SIZE EFFECT IN INTERNATIONAL MARKETS: A SURVEY OF LITERATURE

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Abstract: *The purpose of this paper is to examine whether the size effect prevails in the international markets because there is a criticism that size effect is an outcome of data snooping bias. This study finds that size effect survives in capital markets in United States [US] as well as in other international markets. Further, the study reveals that the size effect appears only in the up-market condition. Recently, size factor has become a popular member in multifactor asset pricing models. However, the role of the size factor in multifactor models in conditional markets is still uncovered.*

Keywords: *Anomalies, International Markets, Size Effect, Size Factor*

1. Introduction

Market anomalies are empirical results that seem to be inconsistent with revealed models of asset-pricing behavior. They indicate either market inefficiency [profit opportunities] or misspecifications in the underlying asset-pricing model. Around three decades ago [BANZ 1981] reported that small firms have significantly higher risk adjusted excess returns than the large firms in US equity markets over the period of 1936-1975. He named this finding as the "size effect". However, Banz did not find the possible reasons for the size effect and it opened a gap of knowledge to examine the size effect and reasons for it to other researchers. Hence, a large body of research has been conducted to address this issue and matters related to it. This paper presents a review of the academic literature related to size effect in international equity returns.

The existence of a size effect in stock returns would have important implications for both practitioners as well as academics due to several reasons. First, if the higher returns on small stocks are due to a large exposure to an underlying risk factor not incorporated in asset pricing models, firms can compute their cost of equity capital more reliably on the basis of an asset pricing model that takes this source of risk into account. Second, the issue whether small stocks yield higher returns than large stocks and whether size effect due to compensation for risk is very important finding for practical investors. Third, the risk based explanations for size anomaly would change the academic view on the validity of standard asset pricing models and also have an impact on research methodologies such as event analysis methodology [RUTLEDGE et al. 2008].

At the beginning, most of the research on size effect concentrates on the US stock markets. Therefore, first the study concentrates on the review of US findings. Subsequently many researchers attempted to give explanations to the size effect. One explanation is that the size effect is the result of data snooping bias. In order to examine the validity of data snooping, the out of sample international studies in size

effect are reviewed next. Further, there are few findings that size effect varies with the market conditions. The use of size effect in multifactor models is also discussed.

The objective of this paper is to present a review of academic literature on size effect and its applications in international equity markets. Therefore, areas to be further research are concerned as a sub objective.

The reminder of the paper is structured as follows. Section 2 presents methodology in empirical studies of size effect. In the section 3 empirical evidence on size effect in the US equity market is examined. An overview of the international evidence on size effect is presented in section 4. Section 5 examines size effect on bull and bear markets. Use of size effect in multifactor asset pricing models is examined in section 6. Section 7 addresses the possible areas for further research and last section is the conclusion of the study.

2. Methodologies used in the empirical literature

This study is begun with an overview of the different methodologies used in empirical literature.

First, a widely used approach is the methodology of [FAMA AND MACBETH 1973]. According to this method, individual company beta [β] is computed to form portfolios using four years of monthly stock returns based on Capital Asset Pricing Model [CAPM] as shown in equation 1.

$$R_i = R_f + b_i(R_m - R_f) + e_t \quad \text{----------(1)}$$

Where,

Ri = monthly returns for asset i

Rm = monthly return on market portfolio

Subsequently, following five years data are used to re-compute beta so as to obtain the average beta of the portfolios. Monthly portfolio returns, with equal weights of individual securities are then re-computed during the next period. The portfolio betas are re-calculated each month to have a time series of betas. Then the portfolio average returns are regressed cross-sectional with portfolio betas and logarithm of market values of equity [size] as shown in equation 2. This allows to test both of the hypothesis that beta and size explain the cross-section of stocks returns by computing time-series average of the coefficient on beta and size. The Fama-MacBeth methodology is applied by the majority of studies on the size effect in the US and it is presented in [BANZ 1981] as follows.

$$E(R_i) = g_0 + g_1\, b_i + g_2[(f_i - f_m)/f_m] \quad \text{----------(2)}$$

Where,

$E(R_i)$ = expected return on security i

g_0 = expected return on a zero- beta portfolio

g_1 = expected market risk premium

f_i =market value (size) of security i

f_m =average market value, and

g_2 = constant measuring the contribution of f_i to the expected returns of a security.

Second, some papers use univariate sorting procedures to test the size effect. Every month t all stocks in the sample are ranked and sorted into portfolios on the basis of their market capitalization [size] and compute portfolio returns. The difference between the average return on the smallest and largest portfolio over the sample period is a measure for the size effect. Risk adjustment is done using CAPM as shown below [See, for example BASU 1977].

$$R_{pt} - R_{ft} = a_p + b_p(R_{mt} - R_{ft}) + e_{pt} \quad \text{---------- (3)}$$

Where,

$R_{p,t}$ = continuously compounded return portfolio p in month t

$R_{f,t}$ = monthly risk free rate at time t

R_{mt} = continuously compounded return on market portfolio in month t.

a_P = the intercept of the regression to measure excess returns [Jensen's alpha] of portfolio P. If the risk explains size anomaly, a_P should be zero.

b_p = the beta of portfolio P.

In addition to above two methods, some papers use [FAMA AND FRENCH 1992] double sorting method [sorting stocks on both size as well as other factors such as beta, book-to-market etc] to test the size effect [See, for example, CHOU et al. 2007].

3. Empirical evidence on size effect in US markets

The size effect refers to the negative relationship between stock returns and market value (market capitalization) of common equity of the firm. The summarized findings of US studies are presented in the table 1. BANZ [1981] was first to uncover this phenomenon based on New York Stock Exchange [NYSE]. Employing the methodology similar to [FAMA AND MCBETH 1973] Banz documented that small firms earn significantly higher excess returns (Alfa) than other size based portfolios during the period from 1936-1977. Further, Banz pointed out that the returns difference of buying small firms than the very large firms was 12 percent per month [19.8 percent per annum].

REINGANUM [1981] analyzed the size effect in a shorter period of 1975 to 1977 with a sample of 566 NYSE and American Stock Exchange [AMEX] firms over the period 1975-1977. He found that the smallest 10 percent of the firms outperformed the largest 10 percent by 1.6 percent per month. The smallest of the 10 size portfolios had

a beta roughly equal to 1 and a return of about 1 percent on a monthly basis in excess of the return on the equally-weighted market index. The largest size portfolio had a beta of 0.83 and underperformed the market by roughly 0.6 percent per month. [BROWN ET AL. 1983] re-examined the size effect using the Reinganum data set of 566 firms over a longer sample period of 1967 to1979 using the Fama Macbeth approach. They found that there was an approximately linear relation between the average daily return on 10 size-based portfolios and the logarithm of the mean size of all firms in the portfolio.

Tabl. 1: Summarized studies of size effect on US market

Study	**No. of portfolios**	**Sample**	**Test period**	**Returns smallest**	**Return largest**	**Size premium**
BANZ [1981]	5	NYSE AMEX	1936-1977	Na	Na	1.52
REINGANUM [1981]	10	566	1975-1979	Na	Na	1.6
BROWN ET AL. [1983]	10	566	1967-1979	1.2	-0.6	1.8
KEIM [1993]	10	1500-2400	1963-1979	1.6	-0.8	2.4
FAMA AND FENCH [1992]	10	NYSE, AMEX & NASDAQ	1962-1989	1.64	0.90	0.74
KIM AND BURNIE [2002]	10	680-835	1976-1995	2.32	1.16	1.16
AL-RJOUB ET AL. [2005]	10	NYSE, AMEX & NASDAQ	1970-1999	1.51	0.50	1.01
FASTERDAY ET AL. [2009]	10	NYSE, AMEX & NASDAQ	1946-2007	1.60	1.1	0.5
MOSSMAN AND RATHAYIL [2010]	10	NYSE, AMEX & NASDAQ	1960-2005	1.57	0.87	0.77

Source: Survey findings

They also showed that the size effect was unstable over time and were reversed in the period 1967 to 1975. KEIM [1983] reported an average excess return of small stocks of 2.4 percent per month in a sample of NYSE and AMEX firms over the period 1963-1979. Evidence was provided that daily abnormal return distributions in January have large means relative to the remaining eleven months, and that the relation

between abnormal returns and size was always negative and more pronounced in January than in any other months. Despite various important contributions by other researchers after the original work by Banz, the literature on the size effect changed off after the appearance of [FAMA AND FRENCH 1992]. Their paper combined the size and book-to-market (B/M) anomalies detected by earlier studies and demonstrated that the empirical shortcomings of the CAPM were too important to be ignored. FAMA AND FRENCH [1992] found that the smallest size decile outperformed the largest by 0.74 percent per month. The results of Fama-MacBeth regressions confirmed that while beta did not help to explain the cross-section of returns, size as well as B/M equity factors had significant explanatory power. The flat relation between beta and returns was believed as the beta was dead. After the millennium, [KIM AND BURNIE 2002] reported that mean rate of return on stocks decreased as firm size increased. Their sample period was from January 1976 to December 1995 and number of sample firms varied among years from 680 to 835. They reported that small size portfolio has a mean return of 2.32 percent and it was double that of large size portfolio. More recently [AL-RJOUB ET AL. 2005] examined size effect using all NYSE, AMEX and National Association of Securities Dealers Automated Quotations (NASDAQ) operating firms for over the period 1970-1999. They reported that average returns of small size firms outperformed the average returns of large size firms during the total sample. However, during the ten year period from 1980-1989 size effect was reversed and in the next decade it again appeared. EASTERDAY ET AL. [2009] re-examined the January related size effect using common stocks traded on NYSE, AMEX and NASDAQ during the period 1946-2007. They found that small firms' returns outperformed the large firms' returns by 0.5 percent for all months. However, the return difference [size premium] between the small firms and large firms was extremely higher for January months. The size premiums were 6.4, 13.1 and 5.8 percents for the sub periods 1940-1962, 1963-1979 and 1980-2007 respectively. MOSSMAN AND RKBMAYIL [2010] found that size effect was persisting during the period 1960-2005. Further, they used the traditional macro economic variables selected by [CHEN, ROLL AND ROSS 1986] to study their effects on size anomaly. Their empirical results showed that macro economic variables did not demonstrate any strong ability to explain the size anomaly returns.

The above findings revel that size anomaly persists in US market over a long period of time [1926-2007]. Further, it is evident that size effect is related with the January effect in US and it seems that investors are not learning of the effect and arbitrage it away.

4. International evidence on size effect

Since 1980 large number of studies has examined the size effect on international data. Table 2 summarizes some of the important studies. The table shows that average monthly returns of small size portfolio are higher than that of the large size portfolio for all the countries.

LEVIS [1985] examined size effect in London Stock Exchange [LSE] from 1958 – 1982 using all the stocks at LSE. He formed 10 equally weighted portfolios and found that small size portfolio has average returns of 1.33 percent while the large size

portfolio has 0.94 percent. However, small firms had lower risk [beta equal to 0.64] than did large firms [beta equal to 1.02]. MILLS AND JORDANOV [2000] also found that small size portfolios outperformed the large size portfolios in LSE from 1985 to 1995. They reported that small firms had significantly higher excess returns than large firms. Further, they found greater predictability for large firms suggesting a risk related size effect that was not explained by beta.

WAHLROOS AND BERBLUND [1986] examined the size anomaly at Helsinki Stock Exchange from 1970-1981 periods. Using the Fama MacBeth cross-sectional regression method, the risk adjusted mean annual returns for the small size portfolio was 8.7 percent per year while it was negative [-2.2 percent] for the large size portfolio. [HERRERA AND LOCKWOOD 1994] examined the size effect on Mexican stock market using data from January 1987 to December 1992. They found that average returns increased with increased [decreased] in beta [size], using the portfolios segmented on size alone. For example, for Mexican size sorted low, medium, and high portfolios' average monthly returns were 5.80 percent, 3.46 percent, and 1.64 percent, and their betas were 1.31, 1.12, and 0.79 respectively.

ELFAKHANI ET AL. [1998] examined the size effect based on nearly 2000 stocks traded in two stock markets exists in Canada: Toronto Stock Exchange and Montreal Stock Exchange from June 1975 through December 1992. Using the Fama-MacBeth methodology they found that average stock returns decrease with the increase of firm size. This evidence was true even after controlling for the Beta variation.

GAR ZA-GOMEZ ET AL. [1998] examined the relationship between cash flow risks, firm size and returns from 1957 to 1994 in Tokyo Stock Exchange. They found that as firm size decreased cash flow risk was increased. Further, smaller firms showed positive excess returns. Thus, firm size may proxy for cash-flow risk and this risk was not captured by beta in explaining the excess returns of small firms over large firms. CHOU ET AL. [2007] also found same results. Further, they found that when stocks were sorted on size, the size was inversely related to the monthly beta, a result that was very similar to the US results.

Among the other studies [MARONEY AND PROTOPAPADAKIS 2002] examined the size effect on seven markets namely, Australia (AUS), Canada (CAN), Germany [DEU], France [FRA], the United Kingdom [UK], Japan [JPN], and the US. The sample period for US and CAN is November 1983 to October 1994 and for AUS, FRA, DEU, UK, and JPN was November 1986 to October 1994.

Their findings of average returns for small and large portfolios were as present in the following table.

Tab. 2: Average returns of small and large portfolio

Country	Small portfolio (%)	Large portfolio (%)	Size premium (%)
AUS	30.4	18.6	11.8
CAN	44.3	8.6	35.7
FRA	17.5	13.8	3.7
DEU	26.6	12.6	14.0
GBR	22.2	18.4	3.8
JPN	21.5	5.7	15.8
USA	47.3	16.7	30.6

Source: Maroney and Protopapadakis [2002]

ANNAERT ET AL. [2002] examined the size anomaly over 15 European country stocks of 2866 from January 1973 until December 2000. Every stock in the sample belonged to one of the following countries: Austria, Belgium, France, Germany, Denmark, Finland, Ireland, Italy, Netherland, Norway, the UK, Switzerland, Spain, Portugal or Sweden. According to the value weighted portfolio returns, small European stocks earned a monthly return of more than 2.6 percent per month, which is much higher than the 1.2 percent per month for the largest stocks. This result was found after excluding the 20 percent smallest stocks of each country from the sample. They found a significant size premium of 1.45 percent per month, or about 19 percent on an annual basis by employing the [FAMA AND FRENCH 1993] three factor model.

Tab.3: Summarized studies of size effect on international markets

Country and study	No. of portfolios	Sample	Test period	Returns smallest	Return largest	Size premium
UK: LEVIS [1985]	10	LSE	1958-1982	1.33	0.94	0.39
Finland: WAHLROOS AND BERGLUND [1986]	10	50	1970-1981	1.2	0.30	0.90
Mexico: HERRERA AND LOCKWOOD [1994]	3	100	1987-1992	5.80	1.64	4.16
Japan: GAR ZA-GOMEZ ET AL. [1998]	10	326-1077	1957-1994	2.38	1.11	1.27
Canada: ELFAKHANI ET AL. [1998]	5	694	1979-1992	2.00	1.02	0.98

UK: MILLS AND JORDANOV 2000]-	10	304-500	1985-1995	3.09	0.95	2.14
Europe:[ANNAERT et al. [2002]	10	2866	1974-2000	2.64	1.19	1.45
Greece: LELEDAKIS ET AL. [2003]	5	203	1990-2000	5.36	3.97	1.39
Japan: CHOU ET AL. [2007]	10	TSE	1975-1997	1.74	0.76	0.98
Sri Lanka: NANAYAKKARA [2008]	5	101	1998-2005	1.83	0.37	1.46
India: SINGH [2009]	4	158	1991-2002	2.33	0.61	1.72

Source: Survey findings

There are number of studies of size effect done based on Athens Stock Exchange [ASE]. LELEDAKIS ET AL. [2003] examine the cross-sectional variation of stock returns for the 1990 -2000 period using the [FAMA AND FRENCH 1992] portfolio grouping procedure. They used size, beta, B/M equity, leverage, earnings-to-price, dividend yield and sales to price as independent variables in the model. However, they found that only size had a significant explanatory power in explaining cross-sectional variation of stock returns. Further, [THERIOU ET AL. 2005] and [KOUSENIDIS 2005] also found that size had a negative relationship with stock returns at ASE.

SINGH [2009] examined five market anomalies including size anomaly using 158 equity shares in Bombay Stock Exchange [BSE] as shown in the table 3, the author found significant size premium of 1.72 percent returns per month. Further, the author reported that “risk is multidimensional and definitely include size, which is probably a proxy for some underlying risk”.

NANAYAKKARA [2008] found that there was an evidence of 1.46 percent monthly difference of returns between smallest stocks and largest stocks traded at Colombo Stock Exchange.

The above findings report that size effect is visible in the international markets. For most of the studies size effect is not captured by CAPM beta. Most studies in agreement that some risk factors not included in traditional asset pricing models are captured by size effect.

5. Size effect and bull versus bear market

Several studies examined the size effect in bull versus bear markets. Generally these studies found that size effect was different depending on the primary condition of the market. BHARDWAJ AND BROOKS [1993] examined the size effect in bull and bear market using dual-beta market model for NYSE and AMEX stocks from 1926 to

1988. The study classified as either a bull month or bear month if the market return in that month was higher or lower than the median market returns over the entire period. The table 4 below shows that for the total period monthly average returns decrease with the size increase. But small firm stocks under-perform large firm stocks in bear months but out-perform them in bull months.

Tab.4: Size effect evidence on Bull and Bear Markets

Country and study	**Number of portfolios**	**Sample**	**Size portfolio**	**Average returns***		
				Total period	**Bull**	**Bear**
US: BHARDWAJ AND BROOKS [1993]-	20	NYSE AMEX	Small Large	2.81 0.81	9.80 4.32	-4.20 -2.61
US: KIM AND BURNIE [2002]	10	680-835	Small Large	2.32 1.16	5.23 4.18	-0.59 -1.87
Chaina: RUTLEDGE ET AL.[2008]	10	1278	Small Large	Na Na	0.135 -0.125	-0.039 0.004

Source: Survey findings

* Returns presented under [RUTLEDGE ET AL. 2008] are average daily excess returns

Na = data is not available

KIM AND BURNIE [2002] found some what different findings to [BHARDWAJ AND BROOKS 1993] taking a sample of 680 to 835 surviving firms from 1976 to 1995. They found that average monthly returns of portfolios were negatively related with size. Portfolio mean returns were positive in bull market and they were negative in bear markets. RUTLEDGE ET AL. [2008] examined the size anomaly in Chinese market from 1998-2003 on conditional markets. They identified the bull market period as the up market of Shanghai A-share month index level and bear market as the downward trend of the index. They reported that in the bullish market average daily excess returns were a monotonically decreasing function of market value of the firm. However, in the bear market small firm recorded negative returns while large firms reported positive returns.

In summary of this sub section, studies found that during bull markets small firms have returns higher than large firms. However during bear markets, small firms have returns that are worse than large firms. Therefore it can be concluded that size effect is visible only in bull market conditions.

6. Size effect and asset pricing models

According to the literature discussed, the size effect was the first of the firm variables that was shown to be related to excess returns. FAMA AND FRENCH [1993] used the size anomaly for the first time to create a size factor[1] in their famous three factor model [market, size and B/M] to explain the cross-section of average stock returns. Since [FAMA AND FRENCH 1993] many researchers have used the size factor to create factor models to explain the variation in cross-section of stock returns [see for an example, FAMA AND FRENCH 1996; DREW AND VEERARAGHAVEN 2002; DREW NAUGHTON AND VEERARAGHAVEN 2003; WANG AND XU 2004; MALIN AND VEERARAGHAVEN 2004). Followings are the recent evidences that use size anomaly in asset pricing models.

MOBAREK AND MOLLAH [2005] examine the stock return determinants of Dhaka Stock Exchange using 123 non-financial companies from 1988 to 1997. The study found that size factor is significantly negatively related with stock returns. The same finding received by [BAHL 2006] for 79 stocks listed on the BSE in India. Using monthly data from Shanghai and Shenzhen Stock Markets from 1994 to 2002, [WANG AND IORIO 2007] found that beta was not an important factor in explaining stock returns but size and B/M factors play a significant role in explaining stock returns. [SIMLAI 2008] re-examined the three factor model of [FAMA and FRENCH 1993] using NYSE, AMEX AND NASDAQ stocks from 1926 to 2007. The author finds that B/M as well as size factors played a strong role in explaining stock returns. In another study [KONSTANTINOS 2008] examined the significance of size B/M and momentum risk factors in explaining portfolio returns in Australian Stock Market (ASM). Overall findings confirmed the existing evidence that there was a strong size effect and a week B/M effect in ASM. BANDOO [2008] also found that size and B/M factors were statistically significant in explaining stock returns at Mauritius Stock Exchange.

7. Further research

Literature shows that the relationship between beta and return is significantly positive in up markets and significantly negative in down market [FLETCHER 1997; SRIYALATHA 2010]. Further, section five of this paper reveals that size anomaly is conditional on state of the market and previous section showed that size factor plays a significant role in explaining cross-sectional variability of stock returns.

However, it is extremely lacking [if not unavailable] to find studies on multifactor asset pricing models [including size factor] in conditional market states. Therefore, this study proposes that multifactor asset pricing models [including size factor] should be expanded in conditional markets because beta as well as size anomaly are subject to market conditions.

[1] [FAMA and FRENCH 1993] formed size and B/M mimicking portfolios by taking the returns difference between the smallest 30 percent and the largest 30 percent of the ranked values of size and B/M portfolios.

8. Summery and conclusion

The size effect refers to the negative relationship between stock returns and market value of common equity of the firm. The size effect was the first of the firm variables that was shown to be related to excess returns. There has been extensive research on size effect in finance literature throughout the last three decades after the inception of size effect by [BANZ 1981]. The purpose of this paper is to examine whether the size effect is prevail in international markets because there is an argument that size effect is a outcome of data snooping bias. Survey of size anomaly in international market would be able to find whether it is special feature in U.S market or common characteristic in capital markets all over the world.

This paper examines size effect in US market since its inception in 1981 to 2010. Studies reveal that size effect survives in the US market with some fluctuations over time. Further, suggest that size effect play a role of proxy for correction of market risk. The international evidence on size effect shows consistent results for the studies concerned here. Small firms seem to outperform large firms in a large number both in developed and developing international markets. The international market findings of size effect reject the criticism that empirical evidence is the result of data snooping bias.

The survey reveals that size effect is survives only in the bull or up market and in the bear or down market size effect can not be seen.

Recent empirical studies have found that size factor which creates by deducting returns of largest size portfolio from the returns of smallest size portfolio, plays an important role in explaining stock returns.

In summary, it can be concluded that size effect is survives in the US as well as other international capital markets. However, size effect is visible only in bull market. Size factor seems to be a key member of multifactor asset pricing models. The potential fruitful extensions of the size anomaly related research studies are: a. to further verifies the relationship between size effect and market conditions of bull [up] or bear [down] markets; b. to examine the size factor loaded multifactor asset pricing models in conditional markets.

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