

Idiosyncratic Volatility Matter? New Zealand Evidence

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Abstract

Standard asset pricing models ignore idiosyncratic risk. In this study we examine if stock idiosyncratic or unique risk affects returns for New Zealand stocks using the factor portfolio mimicking approach of Fama and French (1993, 1996). We find evidence of a negative relationship between firm size and a stock's idiosyncratic volatility. Small firms and firms with high idiosyncratic risk also generate positive risk premia after controlling for market returns. We find no evidence of seasonal effects that can explain our findings. Our study provides support for an asset-pricing model with multiple risk factors.

JEL Classification: G120, G150

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1. Introduction

A number of studies have documented the ability of variables such as firm size (Rosenberg, Reid and Lanstein 1985, Banz 1981, Fama and French 1992), book-to-market equity (Fama and French 1992, 1993, 1996 and 1998), earnings yield (Basu 1983), cash flow yield (Chan, Hamao and Lakonishok 1991), leverage (Bhandari 1988), sales-price ratio (Barbee, Mukherji and Raines 1996) to explain the variation in average stock returns in addition to a firm's systematic risk. Fama and French (2003) conclude these empirical anomalies mean the capital asset pricing model ("CAPM") is likely to be invalidated in many applications.

The role of firm specific or idiosyncratic risk in explaining asset returns is less clear. In an important paper entitled "Risk and Return Revisited", Malkiel and Xu (1997) confirm the controversial finding of Fama and French (1992) that beta lacks explanatory power when attempting to model the annual returns on US stocks from 1963 through 1990. They also confirm Fama and French's empirical findings that portfolios of small companies generate superior returns compared to portfolios of large companies. In addition, Malkiel and Xu (1997) report that a stock's idiosyncratic volatility has a strong positive relationship to returns. Their findings further challenge the validity of the CAPM that only systematic risk should be priced in the market, and that investors should not be compensated for investing in assets with high idiosyncratic or unique risk.

In further work Malkiel and Xu (2002) and Xu and Malkiel (2003) observe that firm specific or unique risk has received little attention in the finance literature given that individual stock idiosyncratic volatility or risk can be eliminated in a well-diversified portfolio.¹ Malkiel and Xu, nevertheless, argue that unique stock risk will affect asset

¹ Hamao, Mei and Xu (2003) also state that the role of idiosyncratic risk in asset pricing has largely been ignored if investors are only assumed to price systematic risk.

returns when not every investor is able to hold the market portfolio. In particular if a group of investors are constrained for exogenous reasons from forming fully diversified portfolios, then the remaining investors are unable to hold the market portfolio. Reasons that can prevent all investors from holding a market portfolio include transactions costs and wealth constraints that limit investors from holding a large number of stocks in their portfolios. Investors may also be constrained by liquidity reasons and other restrictions on their investment decisions that mean investors are unable to form a fully diversified portfolio.

In support of these arguments that all investors are unable to hold the market portfolio Barber and Odean (2000) and Benartzi and Thaler (2001) report that both individual investors' portfolios and mutual fund portfolios' are undiversified. If investors cannot form fully diversified portfolios or are unable to hold the market portfolio, such investors will price unsystematic or idiosyncratic risk into their expectations of stock returns.

In more recent periods stock specific or unique risk may be increasingly important to investors given the empirical findings of Malkiel and Xu (1997) and Campbell, Lettau, Malkiel and Xu (2001) that individual stock volatility for US firms has increased over time while overall market volatility has remained relatively constant. Dennis and Strickland (2004) also show that idiosyncratic volatility has increased over the last twenty years and report that firm specific idiosyncratic volatility is positively related to institutional ownership, increased firm focus and leverage.

In a similar vein Goyal and Santa-Clara (2003) argues that the lack of investor diversification means the relevant measure of risk for many investors is the firm's total risk. Empirical evidence by Guo and Savickas (2003) reports that idiosyncratic volatility and aggregate stock market volatility exhibit strong predictive abilities for excess stock returns. Thus, idiosyncratic risk is an important determinant of the

equity risk premium for individual stocks in addition to the market risk and liquidity risk. Similarly, Drew and Veeraraghavan (2002) show that high idiosyncratic volatility stocks generated superior returns to low idiosyncratic volatility stocks in the markets of Hong Kong, India, Malaysia and Philippines. These findings all support Malkiel and Xu (1997, 2002) and Xu and Malkiel (2003) who document that stock specific idiosyncratic risk is important in explaining the cross-section of expected returns.

In light of this empirical evidence on the role of idiosyncratic risk in explaining asset returns we investigate the relationship between stock excess returns, market risk and factors related to firm size and idiosyncratic volatility for equities listed on the New Zealand Stock Exchange. New Zealand is a small capital market with a different institutional, economic and regulatory environment to the US. While offshore investors are not restricted from investing in New Zealand equities, the small market capitalisation of many stocks mean investors may be exposed to high unique or firm specific risk in the New Zealand market.

The objectives of this paper are therefore twofold. First, we examine if idiosyncratic volatility is priced by investors in New Zealand firms. Second, we examine if firm size is related to stock specific idiosyncratic risk. We also seek to empirically test in the New Zealand market the proposition of Malkiel and Xu (1997) that firm specific idiosyncratic volatility (and not firm size) may explain the size risk premium reported by Fama and French (1992).

The rest of the paper is organized as follows: Section 2 describes the data and methods. Section 3 describes the relationship between returns, idiosyncratic volatility and firm size. Section 4 presents the findings while Section 5 concludes the paper.

2. Data and Methods

2.1 Data

Monthly gross stock returns² and the number of shares outstanding for all stocks listed on the New Zealand Exchange were obtained for the period June 1990 to June 2002. A monthly value weighted gross market index over the same period was also collected.³ To proxy for the risk free rate we obtained monthly yields on long-term Government bonds from the Reserve Bank of New Zealand Website.

2.2 Measure of idiosyncratic volatility

To determine the idiosyncratic volatility for each stock we first computed the monthly variance of returns for each stock in the sample. The monthly variance of stock returns were calculated using 60 months of prior returns ending June of each year t . We take this variance of monthly stock returns as our proxy for the total risk of the firm. We also compute a measure of the stock's "systematic risk" proxied by the covariance of stock's returns with the market returns. To measure systematic risk we also use monthly returns over the prior 60 months period ending June of each year t .

The idiosyncratic volatility for each stock is defined as the difference between the stock's total risk and its systematic risk. Stocks that did not have at least 60 months of continuous returns for the period ending June of each year t were excluded from our sample.⁴ The time period that we test the relationship between stocks

² All stock returns are adjusted for dividends and capitalization changes.

³ All stock price data and number of shares outstanding for each firm were obtained courtesy of Goldman Sachs JB Were (NZ) Limited, a major New Zealand sharebroker and a member of The New Zealand Exchange.

⁴ We used 60 months of prior return data to ensure there were a sufficient number of observations to obtain reasonably reliable estimates of each stock's variance and covariance of returns with the market. We also repeated our analysis by calculating the variance, systematic risk and idiosyncratic risk of stock returns using 24, 36 and 48 months of prior returns. Our results (not reported here) are qualitatively similar to our results reported in this paper.

idiosyncratic risk and returns therefore covers the period 1 July 1995 to 30 June 2002. At the end of June of each year t we also calculated the market value of the firm's equity or market capitalization for each stock in the sample. This equals the closing share price as at the end of June each year multiplied by the number of shares outstanding. Table 1 provides the number of stocks for each year, the average stock idiosyncratic risk and market capitalization of firms in the sample between June 1995 and June 2002. The number of stocks varied between 57 (June 1997) and 77 (June 2002). The average monthly idiosyncratic volatility for stocks in the sample varied between 0.0162 (June 1999) and 0.0367 (June 1996). For all years the average monthly idiosyncratic volatility exceeded the median monthly idiosyncratic volatility. The standard deviation of the monthly average stock idiosyncratic volatility by year varied between 0.028 and 0.069.

The average market capitalization of firms in the sample varied between \$297.6 million (June 1996) and \$609.7 million (June 1997). The average market capitalization exceeded the median market capitalization for each year. This reflects the significant weighting by size of the top ten stocks in the New Zealand market index.

Table 1

Table 1 (columns 3 and 4) details the average monthly stock idiosyncratic risk and market capitalization of firms in the sample (median and standard deviation respectively in parentheses).

Year end	Number of observations	Average monthly idiosyncratic volatility	Average size (market capitalization) \$ million
June 1995	65	0.0334 (0.0129, 0.055)	367.131 (40.49, 1165.73)
June 1996	58	0.0367 (0.0114, 0.069)	297.63 (41.61, 902.01)
June 1997	57	0.0222 (0.0076, 0.039)	609.73 (70.76, 2017.21)
June 1998	61	0.0172 (0.0059, 0.034)	452.94 (54.54, 1826.58)
June 1999	72	0.0162 (0.0068, 0.028)	443.21 (60.21, 1733.25)
June 2000	75	0.0208 (0.0073, 0.037)	430.32 (69.85, 1556.07)
June 2001	75	0.0200 (0.0079, 0.034)	439.92 (71.60, 1279.69)
June 2002	77	0.0203 (0.0086, 0.034)	404.14 (83.72, 1160.04)

3. Relationship between Return, Idiosyncratic Volatility and Firm Size

3.1 Idiosyncratic Volatility and Firm Size

We first examine if idiosyncratic volatility for individual stocks is related to firm size. Large firms are more likely to have diversified revenue streams across a range of different industries and are subject to lower relative expected bankruptcy costs. This reduces a stock's sensitivity to unique risk factors compared to a smaller firm with less diversified revenues. Hence we conjecture small firms will have greater idiosyncratic volatility compared to large firms. Following Malkiel and Xu (1997) for each year over the period 1995 to 2002 we regress our measure of stock idiosyncratic volatility against the log of the firm's market capitalization. The cross-sectional regression model for each year is:

$$IV_{it} = \alpha_{it} + \beta_i \ln(\text{MCAP}_{it}) + \varepsilon_{it} \quad (1)$$

where:

IV_{it} = idiosyncratic volatility for firm i in year t

$\ln(\text{MCAP}_{it})$ = natural logarithm of firm i 's equity market capitalization in year t

Table 2 presents the results of the regression model in equation (1) for each year in the sample period. For all periods the intercept is significantly positive at the one percent level and the coefficient on $\ln(\text{MCAP}_{it})$ is significantly negative at the one percent level. The empirical evidence is strongly supportive that firm size is negatively related to firm idiosyncratic volatility or unique risk. Similar to Malkiel and Xu (1997) for US stocks our results suggest that firm size may proxy for idiosyncratic risk factors in the Fama and French (1992, 1993 and 1996) asset pricing models.

Table 2
Relationship between Idiosyncratic Volatility and Firm Size

This table shows the cross-section relationship between idiosyncratic volatility and firm size for each year in the sample period 1995 to 2002. The regression model is:

$$IV_{it} = \alpha_{it} + \beta_i \ln(\text{MCAP}_{it}) + \varepsilon_{it}$$

where:

IV_{it} = idiosyncratic volatility for firm i in year t

$\ln(\text{MCAP}_{it})$ = natural logarithm of firm i equity market capitalization in year t

Year end	α_{it}	β_{it}	Adj R ²	Number of Firms (Observations)
June 1995	0.2759 (5.08)***	-0.0138 (-4.51)***	0.232	65
June 1996	0.2999 (4.16)***	-0.0151 (-3.70)***	0.182	58
June 1997	0.1417 (3.17)***	-0.0066 (-2.71)***	0.101	57
June 1998	0.1400 (3.99)***	-0.0069 (-3.53)***	0.160	61
June 1999	0.1115 (3.96)***	-0.0053 (-3.42)***	0.131	72
June 2000	0.1736 (4.49)***	-0.0084 (-3.98)***	0.169	75
June 2001	0.1732 (5.06)***	-0.0084 (-4.50)***	0.207	75
June 2002	0.1821 (5.39)***	-0.0089 (-4.82)***	0.227	77

*** Significant at the 1% level

3.2 Idiosyncratic Volatility and Return

To further investigate the relationship between stock returns and idiosyncratic volatility we next divide the stocks in our sample into quintile (five) portfolios based on the ranking of the stock's idiosyncratic volatility at the end of June of each year t. Equally weighted returns on each of the five quintile portfolios are then calculated

from the start of July of each year t to the end of the following June $t + 1$ year. At the end of June $t + 1$ each year the stock's idiosyncratic volatility is re-calculated and the portfolios are rebalanced. An average annual return for each portfolio over the period July 1995 to June 2002 is then calculated. Table 3 reports the annual returns for each portfolio ranked on idiosyncratic risk over the period 1 July 1995 to 30 June 2002. Portfolio one is the portfolio of stocks with the lowest idiosyncratic volatility and portfolio five is the portfolio of stocks with the highest idiosyncratic volatility. Portfolio returns were positive for all years except for the period between July 97 and June 98.

The returns on the portfolio with the highest idiosyncratic risk (portfolio 5) also exceeded the returns on the portfolio with the lowest idiosyncratic risk (portfolio 1) for each year except for the last two years between 1 July 2000 and 30 June 2002. Figure 1 plots the average annual return for the five stock portfolios ranked on idiosyncratic volatility. Portfolio one is the portfolio of stocks with the lowest idiosyncratic volatility and portfolio five is the portfolio of stocks with the highest idiosyncratic volatility. Except for portfolio one the average annual return over the period July 1995 to June 2002 increases monotonically the higher the portfolio's idiosyncratic volatility. The results in both table 3 and figure 1 suggest stock returns are positively related to their level of idiosyncratic or unique risk.

In figure 2 we plot the portfolios ranked on idiosyncratic volatility against the average annual portfolio size (natural log of the firm's market capitalization) over the same period July 1995 to June 2002. Figure 2 confirms the results of the cross-sectional regressions in Table 2 of the negative relationship between firm size and idiosyncratic risk. As already noted it is possible that firm size may proxy for stock idiosyncratic risk as a risk factor to explain asset returns in the Fama and French (1993, 1996) asset pricing models. We examine this possible relationship below.

Table 3

Stocks in the sample are divided into quintile (five) portfolios based on the ranking of each stock's idiosyncratic volatility at the end of June of each year t . Equally weighted returns on each of the five quintile portfolios are then calculated from the start of July of each year t to the end of the following June $t + 1$ year. At the end of June $t + 1$ each year the stock's idiosyncratic volatility is re-calculated and the portfolios are rebalanced. Portfolio one is the portfolio of stocks with the lowest idiosyncratic volatility and portfolio five is the portfolio of stocks with the highest idiosyncratic volatility.

Portfolio ranked on idiosyncratic volatility	1	2	3	4	5
Period	annual return	annual return	annual return	annual return	annual return
July 95- Jun 96	0.1203	0.0307	0.1154	0.2625	0.3004
July 96- Jun 97	0.2867	0.1894	0.0804	0.6301	1.7789
July 97- Jun 98	-0.1983	-0.2518	-0.1839	-0.2074	-0.1623
July 98- Jun 99	0.3476	0.5189	0.3445	0.4258	0.3528
July 99- Jun 00	0.1550	0.0867	0.2459	0.3050	0.6641
July 00- Jun 01	0.3440	0.3272	0.3980	0.2193	-0.4073
July 01- Jun 02	0.2108	0.1417	0.20760	0.1632	0.1510
Average annual return	0.1809	0.1490	0.1726	0.2569	0.3825

Figure 1

Figure 1 plots the average return for portfolios of stocks ranked on idiosyncratic volatility. Portfolio one is the portfolio of stocks with the lowest idiosyncratic volatility and portfolio five is the portfolio of stocks with the highest idiosyncratic volatility. The portfolios are formed based on the ranking of the stock's idiosyncratic volatility at the end of June of each year t . Equally weighted returns on each of the five quintile portfolios are calculated from the start of July of each year t to the end of the following June $t + 1$ year. The portfolios are rebalanced annually. An average return for each portfolio over the period July 1995 to June 2002 is then calculated.

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Figure 2

Figure 2 plots the portfolios ranked on idiosyncratic volatility against the average annual portfolio size (natural log of the firm's market capitalization) over the period July 1995 to June 2002.

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3.3 Firm Size and Return

To test the relationship between size and returns we again sort the sample of stocks into quintiles based on their ranking of market capitalization at the end of June of each year t . Equally weighted returns on each of the five portfolios are then calculated from the start of July of each year t to the end of the following June $t + 1$ year. The size portfolios are then rebalanced annually and portfolio's returns are averaged over the period July 1995 to June 2002.

Table 4 reports the annual returns for each portfolio ranked on market capitalization over the period 1 July 1995 to 30 June 2002. Portfolio one is the portfolio of the smallest (low-capitalization) stocks and portfolio five is the portfolio of the biggest (high-capitalization) stocks. Portfolio returns were again positive for all years except for the period between July 97 and June 98. The returns on the portfolio with the smallest stocks (portfolio one) also exceeded the returns on the portfolio of the largest stocks (portfolio five) for each year except for the years between July 1998 – June 1999 and July 2000- June 2001.

In figure 3 we plot the average annual portfolio return for the five stock portfolios ranked on equity market capitalization. Portfolio one is the portfolio of the smallest (low-capitalization) stocks and portfolio five is the portfolio of the biggest (high-capitalization) stocks. The portfolio of the smallest stocks by market capitalization exhibits the highest average annual return over the period 1995 to 2002. Thereafter apart from portfolio five (the largest size portfolio) returns and size are positively related. The results suggest that the size effect or high returns to small stocks are concentrated in the very small firms only. In figure 4 we plot the average annual

idiosyncratic volatility of each portfolio over the period July 1995 to June 2002. Idiosyncratic volatility decreases monotonically as firm size decreases. The results confirm our previous findings of the negative relationship between idiosyncratic volatility and firm size.

Table 4

Stocks in the sample are divided into quintile (five) portfolios based on their ranking of market capitalization at the end of June of each year t . Equally weighted returns on each of the five portfolios are then calculated from the start of July of each year t to the end of the following June $t + 1$ year. The size portfolios are then rebalanced annually and portfolio's returns are averaged over the period July 1995 to June 2002. Portfolio one is the portfolio of the smallest (low-capitalization) stocks and portfolio five is the portfolio of the biggest (high-capitalization) stocks.

Portfolio ranked on market capitalisation	1	2	3	4	5
Period	annual return	annual return	annual return	annual return	annual return
July 95- Jun 96	0.3007	0.0510	0.2814	0.1036	0.0803
July 96- Jun 97	1.5496	0.3030	0.3084	0.3287	0.3048
July 97- Jun 98	-0.0022	-0.3833	-0.2195	-0.2121	-0.1733
July 98- Jun 99	0.3072	0.4342	0.3640	0.5728	0.3098
July 99- Jun 00	0.9964	0.3283	0.1675	0.0499	0.0215
July 00- Jun 01	0.1017	0.0397	0.0385	0.3350	0.2009
July 01- Jun 02	0.1943	0.1579	0.2306	0.1985	0.1341
Average annual return	0.4925	0.1330	0.1673	0.1967	0.1254

Figure 3

In Figure 3 we plot the average portfolio return for the five stock portfolios ranked on equity market capitalization. Portfolio one is the portfolio of the smallest (low-capitalization) stocks and portfolio five is the portfolio of the biggest (high-capitalization) stocks. The portfolios are formed based on the ranking of the stock's market capitalization at the end of June of each year t . Equally weighted returns on each of the five quintile portfolios are calculated from the start of July of each year t to the end of the following June $t + 1$ year. The portfolios are rebalanced annually in accordance with the current measure of the stock's market capitalization. An average annual return for each portfolio over the period July 1995 to June 2002 is then calculated.

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Figure 4

Figure 4 plots the average annual idiosyncratic volatility of each portfolio over the period July 1995 to June 2002.

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3.4 Time Series Regressions

Our results in tables 3 and 4 and figures 1 to 4 suggest that both stock idiosyncratic volatility and firm size are risk factors that may potentially explain asset pricing returns. The cross-sectional tests also show that idiosyncratic volatility is negatively related to firm size. To control for both firm size and market risk factors and to further examine the role of idiosyncratic risk in explaining asset returns we next undertake time series regressions using the mimicking portfolio approach of Fama and French (1993, 1996). We form six intersection and three zero cost investment portfolios based on firm size and idiosyncratic volatility.

The six intersection portfolios formed are S/L, S/M, and S/H; B/L, B/M, and B/H. S/L are a portfolio of small firms with low idiosyncratic volatility. S/M is a portfolio of small firms with medium idiosyncratic volatility and S/H is a portfolio of small firms with high idiosyncratic volatility. Similarly, B/L, B/M, and B/H are portfolios of big firms with low,

medium and high idiosyncratic volatility respectively. To construct the portfolios all stocks at the end of June of each year t are assigned to two portfolios of size (Small and Big) based on whether their June market equity capitalization (ME) (defined as the product of the closing share price times number of shares outstanding) is above or below the median ME. The same stocks are then allocated in an *independent* sort to three idiosyncratic volatility portfolios (Low, Medium, and High) based on the breakpoints for the bottom 33.33 percent and top 66.67 percent.

The three zero investment portfolios are RMRFT, SMB and HLIVLIV. We define the three zero investment portfolios as follows: RMRFT is the market excess return equal to $R_{mt} - R_{ft}$, where R_{mt} is the value weighted gross index return and R_{ft} is the risk-free rate observed at the end of each month. SMB (Small minus Big) is the monthly difference between the average of the return of the portfolios of small stocks (S/L, S/M and S/H) and the portfolios of big stocks (B/L, B/M and B/H); HLIVLIV (High liquidity minus Low idiosyncratic volatility) is the monthly difference between the average of the return on the portfolios of high idiosyncratic volatility stocks (S/H, B/H) and the portfolio of low idiosyncratic volatility stocks (S/L, B/L). To investigate the relationship between expected returns, firm size and idiosyncratic volatility our model takes the following form:⁵

$$R_{pt} - R_{ft} = a_p + b_p (R_{mt} - R_{ft}) + s_p \text{SMB}_t + i_p \text{HLIVLIV}_t + \varepsilon_{pt} \quad (2)$$

Where:

R_{pt} = the equally weighted monthly return on each portfolio S/L, S/M, S/H, B/L, B/H and B/L respectively;

⁵ We also tested equation (2) using a tax-adjusted form of the capital asset pricing model as follows:

$$R_{pt} - R_{ft}(1-t_d) = a_p + b_p (R_{mt} - R_{ft}(1-t_d)) + s_p \text{SMB}_t + i_p \text{HLIVLIV}_t + \varepsilon_{pt}$$

where: t_d = investor aggregate tax rate on debt. The tax adjusted form of the CAPM accounts for the dividend imputation in New Zealand (see Lally, 1992). Our parameter estimates for t_d are taken from Lally and Marsden (2004). The results were qualitatively similar to those reported in Table 5.

4. Findings

4.1 Intersection and Zero Cost Portfolios

In table 5 we detail the number of stocks in each of the six intersection portfolios (S/L, S/M, and S/H; B/L, B/M, and B/H) over the period July 1995 to June 2002. The total number of firms in the sample varies between 57 (June 1998) and 75 (June 2001 and 2002). Table 5 also shows that the S/H and B/L portfolios have the greatest average number of stocks per year (17.7 firms) followed by B/M, S/M, S/L and B/H portfolios.

Table 5

Number of companies in portfolios formed on size and idiosyncratic volatility

July 1995 to June 2002

The six intersection portfolios formed are S/L, S/M, and S/H; B/L, B/M, and B/H. S/L are a portfolio of small firms with low idiosyncratic volatility. S/M is a portfolio of small firms with medium idiosyncratic volatility and S/H is a portfolio of small firms with high idiosyncratic volatility. B/L, B/M, and B/H are portfolios of big firms with low, medium and high idiosyncratic volatility respectively.

YEAR	S/L	S/M	S/H	B/L	B/M	B/H	Total
July 95- Jun 96	2	12	18	20	9	4	65
July 96- Jun 97	1	12	15	19	7	4	58
July 97- Jun 98	1	12	15	18	7	4	57
July 98- Jun 99	5	9	16	15	11	5	61
July 99- Jun 00	9	9	18	15	15	6	72
July 00- Jun 01	7	8	22	18	17	3	75
July 01- Jun 02	6	11	20	19	14	5	75
AVERAGE	4.4	10.4	17.7	17.7	11.4	4.4	66.1

4.2 Performance of portfolios formed on size and idiosyncratic volatility

In table 6, panel A, we first report the mean monthly excess⁶ returns and standard deviation of returns for portfolios formed on firm size and idiosyncratic volatility. Our tests show that the mean monthly excess returns are positive for all six portfolios. We find that the S/H portfolio has the highest mean excess positive return (0.0197),

⁶ The excess return is the return on the portfolio in excess of the risk free rate.

followed by the S/M portfolio with a mean positive excess return of 0.0110. The S/H portfolio also had the highest standard deviation of returns (0.078). Table 6, Panel B, reports the mean returns on the zero investment portfolios. The mean monthly returns on the value weighted portfolio of all stocks (RMRFT) was 0.0017 (standard deviation = 0.044). The mimic portfolio for size (SMB) generated a return of 0.0047 per month (standard deviation = 0.043) suggesting that small firms are riskier than big firms. The mimic portfolio for liquidity (HIVMLIV) generated a return of 0.0068 per month (standard deviation = 0.052) suggesting that investors required a higher risk premium for high idiosyncratic volatility firms compared to firms with low idiosyncratic volatility.

Table 6
Summary Statistics and Multifactor Regressions for Portfolios Formed on Size and idiosyncratic volatility

The six intersection portfolios formed are S/L, S/M, and S/H; B/L, B/M, and B/H. S/L are a portfolio of small firms with low idiosyncratic volatility. S/M is a portfolio of small firms with medium idiosyncratic volatility and S/H is a portfolio of small firms with high idiosyncratic volatility. B/L, B/M, and B/H are portfolios of big firms with low, medium and high idiosyncratic volatility respectively. The three zero investment portfolios are RMRFT, SMB and HLIVLIV. We define the three zero investment portfolios as follows:

RMRFT is the market excess return equal to $R_{mt} - R_{ft}$, where R_{mt} is the value weighted return on all stocks in the six intersection portfolios and R_{ft} is the risk-free rate observed at the end of each month. SMB (Small minus Big) is the monthly difference between the average of the return of the portfolios of small stocks (S/L, S/M and S/H) and the portfolios of big stocks (B/L, B/M and B/H); HIVMLIV (High liquidity minus Low idiosyncratic volatility) is the monthly difference between the average of the return on the portfolios of high idiosyncratic volatility stocks (S/H, B/H) and the portfolio of low idiosyncratic volatility stocks (S/L, B/L).

Panel A						
Idiosyncratic Volatility Portfolios						
Size	L = Low	M = Medium	H = High	L = Low	M = Medium	H = High
	Summary Statistics					
	Mean excess returns (over the risk free rate)			Standard Deviations		
S = Small	0.0062	0.0110	0.0197	0.0430	0.0601	0.0784
B = Big	0.0075	0.0078	0.0076	0.0456	0.0474	0.0667

Panel B

	Mean return	Standard deviation
RMRF	0.0017	0.0439
SMB	0.0047	0.0427
HIVMLIV	0.0068	0.0517

In table 7 we report the parameter estimates for our multifactor model.⁷ Our results show that the intercept, (a coefficient), is statistically indistinguishable from zero for the S/L, S/M and B/H portfolios. We also observe that the overall market factor, (b coefficient), is statistically significant for all six portfolios at the 1-percent level suggesting that an assets' beta plays an important explanatory role in determining expected returns. The size factor, (s coefficient), is positive and highly significant at the one percent level for the three small portfolios (S/L, S/M and S/H). For the B/L, B/M and B/H portfolios the s coefficient is negative and statistically significant at the five and one percent level for the B/M and B/H portfolios respectively. The behavior of the coefficient for market and size is consistent with the findings of Fama and French (1996) who observe that small firms tend to have positive slopes on SMB while big firms tend to have diminishing positive or negative slopes on SMB.

The coefficient for idiosyncratic volatility (i coefficient) is significant at the one or ten percent level for the portfolios S/L, B/L, S/H and B/H. The coefficient is significantly negative for the S/L and B/L portfolios but becomes positive and significant for the S/H and B/H portfolios. For both the small and large size portfolios the coefficient increases monotonically as the level of idiosyncratic volatility increases. In interpreting the sign of the coefficients the mimic portfolio for idiosyncratic volatility (HIVMLIV) generates positive excess returns of 0.0068 per month suggesting that

⁷ Our results are again qualitatively similar to those reported in table 7 when we use an equally weighted market return R_{mt} in equation (2).

“high” idiosyncratic volatility firms have higher returns (are more risky) than “low” idiosyncratic volatility firms. Accordingly the significant positive (negative) coefficients on the S/H and B/H (S/L and B/L) portfolios are consistent with the finding that firm idiosyncratic volatility is priced and firms with greater unique risk earn higher expected returns. We also test for serial correlation, multicollinearity and heteroscedasticity to determine if any of the assumptions of the Classical Linear Regression Model have been violated. We use the celebrated Durbin-Watson d test to test for serial correlation, Belsley, Kuh and Welsch (1980) approach to test for multicollinearity and White’s General Heteroscedasticity Test for heteroscedasticity. Our tests show no evidence of serial correlation, multicollinearity⁸ or heteroscedasticity in our diagnostic tests of the regression results.

Table 7

Parameter Estimates for the multifactor model

S/L is a portfolio of small firms with low idiosyncratic volatility. S/M is a portfolio of small firms with medium idiosyncratic volatility and S/H is a portfolio of small firms with high idiosyncratic volatility. Similarly, B/L, B/M, and B/H are portfolios of big firms with low, medium and high idiosyncratic volatility respectively.

$$R_{pt} - R_{ft} = a_p + b_p (R_{mt} - R_{ft}) + s_p \text{SMB}_t + i_p \text{HIVMLIV}_t + \varepsilon_{pt}$$

R_{pt} = the equally weighted monthly return on each portfolio S/L, S/M, S/H, B/L, B/H and B/L respectively. RMRFT is the market excess return equal to $R_{mt} - R_{ft}$, where R_{mt} is the value weighted index return and R_{ft} is the risk-free rate observed at the end of each month. SMB (Small minus Big) is the monthly difference between the average of the return of the portfolios of small stocks (S/L, S/M and S/H) and the portfolios of big stocks (B/L, B/M and B/H); HIVMLIV (High liquidity minus Low idiosyncratic volatility) is the monthly difference between the average of the return on the portfolios of high idiosyncratic volatility stocks (S/H, B/H) and the portfolio of low idiosyncratic volatility stocks (S/L, B/L).

*** Significant at the 1% level

** significant at the 5% level

* significant at the 10% level

⁸ We employ the Belsley, Kuh and Welsch (1980) approach to test for multicollinearity. We use the condition index and the variance inflation factors to detect multicollinearity. Condition index is defined as the square root of the ratio of the largest eigenvalue to each individual eigenvalue. It is suggested that if the condition index is between 10 and 30, then there is moderate to strong multicollinearity and if the index exceeds 30 then there is severe multicollinearity. If the condition index is below 10, multicollinearity is said to be absent.

Portfolios ranked on idiosyncratic volatility						
Size portfolios	L = Low	M = Medium	H = High	L = Low	M = Medium	H = High
	a			t stat (a)		
S = Small	0.0058	0.0061	0.0080	1.41	1.25	2.27**
B = Big	0.0069	0.0084	0.0047	2.59***	2.16**	1.13
	b			t stat (b)		
S = Small	0.4987	0.7263	0.8519	5.04***	6.14***	10.03***
B = Big	0.8859	0.6583	0.5328	13.86***	7.04***	5.34***
	s			t stat (s)		
S = Small	0.3031	0.9107	0.8765	3.00***	7.55***	10.11***
B = Big	-0.0568	-0.2228	-0.6302	-0.87	-2.34**	-6.19***
	i			t stat (i)		
S = Small	-0.2724	-0.0859	0.9027	-3.36***	-0.89	12.97***
B = Big	-0.0951	-0.0904	0.7298	-1.82*	-1.18	8.93***
	Adjusted R ²					
S = Small	0.261	0.461	0.836			
B = Big	0.726	0.457	0.688			
	DW Statistic					
S = Small	2.23	1.87	2.09			
B = Big	1.93	1.88	1.91			

4.3 Seasonal effects

Prior research suggests stock returns in the US exhibit a January seasonality effect with returns higher in this month compared to other months in the year (Branch, 1977). The January effect is also particularly pronounced for small stocks (Fama, 1991). In New Zealand (in contrast to the US) the tax year-end for most listed firms is either the end of March or June. Accordingly the January effect in the US may correspond to an April or July effect in the New Zealand market. Brailsford (1993) also reports higher seasonal returns in April for the New Zealand market index over the period January 1967 to October 1991. To test for any seasonality effect we

therefore add dummy variable parameters⁹ for the months of January, April and July in our model. While the results are not reported here (to save space) the inclusion of dummy variables for these months does not alter qualitatively our results reported in Table 7 above. Our findings cannot be explained by seasonal factors.

5. Conclusion

In this paper we use the mimicking portfolio approach of Fama and French (1993, 1996) to examine if idiosyncratic or unique risk affects returns for New Zealand stocks. We find evidence of a negative relationship between firm size and a stock's idiosyncratic volatility. We also observe that small firms and firms with high idiosyncratic risk generate superior returns after controlling for market or systematic risk. Specifically we find that the "mimic" portfolio for size and idiosyncratic volatility generate monthly returns of 0.47% and 0.68% respectively. Since, small firms and firms with high unique risks generate superior returns to big firms and firms with low unique risks, the empirical results suggest such firms carry a risk premia.

We also find that the portfolio of stocks with the highest idiosyncratic volatility generate higher average returns (38.25% p.a.) than the portfolio of stocks with the lowest idiosyncratic volatility (18.09% p.a.) over our sample period between 1995 to 2002. When stocks are ranked on market capitalization we also find that the portfolio of the smallest stocks generates higher average returns (49.25%) compared to the average returns (12.54%) of the portfolio of largest stocks.

⁹ The dummy variable equals one for the months of January, April and July and zero otherwise.

Our findings are consistent with Malkiel and Xu (1997) who observe that idiosyncratic volatility is significantly negatively related to the size of the firm. Consistent with the results of Malkiel and Xu (2002) and Xu and Malkiel (2003) we also report that idiosyncratic volatility may be useful in explaining cross-sectional expected returns for New Zealand stocks. In summary, our results challenge the validity of the CAPM developed by Black (1972), Lintner (1965) and Sharpe (1964) that only systematic risk matters in the pricing of stock returns in the New Zealand market.

References

- Banz, R., 1981, The relation between return and market value of common stocks, *Journal of Financial Economics* 9, 3-18
- Barbee, W.C., Sandip, Mukherji and Gary A. Raines, 1996, Do Sales-Price and Debt-Equity explain stock returns better than book-market and firm size? *Financial Analysts Journal* 52, 56-60.
- Barber, Brad and Terrence Odean, 2000, Trading is hazardous to your wealth: The common stock investment performance of individual investors, *Journal of Finance* 55, 773-806.
- Basu, Sanjoy, 1983, The relationship between earnings yield, market value, and return for NYSE common stocks: Further evidence, *Journal of Financial Economics* 12, 129-156.
- Belsley, D.A., E.Kuh and R.E. Welsch, 1980, *Regression Diagnostics*, New York: John Wiley and Sons Inc.
- Benartzi, S., and R. Thaler, 2001, Naïve diversification strategies in retirement savings plans, *American Economics Review* 91, 79-98.
- Bhandari, L.C., 1988, Debt-equity ratio and expected common stock returns: *Journal of Finance* 43, 507-528.
- Black, F., 1972, Capital market equilibrium with restricted borrowing, *Journal of Business*, July, 444-455
- Branch, B., 1977, A tax loss trading rule, *Journal of Business* 50, 198-207
- Brailsford, T., 1993, Seasonality and institutional factors in the NZ equity market, *Pacific Accounting Review* 5, 1, 1-26
- Campbell J., Lettau, M. Malkiel and Y. Xu, 2001, Have individual stocks become more volatile? *Journal of Finance* 56, 1-43.
- Chan, L.K., Y. Hamao and J. Lakonishok, 1991, Fundamentals and stock returns in Japan, *Journal of Finance* 38, 1393-1414
- Dennis, P., and D. Strickland, 2004, The determinants of idiosyncratic volatility, Working Paper, University of Virginia

- Drew, M., and M. Veeraraghavan, 2002, Idiosyncratic Volatility and Security Returns: Evidence from the Asian Region, *International Quarterly Journal of Finance* Vol 2, 1-13.
- Fama, E., and K. French, 1992, The cross-section of expected stock returns, *Journal of Finance* 42, 427-465.
- Fama, E., and K. French, 1993, Common risk factors in the returns on stocks and bonds, *Journal of Financial Economics* 33, 3-56
- Fama, E., and K. French, 1996, Multifactor explanations of asset pricing anomalies, *Journal of Finance* 51, 55-84
- Fama, E., and K. French, 1998, Value versus growth: The international evidence, *Journal of Finance* 53, 1975-1999.
- Fama, E., and K. French, 2003, The CAPM: Theory and evidence, Working paper No 550, Center for Research in Security Prices, University of Chicago.
- Goyal, A., and P. Santa-Clara, 2003, Idiosyncratic Risk Matters! *Journal of Finance* 58, 975-1008.
- Guo, Hui and Robert Savickas, 2003, Idiosyncratic Volatility, Stock Market Volatility and Expected Stock Returns, Working Paper, The Federal Reserve Bank of St Louis.
- Hamao, Y., J. Mei, and Y. Xu, 2003, Idiosyncratic Risk and Creative Destruction in Japan, NBER Working Paper Number W9642.
- Lally, M., 1992, The CAPM Under Dividend Imputation, *Pacific Accounting Review* 4, 31-44.
- Lally, M. and A. Marsden, 2004, Tax-adjusted market risk premiums in New Zealand: 1931-2002, *Pacific Basin Finance Journal*, forthcoming.
- Lintner, J., 1965, The valuation of risk assets and the selection of risky investments in stock portfolios and capital budgets, *Review of Economics and Statistics* 47, 13-37.
- Malkiel, B. and Y. Xu, 1997, Risk and return revisited, *Journal of Portfolio Management* 23, 9-14.

Malkiel, B. and Y. Xu, 2002, Idiosyncratic risk and security returns, Working Paper, Princeton University.

Rosenberg, Barr, Kenneth Reid, and Ronald Lanstein, 1985, Persuasive evidence of market inefficiency, *Journal of Portfolio Management* 11, 9-17

Sharpe, W., 1964, Capital asset prices: A theory of market equilibrium under conditions of risk, *Journal of Finance* 19, 425-442.

Xu, Yexiao and Burton G. Malkiel, 2003, Investigating the Behavior of Idiosyncratic Volatility, *Journal of Business*, forthcoming

Figure 1.0
Average Returns for Portfolios Ranked on Idiosyncratic Volatility

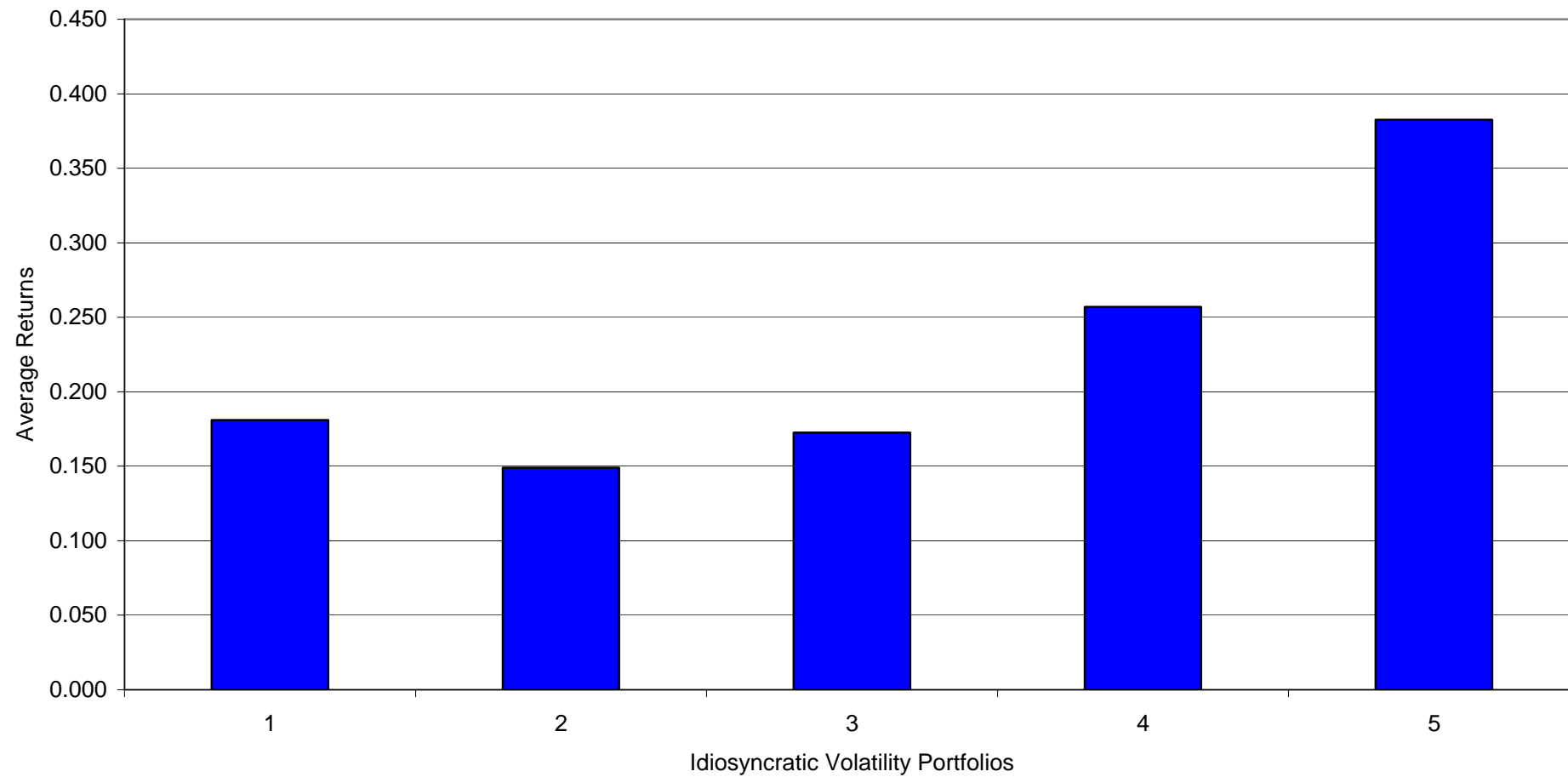


Figure 2.0
Average Market Capitalization for Portfolios Ranked on Idiosyncratic Volatility

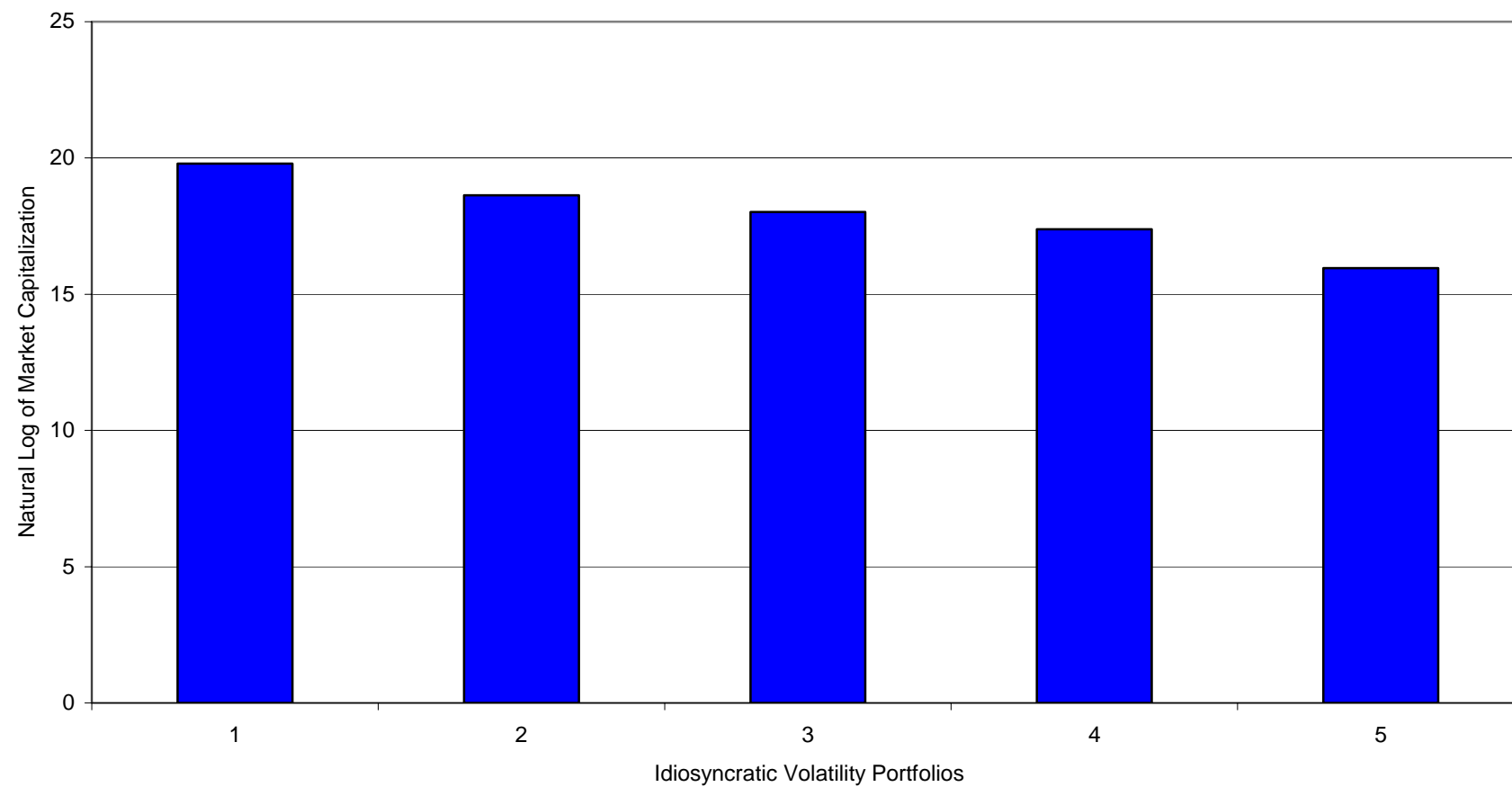


Figure 3.0
Average Returns for Portfolios Ranked on Size

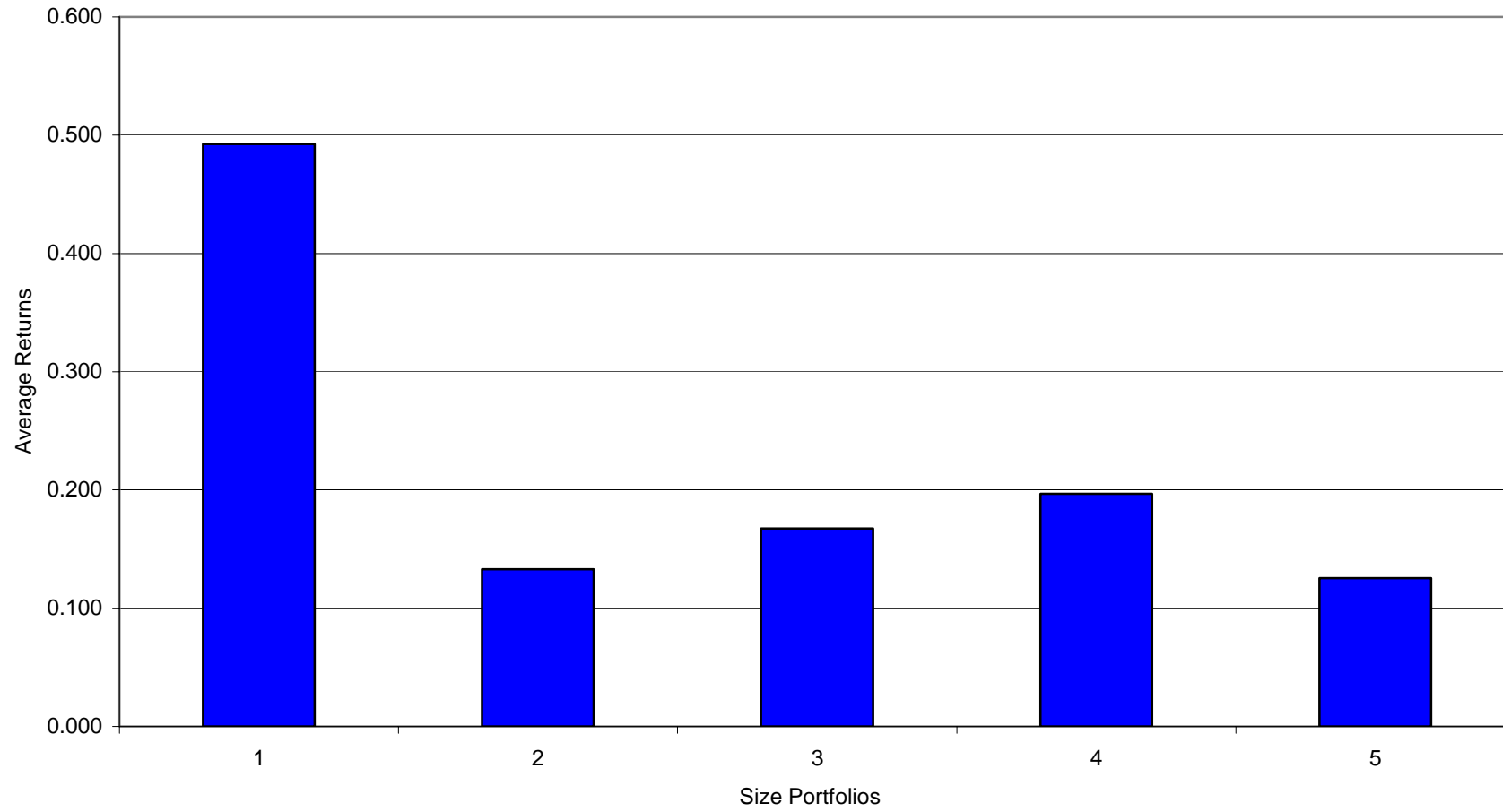
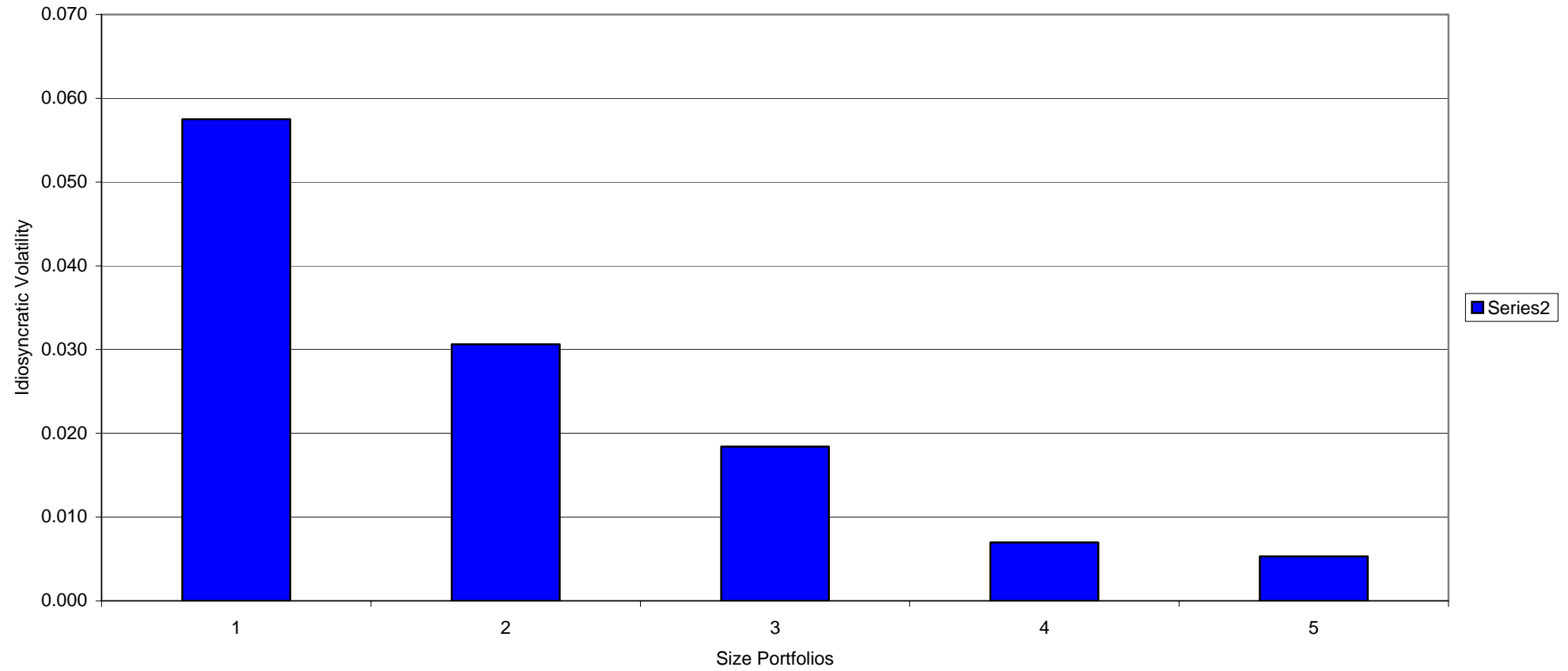


Figure 4.0
Average Idiosyncratic Volatility for Portfolios Ranked on Size



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