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The impact of global risk on the performance of socially responsible and conventional stock indices

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Abstract
Research background: In the last decades social responsible investment has evolved into an important and influential investment class. What supports then the development of SRI? The neoclassical approach suggests that the attractiveness of investment should result from the risk-return relationship that is satisfying for the investor. However, the performance analysis of SRI vs. conventional investment, conducted in numerous research papers, often delivers contradictory conclusions. If financial factors could not explain the phenomenon of SRI, nonfinancial factors may have played a decisive role in the formation of modern SRI market.
Purpose of the article: The purpose of this paper is to analyze financial investment performance of socially responsible vs. respective conventional indices in the periods of high, low and unidentified global risk. Therefore, a following research hypothesis was verified: SR indices perform financially better in high-risk periods than in low-risk periods. This hypothesis is justified by the assumption that, when selecting SRI, investors go by a longer investment horizon than they do when selecting other investments, not subject to such verification.
Methods: Among SR indices, we chose three to compare them with their conventional counterparts: DJSI US vs. DJITR (USA), DJSI Korea vs. KOSPI (South Korea) and Respect

Index vs. WIG20TR (Poland). The VIX index was used as the global measure of risk aversion. To measure the relative performance of SR and conventional indices in different risk periods, we applied risk-adjusted performance measures, including RSD, Sharpe and Treynor ratios, traditional and asymmetrical CAPM.
Findings & Value added: The research shows that conventional and socially responsible indices do not differ statistically in terms of risk and return irrespective of global risk. Our research confirms that the rising, socially responsible, investment market cannot be analyzed only through the prism of simplified rational choices. Additionally, it should be analyzed in terms of moral philosophy and behavioral economics, including the psycho-social features of investors.

Introduction

The traditional approach to investment (Markowitz, 1959) assumes that investors adhere to risk and return analysis while making investment choices. Nonetheless, is investor's satisfaction dependent only on a prize, optimal for an investor, in the form of acceptable rate of return per given risk level? What makes the investment (A) more attractive than the alternative investment (B) is? The neoclassical approach suggests that the attractiveness of investment should result from the risk-return relationship that is satisfying for the investor. However, von Neumann and Morgenstern (1947) showed that rational choice of investment involves their mutual comparison and takes into account calculating for each of them (or for an investment portfolio) an expected satisfaction (utility) level that is specific for the given investor. In turn, in the Encyclical letter Centessimus Annus, John Paul II (1991) indicated: "the decision to invest in one place rather than another, in one productive sector rather than another, is always a moral and cultural choice". The moral approach may have resulted in the development of socially responsible investment (SRI) industry — development that is phenomenal in the world of finance[1]. SRI development is influenced by a growing investors' awareness about the impact of companies, developing in the capital market, on life quality (climate, military, etc.). The influence of religion on financial decisions of investors has also a significant meaning. Individual stock exchange authorities have already noticed the need for the investment analysis that takes into account the approach of securities' issuers to social responsibility. It resulted materially in the creation of socially responsible indices (SR indices). In this paper, we chose to analyze

[1] With $6.57 trillion assets under management in the United States and $21.4 trillion worldwide as of the beginning of 2014, SRI has evolved into an important and influential investment class (Global Sustainable Investment Review, 2014).

three among them, namely, DJSI US, DJSI Korea and Polish Respect Index.

The purpose of this paper is to analyze financial investment performance of socially responsible vs. respective conventional indices in the periods of high, low and unidentified global risk. The Authors of this paper, in the past, conducted a comparative, performance analysis of these indices, in the specific, yearly periods, but not including global risk factor (Śliwiński & Łobza, 2017). Hence, it follows that the financial outperformance of socially responsible over conventional indices cannot be stated. Therefore, in this paper, a following research hypothesis was verified: SR indices perform financially better in high-risk periods (often accompanied by declines in share prices and bear market periods) than in low-risk periods (what often is a basis for share price increases). This hypothesis is justified by the assumption that, when selecting SRI, investors go by a longer investment horizon than they do when selecting other investments, not subject to such verification. This longer investment horizon of SRI investors results from the nature of such investments. Namely, SRI decision is based on an investment process that involves the analysis of non-financial aspects. In turn, other kinds of investments implicate often speculation that is a risky, short-term quest for gain.

Performance differences between socially responsible and conventional investments

The SRI theory has been especially enriched in the last 20 years. Numerous researchers have analyzed funds, indices and strategies that followed the SRI approach. Markowitz and Moskowitz debated in 1980's on the theoretical classification of SRI (Van Liedekerke *et al*., 2007). Markowitz abided by CAPM-style of thinking, claiming the general underperformance of SRI. The cause of this underperformance, according to him, is a decrease of an investment universe that results from accepting social responsibility criteria. In accordance with CAPM, the limitation of diversification possibilities leads to the weakened mean-variance profile of optimal portfolio in comparison to that of original optimal, that is market, portfolio. Moskowitz, in turn, concluded on general outperformance of SRI over traditional investment. He rejected the neoclassical assumption of general market efficiency. He followed that SRI selection process involves information that is not included in market prices due to the short focus of financial markets. The underpinning of his thinking was that CSR is the indicator of managerial competences and, thus, it gains full economic significance. Hence, Mos-

kowitz claimed positive relationship between corporate social performance and corporate financial performance. Śliwiński and Łobza (2017) added a following observation to this discussion. Even though the neoclassical theory is clear that SRI should not perform financially better than market portfolio due to the additional investment criterion, we must remember that Markowitz's mean-variance optimized market portfolio is a theoretical concept. We know that market portfolio that optimizes risk-return trade-off exists, but it cannot be objectively indicated in reality, using current technology. That is why, in many cases, a market index is treated as an approximation of market portfolio. We must remember that Markowitz's mean-variance optimized market portfolio is not the same as the market index. Market indices like DJIA index contain usually the largest and the most influential companies in a given market, but are not based on optimization criteria. In turn, market portfolio in CAPM represents a theoretical bundle of investments that includes all kinds of investments, available in the market (weighted in proportion to its total value). Market portfolio is often estimated by the main market index. However, it is not true that this index represents the optimal portfolio, which is situated on the efficient frontier. The selection criteria for the optimal portfolio are based on optimal behavior of investors. In contrast, the market indices are formed by decisions of stock exchange authorities.

Generally, research delivers contradictory evidence for the financial performance of SRI in a comparison with conventional investment. After the careful review of dozens of papers and based on our own research that compared the financial performance of SR indices versus conventional ones (Śliwiński & Łobza, 2017), we found that, in terms of the financial performance, SRI is generally not different from conventional investment.

Also, one branch of literature states that the difference between SRI and conventional investment performance can exist especially during financial turmoil. Nofsinger and Varma (2014) have found that socially responsible mutual funds outperform conventional mutual funds during market crises and underperform in other market periods. They attribute the diverse performance patterns of both mutual fund types to social responsibility factors, and not to fund management differences or the characteristics of companies in portfolios. Simply, the nature of SRI limits the downside risk. The focus on ESG issues improves the risk management. Socially responsible companies and thus, indirectly, investors, suffer less, for example, from disastrous pollution events and enjoy better relations with their stakeholders. This positive effect in SRI performance, though generally permanent, is especially pronounced in bad economic times because investors tend to notice negative corporate behavior more in such market situation than in the posi-

tive economic periods (cf. Hirshleifer's (2008) legal psychological attraction theory and Shefrin and Statman's (1993) liberalism/paternalism pendulum). Similarly, Oikonomou *et al.* (2012) found that socially responsible corporate activity is weakly negatively related to market risk while the socially irresponsible corporate activity is strongly positively related to market risk. Moreover, two authors refer to Prospect Theory, explaining that, under its framework, investors are likely to choose portfolios with an asymmetric or a skewed performance. This is because the increase in utility for the outperformance in dropping markets is greater than a fall in utility for the underperformance in rising markets. Becchetti *et al.* (2015) also confirm the positive impact of the socially responsible behavior on the downside risk of investment, specifically during the 2007 global financial crisis.

In contrast to the claim of the downside risk protection of SRI, Weber, *et al.* (2010) found that SRI fund portfolio outperformed its conventional counterpart in both bull and bear market phases, but that mean outperformance was substantially higher in the bull, not the bear, phase of the market.

Empirical methodology and the data set

VIX and global market risk

The global risk aversion can be proxied by VIX (Ananchotikul & Zhang, 2014). It is calculated on the basis of variation, contained in the prices of at-the-money S&P 100 Index option prices, and has been published by the Chicago Board Options Exchange (CBOE) since 1993. The CBOE Volatility Index has become the premier benchmark for U.S. stock market volatility. In 2003, CBOE together with Goldman Sachs, updated the VIX methodology which reflects the measure of expected volatility. The new VIX is based on the S&P 500 Index, the core index for U.S. equities, and estimates expected volatility by averaging the weighted prices of SPX puts and calls over a wide range of strike prices. Since then, it has been widely used by financial theorists, risk managers and volatility traders (more: CBOE, 2014). In the periods of calm in the stock market, values of the VIX index are relatively low. When prices are subject to significant fluctuations, market volatility (and thus VIX) increases. Observations of the behavior of the VIX index show that high values of VIX are more correlated with sometimes rapid price declines than low ones are. This is due to the fact that the price increases (which are not the results of market bubbles) are built, in

most cases, in a more stable way, in response to the improvement of fundamentals, and a safe economic and political (both domestic and foreign) environment. The growing trends are interrupted usually by sharp stock-market declines, correlated with high values of VIX.

A global risk measure, in the period from January 1, 1999, to December 31, 2015, defined by the VIX Index, is shown in figure 1. From the beginning of the period till 2002, variable reaches its highest value in September 2002. The years 2003–2007 cover the relatively long episode of a reduced risk. Since October 2007, the VIX's rise had indicated the beginning of the global financial crisis. It was followed by the alternating period of rises and falls, depending on the global economic risk (e.g., EU debt crisis which intensified in early 2010). In the years from 2012 to 2015, VIX indicated the period of the relative calm in the stock market, since the value of the VIX index was relatively low. The average value of the index over these years was generally below 20 points. The renewed problems with the Greek debt crisis, together with the slowdown in the Chinese economy, increased uncertainty in the global financial market. It is evident in the growth of the VIX index.

Based on raw data, the 250 days (appr. 1 year) and the 750 days (appr. three years) moving averages were calculated to smooth out the data by creating a constantly updated average VIX indication. Next, the moving average (MA) strategy, based on so called crossovers. was adopted. It is commonly used in the technical analysis of financial trends. First, the up and down periods were identified for long and short averages to get a basic idea in which way the price is moving. Second, the two MAs were applied to a chart. When the short-term MA runs over the long-term MA, it indicates that a trend is shifting up and that we enter a high-risk period. When the short-term MA runs under the long-term MA, it indicates that the trend is shifting down and the markets are less volatile. To eliminate the problems of unstable MAs (long-term and short-term MAs may swing back and forth, generating multiple signals), in the periods, when long-term and short-term MAs behave differently (one is moving up whereas the other one is moving down), an additional condition was introduced. It requires that both MAs move in the same direction, in the high- and low-risk periods. Thus, when the short-term MA runs over the long-term MA and both MAs are rising, it indicates the high-risk period. When the shorter MA runs under the long-term MA and both MAs are falling, it indicates that the markets are less volatile (the low-risk period). Periods of high, low and unidentified global risk, measured by VIX, were gathered in the table 1.

Relative financial performance measures of SR indices and the data set

In this paper, we focus on indices to avoid a fund management bias and a fund fees bias. We compare three SR indices from different geographical regions, namely the USA, South Korea and Poland, to their conventional counterparts. American and Polish indices are total return ones, while Korean indices are price return indices. The total return indices are generally better measures of stock return, since they take into account cash distributions and treat them as automatically reinvested in given stock than price return ones. In the case of South Korea, we chose price index because TR indices were introduced there only in early 2016. Among publicly available SR indices, we chose DJSI US TR, DJSI Korea PR and Respect Index (Poland). Their respective conventional counterparts are DJITR, KOSPI and WIG20TR[2]. The time frames of our analysis are limited from the downside by the beginning of the existence of specific SR indices, and they are following: from January 1, 1999, to December 31, 2015 (for American indices), from January 3, 2006, to December 31, 2015 (for Korean indices) and from November 20, 2009, to December 31, 2015 (for Polish indices). The size of American, Korean and Polish samples is 4273, 2404 and 1484, respectively.

In our analysis, we first apply five basic measures to capture different patterns of the SRI performance relative to the conventional investment performance, in times of low, unidentified and high market risk, respectively. These are mean, standard deviation, relative standard deviation, and Sharpe and Treynor ratios. We use the same formulas for them that we used in our previous paper (Śliwiński & Łobza, 2017). Then, we do a regression analysis, enhanced by the statistical tests for a robustness check. For that purpose, we use MS excel add-in program called Analysis ToolPak.

Some authors used asymmetric or conditional market models to capture the dynamics of performance (see, for example, Bauer *et al.*, 2006, Rocchia & Bechet, 2011 or Barwick-Barrett, 2015). We follow this approach, using asymmetric capital asset pricing model, in the second part of our analysis.

Calculation of the daily mean, the standard deviation and the relative standard deviation makes up a simple portfolio analysis that takes into account both risk and return. Thus, we can see and compare specific risk-return patterns for these indices in the observed global risk periods.

Both Sharpe and Treynor ratio captures premium over risk-free rate relative to index risk. In the first measure, this premium is related to stand-

[2] The idea and composition of social responsible indices (DJSI US, DJSI Korea and Respect Index) and conventional ones (Dow Jones Industrial Average, KOSPI and WIG20TR respectively) were described in Śliwiński and Łobza (2017).

ard deviation and, in the latter case, to beta. In our analysis, beta is measured against global market to ensure comparability of indices from different markets.

In basic regression analysis, we use CAPM with Jensen's (1968) alpha.

$$R_{p,t} - R_{f,t} = \alpha + \beta \times \left(R_{m,t} - R_{f,t}\right) + \varepsilon_{p,t} \tag{1}$$

where:
$R_{p,t}$ – portfolio rate of return in the *t* period,
$R_{f,t}$ – risk-free rate of return in the *t* period,
$R_{m,t}$ – market rate of return in the *t* period,
β – beta,
α – Jensen's alpha,
$\varepsilon_{p,t}$ – error term.

We extended this model, similarly, to Barwick-Barrett's (2015) approach, so that it could be applied to an asymmetrical analysis within the global risk framework. Below, we present the extended asymmetrical model.

$$\begin{gathered} R_{p,t} - \left[R_{f,t} + \beta^{+} \times \left(R_{m,t} - R_{f,t}\right) \times D_{ci,t}^{+} + \beta^{0} \times \right. \\ \left. \left(R_{m,t} - R_{f,t}\right) \times D_{ci,t}^{0} + \beta^{-} \times \left(R_{m,t} - R_{f,t}\right) \times D_{ci,t}^{-}\right] \\ = \alpha^{+} \times D_{ci}^{+} + \alpha^{0} \times D_{ci}^{0} + \alpha^{-} \times D_{ci}^{-} + \varepsilon_{p,t} \end{gathered} \tag{2}$$

where:
D_{ci}^{+}, D_{ci}^{0}, D_{ci}^{-} – risk indicators based on VIX; D_{ci}^{+} is equal to 1 if the global risk is high in the t period or 0 otherwise; D_{ci}^{0} is equal to 1 if the global risk is unidentified in the t period or 0 otherwise; D_{ci}^{-} is equal to 1 if the global risk is low in the t period or 0 otherwise,
β^{+} – beta only if D_{ci}^{+} is equal to 1 and both D_{ci}^{0} and D_{ci}^{-} are equal to 0,
β^{0} – beta only if D_{ci}^{0} is equal to 1 and both D_{ci}^{+} and D_{ci}^{-} are equal to 0,
β^{-}– beta only if D_{ci}^{-} is equal to 1 and both D_{ci}^{0} and D_{ci}^{+} are equal to 0,
α^{+}– Jensen's alpha only if D_{ci}^{+} is equal to 1 and both D_{ci}^{0} and D_{ci}^{-} are equal to 0,
α^{0}– Jensen's alpha only if D_{ci}^{0} is equal to 1 and both D_{ci}^{+} and D_{ci}^{-} are equal to 0,
α^{-}– Jensen's alpha only if D_{ci}^{-} is equal to 1 and both D_{ci}^{0} and D_{ci}^{+} are equal to 0.

Data sets for indices come from DJSI website (DJSI US and DJSI Korea), Bloomberg (DJITR and KOSPI) and stooq.pl (WIG20TR and Respect Index). We used Poland one-year bond rate as risk-free rate for this country (sourced from Bloomberg). For the USA, we took the one-month Treasury

bill rate from Kenneth R. French Data Library. In turn, South Korea 1-Year Bond Yield from investing.com serves as risk-free rate for South Korea. VIX data set comes from the Chicago Board Options Exchange website.

Results

Performance measures

In the table 2, we present performance measures of US, Korean and Polish indices, respectively, for the whole periods. For each country, the values representing better neoclassical, risk-and-return parameters (higher gain, lower risk), in the comparative analysis of SR and conventional index, were lightly shaded. The equal values were strongly shaded.

In the comparative risk-and-return performance analysis of DJSI US and DJITR, we can notice that DJITR generally dominates (higher gain and/or lower risk) over DJSI US. RSD for DJSI US in high-risk periods is generally lower, but it is the result purely of negative returns for both indices in these periods. DJITR outperforms DJSI US especially in the period characterized by unidentified risk. DJSI US doesn't perform relatively better in the period of high-risk period than in low-risk period. Measured by mean daily rates (and their standard deviations), DJITR outperforms DJSI US more in high-risk than it does in low-risk periods. Both Sharpe and Treynor ratios confirm better investment results for DJITR.

By applying the same approach to South Korea, we have found that in terms of price, not total return, KOSPI slightly outperforms DJSI Korea in general, in both asymmetrical and conventional CAPM-style analysis. There are three exceptions, however. First, Treynor ratio is the same for both indices for the full sample in the asymmetrical analysis. Still, if we include more digits after a decimal point, this measure for conventional index is also higher than that for SR index. Second, DJSI Korea performs better in terms of financial return and risk-adjusted return (RSD, Sharpe and Treynor ratios) than its conventional counterpart for the whole high-risk period. However, risk itself is higher for the first index than that for the latter index in the whole high-risk period. Third, the same pattern holds true for the whole low-risk period.

In case of similar analysis of Respect Index, we found that Respect Index generally dominates over WIG20TR with the exception of the whole low-risk period[3]. RSD for WIG20TR in the unidentified-risk periods is

[3] In case of Respect Index and WIG20TR, high-risk periods were not identified for this

generally lower than that for Respect Index, but, in this period, it is the result only of negative return for this index. Also, in the whole low-risk period, despite relatively higher risk, measured by standard deviation, it is especially visible that SR index delivers higher mean daily rate than its conventional counterpart of 0,03%. Nonetheless, both RSD, Sharpe and Treynor ratios indicate that efficiency of an investment in Respect Index is higher than an investment in corresponding WIG20TR market index.

One-factor regression

In the table 3, one-factor regression results are displayed for US, Korean and Polish indices, respectively. The value shading follows the same pattern as in the table 2. Additionally, the fonts were made bolder to highlight whether standard CAPM or asymmetrical model better fits the data (adjusted R^2) or which type of these two models exhibits relatively lower standard error. T stat signalizes at what confidence level value is statistically significant.

In general, standard CAPM better fits this dataset, but it is more erroneous in comparison to the asymmetrical one (with the exception of Respect Index where both models exhibit the same standard error).

Results in the table 3 show that, first, in general, DJITR had lower global market beta than DJSI US did. The conventional index also outperformed the SR index in terms of excess return, measured by alpha, in all risk categories and for both models. Second, by following the same methodology for Korea, we have achieved mixed results. In asymmetrical analysis, beta is equal for both indices for the whole period and for the whole low-risk period. In the whole high-risk period, beta is higher for KOSPI than that for DJSI Korea. The opposite situation holds true for the whole unidentified-risk period. Although KOSPI generally outperformed DJSI Korea, in terms of alpha, the latter achieved better excess return in both high- and low-risk period than the first one. Third, Respect Index had generally lower global market beta than WIG20TR and dominated the latter in terms of alpha. Results for individual periods, presented in the appendix, confirm outperformance of DJITR over DJSI US and of Respect Index over WIG20TR.

timeframe as the first composition of this index at WSE was on November 19, 2009.

Conclusions

We applied two-step statistical research to comparative performance analysis of socially responsible vs. conventional indices from three countries, including global risk factor, measured by VIX, and global market benchmark.

The statistical analysis showed that in the case of DJSI US, its performance is not higher than that of its corresponding conventional index, both in the periods of low, unidentified, and high risk. However, there was an inverse relationship in the similar, comparative analysis of Polish indices. The SR index behaved better (in terms of the risk and return parameters) than its corresponding conventional index did. In turn, in the case of Korean indices, we received mixed results.

Based on the results of our research and literature review, we can conclude that SR indices do not deliver systematically better results than the respective conventional indices (in terms of risk and return, neoclassically understood) both irrespective of global risk and in the high-risk periods. Hence, we cannot confirm the hypothesis that the outcomes of investment in SR indices improve relatively in the periods of high risk. However, we cannot also state that investing in SR indices hurts financial returns or increases investment risk in the periods of reduced or increased risk. In general, there is no supremacy (or inferiority) of SR indices, in terms of neoclassical return and risk, over conventional ones. Summing up, the research shows that conventional and socially responsible indices do not differ statistically in terms of risk and return. We assume that the same holds true for SR investment vehicles in general. It does not mean, however, that specific types of SRI like best-in-class or material sustainable investing could not outperform conventional investment.

Our observations confirm that the rising, socially responsible, investment market cannot be analyzed only through the prism of utility theory and simplified rational choices, based solely on financial risk and return, which neoclassical economics assumes. Additionally, it should be analyzed in terms of moral philosophy and behavioral economics, including the psycho-social features of investors. To sum up, we should go beyond the limiting assumptions of the neoclassical theory to be able to fully understand the phenomenon of the rising SRI market.

Management of resources by a human being cannot be reduced only to an accomplishment of selfish utility, as it is the concept of *homo economicus*, but it refers to social roles' fulfillment, as the concept of *homo sociologicus* suggests (Dahrendorf, 1959). In economics, the so-called behavioral school attempted to reform the concept of *homo economicus*. It differs

from the classical approach generally in such a way that a person is no longer perceived as rational in the neoclassical sense, for her or his efforts to maximize consumption are limited by heuristics, cognitive errors and group behavior that he or she is subject to. One of the basic principles of behavioral finance is the assumption about human irrationality (as opposed to rationality, neoclassically understood) in the context of decision-making and judgment under risk and uncertainty. In the context of SRIs, mentioned irrationality lies in their selection, even though often they do not give better results in terms of profit to risk optimization. Therefore, not only rate of return and associated risk, but also other factors, whic cannot be simply described with mathematical formulas, constitute investment decision-making criteria.

What supports then the development of SRI? In the 13th century, Thomas Aquinas (1947) wrote that the rule for moral goodness is the right reason. If we assume that most of people want to do good, it is easy to explain this phenomenon. People choose SRI as a form of investment because it promises them some greater good (that cannot be measured only by the rate of return and risk) than a conventional investment does. The development of SRI stems from the fact that, along with the development of capital markets, a need to refer ethics also do this business area has appeared. The words of Pope Benedict XVI, who wrote that the economy needs people-centered ethics to function correctly, can be recalled here (Benedict XVI, 2009, p. 45).

The findings of this study disclose important information and policy implications not only for academia, but also for individual and institutional investors, and regulatory authorities. Future research could include more indices from different markets and apply multi-factor analysis in such a multi-country context. Other opportunities refer to philosophical and socio-psychological aspects of SRI.

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Annex

Table 1. Periods of high, low and unidentified global risk measured by VIX

No.	period	risk (VIX)	sample* (days)
1	01.01.1999 - 26.07.1999	H1: high	141
2	27.07.1999 - 10.06.2002	U1: unidentified	721
3	11.06.2002 - 22.05.2003	H2: high	240
4	23.05.2003 - 18.09.2003	U2: unidentified	82
5	19.09.2003 - 16.05.2006	L1: low	669
6	17.05.2006 - 13.08.2007	U3: unidentified	312
7	14.08.2007 - 08.09.2009	H3: high	522
8	09.09.2009 - 11.10.2010	U4: unidentified	275
9	12.10.2010 - 27.07.2011	L2: low	200
10	28.07.2011 - 11.09.2012	U5: unidentified	284
11	12.09.2012 - 08.10.2014	L3:low	521
12	09.10.2014 - 31.12.2015	U6: unidentified	306
1,3,7	**whole high-risk period**	**H: high**	**903**
5,9,11	**whole low-risk period**	**L: low**	**1390**
2,4,6,8, 10,12	**whole unidentified period**	**U: unidentified**	**1980**
1-12	**whole period**		**4273**

* This is sample size for DJSI US and DJITR. Sample sizes for Polish and Korean indices are different and do not extend to all periods.

Table 2. Standard performance measures for US, Korean and Polish indices

USA (DJSI U.S.. TR. USD)					
period(s) or calculation type	**mean daily rate**	**SD**	**RSD**	**Sharpe**	**Treynor**
whole high-risk	-0.008%	1.888%	226.04	-0.0054	-0.0002
whole low-risk	0.048%	0.686%	14.37	0.0630	0.0005
whole unidentified-risk	0.025%	1.182%	48.02	0.0196	0.0002
full sample (asymmetrical CAPM-style)	0.025%	1.170%	46.47	0.0284	0.0002
full sample (CAPM-style)	0.025%	1.264%	50.20	0.0140	0.0002

Table 2. Continued

USA (DJITR. TR. USD)					
whole high-risk	-0.004%	1.771%	396.66	0.0013	-0.0001
whole low-risk	0.049%	0.670%	13.65	0.0663	0.0005
whole unidentified-risk	0.035%	1.076%	30.86	0.0288	0.0003
full sample (asymmetrical CAPM-style)	0.031%	1.091%	34.97	0.0352	0.0003
full sample (CAPM-style)	0.031%	1.178%	37.76	0.0201	0.0002
Korea (DJSI Korea. PR. KRW)					
whole high-risk	0.020%	2.192%	108.82	0.0037	0.0001
whole low-risk	0.030%	0.899%	29.69	0.0195	0.0004
whole unidentified-risk	0.017%	1.208%	69.68	0.0101	0.00004
full sample (asymmetrical CAPM-style)	0.022%	1.313%	59.44	0.0118	0.0002
full sample (CAPM-style)	0.021%	1.385%	64.93	0.0089	0.0002
Korea (KOSPI. PR. KRW)					
whole high-risk	-0.003%	2.175%	772.74	-0.0069	-0.0003
whole low-risk	0.024%	0.856%	35.29	0.0160	0.0003
whole unidentified-risk	0.035%	1.207%	34.20	0.0263	0.0004
full sample (asymmetrical CAPM-style)	0.024%	1.295%	54.34	0.0161	0.0002
full sample (CAPM-style)	0.023%	1.346%	58.53	0.0104	0.0003
Poland (RESPECT Index. TR. PLN)					
whole high-risk	-	-	-	-	-
whole low-risk	0.062%	1.085%	17.54	0.0473	0.0007
whole unidentified-risk	0.001%	1.256%	1835.90	-0.0103	-0.0001
full sample (asymmetrical CAPM-style)	0.029%	1.176%	40.10	0.0167	0.0003
full sample (CAPM-style)	0.028%	1.167%	40.99	0.0171	0.0003
Poland (WIG20 TR. TR. PLN)					
whole high-risk	-	-	-	-	-
whole low-risk	0.032%	1.001%	30.85	0.0234	0.0003
whole unidentified-risk	-0.008%	1.337%	158.51	-0.0185	-0.0002
full sample (asymmetrical CAPM-style)	0.011%	1.180%	110.17	0.0011	0.0000
full sample (CAPM-style)	0.010%	1.189%	114.19	0.0016	0.0000

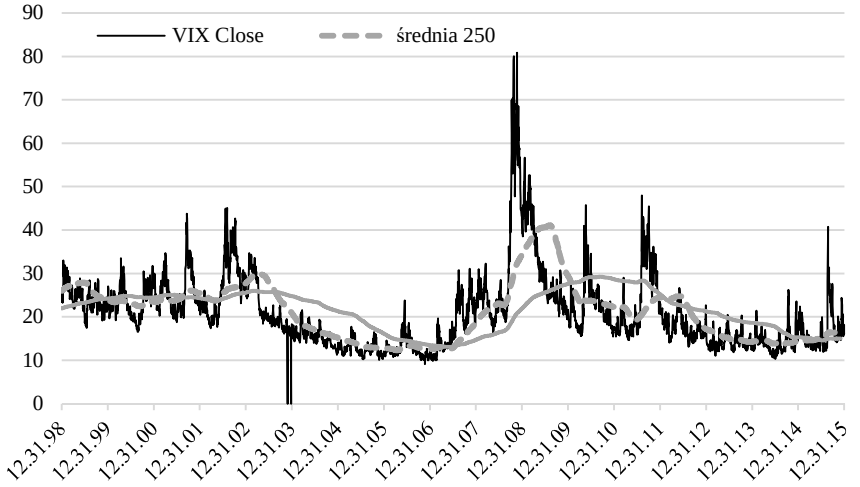
Table 3. One-factor regression results for US, Korean and Polish indices

period(s) or calculation type	beta vs. global market	T Stat (beta)	alpha	T Stat (alpha)	adjusted R^2	standard error
USA (DJSI U.S.. TR. USD)						
whole high-risk	1.19	32.73	0.007%	0.19	73.91%	0.96%
whole low-risk	0.91	32.14	-0.010%	1.32	65.51%	0.40%
whole unidentified-risk	1.08	34.95	0.011%	0.48	72.39%	0.60%
full sample (asymmetrical CAPM-style)	1.05	33.57	0.004%	0.69	70.47%	**0.61%**
full sample (CAPM-style)	1.07	103.36	-0.001%	0.09	**71.43%**	0.68%
USA (DJITR. TR. USD)						
whole high-risk	1.08	31.87	0.013%	0.24	72.80%	0.91%
whole low-risk	0.88	30.98	-0.007%	1.02	64.32%	0.40%
whole unidentified-risk	0.95	31.09	0.020%	0.76	67.90%	0.59%
full sample (asymmetrical CAPM-style)	0.95	31.22	0.010%	0.73	67.77%	**0.60%**
full sample (CAPM-style)	0.98	99.69	0.007%	0.66	**69.93%**	0.65%
Korea (DJSI Korea. PR. KRW)						
whole high-risk	0.55	10.76	0.029%	0.32	18.72%	1.98%
whole low-risk	0.49	6.43	-0.008%	0.66	11.72%	0.84%
whole unidentified-risk	0.50	6.88	-0.006%	0.55	14.15%	1.12%
full sample (asymmetrical CAPM-style)	0.51	7.54	0.001%	0.54	14.32%	**1.21%**
full sample (CAPM-style)	0.51	21.34	0.001%	0.05	**15.91%**	1.29%
Korea (KOSPI. PR. KRW)						
whole high-risk	0.58	11.38	0.006%	0.07	20.51%	1.94%
whole low-risk	0.49	6.87	-0.014%	0.62	12.98%	0.79%
whole unidentified-risk	0.49	7.07	0.012%	0.51	14.83%	1.06%
full sample (asymmetrical CAPM-style)	0.51	7.90	0.003%	0.45	15.41%	**1.16%**
full sample (CAPM-style)	0.52	22.34	0.003%	0.11	**17.17%**	1.25%

Table 3. Continued

period(s) or calculation type	beta vs. global market	T Stat (beta)	alpha	T Stat (alpha)	adjusted R^2	standard error
Poland (RESPECT Index. TR. PLN)						
whole high-risk	-	-	-	-	-	-
whole low-risk	0.69	2.54	0.019%	0.29	18.08%	0.98%
whole unidentified-risk	0.76	13.24	-0.014%	0.82	39.58%	0.97%
full sample (asymmetrical CAPM-style)	0.73	8.23	0.001%	0.57	29.51%	0.97%
full sample (CAPM-style)	0.75	26.83	0.000%	0.01	**32.64%**	0.97%
Poland (WIG20 TR. TR. PLN)						
whole high-risk	-	-	-	-	-	-
whole low-risk	0.70	10.09	-0.010%	0.22	21.13%	0.89%
whole unidentified-risk	0.81	13.54	-0.024%	0.81	40.41%	1.01%
full sample (asymmetrical CAPM-style)	0.76	11.92	-0.017%	0.53	31.38%	**0.96%**
full sample (CAPM-style)	0.80	28.78	-0.020%	0.79	**35.80%**	0.97%

Figure 1. The VIX index in the period of 1991–2015



Source: VIX data: CBOE (www.cboe.com), 250 and 750 days moving averages: own calculation.