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Risk is not rewarded by higher returns in the equity market

-A low Volatility Strategy-

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This article reviews low-risk as an equity investment strategy. The purpose is to highlight the benefits of the strategy compared to investing in a global market portfolio with a focus on the reasons behind the existence of the anomaly. The first section of the article reviews low-risk as an investment strategy and section two is a discussion of whether it is a real anomaly. Sections three and four describe advantages and disadvantages of the strategy whereas sections five to seven focus on the reasons why risk is not rewarded in the equity market.

Background

Equity markets have in recent years been characterised by large drawdowns illustrated by the IT bubble in 2000 and the financial crisis in 2008. Investors may not expect a fall of 50% in their portfolios but such movements occur from time to time. For instance the S&P 500 index declined by more than 50% from its peak in October 2007 to the bottom in March 2009, cf. Chart 1. Likewise, the global equity market represented by MSCI AC World shed more than 40% alone in 2008[1]. Such declines may be disastrous for a pension fund or for investors who are close to retirement

Chart 1: Drawdown for S&P 500 (1950-2018)
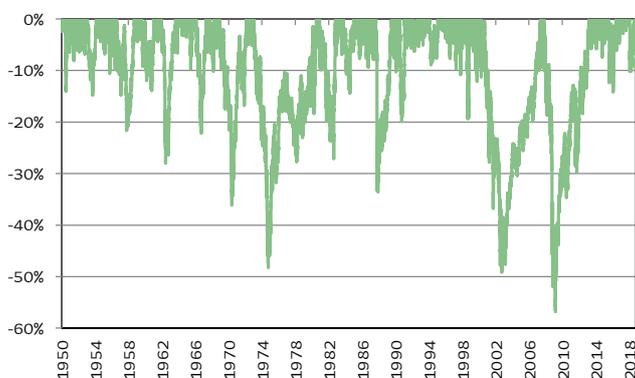
Source: Bloomberg and Jyske Capital

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[1] *Both figures are in USD.*

[2] *1,30 x 0,70 = 0,91*

[3] *1,4 x 0,6 = 0,84*

The large drawdowns have make investors reassess the risk in their equity portfolios. Many investors have recognised that they cannot handle the volatility in the equity market and seek better protection of their capital without sacrificing long-term returns relative to capitalization-weighted indices. Investors have increasingly been focusing on the benefits of low-risk strategies in the wake of the financial crisis. One of the benefits being that such strategies win by typically not losing as much as the general equity market in a situation with plunging equity prices. An investor experiencing a return of 30% followed by a loss of 30% will end up having larger assets (minus 9%[2]) than an investor who experiences a return of 40% followed by a loss of 40% (minus 16%[3]). A low-risk strategy will therefore be beneficiary during a multi-period consideration where the compounding effect becomes visible. In this context, it is worthy of note that drawdowns of more than 20% have been a recurring event in the equity market. For instance the US equity market have on average seen drawdowns of at least 20% every sixth year since 1950, cf. Chart 1.

Low risk does not equal low return

A low-risk strategy is consistent with investing in an equity portfolio with low risk. There are several suggestions as to how risk should be defined and exploited in the best possible way. There are several closely related forms of low-risk investing, focusing on various risk measurements such as beta (the systematic risk of a share in relation to the market as a whole), total volatility (price fluctuations of a share measured by the standard deviation), residual volatility (volatility which cannot be explained by a factor model) and minimum variance portfolios where the total risk (variance) of the portfolio is reduced to a minimum. Irrespective of approach, the portfolio's underlying equities often have some common characteristics. They are typically considered slightly boring with low growth expectations, high dividend yields and high returns on equity. In addition, they often have lower share

turnover and moderate analyst and investor focus compared to high-risk equities.

The common objective of the strategies is typically to reduce the risk of the portfolio without sacrificing the long-term return compared to the general equity market measured by a capitalization-weighted index. Moreover, low-risk investing strategies are more focused on absolute returns and absolute risk compared to other active investing strategies which are more focused on returns and risk in relation to a specific benchmark.

The proposition that returns are positively correlated with risk is very intuitive and the result of Sharpe's recognised Capital Asset Pricing Model (CAPM)[4], according to which the return of securities should be a positive function of risk. The CAPM model's so-called security market line (SML) indicates that there should be a positive linear correlation between the beta of a share and the expected return over a given horizon with a positive slope corresponding to the equity risk premium as illustrated in Chart 2. If equity markets are effective, differences in risk should in other words be the only explanation of differences in expected return.

However, in the early 1970s when CAPM was first tested empirically in the US equity market, it became clear that the risk-adjusted return for equities with a low systematic risk (beta) was higher than predicted by the theory see for instance Black, Jensen & Scholes (1972)[5], Fama & MacBeth (1973)[6] and Haugen & Heins (1975)[7]. In other words, the actual correlation between risk and return turned out to be flatter than projected by the CAPM model

Chart 2: Correlation between risk and return
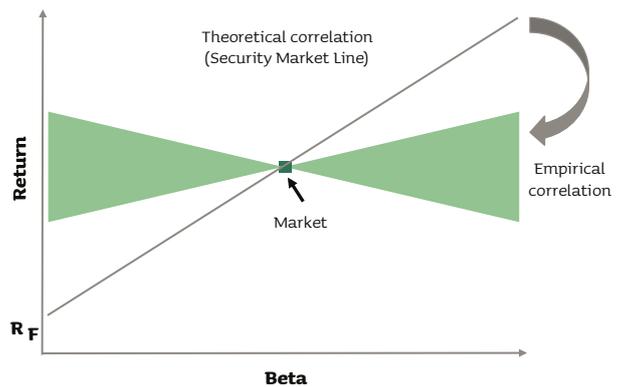
Source: Jyske Capital

Haugen & Heins were the first to identify the negative reward of risk in the US equity market as their working paper was actually released first time in 1969. So, the low-risk anomaly[8], as it has been called, is not a new phenomenon in the financial markets even though – as mentioned above – it is only in recent years investors have seriously started to focus on it.

In recent decades, several new studies have been published – with focus on various time periods and various geographical markets – which, based on varying measurements of risk, verify that investors have not been rewarded for taking risks in the form of a higher long-term return. Several studies even demonstrate a flat or negative correlation between risk and return.

Chart 3 shows the performance of US low-risk equities measured by the historical volatility compared to high-risk equities. Investors earned an annual excess return of 4.38% compared to the risk-free interest rate over the period 1968 to 2008 by investing in the fifth of the equities with the lowest volatility. Investing in the highest volatility quintile would have earned the investors a negative excess return of 6.78%. Investors are punished for investing in the

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[4] "Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk" by William F. Sharpe, The Journal of Finance, Vol. 19, No. 3, September 1964.

[5] "The Capital Asset Pricing Model: Some Empirical Tests" by Fischer Black, Michael C. Jensen and Myron S. Scholes, Studies in the Theory of Capital Markets, 1972.

[6] "Risk, Return and Equilibrium: Empirical Tests" by Eugene F. Fama and James D. MacBeth, The Journal of Political Economy, Vol. 81, No. 3, May/June 1973.

[7] "Risk and the Rate of Return on Financial Assets: Some Old Wine in New Bottles" by Robert A. Haugen and A. James Hines, Journal of Financial and Quantitative Analysis, Vol. 10, No. 5, December 1975.

[8] An anomaly is a fact which is contrary to the predictions of the theory – a deviation or something unusual.

most risky equities over the period since the difference between the two quintiles is 11.16 percentage points. In addition, the risk measured by the standard deviation is rising over the five quintiles. This means that the risk-adjusted return measured by the Sharpe ratio is considerably higher for low-volatility (0.33) equities compared to high-volatility (-0.21) equities.

Chart 3: Risk premiums for US equities
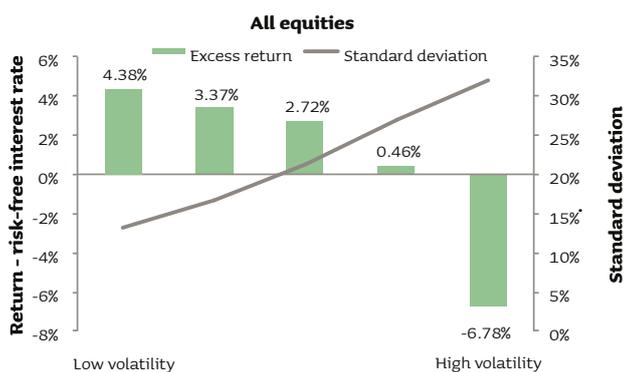
Note: Calculated as geometrical return based on historical volatility over the past 60 months and for equal-weighted volatility quintiles with monthly rebalancing. Based on data from the Centre for Research on Security Prices (CRSP) for the period January 1968 to December 2008.

Source: "Benchmarks as Limits to Arbitrage: Understanding the Low Volatility Anomaly" by Malcolm Baker, Brendan Bradley and Jeffrey Wurgler, Financial Analysts Journal, Vol. 67, No. 1, January/February 2011.

If the realised return for the quintiles is calculated as a simple average instead of a geometrical average, the difference between the two extreme quintiles declines to 6.88 percentage points (5.15% minus -1.73%) compared to 11.16 percentage points for the geometrical average. The difference illustrates that the compounding effect is especially important when comparing portfolios with highly different volatility characteristics. Other studies report similar results – for instance Van Vliet, Blitz & van der Grient (2011) concludes that the difference in return increases by approx. 3 percentage points – the correlation between risk and return become more negative – by taking into account the compounding effect when calculating the average return.

Also, it is remarkable that there is usually a non-liniar (concave) correlation between risk and average return. The average return does not decline consistently over the quintiles, and investors have particularly been punished for investing in the 20% most risky equities.

If only the 1,000 largest US equities are considered, the differences in return between equities with lowest and highest volatility are not quite as pronounced with a positive spread of 2.10 percentage points[9], cf. Chart 4. Therefore, there are indications that the negative correlation between risk and return is stronger for small caps. An assumption that is confirmed by Van Vliet, Blitz & van der Grient (2011)[10], who concludes that the inclusion of small caps can explain approx. 2 percentage points of the negative return spread between high-volatility and low-volatility equities.

Chart 4: Risk premiums for US equities

Note: Calculated as geometrical return based on historical volatility over the past 60 months and for equal-weighted volatility quintiles with monthly rebalancing. Based on data from the Centre for Research on Security Prices (CRSP) for the period January 1968 to December 2008.

Source: "Benchmarks as Limits to Arbitrage: Understanding the Low Volatility Anomaly" by Malcolm Baker, Brendan Bradley and Jeffrey Wurgler, Financial Analysts Journal, Vol. 67, No. 1, January/February 2011.

The difference in return between the two extreme quintiles of the two studies must primarily be attributed to a large difference in return for the highest-volatility quintile (-6.78% against 2.10%), cf.

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[9] *"The risk is also in the study of the 1,000 largest equities increasing over the quintiles, and the risk-adjusted return is therefore still considerably higher for low-volatility equities (Sharpe ratio of 0.39) relative to high-volatility equities (0.21).*

[10] *"Is the relation between Volatility and Expected Stock Returns Positive, Flat or Negative?" by Pim van Vliet, David Blitz and Bart van der Grient, Working Paper, July 2011.*

Charts 3 and 4. On the other hand, the returns of the lowest-volatility quintiles are practically identical (4.38% against 4.20%). The explanation is presumably that there are more companies in a distress-like situation in the high-volatility quintile among the small companies than among the large companies. Therefore, it can be expected that there are more observations among small companies whose equity has been fully or partly lost and hence more observations with very large negative returns. Observations with large negative returns will contribute to reducing the average return – especially in a situation where, as in the two above-mentioned studies, equal-weighted instead of capitalization-weighted quintiles are used.

The low-risk anomaly does not only exist in the US equity market but also in a number of other equity markets. Baker & Haugen (2012)[11] finds that low-volatility equities outperform high-volatility equities in all 21 developed and 12 emerging equity markets investigated for the period 1990 to 2011. They also conclude that the correlation between the volatility effect is relatively low across countries and regions. Therefore, there are considerable diversification effects by utilising the volatility effect in several markets at the same time. Appendix 1 offers an overview of other empirical studies within the low-risk area.

Empirical studies draw mixed conclusions as to the correlation between risk and return which can be explained by different methodological choices. Variation in relation to sample selection criteria (all or only large equities), risk measure (total volatility, residual volatility or beta), return frequencies (daily or monthly returns) and return measurements (simple or geometrical average) lead to different or even opposite conclusions.

In relation to the selection of equities in the study it is for instance of crucial importance whether only surviving equities are included[12]. It should be added that the risk-adjusted return measured by Sharpe ratio – irrespective of differences in methodological choices – is typically significantly higher for low-risk equities.

As opposed to the definition of the sample and the choice of return measurements, the choice of risk measure does not seem to be of crucial importance for the correlation between risk and return. Yet, Haugen & Baker (2008)[13] finds that the spread for extreme deciles is wider for variance of total return and residual risk than that for market beta[14]. Likewise, Blitz & van Vliet (2007)[15] finds that the alpha spread is narrower for the beta-sorted portfolios than for portfolios ranked according to volatility[16]. This indicates that the volatility effect is stronger than the beta effect.

It is worthy of note that the volatility of a share is included in the calculation of the share's beta, and therefore there will often be a certain correlation between the two risk measurements[17]. Therefore, low-volatility portfolios usually have a beta somewhat below 1.

Real anomaly – or the result of data-mining?

In recent years, we have seen dramatic growth in the proliferation of more or less exotic factors

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[11] ”Low Risk Stocks Outperform within All Observable Markets of the World” by Nardin L. Baker and Robert A. Haugen, Working Paper, 2012

[12] In ”Toward the Design of Better Equity Benchmarks: Rehabilitating the Tangency Portfolio from Modern Portfolio Theory” by Lionel Martellini, Journal of Portfolio Management, Vol. 34, No. 4, Summer 2008 the author finds for instance a positive correlation between risk and return in the form of a return spread of 8.5 percentage points between high-volatility and low-volatility equities for US equities during the period 1975-2004. The study is exclusively based on surviving companies and is hence suffering from so-called survivorship bias.

[13] Case Closed” by Robert A. Haugen and Nardin L. Baker, The Handbook of Portfolio Construction, November 2008.

[14] Measured by normalised z scores, variance of total return, residual risk and market beta has a spread of 1.06, 1.06 and 0.49, respectively, calculated as the difference between decile 1 and 10.

[15] ”The Volatility Effect: Lower Risk without Lower Return” by David C. Blitz and Pim van Vliet, Journal of Portfolio Management, Vol. 34, No. 1, Fall 2007.

[16] The alpha spread for beta-sorted portfolios is approx. 3-7 percentage points lower for each region compared to the alpha spread for portfolios sorted by volatility.

[17] A share's beta is calculated as the correlation between the return on the share and the market return multiplied by the ratio between the standard deviation (volatility) of the share and the standard deviation (volatility) of the market or as $=\rho\rho\_!$

which according to back-test results deliver impressive excess returns resulting in high Sharpe ratios. This does not necessarily mean that these strategies will generate excess returns in the future. If a very large number of back-tests are performed, we are bound to find factors generating impressive results – these so-called "data-mined"[18] factors will, however, not necessarily have any future premium.

The following factors underline that the low-risk anomaly is a real factor and not a result of data-mining and hence increase the likelihood that the anomaly will persist in the future[19]:

- The low-risk factor was discovered several decades ago in the beginning of the 1970s and has survived several database revisions and comprehensive so-called "out-of-sample" tests.

- The factor has been investigated, tested and debated in leading academic magazines through decades. Appendix 2 contains an over- view of some of the academic articles published within this subject.

- The low-risk factor does not only exist in the US but also in other regions and countries. Several studies have documented that the factor exists in a number of developed as well as emerging equity markets. Cf. Baker & Haugen's (2012)[20] results, showing that low-volatility equities operformed in 21 developed and 12 emerging equity markets in the period 1990-2011.

- The factor premium does not change dramatically as a result of minor variations in the factor definition/construction. The low-risk factor turned out to be robust regardless of the   definition of risk (volatility or beta) and changes to the period during which the risk is measured. Ang, Hodrick, Xing & Zhang (2009)[21] reaches the same conclusion – that there is a strong negative correlation between the expected return and historical volatility – with other volatility periods (volatility measured over 3, 6 and 12 months) than volatility measured over one month.

- The low-risk anomaly has a credible explanation, cf. the section on why risk is not rewarded. The factor is related partly to a number of systemic reasons partly a number of deep-rooted behavioural reasons which are present among many investors.

- The factor is typically highly significant in empirical studies with a t-value considerably above 2.0. Hence, there is room to adjust for data-mining and other biases and still obtain a significant t-value[22].

- Also, it is interesting that the low-risk anomaly can apparently not be explained by other factors/ anomalies such as value, momentum and size. This strengthens the argument that this is an independent anomaly. Blitz & van Vliet (2007)[23] finds for instance that the volatility effect is robust in relation to control of the value and size effects. Likewise, Baker, Bradley & Wurgler (2011)[24] show that the volatility effect does not only apply to the small-cap segment of

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[18] *Data-mining means search for patterns and structures in large data sets.*

[19] *Reference is made to "Finding Smart Beta in the Factor Zoo" by Jason Hsu and Vitali Kalesnik, Research Affiliates, July 2014,for a detailed review of the relevant characteristics for assessing a potential factor.*

[20] *"Low Risk Stocks Outperform within All Observable Markets of the World" by Nardin L. Baker and Robert A. Haugen, Working Paper, 2012*

[21] *"High Idiosyncratic Volatility and Low Returns: International and further U.S. Evidence" by Andrew Ang, Robert J. Hodrick, Yuhang Xing and Xiaoyan Zhang, Journal of Financial Economics, Vol. 91, No. 1, January 2009.*

[22] *Some recommend a t-value of at least 3.5 and preferably 4.0 instead of the traditional t-value of 2.0 – see for instance "Finding Smart Beta in the Factor Zoo" by Jason Hsu and Vitali Kalesnik, Research Affiliates, July 2014.*

[23] *"The Volatility Effect: Lower Risk without Lower Return" by David C. Blitz and Pim van Vliet, Journal of Portfolio Manament, Vol. 34, No. 1, Fall 2007.*

[24] *"Benchmarks as Limits to Arbitrage: Understanding the Low Volatility Anomaly" by Malcolm Baker, Brendan Bradley and Jeffrey Wurgler, Financial Analysts Journal, Vol. 67, No. 1, January/February 2011.*

the equity market but is also present among large-caps.

Lower drawdowns in times of crisis

A low-risk portfolio will typically not be able to generate a market return when equity markets are surging. On the other hand, a low-risk portfolio has the attractive attribute that investors obtain better protection of their capital in times of crisis compared to traditional capitalization-weighted equity indices. Over the past 16 years, a global low-volatility index measured by the MSCI World Minimum Volatility index has only outperformed a global equity index measured by MSCI World in 25% of the time corresponding to 28 of 112 months in rising markets. On the other hand in declining markets low-volatility equities have outperformed 84% of the time corresponding to 67 of 80 months.

This asymmetrical risk-return profile is attractive since investors have an asymmetrical utility function – the joy of a gain is usually experienced to be less than the pain of a similar loss. Chart 5 shows that low-risk equities measured by the volatility of the equities have outperformed the global equity market during practically all major crises over the

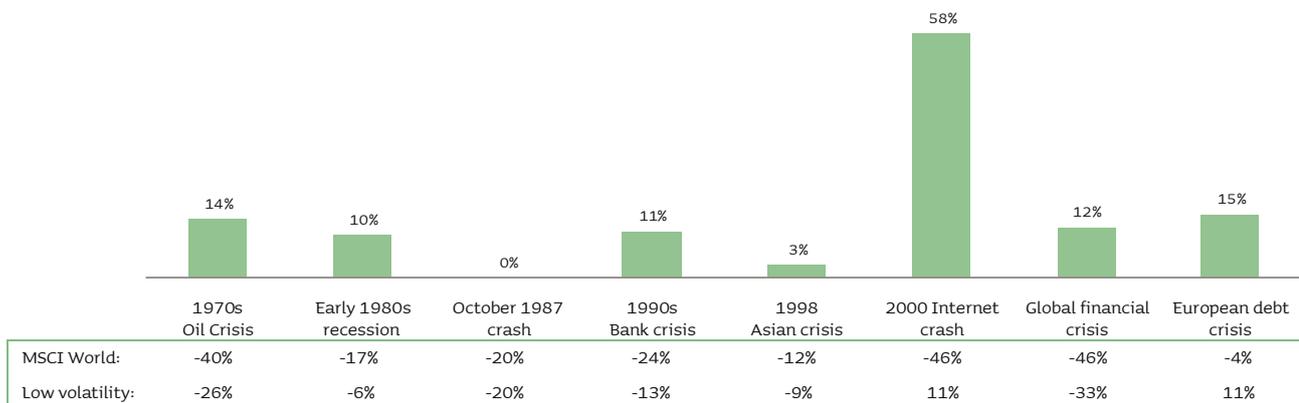past decades – from the oil crises in the 1970s to the global financial crisis in 2008.

Disadvantages of low-risk strategies

There are potential disadvantages of investing in low-risk equities. A low-risk equity portfolio has a high tracking error relative to the general equity market. The reason is that low-risk investing strategies are not as focused on a benchmark as more traditional active investing strategies which typically have risk constraints such as tracking error in relation to a specific benchmark. This means that the return on low-risk investing strategies may from time to time deviate considerably from the return on a traditional market portfolio. For instance low-volatility equities underperformed by more than 20 percentage points in 1999[25].

An investment in low-risk equities requires a long investment horizon and not least considerable patience since the excess return for low-risk strategies is primarily founded in periods with declining equity prices.

In addition, low-risk strategies are often linked with an increased concentration risk in individual securities, sectors and countries. For instance investment

Chart 5: Excess return for the 20% least volatile global equities in times of crisis

	1970s Oil Crisis	Early 1980s recession	October 1987 crash	1990s Bank crisis	1998 Asian crisis	2000 Internet crash	Global financial crisis	European debt crisis
Excess return	14%	10%	0%	11%	3%	58%	12%	15%
MSCI World:	-40%	-17%	-20%	-24%	-12%	-46%	-46%	-4%
Low volatility:	-26%	-6%	-20%	-13%	-9%	11%	-33%	11%

Note: The return is for a market-value-weighted MSCI World index, hedged in USD and for the lowest quintile based on two-year historical volatility. The figures may not sum due to rounding. The times of crisis are March 1973-September 1974, April 1981-July 1982, September 1987-November 1987, January 1990-September 1990, July 1998-September 1998, April 2000-September 2002, July 2008-February 2009 and May 2010-September 2011.

Source: MSCI and AllianceBernstein

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[25] *Measured by the difference in return between the MSCI World Minimum Volatility and the MSCI World indices calculated in USD.*

in low-volatility equities has historically been dominated by the two sectors consumer staples and utility. The lack of diversification has occasionally resulted in concern about the sensitivity of the investment strategy towards one-off events such as Deepwater Horizon's oil leak and the disaster at the Fukushima nuclear plant in Japan.
Critics have also stated that low-risk investing only deliver high returns due to the exposure to specific stable industries.

Critics have also stated that low-risk investing only deliver high returns due to the exposure to specific stable industries. In this context, it is interesting that Asness, Frazzini & Pedersen (2014)[26] conclude that low-risk investing is not only driven by low-risk industries. On the contrary, they find that low-risk investing works in almost all industries[27]. Hence, their results reject the popular view that low-risk investing is generally associated with investing in a few specific industries.

Finally, low-volatility strategies are based on the assumption that the volatility and correlations of equity prices are stable, which is not necessarily the case. This is in particular relevant for the so-called minimum variance strategies which by means of an optimizer attempt to minimise the total absolute risk of the portfolio.

Why is risk not rewarded?

Why is low-risk investing rewarded when this should not be the case according to theory? Why is it possible to generate a long-term excess return when the potential is clear to most people and well-documented in academic literature? Or in other words: why is it that risk-seeking investors do not eliminate the excess return through arbitrage?

Academic literature has many empirical evidence of the existence of a low-risk anomaly but there is no consensus about the reasons why the anomaly exists. A wide range of explanations have been suggested, which can roughly be divided into systemic and psychological/behavioural reasons. All explanations increase the demand for highrisk equities and result in a higher valuation, which suppresses the expected future return. The consequence is that investors overpay for highrisk equities.

Systematic reasons

The wide use of benchmarks among investors is often stated as an important reason why the anomaly is not eliminated through arbitrage. This is called the limits to arbitrage hypothesis. Benchmark-driven portfolio managers focus on risk and return compared to a benchmark, not absolute risk and return[28]. A share with low absolute risk may well be among the more risky equities with a high relative risk in relation to the benchmark and hence not so attractive to relative managers[29]. In other words, many portfolio managers are looking for good stories which can "beat" the market, not for boring equities with a high relative risk. In addition, portfolio managers have an incentive to tilt the portfolio towards high-risk equities since this is a simple way to outperform the benchmark in rising equity markets, assuming that CAPM holds firm. Finally, portfolio managers are usually paid a fixed salary and a bonus if the performance is sufficiently high. This provides a further incentive to invest in risky equities since it increases the expected value of the remuneration[30].

Various restrictions in relation to the use of leverage and short selling of equities are other reasons behind the existence of the anomaly. Many investors –

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[26] "Low-Risk Investing without Industry Bets" by Clifford S. Asness, Andrea Frazzini and Lasse H. Pedersen, Financial Analysts Journal, Vol. 70, No. 4, July/August 2014.

[27] The industry-neutral BAB (betting against beta) factor deli-ered positive returns in each of the 49 industries in the US for the period 1926-2012 and in 60 of 70 global industries for the period 1986-2012.

[28] In other words, benchmark-oriented investors focus on a maximisation of information ratio (excess return compared to benchmark divided by tracking error) instead of Sharpe ratio (excess return compared to a risk-free interest rate divided by the standard deviation).

[29] A low-risk share with positive alpha may increase the Sharpe ratio but at the same time actually reduce the Information ratio.

[30] The remuneration resembles a call option on the return of the portfolio whose value may be enhanced by creating a more volatile portfolio – the likelihood that an option comes into the money is increased as the volatility is increased.

pension funds, mutual funds etc. – are not allowed to or are not willing to use leverage. These investors therefore tend to favour high-risk equities to obtain the desired risk exposure whereas investors who can use leverage will attempt to benefit from leveraged positions in low-risk equities in order to take advantage of for instance the volatility effect. Likewise, limitations relating to short selling of equities may be a limitation in order to exploit the higher valuation of high-risk equities.

The participants in the financial markets, including analysts and portfolio managers, are generally attracted by equities with an interesting story and much media coverage. Analysts want to impress their clients in promoting their career opportunities and are therefore attracted by hot stocks, i.e. equities which typically involve higher risk than the average and the boring low-risk equities. The hypothesis is confirmed by the fact that institutional investors generally own more volatile equities and that the analyst and news coverage is considerably larger for these equities[31].

Psychological and behavioural reasons

Other reasons for the existence of the anomaly appear from the study of human psychology and behaviour. CAPM is a theoretical construction which does not take into account the illogical and irrational behaviour of human beings[32]. Behavioural models of security prices combine two factors. Firstly, market participants are irrational in a particular way. Secondly, there is a limit to arbitrage – an explanation for why "smart money" does not attempt to offset the price impact of any irrational demand.

Mental accounting means that many private investors divide their assets into two parts – the stable part designed to avoid poverty and the more speculative part to get a shot at riches. The speculative part includes lottery-like investments, i.e. equities with a small likelihood of a large gain combined with

a large likelihood of a small loss. In the CAPM world – with a linear correlation between risk and return – no people will ever buy a lottery ticket since the average expected return on the investment will be negative. But this is not the way it works in the real world. Investors go for the big win in the equity market although the expected return is negative, and likewise large amounts are spent on lotteries and roulette even though the expected return is negative. The maximum expected return for a young volatile technology company is much higher than for a stable utility company. Therefore, investors tend to overestimate the return and underestimate the risk involved in equities with a lottery-like profile. In other words, many investors are willing to pay more for risky equities in the same way as many people play the lottery even though they are fully aware that they have all odds against them. When equities with such a profile are bid up by investors, they become overvalued and subsequently underperform.

Attention bias reflects that investors tend to be attracted by so-called headline-grabbing equities or equities linked to exciting anecdotes, i.e. equities with comprehensive media coverage, high trading volume on the stock exchange and extreme short-term returns. Such equities are typically in the segment with high-risk equities whereas the boring low-risk equities have low attention among investors.

Psychological investigations have shown that the brain uses shortcuts to reduce the complexity of analysing information. The use of shortcuts makes it possible for the brain to organise and process large volumes of information very quickly. Such shortcuts can make it difficult for investors to analyse new information correctly and may lead to wrong conclusions. Representativeness means assessments based on stereotypes. Apple and Microsoft are examples of technology companies which have grown very successful and which have been good investments. Hence, investors may easily be prompted to conclude that the road to success is paved with speculative investments in new technologies.

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[31] Cf."Low Risk Stocks Outperform within All Observable Markets of the World" by Nardin L. Baker and Robert A. Haugen, Working Paper, 2012.

[32] Reference is made to "The Psychology of Investing" by John R. Nofsinger, Fifth Edition, 2013, for a detailed description of the way in which human psychology and behaviour affect investment decisions.

Therefore, investors are looking for the next Apple or Microsoft and forget that many technologies never obtain commercial success. The consequence is that investors overpay for high-risk equities.

Finally, overconfidence signals that human beings generally have an exaggerated belief in own skills. Even in areas where we have moderate knowledge and expertise, such as the financial markets. For investors with exaggerated belief in own skills it makes sense to be active in the segment of highrisk equities since this segment potentially leads to the largest reward of competence.

Conclusions

In several academic studies it has been documented that the correlation between risk and return is flatter than predicted by theory. Many studies even find a negative correlation between risk and return. In other words, it has in the past been possible to generate an excess return in the equity market by pursuing low-risk investing strategies. Especially the risk-adjusted return, illustrated by a high Sharpe ratio, has been very attractive compared with the general equity market since the strategies involve a lower risk than the general market.

The fact that the low-risk anomaly is based on a number of systemic and behavioural reasons strengthens our belief that it will persist in the future. The anomaly will not be eliminated until enough investors realise the error and adjust their investment behaviour. It must be mentioned that in recent years we have seen strong growth in the number of funds pursuing low-risk strategies and the capital allocated against these strategies. But as long as capitalization-weighted benchmarks continue to be the dominant form of performance contract between investors and asset managers, the anomaly will in all probability continue to exist.

Likewise, irrational behaviour based on the constraints or the structure in the investment industry will probably not disappear unless large industry-wide changes are implemented. For instance in the form of changes that eliminate the constraints in relation to the use of leverage and short selling of equities or changes to the way of structuring incentive contracts for portfolio-managers.

Appendix 1 – List of selected empirical studies

Asness, Frazzini & Pedersen (2014)	Low-risk investment (purchase of low-beta equities and short sell-ing of high-beta equities) is not only a bet on specific industries, but can be used to select equities within an industry and to select indus-tries.	US equities for the period 1926-2012 and global equities for the period 1986-2012
Li, Sullivan & Garcia-Feijoo (2014)	Value-weighted low-volatility portfolios outperform high-volatility portfolios. Alpha plunges when penny stocks (<USD 5) are excluded and disappear completely for equal-weighted portfolios.	US equities for the period 1963-2010
Baker & Haugen (2012)	Low-volatility equities outperform in all 21 developed equity mar-kets and all 12 emerging equity markets.	Equities from 21 developed and 12 emerging markets for the period 1990-2011
Baker, Bradley & Wurgler (2011)	Low-risk equities – measured by volatility or beta - have consistently outperformed high-risk equities.	US equities for the period 1968-2008
Haugen & Baker (2009)	The most risky equities – measured by beta, variance and residual vola-tility – have generally yielded the lowest returns.	US equities for the period 1963-2007
Ang, Hodrick, Xing & Zhang (2009)	Strong negative correlation between expected return and historical vola-tility also exists in other large developed markets outside the US (Can-ada, France, Germany, Italy, Japan and the UK).	Equities from 23 developed markets for the period 1980-2003
Blitz & van Vliet (2007)	Low-volatility equities have a higher risk-adjusted return – mea-sured by Sharpe ratio and CAPM alpha – than the market portfolio. The volatility effect applies globally and in the US, Europe and Japan.	Global, US, European and Japanese equities for the period 1985-2006
Clarke, de Silva & Thorley (2006)	The risk (standard deviation) can be reduced by a fourth for minimum variance portfolios compared to the capitalization-weighted market benchmark without compromising the return.	US equities for the period 1968-2005
Ang, Hodrick, Xing & Zhang (2006)	High-volatility equities have a significantly lower return than low-vol-atility equities. The effect cannot be explained by deviations in rela-tion to size, book-to-price, leverage and liquidity.	US equities for the period 1963-2000
Haugen & Baker (1996)	No correlation between beta and average return. Neither market nor APT-derived betas have significant t-values in a regression model.	US equities for the period 1979-1993
Fama & French (1992)	No obvious correlation between beta and average return. A regression analysis shows a flat correlation between beta and average return.	US equities for the period 1964-1979
Haugen & Baker (1991)	It is possible to design portfolios with the same or higher returns – but significantly lower volatility – than capitalization-weighted portfolios (for instance Wilshire 5000).	US equities for the period 1972-1989
Haugen & Heins (1975)	The results indicate that equity portfolios with lower variance in the monthly returns have obtained a higher average return than portfolios with higher variance.	US equities for the period 1926-1971
Fama & MacBeth (1973)	Positive correlation between beta and return, but the slope is flat-ter than expected (predicted by CAPM).	US equities for the period 1926-1968
Black, Jensen & Scholes (1972)	Positive correlation between beta and return, but the slope is flat-ter than expected. High-beta equities have a negative alpha whereas low-beta equities have a positive alpha.	US equities for the period 1926-1966

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