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# The impact of ethical investing on returns, volatility and income

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Ethical investing is now a mainstream issue. Charities, faith-based investors and institutions are adopting more ethical investment approaches to ensure their capital is aligned with their mission, and investment managers are being challenged to meet this growing demand.

In the meantime, however, there have been few studies of the impact of imposing ethical constraints on an investment portfolio.

Against this backdrop, we commissioned Dr Chendi Zhang and Dr Lucius Li of Warwick Business School to analyse the impacts of commonly applied ethical screens in order to provide an independent, academic starting point for interested investors.

Historically, ethically minded investors have sought to avoid investing in areas such as tobacco, alcohol, weapons, pornography and gambling. More recently, the increasing social awareness of climate change has sharpened the focus on fossil fuels. Dr Zhang's paper evaluates the impact of excluding these areas from investment portfolios – in terms of performance, yield and volatility. In some cases, a sector-wide screen is applied (e.g. excluding the tobacco sector), while in others, such as pornography, a materiality threshold is used to identify businesses deriving significant revenue from particular activities.

The study is far-reaching. It covers over 10,000 stocks in 28 developed and emerging markets, and 1,283 US corporate bonds. The sample period runs from 2004 to 2015.

# Key findings

## Issues and geography matter

Within developed markets, tobacco and alcohol exclusions have had the largest negative impact on risk-adjusted performance, at -0.15% and -0.13% respectively. Overall, threshold-based screening of 'sin stocks' has reduced returns by 0.47% p.a.

Within those headline numbers, there have been significant variations: UK (-1.00% p.a.), Asia-Pacific (-0.41% p.a.) and US (-0.34% p.a.), while Europe ex UK has been largely unaffected.

The individual screens themselves have also shown significant variability. Excluding alcohol in the US has had a negative impact of 0.03% p.a., while in the UK it has benefited performance by 0.57% p.a. Likewise, excluding tobacco has cost 0.02% p.a. in the US, while in the UK it has reduced performance by 0.43% p.a. Excluding the five key areas in Europe (ex UK) has historically delivered a 0.01% p.a. positive impact. Within developed markets, weapons and gambling have had very little impact across geographic areas.

## Defining how screens are implemented can have a significant impact

Portfolios which implement materiality or threshold-based sin-stock screens excluded more of the investible universe by market capitalisation (10.52%) when compared with sector-only screens (8.77%). Portfolio theory would suggest that the more one reduces an investible universe, the greater should be the impact on volatility, given the reduced opportunity set. This is supported by Dr Zhang's findings.

## Periods of tailwinds and headwinds

There were significant reductions in returns from ethically restricted developed market portfolios during and after crisis periods, i.e. from 2006 to 2014. In particular, from 2011 to 2013, the reduction in returns from excluding sin stocks was the largest, at 0.9% p.a. Conversely, exclusion of sin stocks had a positive impact on returns (of 0.2% p.a.) during the period from 2004 to 2006.

## Fossil fuels

For developed markets, there was no significant impact of fossil fuel screens on portfolio returns, volatility and income over the course of the study. Exclusion of fossil fuel stocks increased portfolio returns by 0.02% p.a., lowered volatility by 0.02%, and reduced the dividend yield by 0.03% p.a. The *de minimis* impact on yield is perhaps surprising given that oil & gas has historically been heralded as one of the best yielding sectors – providing investors with a source of stable, predictable income.

As one would expect, there is some linkage between fossil fuel stock performance and fossil fuel prices in developed markets. During periods of sustained fossil fuel price weakness, the benefit of avoidance was as much as 0.86% between 2012 and 2014. For the UK, the performance uplift was 1.81% over the same period – reflecting the high weighting of the oil & gas sector within the UK market.

Interestingly, emerging-market portfolios benefited significantly from a fossil fuel exclusion policy over all rolling three-year periods. This is surprising given that this was the case even in periods when oil prices were rising rapidly in the lead-up to 2008, and then again between 2009 and 2011. Over the period of the study, exclusions increased portfolio returns by 1.1% p.a., increased volatility by 0.8% p.a., and had an insignificant negative impact on yield. 2008 – 2010 was the period during which avoiding fossil fuels had the biggest positive impact (+2.6% p.a.). It could be argued that this positive effect has been attributable to the fact that many emerging-market oil companies are under state control, and as a result are not necessarily managed with shareholders' best interests in mind.

## Economic backdrop

The macroeconomic backdrop is likely to play an important part in the impact of screens over time. During periods of growth or expansion, investors may be prepared to invest in growth-orientated sectors of the market. Conversely, during periods of depressed growth and heightened levels of uncertainty, investors may seek 'havens', such as sectors characterised by higher yields and greater liquidity. Tobacco and oil & gas producers are examples of these sectors.

## SUMMARY IMPACT ANALYSIS (SIN SCREENS)<sup>1</sup>

Sin screen	Performance impact (p.a)	Volatility impact	Yield impact
Developed markets	Reduces 0.3 – 0.5%	Increases 0.3 – 0.4%	Reduces 0.05 – 0.06%
UK	Reduces 0.5 – 1.0%	Increases 0.8 – 0.9%	Reduces 0.05 – 0.08%
US	Reduces 0.3%	No significant impact	Reduces 0.02 – 0.03%
Europe ex-UK	Increases 0.0 – 0.3%	Increases 0.6%	Reduces 0.04 – 0.07%
Asia Pacific	Reduces 0.1 – 0.4%	Increases 0.3 – 0.4%	Reduces 0.03%
Emerging markets	Reduces 0.0 – 0.1%	Increases 0.2%	No significant impact
US corporate bonds	No significant impact	No significant impact	No significant impact

<sup>1</sup> For further information, please see the full version of the paper, beginning on page 5 of this document.

## SUMMARY IMPACT ANALYSIS (FOSSIL FUEL SCREENS)<sup>2</sup>

Fossil fuel screen	Performance impact (p.a)	Volatility impact	Yield impact
Developed markets	No significant impact	No significant impact	Reduces 0.03%
UK	Increases 0 – 0.2%	Increases 0.1 – 0.2%	Increases 0.03%
US	Reduces 0.2 – 0.3%	Increases 0.1%	Increases 0.01%
Europe ex-UK	No significant impact	Increases 0.1 – 0.2%	Reduces 0.06%
Asia Pacific	No significant impact	Reduces 0.1 – 0.2%	Reduces 0 – 0.01%
Emerging markets	Increases 1.1 – 1.2%	Increases by 0.7 – 0.8%	Reduces 0.06%
US corporate bonds	No significant impact	No significant impact	No significant impact

<sup>2</sup> For further information, please see the full version of the paper, beginning on page 5 of this document.

What is clear is that, when selecting managers, the ability to find suitable substitutes to mitigate the impacts of excluded areas is important. However, this research does not investigate the impact of manager discretion given the complexity of measuring such decisions and timing.

Ethical investing considers both financial and non-financial aspects of investing. It is therefore important for both investors and managers to be aware of the potential impacts (on investible universe, performance, volatility and yield) when building ethical investment policies and looking at how these will be implemented.

We hope that Dr Zhang and Dr Li's independent work is a useful starting point for investors; while the past is clearly not a perfect guide to the future, it seems a sensible starting point for discussions. The report highlights a number of points, but, importantly, it shows that the impact of ethical exclusions can vary over time. Investors need to be aware of this variability and factor it into their decision-making.

The social and political pressures that have brought about the move towards ethical investing seem to be well entrenched. As such, we believe that this is a topic that will be of increasing importance for trustees, their advisors and investment managers.

## For more information



### Freeman Le Page

SRI Investment relationship manager

020 7163 4424

freeman\_lepage@newton.co.uk

[www.newton.co.uk/impact-of-ethical](http://www.newton.co.uk/impact-of-ethical)



### Stephanie Gore

Business development, charities

020 7163 6377

stephanie\_gore@newton.co.uk

# The impact of ethical investing on returns, volatility and income

Dr Lucius Li and Dr Chendi Zhang

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<b>Table of contents</b>	<b>Page</b>
Executive summary	6
1. Introduction	6
2. Data and summary statistics	7
2.1. International data	7
2.2. Measures of sin and fossil fuel stocks	7
2.3. Sample construction	8
2.4. Summary statistics	8
3. Impact of sin screens	9
3.1. Developed markets	9
3.2. Developed markets by region	10
3.3. Emerging markets	11
3.4. Risk-adjusted returns by individual screens	12
3.5. Risk-adjusted returns by rolling 3-year periods	13
3.6. US bonds	14
3.7. Summary of findings on sin screens	14
4. Impact of fossil fuel screens	14
4.1. Developed markets	14
4.2. Developed markets by region	15
4.3. Emerging markets	16
4.4. Risk-adjusted returns by individual screens	16
4.5. Risk-adjusted returns by rolling 3-year periods	17
4.6. US bonds	18
4.7. Summary of findings on fossil fuel screens	18
5. Conclusions	18
Acknowledgements	19
References	19

## Executive summary

- We study the impact of ethical investing (based on sin and fossil fuel screens) on returns, volatility and income from January 2004 to July 2015. We analyse 10,059 stocks in 28 developed and emerging markets and 1,283 bond issues in the US. Sin screens covered in this study include adult entertainment, alcohol, gambling, tobacco and weapons. Fossil fuel (FF) screens involve coal and oil & gas.

### Summary of findings on sin screens

- For a developed markets portfolio, the exclusion of sin stocks reduces stock returns by 0.3 – 0.5% per annum and increases volatility slightly by 0.3 – 0.4% per annum. Sin screens also lead to a very mild reduction of 0.05% per annum in dividend yield.
- For the US, sin screens reduce portfolio returns by 0.3% per annum. There is a larger impact for the UK: the returns drop by 0.5 – 1% per annum and the volatility increases by 0.8 – 0.9% per annum.
- For a Europe ex UK portfolio, excluding sin stocks increases returns by up to 0.3% per annum, while the portfolio volatility increases by 0.6% per annum. For an Asia-Pacific portfolio, the returns drop by 0.1 – 0.4% per annum and volatility rises by 0.3 – 0.4% per annum.
- The reduction in returns for developed markets is mainly driven by the exclusion of alcohol (0.2% per annum) and tobacco stocks (0.1% per annum). Across regions, the UK is the most affected by the exclusion of tobacco: the reduction is 0.4% per annum.
- The return reduction from sin screens is largest from 2011 to 2013: 0.9% per annum. In contrast, the exclusion of sin stocks has a positive impact on returns (0.2% per annum) during 2004 – 2006.
- For emerging markets, sin screens do not have a statistically significant effect on portfolio returns, volatility and dividend yield. There is a mild increase in volatility of 0.2% per annum.
- The exclusion of sin companies does not have a significant impact on US corporate bond yields, coupon rates or ratings.

### Summary of findings on fossil fuel screens

- For developed markets, there is no significant overall impact of fossil fuel screens on portfolio returns, volatility or income.
- For a US portfolio, excluding fossil fuel stocks reduces its return by 0.2 – 0.3% per annum, the largest reduction among all developed regions. For a UK portfolio, excluding fossil fuel stocks, in contrast, increases its return by up to 0.2%, and its volatility by 0.1 – 0.2% per annum.
- For a Europe ex UK portfolio, the exclusion does not have a significant effect on stock returns, but it increases the volatility by 0.1 – 0.2% per annum. Dividend yield is reduced by 0.06% per annum. For an Asia-Pacific portfolio, the effect is negligible on returns and dividend yield. It decreases the volatility by 0.1 – 0.2% per annum.
- During the early sample period until the recent financial crisis (2004 – 2008), the exclusion of fossil fuel stocks in

developed markets reduces risk-adjusted return by 0.3% per annum; but it has a positive impact on returns from 2010 to 2015. In particular, the increase in the risk-adjusted return is the highest from 2012 – 2014 (0.9% per annum) owing to sustained weakness in fossil fuel prices. For the UK, the effect is 1.8% for this period (after the 2010 BP oil spill).

- For emerging markets, the exclusion of fossil fuel stocks increases portfolio return by 1.1% per annum. Volatility increases by 0.8% per annum and dividend yield decreases by 0.06% per annum.
- The increase in portfolio returns for emerging markets is driven by oil & gas stock exclusion: the effect is 0.7% per annum. The increase is the highest for 2008 – 2010 (2.6% per annum) and lowest for 2005 – 2007 (0.03% per annum).
- For US corporate bonds, fossil fuel screens do not have a significant impact on their yield, coupon rate, or rating.

*“The life of money-making is one undertaken under compulsion, and wealth is evidently not the good we are seeking; for it is merely useful and for the sake of something else.” – Aristotle, written around 350 B.C.*

*“It is not from the benevolence of the butcher, the brewer or the baker, that we expect our dinner, but from their regard to their own self interest.” – Adam Smith, 1776, The Wealth of Nations*

## 1. Introduction

Ethical investing, or socially responsible investing (SRI), considers both financial and non-financial consequences of investments. In the US, assets that apply various environmental, social and governance (ESG) criteria are worth \$6 trillion and account for 18% of total assets under management (USSIF, 2014). SRI represents about 11% of professionally managed assets in Europe (Eurosif, 2014). The Global Sustainable Investment Alliance estimates that, broadly speaking, the sustainable investment market has taken a 30% market share of professionally managed assets globally (GSIA, 2014).

Related academic literature offers two contrasting views on the effect of ethical investing. One argues that ethical investing (broadly defined) improves investment performance: firms with good corporate governance and a high level of employee satisfaction have higher future stock returns (Gompers, Ishii, and Metrick, 2003; Edmans, 2011; Edmans, Li, and Zhang, 2015). The other documents that it pays to be ‘bad’. For example, Hong and Kacperczyk (2009) show that stocks in alcohol, tobacco and gambling industries outperform other stocks in the US.

In this paper, we explore the impact of sin and fossil fuel screens on total returns, risk-adjusted returns, volatility and income for 28 developed and emerging economies. Sin screens include adult entertainment, alcohol, gambling, tobacco and weapons. Fossil fuel screens consist of coal, and oil & gas. The sample covers 10,059 stocks and 1,283 bonds from January 2004 – July 2015.

We find that sin screens reduce developed-market equity portfolio returns by 0.3 – 0.5% per annum. By excluding sin stocks, US portfolio returns are reduced by 0.3% and UK portfolio returns by 0.5 – 1% per annum. The exclusion of tobacco and alcohol stocks drives those significant reductions. Meanwhile, removing sin stocks creates more volatile portfolio returns: developed-market portfolio return volatility increases by 0.4% per annum after excluding sin stocks. For the UK, the increase is particularly large at 0.8 – 0.9% per annum. Regarding portfolio income measured by annual dividend yield, the impact is neglectable at -0.05%. In contrast, there is a muted impact of sin screens on emerging-market equity portfolio returns. The volatility increases slightly by 0.2% per annum. For the US corporate bond market, there is no significant impact on bond returns and creditworthiness.

On fossil fuel screens, we find no economically and statistically significant impact on developed-market portfolio returns, volatility or dividend yield. There are regional differences though: exclusion of fossil fuel stocks reduces US portfolio returns by 0.2 – 0.3% per annum and increases UK portfolio returns by up to 0.2% per annum. The volatility increases by 0.1 – 0.2% for the US, the UK, and Europe ex UK. The effects on dividend yield are small across regions. In contrast, fossil fuel screens increase emerging-market portfolio returns and volatility by 1.1% and 0.7% per annum, respectively. These increases are mainly driven by the poor performance of oil & gas core stocks during the recent financial crisis. For the US corporate bond market, there are no significant effects from fossil fuel stock exclusion.

The rest of the paper is structured as follows. Section 2 describes our data and introduces measures for sin and fossil fuel screens. Section 3 studies the impact of sin screens on portfolio returns, volatility and income. Section 4 examines the impact of fossil fuel screens. Section 5 concludes.

## 2. Data and summary statistics

### 2.1. International data

International data on stocks and bonds are based on Li and Zhang (2015). For developed markets, we use stocks covered by the Ethical Investment Research Service (EIRIS) to form our stock universe. We use annual snapshots from 2003 to 2014. We have removed South Korean firms owing to incomplete data coverage. As a result, the developed-market equity universe includes stocks in 23 countries. They are the US, the UK, Europe ex UK (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland), and Asia-Pacific (Australia, Hong Kong, Japan, New Zealand, and Singapore). For emerging markets, we collect data from Datastream on stocks in the BRICS countries - Brazil, Russia, India, China and South Africa. Our sample contains 3,599 stocks for developed markets and 6,460 stocks for emerging markets.

Firm-level data for the US stocks are collected from the CRSP/Compustat Merged database. We multiply common shares outstanding (CSHOQ – the database variable name) by closing

price (PRCCM) to obtain market value. CRSP stock returns (TRT1M) are employed. Dividend yield is calculated as the annualised dividend dollar amount (DVRATE) divided by the closing price.

For other developed countries and emerging markets, stock returns and accounting data are obtained from Datastream/WorldScope. All the stocks are primary quotes and major securities. We use the total return index (RI) to calculate percentage returns. We obtain market value by multiplying common shares outstanding (WC05301) by adjusted closing price (P). All variables are in US dollars.

Data on US bond ratings and issuing characteristics are drawn from the Mergent Fixed Income Securities Database (FISD). The Bond Ratings sub-dataset includes ratings assigned by the three leading rating agents: Moody's, S&P, and Fitch. The Bond issues sub-dataset contains data on yield to maturity, coupon rate and maturity, all at issuance. The two sub-datasets are matched using bond CUSIPs and dates. Consistent with prior literature on bond performance (Becker and Milbourn, 2011; Lin, Wang, and Wu, 2011), we exclude bonds that are callable, puttable, convertible, substitutable, or exchangeable. We also exclude US issues by foreign issuers, defaulted bond issues, bonds denominated in foreign currencies, bonds with refund protection, and bonds with short maturity (less than one year). We keep only fixed-coupon and zero-coupon corporate bonds. Hence, we have 1,283 US corporate bonds within our bond universe.

To measure the credit risk of a bond, we assign a numerical value to each of the 21 bond rating levels (except level D) provided by Moody's, S&P, or Fitch, whichever gives the first rating to the bond at the time of issuance (Becker and Milbourn, 2011). Specifically, a score of 28 is assigned to rating AAA. Aa+ and AA+ are assigned with 26, and then the score decreases by 1 as the rating drops by one level. For instance, for the next rating level, Aa or AA, a score of 25 is assigned. To the end, we have a numerical value of 4 assigned to rating C.

### 2.2. Measures of sin and fossil fuel stocks

Sin stocks in this paper refer to stocks involved in adult entertainment, alcohol, gambling, tobacco, or weapons. We employ two ways to measure sin stocks: by sector and by turnover threshold classified using. For sector-based screens, we consider firms with Industry Classification Benchmark (ICB) codes equal to 3533 (brewers) and 3535 (distillers and vintners) as alcohol stocks, 3785 as tobacco stocks, 5752 as gambling stocks, and 2717 as defence stocks.

For turnover threshold screens, we use EIRIS data for turnover screens. We consider firms with a “Yes” answer to either of the following questions as adult entertainment stocks: “Does the company provide adult entertainment services (other than through mobile telecommunications)?” or “Does the company provide adult entertainment services via a mobile telecommunications network (excluding Japan)?”. In the earlier period during our sample, the two questions were combined into

one question “Does the company provide adult entertainment services?”. While acknowledging that telecommunications companies are not a major cause of concern for adult entertainment screening in investment practice, we are unable to separate telecommunications companies from other firms throughout our sample period across countries. Hence we adopt this broader and more consistent screen on adult entertainment.

For alcohol stocks, we require firms with an answer larger than 10% to the question: “What proportion of turnover comes from alcohol sale or production?”. For gambling stocks, we require firms with an answer larger than 10% to the question: “What proportion of turnover comes from gambling?”. Similarly, for tobacco or weapons stocks, we require firms with an answer larger than 10% to the respective questions: “What proportion of turnover comes from tobacco sale or production?” and “What proportion of turnover can be estimated to relate to military sales?”, respectively.

Fossil fuel stocks consist of coal, oil & gas, and oil & gas services stocks. Since the EIRIS dataset does not provide historical data on fossil fuel, we use sector-based screens for fossil fuel stocks. We consider firms with ICB codes equal to 1771 as coal stocks, 0533 (exploration and production) and 0537 (integrated oil & gas) as oil & gas core stocks, and 0573 (oil equipment and services) and 0577 (pipelines) as oil & gas services stocks. We employ two definitions of fossil fuel stocks: any stocks belonging to the coal and oil & gas core are termed “fossil fuel core”; fossil fuel core plus oil & gas services are considered as “fossil fuel extended”. The former (fossil fuel core) is narrower and more carbon-intensive than the latter (fossil fuel extended).

### 2.3. Sample construction

In this paper, we take a portfolio perspective to examine the impact of ethical investing. The equity portfolio is value-weighted and constructed at the beginning of each year using the list of firms in the previous year. The weights are based on end-of-previous-period stock market values. The EIRIS firm lists for developed markets start from 2003; therefore our sample period

begins with January 2004 and lasts until July 2015. We use the same period for emerging markets as well as bond markets.

For equity portfolios, *total returns* are defined as time series averages of raw returns of a value-weighted portfolio in US-dollar terms. *Risk-adjusted returns* are calculated as alphas of the CAPM regression, where we use FTSE Developed and Emerging Markets indices as benchmarks. *Volatility* is computed as the standard deviation of raw returns of value-weighted portfolio. *Dividend yield* is calculated as annual dividend divided by stock price. For bond portfolios, *yield* refers to yield to maturity at issuance. *Coupon rate* is the fixed annualised coupon rate at issuance. *Rating* is the numerical value assigned to each rating provided by rating agencies. All variables except the ratings are annualised and expressed in percentage terms. In all tables, \*\*\*, \*\*, and \* indicate significance at the 1%, 5%, and 10% level, respectively.

For our developed markets equity universe, non-US firms’ return and accounting data are initially matched with EIRIS firm lists using SEDOL codes. This leads to 3,599 firms in total that have data on return, dividend yield, price, end-of-last-period market value, and both ICB and SIC codes. For our emerging markets equity universe, there are a total of 6,460 firms that have the relevant data.

### 2.4. Summary statistics

Table 1 presents the market value weights for each sin and fossil fuel screen. Adult entertainment stocks account for 5.07% of the developed markets equity universe market value.<sup>3</sup> Alcohol stocks weigh 1.62% using a sector-based screen and 2.28% using a turnover-based screen. Gambling stocks are comparably less represented in our sample with 0.51% (0.59%) using a sector (turnover) screen. Tobacco stocks account for a respectful 1.14% (1.33%) using a sector (turnover) screen. Weapons stocks weigh 0.42% using a sector screen, compared to a much larger proportion of 1.25% using a turnover screen. In total, sin firms account for 8.77% (10.52%) of the market value of the entire developed markets using a sector screen (turnover screen).

<sup>3</sup> Firms that fall into these categories include a number of large telecommunications companies, for example AT&T, BT Group, News Corporation, Telefonica, Virgin Media, and Vodafone Group. This explains the relatively high weight of adult entertainment stocks in the developed markets equity universe.

**TABLE 1 SUMMARY STATISTICS**

	Market capitalisation weight %		
	Developed markets		BRICS
	Screened by sector	Screened by turnover	Screened by sector
<b>Sin screen</b>			
Adult entertainment (incl. mobile)	5.07	5.07	
Alcohol	1.62	2.28	1.52
Gambling	0.51	0.59	0.03
Tobacco	1.14	1.33	0.01
Weapons	0.42	1.25	0.04
Sin total	8.77	10.52	1.61
<b>Fossil fuel (FF) stocks</b>			
Coal	0.06		1.77
Oil & gas core	5.73		5.20
Oil & gas services	0.78		0.29
FF extended	6.57		7.26
Other stocks	84.66	89.48	91.13
Total	100.00	100.00	100.00

Note: Portfolio weights reported in the table are based on market capitalisation in % and average across months from January 2004 to July 2015.

With regard to fossil fuel firms, oil & gas core stocks are the most prominent in the developed markets stock universe with a market value weight of 5.73%. Oil & gas services account for 0.78% and coal stocks weigh a mere 0.06%. The weights of all fossil fuel stocks add up to 6.57%.

The sin and fossil fuel industries in the emerging markets stock universe are classified using sector-based screens. There is no sector-based classification for adult entertainment. Alcohol stocks account for 1.52% of the market value of the entire emerging markets. This is the highest of all the sin screens: 0.03% for gambling stocks, 0.01% for tobacco stocks, and 0.04% for weapons stocks. Oil & gas core stocks are again the most weighted non-ethical stocks, taking up a share of 5.20%. Coal stocks weigh 1.77%, which is considerably larger than their weight in developed markets (0.06%). Oil & gas services stocks account for 0.29%. Overall, total market value weights for both sin and fossil fuel stocks are 15.34% for developed markets and 8.87% for emerging markets.

### 3. Impact of sin screens

In this section, we examine whether the screening of sin stocks affects equity and bond portfolio returns, volatility, and dividend yield. We start by discussing results for developed markets and individual regions. Then we move on to results for emerging markets. Results by individual screens and rolling 3-year periods are discussed afterwards, before the US bond results.

#### 3.1. Developed markets

There are 3,599 firms from 23 countries in our developed markets equity universe. Table 2 presents portfolio performance before and after sin screens, and highlights the differences. The total return for the developed markets portfolio is 7.95% per annum. After adjusting for the FTSE Developed Index, the average adjusted return is -0.88%. Portfolio risk is measured by volatility of total return, which is 16.80% before screening. For portfolio income, the average annual dividend over price is 2.80%.

**TABLE 2 IMPACT OF SIN SCREENING IN DEVELOPED MARKETS**

	Total return	Risk-adjusted return	Volatility	Dividend yield
Universe	7.95	-0.88	16.80	2.80
Screened by sector	7.67	-1.31	17.13	2.74
<b>Difference</b>	<b>-0.27</b>	<b>-0.43**</b>	<b>0.33</b>	<b>-0.06</b>
Screened by turnover	7.63	-1.35	17.14	2.75
<b>Difference</b>	<b>-0.32</b>	<b>-0.47**</b>	<b>0.35</b>	<b>-0.05</b>

Note: All figures are in % per annum. *Difference* indicates the performance of the screened portfolio relative to the universe. \*\*\*, \*\*, and \* indicate statistical significance of 1%, 5%, and 10% respectively.

The total return of the developed markets portfolio drops from 7.95% to 7.67% after excluding sin stocks based on sector screens. The difference is 0.27% per annum and statistically insignificant. The market risk-adjusted return has a significant (at 5% level) decrease of 0.43% per annum. The volatility increases by an insignificant 0.33% to 17.13% per annum. The portfolio income, measured by dividend yield, drops by a statistically insignificant 0.06%.

When we screen out sin stocks by turnover threshold using EIRIS turnover criteria, the total return of the developed markets portfolio drops by an insignificant 0.32% from 7.95% to 7.63%. The difference is larger than that screened by sector, because turnover screening (based on a 10% threshold) is broader than

that of sector screening. Similarly, the market risk-adjusted return decreases by a significant 0.47% (at 5% level) and decreases further by 0.04% from the risk-adjusted return based on sector screening. The risk and income of the portfolio are, respectively, 17.14% and 2.5% per annum, similar to those based on sector screening.

### 3.2. Developed markets by region

We conduct the same analysis for four different regions: the US, the UK, Europe, and Asia-Pacific. Panel A of Table 3 shows the US results. The total return is 11.88% and the risk-adjusted return is 4.54%. The volatility is lower than the universe portfolio average, standing at 15.84%. Dividend yield is 1.53%, about half of the dividend yield for the universe portfolio average.

**TABLE 3 IMPACT OF SIN SCREENING IN DEVELOPED MARKETS BY REGION**

<b>Panel A: US</b>				
	<b>Total return</b>	<b>Risk-adjusted return</b>	<b>Volatility</b>	<b>Dividend yield</b>
Universe	11.88	4.54	15.84	1.53
Screened by sector	11.61	4.26	15.86	1.51
<b>Difference</b>	<b>-0.27</b>	<b>-0.28</b>	<b>0.02</b>	<b>-0.03</b>
Screened by turnover	11.54	4.20	15.85	1.51
<b>Difference</b>	<b>-0.34*</b>	<b>-0.34**</b>	<b>0.01</b>	<b>-0.02</b>
<b>Panel B: UK</b>				
	<b>Total return</b>	<b>Risk-adjusted return</b>	<b>Volatility</b>	<b>Dividend yield</b>
Universe	8.67	-0.49	18.46	3.32
Screened by sector	8.21	-1.29	19.35	3.25
<b>Difference</b>	<b>-0.46</b>	<b>-0.80</b>	<b>0.88</b>	<b>-0.08</b>
Screened by turnover	8.00	-1.50	19.29	3.28
<b>Difference</b>	<b>-0.67*</b>	<b>-1.00</b>	<b>0.83</b>	<b>-0.05</b>
<b>Panel C: Europe ex UK</b>				
	<b>Total return</b>	<b>Risk-adjusted return</b>	<b>Volatility</b>	<b>Dividend yield</b>
Universe	8.36	-2.03	20.86	3.23
Screened by sector	8.66	-1.93	21.44	3.16
<b>Difference</b>	<b>0.29</b>	<b>0.10</b>	<b>0.58</b>	<b>-0.07</b>
Screened by turnover	8.56	-2.02	21.44	3.19
<b>Difference</b>	<b>0.19</b>	<b>0.01</b>	<b>0.58</b>	<b>-0.04</b>
<b>Panel D: Asia-Pacific</b>				
	<b>Total return</b>	<b>Risk-adjusted return</b>	<b>Volatility</b>	<b>Dividend yield</b>
Universe	8.04	0.25	16.14	2.36
Screened by sector	7.92	-0.02	16.46	2.33
<b>Difference</b>	<b>-0.12</b>	<b>-0.27</b>	<b>0.32</b>	<b>-0.03</b>
Screened by turnover	7.80	-0.16	16.50	2.33
<b>Difference</b>	<b>-0.24</b>	<b>-0.41</b>	<b>0.37</b>	<b>-0.03</b>

Note: All figures are in % per annum. *Difference* indicates the performance of the screened portfolio relative to the universe. \*\*\*, \*\*, and \* indicate statistical significance of 1%, 5%, and 10% respectively.

Total return and risk-adjusted return drop by, respectively, 0.27% and 0.28% per annum when we exclude sin stocks by sector from the US equity universe. Volatility increases by 0.02% per annum and dividend yield decreases by 0.03%. All the changes are insignificant. When we do the screens by turnover threshold, reductions of total return and risk-adjusted return are both significant at at least the 10% level, reaching 0.34%. This shows that sin screens of the US firms contribute to our earlier developed market return results. Volatility and dividend yield results are similar to those based on sector screening. Their differences from the US equity universe counterparts are small and insignificant.

For the UK equity universe, the results are shown in Panel B of table 3. Total return is 8.67% per annum. After adjusting for market risk, the return becomes -0.49%. When the universe is screened by sector, the total return goes down by 0.46% and the risk-adjusted return drops by a rather large 0.80% per annum. Volatility increases by 0.88%, which is the largest change (in magnitude) among all of our volatility results. Dividend yield drops by 0.08%. When the universe is screened by turnover, the total return is 8%, which results in a significant (at 10% level) drop of 0.67% from the UK equity universe portfolio return. Reduction in risk-adjusted return owing to sin screens is an insignificant 1%. Volatility increases by 0.83% and dividend yield drops by 0.05%. In sum, the UK results of large economic value contribute substantially to the developed markets portfolio outcomes.

Panel C of Table 3 shows that for the Europe ex UK equity universe there is no statistically significant impact from sin screens. In terms of their economic values, sin screens by sector

increase total return by 0.29% per annum, risk-adjusted return by 0.10%, and volatility by 0.58%, but decrease dividend yield by 0.07%. Note that the changes in returns are positive when compared to the negative numbers in other regions. The changes induced by turnover-based screens are similar: the total return increases by 0.19% per annum; the risk-adjusted return barely changes, with a 0.01% increase; the volatility increases by the same 0.58%; and the dividend yield decreases by 0.04%.

Panel D of Table 3 shows the results for the Asia-Pacific region. The sector-based sin screens reduce total return by 0.12%, risk-adjusted return by 0.27%, and dividend yield by 0.03%, and increase volatility by 0.32%. Results are similar using turnover screens.

### 3.3. Emerging markets

Table 4 presents the impact of sin screens on stock returns, volatility and income in emerging markets including Brazil, Russian, India, China and South Africa. Total portfolio return for the emerging markets is 17.64% per annum, which is more than twice the total return for developed markets (7.95%). Risk-adjusted return is a highly positive 6.24% per annum, while volatility scales up almost twice to 28.09%. Dividend yield (2.15%), in contrast, is similar in magnitude to that for developed markets.

Regarding the impact of sin screens in emerging markets, overall there are no statistically significant impacts on stock total return, risk-adjusted return, volatility, and dividend yield. The economic values of those changes are very small: total return drops by 0.12% p.a. and volatility increases by 0.24% p.a. There is no significant impact on risk-adjusted return or dividend yield.

**TABLE 4 IMPACT OF SIN SCREENING IN EMERGING MARKETS**

	<b>Total return</b>	<b>Risk-adjusted return</b>	<b>Volatility</b>	<b>Dividend yield</b>
Universe (BRICS)	17.64	6.24	28.09	2.15
Screened by sector	17.76	6.24	28.34	2.15
<b>Difference</b>	<b>0.12</b>	<b>0.00</b>	<b>0.24</b>	<b>0.00</b>

Note: All figures are in % per annum. *Difference* indicates the performance of the screened portfolio relative to the universe. \*\*\*, \*\*, and \* indicate statistical significance of 1%, 5%, and 10% respectively.

### 3.4. Risk-adjusted returns by individual screens

We further investigate which individual sin screens have the largest impact for the previous results. Table 5 presents risk-adjusted return results by regions for each individual sector-based

screen. The exclusion of alcohol stocks reduces return by 0.15% p.a., which is statistically significant at the 10% level. The tobacco screen decreases return by 0.13% p.a., which is statistically significant at the 1% level.

**TABLE 5 IMPACT OF SIN SCREENING BY INDIVIDUAL SCREENS BASED ON SECTOR: RISK-ADJUSTED RETURNS**

	Developed	US	UK	Europe ex UK	Asia-Pacific
Universe	-0.88	4.54	-0.49	-2.03	0.25
Ex. adult entertainment	-0.94	4.59	-0.86	-2.04	0.15
<b>Difference</b>	<b>-0.07</b>	<b>0.05</b>	<b>-0.37</b>	<b>-0.01</b>	<b>-0.10</b>
Ex. alcohol	-1.03	4.56	0.06	-1.86	0.19
<b>Difference</b>	<b>-0.15*</b>	<b>0.02</b>	<b>0.56</b>	<b>0.17</b>	<b>-0.06</b>
Ex. gambling	-0.88	4.52	-0.53	-2.03	0.18
<b>Difference</b>	<b>-0.01</b>	<b>-0.02</b>	<b>-0.03</b>	<b>0.00</b>	<b>-0.07</b>
Ex. tobacco	-1.01	4.33	-0.92	-2.05	0.20
<b>Difference</b>	<b>-0.13***</b>	<b>-0.21</b>	<b>-0.43***</b>	<b>-0.01*</b>	<b>-0.05</b>
Ex. weapons	-0.90	4.44	-0.55	-2.03	0.25
<b>Difference</b>	<b>-0.02</b>	<b>-0.10*</b>	<b>-0.06</b>	<b>0.01</b>	<b>0.00</b>
Ex. Sin stocks	-1.31	4.26	-1.29	-1.93	-0.02
<b>Difference</b>	<b>-0.43**</b>	<b>-0.28</b>	<b>-0.80</b>	<b>0.10</b>	<b>-0.27</b>

Note: All figures are in % per annum. *Difference* indicates the performance of the screened portfolio relative to the universe. \*\*\*, \*\*, and \* indicate statistical significance of 1%, 5%, and 10% respectively.

The tobacco stock screen reduces the UK portfolio return by 0.43% (statistically significant at the 1% level) and 0.21% for the US. In addition, the exclusion of weapons stocks negatively affects the US portfolio return (a statistically significant 0.10% at the 10% level).

Table 6 shows the turnover-based screening impact on risk-adjusted returns. Consistent with the results based on sector screens, the exclusions of alcohol and tobacco stocks have negative effects on risk-adjusted returns: -0.13% and -0.15% per annum. The exclusion of UK tobacco stocks reduces risk-adjusted return by 0.43%, which is statistically significant at the 1% level.

**TABLE 6 IMPACT OF SIN SCREENING BY INDIVIDUAL SCREENS BASED ON TURNOVER: RISK-ADJUSTED RETURNS**

	Developed	US	UK	Europe ex UK	Asia-Pacific
Universe	-0.88	4.54	-0.49	-2.03	0.25
Ex. adult entertainment	-0.95	4.59	-0.86	-2.04	0.14
<b>Difference</b>	<b>-0.07</b>	<b>0.05</b>	<b>-0.37</b>	<b>0.00</b>	<b>-0.11</b>
Ex. alcohol	-1.01	4.51	0.08	-1.90	0.06
<b>Difference</b>	<b>-0.13</b>	<b>-0.03</b>	<b>0.57</b>	<b>0.13</b>	<b>-0.19</b>
Ex. gambling	-0.88	4.53	-0.52	-2.03	0.19
<b>Difference</b>	<b>-0.01</b>	<b>-0.01</b>	<b>-0.03</b>	<b>0.00</b>	<b>-0.06</b>
Ex. tobacco	-1.03	4.53	-0.93	-2.07	0.13
<b>Difference</b>	<b>-0.15***</b>	<b>-0.02</b>	<b>-0.43***</b>	<b>-0.04**</b>	<b>-0.12</b>
Ex. weapons	-0.88	4.53	-0.52	-2.03	0.19
<b>Difference</b>	<b>-0.01</b>	<b>-0.01</b>	<b>-0.03</b>	<b>0.00</b>	<b>-0.06</b>
Ex. sin stocks	-1.35	4.20	-1.50	-2.02	-0.16
<b>Difference</b>	<b>-0.47**</b>	<b>-0.34*</b>	<b>-1.00*</b>	<b>0.01</b>	<b>-0.41</b>

Note: All figures are in % per annum. *Difference* indicates the performance of the screened portfolio relative to the universe. \*\*\*, \*\*, and \* indicate statistical significance of 1%, 5%, and 10% respectively.

### 3.5. Risk-adjusted returns by rolling 3-year periods

To study the effects of the sin screen, we run the analysis of risk-adjusted returns for rolling 3-year periods within our sample period from 2004 to 2015. This generates ten 3-year windows for our results, shown in Table 7. The effect of sin stock exclusion occurs mostly during and after the financial crisis period from 2006 to 2015. Specifically, the reductions (statistically significant at at least the 5% level) for developed markets include 0.61% from 2006 to 2008, 0.65% from 2009 to 2011, 0.82% from 2010 to 2012, and 0.93% from 2011 to 2013.

For the UK portfolio return, the significant (at at least the 5% level) drops are 1.46% from 2006-2008, 1.83% from 2010-2012, and 2.41% from 2011 to 2013. For the Europe ex UK portfolio

return, the significant (at at least the 10% level) decreases are 0.66% from 2006 to 2008, 0.79% from 2007 to 2009, 0.75% from 2008 to 2010, and 1.02% from 2009 to 2011. For the US, one significant (at the 10% level) reduction is 0.62% from 2012 to 2014. For Asia-Pacific, the significant negative effect occurs after the crisis period: 0.61% from 2010 to 2013 and 0.82% from 2011 to 2013 (at at least the 10% level).

For emerging markets, the change in risk-adjusted returns is significantly positive at 0.33% at the 10% level from 2013 to 2015. For other sub-periods, the changes are insignificant and range in value from a reduction of 0.05% (2008 – 2010) to an increase of 0.26% (2012 – 2014).

**TABLE 7 IMPACT OF SIN SCREENING BY 3-YEAR SUB-PERIODS: RISK-ADJUSTED RETURNS**

		Screened by turnover threshold				Screened by sector	
		Developed	US	UK	Europe ex UK	Asia-Pacific	BRICS
2004-2006	Universe	2.54	4.42	6.34	2.16	1.82	-0.20
	Ex. sin stocks	2.70	4.23	5.67	3.06	1.04	-0.37
	<b>Difference</b>	<b>0.16</b>	<b>-0.19</b>	<b>-0.67</b>	<b>0.91</b>	<b>-0.78</b>	<b>-0.17</b>
2005-2007	Universe	2.52	4.80	2.04	4.46	2.32	9.23
	Ex. sin stocks	2.34	4.60	1.29	4.28	2.63	9.48
	<b>Difference</b>	<b>-0.18</b>	<b>-0.20</b>	<b>-0.75</b>	<b>-0.18</b>	<b>0.31</b>	<b>0.24</b>
2006-2008	Universe	1.98	7.25	-2.96	6.62	0.64	21.46
	Ex. sin stocks	1.37	7.11	-4.43	5.96	0.37	21.60
	<b>Difference</b>	<b>-0.61**</b>	<b>-0.14</b>	<b>-1.46**</b>	<b>-0.66*</b>	<b>-0.27</b>	<b>0.13</b>
2007-2009	Universe	1.15	2.35	-1.95	2.89	1.58	15.25
	Ex. sin stocks	0.78	2.40	-2.94	2.10	1.94	15.32
	<b>Difference</b>	<b>-0.38</b>	<b>0.05</b>	<b>-0.99</b>	<b>-0.79*</b>	<b>0.36</b>	<b>0.07</b>
2008-2010	Universe	-0.15	3.42	-1.44	-2.42	1.82	-0.09
	Ex. sin stocks	-0.60	2.98	-1.96	-3.17	1.79	-0.14
	<b>Difference</b>	<b>-0.45</b>	<b>-0.44</b>	<b>-0.52</b>	<b>-0.75*</b>	<b>-0.03</b>	<b>-0.05</b>
2009-2011	Universe	-3.62	2.37	-2.86	-8.03	-0.67	6.15
	Ex. sin stocks	-4.26	2.31	-1.09	-9.05	-0.53	5.93
	<b>Difference</b>	<b>-0.65**</b>	<b>-0.06</b>	<b>1.77**</b>	<b>-1.02***</b>	<b>0.14</b>	<b>-0.22</b>
2010-2012	Universe	-4.00	1.93	-0.91	-7.08	-1.20	-5.09
	Ex. sin stocks	-4.82	1.19	-2.74	-7.66	-1.82	-5.28
	<b>Difference</b>	<b>-0.82***</b>	<b>-0.75</b>	<b>-1.83**</b>	<b>-0.58</b>	<b>-0.61*</b>	<b>-0.19</b>
2011-2013	Universe	-5.74	3.84	-3.33	-6.16	-4.52	1.68
	Ex. sin stocks	-6.67	3.29	-5.74	-6.66	-5.34	1.89
	<b>Difference</b>	<b>-0.93***</b>	<b>-0.55</b>	<b>-2.41***</b>	<b>-0.50</b>	<b>-0.82**</b>	<b>0.21</b>
2012-2014	Universe	-5.96	10.50	-6.75	-8.57	-4.86	4.79
	Ex. sin stocks	-6.16	9.88	-7.58	-8.79	-4.77	5.04
	<b>Difference</b>	<b>-0.20</b>	<b>-0.62*</b>	<b>-0.84</b>	<b>-0.22</b>	<b>0.10</b>	<b>0.26</b>
2013-2015	Universe	-4.47	12.11	-4.97	-9.66	-2.79	7.94
	Ex. sin stocks	-5.14	11.73	-4.64	-9.00	-2.69	8.28
	<b>Difference</b>	<b>-0.67</b>	<b>-0.38</b>	<b>0.33</b>	<b>0.66</b>	<b>0.10</b>	<b>0.33*</b>

Note: All figures are in % per annum. Difference indicates the performance of the screened portfolio relative to the universe. \*\*\*, \*\*, and \* indicate statistical significance of 1%, 5%, and 10% respectively.

### 3.6. US bonds

Table 8 presents the impact of sin screens on bond issuing yield, coupon, and rating. Across all bond issues in our sample, average yield to maturity is 4.64%, the same as the coupon rate. The average rating is 22.97, which corresponds to A+. Excluding sin stocks does not affect the average yield, coupon rate, or rating.

### 3.7. Summary of findings on sin screens

Overall, the exclusion of sin stocks reduces developed-market portfolio returns by 0.3 – 0.5% per annum, increases its volatility by 0.3 – 0.4% per annum, and leads to an insignificant reduction of 0.05% in dividend yield. For the US, sin screens reduce portfolio returns by 0.3% per annum. There is larger impact for the UK: the returns drop by 0.7 – 1% per annum and the volatility increases by 0.8 – 0.9% per annum. For the Europe ex UK portfolio, excluding sin stocks increases its returns by 0.1 – 0.3% per annum, while the portfolio volatility increases by 0.6%.

In addition, the returns for the Asia-Pacific portfolio drop by 0.1 – 0.4% per annum, and volatility rises by 0.3 – 0.4%.

The significant reductions in developed-market portfolio returns are driven by the exclusion of alcohol (-0.15%) and tobacco stocks (-0.13%). The UK portfolio is the most affected by tobacco exclusion: its return reduces by 0.43% per annum. Across sub-periods, the reduction in return from sin stock exclusion is the largest from 2011 to 2013, at 0.9% per annum. In contrast, return increases by 0.2% during 2004 – 2006.

For emerging markets, there is no statistically significant effect of sin screens on portfolio returns, volatility, or dividend yield. There is a mild increase in volatility of 0.2% per annum.

For US corporate bond market, the exclusion of sin companies does not have a significant impact on yield, coupon rate, or rating.

**TABLE 8 IMPACT OF SIN SCREENING IN US BOND MARKET**

	Yield	Coupon rate	Rating
Universe	4.64	4.64	22.97
Screened by sector	4.64	4.63	23.00
<b>Difference</b>	<b>0.00</b>	<b>-0.01</b>	<b>0.03</b>

Note: All figures are in % per annum. *Difference* indicates the performance of the screened portfolio relative to the universe. \*\*\*, \*\*, and \* indicate statistical significance of 1%, 5%, and 10% respectively.

## 4. Impact of fossil fuel screens

In this section, we investigate the impact of the exclusion of fossil fuel stocks on equity and bond portfolio returns, volatility, and dividend yield. We employ two different definitions of fossil fuel screens: *fossil fuel core* refers to the screening of coal, oil & gas exploration and production, and integrated oil & gas; *fossil fuel extended* is a broader definition that also includes the screening of oil & gas equipment, services and pipelines.

### 4.1. Developed markets

Table 9 shows that fossil fuel screens do not have significant impact on stocks returns, volatility or income. The exclusion of *fossil fuel core* increases total return by a mere 0.03% per annum, risk-adjusted return by 0.02%, and volatility by 0.05%. It reduces dividend yield by 0.03%. When we use the broader definition of *fossil fuel extended*, the results are similar. Risk-adjusted return and dividend yield have insignificant changes from including oil & gas services stocks in the screenings.

**TABLE 9 IMPACT OF FOSSIL FUEL SCREENING IN DEVELOPED MARKETS**

	Total return	Risk-adjusted return	Volatility	Dividend yield
Universe	7.95	-0.88	16.80	2.80
Ex. Fossil fuel core	7.98	-0.86	16.84	2.77
<b>Difference</b>	<b>0.03</b>	<b>0.02</b>	<b>0.05</b>	<b>-0.03</b>
Ex. Fossil fuel extended	7.94	-0.86	16.77	2.77
<b>Difference</b>	<b>-0.01</b>	<b>0.02</b>	<b>-0.02</b>	<b>-0.03</b>

Note: All figures are in % per annum. *Difference* indicates the performance of the screened portfolio relative to the universe. \*\*\*, \*\*, and \* indicate statistical significance of 1%, 5%, and 10% respectively.

#### 4.2. Developed markets by region

We calculate the effects of fossil fuel screens by region, which are reported in Table 10. In general, there are no significant changes in all four variables when we apply either fossil fuel core or extended screens. Applying *fossil fuel core* screens decreases the total return by 0.15% for the US and increases returns by

0.24% per annum for the UK. Applying a coarser definition of *fossil fuel extended* reduces the total return further. For example, the reduction of the return is 0.31% per annum for the US. Excluding *fossil fuel core* stocks for the UK increases the risk-adjusted return by 0.16% and the volatility by 0.19% per annum.

**TABLE 10 IMPACT OF FOSSIL FUEL SCREENING IN DEVELOPED MARKETS BY REGION**

Panel A: US				
	Total return	Risk-adjusted return	Volatility	Dividend yield
Universe	11.88	4.54	15.84	1.53
Ex fossil fuel core	11.73	4.39	15.95	1.54
<b>Difference</b>	<b>-0.15</b>	<b>-0.15</b>	<b>0.12</b>	<b>0.01</b>
Ex fossil fuel extended	11.56	4.27	15.91	1.54
<b>Difference</b>	<b>-0.31</b>	<b>-0.27</b>	<b>0.07</b>	<b>0.01</b>
Panel B: UK				
	Total return	Risk-adjusted return	Volatility	Dividend yield
Universe	8.67	-0.49	18.46	3.32
Ex fossil fuel core	8.91	-0.33	18.65	3.35
<b>Difference</b>	<b>0.24</b>	<b>0.16</b>	<b>0.19</b>	<b>0.03</b>
Ex fossil fuel extended	8.77	-0.47	18.58	3.35
<b>Difference</b>	<b>0.10</b>	<b>0.03</b>	<b>0.12</b>	<b>0.03</b>
Panel C: Europe ex UK				
	Total return	Risk-adjusted return	Volatility	Dividend yield
Universe	8.36	-2.03	20.86	3.23
Ex fossil fuel core	8.41	-2.06	21.04	3.17
<b>Difference</b>	<b>0.05</b>	<b>-0.03</b>	<b>0.18</b>	<b>-0.06</b>
Ex fossil fuel extended	8.41	-2.03	20.99	3.17
<b>Difference</b>	<b>0.05</b>	<b>0.00</b>	<b>0.13</b>	<b>-0.06</b>
Panel D: Asia-Pacific				
	Total return	Risk-adjusted return	Volatility	Dividend yield
Universe	8.04	0.25	16.14	2.36
Ex fossil fuel core	8.01	0.27	16.03	2.36
<b>Difference</b>	<b>-0.02</b>	<b>0.02</b>	<b>-0.10</b>	<b>0.00</b>
Ex fossil fuel extended	8.00	0.29	15.98	2.36
<b>Difference</b>	<b>-0.04</b>	<b>0.04</b>	<b>-0.15</b>	<b>-0.01</b>

Note: All figures are in % per annum. *Difference* indicates the performance of the screened portfolio relative to the universe. \*\*\*, \*\*, and \* indicate statistical significance of 1%, 5%, and 10% respectively.

### 4.3. Emerging markets

The largest effects of fossil fuel screens are from the emerging markets, exhibited in Table 11. The exclusion of *fossil fuel core* improves the total return by 1.2% (significant at the 5% level) and the risk-adjusted return by 1.08% per annum (significant at the 10% level). Using *fossil fuel extended* screens results in similar

outcomes. When we compare effects in emerging markets to those in the developed markets, the total returns of emerging markets are almost twice as much as those of the developed markets. The volatilities of the emerging markets are more than 1.5 times those for the developed markets. There is no significant impact on volatility or dividend yield.

**TABLE 11 IMPACT OF FOSSIL FUEL SCREENING IN EMERGING MARKETS**

	Total return	Risk-adjusted return	Volatility	Dividend yield
Universe (BRICS)	17.64	6.24	28.09	2.15
Ex. fossil fuel core	18.84	7.32	28.82	2.09
<b>Difference</b>	<b>1.20**</b>	<b>1.08*</b>	<b>0.73</b>	<b>-0.06</b>
Ex. fossil fuel extended	18.84	7.32	28.86	2.09
<b>Difference</b>	<b>1.20**</b>	<b>1.08*</b>	<b>0.76</b>	<b>-0.06</b>

Note: All figures are in % per annum. *Difference* indicates the performance of the screened portfolio relative to the universe. \*\*\*, \*\*, and \* indicate statistical significance of 1%, 5%, and 10% respectively.

### 4.4. Risk-adjusted returns by individual screens

Table 12 shows that the exclusion of coal contributes to an increase in risk-adjusted returns of the developed-market portfolio by a very small 0.02% per annum. This effect is concentrated on the UK and Asia-Pacific as the increase is 0.02% and 0.04% respectively. The US stock return decreases by 0.14% (0.26%)

per annum when we exclude oil & gas core (extended) stocks. For the UK, excluding oil & gas core stocks increases the stock return by 0.14% per annum. For emerging markets, the exclusion of oil & gas core (extended) stocks increases the risk-adjusted return by 0.76% (0.77%) per annum, which is significant at the 10% level.

**TABLE 12 IMPACT OF FOSSIL FUEL SCREENING BY INDIVIDUAL SCREENS: RISK-ADJUSTED RETURNS**

	Screened by turnover threshold					
	Developed	US	UK	Europe ex UK	Asia-Pacific	BRICS
Universe	-0.88	4.54	-0.49	-2.03	0.25	6.24
Ex. coal	-0.86	4.54	-0.48	-2.04	0.29	6.53
<b>Difference</b>	<b>0.02</b>	<b>0.00</b>	<b>0.02</b>	<b>-0.01</b>	<b>0.04</b>	<b>0.27</b>
Ex. oil & gas core	-0.88	4.40	-0.35	-2.06	0.24	7.00
<b>Difference</b>	<b>0.00</b>	<b>-0.14</b>	<b>0.14</b>	<b>-0.03</b>	<b>-0.01</b>	<b>0.76*</b>
Ex. oil & gas extended	-0.88	4.28	-0.48	-2.03	0.25	7.01
<b>Difference</b>	<b>0.00</b>	<b>-0.26</b>	<b>0.01</b>	<b>0.00</b>	<b>0.00</b>	<b>0.77*</b>
Ex. Fossil fuel core	-0.86	4.39	-0.33	-2.06	0.27	7.32
<b>Difference</b>	<b>0.02</b>	<b>-0.15</b>	<b>0.16</b>	<b>-0.03</b>	<b>0.02</b>	<b>1.08*</b>
Ex. Fossil fuel extended	-0.86	4.27	-0.47	-2.03	0.29	7.32
<b>Difference</b>	<b>0.02</b>	<b>-0.27</b>	<b>0.03</b>	<b>0.00</b>	<b>0.04</b>	<b>1.08*</b>

Note: All figures are in % per annum. *Difference* indicates the performance of the screened portfolio relative to the universe. \*\*\*, \*\*, and \* indicate statistical significance of 1%, 5%, and 10% respectively.

#### 4.5. Risk-adjusted returns by rolling 3-year periods

As shown in Table 13, for the sub-periods before and during the financial crisis (2004 to 2009), the effect on stock returns from excluding fossil fuel core stocks is negative, albeit insignificant for the entire developed market and for sub-regions. The effect becomes positive and significant after 2009. For example, removing fossil fuel core stocks improves the risk-adjusted return for the UK by 1.51% from 2010 to 2012 and by 0.65% from 2011 to 2013 after the BP oil spill in 2010. The effect from the

UK is significant at, at least, the 10% level with a 1.81% increase from 2012 to 2014 and a 1.03% increase from 2013 to 2015.

For emerging markets, the effects from fossil fuel core screens are positive across different sub-periods and occur mostly during and after financial crisis. For instance, the return increases by 1.77% from 2006 to 2008, 2.56% from 2008 to 2010, and 0.83% from 2011- 2013.

**TABLE 13 IMPACT OF FOSSIL FUEL SCREENING BY 3-YEAR SUB-PERIODS: RISK-ADJUSTED RETURNS**

		Screened by sector					
		Developed	US	UK	Europe ex UK	Asia-Pacific	BRICS
2004-2006	Universe	2.54	4.42	6.34	2.16	1.82	-0.20
	Ex. fossil fuel core	2.28	3.92	6.30	1.96	1.81	0.68
	<b>Difference</b>	<b>-0.26</b>	<b>-0.50</b>	<b>-0.04</b>	<b>-0.20</b>	<b>-0.01</b>	<b>0.88</b>
2005-2007	Universe	2.52	4.80	2.04	4.46	2.32	9.23
	Ex. fossil fuel core	2.46	4.70	1.98	4.52	2.18	9.27
	<b>Difference</b>	<b>-0.06</b>	<b>-0.10</b>	<b>-0.05</b>	<b>0.07</b>	<b>-0.13</b>	<b>0.03</b>
2006-2008	Universe	1.98	7.25	-2.96	6.62	0.64	21.46
	Ex. fossil fuel core	1.69	6.89	-3.57	6.66	0.16	23.23
	<b>Difference</b>	<b>-0.29</b>	<b>-0.36</b>	<b>-0.61</b>	<b>0.03</b>	<b>-0.48</b>	<b>1.77</b>
2007-2009	Universe	1.15	2.35	-1.95	2.89	1.58	15.25
	Ex. fossil fuel core	1.01	2.80	-2.80	2.98	1.09	17.25
	<b>Difference</b>	<b>-0.14</b>	<b>0.45</b>	<b>-0.85</b>	<b>0.09</b>	<b>-0.50</b>	<b>1.99</b>
2008-2010	Universe	-0.15	3.42	-1.44	-2.42	1.82	-0.09
	Ex. fossil fuel core	0.05	3.74	-1.16	-2.21	1.64	2.46
	<b>Difference</b>	<b>0.20</b>	<b>0.32</b>	<b>0.28</b>	<b>0.21</b>	<b>-0.17</b>	<b>2.56*</b>
2009-2011	Universe	-3.62	2.37	2.86	-8.03	-0.67	6.15
	Ex. fossil fuel core	-3.74	1.92	3.71	-8.24	-0.75	7.12
	<b>Difference</b>	<b>-0.13</b>	<b>-0.45</b>	<b>0.85</b>	<b>-0.20</b>	<b>-0.09</b>	<b>0.97</b>
2010-2012	Universe	-4.00	1.93	-0.91	-7.08	-1.20	-5.09
	Ex. fossil fuel core	-3.66	1.84	0.60	-7.04	-1.00	-4.41
	<b>Difference</b>	<b>0.34</b>	<b>-0.09</b>	<b>1.51</b>	<b>0.03</b>	<b>0.21</b>	<b>0.68</b>
2011-2013	Universe	-5.74	3.84	-3.33	-6.16	-4.52	1.68
	Ex. fossil fuel core	-5.48	3.77	-2.67	-6.16	-4.23	2.50
	<b>Difference</b>	<b>0.27</b>	<b>-0.08</b>	<b>0.65</b>	<b>0.00</b>	<b>0.29*</b>	<b>0.83</b>
2012-2014	Universe	-5.96	10.50	-6.75	-8.57	-4.86	4.79
	Ex. fossil fuel core	-5.10	10.90	-4.93	-7.91	-4.52	5.01
	<b>Difference</b>	<b>0.86***</b>	<b>0.40</b>	<b>1.81***</b>	<b>0.66**</b>	<b>0.35**</b>	<b>0.23</b>
2013-2015	Universe	-4.47	12.11	-4.97	-9.66	-2.79	7.94
	Ex. fossil fuel core	-3.78	12.56	-3.94	-9.09	-2.46	8.21
	<b>Difference</b>	<b>0.69**</b>	<b>0.45</b>	<b>1.03*</b>	<b>0.56</b>	<b>0.34**</b>	<b>0.27</b>

Note: All figures are in % per annum. *Difference* indicates the performance of the screened portfolio relative to the universe. \*\*\*, \*\*, and \* indicate statistical significance of 1%, 5%, and 10% respectively.

#### 4.6. US bonds

Table 14 shows that fossil fuel screens do not have significant impact on bond performance. The exclusion of *fossil fuel core* stocks reduces bond yields by 0.01% and coupon rates by 0.02%, and increases ratings by 0.06 out of a 28-point scale. The results remain similar when we apply the extended fossil fuel screens.

#### 4.7. Summary of findings on fossil fuel screens

To sum up, there are significant effects of fossil fuel screens for the return and volatility of the emerging markets portfolio. The exclusion of fossil fuel stocks increases the portfolio return by 1.1% per annum at the 5% level. The volatility increases by 0.8% per annum and dividends decrease by 0.06%. The increase in return is the highest for 2008 – 2010 (2.6% per annum) and the lowest for 2005 – 2007 (0.03% p.a.).

For developed markets, there is no significant impact of fossil fuel screens on returns, volatility or income. For the US portfolio, excluding fossil fuel stocks reduces its return by 0.15 – 0.3% per

annum. This is the largest reduction among all developed regions. In contrast, the returns increase by 0.1 – 0.2% per annum for the UK and 0.05% for Europe ex UK. The impact of fossil fuel screens on volatility is 0.1 – 0.2% per annum for all regions. In contrast, the impact of dividend yield is neglectable. For the US, excluding oil & gas based on the extended definition reduces its portfolio return by 0.26% p.a., which is the largest in economic terms among all regions.

In terms of sub-periods, the effect of the exclusion of fossil fuel stocks for developed markets is twofold: a negative effect from 2004 to 2009 (-0.29 to -0.06% per annum) and a positive effect from 2010 to 2015 (0.27 – 0.86% per annum). The increase of returns is the highest from 2012 – 2014 at 0.9% per annum owing to sustained weakness in fossil fuel prices.

For US corporate bonds, fossil fuel screens do not have a significant impact on their yield, coupon rate, or rating.

**TABLE 14 IMPACT OF FOSSIL FUEL SCREENING IN US BOND MARKETS**

	Yield	Coupon rate	Rating
Universe	4.64	4.64	22.97
Ex. fossil fuel core	4.63	4.62	23.03
<b>Difference</b>	<b>-0.01</b>	<b>-0.02</b>	<b>0.06</b>
Ex. fossil fuel extended	4.63	4.62	23.03
<b>Difference</b>	<b>-0.01</b>	<b>-0.02</b>	<b>0.06</b>

Note: All figures are in % per annum. *Difference* indicates the performance of the screened portfolio relative to the universe. \*\*\*, \*\*, and \* indicate statistical significance of 1%, 5%, and 10% respectively.

## 5. Conclusions

This paper investigates the effect of ethical investing on returns, volatility and income. Sin screens reduce stock returns of a developed markets portfolio by 0.3 – 0.5% per annum, increase its volatility by 0.3 – 0.4% per annum, and reduce dividend yield by 0.05%. Moreover, we show that tobacco and alcohol stocks are the main driver for the developed markets results. The effects occur mainly during and after the recent financial crisis period. There is no significant impact on emerging-market stocks or US bonds.

In contrast, fossil fuel screens have no impact on stock returns or risk in developed-market equities or US bonds. They reduce the annualised dividend yield by 0.03 – 0.06%. For the US, they have a negative impact on stock returns, at 0.2% per annum. Interestingly, the fossil fuel screens increase returns and risks in emerging-market equities. Oil & gas stocks drive the increases, which happen mainly during the crisis period.

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