EC331: Research in Applied Economics

SIN AVERSION IN THE UK STOCK MARKET: THE EFFECT OF SOCIAL NORMS

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ABSTRACT

This paper provides evidence for the effects of social norms on financial markets by studying 'sin stocks' on the London Stock Exchange – publicly traded alcohol, tobacco and gambling companies. It hypothesises that there exist social norms against funding operations that promote 'sin' and finds that these stocks are held less by norm-constrained institutional investors. Three samples, 'non-sin', 'comparable' and 'sin' stocks are collected from Thomson Reuters DataStream and a panel regression is used to test patterns in institutional ownership in the United Kingdom (UK). The paper then applies time-series asset pricing models to find evidence of positive risk-adjusted returns between January 2003 and December 2010. The results suggest that 'size' and 'value' effects are important determinants of stock returns in this period. Risk-adjusted returns also imply that "sin aversion" has an opportunity cost that socially responsible investors are willing to bear.

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SECTION I: INTRODUCTION

1.1. Introduction

Socially responsible investing (SRI) is an investment strategy that is subject to a social norm[1]. It "seeks to generate both financial and sustainable value and integrates environmental, social and governance (ESG) issues into financial analysis" (FT, 2013). There are generally three types of investing strategies (Sandaker & Overbye, 2010):

- Investment Screening
- Shareholder Advocacy
- Community Investing

Investment screening is one of the most common forms of socially responsible investing in the UK and has experienced a growth of 213% since 2009, the highest among all SRI strategies (Eurosif 2012, p. 61). While 'positive screening' involves investing in companies with positive ESG profiles, 'negative screening' involves excluding companies that are incompatible with the social profiles that SRI investors aim to uphold. This study focuses on the latter, specifically the exclusion of UK 'sin stocks'– publicly traded alcohol, tobacco and gambling companies[2].

From a portfolio optimisation perspective, this strategy is somewhat paradoxical: by restricting their opportunity set, investors may forgo lucrative investments. One reason could be that the investments of institutions, unlike individual investors, are subject to greater

[1] A social norm is defined as "an act whose utility to the agent performing it depends in some way on the beliefs or actions of other members of the community" (Akerlof, 1980).
[2] Sin stocks also include the defence industry, pornography and biotechnology industries. Tobacco, alcohol and gambling are the most popular screens (Salaber, 2007).

public and regulatory scrutiny[3]. As a result, a social norm may persist if investing in these stocks conflict with either the investor's or the community's shared values (Akerlof, 1980). This paper explores whether social norms cause this behaviour and if UK institutional investors pay a high opportunity cost for being 'socially responsible'.

There are two areas of focus. This paper first collects 'sin stocks' from Thomson Reuters DataStream and it tests social norm effects against two control samples: 'non-sin' stocks and identified economic substitutes, 'comparable stocks'. A panel regression is used to test patterns of institutional ownership from 2002 – 2010 and it hypothesises that institutional investors hold less sin stocks in their portfolios. The study of institutional ownership is central as the UK SRI market is 97% dominated by these investors (Eurosif 2012, p. 60). As previous empirical work has focused on the US market, this paper is one of the first to study the ownership of sin stocks on the London Stock Exchange.

In the second section, it explores whether sin stocks exhibit a return premium between January 2003 – December 2010. For reasons that will be discussed, this outperformance is one that is not easily explained by traditional portfolio theory. It first adopts the Capital Asset Pricing Model (CAPM) used by the existing UK analysis of sin stocks (Fabozzi et al., 2008). This is the simplest specification that controls for the market risk premium (the return on the market index net of the risk free rate). This paper contributes by controlling for 'size' and 'value' effects, using the Fama-French (1997) three factor model, and the 'momentum' effect, using the four factor Carhart (1997) model. The analysis hopes to determine which asset pricing model is the most efficient for explaining UK stock returns over the sample period.

[3] The financial literature considers four main types of 'institutional investors': long term institutions (banks and independent investment advisors), insurance companies and mutual funds. Under the 1995 UK Pensions Act, trustees of these funds must publicly disclose their ESG based investments (Dawson 2012, p.18).

The paper is organised as follows. Section 1.2 discusses related literature on social norms and sin stocks. Section 1.3 provides a theoretical framework and develops two hypotheses. Section 2.1 provides details on data collection and Section 3 outlines the empirical analysis including methodology, descriptive statistics and results. Section 4 finally concludes.

1.2. Literature Review

The literature on social norms originates from the labour markets. Becker (1957) proposes a taste-based model of discrimination where agents (employers) have to bear financial costs for refusing to enter contracts with certain classes of workers. Following this, Akerlof (1980) and Romer (1984) give conditions under which social customs, which may disadvantage an individual, can persist if that individual faces a reputation loss for disobeying the custom. Over the last few years, empirical research has applied this theory of social norms to socially responsible investing and the exclusion of sin stocks. It has focused on two key areas: their institutional ownership and the financial performance.

Hong & Kacperczyk (2009) give the seminal empirical investigation of US sin stocks. They find that a sample of 193 sin stocks listed on the NYSE, AMEX and NASDAQ exchanges exhibit 24% less institutional ownership relative to the mean. For the period 1980 - 2006, they control for liquidity (proxied by market-capitalisation), value (the market-to-book ratio), volatility and market risk (the 'beta' of a stock)[4]. A pooled OLS panel regression is run, clustering standard errors using the 49 industries identified by Fama & French (1997). The advantage of this is that unobserved heterogeneity related to industry effects is controlled.

Durand & Koh (2011) extend the research by using a more specific control group. They find that sin stocks are held less relative to 'saint' stocks, constituent companies of the FTSE KLD

[4] Del Guercio (1996) and Gompers & Metrick (2001) provide the seminal contribution of share ownership determinants.

400 Social Index. A pooled OLS regression is run from 1990 to 2008 and, like Hong & Kacperczyk (2009), they distinguish between the four types of institutional investors. Unlike other investors, independent investment advisors and mutual funds have larger ownership of sin stocks. This is consistent with the notion that they are less constrained by social norms and will continue to invest in these securities. However, the use of a dummy variable to proxy for "sin" assumes that social norms against sin stocks are constant over time and across different sin industries.

Liu et al. (2011) therefore study social norms in a dynamic setting. Consumption data is used to proxy for social norms for each of the tobacco, alcohol and gambling industries. Institutional ownership of US sin stocks is found to be increasing in the degree of social norm acceptance and this effect is less for firms with higher expected financial performance. This is based on the hypothesis that when a stock is expected to perform well, the price of obeying the social norm becomes high and therefore there exists a greater opportunity cost to socially responsible investing. The regression, however, is limited by the quality of proxy variables used. The use of 'Las Vegas visitor volume' to proxy for the level of social norms against gambling does not consider the percentage of visitors who are foreigners and it assumes that casinos are the only gambling option available. Despite the broad scope of these studies, there has yet to be an application to the study of institutional ownership in the UK context.

The second part of the literature focuses on stock returns. While evidence of higher returns on ethical investing (positive-screening) has been mixed[5], previous research on sin investing (negative-screening) provides consistent evidence in support of excess returns relative to the market. This, however, assumes that the chosen asset-pricing model captures all of the relevant market risk. Under the Capital Asset Pricing Model (CAPM), Fabozzi et al. (2008)

[5] Hamilton et al. (1993) and Statman (2000) find that there is no risk-adjusted return difference between ethical and non-ethical funds, while Chow et al (2010) find that ethical stocks on the KLD 400 index do generate positive returns.

find that UK sin stocks have had an excess return of 8.19% in an average year from January 1970 – June 2007[6]. While the CAPM is a cornerstone of financial economics and is extensively applied, vast literature shows that it does not capture all of the relevant factors that determine return (Fama & French 1997; Carhart 1997).

Salaber (2007a) extends this by using a three factor Fama-French (1997) model which controls for 'size' and 'value'. The paper finds that European sin stocks exhibit excess risk-adjusted returns of 0.33% per month between 1975 and 2006 in high tax, litigious and Protestant countries[7]. However, the study does not control for stock 'momentum' effects which are a key determinant of returns (Carhart, 1997). Furthermore, UK sin stocks are grouped within a 'global portfolio' among 17 European countries. This assumes that markets are segmented (agents only invest in their countries) which is highly controversial given evidence of increasing foreign diversification (Amadi, 2004).

Future investigations into ownership and returns would benefit from a UK study incorporating multi-factor asset models. This would isolate return effects on the London Stock Exchange and would rest on few assumptions relative to previous cross-country studies.

[6] The UK is tested in a 21 country sample.
[7] Taxation and litigation risk are examples of 'firm-specific' risk that might not be diversifiable when a significant portion of investors neglect sin stocks. The effect of religion is derived from the findings of Fairbanks (1977) that Protestants support strict alcohol and gambling controls. Investing in sin companies is against their SRI preferences (Salaber, 2007).

1.3. Theory & Hypotheses Development

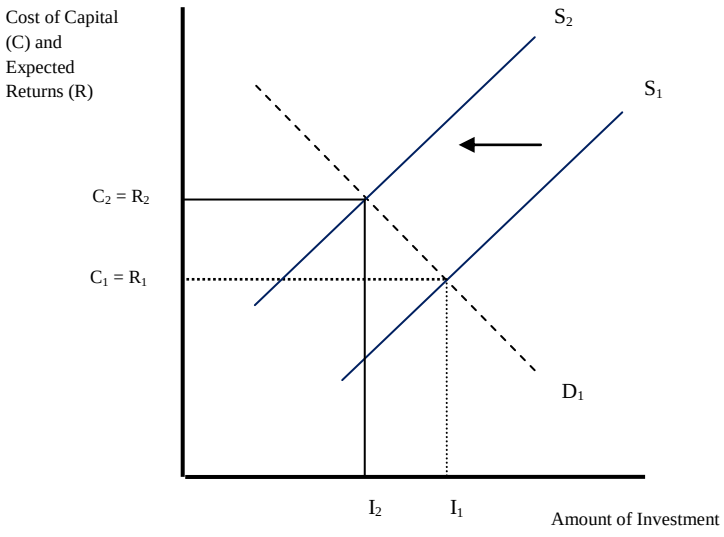
The following section outlines the theoretical link between social norms and expected returns from which hypotheses are developed (Appendix A provides further detail).

According to Akerlof (1980), social customs that are disadvantageous to the individual may persist if individuals are sanctioned by a reputation loss for disobeying the custom. An institutional investor may fear the consequences following public disclosure of his shareholdings if these conflict with either his or the community's shared beliefs. Thus Hypothesis 1 proposes:

> ***Hypothesis 1****: Norm-constrained institutional investors are less willing to hold sin stocks relative to other stocks.*

If a significant portion of investors neglect these stocks, Merton (1987) argued markets become segmented and as a result this withdraws capital from sin companies. This leads to an inward shift in the capital supply curve (S_1 to S_2):

Figure I: The 'Neglected Stock Effect'



Source: Statman (2000, p. 36)

According to the Capital Asset Pricing Model (CAPM), the firm's cost of equity capital is equivalent to the expected return to an investor:

$$E(R_t) - Rf_t = \alpha_t + \beta_1(Rm_t - Rf_t) \quad \textbf{(1)}$$

where '$E(R_t) - Rf_t$' is the expected return on the stock, excess of the risk free rate in the economy, β_1 is the 'Beta' on the stock and '$Rm_t - Rf_t$' is the 'market risk premium'. An expected return is required to induce investors to buy the stock and therefore this incurs an equivalent cost to current shareholders. The expected return caused by boycotting sin stocks is not a function of the 'market risk premium' predicted by the CAPM. This explains why sin stocks may exhibit a positive alpha (α_t). Investors are compensated for *not* being exposed to any risk.

The implication on the firm's equity cost of capital (λ_k), and therefore the stock's expected return, depends on the following factors (James & Rivoli, 1997):

$$\lambda_k = \frac{\delta\sigma^2 x_k(1 - q_k)}{q_k} \quad \textbf{(2)}$$

where 'x_k' is the weight of the stock in the market portfolio, 'δ' captures risk aversion, 'σ' is the specific risk[8] of the firm and '$(1 - q_k)$' is the fraction of investors who boycott the stock. The expected return is greater when more investors boycott the stock and when the firm has greater specific risk.

[8] Also known as 'unsystematic' risk – one that is very specific to a small number of assets and can be eliminated by portfolio diversification.

Therefore, based on the following two assumptions:

> ***Assumption 1****: The neglect of sin stocks is stable across the sample period.*

> ***Assumption 2****: There are a sufficient number of socially responsible investors neglecting sin stocks.*

the second hypothesis is as follows:

> ***Hypothesis 2****: Sin stocks exhibit a return premium, even after adjusting for determinants of returns. 'Non-sin' stocks and 'comparable' stocks do not.*

SECTION II: EMPIRICAL ANALYSIS

2.1. Data Selection

Thomson Reuters DataStream is used to collect three stock samples: 'sin' stocks, 'non-sin' stocks and 'comparable' stocks. While non-sin stocks represent the dominant universe of stocks on the London Stock Exchange, comparable stocks are carefully chosen from economic substitutes to sin stocks:

Figure II: 24 Sample Industries

Portfolio	Industry	Companies
SIN	Alcohol	11
	Tobacco	3
	Gambling	30
	TOTAL	**44**
NON-SIN	Aerospace & Defence	8
	Alternative Energy	18
	Automobiles & Parts	11
	Business & Computer Services	241
	Chemicals	22
	Farming & Fishing	26
	Gas, Water & Utilities	14
	General Retailers	43
	Healthcare Equipment/Services	69
	Household Goods & Construction	48
	Industrials	66
	Leisure Goods	16
	Media	71
	Mining	142
	Oil	128
	Personal Goods	30
	Pharmaceuticals	60
	Technology & Telecoms	95
	TOTAL	**1108**
COMPARABLE	Soft Drinks	4
	Food Products	25
	Travel & Leisure	146
	TOTAL	**175**

Notes

See Appendix C (Figure III) for a time series display

The sin portfolio contains alcohol, tobacco and gambling stocks from January 2003 – December 2010. These are collected from the '*Distillers & Vintners*', '*Brewers*', '*Tobacco*' and '*Gambling*' industries. 44 companies were identified and there are on average 25 stocks in the sample at any one point. As many sin companies are privately held, the sample size is small and is dominated by many larger brands such as Diageo, Imperial Tobacco and 888 Holdings. Nevertheless, the size is comparable to previous research[9].

Non-financial stocks from 18 industries were used to form the non-sin sample of 1108 companies. For the more specific 'comparable' sample, the industries used by the seminal work of Hong & Kacperczyk (2009) are adopted. Companies from '*Soft Drinks*' are used as an alternative to alcohol beverages and '*Food Products*' are used for tobacco companies. While the former seems an intuitively strong alternative, one can also argue that the latter has similar habit forming characteristics to tobacco[10]. As a control for gambling companies the remaining stocks from the '*Travel & Leisure*' industry were used. Like gambling, these companies provide recreational activities generally considered as non-essential.

To prevent survivorship bias both active and inactive stocks are included. DataStream repeats the last known value for inactive stocks, so the methodology of Ince & Porter (2006) is used to delete all observations from the end of the sample up until the last non-zero data point. The sample is cross-checked with both UK SIC (2007) industries and an official list provided by the London Stock Exchange, before an outlier analysis is conducted where 11 stocks are removed. For all stocks, institutional ownership control variables are collected from Thomson Reuters DataStream and, as portfolio-level returns are investigated, risk factors are collected from Gregory et al. (2013).

[9] Fabozzi et al. (2008) find 46 UK sin stocks from January 1990 – June 2007.
[10] Many supermarkets that reside in the '*Food Products'* group also have partial tobacco operations. As a result, UK SIC (2007) classifications group Tesco Plc. and WM Morrisons in the '*Tobacco*' industry.

2.2. Institutional Ownership

2.2.1. Methodology

This section investigates whether sin stocks have less institutional ownership after controlling for important stock characteristics. A panel regression model is run for yearly data from 2002 – 2010:

$$IO_{it} = a_o + a_1 SIN_{it} + a_2 COMP_{it} + a_3 LOGSIZE_{it} + a_4 LOGMTB_{it} + a_5 VOL_{it} + \varepsilon_{it} \quad (3)$$

$$i = 1,\ldots, N,$$
$$t = 1,\ldots, T,$$

The relevant coefficient is a_1 which measures whether sin stocks have a different ownership structure than other stocks. The null hypothesis is that a_1 equals zero, whereas the theory in Section 1.3 predicts it will be significantly less. If sin stocks are part of the wider consumer goods industry, this possibly accounts for some differences in ownership. This factor is controlled by including the $COMP_{it}$ variable. Gompers & Metrick (2001) identify that institutions are attracted to stocks with low price volatility and high book-to-market ratios. Due to their large positions they also seek out liquid stocks, as proxied by their firm size. The variables $LOGSIZE_{it}$, $LOGMTB_{it}$ and VOL_{it} therefore control for market-capitalisation, market-to-book ratio and average stock price volatility respectively[11].

A pooled OLS regression is estimated but suffers from heteroskedasticity and serial correlation. To address this issue a random-effects regression[12] is run with clustered standard errors at the industry level. As an institution may invest in other stocks in the same industry for liquidity and diversification reasons, this explains the serial correlation within industries. While Hong & Kacperczyk (2009) also use the Fama & Macbeth (1973) regression with

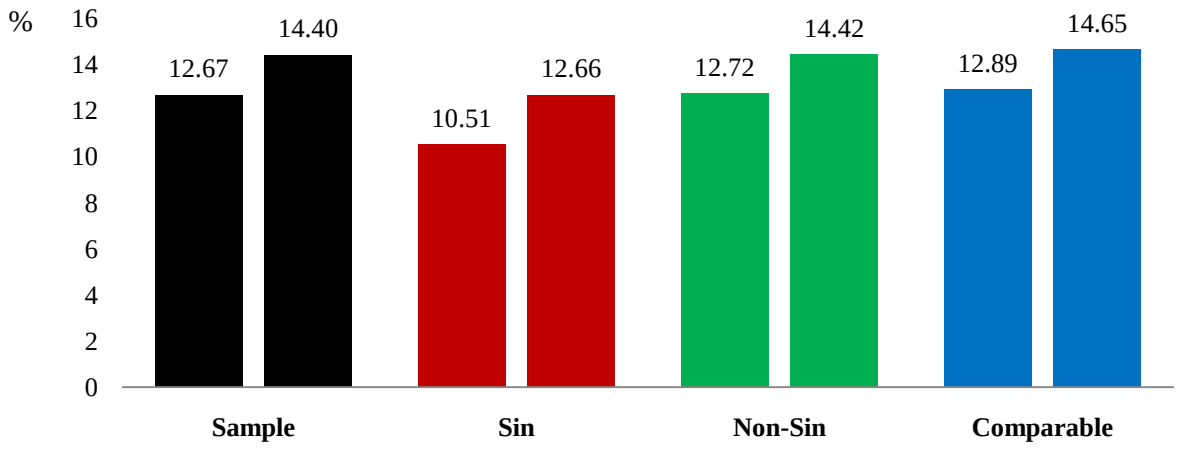
[11] Since IO_{it} is measured as a percentage, it is helpful to have other variables as percentages or in natural logs. Other control variables, such as 'Beta' or a 'FTSE Index Inclusion' dummy variable, were not available in time-series form.

[12] See Appendix C (Figure VII) for diagnostic tests. Results from a Hausman test suggest a fixed-effects model is preferable. As SIN_{it} and $COMP_{it}$ are linear combinations of the panels and time invariant they are omitted from the regression. Fixed-effects is therefore not appropriate.

Newey-West standard errors, clustering makes fewer assumptions about how errors are correlated over time[13]. The sample period is then disaggregated, testing whether the neglect of sin stocks is stable across the period (Assumption 1 made in Section 1.3).

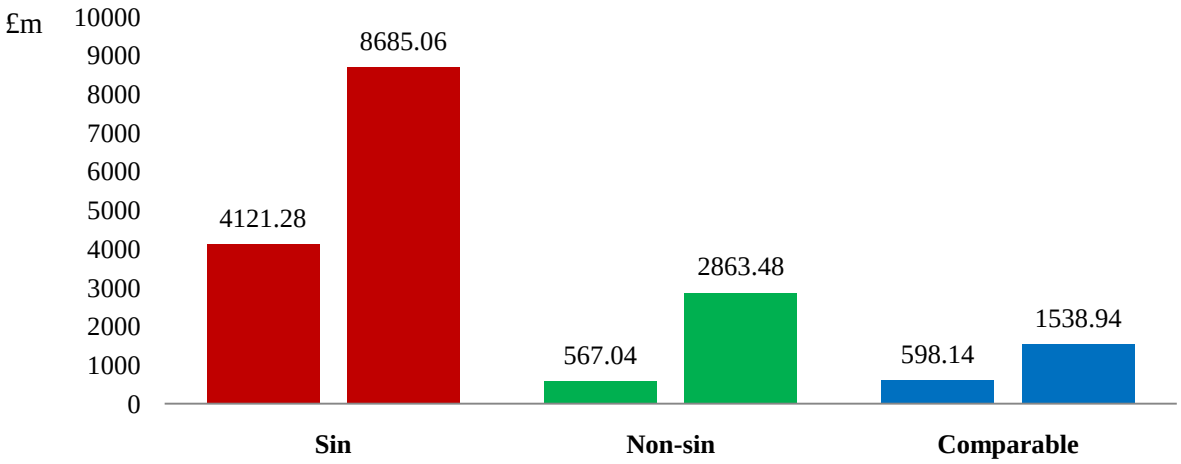
The following graphs report summary statistics, where the first and second bars represent the mean and standard deviation respectively. The mean institutional ownership in the sample is 12.67%, where on average 10.51% of the shares of sin companies are held by institutional investors. The mean for comparable stocks is 12.89%. Assuming that they offer similar diversification benefits as sin stocks, this offers preliminary support to the hypothesis that sin stocks are shunned due to social norms.

Figure III: Institutional Ownership



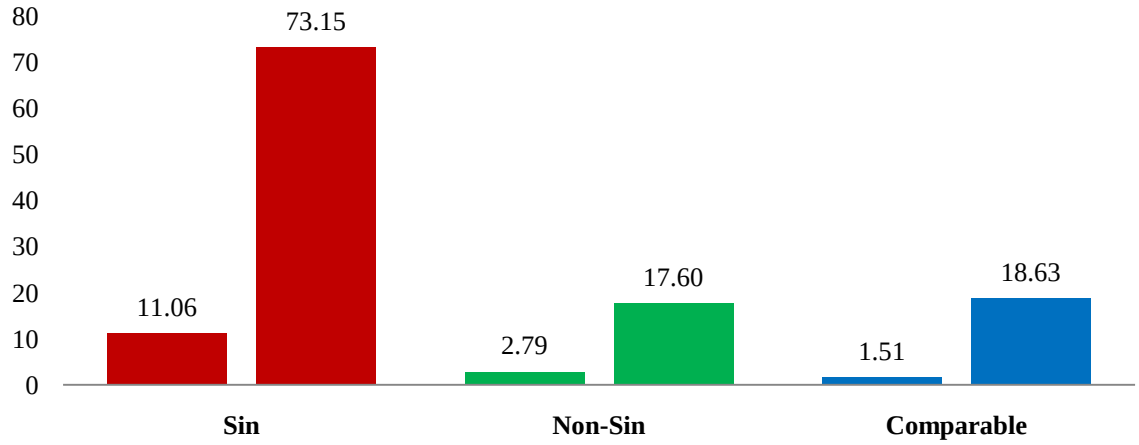
[13] Clustered errors keep the assumption of zero correlation across groups like a fixed-effects regression, but do not restrict the within-group correlation (Nichols & Schaffer, 2007).

Figure IV: Market Capitalisation



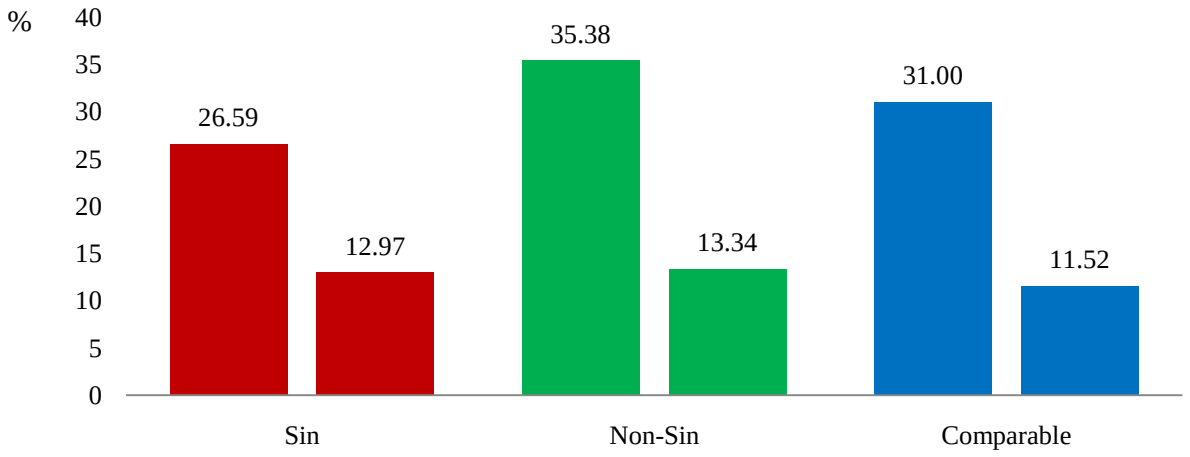
The average market capitalisation for sin stocks is considerably higher than for both control samples where an average sin firm is worth £4.12bn with a standard deviation of £8685.06m. This is a result of the sample size as many smaller sin firms are privately owned and larger firms therefore skew the mean. For example, Diageo and Imperial Tobacco are on average worth £25.00bn and £14.15bn respectively.

Figure V: Market-to-book Ratio



Similarly, the market-to-book ratio of sin stocks is very high either reflecting a higher present value of growth opportunities or a result of their high share price. Given that both variables are scaled by the share price and a high standard deviation is reflected in both Figure IV and Figure V, it is likely that the latter explanation prevails.

Figure VI: Price Volatility (%)



The volatility of sin share prices is less than in other groups. Sin stocks deviate by 26.59% from their mean price in an average year. One explanation is that, due to their addictive qualities, the price inelasticity of demand for their products reduces cyclicality (Salaber, 2007b).

2.2.2. Results

Figure VII: Institutional Ownership (2002 – 2010)

	Pooled OLS	Random effects	Random effects	2002-2005	2006-2010
	(1)	(2)	(3)	(4)	(5)
SIN_{it}	**-0.0259**** (0.0127)	**-0.0200** (0.0137)	**-0.0281**** (0.0127)	**-0.0436***** (0.0159)	**-0.0495***** (0.0162)
$COMP_{it}$	**-0.0033** (0.0072)	**0.0017** (0.0129)	**0.0047** (0.0117)	**-0.0036** (0.0118)	**-0.0270**** (0.0109)
$LOGSIZE_{it}$	**0.0160***** (0.0010)	**0.0114***** (0.0024)	**0.0010***** (0.00193)	**0.0276***** (0.0027)	**0.0062***** (0.0019)
$LOGMTB_{it}$	**-0.0078***** (0.0022)	**-0.0076***** (0.0029)	**-0.0073***** (0.0023)	**-0.0296***** (0.0040)	**-0.0030** (0.0021)
VOL_{it}	**0.0139** (0.0167)	**0.0153** (0.0325)			
N	4145	4145	7425	2901	4524
R^2	5.61%	5.54%	5.69%	15.02%	2.33%
Rho	-	47.29%	40.70%	39.35%	58.77%

Notes:

Independent variable: IO_{it}
Robust standard errors in parentheses: * p < 0.10, ** p<0.05, *** p < 0.010
Standard errors are adjusted for 24 industry clusters in Column (2) – (5)
Overall R^2 is reported
Constant is not reported
$LOGSIZE_{it}$ and $LOGMTB_{it}$ reported in logs, while IO_{it} and VOL_{it} in decimals.

Figure VII reports regression results. The OLS model (Column 1) initially gives a negative and significant coefficient on SIN_{it} but, as previously discussed, it suffers from heteroskedasticity and serial correlation. As shown by Column 2, the random effects model can explain 47.29% of the variation across panels. This confirms that the Pooled OLS model

likely suffers from omitted relevant variable bias[14]. Under the random-effects model a negative but insignificant coefficient in front of SIN_{it} is found (-0.0200). However, the coefficient on VOL_{it} enters insignificantly and does not add to the explanatory power. Therefore it is excluded from the final specification, shown in Column 3.

The results of the final random-effects regression (Column 3) display a significant and negative coefficient of -0.0281 in front of SIN_{it}. As the sample mean ownership is 12.67%, this implies that sin stocks have approximately 9.86% of their shares held by institutions after adjusting for the control variables. This is a 22% shortfall relative to the mean, which is similar to US evidence finding a 24% shortfall (Hong & Kacperczyk, 2009). Comparable companies do not exhibit a significantly different institutional ownership structure than the mean as predicted by the theory. Social norms do not inflict these stocks.

The overall R^2 of 5.69% is relatively low, likely attributable to the weak explanatory power of the control variables. $LOGSIZE_{it}$ exhibits the highest correlation (0.2276) with the dependent variable and enters significantly in the regression at the 1% level, consistent with evidence that 'liquidity' is the greatest determinant for institutional investment (Gompers & Metrick, 2001). The highly significant and negative coefficient in front of $LOGMBT_{it}$ also indicates that institutions weakly favour value stocks, as the net book value of the company is valued more than the prevailing market value. The small coefficients could be due to the fact that $LOGSIZE_{it}$ and $LOGMBT_{it}$ are both scaled by share price. This results in a high correlation (0.3217) between the two variables, but an F-test confirms no presence of multicollinearity.

In Columns 4 and 5 the sample is split into two periods, 2002 – 2005 and 2006 – 2010, to test the stability of the SIN_{it} variable. There is a highly significant (1% level) and negative

[14] Results of a Lagrangian Multiplier test show that there exists a significant amount of variation across panels (1% level).

coefficient in front of the SIN_{it} dummy under both random-effects regressions, suggesting that the neglect of sin stocks is stable. This evidence is more robust than that provided by Hong & Kacperczyk (2009) where the coefficient value is only significant at the 1% level between 1980 – 1984[15]. The results therefore offer support to Merton's (1987) Assumption 1 made in Section 1.3.

2.3. Implications for Stock Returns

The results suggest that institutional investors neglect sin stocks from their portfolios after adjusting for liquidity, value and price volatility. Given this 'segmentation', the following section investigates whether investors receive an expected return above that predicted by the CAPM (Hypothesis 2).

2.3.1. Methodology

Multi-factor asset pricing models are used in an OLS time series regression from January 2003 – December 2010:

$$\boldsymbol{Portfolio_t - Rf_t = \alpha_t + \beta_1(Rm_t - Rf_t) + \beta_2 SMB_t + \beta_3 HML_t + \beta_4 UMD_t + \varepsilon_t} \quad \textbf{(4)}$$

$$\textbf{t = 1,...,T,}$$

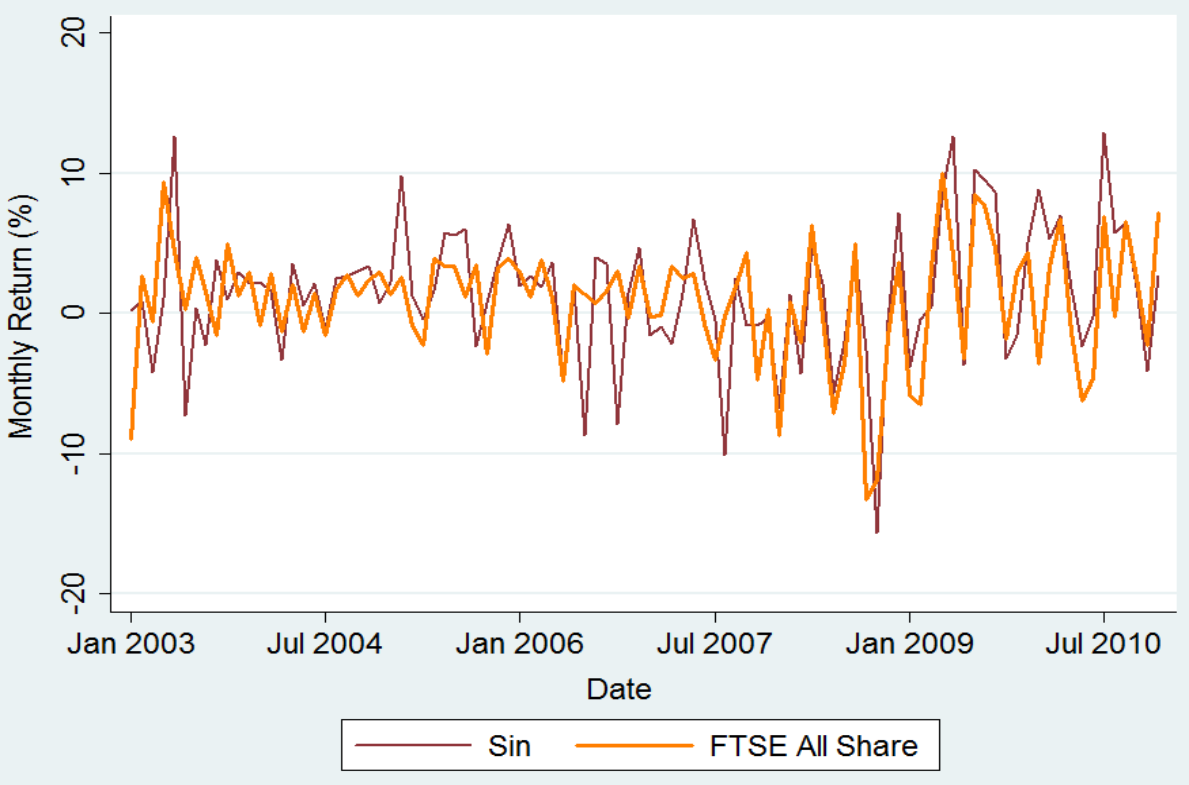
where '$Portfolio_t$' is the monthly return on the respective portfolio and 'Rf_t' is the monthly return on the UK 1 month Treasury Bill. '$Portfolio_t - Rf_t$' is therefore the excess return on the portfolio. The CAPM controls for the market risk premium ($Rm_t - Rf_t$), the Fama & French model additionally for size (SMB_t) and value (HML_t), while the Carhart model also includes

[15] Hong & Kacperczyk (2009) disaggregate the time period of 1980 – 2006 into five sub-periods. The coefficient on SIN_{it} varies from -0.0163 to -0.0638.

momentum (UMD_t). The coefficient of interest is α_t ('alpha'), the excess risk-adjusted return on the portfolio, which the theory predicts is positive for sin stocks.

Before adjusting for risk, summary statistics are reported. The sin portfolio has outperformed the FTSE All Share Index by approximately 7.54% per year over the sample period:

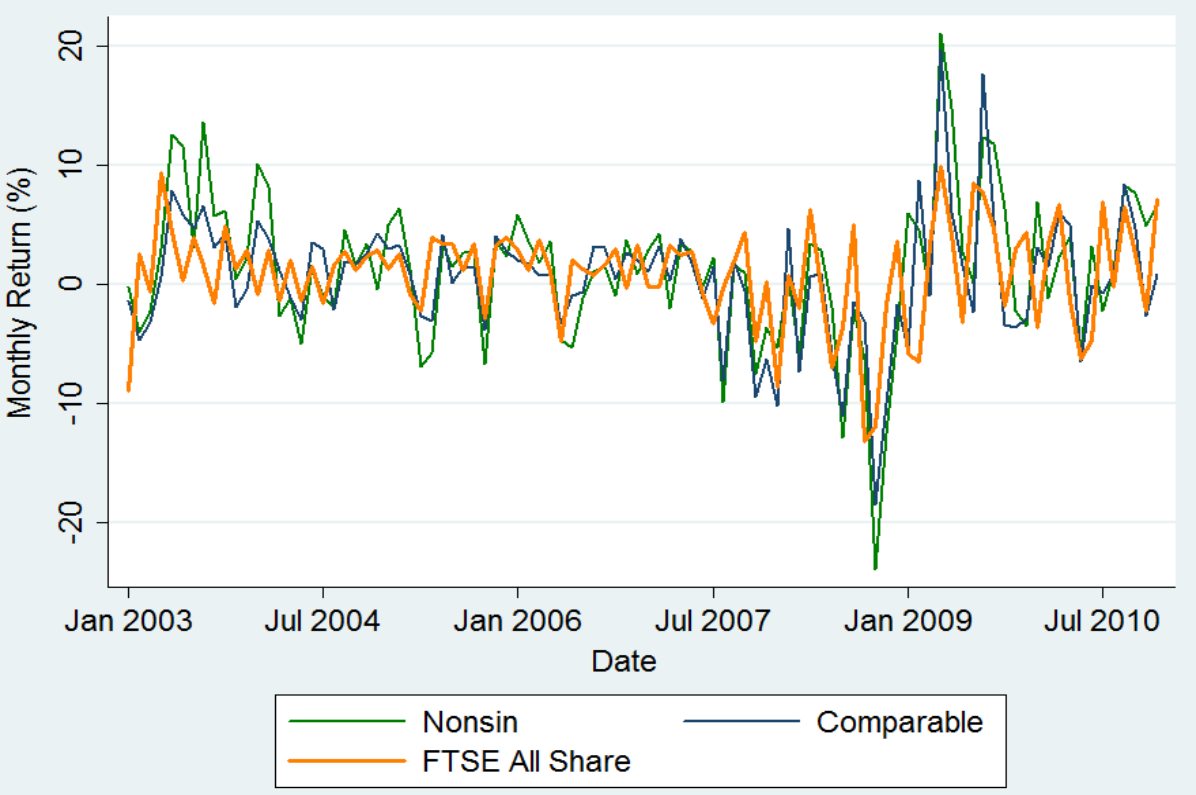
Figure VIII: Sin Returns (%)



Notes

See Appendix C (Figure IV) for numerical descriptive statistics.

Figure IX: Control Returns (%)



In contrast, comparable stocks have underperformed the market by approximately 4.15%, whereas non-sin stocks have outperformed the market by roughly 5.64%. One reason for this could be that discarded stocks, mostly financial companies, experienced severe underperformance over the period. If Hypothesis 2 holds, non-sin outperformance should be a function of risk rather than the effect of social norms. The theory predicts no excess risk-adjusted returns for non-sin stocks.

2.3.2. Results

Figure X: Risk Adjusted Returns (Jan 2003 – Dec 2010)

	Model	α_t	$Rm_t - Rf_t$	SMB_t	HML_t	UMD_t	R^2
Sin_t	CAPM	**0.7502*** (0.0405)	**0.7023***** (0.0946)				36.26%
	Fama	**0.6805*** (0.3873)	**0.6278***** (0.0935)	**0.1673** (0.1170)	**0.2028** (0.1237)		41.98%
	Carhart	**0.6277** (0.3967)	**0.6431***** (0.0967)	**0.1993** (0.1270)	**0.2075*** (0.1243)	**0.0628** (0.3967)	41.62%
$Non\text{-}sin_t$	CAPM	**0.6119** (0.5763)	**0.6966***** (0.1346)				21.35%
	Fama	**0.4350** (0.4401)	**0.6191***** (0.1063)	**1.0496***** (0.1329)	**-0.3357**** (0.1406)		54.27%
	Carhart	**0.2993** (0.4463)	**0.6585***** (0.1088)	**1.132***** (0.1429)	**-0.3236**** (0.1399)	**0.1615** (0.1075)	54.89%
$Comp_t$	CAPM	**-0.1391** (0.4598)	**0.6783***** (0.1074)				29.05%
	Fama	**-0.2911** (0.3557)	**0.5844***** (0.0859)	**0.7491***** (0.1074)	**-0.8048** (0.1136)		57.66%
	Carhart	**-0.3274** (0.3648)	**0.5949***** (0.0889)	**0.7711***** (0.1168)	**-0.0773** (0.1143)	**-0.3274** (0.3648)	57.31%

Notes

Independent variable: $Portfolio_t - Rf_t$
Observations: 96
Standard errors in parentheses: * p < 0.10, ** p<0.05, *** p < 0.010
Adjusted R^2 are reported
Coefficients and standard errors are reported to four decimal places
Coefficients reported in % monthly return

Sin stocks exhibit excess risk-adjusted returns of 75 basis points per month under the CAPM (coefficient on α_t of 0.7502). This becomes more conservative under the Fama-French model at 68 basis points, significant at the 10% level in both models. Investors who shun sin stocks therefore pay an opportunity cost of 8.47% per year, which is comparable to Fabozzi et al.'s (2008) finding of 8.19%. The coefficients of SMB_t and HML_t suggest that neither the 'size' or 'value' effects are significant determinants of sin stock returns over the period. An F-test shows that the two variables are jointly significant at the 1% level and implies that returns are instead explained by the portfolio's market risk (coefficient on $Rm_t - Rf_t$). This coefficient, also known as 'Beta', implies that a 1% increase in the market return is associated with a 0.6278% increase in sin stock returns. This is similar to European evidence, where Salaber (2007a) finds a Beta of 0.7243. This relationship implies that sin stocks are relatively defensive to the market and perhaps could be due to the low cyclicality of sin products.

Non-sin stocks no longer exhibit excess returns once adjusted for risk as the alpha of the portfolio is insignificantly positive (0.4350). Notice that the coefficient on SMB_t is very high for non-sin stocks and comparable stocks (1.0496 and 0.7491 respectively), whereas this is small and insignificant for sin stocks (0.1673). This implies that both control groups have behaved like 'small-cap' stocks, which is expected due to the low market capitalisations of both portfolios (see Figure IV).

As '$Rm_t - Rf_t$' enters significantly at the 1% level for all regressions, the results confirm that the CAPM is a suitable benchmark for predicting stock returns. Misspecification tests are carried out to test if it captures all of the relevant market risk, but results indicate no evidence for omitted relevant variables. But if this is the case, the coefficients on SMB_t and HML_t should be zero for all regressions. The results from the two control samples provide strong support for the alternative hypothesis. Furthermore, the superior explanatory power of the

Fama-French model (an average R^2 of 51%) suggests that it improves upon the CAPM in terms of goodness of fit.

The additional momentum factor (UMD_t) does not enter significantly in any regression, nor does the Carhart model exhibit higher explanatory power than the Fama-French model (also exhibiting an average R^2 of 51%). This is similar to the findings of Hong & Kacperczyk (2009) in the US context, who apply the Carhart model over a longer time period from 1926 – 2006. This result thus indicates that 'stock momentum' does not significantly determine UK stock returns over the period.

SECTION III: CONCLUSIONS

3.1. Conclusion

This paper helps explain the differences in returns that cannot be explained by traditional portfolio theory. Relative to the average firm, it finds that sin companies have a 22% lower proportion of their shares held by institutional investors. This is consistent with the theory that a social custom can persist if agents have to pay a reputation loss for disobedience (Akerlof, 1980). The paper then contributes by utilising two multi-factor asset pricing models. Consistent with the theory of segmented markets (Merton, 1987), sin stocks have exhibited excess risk-adjusted returns of 68 basis points in an average month. Non-sin stocks also outperform the market by 5.64% in an average year, but this is merely a compensation for market risk. While historical stock performance (momentum) does not help explain returns, the significance of the 'size' and 'value' effects imply that the Fama – French model (1997) is the most efficient model for explaining UK stock returns over this period.

3.2. Implications

The purpose of this paper has not been to pass any judgement on socially responsible investing itself or to suggest that a rational investor should overweight sin stocks. The results imply that socially responsible investors are paying a high opportunity cost for their actions. If these investors gain utility for complying with social norms, such behaviour may be rational. However, due to the excess returns on sin stocks more wealth is shifted away from socially responsible investors as more investors, subject to social norms, enter the market. This result will prove valuable to the cost-benefit analyses used by portfolio managers and their clients. Second, the efficiency of the Fama-French model has implications for the

direction of future research. The CAPM does exhibit *some* explanatory power, but overall it is an incomplete specification to price portfolio risk.

3.3. Limitations

Limitations on data means that investors are not disaggregated by 'type', resulting in omitted variables in the panel regression. As 'Beta' and 'FTSE Index Inclusion' variables were not available, risk could not be controlled for when investigating ownership. The time period is also shorter than others and is curtailed by the start date of institutional ownership data, available from 2002, and the end date of the return factors, up until 2010. The use of a SIN_{it} dummy variable in the panel regression also assumes that social norms are constant over time, as does the unconditional asset pricing models with constant risk factors. The question remains whether there are enough norm-constrained investors to increase the cost of capital of sin companies. Ethical funds currently constitute approximately 1.10% of UK assets under management (IMA, 2013), indicating that the UK SRI market is still relatively niche at this stage. Nevertheless, the theory provided by James & Rivoli (1997) suggests that there could be a substantial effect on firms that are larger, faster growing or have high idiosyncratic risk.

3.4. Recommendations

An analysis of different institutional investors would provide insight into whether social norms have a homogenous effect. However, this may be restricted by data availability. Future research may attempt to control for firm specific risk (e.g. tax and litigation risk) to more accurately identify social norm effects derived from investor behaviour. Furthermore, an investigation into sin stocks across the business cycle (Salaber, 2007b), perhaps applying a dynamic GARCH model, could improve upon the static nature presented in this paper.

Appendix A: Variable Descriptions

Institutional Ownership

Variable Name	Description
IO_{it}	Free Float Investment Co. Held – the proportion of total shares issued held as long term strategic holdings by investment firms (investment banks or institutions) seeking a long term return of company i at the end of year t. Reported as a decimal in the regression. **Source: TR DataStream, Code: "NOSHIC"**
SIN_{it}	Dummy variable. Takes a value of 1 if a 'sin stock' and 0 'otherwise'.
$COMP_{it}$	Dummy variable. Takes a value of 1 if a 'comparable stock' and 0 'otherwise'.
$LOGMBT_{it}$	Market to book value is the share price of the company divided by the net book value. Reported in logs. **Source: TR DataStream, Code: "MVBT"**
$LOGSIZE_{it}$	Market capitalisation – the share price multiplied by the number of ordinary shares in issue. MV is reported in million units of GBP while regression variable reported in logs. **Source: TR DataStream, Code: "MV"**
VOL_{it}	Price Volatility. A measure of a stock's average annual price movement to a high and low from a mean price for each year. Reported as a decimal in the regression. **Source: TR DataStream, "VOL"**

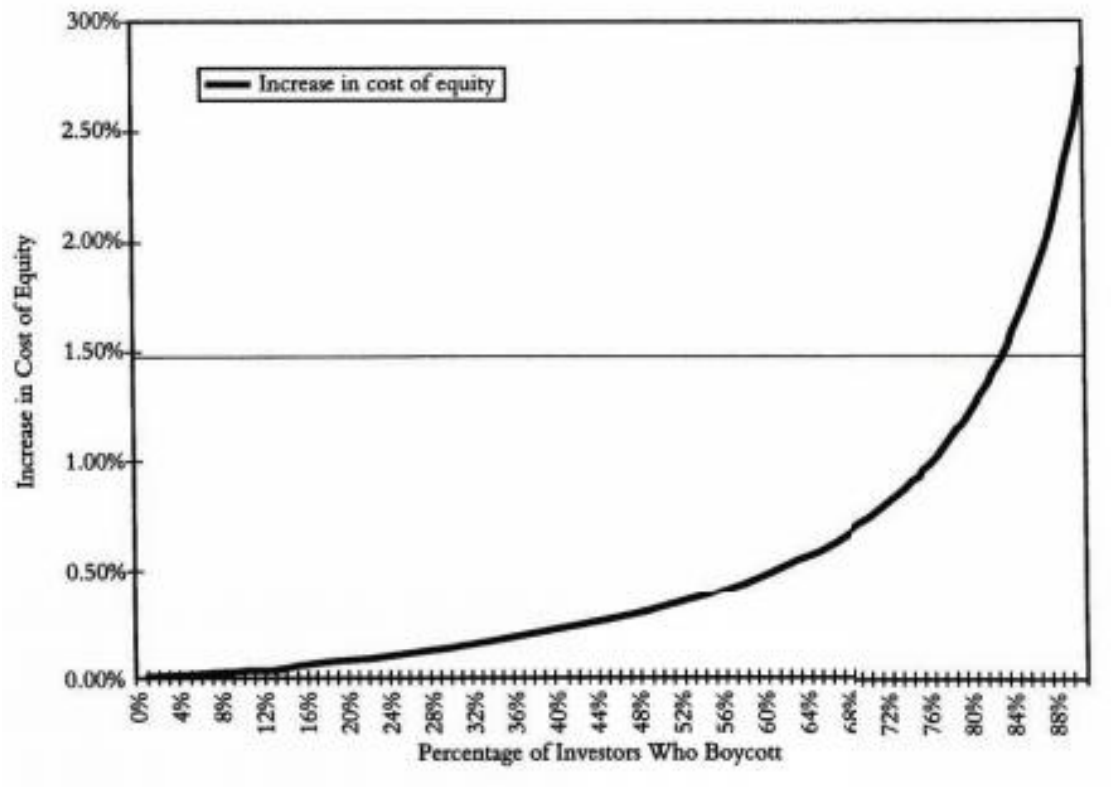
Portfolio Returns

Variable Name	Underlying Variable
$\mathbf{Sin_t}$	Arithmetic return on equally weighted portfolio of sin stocks. The portfolio contains alcohol, tobacco and gambling companies. **Source: TR DataStream**
$\mathbf{Comp_t}$	Arithmetic return on an equally weighted portfolio of comparable stocks. The portfolio contains companies from the following industries: "*Soft drinks*", "*Food Products*", "*Travel & Leisure*". **Source: TR DataStream**
$\mathbf{Non\text{-}sin_t}$	Arithmetic return on an equally weighted portfolio of Non-sin stocks. The portfolio contains companies from 18 DataStream industries excluding financial stocks, sin stocks and comparable stocks. **Source: TR DataStream**
$\mathbf{Rm_t}$	Return on the market portfolio. Proxied by FTSE All Share index. When net of the risk free rate this represents the "market risk premium". **Source: Gregory et al. (2013)**
$\mathbf{Rf_t}$	Risk free rate of return. Proxied by the 1 month UK Treasury Bill. **Source: Gregory et al. (2013)**
$\mathbf{SMB_t}$	"Size effect" – the average return of a portfolio long on three types of "small stocks" (those with high "S/H", medium "S/M", low "S/L" book to market ratios), short on three types of "big stocks" (those with high "B/H", medium "B/M", low "B/L" book to market ratios). **Source: Gregory et al. (2013)**
$\mathbf{HML_t}$	"Value effect" – the average return of a portfolio long on "value stocks" (both big stocks "B/H" and small stocks "S/H) and short on "growth stocks" (both big stocks "B/L" and small stocks "S/L"). **Source: Gregory et al. (2013)**
$\mathbf{UMD_t}$	"Momentum effect" – the average return of a portfolio long on past one-year returns winners (both of small stocks "S/U" and big stocks "B/U") and short on prior losers (both of small stocks "S/D" and big stocks "B/D"). **Source: Gregory et al. (2013)**

Appendix B: Merton's (1987) model

The following section provides greater detail of James & Rivoli's (1997) adaption of Merton's (1987) model to socially responsible investing. As seen from equation (1) in Section 1.3, a firm's increase in cost of equity capital, equivalent to an investor's expected return, is determined by q_k, the fraction of investors willing to invest in the firm, x_k , the weight of the stock in the market portfolio, δ, market risk aversion[16], and σ, the idiosyncratic risk of the firm. James & Rivoli (1997) assume that a firm has an idiosyncratic risk of 40% and weight in the market portfolio of 1%, yielding the following effect of negative screening by a group of investors:

Figure II: Effect of screening on the cost of equity capital

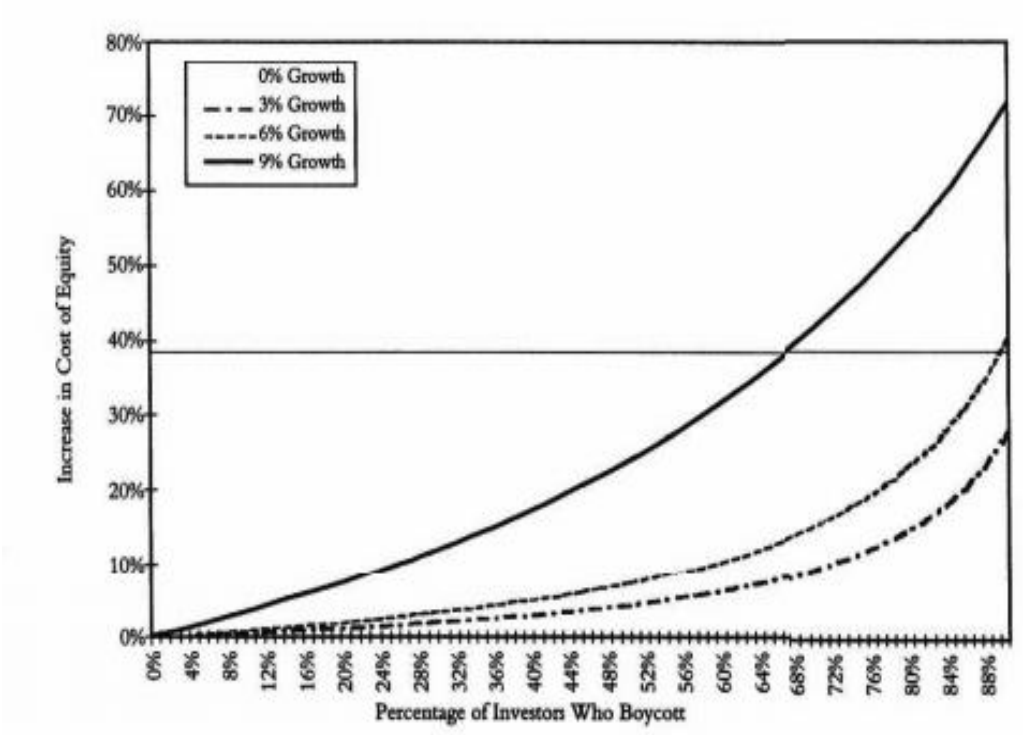


Source: James & Rivoli (1997)

[16] Merton (1987) suggests that a risk aversion of 2 is reasonable.

As can be seen, if 50% of investors boycott the stock, the cost of equity that the company would face would increase by 0.32%[17]. They demonstrate that a substantial fraction of the capital market must boycott a firm for a sizeable increase in the cost of equity capital for the firm. However, a boycott will have a much higher impact on faster growing firms:

Figure II: Effect of screening on a growing company



Source: James & Rivoli (1997)

As shown from above, a fast-growing, high-risk or larger firm would have much more to lose from an investor boycott than a small firm with lower growth or less firm-specific risk. James & Rivoli (1997) also indicate the level of risk aversion used by Merton (1987) is too low and when adjusted upwards, the impact of an investor boycott becomes substantially greater. One therefore has reason to expect the cost of capital can be sufficiently implicated even when a very small proportion of investors are socially responsible.

[17] When this increases to 76% of investors, the cost of capital increases by roughly 0.96%.

Appendix C: Empirical Analysis

Figure III: Time Series View of Portfolios

This table gives a time-series display of the portfolios from 2002 – 2010. It indicates the number of sin stocks (measured by availability of IO_{it} data) at the end of each year:

YEAR	SIN	NON SIN	COMPARABLE
2002	24	616	126
2003	22	631	119
2004	24	721	114
2005	29	853	113
2006	33	912	110
2007	24	912	109
2008	24	881	93
2009	22	813	80
2010	20	730	69
Mean	**25**	**785**	**104**

Figure IV: Further Portfolio Descriptive Statistics

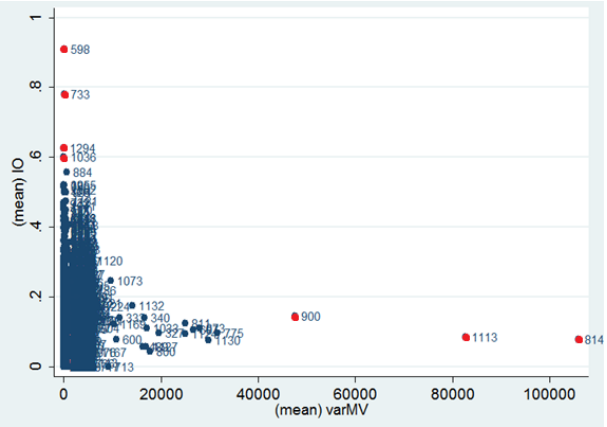
This table provides annual effective rates (AER) of all portfolios and risk factors. These are calculated by: $AER = (1 + MMR)^{12} - 1$. This takes in account of compounded interest. All portfolios and factors have 96 observations and figures are rounded to 2 decimal places.

	Variable	Monthly Mean Return (MMR) %	Annual Effective Rate (AER) %	Standard Deviation %	Min %	Max %
Portfolio returns	$Sin_t - Rf_t$	1.17	14.98	4.93	-15.95	12.85
	$Non\text{-}sin_t - Rf_t$	1.03	13.08	6.30	-24.21	21.04
	$Comp_t - Rf_t$	0.27	3.29	5.30	-18.85	19.69
Risk factors returns	$RmRf_t$	0.60	7.44	4.26	-13.61	9.90
	SMB_t	0.31	3.78	4.10	-11.83	18.54
	HML_t	0.31	3.78	3.96	-7.60	20.95
	UMD_t	0.51	6.29	4.84	-27.37	14.06

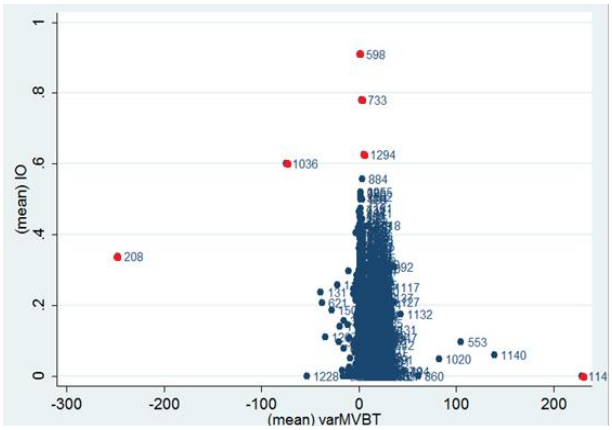
Figure V: Data Selection: Robustness Checks

An analysis is conducted on the stock samples to remove any outstanding outliers. Two of the control variables in the panel regression, $LOGSIZE_{it}$ and $LOGMBT_{it}$, are both scaled by the share price (P). Outlier stocks are cross checked with external sources to explore consistency in the DataStream data and any unusual stocks (10 non-sin and 1 comparable stock) are discarded (highlighted in red):

IO_{it} - MV_{it}



IO_{it} - $MVBT_{it}$



Data Cross-Checks

The sample is cross checked with UK SIC (2007) codes available from FAME. However, this data source faces further limitations. The classification of "*Tobacco"*, for instance, includes supermarkets such as Tesco, WM Morrison Supermarkets and Ocado Group, which do not derive a substantial portion of their revenues from tobacco products.

All the companies listed on the LSE Main Market are also considered in the analysis before removed if pre-requisite data is not available. There are approximately 1800 companies listed on the Main Market of the London Stock Exchange, which puts the non-sin sample in a relatively good context in terms of size and stock diversity (London Stock Exchange, 2013b).

Figure VI: Correlation matrix and Multicollinearity tests

Institutional Ownership

	IO_{it}	$LOGSIZE_{it}$	$LOGMBT_{it}$	VOL_{it}
IO_{it}	1.0000			
$LOGSIZE_{it}$	0.2276	1.0000		
$LOGMBT_{it}$	0.0215	0.3217	1.0000	
VOL_{it}	0.0167	-0.0009	-0.0021	1.0000

Test	Null Hypothesis	Result	Outcome (1% level)
F-test	$LOGSIZE_{it} = 0$	$Chi^2 = 25.04$	Reject
Model: Random-effects	$LOGMBT_{it} = 0$	$Pr > Chi^2 = 0.0000$	

Time-series Returns

	$Rm_t - Rf_t$	SMB_t	HML_t	UMD_t
$Rm_t - Rf_t$	1.0000			
SMB_t	0.2002	1.0000		
HML_t	0.0264	0.3019	1.0000	
UMD_t	0.0250	-0.0029	0.0330	1.0000

Test	Null Hypothesis		Result	Outcome (1% level)
F-test **Model: Fama-French**	$SMB_t = 0$ $HML_t = 0$	**Sin**	F (2, 92) = 5.63 P > F = 0.0049	Reject
		Non-sin	F (2, 92) = 34.84 P > F = 0.0000	Do not reject
		Comp	F (2, 92) = 32.76 P > F = 0.0000	Do not reject

Diagnostic Tests

Figure VII: Institutional Ownership

Test	Null Hypothesis	Result	Outcome (1% level)
Breusch-Pagan Test **Model: OLS**	Homoskedasticity	$Chi^2 = 128.18$ $Pr > Chi^2 = 0.0000$	Reject
Wooldridge Test **Model: OLS**	No first order serial correlation	$F = 54.627$ $Pr > F = 0.0000$	Reject
Hausman Test **Model: Random-effects and Fixed-effects**	Both fixed effects and random effects are consistent	$Chibar^2 = 44.69$ $Pr > Chibar^2 = 0.0000$	Reject
Breusch and Pagan Lagrangian Multiplier (LM) **Model: Random-effects**	No random effects $var(u) = 0$	$Chi^2 = 1465.56$ $Pr > Chibar^2 = 0.0000$	Reject

Result: The Breusch-Pagan and Wooldridge tests find that the OLS model suffers from heteroskedasticity and first order serial correlation respectively. A Hausman test shows that a fixed-effects model is better than the random-effects model. However, a fixed-effects model is not appropriate as it omits the dummies of interest (as they are linear combinations of the panels). A Breusch and Pagan Lagrangian Multiplier under the random-effects regression finds that there is significant variation across panels. Therefore a random-effects model is chosen and serial correlation is addressed through clustering standard errors.

Figure VIII: Portfolio Returns: Homoskedasticity and Misspecification test

Test	Null Hypothesis	Result		Outcome (1% level)
Breusch-Pagan **Model: Fama-French**	Homoskedasticity	**Sin**	Chi^2= 0.00 Pr>Chi^2 = 0.9564	Do not reject
		Non-sin	Chi^2= 0.04 Pr>Chi^2=0.8330	Do not reject
		Comp	Chi^2= 0.20 Pr>Chi^2= 0.6558	Do not reject
Ramsey RESET test **Model: CAPM**	No omitted relevant variables	**Sin**	F (3, 91) = 0.39 P > F = 0.7633	Do not reject
		Non-sin	F (3, 91) = 1.30 P > F = 0.2785	Do not reject
		Comp	F (3, 91) = 1.35 P > F = 0.2619	Do not reject

Result: The one-factor CAPM model does not suffer from omitted relevant variable bias according to a RESET test. To test the robustness of the final specification (Fama-French), a Breusch Pagan test is run. The model does not suffer from heteroskedasticity.

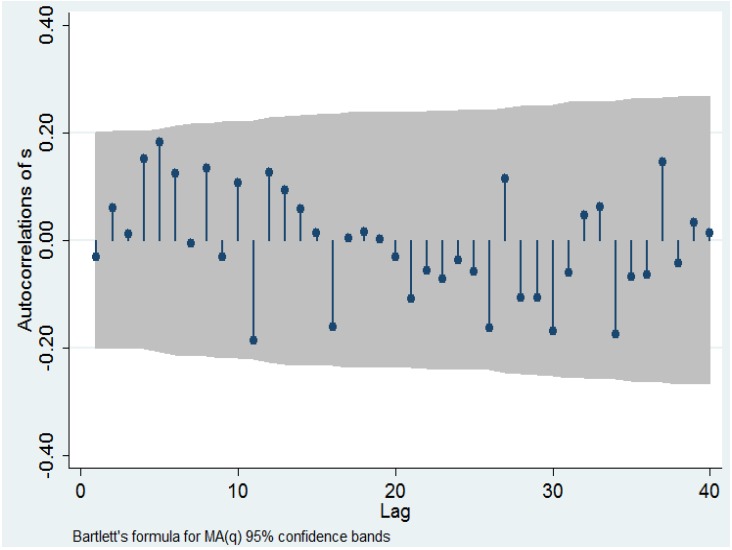
Figure IX: Portfolio Returns: Serial Correlation

Test	Null Hypothesis	Result		Outcome (1% level)
Breusch-Godfrey **Model: Fama-French with 6 lags of residual**	No Serial Correlation	**Sin**	F = 1.23 Pr >F = 0.2991	Do not reject
		Non-sin	F = 2.69 Pr>F =0.0199	Do not reject
		Comp	F = 0.70 Pr >F = 0.6541	Do not reject

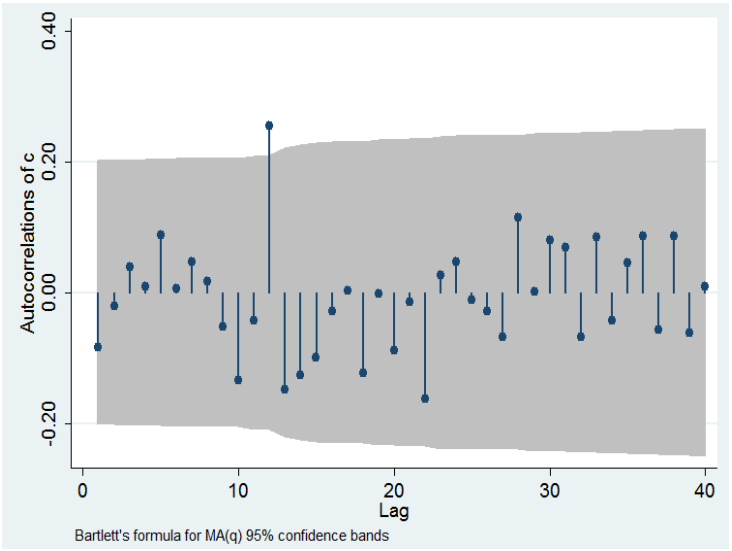
Result: The autocorrelation functions (see Figure X) show mild serial correlation in the non-sin and comparable portfolio at the 10^{th} and 12^{th} lag respectively. However, a Breusch Godfrey test with 6 lags reveals that there is no significant serial correlation at the 1% level.

Figure X: Portfolio Returns: Autocorrelation Functions

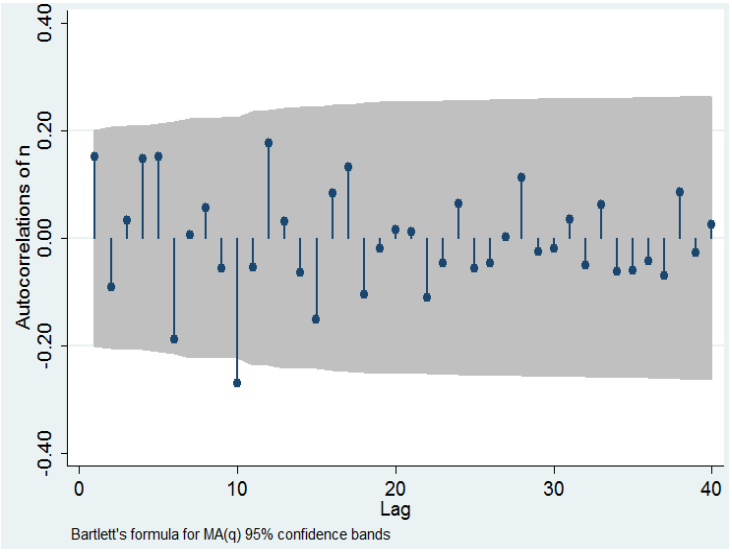
Sin



Comparable



Non-sin



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