Returns to Unethical Investing

New evidence on sin stock performance in Europe

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Abstract

This paper studies the returns to unethical investing in Europe over the time period 1965 through 2011. Using a sample of 285 alcohol, defence, gambling and tobacco stocks, it is first shown that the slight sin stock outperformance found is attributable solely to the tobacco industry. Thus, contrary to evidence from American and Asian markets, most sin industries outperform neither the market nor portfolios of comparable industries. Second, it is hypothesized that the returns to unethical investing have increased due to an increased neglect of sin stocks stemming from a rise in socially responsible investing. Inconsistent with this hypothesis, it is shown that the increase is not present uniformly throughout the sin industries. Instead, the outperformance once again pertains exclusively to the tobacco index, which exhibits a substantial upward trend in its outperformance.

Keywords: unethical investing, sin stocks, socially responsible investing, performance evaluation, comparable portfolios

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1 INTRODUCTION

"Some sins do bear their privilege on earth."

William Shakespeare, King John (1598)

According to classical portfolio theory, investors should base investment decisions on risk and return only. At odds with this maxim, Socially Responsible Investing (SRI) also takes ethical aspects into consideration by using screening procedures to avoid investing in companies perceived as sinful. This screening can be either positive, investing only in best-in-class companies supporting ethnic diversity and sustainability, or negative, excluding companies engaged in sinful businesses or other immoral activities such as exploiting childhood labour. In either case, they narrow the investment universe, thus potentially worsening the optimal risk-return relationship.

SRI began in the 1960s and, despite potential downsides, developed considerably in the 1980s, when the Social Investment Forum was founded in the United States. In Europe, SRI skyrocketed in the late 1990s and 2000s, and now constitutes more than ten per cent of the European asset management industry (Eurosif 2010). Unethical investing – that is, investing in stock of companies involved in sinful businesses – on the other hand, has not caught as widespread attention.[1]

Building on the upward trend, the performance of SRI has been studied extensively, and even though the conclusion is not entirely clear, most studies indicate that SRI neither under- nor outperforms conventional investing (Hamilton et al. 1993, Kreander et al. 2005, Schröder 2004, 2007, Statman 2000). Conversely, the performance of the opposite investment strategy – that is, socially irresponsible or unethical investing – has not been studied as extensively. Especially, although there are quite well-documented benefits from unethical investing in the United States and Asia, there are, to best of the authors' knowledge, only two studies – Lobe and Walkshäusl (2011) and Salaber (2009a) – concerned with the European market, and these find different results.

To clarify the issue, this paper investigates whether unethical investing manages to outperform conventional investing – that is, whether there is an "immorality premium" – in Europe. Considering the evidence of an immorality premium on the American market (Hong and Kacperczyk 2009), it is first hypothesized that there is a similar premium in Europe.

Following this hypothesis, Jensen's alpha from single- and multi-factor frameworks is used to compare the performance of various sin indices to that of the market and various portfolios of comparable industries. Over the time period 1965 through 2011, the average excess return from

[1] There are, however, exceptions. For example, the American Vice Fund invests solely in alcohol, defence, gambling and tobacco companies.

the CAPM is 2.9 per cent per year, significant at the ten per cent level. This indicates that the sin index outperforms the market. However, using the CAPM to test the performance of various sub-indices, it is shown that this outperformance pertains exclusively to the tobacco industry.

Over the more recent time period 1991 through 2011, the performance of the sin index is tested using both single- and multi-factor frameworks. The CAPM yields an average excess return of 4.7 per cent per year, significant at the five per cent level. However, this alpha vanishes under the three- and four-factor frameworks. Also, testing the performance of the sub-indices over the more recent time period again indicates that the alpha is attributable solely to the tobacco index.

Further testing of the sin indices – this time against portfolios of comparable industries, a methodology used to mitigate industry effects – provides further evidence that only the tobacco index manages to yield abnormal returns significantly above zero.[2] Depending on time period and framework, the tobacco index yields annualized returns of between 7.8 and 14.3 per cent in excess of the various comparable portfolios.

Second, it is hypothesized that the neglect of sin stocks has increased due to the growing interest in SRI and the increased use of ethical screening mentioned above. This neglect is supposed to lead to increased risk (Merton 1987), thus improving the returns to unethical investing. If this is true, it should be possible to see an upward trend in the abnormal returns to unethical investing.

This hypothesis is tested using the CUSUM and CUSUM-sq tests as well as moving regressions. Consistent with the hypothesis an upward trend is exhibited in the sin index. However, once the tests are performed on the sub-indices, it is once again shown that the result applies mostly to the tobacco index. The notion that tobacco drives the outperformance of the sin index is further supported by robustness tests showing that once the tobacco industry is excluded from the sin index, there are no significant abnormal returns.

The findings in this paper do not support the hypothesis that unethical investing outperforms conventional investing in Europe. Actually, the slight outperformance seen pertains exclusively to the tobacco index. This means that there is a substantial tobacco premium – which has also increased over time – but no clear immorality premium.

This paper proceeds as follows. In section 2, previous literature on unethical investing is introduced. Sections 3 and 4 present the data and methodology used in this paper. Section 5 displays the empirical results retrieved, which are then discussed in section 6. Section 7 concludes.

[2] In fact, the defence index underperforms its comparable portfolio under a multi-factor framework.

2 PREVIOUS LITERATURE

The previous research on the topic of unethical investing, summarized in **Table 1**, is not overly extensive. The most influential article on sin stock performance is written by Hong and Kacperczyk (2009). They study the American stock market, and find that an equal-weighted portfolio long sin stocks and short comparable stocks yielded a statistically significant average excess return of around 3.5 per cent per year, even when controlling for the size, value and momentum factors, over the time period 1926 through 2006.

In explaining these results, they hypothesize that there is a societal norm against funding sinful operations. Consistent with this hypothesis, they find that sin stocks are less held by norm-constrained investors such as pension funds and also that they are less covered by stock market analysts. Thus, they conclude that the neglect of sin stocks together with higher litigation risk is what explains the abnormal risk-adjusted returns.

A couple of studies investigating the performance difference between SRI and unethical investing include tests of sin stock performance on the American stock market. For example, Liston and Soydemir (2010) obtain average excess returns ranging from 7.0 to 8.2 per cent per year over a relatively short time period using conventional one-, three-, and four-factor models. Statman and Glushkov (2008) find that the small benefit received from SRI is largely offset by the return disadvantage suffered from excluding sin stocks, which they find to outperform the market by 3.3 per cent per year using a CAPM framework.

Furthermore, Salaber (2009b) studies the performance of American sin stocks during recessions, and before performing her cross-sectional tests she finds that a sin stock portfolio outperformed the market by some 3.7 per cent per year, whereas a portfolio long sin stocks and short comparable stocks outperformed the market by 2.3 per cent per year. All these numbers benefit from statistical significance, lending support to Hong and Kacperczyk's (2009) results and further indicating that there is an immorality premium present in the United States.

The performance of sin stocks has also been studied outside the United States. Visaltanachoti et al. (2009) study the performance of sin stocks on the stock markets in China and Hong Kong. They find that 32 out of the 46 sin stocks in their sample had risk-adjusted abnormal returns over their sample period. The CAPM regressions for China and Hong Kong yielded average excess returns of 6.1 and 33.3 per cent per year, where both numbers are statistically significant at the one per cent level.

Regarding the rest of the world, Fabozzi et al. (2008) find a highly statistically significant outperformance of sin stocks under the CAPM framework. In their total sample, the outperformance amounts to an average of 13.7 per cent per year, and results of this magnitude seem quite evenly distributed throughout their sample.

Lobe and Walkshäusl (2011), using a sample of 755 sin stocks from 51 countries, investigate the performance of sin stocks for different sub-regions around the world. However, contrary to other authors, they do not find any statistically significant outperformance for the sin stock sample as a whole. Neither their American nor their European sub-samples exhibit statistically significant risk-adjusted abnormal returns. In contrast, Salaber (2009a) finds a statistically significant average excess return of more than 4.0 per cent per year under the CAPM framework.

By and large, previous research on the subject of sin stock performance indicates that there are economic benefits to be gained from investing in sin stocks, at least in the United States and Asia. In Europe, the mixed findings of Lobe and Walkshäusl (2011) and Salaber (2009a) indicate that the matter is less clear.

3 DATA

3.1 Preliminaries

This paper uses data from 20 European countries over the time period 1965 through 2011. The aim is to include a large share of the European stock markets while concurrently assuring that the stock markets chosen fulfil certain criteria when it comes to market efficiency and transparency. Thus, the twenty largest countries in terms of market capitalization which are also ordinary members of both the International Organization of Securities Commissions (IOSCO) and the World Federation of Exchanges (WFE) are chosen.[3] The countries are Austria, Belgium, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, the Netherlands, Norway, Poland, Portugal, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.[4]

All data for both active and dead or delisted financial instruments from the 20 countries is downloaded from Thomson Datastream (Datastream). Dead and delisted instruments are included in order to mitigate the issue of survivorship bias (Brown et al. 1992). The data has been subject to the screening procedure described in **Appendix A**. This procedure is undertaken in order to remove data that is not useful for this study, or even erroneous, and gives a final list of 14 717 stocks. Datastream uses the Industry Classification Benchmark (ICB) developed by Dow Jones and FTSE for industry classification. The industry and sector classifications are static variables where only the latest quote is available. Thus, if some stocks have had their industry or sector classification changed, these variables are not able to detect such changes. In this paper, it is assumed that stocks are stable with regard to their industry and sector classifications, and that industry reclassifications are rare and have negligible effects on the results.

The dynamic variables are the monthly total return index, the market capitalization and the price-to-book ratio. In Datastream, stock prices are available on a daily basis, but the dividend information is restricted to a yearly basis. Thus, the monthly returns used in this paper are calculated using the total return index variable available from Datastream, which assumes that all dividends are reinvested. In order to mitigate any effects from currency fluctuations in the data, all time-series variables are downloaded in Euro.[5] Lacking interest rates spanning the entire sample period, a combination of interest rates is used to calculate excess monthly returns.[6]

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[3] These criteria include about 96 per cent of the European equity markets.
[4] Russia and Turkey are excluded since they are not strictly European, but Eurasian.
[5] The Euro was introduced on January 1, 1999. In this paper, the European Currency Unit (ECU), which was a basket of European currencies, is used for the pre-1999 period.
[6] Lacking market-based interest rates, a United Kingdom central bank base rate is used during 1965 through 1974. Next, a German one-month rate is used for the period 1975 through 1998, and from 1999 onwards the one-month Euribor rate is used.

3.2 Sin stock definition

In this paper, the sample of sin stocks consists of stocks from the alcohol, defence, gambling and tobacco industries. This selection is made for a number of reasons. First, using a narrow definition of what is considered sinful results in a sample with a higher concentration of sin, thus potentially enabling more distinct results. This also helps in ascertaining that no border line cases are included. Second, screening based on industry classification is easy and requires no arbitrary cut-off points or judgements of business conduct on a firm level.[7] Third, SRI funds utilizing negative screens usually exclude stocks that are easy to identify, for example by excluding entire industries. When doing so, the alcohol, defence, gambling and tobacco industries are most often excluded (Carlsson Reich et al. 2001, p. 14; Statman 2000, p. 31). Finally, previous research on the subject has defined a number of industries as sinful, but agrees on including alcohol, defence, gambling and tobacco as sin stocks, as witnessed by **Table 2**.

3.3 Sin stock and comparable portfolio data

The alcohol industry is identified by ICB codes 3535 (Brewers) and 3533 (Distillers & Vintners). It includes producers, distillers, vintners, blenders and shippers of wine and spirits, but also manufacturers and shippers of cider and malt products. In the sample, there are 100 brewer stocks and 71 distiller and vintner stocks, making a total of 171 alcohol stocks, among them companies like Heineken and Pernod Ricard.

There are 20 defence companies, including companies like BAE Systems and Thales Group, in the sample. The defence industry is identified by ICB code 2717 (Defense), and includes companies producing components and equipment such as military aircraft, radar equipment and weapons. The gambling industry is identified by ICB code 5752 (Gambling), and includes companies providing gambling and casino facilities, including online casinos and racecourses as well as manufacturers of casino and lottery equipment. There are 73 gambling stocks in the sample, among them companies like Bwin Party Digital Entertainment and Ladbrokes.

Finally, there are 21 tobacco stocks in the sample, among them British American Tobacco and Swedish Match. The tobacco industry is identified by ICB code 3785 (Tobacco), and includes manufacturers and distributors of cigarettes and other tobacco products. The alcohol, defence, gambling and tobacco stocks constitute a total sample of 285 sin stocks, whose evolution over the sample period, in total and for the various industries as well as the entire sample, is exhibited in **Table 3**.

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[7] Contrarily, whether a company exploits childhood labour or is environmentally unfriendly is not as clearly observed, and thus calls for judgement.

Since the performance of the sin stocks is tested against comparable industries, data for a large number of industries is downloaded. Once all the data from all industries is retrieved, a value-weighted sin index, named SINDEX, of the 285 sin stocks is created by weighting the total stock returns by their respective market capitalizations. Also, the value-weighted sub-indices ALCOHOL, DEFENCE, GAMBLING and TOBACCO are created. As shown in **Figure 1**, ALCOHOL is the largest sub-index, followed by TOBACCO, DEFENCE and GAMBLING. Furthermore, indices of the comparable portfolio industries, as well as a number of portfolios long a sin index and short a comparable portfolio, are created.

3.4 Market portfolio and risk factors

To evaluate the performance of SINDEX as well as the different sub-indices, the market portfolio or a proxy for the market portfolio must be used. Lacking a market index spanning the entire sample period, a value-weighted market portfolio is created from the screened list of 14 717 stocks.[8] The market portfolio is created by weighting the monthly stock returns by their market capitalizations, and rebalanced on a monthly basis. As described more thoroughly in **Appendix B**, the market portfolio created in this study is a reliable representation of the true market.

European versions of the well-known size, value and momentum factors are obtained from the website of Kenneth French.[9] Two size portfolios, where small stocks are the bottom 10 per cent stocks and big stocks are the top 90 per cent stocks, are created on the basis of market capitalization. Next, these size portfolios are interacted with the value and momentum portfolios to construct the factors used in the regressions.[10] The size, value and momentum factors are expressed in United States Dollar, and are thus converted to ECU and Euro with the use of historical exchange rates from Datastream.

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[8] As mentioned above, the screening procedure is described in **Appendix A**.
[9] The Internet address is http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/.
[10] For further details regarding the construction of the size, value and momentum factors, the interested reader is referred to Kenneth French's website. The Internet address is http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library/f-f_developed.html.

4 METHODOLOGY

4.1 The CAPM

One of the most commonly used performance measurement models is the capital asset pricing model (CAPM), which was developed independently by Sharpe (1964) and Lintner (1965). In the CAPM, the only relevant risk is non-diversifiable market risk, implying that only an asset's exposure to market risk is priced. This risk is measured by the market beta, which expresses the sensitivity of the asset's returns to the returns of the market portfolio. As this is the only factor explaining asset returns, CAPM provides predictions that are both intuitive and theoretically powerful. Estimating the CAPM is done through the following regression model:

$$r_{i,t} - r_{f,t} = a_i + \beta_{i,MKT} * MKT_t + \varepsilon_{i,t}$$

where

$r_{i,t} - r_{f,t}$	=	The monthly total return of an index, *i*, at time *t*, in excess of the risk-free rate at time *t*.
MKT_t	=	The monthly total return of the market portfolio at time *t*, in excess of the risk-free rate at time *t*.
$\varepsilon_{i,t}$	=	An error term with zero mean that represents the variation not explained by the variables in the regression model.

The α intercepts and β coefficients are unknown parameters estimated by the ordinary least squares (OLS) regression method. The β coefficient, or market beta, measures the index' exposure to systematic risk. A market beta above one indicates that the index is exposed to more systematic risk than the market, whereas a beta below one indicates that the index infers lower systematic risk than the market. The intercept, α, is Jensen's alpha, and measures the out- or underperformance relative to the market portfolio.

4.2 The multi-factor models

Despite its qualities, the CAPM has been questioned. For example, Banz (1981) showed that over the period 1936 through 1977, small firms had higher average returns than medium and large size firms, even after adjusting for risk using the CAPM. Furthermore, the CAPM is not able to explain the positive relationship between stock returns and the ratio of book value of equity to market value of equity found by Rosenberg et al. (1985). Instead, value stocks – that is, stocks with high book-to-market ratios – yield higher risk-adjusted returns than growth stocks – that is, stocks with low book-to-market ratios. These findings imply that a single-factor model using only the market beta to explain stock returns can be improved upon by adding additional risk factors.

4.2.1 The Fama-French three-factor model

The characteristics of stock returns and their relationship to the size effect documented by Banz (1981) and the book-to-market effect documented by Rosenberg et al. (1985) have been investigated in a number of studies by Fama and French (1992, 1993, 1996). Fama and French (1993) develop a three-factor model where the market factor used in the CAPM is complemented with a size factor and a value factor – which is based on the book-to-market ratio – in order to better explain the variations in stock returns.

The size factor, which is often called SMB for "small minus big", is defined as the total return difference between a portfolio of small stocks and a portfolio of large stocks. In this paper, the small and big stock portfolios consist of the 10 per cent smallest and 90 per cent largest European stocks. The value factor, which is often called HML for "high minus low", is the total return difference between a portfolio of stocks with high book-to-market ratios and a portfolio of stocks with low book-to-market ratios. In this paper, the value and growth portfolios consist of the 30 per cent highest and the 30 per cent lowest book-to-market stocks, respectively.

Combining the market factor from the CAPM with the size (or SMB) and value (or HML) factors gives the following regression model:

$$r_{i,t} - r_{f,t} = a_i + \beta_{i,MKT} * MKT_t + \beta_{i,SMB} * SMB_t + \beta_{i,HML} * HML_t + \varepsilon_{i,t}$$

where

$r_{i,t} - r_{f,t}$ = The monthly total return of an index, *i*, at time *t*, in excess of the risk-free rate at time *t*.

MKT_t = The monthly total return of the market portfolio at time *t*, in excess of the risk-free rate at time *t*.

SMB_t = The monthly total return difference, at time *t*, between a portfolio of the 10 per cent smallest European stocks and a portfolio of the 90 per cent largest European stocks.

HML_t = The monthly total return difference, at time t, between a portfolio of the 30 per cent highest European book-to-market ratio stocks and a portfolio of the 30 per cent lowest European book-to-market ratio stocks.

$\varepsilon_{i,t}$ = An error term with zero mean that represents the variation not explained by the variables in the regression model.

If the regressions exhibit statistically significant α coefficients – that is, α coefficients significantly different from zero – there is evidence of out- or underperformance of the sin index. If the β coefficients are significantly different from zero the sin indices are significantly exposed to the different factors.

4.2.2 The Fama-French-Carhart four-factor model

In one of their articles on the size and value factors, Fama and French (1996, p. 82) conclude that in addition to explaining the returns of portfolios formed on size and book-to-market, the three-factor model described above is also well-suited to explain various other stock return patterns. However, they admit that their three-factor model does not explain the continuation of short-term returns documented by Jegadeesh and Titman (1993).

Carhart (1997) added a momentum factor to the Fama-French three-factor model when evaluating the performance of mutual funds, and found that much of what appeared to be alphas was in fact explained by an exposure to previous winner stocks. The momentum factor, which is often called MOM, is defined as the total return difference between a portfolio of recent winner stocks and a portfolio of recent loser stocks. In this paper, the winner and loser portfolios consist of the 30 per cent best and worst performing stocks during the most recent year, respectively.

Combining the Fama-French three-factor model with the momentum factor, MOM, gives the following regression model:

$$r_{i,t} - r_{f,t} = a_i + \beta_{i,MKT} * MKT_t + \beta_{i,SMB} * SMB_t + \beta_{i,HML} * HML_t + \beta_{i,MOM} * MOM_t + \varepsilon_{i,t}$$

where

$r_{i,t} - r_{f,t}$ = The monthly total return of an index, i, at time t, in excess of the risk-free rate at time t.

MKT_t = The monthly total return of the market portfolio at time *t*, in excess of the risk-free rate at time *t*.

SMB_t = The monthly total return difference, at time *t*, between a portfolio of the 10 per cent smallest European stocks and a portfolio of the 90 per cent largest European stocks.

HML_t = The monthly total return difference, at time *t*, between a portfolio of the 30 per cent highest European book-to-market ratio stocks and a portfolio of the 30 per cent lowest European book-to-market ratio stocks.

MOM_t = The monthly total return difference, at time *t*, between a portfolio of the 30 per cent best-performing European stocks and a portfolio of the 30 per cent worst performing European stocks during the most recent year.

$\varepsilon_{i,t}$ = An error term with zero mean that represents the variation not explained by the variables in the regression model.

If the regression exhibits statistically significant α coefficients, there is evidence of out- or under-performance of the sin indices. The β coefficients will, if they are significantly different from zero, indicate exposure to market risk as well as the size, value and momentum factors.

4.3 The long-short portfolio approach

When testing the performance of their sin index, Hong and Kacperczyk (2009) construct a portfolio that is long the sin index and short an index of non-sinful stocks with characteristics similar to those of the sin stocks. In this paper, this approach is used to eliminate potential industry-specific characteristics that might otherwise affect the results, while concurrently creating a cash – albeit not necessarily market – neutral portfolio. The long-short portfolio approach requires the choice of reasonable comparable portfolios before the performance of the long-short portfolios can be tested.

4.3.1 Choice of comparable portfolios[11]

Apart from the general criterion that the comparable portfolios have to have characteristics similar to those of the sin indices in order for the tests to actually eliminate industry effects, there are

[11] This section has benefited from statistical support from Jan Eklöf, Associate Professor at the Center for Economic Statistics at the Stockholm School of Economics.

two formal requirements that the comparable portfolios need to fulfil. First, in order for the comparable portfolios to be similar to the sin indices in terms of returns, the total return series of the chosen comparable portfolios have to have among the highest correlations with the total return series of the sin indices.[12]

Second, in order to obtain results that are valid over the entire sample period, the potential total return differences between the sin indices and the comparable portfolios are not allowed to have changed over time. To test whether there is a total return difference change over time, the following regression model is estimated:

$$DIFF_{i,t} = \lambda_0 + \lambda_1 * TIME_t + \varepsilon_{i,t}$$

where

$DIFF_{i,t}$	=	The monthly total return of a long-short portfolio, *i*, at time *t*, calculated as the monthly total return of a value-weighted sin index, net of the monthly total return of the corresponding value-weighted comparable portfolio.
$TIME_t$	=	A monthly time variable.
$\varepsilon_{i,t}$	=	An error term with zero mean that represents the variation not explained by the variables in the regression model.

If the regressions exhibit statistically significant slope coefficients – that is, if the λ_1 coefficients are significantly different from zero – there is a change in the return difference over time, and care must be taken when inferences regarding the entire time period are drawn.

4.3.2 Long-short portfolio performance

Once the most suitable comparable portfolios have been obtained and the long-short portfolios have been tested for changes over time, the performance of said long-short portfolios can be tested. This is done by once again utilizing the CAPM and multi-factor frameworks described above, but this time using the long sin-short comparable portfolios rather than the sin indices as dependent variables. The interpretations of potential statistically significant slope coefficients and significant alphas are, however, still the same.

[12] The correlation is easy to retrieve using a statistical software package like Stata.

4.4 The CUSUM and CUSUM-sq tests[13]

Regression analysis of time-series data normally rests upon an assumption of constancy of the regression relationship over time (Brown et al. 1975, p. 149). However, as the authors note, this assumption might not always hold, and thus it might be useful to test whether the assumption is valid in a particular case.

In order to test the stability of regression relationships, Brown et al. (1975) develop a method that constructs plots of the cumulative sums (CUSUM) and cumulative sums of squares (CUSUM-sq) of the so-called recursive residuals. They show that the recursive residuals are uncorrelated with zero mean and constant variance under the null hypothesis, and employ these results to show how to calculate the CUSUM and CUSUM-sq of the recursive residuals as well as suitable confidence bands for the test.[14] Furthermore, they explain that if the CUSUM or CUSUM-sq curves break the confidence bands in either direction, there is evidence of instability in the regression relationship.[15]

Brown et al. (1975) also indicate another useful way of investigating potential time variation of regression coefficients. By running the studied regression over a segment of the sample period and moving this segment over time, it is possible to retrieve series of regression coefficients, which can then be plotted against time. This method is useful both in itself and as a way to identify the reason for potential inconstancy shown by the CUSUM and CUSUM-sq tests (Brown et al. 1975, p. 155), and is employed in this paper.

[13] This section has benefited from statistical support from Jan Eklöf, Associate Professor at the Center for Economic Statistics at the Stockholm School of Economics.
[14] Their explanation of how the recursive residuals are retrieved as well as their derivation of the CUSUM and CUSUM-sq tests are beyond the scope of this paper. The interested reader is referred to Brown et al. (1975, pp. 150-155).
[15] The CUSUM and CUSUM-sq tests can be performed with the statistical software package Stata, which gives the CUSUM and CUSUM-sq as well as the confidence bands at the 5 per cent significance level.

5 EMPIRICAL RESULTS

5.1 Descriptive statistics

Table 4 reports descriptive statistics for the variables included in the time-series regressions. The mean excess returns are higher for the various sin indices than they are for the market portfolio over the period 1965 through 2011. Especially, TOBACCO yields high mean returns. Over the shorter time period 1991 through 2011 DEFENCE and GAMBLING yield mean returns lower than that of the market. TOBACCO once again yields the highest mean return, and just like over the entire sample period, this higher return is not accompanied by the highest standard deviation, indicating a strong performance.

Table 5 exhibits the evolution of the mean and median market capitalizations. The stocks in the sin index and the different sub-groups, except for gambling, tend to have higher market capitalizations than the market portfolio as a whole. **Table 6** shows the evolution of the mean and median price-to-book ratios. The stocks in the sin index have a mean price-to-book ratio which is slightly lower than that of the market as a whole. The median, however, is higher. The sub-groups all have median price-to-book ratios higher than that of the market, but the alcohol and defence stocks have mean price-to-book ratios below that of the market.

5.2 Factor model regressions

5.2.1 The CAPM

The first model used is the CAPM, which is used to test the performance of the sin portfolio, SINDEX, as well as the four sub-indices, ALCOHOL, DEFENCE, GAMBLING and TOBACCO, over the period 1965 through 2011. The results can be seen in **Table 7**.

SINDEX yields a risk-adjusted abnormal return of some 24 basis points per month, or around 2.9 per cent per year. This number benefits from statistical significance at the ten per cent level. The sub-indices yield alphas of between 7 and 73 basis points per month, but these alphas are – with the exception of TOBACCO, which yields a statistically significant average excess return of 9.1 per cent per year – not significant at conventional significance levels.

The market beta of SINDEX is 0.88, indicating a somewhat lower systematic risk than the market as a whole. For the sub-indices, the market betas span from 0.79, for ALCOHOL, to 1.28, for GAMBLING, indicating that the sub-indices carry different amounts of market risk. All market betas benefit from high statistical significance.

5.2.2 The multi-factor models

The multi-factor models used are the Fama-French three-factor model, which is the CAPM augmented with the Fama-French size and value factors, and the Fama-French-Carhart four-factor model, which is the Fama-French three-factor model augmented with Carhart's momentum factor. These models are used to test the performance of the sin portfolio, SINDEX, as well as the sub-indices, ALCOHOL, DEFENCE, GAMBLING and TOBACCO, over the period when the size, value and momentum factors are available, namely since 1991. The results are exhibited in **Table 8**.

Over the 21 years since 1991, SINDEX yields an average alpha of 38 basis points per month or some 4.7 per cent per year under the CAPM framework. This alpha is also present when the model is augmented by the size factor, and benefits from statistical significance at the five per cent level. Once the value and momentum factors are included, the alpha shrinks – but is still significant in economic terms – and the statistical significance disappears. The market beta of SINDEX hovers around 0.64 irrespective of factor model – indicating that the exposure to systematic risk is somewhat below two thirds of that of the market as a whole – and is highly statistically significant. SINDEX is not exposed to the size factor, SMB, or the momentum factor, MOM, but loads heavily on the value factor, HML, indicating that the stocks in SINDEX exhibit value stock characteristics.

ALCOHOL exhibits characteristics similar to those of SINDEX as a whole. For example, the market beta is similar to that of SINDEX at 0.62, indicating systematic risk exposure similar to that of SINDEX. Also, ALCOHOL is not exposed to the size or momentum factors, but exhibits the same value stock characteristics as SINDEX. A difference compared to SINDEX is that the alpha of ALCOHOL, albeit being of substantial magnitude in economic terms at some 33 basis points per month in the one- and two-factor regressions, is not statistically significant.

DEFENCE is quite dissimilar to SINDEX. It does not offer any significant alphas; in fact, the DEFENCE alphas are negative, although from a statistical viewpoint not significantly different from zero. Furthermore, the market beta of DEFENCE, which is around 1.09 irrespective of factor model, indicates a systematic risk exposure about 70 per cent higher than that of SINDEX. The significant loading on the value factor, however, is something DEFENCE has in common with SINDEX, but whereas SINDEX and ALCOHOL have HML loadings significant even at the one per cent level, the HML loading of DEFENCE is statistically significant only at the ten per cent level.

GAMBLING also exhibits no significant alphas in either of the factor regressions. It has a market beta of around 1.03, indicating a slightly higher systematic risk exposure than the market as a whole, and also systematic risk exposure about 60 per cent higher than that of SINDEX. Contrary to SINDEX and the other sub-indices, GAMBLING does not load on the HML factor, but instead displays small stock characteristics as it is heavily exposed to the size factor, SMB.

Finally, TOBACCO is the sub-index that performs best under the multi-factor framework. Since 1991, TOBACCO yielded an average annualized abnormal return of 13.7 per cent per year for investors adhering to the CAPM, but even in the three- or four-factor models, TOBACCO yielded economically sizeable alphas significant at the five per cent level or better. TOBACCO's beta is around 0.37, which is clearly lower than that of SINDEX and indicates a low exposure to market risk. Furthermore, TOBACCO is somewhat exposed to the size and value factors, but these exposures are not as high as those of some of the other sub-indices. The adjusted R-squared values of the factor regressions are not as high for TOBACCO as they are for the other sin indices, indicating that the single- and multi-factor models do not explain TOBACCO returns as well as they explain the other sin index returns.

5.3 Long-short portfolio results

5.3.1 Choice of comparable portfolios

As previously mentioned, the comparable portfolios are required to have among the highest correlations with the respective sin indices. Thus, a large number of correlations are obtained, and a portfolio which has characteristics similar to, and is highly correlated with, the respective sin indices is chosen as comparable portfolio. The highest correlations are summarized in Panel A of **Table 9**.

The best comparable portfolio for ALCOHOL is Restaurants & Bars. In fact, this portfolio correlates clearly better with ALCOHOL than does Soft Drinks, which is the comparable portfolio Hong and Kacperczyk (2009) use. Furthermore, using Aerospace as comparable portfolio for DEFENCE, as Hong and Kacperczyk (2009) do, is not optimal on the European market since Heavy Construction exhibits a higher correlation.

Once the comparable portfolios are chosen, the long-short portfolios are created by calculating the return difference between the sin indices and the comparable portfolios. In order to test whether this return difference changes over time, the regressions of the long-short portfolios on the monthly time variable are run. The results are shown in Panel B of **Table 9**.

The λ_1 coefficients are not statistically significant at conventional significance levels. These insignificant λ_1 coefficients – and the inability of the monthly time variable to explain the total return difference witnessed by the small adjusted R-squared values – imply that it is possible to draw inferences regarding the performance of the long-short portfolios without worrying about changes in the potential total return differences. Thus, the comparable portfolios can be used with confidence in performance tests.

5.3.2 Performance of long-short portfolios

First, the CAPM is used to test the performance of the long-short portfolios over the entire time period. Thus, the various long-short portfolios are regressed on the market factor. The results are shown in **Table 10**.

The long-short portfolios invested in DEFENCE and GAMBLING yield alphas that are quite substantial in economic terms; for example, the long DEFENCE-short Heavy Construction portfolio yields an average annualized excess return of 2.2 per cent per year. However, these alphas are not statistically significant at conventional significance levels. The long TOBACCO portfolio, however, yields an average monthly alpha of 63 basis points. This corresponds to 7.8 per cent above that of the comparable portfolio Food Products on an annual basis. This alpha benefits from statistical significance at the five per cent level.

Since these are long-short portfolios, they are cash neutral, but as witnessed by the market betas, they are not necessarily market neutral. The betas of the long DEFENCE and TOBACCO portfolios are not significantly different from zero, whereas the long ALCOHOL portfolio has a significantly negative market beta, indicating a negative exposure to the market and countercyclical returns.

Second, the multi-factor model is used to test the performance of the long-short portfolios over the time period since 1991. The various long-short portfolios are regressed on the market, size, value and momentum factors, and the results are shown in **Table 11**.

The various long-short portfolios yield different results. Compared to Restaurants & Bars, ALCOHOL yields economically but not statistically significant alphas. The long ALCOHOL-short Restaurants & Bars portfolio is negatively exposed to the market, indicating counter cyclicality. Also, it does not load on the size and value factors, and is only slightly exposed to the momentum factor.

DEFENCE does not outperform Heavy Construction. Instead, the long DEFENCE-short Heavy Construction portfolio exhibits slightly negative but statistically insignificant alphas under all factor models. The long DEFENCE portfolio exhibits market betas very close to zero, implying that it is both cash and market neutral. The portfolio is negatively exposed to the size factor at the five per cent significance level. The long GAMBLING-short Hotels portfolio also exhibits small and not very significant market betas, but no statistically significant alphas. Also, it is significantly negatively exposed to the value factor.

TOBACCO outperforms its comparable portfolio, as witnessed by the significant positive alphas offered by the long TOBACCO-short Food Products portfolio in all multi-factor regressions. For example, TOBACCO yields an average annualized alpha of 14.3 per cent in excess of Food Products for investors adhering to a four-factor framework. Furthermore, the portfolio exhibits significant negative market betas of around –0.24, indicating that the long TOBACCO portfolio is countercyclical. The long TOBACCO portfolio is not significantly exposed to any of the size, value and momentum factors.

5.4 The CUSUM and CUSUM-sq test results

Over the time period 1965 through 2011 the market beta of SINDEX is 0.88, whereas it is 0.64 over the period since 1991. Furthermore, out of the four sub-indices, three exhibit lower market betas during the more recent time period.[16] These changes imply that the implicit assumption of constant regression relationships might not hold for SINDEX and the sub-indices, and thus the CUSUM and CUSUM-sq tests are performed for all indices. The significance level is 5 per cent.

For the CAPM regression of SINDEX against the market portfolio, the results are displayed in **Figure 2**. In Panel A, the CUSUM-sq line breaks the lower confidence band, implying instability in the regression relationship over time. Running regressions over 120 and 240 months – that is, ten and twenty years – at a time, moving the regression window one month at a time and plotting the resulting alphas and market betas against time gives the graphs in Panel B. It seems that both the alpha and the market beta have changed over time; the alpha seems to have increased whereas the market beta seems to have declined.

The results for ALCOHOL are exhibited in **Figure 3**. The CUSUM-sq graph in Panel A indicates that the relationship between ALCOHOL and the market is not constant over time since the CUSUM-sq line breaks the lower confidence band. Once again rolling the ten- and

[16] The market beta of ALCOHOL has decreased from 0.79 to 0.61, that of GAMBLING has decreased from 1.28 to 0.98, and the market beta of TOBACCO has decreased from 0.84 to 0.40. The market beta of DEFENCE has increased somewhat, from 1.06 to 1.09.

twenty-year regressions one month at a time indicates that the ALCOHOL alpha has increased whereas its exposure to the market has decreased over the sample period. The CUSUM-sq plot for DEFENCE, exhibited in Panel A of **Figure 4**, also exhibits a departure from constancy in the form of a CUSUM-sq curve that breaks through the upper confidence band quite significantly. The parameters from the moving regressions, shown in Panel B, indicate that the market beta has not changed; instead, the alpha has declined.

Performing the test for GAMBLING, exhibited in Panel A of **Figure 5**, also yields a CUSUM-sq line that crosses the upper confidence band, indicating inconstancy in the regression relationship for GAMBLING as well. The plot of the alphas and market betas retrieved from the moving regressions, shown in Panel B, indicate a decrease in market beta, from values close to two to values slightly below one. The alpha has fluctuated, but has hovered around zero.

For TOBACCO, neither the CUSUM nor the CUSUM-sq line crosses the confidence bands, as witnessed by Panel A in **Figure 6**. However, the CUSUM-sq is close to the lower confidence band during much of the period. For completeness, moving regressions are run and the alphas and market betas are plotted in Panel B. The graph indicates that the market beta of TOBACCO has decreased substantially, from above one to below 0.50. Furthermore, the alpha has been positive over most of the time period, and it has also shown a quite substantial upward trend.

5.5 Robustness tests[17]

A number of robustness tests are considered. First, the parameters used in all regression models – that is, the risk-free rate and the market portfolio – are changed. Since a combination of risk-free rates is used, one of which is not market-based, the CAPM and multi-factor regressions are run using a number of different risk-free rates. The results remain virtually unchanged, even when an American market-based risk-free rate is allowed to replace the United Kingdom central bank base rate. Also, since a market portfolio created for the purpose of this study rather than some common market index is used in this paper, the CAPM and multi-factor regressions are run using some other market proxies. Neither the regression coefficients nor their significance levels exhibit any sizeable deviations from those reported in this paper when the MSCI Europe and FTSE Europe indices or Kenneth French's market portfolio are used.

Second, even though the OLS regression method assumes homoscedasticity – that is, constant variance of the error terms – there might be problems with heteroskedasticity. To ascertain that

[17] For brevity, not all robustness test results are displayed in this paper. All the results described in this section are, however, available from the authors.

this issue does not affect the regression results, all regression relationships are tested for heteroskedasticity using the Breusch-Pagan and White tests. If either of the tests indicates heteroskedasticity, the regressions are re-estimated using Huber-White standard errors. Applying these heteroskedasticity-consistent standard errors does not change the main results of the paper.

Third, the results from the CAPM and multi-factor regressions indicate that SINDEX' outperformance is heavily dependent on the tobacco index. Thus, in order to test whether the regression results are robust to the exclusion of the tobacco index, CAPM and multi-factor regressions of a sin index excluding tobacco are estimated. The results are displayed in **Table 12**. Panel A shows that, once tobacco stocks are excluded from the sin index, the alpha is only 9 basis points per month, which represents a drop of 15 basis points compared to SINDEX (which includes tobacco stocks). In addition, the alpha no longer benefits from statistical significance.

Panel B of **Table 12** exhibits the multi-factor results over the time period 1991 through 2011, which point in the same direction. Compared to SINDEX, the sin index excluding tobacco stocks yields a 20 basis points lower alpha under the one- and two-factor models. Also, these alphas are – as opposed to the SINDEX alphas – not statistically significant at conventional levels. Another major difference is that whereas SINDEX is not exposed to the size factor, SMB, the sin index excluding tobacco stocks is slightly exposed to the size factor.

Finally, to further test the robustness of the methodology employed in this paper, the comparable portfolio approach is revisited using some additional comparable portfolios.[18] These are chosen on the basis of the same criteria as mentioned above, and the results indicate that the performance of the sin indices is quite sensitive to what comparable portfolio is chosen. The exception is TOBACCO, which outperforms Restaurants & Bars as well.

In reference to earlier work by Hong and Kacperczyk (2009), who also use comparable portfolio testing, the performance of ALCOHOL and DEFENCE is tested against Soft Drinks and Aerospace, respectively. Contrary to what Hong and Kacperczyk found in the United States, Aerospace outperforms DEFENCE in Europe. This outperformance is even statistically significant over the time period 1991 through 2011, where the alpha of the long DEFENCE-short Aerospace portfolio is a negative 0.74 basis points per month under the four-factor framework. ALCOHOL, which does not manage to outperform Restaurants & Bars, yields economically but not statistically significant alphas when compared to Soft Drinks.

[18] These additional comparable portfolios are Soft Drinks for ALCOHOL, Aerospace for DEFENCE, Restaurants & Bars for GAMBLING and Restaurants & Bars for TOBACCO.

6 DISCUSSION

This paper aims to clarify whether unethical investing outperforms conventional investing in Europe. Thus, the performance of a number of sin indices is first tested using the CAPM. At first glance, sin stocks seem to outperform the market as a whole over the time period 1965 through 2011, as witnessed by an average monthly alpha of 24 basis points benefiting from statistical significance at the ten per cent level. However, separating SINDEX into the four sub-indices shows that even though they yield alphas that are positive, only the TOBACCO alpha is significantly different from zero. These results raise the question of whether there actually is an immorality premium, or if the entire effect is attributable solely to TOBACCO.

The multi-factor regressions, which are run over the time period 1991 through 2011, show that SINDEX yields an average monthly alpha of 38 basis points, statistically significant at the five per cent level, under a one-factor framework. However, studying the one-factor regressions of the sub-indices shows that the alphas are not present in all the sub-indices; instead, it is once again only TOBACCO that exhibits statistically significant alphas, lending support to the concern that the seeming immorality premium pertains exclusively to TOBACCO. This result is supported by the robustness test where tobacco stocks are excluded from the sin index, which showed that the sin index excluding tobacco stocks does not yield statistically significant alphas.

Once the value factor, HML, is included, the SINDEX alpha vanishes; what appeared to be an alpha under the CAPM and two-factor model is actually exposure to the value factor. The same value factor exposure can be seen for ALCOHOL and TOBACCO, and to some extent for DEFENCE, which implies that these indices exhibit value stock characteristics. Nevertheless, as was seen in **Table 6**, the sample of sin stocks tends to have price-to-book ratios about as high as – or even higher than – the market as a whole, which is not consistent with the value stock exposure.[19]

However, as Fama and French (1993, pp. 4-5) note, the size and value factors are empirically observed proxies for other, unknown, common risk factors. Thus, stocks that are exposed to the same underlying risk factors can be exposed to the size and value factors without actually exhibiting the proxy factor, in this case a high book-to-market ratio.

A potential explanation for the value factor exposure is that value stocks are, in general, stable in terms of their cash flows, and also offer high and stable dividend pay-out ratios. The same thing can be said about the sin stocks in this paper, which, due to the addictive nature of their prod-

[19] Having a high price-to-book ratio is the same as having a low book-to-market ratio, as the price-to-book ratio and the book-to-market ratios are inversely related.

ucts, have stable earnings. Also, as witnessed by their market betas, they do not fluctuate as much over the business cycle as the market as a whole. Thus, even though sin stocks do not exhibit the value factor characteristic per se – that is, a high book-to-market ratio – they do have characteristics similar to those of other value stocks and thus load heavily on the HML factor.

GAMBLING loads heavily on the size factor, SMB, implying that the size factor is useful in explaining GAMBLING returns. This result contrasts the result from SINDEX as a whole, and is probably due to the characteristics of the gambling industry. The gambling industry is a small, fast-growing and largely Internet-based industry with low entry barriers, where new companies appear all the time. Thus, gambling companies are, in general, small and their stocks load positively on the size factor. The tobacco industry, on the other hand, is characterized by high legislative entry barriers and economies of scale, implying that the firms are able to grow, and thus loads heavily negatively on the size factor.

Since the CAPM and multi-factor regressions indicate that the seeming immorality premium pertains to only TOBACCO, the performance of the sub-indices is tested against comparable portfolios to investigate whether they are at least able to outperform their industry counterparts. Once again, the pattern showing that only TOBACCO displays superior performance can be seen. Furthermore, since the performance of the various sub-indices is quite sensitive to changes in what comparable industry is used, the spurious alphas seen in some of the tests cannot be relied upon – once again TOBACCO is the only sub-index which consistently manages to offer superior returns.

This finding – that is, that there seems to be a small immorality premium, which however pertains to TOBACCO exclusively – is not contradictory to the findings of Lobe and Walkshäusl (2011). Even though they do not find even moderately significant alphas under either their single- or multi-factor frameworks, this might well be due to their wide sin stock definition. By including the four industries used in this paper as well as adult entertainment and nuclear power, they enlarge their sample by including stocks that are neglected by institutional investors to a lesser extent, and thus cannot expect to find as sizeable alphas. However, it is likely that they would have found a slight alpha had they used a narrower sin stock definition.[20]

Salaber (2009a) finds more significant results than those that the sample used in this paper yield over the same time period.[21] Although there are slight differences with regard to the countries

[20] Running the basic CAPM regression with the sample used in this paper over the time period studied by Lobe and Walkshäusl (2011) gives an alpha of 49 basis points per month, significant at the five per cent level, stemming solely from TOBACCO.
[21] The basic CAPM regression yields an alpha of 23 basis points, which is, however, not statistically significant at conventional levels.

and industries used – for example, Salaber (2009a) does not include the badly performing defence industry – the only plausible explanation for the sizeable difference is related to the number of dead stocks included. In this paper, roughly 57 per cent of the sin stocks have died or been delisted, whereas the corresponding number in Salaber's (2009a) paper is only 22 per cent. Thus, it is possible that her results are exaggerated by a slight survivorship bias. Also, since there are, apart from the difference in the number of dead or delisted stocks, no major data differences between her study and this paper, it is possible that the sin effect she documents is actually due to only tobacco stocks, implying that, for her too, the results are not as clear as they seem at first glance.

Despite the disappointing performance of both SINDEX and most sub-indices in the single- and multi-factor frameworks, the immorality premium is offered one last chance to redress; there might be a change over time. As Hong and Kacperczyk (2009) hypothesize, there might be a societal norm against funding sinful operations. In line with this hypothesis, Hong and Kacperczyk (2009) find that norm-constrained investors like pension funds hold sin stocks to a lesser extent as a result of the societal norm, and also that analysts focus less on sin stocks.

Extending Hong and Kacperczyk's (2009) reasoning, it is probable that the societal norm against unethical investing can be found in Europe as well. In light of the increased focus on SRI and ethical investing which emerged in the 1980s, it is also likely that this societal norm has grown stronger over time. Moreover, Eurosif (2010) states that exclusionary screens – that is, screens that exclude stocks based on one or two criteria – are common in Europe, implying that excluding the very stocks studied in this paper is common. Thus, it is likely that European sin stocks are neglected by large investor groups, just as they are in the United States.

Neglect of certain stocks and the effect such neglect has on stock returns has been investigated empirically by, inter alia, Arbel et al. (1983), who find that securities not suited to the requirements of institutional investors attract minimal coverage by analysts, resulting in a premium as compensation for pricing inefficiencies and lack of information.[22] Consistent with the finding of Arbel et al. (1983), Merton (1987) theoretically shows that neglected firms are expected to earn higher returns as compensation for risk related to limited information – neglect depresses the stock prices relative to their fundamental values, leading to higher returns.

This neglect effect – that is, that stock prices are depressed relative to their fundamental values – implies that the CAPM no longer holds (Merton 1987). Thus, not only systematic risk is relevant for pricing. For sin stocks, this means that other risk factors such as litigation risk – that is, the

[22] Even though Arbel et al. (1983) study small stocks, their results can be applied more broadly to neglected stocks.

risk of facing lawsuits and prohibitive legislation – is also relevant for pricing (Hong and Kacperczyk 2009). This relevant idiosyncratic risk results in higher returns that are not well explained by conventional asset pricing models, which mainly consider systematic risk.

An increased neglect of sin stocks in Europe consistent with the increased focus on SRI is plausible. Thus, there might be something to the hypothesis that the SINDEX alpha – albeit not significant over the entire sample period – can at least exhibit an increase over time. In fact, the single-factor alpha found in this paper is more substantial during the post-1991 period than over the entire sample period, and the statistical significance is higher. The post-1991 regressions also display a lower market exposure, further indicating a change in the regression relationship.

Testing whether the basic SINDEX CAPM regression relationship is constant over time using the CUSUM and CUSUM-sq tests shows that the regression relationship does indeed exhibit instability over time, and the moving regressions further indicate that the alpha trends upwards over time whereas the market beta trends downwards. However, performing the CUSUM and CUSUM-sq tests as well as running the moving regressions for the various sub-index CAPM regressions reveals that, once again, the picture is not that clear.

The upward trend in alpha exhibited by SINDEX, together with the downward trending market beta, are present for both ALCOHOL and TOBACCO. The downward trend in market beta can also be seen for GAMBLING, which, however, does not exhibit any change in alpha over time. DEFENCE exhibits a quite stable market beta; instead, the alpha seems to have decreased substantially over the sample period.

The increased alpha exhibited by SINDEX indicates that the returns to unethical investing have increased over time, consistent with the neglect effect hypothesis. Furthermore, it is evident from the change of the market beta that this increase in alpha has not come at the cost of a higher systematic risk; rather, the exposure to market risk has declined over time. However, only two out of the four sub-indices exhibit alphas that trend upwards over time, and the clear trend exhibited by SINDEX is in fact the TOBACCO alpha augmented with the upward trending ALCOHOL alpha.[23] Since an alpha is not present in all four sub-indices, the presence of an immorality premium is once again questioned.

[23] These sub-indices constitute between 70 and 98 per cent of SINDEX over the sample period, as displayed in **Figure 1**.

7 Conclusion

Although recent research has shown that unethical investing outperforms conventional investing in the United States and Asia over a broad number of sinful industries, the issue has been less clear in Europe. One previous study has indicated that unethical investing outperforms conventional investing, whereas the other indicates that it does not. Using a number of tests and different time periods, this paper shows that the slight premium found in Europe is attributable solely to the tobacco industry – while it is still possible that some sins do bear their privilege on earth, this is not true for investing in unethical stocks in Europe, where there is no immorality premium.

The returns to unethical investing in the United States are often attributed to the neglect effect hypothesis. This hypothesis states that institutional investors and analysts tend to neglect sin stocks on behalf of the general public, which is not interested in funding sinful businesses. This neglect, in turn, leads to pricing inefficiencies and higher information risk. Inherent in this neglect effect hypothesis is an assumption of limits to arbitrage, or else arbitrageurs would quickly exploit the mispricing of the neglected stocks.

Contrasting the findings in this paper to those in the United States, one potential explanation for the difference is that sin stocks are not neglected to such a large extent in Europe as they are in the United States. Consequently, studying the extent to which institutions hold sin stocks in Europe could be an interesting future research field helping to explain the difference in sin stock performance. Another conceivable explanation is that the limits to arbitrage are less severe in Europe, meaning that sin stocks are mispriced to a lesser extent in Europe than they are in United States. Thus, studying if the limits to arbitrage hypothesis can help in explaining the difference between Europe and the United States might offer interesting results relating to the functioning of capital markets around the world.

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APPENDIX A

As described by Ince and Porter (2006), Thomson Datastream (Datastream) is known to provide somewhat erroneous data. Particularly, there might be errors when it comes to classification, broad market coverage and handling small and delisted stocks (Ince and Porter 2006, p. 464). However, they state that excluding non-common equity and correcting errors in the data significantly improves time-series properties of the data. In this study, what Ince and Porter (2006, pp. 477-479) refer to as level 1 screening, augmented by some of the methods suggested in the level 2 screening as well as some methods developed by Schmidt et al. (2011), is undertaken in order to mitigate the errors in Datastream data and improve the validity of the results.

Data on all available financial instruments from the 20 countries in the sample is downloaded from Datastream. In order to avoid issues of survivorship bias – which, according to Brown et al. (1992), can be severe in performance studies – dead and delisted instruments are included in the sample, giving a total of 52 469 instruments. Unwanted instruments such as warrants, exchange-traded funds and preference shares are excluded on the basis of static variables, and only major securities trading on their domestic markets are included.[24] After these initial screens, the sample consists of 20 488 stocks. Stocks missing any of the variables used in this study are excluded. Thus, stocks without records in industry or sector classification, total return index, price-to-book ratio, market capitalization, dividend yield or adjusted price are excluded, giving a sample of 16 350 stocks.

The 16 350 stocks are further screened on the basis of both static and dynamic variables. 57 stocks for which the base date and the end date are the same, implying they are introduced and delisted on the same day, are excluded.[25] Stocks with names including "GDR", "PF", "PREF", "PRF" or "REIT" are excluded, since there are concerns that these are not common equities, global depositary receipts, preference shares or real estate investment trusts (Schmidt et al. 2011, p. 30; Ince and Porter 2006, p. 471). This screen identifies 25 stocks.[26]

When it comes to dynamic variables, 1 099 stocks with prices below 0.1 units of domestic currency are excluded due to potential rounding errors caused by Datastream (Ince and Porter 2006, p. 473). Likewise, six stocks with prices exceeding 1 000 000 units of domestic currency are excluded due to potential rounding errors (Schmidt et al. 2011, p. 30). Schmidt et al. (2011, p. 8)

[24] The Datastream static variable mnemonics and statuses are TYPE="EQ", MAJOR="Y", ISINID="P" and GEOGN="COUNTRY", where COUNTRY is replaced by the 20 countries in the sample.
[25] In Datastream, these stocks have the same date in the static BDATE and TIME variables.
[26] Stocks with names including "ADP", "CIP", "GSH", "RSP", "VVPR", "AFV", "CERTIFICATES", "RESPT", "SBVTG", "VCT", "DUPLICATE", "DUPL" or "DUAL PURP" are also excluded for various reasons, some of which are country-specific.

note that wrongly positioned decimal points in Datastream is a likely cause of some erroneous dividend yields, and thus exclude stocks with dividend yields above 50 per cent of the adjusted price. Applying the same approach in this paper removes 301 stocks from the sample. Following Schmidt et al. (2011, p. 30), stocks with yearly returns above 890 per cent are excluded. This screen identifies 264 stocks. Finally, on the basis of the total return index all zero returns from the last non-zero observation to the end of the period are deleted.[27]

Once these screens have been performed, a list of 14 717 out of the initial 52 469 stocks remains.[28] This list of stocks constitutes the entire European equity market in this study, and also the market portfolio used in the performance tests.

[27] This screen is used because Datastream reports the return as zero when a stock is dead or delisted, which biases the results.
[28] Note that all the screens were performed on the list of 16 350 stocks. Thus, the numbers do not add up, since some stocks are excluded on the basis of more than one of the screening methods.

APPENDIX B

In order to ascertain that the market portfolio created in this paper is as reliable a representation of the true market as common market indices, its performance in terms of a number of measures is compared to that of some broad market indices. The comparison is shown in **Table B1**.

Panel A reports the overall performance of the market portfolio, MARKET, and compares it to that of three common and widely used market indices – MSCI Europe, FTSE Europe and Kenneth French's market portfolio – over the time period 1994 through 2011.[29] As evidenced by the table, MARKET is similar to the various market indices in terms of risk, measured by the standard deviation, and return. Furthermore, the extent to which MARKET is similar to the various market indices is in agreement with corresponding comparisons (Schmidt et al. 2011).

Panel B reports the correlations between MARKET and the various market indices. Since Schmidt et al. (2011) and Ince and Porter (2006) find correlations similar to those reported in Panel B, the notion that MARKET is as good a representation of the true market is supported. It is evident that MARKET's correlation is highest with Kenneth French's market index, which is most likely because these indices have a broader market coverage than the MSCI and FTSE market indices. Also, since Kenneth French's size, value and momentum factors are used for performance tests, it is reassuring that his market index best resembles the one created in this study.

Panel C, finally, displays a comparison of MARKET and the MSCI Europe index over the time periods 1970 through 1979 and 1980 through 2011. During the latter period, the indices are similar in terms of risk and return, and the correlation is 0.9870, which is in line with what was obtained in Panel B. During the former period, however, the difference is quite big, and the correlation is only 0.9240, which is low compared to what was obtained in Panel B. Furthermore, there are differences when it comes to risk and return over this time period.

This difference might be the effect of incomplete market coverage in Datastream, especially with regard to dead and delisted stocks. This is a general problem with Datastream investigated by Ince and Porter (2006). If this is the case, a resulting potential survivorship bias might be the explanation for the higher returns yielded by MARKET. Although this might be a cause for concern, the authors of this paper see no reason to believe that this problem should be more pronounced for the market as a whole than for the sample of sin stocks, or vice versa. Thus, as long as the market is used to compare the performance of a sample of stocks which suffer from the same potential problem, it should have negligible effects on the results.

[29] The time period is limited by the FTSE index, which was introduced in 1994.

Table B1: Market portfolio comparison

The table describes the comparison between the market portfolio created in this study, MARKET, and a number of widely used market indices. Panel A reports descriptive statistics. The numbers are the percentage monthly returns and standard deviations for the various market indices over the time period 1994 through 2011. Panel B reports the correlations between the various market indices, likewise over the time period 1994 through 2011. Panel C shows a comparison of the market portfolio created in this study, MARKET, and the MSCI Europe market index, divided into the sub-periods 1970-1979 and 1980-2011. The numbers are the percentage monthly returns and standard deviations as well as the correlations.

Market index	**Mean**	**Standard Deviation**	**Min**	**Max**
MARKET	0.60	4.52	-13.26	13.91
MSCI Europe	0.61	4.75	-13.82	14.41
FTSE Europe	0.62	4.75	-14.24	14.76
French's market	0.62	4.62	-13.68	14.02

Panel A: Descriptive statistics (1994-2011)

Market index	**MARKET**	**MSCI Europe**	**FTSE Europe**	**French's market**
MARKET	1.0000			
MSCI Europe	0.9882	1.0000		
FTSE Europe	0.9882	0.9988	1.0000	
French's market	0.9919	0.9920	0.9918	1.0000

Panel B: Correlations (1994-2011)

1970-1979

Market index	**Mean**	**Standard Deviation**	**Min**	**Max**	**Correlation**
MARKET	1.01	4.59	-12.53	22.58	0.9240
MSCI Europe	0.82	4.11	-11.65	22.12	

1980-2011

Market index	**Mean**	**Standard Deviation**	**Min**	**Max**	**Correlation**
MARKET	0.97	4.45	-23.30	13.91	0.9870
MSCI Europe	0.98	4.68	-23.38	14.41	

Panel C: Comparison of MARKET and MSCI Europe (1970-1979 and 1980-2011)

Table 1: Previous research

The table describes the previous research on unethical investing. The sample size refers to the total number of studied sin stocks. The main results columns exhibit the percentage monthly alphas under the CAPM and multi-factor frameworks. The stars *, ** and *** denote statistical significance at the 10%, 5% and 1% significance levels, respectively.

Author	Region	Period	Sample size	Weighting	Performance measure	Main results (%)	
						CAPM	Multi-factor
Fabozzi et al. (2006)	21 countries	1970-2007	267	Equal	Jensen's alpha	0.96***	N.A.
Hong & Kacperczyk (2009)	The U.S.	1926-2006	193	Equal	Jensen's alpha	0.30**	0.31**
Liston & Soydemir (2010)	The U.S.	2001-2007	N.A.	Equal	Jensen's alpha (Sharpe ratio)	0.66***	0.57***
Lobe & Walkshäusl (2011)	51 countries (22 European)	1995-2007	755	Value	Jensen's alpha (Sharpe ratio)	0.18 (0.18)	0.13 (-0.20)
Salaber (2009a)	18 European countries	1975-2006	158	Value	Jensen's alpha	0.33*	0.30
Salaber (2009b)	The U.S.	1926-2005	183	Equal	Jensen's alpha	N.A.	0.30***
Statman & Glushkov (2008)	The U.S.	1992-2007	198	Equal (Value)	Jensen's alpha	0.27**	0.19
Visaltanachoti et al. (2009)	China Hong Kong	1995-2007	46	N.A.	Jensen's alpha	0.50*** 2.43***	N.A.

Table 2: Sin stock definitions used in previous research

The table shows which industries authors studying unethical investing have chosen to include in their samples of sin stocks. Parentheses indicate that the industry has been included in robustness tests.

Author	Adult Entertainment	Alcohol	Biotech	Defence/ Weapons	Gambling	Nuclear Power	Tobacco
Fabozzi et al. (2006)	X	X	X	X	X		X
Hong & Kacperczyk (2009)		X		(X)	X		X
Liston & Soydemir (2010)		X			X		X
Lobe & Walkshäusl (2011)	X	X		X	X	X	X
Salaber (2009a)		X			X		X
Salaber (2009b)		X			X		X
Statman & Glushkov (2008)		X		X	X	X	X
Visaltanachoti et al. (2009)		X			X		X

Table 3: Evolution of the number of stocks in the sample

The table reports the evolution of the number of sin stocks in the sample on the last trading day of the year on a semi-annual basis. The number of sin stocks is reported in total and broken down into the sub-groups alcohol, defence, gambling and tobacco. The evolution of the number of stocks in the market portfolio is also exhibited. Dead stocks are stocks that defaulted, merged or were delisted.

	Total sin		Alcohol		Defence		Gambling		Tobacco		Market	
Year	**Active**	**Dead**	**Active**	**Dead**	**Active**	**Dead**	**Active**	**Dead**	**Active**	**Dead**	**Active**	**Dead**
1965	18	0	14	0	1	0	1	0	2	0	441	0
1967	19	0	14	0	1	0	2	0	2	0	463	0
1969	24	0	16	0	3	0	3	0	2	0	980	0
1971	25	0	17	0	3	0	3	0	2	0	1 045	0
1973	54	0	40	0	5	0	3	0	6	0	1 816	0
1975	58	0	43	0	6	0	3	0	6	0	1 889	0
1977	58	1	44	0	6	0	3	0	5	1	1 922	3
1979	59	1	45	0	6	0	3	0	5	1	1 968	8
1981	63	1	48	0	7	0	3	0	5	1	2 115	17
1983	66	1	51	0	7	0	3	0	5	1	2 319	18
1985	66	5	50	4	7	0	4	0	5	1	2 650	136
1987	74	9	56	7	8	0	5	0	5	2	3 207	371
1989	122	18	96	13	8	0	10	0	8	5	4 388	701
1991	126	23	99	18	8	0	11	0	8	5	4 607	1 172
1993	123	32	93	27	8	0	12	0	10	5	4 632	1 592
1995	128	38	97	30	7	1	15	0	9	7	4 948	2 008
1997	131	53	92	43	9	1	20	0	10	9	5 426	2 599
1999	135	67	94	53	9	2	23	2	9	10	5 896	3 402
2001	141	78	91	63	9	2	31	3	10	10	6 222	4 265
2003	123	101	76	80	8	3	30	7	9	11	5 787	5 168
2005	135	114	74	90	10	4	44	7	7	13	6 232	5 852
2007	135	138	71	97	13	5	45	21	6	15	6 888	6 684
2009	128	147	69	100	13	5	41	26	5	16	6 440	7 615
2011	123	162	62	109	13	7	44	29	4	17	6 226	8 491
Total	**285**		**171**		**20**		**73**		**21**		**14 717**	

Table 4: Summary statistics for time-series regression variables

The table reports summary statistics for the variables used in the time-series regressions. Panel A describes the dependent variables used in the CAPM regressions for the time period 1965 through 2011. Panel B shows the dependent variables used in the multi-factor regressions for the time period 1991 through 2011. All variables in Panel A and B are the monthly returns of the respective sin indices in excess of the risk-free rate. Panel C reports the independent factor variables used in the CAPM and multi-factor regressions. MKT is the return of the market portfolio in excess of the risk-free rate, whereas SMB, HML and MOM are the size, value and momentum factors used in the multi-factor regressions. Panel D shows the long-short portfolios used in the CAPM regressions for the time period 1965 through 2011. Panel E describes the long-short portfolios used in the multi-factor regressions over the time period 1991 through 2011. All returns and standard deviations are monthly percentage numbers.

Variable	Mean	Standard Deviation	No. of obs.
SINDEX	0.73	4.90	564
ALCOHOL	0.63	4.73	564
DEFENCE	0.74	8.37	564
GAMBLING	0.79	8.49	564
TOBACCO	1.20	6.89	564

Panel A: Dependent variables used in CAPM regressions (1965-2011)

Variable	Mean	Standard Deviation	No. of obs.
SINDEX	0.63	4.06	252
ALCOHOL	0.56	4.32	252
DEFENCE	0.30	7.00	252
GAMBLING	0.23	6.41	252
TOBACCO	1.23	5.97	252

Panel B: Dependent variables used in multi-factor regressions (1991-2011)

Variable	Mean	Standard Deviation	No. of obs.
MKT (1965-2011)	0.57	4.46	564
MKT	0.38	4.43	252
SMB	-0.08	2.36	252
HML	0.42	2.44	252
MOM	0.94	4.24	252

Panel C: Independent variables used in CAPM and multi-factor regressions (1991-2011)

Variable	Mean	Standard Deviation	No. of obs.
ALCOHOL – Restaurants & Bars	0.08	4.60	564
DEFENCE – Heavy Construction	0.18	7.33	564
GAMBLING – Hotels	0.18	6.30	564
TOBACCO – Food Products	0.63	6.22	564

Panel D: Long-short portfolio variables from CAPM regressions (1965-2011)

Variable	Mean	Standard Deviation	No. of obs.
ALCOHOL – Restaurants & Bars	0.09	4.35	252
DEFENCE – Heavy Construction	-0.08	5.75	252
GAMBLING – Hotels	-0.03	4.78	252
TOBACCO – Food Products	0.93	7.09	252

Panel E: Long-short portfolio variables from multi-factor regressions (1991-2011)

Table 5: Market capitalization of the stocks in the sample

The table exhibits the evolution of the mean and median market capitalization, reported in millions of European Currency Units (ECU) or Euro on the last trading day of the year, for the sin stocks in the sample. The market capitalization is reported for the total sample of sin stocks as well as the sub-groups alcohol, defence, gambling and tobacco. The evolution of the market capitalization of the market portfolio is also exhibited.

	Total sin		Alcohol		Defence		Gambling		Tobacco		Market	
Year	**Mean**	**Median**	**Mean**	**Median**	**Mean**	**Median**	**Mean**	**Median**	**Mean**	**Median**	**Mean**	**Median**
1965	139	18	92	14	15	15	40	40	582	582	53	11
1967	144	16	90	13	16	16	30	30	702	702	56	11
1969	142	10	94	10	5	2	49	6	871	871	37	3
1971	182	14	130	14	10	5	75	34	1 042	1 042	49	5
1973	120	18	113	21	27	10	60	41	275	13	76	8
1975	107	19	95	25	36	6	38	54	299	9	79	7
1977	122	30	101	35	31	11	225	139	322	10	93	10
1979	120	28	95	29	105	24	188	99	292	12	107	13
1981	148	35	92	32	172	37	287	288	476	20	137	16
1983	262	46	177	42	208	56	368	491	1 003	26	189	24
1985	447	65	280	59	564	136	633	586	1 695	35	281	32
1987	497	74	307	55	499	129	749	217	2 001	136	275	41
1989	603	54	332	48	629	125	693	98	2 793	30	349	51
1991	625	60	521	52	561	73	634	92	1 567	59	339	43
1993	885	71	548	64	770	139	685	150	3 888	100	467	50
1995	807	72	504	57	883	127	580	114	3 498	249	459	49
1997	1 085	81	756	66	1 654	198	591	93	3 677	879	735	62
1999	1 043	107	759	62	2 709	177	539	184	3 357	2 556	1 182	73
2001	1 323	89	1 079	54	3 097	192	463	86	4 660	3 554	1 010	53
2003	1 275	111	1 033	69	1 814	204	572	118	5 399	3 992	844	46
2005	1 818	107	1 449	82	2 787	201	965	129	8 983	5 046	1 049	54
2007	2 031	94	1 904	79	2 881	107	539	73	11 575	4 988	1 122	57
2009	1 797	78	1 954	62	2 009	94	341	50	9 778	3 844	809	37
2011	2 169	84	2 551	78	1 211	97	301	53	15 580	5 390	789	36
Average	**746**	**58**	**627**	**47**	**945**	**91**	**402**	**136**	**3 513**	**1 423**	**441**	**33**

Table 6: Price-to-book ratio of the stocks in the sample

The table shows the evolution of the mean and median price-to-book ratio, measured on the last trading day of the year, for the sin stocks in the sample. The price-to-book ratio is reported for the total sample of sin stocks as well as the sub-groups alcohol, defence, gambling and tobacco. The evolution of the price-to-book ratio of the market portfolio is also exhibited. The price-to-book ratio is available only since 1980.

	Total sin		**Alcohol**		**Defence**		**Gambling**		**Tobacco**		**Market**	
Year	**Mean**	**Median**	**Mean**	**Median**	**Mean**	**Median**	**Mean**	**Median**	**Mean**	**Median**	**Mean**	**Median**
1980	0.72	0.62	0.71	0.62	0.82	0.82	0.75	0.75	0.59	0.59	1.47	0.79
1981	0.68	0.59	0.71	0.58	0.56	0.58	0.80	0.80	0.61	0.61	1.46	0.75
1982	0.77	0.83	1.02	0.83	0.16	0.47	0.76	0.76	0.89	0.89	1.51	0.88
1983	1.00	1.01	1.43	1.34	-0.48	0.60	1.05	1.05	0.94	0.94	1.82	1.14
1984	1.74	1.49	1.73	1.52	2.31	2.05	1.38	1.38	1.04	1.04	2.27	1.25
1985	2.20	1.89	2.33	2.24	2.50	1.75	1.63	1.68	1.27	1.27	2.34	1.58
1986	2.24	1.99	2.44	2.24	2.00	1.84	1.65	1.65	1.75	1.75	3.16	1.91
1987	1.82	1.45	1.87	1.51	1.95	1.81	1.33	1.31	1.67	0.84	2.82	1.55
1988	2.57	2.07	2.92	2.32	1.84	1.86	1.34	1.44	2.10	1.91	2.49	1.68
1989	3.10	2.04	3.68	2.51	1.38	1.34	1.71	1.39	2.64	2.75	2.40	1.79
1990	2.90	1.73	3.42	2.01	0.86	0.91	2.07	1.03	2.62	2.37	1.87	1.29
1991	2.88	2.01	3.31	2.48	0.98	0.85	1.93	1.21	2.85	3.10	2.01	1.29
1992	2.75	1.70	3.10	2.05	0.97	0.78	2.18	0.96	2.53	2.85	5.25	1.19
1993	2.86	2.02	3.13	2.41	1.44	1.21	2.41	1.32	2.69	2.70	2.52	1.67
1994	2.55	1.95	2.78	2.19	1.61	1.32	2.09	1.41	2.19	1.76	2.05	1.57
1995	2.69	1.91	2.82	2.01	2.48	2.22	2.14	1.37	2.80	1.91	2.33	1.49
1996	3.76	2.03	3.20	2.06	8.82	2.67	4.81	1.95	1.93	1.97	2.81	1.61
1997	2.53	2.11	3.03	2.24	2.45	1.46	1.13	2.03	1.24	1.82	3.69	1.80
1998	7.71	2.25	3.51	2.59	4.19	2.42	1.21	1.63	56.80	2.43	2.83	1.67
1999	3.83	2.30	3.91	2.32	3.21	2.00	4.29	1.92	2.68	2.86	3.44	1.85
2000	3.00	2.21	2.69	2.18	2.97	2.60	4.59	2.41	1.56	2.59	3.08	1.71
2001	2.59	2.07	2.83	2.03	2.19	2.07	3.45	2.27	-1.74	2.67	2.45	1.41
2002	4.18	1.83	2.82	1.83	1.85	1.30	2.68	1.91	22.23	3.95	1.67	1.13
2003	4.39	2.10	3.10	2.07	1.84	1.59	6.26	3.09	11.64	5.94	2.99	1.46
2004	4.89	2.23	3.85	1.93	2.78	2.04	6.18	4.16	11.54	4.68	2.99	1.71
2005	6.61	2.37	3.89	2.01	3.14	2.53	11.07	3.77	13.13	7.19	28.48	1.90
2006	15.81	2.63	4.31	2.36	4.50	2.74	35.20	2.97	18.32	12.10	4.71	2.14
2007	5.36	2.46	5.56	2.49	2.33	2.05	3.32	2.68	22.46	5.72	3.87	1.88
2008	2.68	1.66	3.73	1.54	1.78	1.47	0.27	1.72	8.11	4.00	3.43	0.94
2009	3.89	1.74	3.00	1.70	2.12	1.86	5.15	1.44	9.99	2.82	2.81	1.20
2010	2.23	1.67	3.20	1.81	2.78	1.92	2.75	1.37	-15.38	0.82	2.83	1.32
2011	3.24	1.62	4.15	1.69	2.77	1.64	2.83	1.20	-4.92	2.07	2.13	1.02
Average	**3.44**	**1.83**	**2.94**	**1.93**	**2.22**	**1.65**	**3.76**	**1.75**	**5.90**	**2.84**	**3.50**	**1.45**

Table 7: CAPM results

The table reports the results from the time-series regressions of the different sin indices on the market portfolio over the time period 1965 through 2011. The dependent variables are calculated as the total return of the value-weighted sin indices in excess of the risk-free rate. MKT denotes the exposure to the total return of the value-weighted market portfolio in excess of the risk-free rate. The table exhibits the regression coefficients with standard errors in parentheses, as well as the number of observations and the adjusted R-squared values. The alphas are expressed as percentages. The stars *, ** and *** denote statistical significance at the 10%, 5% and 1% significance levels, respectively.

INDEX	Alpha (%)	MKT	No. of obs.	Adjusted R^2
SINDEX	0.24* (0.12)	0.88*** (0.03)	564	0.6412
ALCOHOL	0.19 (0.13)	0.79*** (0.03)	564	0.5555
DEFENCE	0.14 (0.29)	1.06*** (0.07)	564	0.3195
GAMBLING	0.07 (0.27)	1.28*** (0.06)	564	0.4493
TOBACCO	0.73*** (0.25)	0.84*** (0.05)	564	0.2970

Table 8: Multi-factor results

The table reports the results from the time-series regressions of the different sin indices on the market portfolio as well as the size, value and momentum factors over the time period 1991 through 2011. The dependent variables are calculated as the total return of the value-weighted sin indices in excess of the risk-free rate. MKT denotes the exposure to the total return of the value-weighted market portfolio in excess of the risk-free rate. SMB denotes the exposure to the return difference between a portfolio of small cap stocks and a portfolio of large cap stocks. HML denotes the exposure to the return difference between a portfolio of high and a portfolio of low book-to-market. MOM denotes the exposure to the return difference between a portfolio of winner stocks and a portfolio of loser stocks during the most recent year. The table exhibits the regression coefficients with standard errors in parentheses, as well as the number of observations and the adjusted R-squared values. The alphas are expressed as percentages. The stars *, ** and *** denote statistical significance at the 10%, 5% and 1% significance levels, respectively.

INDEX	Alpha (%)	MKT	SMB	HML	MOM	No. of obs.	Adjusted R^2
SINDEX	0.38** (0.18)	0.64*** (0.04)				252	0.4886
SINDEX	0.38** (0.18)	0.64*** (0.04)	0.02 (0.08)			252	0.4867
SINDEX	0.30 (0.18)	0.64*** (0.04)	0.03 (0.08)	0.20*** (0.07)		252	0.4995
SINDEX	0.22 (0.19)	0.65*** (0.04)	0.03 (0.08)	0.23*** (0.08)	0.07 (0.05)	252	0.5015
ALCOHOL	0.33 (0.21)	0.61*** (0.05)				252	0.3848
ALCOHOL	0.34 (0.21)	0.62*** (0.05)	0.10 (0.09)			252	0.3853
ALCOHOL	0.24 (0.21)	0.61*** (0.05)	0.12 (0.09)	0.25*** (0.09)		252	0.4033
ALCOHOL	0.17 (0.22)	0.62*** (0.05)	0.12 (0.09)	0.27*** (0.09)	0.05 (0.05)	252	0.4030
DEFENCE	-0.11 (0.32)	1.09*** (0.07)				252	0.4723
DEFENCE	-0.11 (0.32)	1.10*** (0.07)	0.11 (0.14)			252	0.4714
DEFENCE	-0.20 (0.32)	1.09*** (0.07)	0.12 (0.14)	0.24* (0.13)		252	0.4762
DEFENCE	-0.19 (0.34)	1.09*** (0.08)	0.12 (0.14)	0.23* (0.14)	-0.01 (0.08)	252	0.4741
GAMBLING	-0.15 (0.30)	0.98*** (0.07)				252	0.4570
GAMBLING	-0.12 (0.28)	1.05*** (0.07)	0.65*** (0.12)			252	0.5104
GAMBLING	-0.15 (0.29)	1.05*** (0.07)	0.66*** (0.12)	0.06 (0.12)		252	0.5090
GAMBLING	-0.06 (0.30)	1.03*** (0.07)	0.66*** (0.12)	0.03 (0.12)	-0.07 (0.07)	252	0.5090
TOBACCO	1.08*** (0.36)	0.40*** (0.08)				252	0.0832
TOBACCO	1.07*** (0.36)	0.36*** (0.08)	-0.32** (0.16)			252	0.0952
TOBACCO	0.94*** (0.36)	0.35*** (0.08)	-0.30* (0.15)	0.32** (0.15)		252	0.1082
TOBACCO	0.81** (0.38)	0.38*** (0.09)	-0.30** (0.15)	0.36** (0.15)	0.11 (0.09)	252	0.1097

Table 9: Choice of comparable portfolio

The table reports the results from the tests used for determining which are the best suited comparable portfolios. Panel A exhibits the correlations between the sin indices, ALCOHOL, DEFENCE, GAMBLING and TOBACCO, and their various comparable portfolios. Panel B reports the results from the time-series regressions of DIFF, defined as the total return of the different value-weighted sin indices in excess of the total return of the corresponding value-weighted comparable portfolios, on a monthly time variable over the time period 1965 through 2011. The table exhibits the regression coefficients with standard errors in parentheses, as well as the number of observations and the adjusted R-squared values. λ_0 is the intercept and λ_1 is the slope coefficient. The stars *, ** and *** denote statistical significance at the 10%, 5% and 1% significance levels, respectively.

INDEX	**Restaurants & Bars**	**Heavy Construction**	**Hotels**	**Food Products**
ALCOHOL	0.7151			
DEFENCE		0.5092		
GAMBLING			0.6775	
TOBACCO				0.5063

Panel A: Correlations between sin indices and comparable portfolios (1965-2011)

PORTFOLIO	**λ_0**	**λ_1**	**No. of obs.**	**Adjusted R^2**
DIFF (ALCOHOL – Restaurants & Bars)	-0.006371 (0.004501)	0.000016 (0.000012)	564	0.0015
DIFF (DEFENCE – Heavy Construction)	0.010728 (0.007170)	-0.000026 (0.000019)	564	0.0016
DIFF (GAMBLING – Hotels)	0.008645 (0.006158)	-0.000020 (0.000016)	564	0.0009
DIFF (TOBACCO – Food Products)	-0.001135 (0.006085)	0.000022 (0.000016)	564	0.0014

Panel B: Regressions of long-short portfolios on a monthly time variable (1965-2011)

Table 10: CAPM regressions of the long-short portfolios

The table reports the results from the time-series regressions of the different long sin-short comparable portfolios on the market portfolio over the time period 1965 through 2011. The dependent variables are defined as the total return of the different value-weighted sin indices in excess of the total return of the corresponding value-weighted comparable portfolios. MKT denotes the exposure to the total return of the value-weighted market portfolio in excess of the risk-free rate. The table reports the regression coefficients with standard errors in parentheses, as well as the number of observations and the adjusted R-squared values. The alphas are expressed as percentages. The stars *, ** and *** denote statistical significance at the 10%, 5% and 1% significance levels, respectively.

PORTFOLIO	Alpha (%)	MKT	No. of obs.	Adjusted R^2
DIFF (ALCOHOL – Restaurants & Bars)	0.04 (0.19)	-0.23*** (0.04)	564	0.0473
DIFF (DEFENCE – Heavy Construction)	0.18 (0.31)	-0.01 (0.07)	564	-0.0017
DIFF (GAMBLING – Hotels)	0.12 (0.27)	0.11* (0.06)	564	0.0048
DIFF (TOBACCO – Food Products)	0.63** (0.26)	-0.01 (0.06)	564	-0.0018

Table 11: Multi-factor regressions of the long-short portfolios

The table reports the results from the time-series regressions of the different long sin-short comparable portfolios on the market portfolio as well as the size, value and momentum factors over the time period 1965 through 2011. The dependent variables are defined as the total return of the different value-weighted sin indices in excess of the total return of the corresponding value-weighted comparable portfolios. MKT denotes the exposure to the total return of the value-weighted market portfolio in excess of the risk-free rate. SMB denotes the exposure to the return difference between a portfolio of small cap stocks and a portfolio of large cap stocks. HML denotes the exposure to the return difference between a portfolio of high and a portfolio of low book-to-market. MOM denotes the exposure to the return difference between a portfolio of winner stocks and a portfolio of loser stocks during the most recent year. The table reports the regression coefficients with standard errors in parentheses, as well as the number of observations and the adjusted R-squared values. The alphas are expressed as percentages. The stars *, ** and *** denote statistical significance at the 10%, 5% and 1% significance levels, respectively.

PORTFOLIO	Alpha (%)	MKT	SMB	HML	MOM	No. of obs.	Adjusted R^2
DIFF (ALCOHOL – Restaurants & Bars)	0.21 (0.26)	-0.30*** (0.06)				252	0.0923
DIFF (ALCOHOL – Restaurants & Bars)	0.21 (0.26)	-0.31*** (0.06)	-0.06 (0.11)			252	0.0896
DIFF (ALCOHOL – Restaurants & Bars)	0.16 (0.27)	-0.31*** (0.06)	-0.05 (0.11)	0.13 (0.11)		252	0.0909
DIFF (ALCOHOL – Restaurants & Bars)	0.01 (0.28)	-0.28*** (0.06)	-0.05 (0.11)	0.18 (0.11)	0.13* (0.07)	252	0.1005
DIFF (DEFENCE – Heavy Construction)	-0.09 (0.36)	-0.00 (0.08)				252	-0.0040
DIFF DEFENCE – Heavy Construction)	-0.10 (0.36)	-0.04 (0.08)	-0.31** (0.16)			252	0.0080
DIFF (DEFENCE – Heavy Construction)	-0.08 (0.37)	-0.03 (0.08)	-0.32** (0.16)	-0.05 (0.15)		252	0.0045
DIFF (DEFENCE – Heavy Construction)	-0.04 (0.38)	-0.04 (0.09)	-0.32** (0.16)	-0.07 (0.15)	-0.03 (0.09)	252	0.0010
DIFF (GAMBLING – Hotels)	0.05 (0.30)	-0.19*** (0.07)				252	0.0278
DIFF (GAMBLING – Hotels)	0.05 (0.29)	-0.18** (0.07)	0.16 (0.13)			252	0.0295
DIFF (GAMBLING – Hotels)	0.20 (0.30)	-0.16** (0.07)	0.13 (0.13)	-0.38*** (0.12)		252	0.0622
DIFF (GAMBLING – Hotels)	0.07 (0.31)	-0.13* (0.07)	0.13 (0.13)	-0.33*** (0.12)	0.11 (0.07)	252	0.0664
DIFF (TOBACCO – Food Products)	1.02** (0.44)	-0.22** (0.10)				252	0.0157
DIFF (TOBACCO – Food Products)	1.01** (0.44)	-0.24** (0.10)	-0.17 (0.19)			252	0.0149
DIFF (TOBACCO – Food Products)	1.03** (0.45)	-0.24** (0.10)	-0.18 (0.19)	-0.05 (0.18)		252	0.0113
DIFF (TOBACCO – Food Products)	1.12** (0.47)	-0.26** (0.11)	-0.17 (0.19)	-0.08 (0.19)	-0.08 (0.11)	252	0.0091

Table 12: CAPM and multi-factor results excluding tobacco

The table reports the results from the time-series regressions of the sin index excluding tobacco stocks. Panel A exhibits the results from the CAPM regression over the time period 1965 through 2011. The dependent variable is the total return of the value-weighted sin index excluding tobacco in excess of the risk-free rate. MKT denotes the exposure to the total return of the value-weighted market portfolio in excess of the risk-free rate. Panel B displays the results from the multi-factor regression over the time period 1991 through 2011. The dependent variable is the total return of the value weighted sin index excluding tobacco in excess of the risk-free rate. MKT denotes the exposure to the total return of the value- weighted market portfolio in excess of the risk-free rate. SMB denotes the exposure to the return difference between a portfolio of small cap stocks and a portfolio of large cap stocks. HML denotes the exposure to the return difference between a portfolio of high and a portfolio of low book-to-market. MOM denotes the exposure to the return difference between a portfolio of winner stocks and a portfolio of loser stocks during the most recent year. Both panels exhibit the regression coefficients with standard errors in parentheses, as well as the number of observations and the adjusted R-squared values. The alphas are expressed as percentages. The stars *, ** and *** denote statistical significance at the 10%, 5% and 1% significance levels, respectively.

INDEX	Alpha (%)	MKT	No. of obs.	Adjusted R^2
SIN excl. TOBACCO	0.09 (0.12)	0.87*** (0.03)	564	0.6649

Panel A: CAPM regression of sin portfolio without tobacco (1965-2011)

INDEX	Alpha (%)	MKT	SMB	HML	MOM	No. of obs.	Adjusted R^2
SIN excl. TOBACCO	0.18 (0.18)	0.72*** (0.04)				252	0.5676
SIN excl. TOBACCO	0.18 (0.18)	0.74*** (0.04)	0.15* (0.08)			252	0.5725
SIN excl. TOBACCO	0.10 (0.18)	0.73*** (0.04)	0.16** (0.07)	0.20*** (0.07)		252	0.5840
SIN excl. TOBACCO	0.06 (0.18)	0.74*** (0.04)	0.16** (0.08)	0.22*** (0.08)	0.04 (0.04)	252	0.5835

Panel B: Multi-factor regressions of sin portfolio without tobacco (1991-2011)

Figure 1: Weights of sub-indices in the total sin index

The figure exhibits the relative size of the different sub-indices, ALCOHOL, DEFENCE, GAMBLING and TOBACCO, measured by their total market capitalization on the last trading day of the year over the sample period 1965 through 2011.

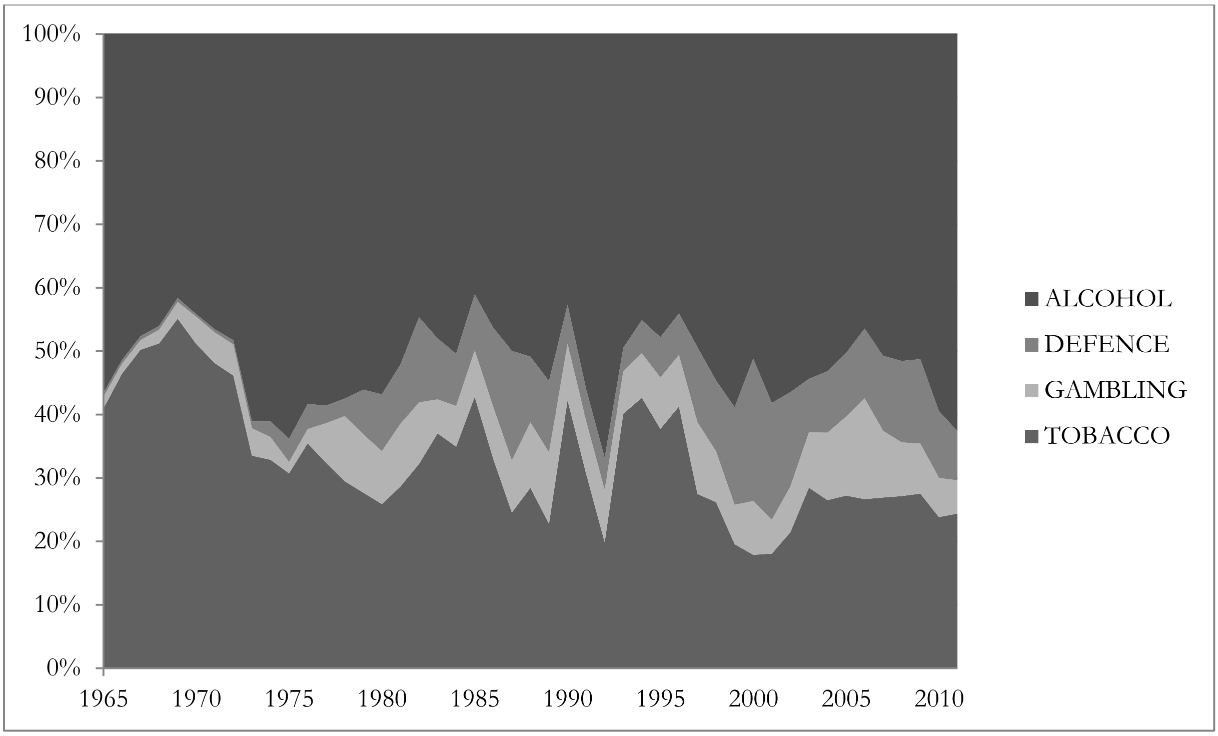
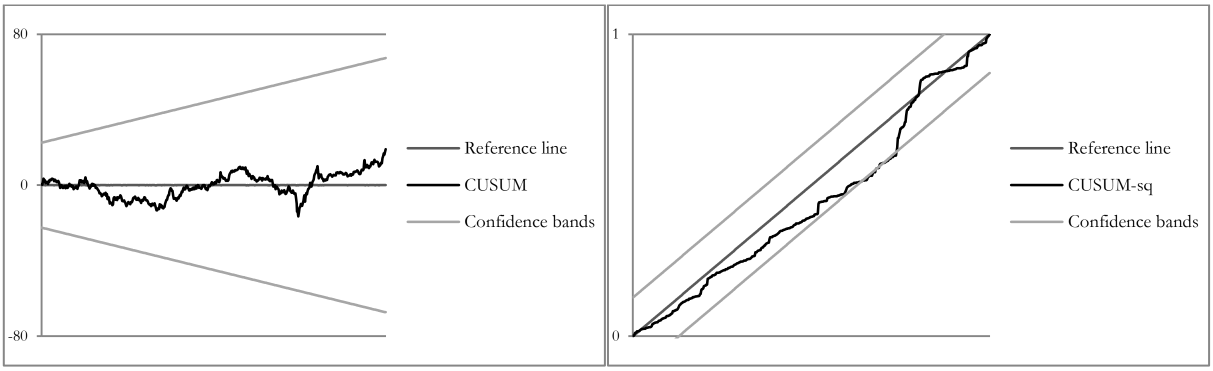
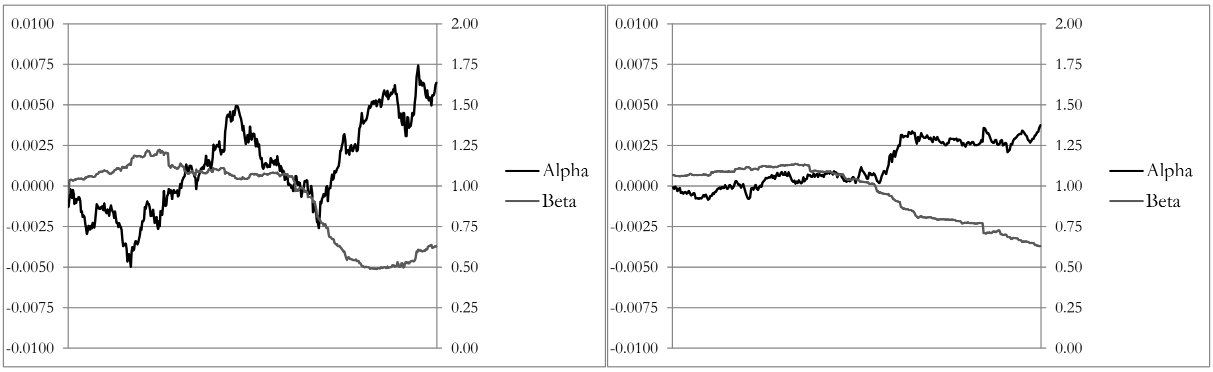


Figure 2: CUSUM and CUSUM-sq tests – SINDEX

Figure 2 exhibits the results from the CUSUM and CUSUM-sq tests for SINDEX over the time period 1965 through 2011. Panel A depicts the plots of the cumulative sums and cumulative sums of squares of the recursive residuals. Panel B shows the estimated parameters from ten- and twenty year CAPM regressions, moving one month at a time.



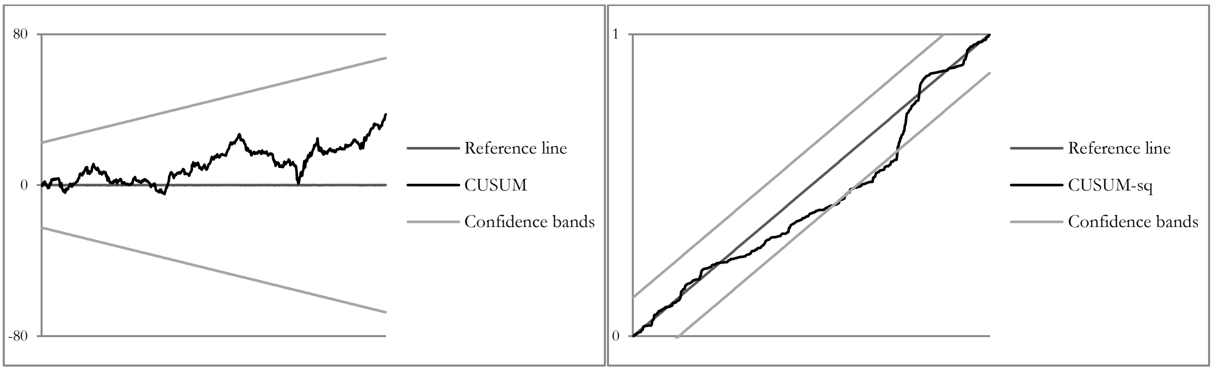
Panel A: CUSUM and CUSUM-sq tests for SINDEX



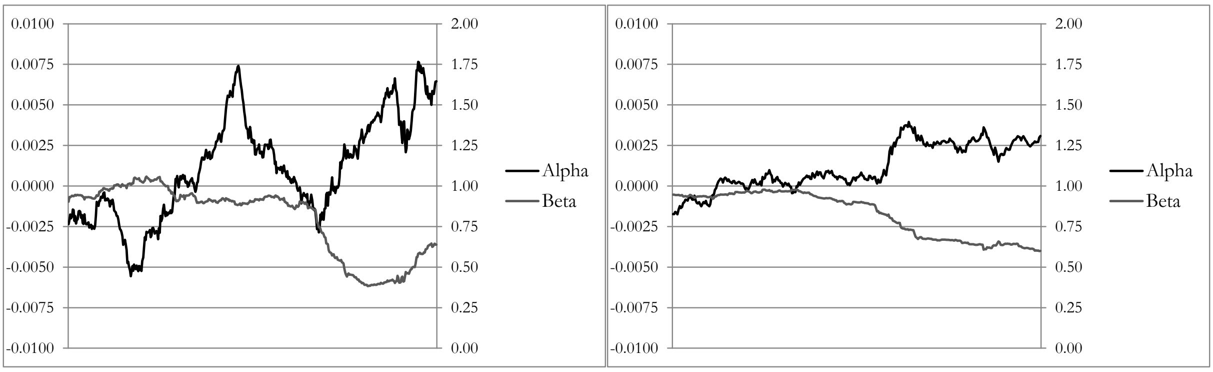
Panel B: Parameters estimated from ten- and twenty-year moving regression for SINDEX

Figure 3: CUSUM and CUSUM-sq tests – ALCOHOL

Figure 3 exhibits the results from the CUSUM and CUSUM-sq tests for ALCOHOL over the time period 1965 through 2011. Panel A depicts the plots of the cumulative sums and cumulative sums of squares of the recursive residuals. Panel B shows the estimated parameters from ten- and twenty year CAPM regressions, moving one month at a time.



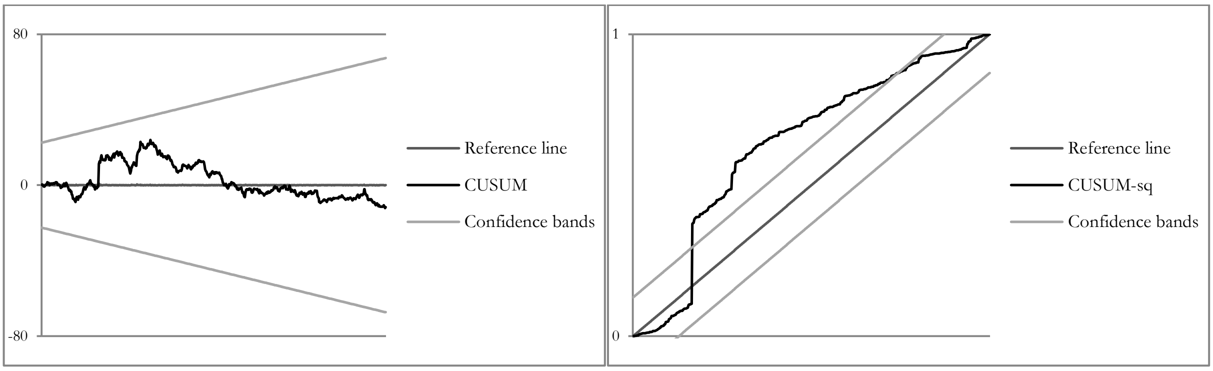
Panel A: CUSUM and CUSUM-sq tests for ALCOHOL



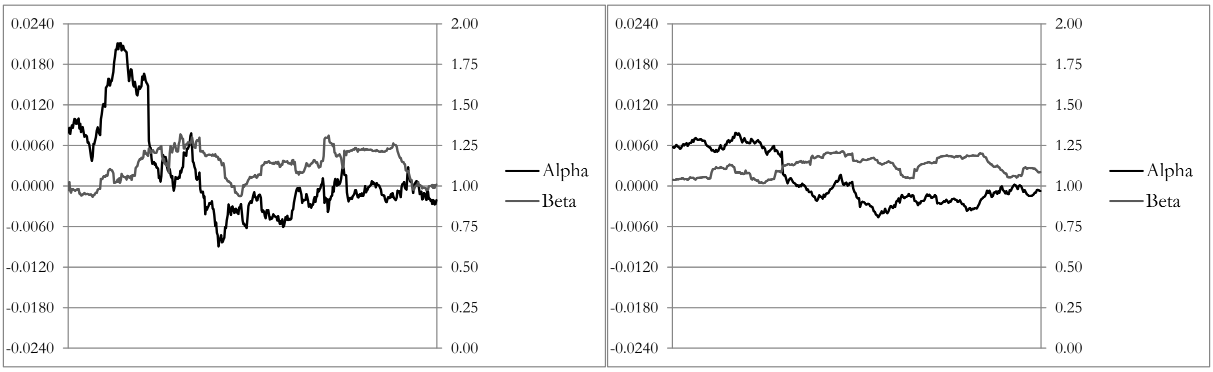
Panel B: Parameters estimated from ten- and twenty-year moving regression for ALCOHOL

Figure 4: CUSUM and CUSUM-sq tests – DEFENCE

Figure 4 exhibits the results from the CUSUM and CUSUM-sq tests for DEFENCE over the time period 1965 through 2011. Panel A depicts the plots of the cumulative sums and cumulative sums of squares of the recursive residuals. Panel B shows the estimated parameters from ten- and twenty year CAPM regressions, moving one month at a time.



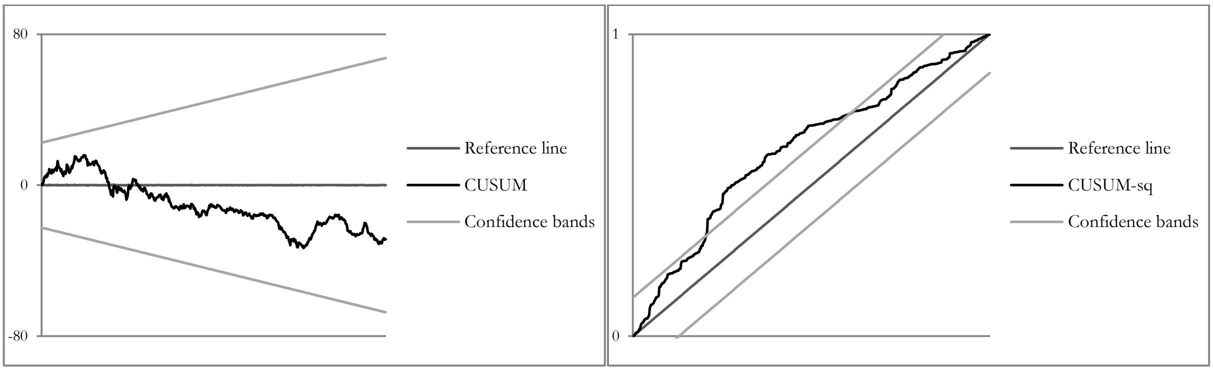
Panel A: CUSUM and CUSUM-sq tests for DEFENCE



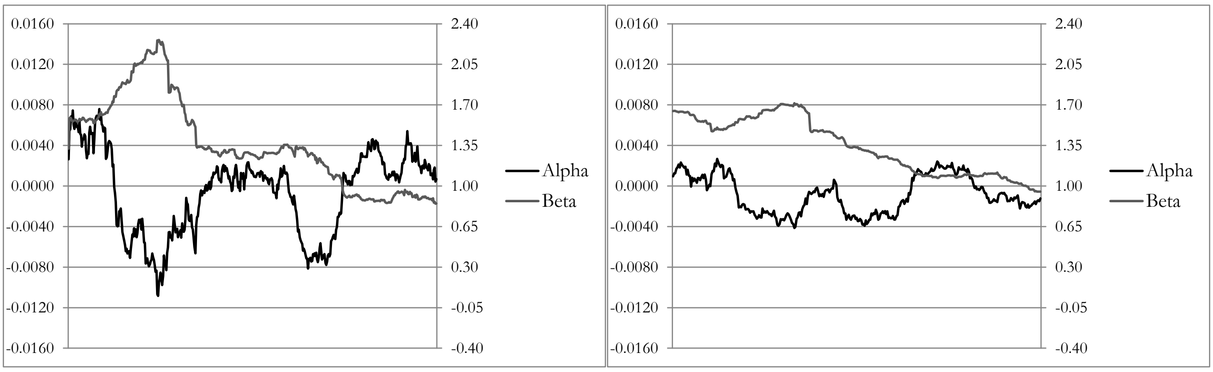
Panel B: Parameters estimated from ten- and twenty-year moving regression for DEFENCE

Figure 5: CUSUM and CUSUM-sq tests – GAMBLING

Figure 5 exhibits the results from the CUSUM and CUSUM-sq tests for GAMBLING over the time period 1965 through 2011. Panel A depicts the plots of the cumulative sums and cumulative sums of squares of the recursive residuals. Panel B shows the estimated parameters from ten- and twenty year CAPM regressions, moving one month at a time.



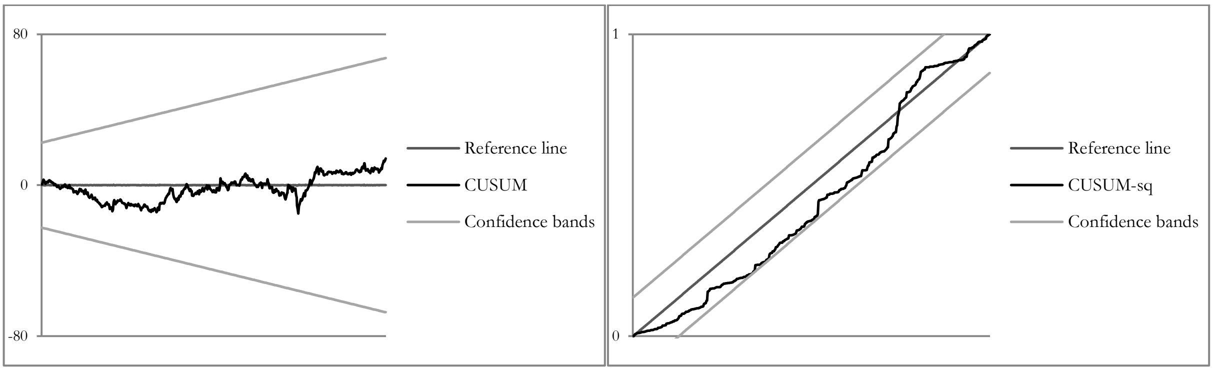
Panel A: CUSUM and CUSUM-sq tests for GAMBLING



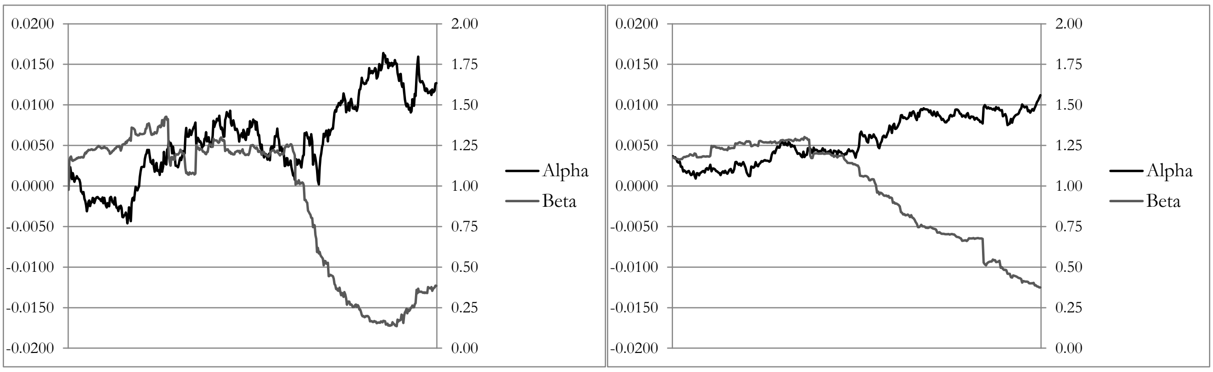
Panel B: Parameters estimated from ten- and twenty-year moving regression for GAMBLING

Figure 6: CUSUM and CUSUM-sq tests – TOBACCO

Figure 6 exhibits the results from the CUSUM and CUSUM-sq tests for TOBACCO over the time period 1965 through 2011. Panel A depicts the plots of the cumulative sums and cumulative sums of squares of the recursive residuals. Panel B shows the estimated parameters from ten- and twenty year CAPM regressions, moving one month at a time.



Panel A: CUSUM and CUSUM-sq tests for TOBACCO



Panel B: Parameters estimated from ten- and twenty-year moving regression for TOBACCO