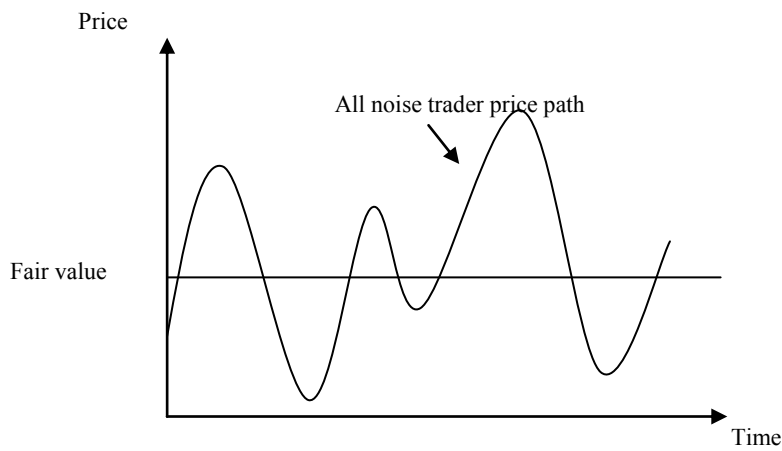
Fig. 1. Hypothetical mispricing process without holding and transaction costs

Figure 1 shows the relationship between the intrinsic value of a stock and mispricing overtime. The wave-like line stands for the mispricing when the investors are irrational. Without the costs (holding and transaction costs), the rational trader in market will push the wave-like line into a straight, horizontal line, which represents the intrinsic value of the stock. The price wave represents the all noise trader equilibrium.
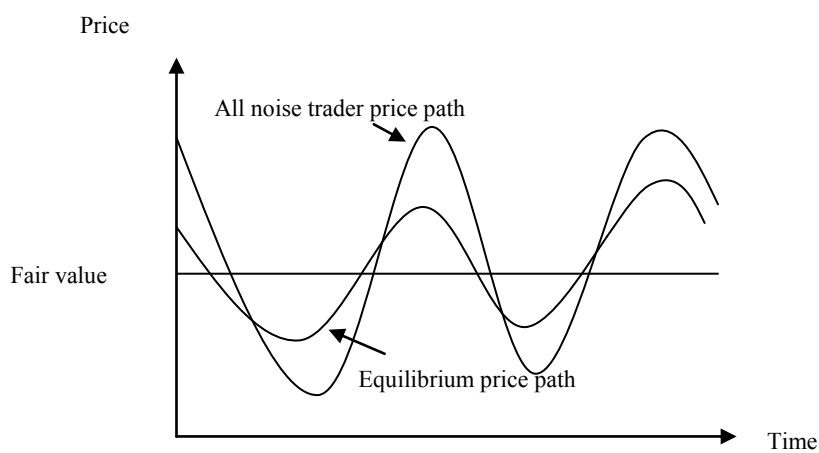
Fig. 2. Hypothetical mispricing process when holding costs exit

Fig. 2 considers equilibrium with holding cost. Investors will take the arbitrage position when price derives from fair value. When holding costs exit, arbitrageurs will never enter the position until the profit still keep positive when it's minus by the holding costs.

c. *Transaction cost*

Transaction cost is a cost incurred in making an economic exchange Commissions and brokerage fees are examples of transaction costs.
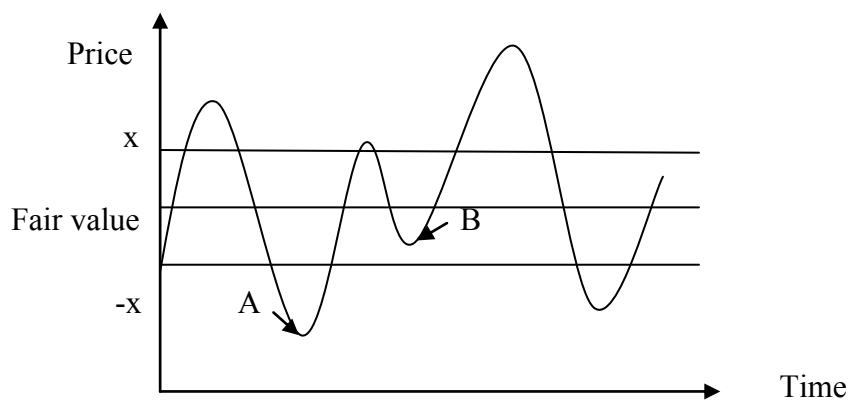
Fig. 3. Hypothetical mispricing process when transaction costs exit.

Figure 3 showed the situation with only exit transaction cost. Both x and –x stand for transaction boundary. The area between the boundaries will make any arbitrage unprofitable (As if point B), whereas the area outside the boundary will make arbitrage profitable (As if point A).

d. Summary:

Mispricing has the same relationship with holding costs and transaction costs: the greater the cost, the greater the potential mispricing. Those costs decrease the possibility of rational traders to trade against the mispricing.

## How does idiosyncratic risk Make Arbitrage Costly?

a. In practice, idiosyncratic risk cannot be fully diversified away.

Idiosyncratic risk is also called unsystematic risk. It is the risk of price change due to the unique circumstances of a specific security, as opposed to the overall market.

In paper Jonasson and Karakitsios (2006), financial theory and standard asset-pricing models illustrate that idiosyncratic diversifying the portfolios can eliminate future risk. Although former studies state that a portfolio is well diversified only if it is containing approximately 20 to 30 stocks, Malkiel & Xu (2004) challenge that this is only true if the stocks are picked out randomly.

Investors may fail to diversify their portfolios in a way that completely eliminates idiosyncratic risk. This may be due to for instance capital constraints, transaction costs and liquidity needs. Reasons for large holdings of individual stocks may also be due to controlling incentives and restrictions set by corporate compensation policies. Investors with under-diversified portfolios are not only affected by shifts in the market volatility,

but also from shifts in idiosyncratic volatility (Campbell et al. 2001).

b. *The role of idiosyncratic risk*

Revisit portfolio theory (Markowitz, 1952) can explicitly consider the impact of idiosyncratic risk. Assume an investor can buy and sell any risk-free security, market and mispriced security. And we assume this investor is a price taker as did in Petajisto (2004) and Fama and French (2005).

A rational investor will regroup the hedged portfolio by selecting the appropriate mispriced securities, then holds it and short the same number of share to the market. In the case that covariance is only determined by market factor, each of the hedge portfolios will only exposed to idiosyncratic risk. This framework ruled out any other relevant factors other than mispricing. Thus, the stock alpha only come from the hedged position.

Hedged position return can be written as r_i, where:

$$r_i = \alpha_i + r_f + e_i \qquad\qquad (1)$$

In the case that no market risk exists and all securities are correctly priced, the return will be the same as risk-free rate r_f. However, if mispricing exists, the alpha will be represented by α_i. Unexpected noise will be represented by e_i. Once the position is fully hedged, the risk and noise will be uncorrelated, total risk of the portfolio will be written as:

$$\sigma_p^2 = \sigma_m^2 \, x_m^2 + \sum_{i=1}^{n} \sigma_i^2 \, x_i^2 \qquad\qquad (2)$$

In the equation above, x_i is the weight of security I, σ_i is the idiosyncratic risk and σ_m stands for volatility (of market return).

If we extend the topic with mean-variance investor in the market, we use risk aversion parameter λ and take it to the following equation:

$$U = x_f \, r_f + x_m \, E(\, r_m \,) + \sum_{i=1}^{n} (\alpha_i \; + \; r_f) \, x_i - \frac{\lambda}{2} \sigma_p^2$$

Where the optimal portfolio weights are calculated by setting the first-order condition to zero, and all weights sum to 1.

c. idiosyncratic risk deters arbitrage

Some studies point out that idiosyncratic risk deters arbitrage. Pontiff (1996 and 2006) argues that idiosyncratic risk is a significant cost to the arbitrageur because it is the single largest impediment to market efficiency. He also proposes a framework in which idiosyncratic risk is important, regardless of whether arbitrageurs have access to many or few arbitrage opportunities.

Shleifer and Vishny (1997) illustrate that arbitrage risk is important to the existence of mispricing. Arbitrageurs research each stock they invest in carefully, and then select some of them in their arbitrage portfolios. Arbitrageurs can eliminate the systematic risk by hedging, or taking the systematic risk can compensate them. However, hedging if they fail to diversify their portfolios cannot eliminate the

idiosyncratic risk. So that idiosyncratic risk is added to the total portfolio risk without a corresponding increase in expected returns. Therefore, risk-averse arbitrageurs pay lots of attention to idiosyncratic risk.

Treynor and Black (1973) who focus on active portfolio management theory shows that in a mean-variance framework that the portfolio weights chosen by an informed arbitrageur are negatively related to a security's idiosyncratic risk and positively related to a security's alpha. Pontiff (2006) further contends that this implies an arbitrageur's weight in a given mispriced security is independent of the number of other mispriced securities in the portfolio. Therefore, the security's idiosyncratic risk will limit the position an arbitrageur takes in any individual security.

On the other hand, Bennett and Sias (2008) conclude that it is essentially impossible to form the well-diversified portfolios. Risk-averse arbitrageurs would like to give more weights to stocks with lower expected idiosyncratic risk when they decide which mispriced stocks can be taken into the position.

Idiosyncratic risk affects investment decision

Ross (2004) points out idiosyncratic risk affect investment through the way of affecting managerial risk attitude. In practice, companies have different compensation schedule for their employees, such as bonus, options and shares. Because of those

schemes, Decision makers who have different risk attitude would pay close attention to the idiosyncratic variability and would have different reactions. For example, when a project is with high idiosyncratic risk, risk aversion decision makers are unwilling to take it, because it leads to an increase in the variability of the firm's cash flows.

Froot et al. (1993) show that though the decision makers are risk-neutral, convex costs of external finance may induce firms to behave in a risk-averse fashion. Decision makers will avoid excessive risk-taking because of this motive, even if that risk is idiosyncratic. Thus, the likelihood of financial constraints can be considered as increasing the effective risk aversion of the decision makers.

However, it will raise another issue. If the decision makers use to value a project depends on its idiosyncratic risk, absent any other frictions, it will lead to inefficient investment decisions from the shareholders' perspective. A feasible way that shareholders can prevent this destruction in value is through increased monitoring. Furthermore, monitoring may be easier or more effective when institutions rather than households own the majority of the firm. The former have more expertise and since they typically hold larger shares, suffer less from the free-rider problem. Thus, we expect the effect to be stronger for firms with low levels of institutional ownership. Indeed, the level of insider ownership matters for the sensitivity of investment to idiosyncratic risk only when institutional ownership is low.

Data and brief Methodology

a. Sample Source

Our data sample includes monthly short positions for TSX 60 stocks during the period January 2002 through January 2011 (This is chosen because the short interest data is not completely available prior 2000). Since the number of shares shorted in each stock is collected by the Toronto exchange on 15th date each month, these data only reflects the completed trade before the reporting date, and incomplete trade data is not reported under Toronto Stock exchange policy. Unlike Gang, Ying and McLean (2009), we extract daily prices, volumes, and market to book ratios, value-weighted returns and monthly short interest directly from Bloomberg. However, similar information can also be accessed through Google Finance or other exchanges' websites. At last, in order to prevent exchange effect, all the units have been converted into US dollar.

Similar to that in Gang, Ying and McLean (2009), we assume that all the portfolio strategies we mentioned in this paper are applied after the month information has been released. For instance, if short interest for February is released then we measure the returns started from March. We believe it is rational to assume that most educated investors can implement their strategy according to previous month's information.

b. Arbitrage Cost Estimates

Following Pontiff (1996) and Gang, Ying and McLean (2009), we divided our arbitrage estimates into holding cost and transaction cost. Transaction cost appears when a position is either open or closed, and holding cost only occurs in every period that position is kept open.

b.1. Holding costs estimates

Since we only want to test the hypothesis in Canadian Large Cap stocks, we followed Treynor and Black (1973), Pontiff (1996,2006), and Shleifer and Vishny (1997) and identify idiosyncratic risk as our holding cost. As conducted in Gang, Ying and McLean (2009), we calculate idiosyncratic risk by running a regression on the previous on hundred days' returns of each stock on a daily basis of modified 4-factor model. The four factors are: Size, market to book ratio, momentum and the difference between value-weighted market index and risk-free rate. To correctly measure the mispricing without any lags, only those stocks with more than twenty-five days' returns are included in our sample. As for measuring the mispricing, we took the standard deviation of the residuals from those regressions and identify them as idiosyncratic risk.

The reason for why we only use four-factor model instead of five or more is that adding more factors into the regression will not significantly change the residuals. Moreover, there are plenty of studies showed high correlation exists among different measures of idiosyncratic risk. Strong evidence can be draw from the paper of

Zhuravskaya and Wurgler (2002), in which it showed that multiple factor model has similar result as the four factor model.

b.2. Transaction Costs Estimates

In order to fit Canadian Stock Market, we used three proxies to form the transaction cost estimates, they are size, price and dollar trading volume.

Size is included because Ali, Hwang, and Trombley (2003), Gang, Ying and McLean (2009) used it to evaluate transaction cost. According to their research, small size stocks tend to be less liquid and have higher bid ask spreads. Dollar volume is included to measure the liquidity of the security. We calculate dollar volume by taking the volume traded each day for the previous month and take the average among them. For example, we suppose a stock with larger dollar volume will be more liquid than that with smaller dollar volume, and also the volume amount is negatively correlated with the change in price when traded. The above has been tested in Spiegel and Wang (2006), in which the dollar volume is identified to be the only significant measure for liquidity. Price is included to calculate the market value of the security, and this method has also be used by Ali, Hwang , and Trombley (2003).

b.3. Other Estimates

Other estimates has been used to evaluate our short interest portfolios in cross

sectional testing, they are Size, Momentum and market to book ratio. We use size to setup a liquidity measure, and we use market to book value to detect whether a company is overvalued or undervalued. Momentum is calculated by using previous 180 days return with a 30 days gap.

c. Short Interest Portfolio

Our short interest portfolio is selected using two methods. The first method is to group securities under absolute benchmark, and the other method is to select securities under relative rank.

In our first method, a benchmark is selected, since we modified our short interest estimate by dividing it by shares outstanding, we believe a short interest value that larger than 1 indicates a highly shorted stock. Following Desai, Ramesh, Thiagarajan and Balachandran (2002), we grouped the stocks with Short Interest larger than 1 into our high short interest portfolio, and those with short interest below one into our low short interest portfolio.

The second method is similar to that in Asquith, Pathak, and Ritter (2005), we use percentile as a benchmark instead of a constant number. This allows us to identify high short interest stock for each month. For instance, for every monthly stock with short interest above 99th percentile, we group them into our high short interest portfolio, and for those with that below 99th percentile are grouped as low short interest portfolio.

d. Summary Stat

Table 1 below showed our result for high and low short interest portfolios from period January 1ˢᵗ 2002 to July 1ˢᵗ 2007, this period is selected to separate the influence caused by financial crisis. Following Gang, Ying and McLean (2009) conducted for U.S. market, we calculate the median of each variable each month, and then take the average of each median.

TABLE 1 High Short Interest Portfolios (2002 to 2005)

	SI	IR	SIZE	MKT/BK	VOLD	MOM	PRC
High SI (95~99%tile)	4.948	1.983%	7830.51	2.20	3183829.31	1.97	18.69
Low SI (<95%tile)	0.593	1.392%	3583.14	2.09	302949.92	10.62	17.57
High SI (>=99%tile)	6.736	1.823%	6839.41	2.09	2940843.54	1.99	17.53
Low SI (<99%tile)	0.512	1.314%	3984.86	2.05	320494.19	10.08	15.89
High SI (0.5~1)	0.782	1.593%	7021.58	2.19	4530304.85	2.92	20.32
Low SI (<0.5)	0.334	1.143%	9938.55	2.03	2104948.43	1.16	19.54
High SI (>=1)	2.098	1.498%	6494.33	2.08	3104955.55	2.04	18.03
Low SI (<1)	0.427	1.287%	3058.25	2.01	32049.96	4.38	16.24

The first column in the table shows the time series average of each median short interest. For high short interest portfolios, the value is 6.736 to 0.782 considering the different method we use. As for the low short interest portfolio, the short interest ranged from 0.334 to 0.512. This result is similar to that formed in Pontiff (2006) and Gang, Ying and McLean (2009).

TABLE 2 Short Interest Comparison US vs. CAD

	US market	CAD market
High SI portfolio	23.3~6.7	6.736~ 0.782

| Low SI portfolio | 0.3~0.2 | 0.334~0.512 |

Compares to the same research conducted in US market, Table 2 showed the difference in high short interest portfolio between US and Canadian stocks. Compares to the high short interest portfolio in Canadian market, U.S. short interest portfolios tend to have more shares shorted. This appears to be rational because U.S. market is considered larger and more liquid than Canadian market.

The second column in Table 1 reveals idiosyncratic risk for portfolios at different short interest level. It appears that higher short interest portfolios have higher idiosyncratic risk, and the difference is significant enough to affect investors' decision. For instance, a high short interest portfolio at 95~99 percentile has Idiosyncratic risk 1.983%, but for portfolio below 95 percentile the risk level dropped to 1.392%. Another thing worth mentioning is that highly shorted US market stocks tend to have higher idiosyncratic risk than that in Canadian market.

TABLE 3 Idiosyncratic risk Comparison (US vs. CAD)

	US market	CAD market
HighSI (95~99%tile)	3.2	2.0
Low SI (<95%tile)	2.9	1.4
High SI (>=99%tile)	2.9	1.8
Low SI (<99%tile)	2.9	1.3

Table 3 shows that to the data from Ying and McLean (2009), we find that highly shorted Canadian `large cap` stocks are on average 1.2% less risky than total

US market stocks. This has two implications; first, large stocks tend to have low Sigma. Second, we have successfully excluded the short interest fluctuation caused by financial crisis and the market bubble. One more result showed in this comparison is that the effect of higher idiosyncratic risk tend to follow higher short interest exist among Canadian large cap stocks.

The third column in Table 1 showed that highly shorted portfolios tend to be larger (in size) than less shorted portfolios. For instance, the size of 95~99 percentile stocks appears to be twice the size as those with below 95 percentiles. This ratio is similar to that in Gang, Ying and McLean (2009), Asquith, Pathak, and Ritter (2005) and Hutton, Sloan, Dechow and Meulbroek (2001), who also argue that short sellers favor large firms. One reason to explain this can be found in D'Avolio (2002), where he shows that it is relatively cheaper to borrow from large size company because of higher liquidity.

The fourth column in Table 1 shows the Market to book ratio, and the result implies that highly shorted stocks tend to be growth stocks, this results follows the test done in Gang, Ying and McLean (2009) and Asquith, Pathak, and Ritter (2005) and Dechow, Hutton, Meulbroek, and Sloan (2001). Although the difference is not as significant present in U.S. market, we believe it is because our sample only consists of large cap stocks, which diluted the large capital gap.

The fifth column revealed the average daily trading volume, and this is used as

an estimate for liquidity measure. The trading volume in the high short interest portfolio is several times larger than that in low short interest portfolio. This is similar to the result in Gang, Ying and McLean (2009).

d. Financial Crisis

The following table is constructed for period between July 1st 2007 and January 1st 2011; which has covered the entire financial crisis period.

TABLE 4 High Short Interest Portfolios (2005 to 2011)

	SI	IR	SIZE	MKT/BK	VOLD	MOM	PRC
High SI (95~99%tile)	7.837	4.673%	8384.42	2.54	3294845.24	2.34	14.76
Low SI (<95%tile)	2.958	2.958%	4098.23	2.11	329484.03	11.65	12.53
High SI (>=99%tile)	6.485	5.634%	7284.75	2.43	3919484.44	1.56	14.23
Low SI (<99%tile)	2.494	2.114%	3749.51	2.13	384887.25	11.87	11.54
High SI (0.5~1)	2.644	4.948%	7389.14	2.64	4693858.89	2.34	15.81
Low SI (<0.5)	1.059	1.983%	9492.41	2.57	2231423.17	1.43	12.39
High SI (>=1)	4.636	2.847%	7263.31	2.58	3929848.56	2.26	15.23
Low SI (<1)	2.058	1.287%	3928.31	2.73	398483.32	4.66	12.75

Compares to table 1, although higher risk follows higher short interest, both short interest and idiosyncratic risk rises, suggesting that during the crisis more shares are shorted and higher risk is embedded into the portfolio. This result corresponds to the fact that most of the stocks suffer from great volatility during the crisis, which implies that both short interest and idiosyncratic risk are higher than normal level under extreme market condition.

e. Summary of the results

Since higher idiosyncratic risk tends to correlate with higher short interest in Canadian large Cap Stocks, it is rational to believe that under normal and extreme market condition, holding a Canadian large cap stock that has higher short interest will increase the idiosyncratic risk more than holding low short interest stocks. This implies that while considering buying large cap stock for diversification or arbitrage in Canadian market, short interest is a significant factor to be considered before making any trade.

Conclusion

Considering some papers have proved that highly shorted stocks tend to correspond to high idiosyncratic risk in U.S. stock market, we extend this hypothesis to Canadian large cap stocks and draw similar conclusion. Our results are consistent with observations in other papers in that we all used similar proxies and methods. Common conclusion we all held is that regardless in U.S. market or Canadian market, it is the idiosyncratic risk that prevents investors from fully arbitraging the mispricing away, and this relationship held even under financial crisis.

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