Does it pay to be good? An analysis of vice and virtue stock performance in the Eurozone

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ABSTRACT

This paper provides a performance analysis of vice and virtue stocks in the Eurozone for the period between January 2005 and December 2014. In order to do so, a vice index consisting of listed Eurozone companies operating in selected vice industries is created and subsequently matched with a corresponding virtue index, which for the purpose of this analysis is represented by the DJSI Eurozone. The tools used to conduct the performance evaluation are the Sharpe ratio, the capital asset pricing model and the Carhart four-factor model. The analysis indicates no consistent outperformance or underperformance of one or the other index, yet the realised performance over the whole period favours the vice index. Consequently, it can be concluded that from a statistical point of view, there is no substantial advantage or disadvantage in being "good" when investing into stocks, as such it is a matter of investor preference, with the note that historical returns do favour vice stocks.

JEL classification: G11; G15; G17

Keywords: CAPM, Eurozone, four-factor model, Sharpe ratio, virtue stocks, vice stocks.

1. INTRODUCTION

The drive for return maximisation and risk minimisation is a central issue for investors and plays an important role in their actorness on the market. This assumption can be trailed back to the work of Bernoulli (1968) and von Neumann and Morgenstern (1944) and is known as the *expected utility hypothesis*. Yet conducting a more pragmatic examination, we are soon to discover a number of cognitive biases as important determinants in the actions of financial investors. These were prominently described by Kahneman and Tversky (1979) and termed *prospect theory*.

One of the biases intrinsic to the financial investment world are social norms. This type of discrimination in decision-making in the area of economics was first elaborated in Becker's 'The Economics of Discrimination' (1957). He describes how agents bear the economic costs of not interacting with certain people for reasons of social norms imposed onto them by society.

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Research by Hong and Kacperczyk (2009) suggests that financial investors are indeed willing to pay a price in order to oblige to social norms. In other words, they are willing to forgo higher returns or lower risk by not investing into stocks of industries deemed as a vice, even though this is not a rational choice from an economic point of view.

Continuing from that, we enter two distinct investment strategies: *vice investing* and *virtue investing*.[2] From a semantic point of view, virtue implies moral excellence, goodness and righteousness. More specifically, it is to be understood as investing that generates profit and at the same time produces positive externalities (e.g. environmentalism). A vice, on the other hand implies an immoral or evil habit or practice. In the investment world, it refers to investing into industries with a real or perceived negative externality, with the sole objective of the investor being economic benefits. Finally, it has to be noted that the definition of what exactly constitutes a vice or virtue investment varies and is therefore endogenous. A very clear example of this can be provided when contrasting Christian and Muslim societies. Muslim societies would define interest (*riba*) as a vice (*haram*) (Ahmad, 2015), while Christian societies would not, even though historically, there was some impetus to do so, perhaps most prominently by Thomas Aquinas (for further reading on this topic research the topics *theory of just price* and *concept of usury*).

This paper analyses the performance of vice and virtue investments within the Eurozone in the time period of January 2005 to December 2014 in order to assess which of the two strategies is more efficient. The question examined is whether there is a significant difference in performance between vice and virtue investments. The hypothesis is that there are no significant differences between vice and virtue investments, under the assumption that these assets are correctly valued, that the Eurozone financial market is efficient and finally that the return characteristics of the stocks are derived exclusively through their risk characteristics. While these assumptions do appear to be logical, they do not hold in the case of vice assets, as will be examined in more detail in the literature review. Vice assets are assumed to be a victim of social stigma producing higher returns for their risk profile. The performance of these assets is determined through the utilisation of the Sharpe ratio, the capital asset pricing model (CAPM) and the four-factor model.

The paper is structured in the following manner: Section 2 provides a literature review of the existing research on the topic, Section 3 describes the collection, organisation and preparation of the data for analysis, Section 4 explains the methods used in the performance examination, Section 5 provides the results and their interpretation, Section 6 provides the conclusions and Section 7 provides a list of references.

2. LITERATURE REVIEW

The examination of vice and virtue asset performance is not unprecedented in the academic literature. Examinations of the factors that are indicative for the performance of virtue investments are especially frequent. In this section, a review of the papers deemed most relevant for this study is provided.

We begin with the paper presented by Jo, Saha, et al. (2010), as using only the Sharpe ratio, it employs the most straightforward methodology of performance measurement. The paper compares the DS400 (a virtue index) to the S&P500, and then also compares two funds, the DSEFX (a virtue fund) and the VICEX (a vice fund now known as the Barrier fund) with each other. The findings were that on the long term, the DS400 outperforms the S&P500, while the VICEX outperforms the DSFEX in almost every period (Jo, Saha, Sharma, & Wright, 2010, p. 8).

[2] It should be noted that the terms *vice investing* and *virtue investing* were taken up on a partially arbitrary and partially semantic basis. Therefore, alternative terms are equally valid to describe these types of investing. Alternative terms for virtue investing found in academic literature also include: socially responsible investing (SRI), investing on the basis of environmental, social and corporate governance (ESG) criteria, investing on the basis of corporate social responsibility (CSR) criteria, green investing, sustainable investing, faith-based investing and faith-compliant investing. The only significant alternative term for vice investing found in the academic literature is sin investing.

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Lobe and Walkshäusl (2011) conduct a more extensive analysis of vice and virtue asset performance, as they cover the period between 1995 and 2007. They constructed a number of region and industry specific vice and virtue indices. In order to examine their performance, the authors use the Sharpe ratio, the CAPM and the four-factor model. The authors find no evidence for a statistically significant difference between vice indices and their comparables, even after employing the four-factor model analysis. They conclude that choosing vice or virtue bears no significant advantage and is up to the investors' non-financial preferences.

A fairly significant paper, in terms of being cited by the literature reviewing the performance of vice and virtue equities, is that of Hong and Kacperczyk (2009). The question addressed within their study is whether in order to adhere to social norms, investors forgo bigger potential returns by not investing into stocks that can be classified as vice investments. The paper also addresses many contextual questions that give an overall insight into the behaviour and perception of vice stocks, namely that vice stocks receive less analyst coverage and are held in smaller quantities by institutions in comparison to other kinds of stocks. The performance measurement applied by the authors is the four-factor model, which they used to analyse the period of 1965–2006, focusing mostly on Western Europe and North America. They conclude that the vice stocks outperform their comparables and that consequently, social norms have a significant effect on the decision-making of the investors, given that vice stocks are undervalued by up to 20%. The authors suggest that vice firms should rather rely on debt for financing their operations, because of the presumably lower discrimination on that market.

The research conducted by Fabozzi, Ma and Oliphant (2008) is a fairly extensive analysis of vice stock returns, as it covers the timeframe of January 1970 to June 2007 and examines Asia, North America and Europe. After collecting the sample of stocks that were to form the baseline of the research, the authors first computed the simple returns and then the excess market returns as well as the risk-adjusted excess returns. They confirmed that vice stocks do produce abnormal returns, even though these vary significantly from country to country. The reasons given for the outperformance were high potential costs of adhering to social norms for non-vice firms and high barriers of entry into vice industries, which as a consequence comes to facilitate positive monopolistic returns. Further, the evidence provided is consistent with the notion of the undervaluation of vice stocks because of the negative perception of these assets by the average investor.

A fairly interesting approach to the issue can be found in the paper by Salaber (2007), as it focuses mainly on Europe and examines whether religion, litigation risk and the level of excise taxation impact the performance of vice stocks. The author sets up three hypotheses for testing. The first hypothesis states that vice stocks exhibit higher risk-adjusted returns only in Protestant countries. The reason for this is that Protestant countries tend to have stricter regulations regarding alcohol and gambling, going by the assumption that Protestants are less willing to promote vice. As such, they will be more vice-averse or alternatively will require higher returns to justify their investment into vice. The second hypothesis is the assumption that for reasons of negative externalities caused by tobacco, alcohol and gambling, these industries have an increased litigation risk. This should have the effect that these industries yield higher risk-adjusted returns, which has a depressing effect on the stock prices. The third hypothesis is similar to the second and assumes that vice stocks with a high excise taxation have higher risk-adjusted returns. All three hypotheses the author made were confirmed. Salaber states that vice stocks perform best in protestant countries (because of "sin aversion"), countries with a high litigation risk (because of "high external costs") and countries with higher excise taxation. This is a significant finding as previous research based the excess returns of the vice assets solely on them being neglected by investors. Yet because of the limitation of the data, the paper does not provide to what extent these factors are significant.

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Finally, research on virtue asset performance indicators is available in far greater quantities than the one examining vice assets. Therefore, two articles that are themselves literature reviews were reviewed, namely the work of RBC Global Asset Management (2012) and Sjöström (2011), both reviewing about 20 papers. The conclusions of these are that there is no disadvantage having a virtue investing strategy in comparison to general investing strategies, yet at the same time there is no indication that a virtue investing strategy would produce abnormal returns, unlike in some of the papers described above regarding the vice investing strategy.

3. DATA

This paper covers a timeframe of ten years, from January 2005 to December 2014, where the data is collected in monthly intervals. These intervals represent the closing price of the stock on the first trading day of a particular month (the reason why the data was not derived for the last trading day is a matter of convenience, as Yahoo! Finance provides only monthly data for the first trading day of a particular month). As a result, 120 data points are accumulated for each variable of the analysis, which is perceived as sufficient to produce conclusive results. The market frame (investable stock universe) of this paper is limited to the Eurozone. The Eurozone is defined as the territory of all member states of the EU that have adopted the Euro as their currency. In order to consider a stock to be a part of this stock universe, the company that has issued the stock needs to be incorporated in one of these countries. If the information for a stock included in the analysis is already available from the starting date of the analysis (January 2005) but the country in question joined the Eurozone only later in time (e.g. Malta joining in January 2008), the stock is only included into the analysis from the date when the country in question joined the Eurozone.

To execute the analysis, the following data had to be collected: information on the historical market development in the Eurozone in the form of a benchmark index (EURO STOXX index); information on the historical development of virtue assets in the form of a virtue index (DJSI Eurozone index); historical stock returns of stocks of industry branches defined as a vice, from which the vice index would be constructed (from this point on referred to as Vicex, which is not to be confused with the former name of the Barrier fund, which also carried that name); the historical risk-free rate; and the factors for the four-factor model.

What regards the question which industries to include as vice industries, the initial intention was to include the alcohol, defence, gambling, nuclear, tobacco and sex industries, as these are most frequently classified as vice industries in consideration of exclusion practices of virtue indices (one of the reasons why the DJSI Eurozone was chosen as the virtue index is its exclusion of these industry categories). In order to represent a vice industry in a substantive manner, the aim was to collect at least ten stocks of any particular vice industry. In some cases, as described below, this was not possible due to the limited presence of certain industries on the stock market.

The tobacco industry could not be included in the analysis as it was found that no public tobacco companies exist in the Eurozone. Overall, four tobacco companies on stocks exist in the European Economic Area: British American Tobacco (UK), Imperial Tobacco (UK), Swedish Match (Sweden) and Japan Tobacco International (Switzerland). The sex industry was found to have a negligible presence on the stock markets, which is in tandem with other literature consulted (e.g. Hong and Kacperczyk 2009, 20). Only two companies from this industry were found, namely Beate Uhse AG (Germany) and Private Media (Spain). Similarly, when searching for gambling companies, only seven such companies were collected. By consulting the Stockholm International Peace Research Institute (SIPRI), nine companies belonging to the defence industry could be found. Therefore, even though the threshold of ten companies was not reached, confidence is high that these stocks represent most if not all of the defence industry's market capitalisation in the Eurozone. Ten alcohol and eleven nuclear industry stocks were collected. The reason for the

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number of nuclear energy stocks is that Siemens AG announced that it would exit the nuclear industry in 2011 as such it had to be removed from the index and was replaced by Areva SA. In total, 39 vice stocks were collected, representing the alcohol, defence, gambling, nuclear and sex industries (for the full list of companies whose stocks were used in this paper, please refer to the Annex, Table A1).

The historical stock information was taken from Yahoo! Finance. Because the market capitalisation was also an information of significance for the analysis and given that in some cases, Yahoo! did not provide this information, Google Finance was also used as a complementary tool of data collection. The factors for the four-factor model were attained from Kenneth French's website, which provides this information for different geographical regions, one of these being Europe. The methodology for the calculation of the rate and the factor loadings can be found on the webpage (French, 2015). The risk-free rate that was taken to be representative for the Eurozone was the yield of the 10-year German government bond (FRED, 2015). The reason for this choice was that it is the biggest and arguably the most stable Eurozone economy, thus being least risky. The reason why the 10-year bond was chosen and not the 30-year bond is that the timeframe of the analysis is 10 years.

Having attained the necessary information, the next step was to construct the individual vice indices as well as the collective Vicex. The specific type of index constructed was the total return index (also called gross return index by STOXX), given that the EURO STOXX and the DJSI Eurozone are also total return indices. This type of index, other than only taking into consideration the price change of the stock, also assumes that the dividends yielded by the stock are reinvested. Because of that, the stock prices used within the analysis are the adjusted stock prices provided by Yahoo! Finance. In practice, this means that they are already adjusted for stock splits and the payments of dividends. The equation used for the computation of the industry indices is:

$$Index_{(t)} = \sum_{i=1}^{n} \frac{p_{it} * w_{it}}{p_{i1}} \tag{1}$$

where $Index_{(t)}$ represents the value of the index at time t, n is the number of companies in the index, p_{it} is the price of company i at time t, p_{i1} is the price of company i at time $t = 1$ and w_{it} is the weight of company i at time t and was computed using the equation below:

$$W_{(i,t)} = \frac{market\ capitalization\ of\ stock\ i}{total\ industry\ capitalization\ t} \tag{2}$$

where the market capitalisation of stock i is the market capitalisation of the company in August 2015 (an explanation for this is given below) and the total market capitalisation t is the total industry capitalisation at time t. Because the capitalisations of individual stocks in specific industries could have excessively disproportional weights, there was a need to cap the weights to a certain maximum. The maximum weight a single stock could take in an index at any point was calculated using the equation:

$$w_{\max(t)} = \frac{200\%}{n_t} \tag{3}$$

where $w_{max\,(t)}$ is the maximum weight the stock could take and n_t is the number of stocks in the index at time t. The value produced from this equation is the maximal percentage of the weight a stock could take. The numerator of 200% is arbitrary, yet there are practical reasons for this

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number. Recalling that the maximal number of stocks an industry portfolio would include at any point is ten or less, if the numerator was set to 100% it is clear that once the portfolio would reach the ten stock benchmark, the maximal weight any stock in the portfolio could take would be 10%, which would in practice mean that the portfolio would become equally weighted. This would consequently eliminate the purpose of weighting.

There are two reasons that necessitated this weighting. First, if we assume that there is no weighting, it means that all companies contribute with an equal effect to the index, which is deemed to not be a realistic representation of the performance of a specific industry, especially if we consider that certain companies have capitalisations that differ from one another 100 times or more. Secondly, if we apply an indiscriminate weighting, it may happen that a single company would influence nearly all movement in the index, which practically eliminates the need to create an index. If we consider that almost all of the variance within an index is derived from one stock alone, it would make more sense to simply examine the single stock. A good example for the need to apply this measure, yet not representative for all industries examined, is the alcohol industry, where the stocks of Anheuser-Busch InBev and LVMH SA together represent more than 80% of the total capitalisation.

In the case where assigning a maximal weight to a stock would have the result that another stock would surpass $w_{max\,(t)}$, that stock was also assigned the maximal weight. In the indices where $w_{max\,(t)}$ was applied, an adjusted $w_{(i,t)}$ was calculated for the rest of the stocks in the portfolio by using the equation:

$$W_{(i,t)} = \frac{market\ capitalization\ of\ stock\ i}{total\ industry\ capitalization\ t - excluded\ capitalization\ t} \tag{4}$$

where the excluded capitalisation is the capitalisation of the stocks that surpassed the maximum weight and had to have their weights capped.

While choosing the market capitalisation of August 2015 might not seem outright logical, as the assumption that the proportional capitalisation of individual companies and industries remains constant through time does not hold in practice, this had to be done, as there is a general lack of information regarding the market capitalisation of a particular company in the past. Therefore, this solution was conceived as a compromise, considering that not all the stocks in an industry index have existed for the whole lifetime of the index. It is to be noted that the weights of individual stocks within an index are rebalanced through time as stocks are added to and removed from the index.

It was decided that the divisor for the index would be the price of each individual stock at time $t = 1$. As a result, all indices begin with the value of one. This decision was made as it was felt that starting with a value of one would provide for the cleanest examination of data, yet in the end, the decision was fully arbitrary in nature and in practice, the starting value of the indices could have been any number. The Vicex itself was calculated in the same way as the other vice industry indices and essentially represents a weighted combination of the defence, alcohol, nuclear and gambling indices, as presented in Figure 1.

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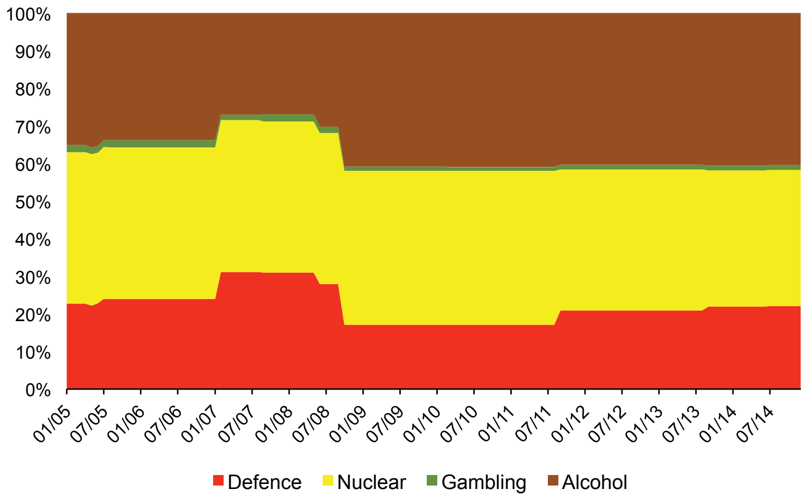
Figure 1
Industry weights in the Vicex through time



Description: This figure shows how the proportionality of weights in the Vicex developed over time. Time is represented on the x-axis of the index. It should further be noted that the gambling industry constitutes a very small amount of the total capitalisation of the index. Therefore, at no point the gambling industry makes up more than 2% of the index.

The first step of the analysis itself was the calculation of the monthly return of an index. This was achieved using the following equation:

$$r_{(t)} = \frac{P_t - P_{t-1}}{P_{t-1}} \tag{5}$$

where $r_{(t)}$ is the return at time t, P_t is the price of the stock at time t and P_{t-1} is the price of the stock at time t–1. The average returns were calculated for the ten-year period, using the arithmetic mean equation:

$$\bar{x} = \frac{\sum_{n=1}^{k} x_n}{n} \tag{6}$$

where the average is the sum of all values of returns in the sample, divided by n, which represents the total number of terms in the sample. In practice, the averages were calculated using the Excel command =AVERAGE. The standard deviation represents how much the members of a group in a certain dataset differ from the mean value of the group and as such represents a measure of risk. For the calculation of the standard deviation, the following equation was used:

$$\sigma = \sqrt{\frac{\sum_{i=1}^{n} (x_i - \bar{x})^2}{n-1}} \tag{7}$$

where n is the number of data points, x_i is each value of the dataset and $\bar{x}$ is the mean of all values in the dataset. In practice, the standard deviation was calculated through the usage of the Excel function =STDEV.S.

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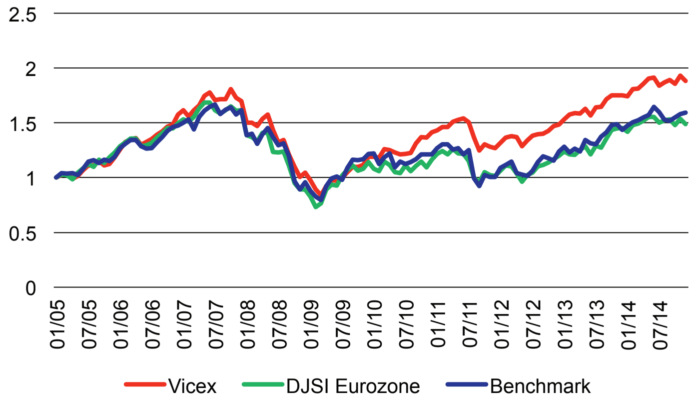
Figure 2
Vice vs. virtue indices



Description: The figure is a visualisation of the performance of the vice, virtue and benchmarks indices.

4. METHODOLOGY

In order to examine the performance of the indices compared, the Sharpe ratio, CAPM and four-factor model were used. The Sharpe ratio was chosen in order to provide an upfront and easy comparison in the form of a ratio between the selected indices. The CAPM and the four-factor model were selected because they provide for the possibility of a regression analysis through which one can determine if the results have statistical significance and because one is built on the other. Therefore, it is possible to gain insight into the factors that are significant in determining the outperformance of one index over the other. Another reason for choosing these three measurement criteria is that these are most frequently employed in performance measurement in the main articles examined the literature review and as such the comparability of results is enhanced.

The Sharpe ratio was introduced by William F. Sharpe (1966). It is a means of measuring the performance of an asset by adjusting it by its total risk. More specifically, it measures excess return per unit of deviation in an investment. The risk in this case is the total risk of a company, while for example, the Treynor ratio only includes systematic risk. The Sharpe ratio is calculated using the following equation:

$$Sharpe\ ratio_i = \frac{\overline{r_i} - \overline{r_f}}{\sigma_i} \tag{8}$$

where $\bar{r}_l$ is the average return of asset i over the selected time period, $\bar{r}_f$ is the average risk-free rate over the same period and σ is the standard deviation of the selected asset over the given time period.

The CAPM was introduced by a number of authors independently (e.g. Sharpe (1964)). It was elaborated as a tool through which one could determine a theoretically appropriate return on an asset in regard to the systematic risk of the asset. It represents the idea that the investors need to be compensated for the time value of money and risk. The time value of money in this case is represented by r_f, while the (systematic) risk is represented by the so called beta (β). The risk provides us with the assets' sensitivity to non-diversifiable risk. The CAPM is calculated using the following equation:

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$$E(r_i) = r_f + \beta_i(r_m - r_f) \tag{9}$$

where $E(r_i)$ is the expected return of an asset, r_f is the risk-free rate, β_i is the β of the asset in question in regard to the market, and r_m represents the market returns. The term $(r_m - r_f)$ represents the market premium, which is calculated by subtracting the risk-free rate from the market returns.

The main point of interest within the analysis of the CAPM is to find out whether there is a statistically significant positive alpha (α) (also known as the Jensen's alpha in the case of CAPM). If so, this would imply that the index in question outperformed the market (has produced returns that are abnormal). α is calculated through the usage of linear regression in SPSS and received as a constant (intercept).

Because of the well-known and empirically proven fallacies inherent in the CAPM (e.g. different predicted and realised returns, as well as other risk factors for which the CAPM does not account for), there is a need to complement the model with the four-factor model. The four-factor model includes the three factors of the French and Fama three-factor model, which by itself constitutes an improvement over the one factor model (referred to as the CAPM, but also known as the market model) and also includes the momentum factor (MOM) introduced by Carhart (1997).

French and Fama (1993) determined that there are two other asset classes tending to perform better than the market. On the one hand, these are stocks with a small market capitalisation, represented as SMB (which means Small (market capitalisation) Minus Big and describes the size premium one would expect to earn on small caps, which tend to be riskier). On the other hand, these are stocks with a high book-to-market ratio, represented as HML, which stands for High (book-to-market ratio, more popularly termed as the price/book ratio) Minus Low, and describes the circumstance in which companies with a high book-to-market ratio (value stocks) outperform those with low ones (growth stocks). Because these factors could not be explained by the CAPM, the so-called three-factor model was created, which is represented by the following equation:

$$r_t - r_{t,f} = \alpha + \beta_{t,m}(r_{t,m} - r_{t,f}) + \beta_{SMB}(SMB_t) + \beta_{HML}(HML_t) + \varepsilon_t \tag{10}$$

For the means of brevity, only terms not covered when explaining the CAPM are explained: β_{SMB} represents the size loading factor; β_{HML} represents the value loading factor; SMB_t represents the size premium at time t; HML_t represents the value premium at time t; and ε_t represents an error term which can interpreted as the firm-specific risk and as such cannot be explained by the model. The three-factor model has a higher explanatory power than the CAPM, which is not surprising from a statistical point of view, considering that it includes more factors.

To further explain the SMB and HML factor loadings, if $\beta_{SMB} > 0$, it implies that the index in question consists of stocks with a small market capitalisation (small caps) or at the very least that it behaves as if it was made up of such stocks (this holds true for any of the factor loadings described). If $\beta_{SMB} < 0$, then it would suggest that this index is made up of stocks with a high market capitalisation (big caps). If $\beta_{HML} > 0$ the index in question is made up out of value stocks, while a value of $\beta_{HML} < 0$ would indicate that the index in question is mostly made up of growth stocks (Bernstein, 2001).

Building on the three-factor model, the Carhart four-factor model includes a so-called momentum factor (in the model it is represented by MOM, which stands for MOnthly Momentum) into the model as the fourth factor. The momentum factor describes the tendency of stocks that are rising to continue rising and for stocks that are falling to continue to fall further. The four-factor model is defined through the following equation:

$$r_t - r_{t,f} = \alpha + \beta_{t,m}(r_{t,m} - r_{t,f}) + \beta_{SMB}(SMB_t) + \beta_{HML}(HML_t) + \beta_{MOM}(MOM_t) + \varepsilon_t \tag{11}$$

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Continuing from the explanation of the three-factor model, β_{MOM} represents the momentum loading factor and MOM_t represents the momentum premium at time *t*. If $\beta_{MOM} > 0$ it means that the returns of the asset in question were significantly influenced by the momentum factor (alternatively interpreted also as seasonality), while $\beta_{MOM} < 0$ would suggest the absence of such an effect (Carhart, 1997). As in the CAPM, the actual interest of the model is the so-called four-factor α. Achieving such a statistically significant value implies that the index in question produced abnormal returns.

In regard to the statistical analysis of the data, a p-value that is equal or less than 0.1 will be interpreted as statistically significant. Statistical significance will be reported at 10%, 5% and 1% levels. The R^2 measure is also reported (it explains how much of the variance of the assets' risk premium can be accounted by the factors of the model).

The existence of heteroscedasticity (a circumstance where there is a sub-population of variables that have different values from other variables within a population or sample) and autocorrelation (a mathematical representation of the degree of similarity between a given time series and a lagged version of itself over successive time intervals), is also tested for. Heteroscedasticity is tested for by looking at the residual statistics table in order to see whether the mean of the residual is a value significantly higher than zero (if not then there is no heteroscedasticity) and autocorrelation is tested by applying the Durbin-Watson measure. It is deemed that autocorrelation exists if the value of the measure is either lower than 1.5 or higher than 2.5 (University of Minnesota, 2015). Because these two statistical circumstances did not manifest in the frame of the analysis, they are not reported.

5. RESULTS

This section describes the results of the analysis. The numbers ^{1}, ^{5} and ^{10} noted in the upper right corner of the values produced through linear regressions signify the p-value of a certain variable (e.g. 1 means that the output is significant within the 1% level, thus the p-value was $p \geq 0.01$). If no such number is reported, it means that the value in question is statistically not significant (thus the p-value is $p > 0.1$). The coefficients of the analysis are interpreted only within the description of the ten-year period, as these factor loadings are deemed to be the most representative. The information provided on the performance of the benchmark is there only for reference reasons.

Looking at the ten-year period and observing the Sharpe ratio, we can see that several vice assets have substantially beaten the benchmark. The DJSI just barely did not manage to beat the benchmark. The clear outperformer of the period is the gambling industry, indeed so much so that its returns are statistically significant in both the CAPM and the four-factor model. Yet the model does not very well explain the returns of this industry with R^2 being only 7%. At the same time, we cannot find any statistically significant alphas for other indices analysed (observing the four-factor model). The conclusion that we can draw from this is that there is no general tendency for vice or virtue industries to outperform the market in a consistent manner.

Looking at the statistically significant coefficients in the four-factor model table, we can see that the virtue index consists largely of big companies (unsurprising given the nature of the DJSI) unaffected by seasonality and is made up mostly of value stocks. This by itself is interesting as previous research suggests that virtue assets should mostly behave like growth stocks. At the same time, the only other conclusion that one can make for the Vicex is that it is made up of growth stocks, even though substantially less than the virtue index. Looking at the vice industries, we can see that in general they are unaffected by cyclical business (low or insignificant MOM factor loading), they mostly behave as value stocks (high HML factor loading, except for the alcohol and sex industries), they significantly differ from industry to industry what regards the size of their constituents (high factor loading for the sex industry and low factor loading for the nuclear industry) and finally that they are far less volatile than the market.

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Table 1
Sharpe ratio and CAPM January 2005–December 2014

	Avg. Ret.	Std. Dev.	Sharpe	CAPM (α)	CAPM (β)	CAPM (R^2)
Defence	0.99%	0.07	0.13	.601	.648[1]	.273
Nuclear	0.41%	0.05	0.06	.067	.542[1]	.371
Gambling	1.18%	0.06	0.18	.948[10]	.284[1]	.067
Sex	-1.52%	0.10	-0.16	-1.766[10]	.279	.021
Alcohol	0.74%	0.05	0.13	.411	.507[1]	.313
Vicex	0.61%	0.04	0.12	.277	.522[1]	.488
DJSI	0.46%	0.05	0.07	.074	.636[1]	.473
Benchmark	0.54%	0.05	0.08	/	/	/

Notes: "Avg. Ret." stands for average return; "Std. Dev." stands for the standard deviation; "Sharpe" stands for the Sharpe ratio; "CAPM (α)" stands for the alpha of the CAPM as given by the intercept; "CAPM (β)" stands for the beta of the CAPM; "CAPM (R^2)" is the *r squared* measure as provided by the CAPM.

Table 2
Four-factor model January 2005–December 2014

	α	β	SMB	HML	MOM	R^2
Defence	.405	.584[1]	.666[5]	.509[10]	.265[10]	.328
Nuclear	.037	.445[1]	-.331[10]	.901[1]	.130	.528
Gambling	1.052[10]	.247[5]	.099	-.016	-.114	.073
Sex	- .986	-.220	1.159[5]	1.199[5]	-.704[1]	.196
Alcohol	.390	.572[1]	-.236	-.282	-.008	.330
Vicex	.237	.507[1]	-.176	.276[10]	.073	.514
DJSI	.268	.525[1]	-.663[1]	.699[1]	-.131[10]	.671

Notes: α stands for the alpha of the four-factor model as given by the intercept; β, SMB, HML and MOM are the factor loadings of the four-factor model and explain the return behaviour of the index in question. Finally R^2 is the *r squared* measure as provided by the four-factor model.

6. CONCLUSIONS

Looking at the realised returns and primarily at the Sharpe ratio, we can conclude that vice investments did perform better than virtue investments, yet observing the expected returns derived from the alpha value, we can see that no statistically significant outperformance of vice or virtue assets can be detected. As such it is taken that the hypothesis which was set out is confirmed—by default one should not expect that vice assets would outperform virtue assets or vice versa. One exception of this was the alpha of the gambling index, yet the returns of this industry are not well explained by the four-factor model and CAPM, so it remains unclear why the industry performed so well.

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The findings of this study are similar to the findings of Lobe and Walkshäusl (2011) and conclude that there is no significant advantage or disadvantage when applying either investment strategy, or at least that one should not expect one strategy to outdo the other by default. One question that would be interesting to approach is whether the results would be different when continuing the research of Salaber (2007), which suggests that vice assets would normally excel in performance in Protestant countries. By her definition, most of the countries within this study are Catholic, where vice assets tend to perform worse given the reduced neglect effect, thus extending the scope of this study to the United Kingdom and Sweden could substantially enhance the conclusions.

While the results of this study were significant, the research could be further improved by including delisted companies into the list of companies and thus avoiding the effect of the survivor bias (explained through the notion that a company that survived for a significant amount of time also had to be successful to a certain extent) and by using the real (historical) market capitalisation weights instead of the generalised weights used in this paper. Both of these considerations could have been very easily addressed by accessing databases such as Bloomberg, Capital IQ or DataStream, yet considerable financial resources would have been required in order to do so.

REFERENCES

Yousri Ahmad, A.-R. (2015). *Riba, Its Economic Rationale and Implications*. Retrieved from http://www.islamic-banking.com/iarticles_8.aspx

Becker, G. S. (1957). *The Economics of Discrimination*. Chicago: University of Chicago Press.

Bernoulli, Daniel (1968). *Specimen theoriae novae de mensura sortis*. Gregg, Farnborough

Bernstein, W. J. (2001). Rolling Your Own: Three-Factor Analysis. Retrieved from http://www.efficientfrontier.com/ef/101/roll101.htm

Carhart, M. M. (1997). On Persistence in Mutual Fund Performance. *The Journal of Finance*, *52*(1), 57–82. doi:10.1111/j.1540-6261.1997.tb03808.x

Fama, E. F., & French, K. R. (1993). Common risk factors in the returns on stocks and bonds. *Journal of Financial Economics*, *33*(1), 3–56. doi:10.1016/0304-405X(93)90023-5

FRED. (2015, August 11). *Long-Term Government Bond Yields: 10-year: Main (Including Benchmark) for Germany©*. Retrieved August 11, 2015, from https://research.stlouisfed.org/fred2/series/IRLTLT01DEM156N

French, K. R. (2015). *Description of Fama & French European Factors and Portfolios*. Retrieved August 15, 2015, from http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library/details_european.html

Hong, H., & Kacperczyk, M. (2009). The price of sin: The effects of social norms on markets. *Journal of Financial Economics*, *93*(1), 15–36. doi:10.1016/j.jfineco.2008.09.001

Jo, H., Saha, T., Sharma, R., & Wright, S. (2010). Socially Responsible Investing vs. Vice Investing. In AABRI (Ed.), *Academic and Business Research Institute Conference – Las Vegas 2010*.

Kahneman, D., & Tversky, A. (1979). Prospect theory: An analysis of decision under risk. *Econometrica*, *47*(2), 263. doi:10.2307/1914185

Lobe, S., & Walkshäusl, C. (2014). Vice versus virtue investing around the world. *Review of Managerial Science*, *10*(2), 303–344. doi:10.1007/s11846-014-0147-3

RBC Global Asset Management. (2012). *Does Socially Responsible Investing Hurt Investment Returns?* Retrieved from http://funds.rbcgam.com/_assets-custom/pdf/RBC-GAM-does-SRI-hurt-investment-returns.pdf

Salaber, J. (2007). *The determinants of sin stock returns: Evidence on the European market*. Retrieved from BIRD, https://basepub.dauphine.fr/handle/123456789/3028

Sharpe, W. F. (1964). Capital asset prices: A theory of market equilibrium under conditions of risk. *The Journal of Finance*, *19*(3), 425–442. doi:10.2307/2977928

Sharpe, W. F. (1966). Mutual fund performance. *The Journal of Business*, *39*(1), 119–138. doi:10.2307/2351741

Sjöström, E. (2011). The performance of socially responsible investment – A review of scholarly studies published 2008-2010 by Emma Sjöström: *SSRN*. doi:10.2139/ssrn.1948169

University of Minnesota. (2015). *Durbin Watson Test*. Retrieved August 30, 2015, from University of Minnesota: http://www.tc.umn.edu/~ryoox001/images/DurbinWatson_test.pdf

Von Neumann, J., & Morgenstern, O. (1944). *Theory of games and economic behavior*. United States: Princeton University Press.

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ANNEX: LIST OF COMPANIES

Table A1
List of companies used to construct the vice index

#	Name	Country	Industry	Date	Market Cap.
1	Anheuser-Busch InBev	Belgium	Alcohol	10/2008	176.82 bn
2	Brauerei Ottakringer	Austria	Alcohol	1/2005	0.23 bn
3	C&C Group plc	Ireland	Alcohol	1/2005	1.18 bn
4	Davide Campari	Italy	Alcohol	5/2005	4.2 bn
5	Groupe Laurent-Perrier	France	Alcohol	1/2005	0.49 bn
6	Heineken	Netherlands	Alcohol	1/2005	19.34 bn
7	Lanson-BCC	France	Alcohol	1/2005	0.25 bn
8	LVMH SA	France	Alcohol	1/2005	88.19 bn
9	Pernod Ricard	France	Alcohol	6/2008	29.28 bn
10	Rémy Cointreau SA	France	Alcohol	1/2005	3.11 bn
11	Airbus Group SE	France	Defence	2/2007	52.37 bn
12	CNH Industrial N.V.	Netherlands	Defence	9/2013	11.34 bn
13	Dassault Aviation SA	France	Defence	1/2005	17.45 bn
14	Fincantieri S.p.A.	Italy	Defence	7/2014	1.24 bn
15	Finmeccanica SpA	Italy	Defence	7/2005	7.62 bn
16	Rheinmetall AG	Germany	Defence	6/2005	2.18 bn
17	Safran SA	France	Defence	1/2005	29.19 bn
18	Thales SA	France	Defence	1/2005	12.91 bn
19	ThyssenKrupp AG	Germany	Defence	1/2005	13.49 bn
20	Bet-At-Home.com	Germany	Gambling	8/2005	0.291 bn
21	GOFP S.A.	Greece	Gambling	1/2005	2.33 bn
22	Groupe Partouche SA	France	Gambling	1/2005	0.2 bn
23	Mybet Holding	Germany	Gambling	1/2006	0.024 bn
24	Paddy Power plc	Ireland	Gambling	1/2005	3.62 bn
25	Snai S.p.A.	Italy	Gambling	1/2005	0.15 bn
26	Unibet SDR	Malta	Gambling	9/2007	1.95 bn
27	Ansaldo STS S.p.A.	Italy	Nuclear	3/2006	1.88 bn
28	Areva SA	France	Nuclear	9/2011	3.25 bn
29	Bouygues	France	Nuclear	1/2005	11.61 bn
30	E.ON	Germany	Nuclear	12/2007	24.18 bn
31	Electricite de France SA	France	Nuclear	11/2005	40.75 bn
32	Endesa SA	Spain	Nuclear	1/2005	20.62 bn
33	Enel SpA	Spain	Nuclear	1/2005	41.15 bn
34	Engie SA	France	Nuclear	1/2005	43.62 bn
35	Fortum Oyj	Finland	Nuclear	1/2005	14.33 bn
36	Iberdrola	Spain	Nuclear	5/2005	40.5 bn
37	Siemens AG	Germany	Nuclear	1/2005	87.39 bn
38	Beate Uhse AG	Germany	Sex	1/2005	0.036 bn
39	Private Media Group	Spain	Sex	3/2008	0.00041 bn

Description: The companies are sorted by the alphabetical name of their contextual industry and afterwards by their name. The date is the date on which the company stock data became available, and was thus included into the vice index. The market capitalisation is indicated in Euros.

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