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Pricing sin stocks: Ethical preference vs. risk aversion

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Pricing Sin Stocks: Ethical Preference vs. Risk Aversion*

Abstract

We develop a model that reproduces the return and volatility spread between sin and non-sin stocks, where investors trade off dividends with the ethical assessment of companies. We relax the assumption of boycott behaviour and investigate the role played by the dividend share of sin stocks on their return and volatility spread relative to non-sin stocks. We empirically show that the dividend share predicts a positive return and volatility spread. This pattern is reproduced by our model when dividends and ethicalness are complementary goods and investors are sufficiently risk averse.

Keywords: asset pricing, general equilibrium, sin stocks

JEL Classification: D51, D91, E20, G12

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1 Introduction

Recently there has been an increasing interest in the return of sin stocks compared to ethical stocks. The reason for this interest is twofold. First, from a portfolio management perspective, the existence of a significant return differential between the two categories of stocks might generate profit opportunities. Second, from a theoretical economic point of view, researchers aim to identify the economic mechanism through which the firm's ethical/unethical behavior is incorporated into stock prices.

A large part of the existing literature finds that sin stocks yield, on average, higher returns than non-sin comparable stocks. This “sin premium” is usually explained using the concept of “boycott” risk, which is based on the idea that socially responsible investors refuse to hold stocks of sin companies (see [Heinkel, Kraus, and Zechner, 2008](#); [Hong and Kacperczyk, 2009](#); [Luo and Balvers, 2017](#)).¹ As a result, sin companies are underpriced relative to non-sin comparable companies. According to this view, socially responsible investors, who seek out *ethical* investments, are willing to receive dividends solely from non-sin companies and, therefore, dividend payments may not play an important role in the pricing of sin stocks.

In this paper, we suggest a different approach to explain the link between ethical behavior and stock prices. We start by assuming that investors are willing to hold all categories of stocks and, therefore, do not boycott a particular class of companies. As a result, investors receive dividends from both sin and non-sin companies, and evaluate dividend payments according to their preferences for firms' ethicalness. In our model, dividends and ethicalness may be complementary goods, i.e., the marginal utility of an additional unit of the “non-sin dividend” is higher than the marginal utility of an additional unit of the “sin dividend”. Alternatively, dividends and ethicalness may be

¹The term “socially responsible investors” refers to agents who support investments in companies actively engaged in ethical themes like environmental sustainability, social justice, gender equality, while avoiding companies whose business is related to addictive substances like tobacco, alcohol, gambling, etc.

substitutes, i.e., the marginal utility of an additional unit of the sin dividend is higher than that of an additional unit of the non-sin dividend.

The relation between marginal utilities of dividends and ethicalness, however, is not the only determinant of the return differential between sin and non-sin stocks. What really matters is the marginal rate of substitution between dividends and ethicalness, which, in turn, depends on the interaction between dividend-ethicalness complementarity and risk aversion.

Theoretically, we show that sin companies have higher average returns and volatility than non-sin companies in two cases:

- i. When dividends and ethicalness are substitute goods and investors have low risk aversion (i.e., smaller than log utility);
- ii. When dividends and ethicalness are complementary goods and investors have high risk aversion (i.e., higher than log utility).

In both cases, the marginal rate of substitution between dividend payments and ethicalness is positive, which implies that investors would like to receive more dividends from non-sin companies than from sin companies. As a result, investors require a premium to be compensated for the risk of receiving large dividends from sin companies. Unlike models based on boycott risk, where ethical investors reject any payoffs from sin stocks, we illustrate that leaving open the possibility of receiving dividends from both sin and non-sin stocks not only helps to explain their average return and volatility, but also their conditional counterparts, i.e., conditional on holding the dividend share of sin stocks fixed.

In particular, the dynamics of conditional returns allows us to distinguish between the two preference specifications above. When dividend and ethicalness are substitute goods and agents have low risk aversion (case i.), the return and volatility spreads are decreasing in the dividend share of sin stocks (relative to non-sin stocks). Conversely, when dividend

and ethicalness are complementary goods and agents have high risk aversion (case ii.), the return and volatility spreads are increasing in the dividend share of sin stocks. To the best of our knowledge, our model is the first to investigate how these spreads relate to the dividend payments of sin companies and investors' preferences.

Using data on U.S. public companies, we also provide evidence consistent with the preference specification in case ii. Hence, we conclude that a model in which dividends and ethicalness are complementary goods and investors are sufficiently risk averse (i.e., more risk averse than log utility) can explain the observed patterns of the unconditional (and conditional) return and volatility spread between sin and non-sin comparable stocks. In particular, our model performs reasonably well in capturing the volatility differential between these two groups of stocks.

In conclusion, we provide a twofold contribution to the literature on the pricing of sin stocks. First, from a theoretical point of view, we emphasize the importance of a previously disregarded economic channel, namely the marginal rate of substitution between dividends and firms' ethicalness, in explaining the unconditional (and conditional) return and volatility spreads between sin and non-sin stocks. Differently from models based on boycott risk, our mechanism also helps to rationalize the mixed international evidence on the returns of sin stocks (Phillips, 2011; Durand, Koh, and Tan, 2013; Fauver and McDonald, 2014). Whereas in the U.S. and in Europe we typically observe that institutional investors underweight sin stocks and, at the same time, sin stocks pay higher returns than non-sin stocks, in other countries, such as some in the Asia Pacific, we observe that ethical companies tend to pay higher risk-adjusted returns even though institutional investors underweight sin stocks. Our model reconciles this evidence suggesting that the return differential may also be explained by the individual investors' marginal rate of substitution between dividends and firms' ethicalness and not only by the boycott strategy of institutional investors. A different theoretical approach to explain the return differ-

ential between sin stocks and non-sin stocks is provided by [Albuquerque, Durnev, and Koskinen \(2014\)](#). A crucial role in their model, which features a production economy with socially and non-socially responsible firms, is played by the consumers' expenditure share on responsible goods (non-sin goods). When the share of responsible goods is sufficiently small, responsible firms have lower systematic risk and higher valuation than non-responsible firms. Our approach differs from theirs in one important aspect: We build an endowment economy and focus on investors' behavior. Their focus, instead, is on firms' choices. Although the respective approaches and frameworks are different, the two papers share an important conclusion: The return differential between sin and non-sin stocks depends not only on investors' preferences but also on the diversification risk induced by the consumption/dividend stream of sin and non-sin firms.

Second, from an empirical point of view, we provide new insights on the determinants of the conditional return and volatility spreads between sin and non-sin stocks. [Hong and Kacperczyk \(2009\)](#) and [Luo and Balvers \(2017\)](#) focus on the unconditional sin premium, showing evidence that supports the presence of socially responsible investors, for whom the sinful activity of firms and the demand of their stocks act as mutually exclusive forces. In our model, instead, we relax the assumption of boycott behavior by letting these opposite forces coexist. In addition, our approach is capable of embodying the properties that arise from the study of conditional returns and standard deviations of sin and non-sin stocks. This is a novelty with respect to the existing literature, which typically focuses on differences in returns only.

The rest of the paper is organized as follows. In [Section 2](#), we provide motivating evidence on the returns of sin stocks. In [Section 3](#), we present a two-good general equilibrium model where agents' preferences account also for the perceived ethicalness of the consumed goods (i.e., dividends from sin and non-sin stocks). In [Section 4](#), we test the empirical predictions of the model. [Section 5](#) concludes.

2 Background and motivation

To study the return differential between sin and non-sin companies, we follow the approach proposed by [Hong and Kacperczyk \(2009\)](#). We construct an equally weighted portfolio of U.S. publicly traded companies involved in the production of alcoholic beverages, smoke products, and gaming (sin companies). We analyze the returns of this portfolio compared to a portfolio of otherwise comparable non-sin companies (food, soda, fun, and meals industries) over the time period 1965Q1-2015Q4.² Table 1 shows that the average quarterly excess return on the sin portfolio is equal to 2.3% (Panel A), while the average quarterly excess return on the comparable portfolio is equal to 1.7% (Panel B). The sin portfolio also exhibits higher standard deviation than the portfolio of comparable companies (12.0% vs 11.2%). [Hong and Kacperczyk \(2009\)](#) find similar results during the time period 1965-2005: Higher excess returns (2.8% vs. 0.75%) and higher standard deviation (9.73% vs. 4.45%) of sin stocks. We find that the differential return of sin stocks is even larger for value-weighted portfolios (3.8% vs. 2.9% quarterly), while the difference in the standard deviation is similar to the case of equally weighted portfolios (9.5% vs. 8.7%).

[Hong and Kacperczyk \(2009\)](#) classify as sin companies only those companies producing sin goods but not those involved in their distribution. We build an extended sin portfolio that includes also companies operating in the retail sector (Panel C). In this case, the difference between the quarterly returns of sin and non-sin stocks is smaller for the equally weighted portfolios (1.8% vs. 1.7%), but of the same magnitude for the value-weighted portfolios (3.8% vs. 2.9%).

Our results are in line with the empirical evidence provided by [Fabozzi, Ma, and Oliphant \(2008\)](#), who document an annualized excess return of sin stocks of about 11% with respect to the market over the period 1970-2007. The evidence of a sin premium is

²We provide further details on portfolio construction in Appendix C.

robust for different countries: [Fabozzi et al. \(2008\)](#) analyze 21 national markets (including European, U.S., and Asian markets) and [Salaber \(2007\)](#) considers European markets.

Overall, this analysis suggests that in the U.S. sin companies pay on average higher returns than non-sin companies and, in addition, are characterized by higher standard deviation. Below, we propose a tractable general equilibrium model that aims to endogenize such differences.

3 The economy

Our model is built on a continuous-time [Lucas \(1978\)](#) economy with an infinite horizon. There are two firms: A “sin” firm and a “non-sin” comparable firm indexed by “s” and “c”, respectively.³ The uncertainty is represented by a filtered probability space $(\Omega, \mathcal{F}, \{\mathcal{F}_t\}, \mathbb{P})$ on which we define a two-dimensional Brownian motion $B_t = (B_{s,t}, B_{c,t})$ that captures production randomness over time.

3.1 Consumption goods

There are two perishable consumption goods, $i \in \{s, c\}$. A convex combination of the two consumption goods (with weights α and $1 - \alpha$, respectively) serves as the numeraire. The price of the numeraire is normalized to unity and the relative prices of the two consumption goods are given by $p_t = (p_{s,t}, p_{c,t})$. Consumption goods are produced by two firms according to the following production technology

$$dD_{i,t} = D_{i,t} (\nu_i dt + \phi_i dB_{i,t}), \quad (1)$$

where $D_{i,t}$ represents the total supply of good i , and $D_{i,0}$, ν_i and ϕ_i are positive coefficients, with $i \in \{s, c\}$. In the Lucas’ pure-exchange economy, $D_{i,t}$ represents both the

³We use the terms “non-sin” and “non-sin comparable” interchangeably to refer to “c” firms.

supply of consumption good and the dividend of firm i . Therefore, when describing the implications of our theoretical framework, we use the terms consumption and dividend interchangeably.⁴

3.2 Financial market

There are three securities traded on the market: Two risky assets (stocks) in positive supply of one unit and one risk-free asset (bond) in zero-net supply. Stock i represents the claim to dividend i paid in units of good i , where $i \in \{s, c\}$. The stock price, denoted by $S_{i,t}$, evolves as follows

$$dS_{i,t} + p_{i,t}D_{i,t}dt = S_{i,t}\mu_{i,t}dt + S_{i,t} \sum_{j \in \{s,c\}} \sigma_{j,t}^i dB_{j,t}. \quad (2)$$

The price of the risk-free asset (in term of the numeraire) satisfies

$$S_{0,t} = e^{\int_0^t r_s ds} \quad (3)$$

for some risk-free rate of return r_t . The variables $\mu_{i,t}$, $\sigma_{j,t}^i$, r_t , $p_{i,t}$, for $i, j \in \{s, c\}$, are to be endogenously determined in equilibrium.

3.3 Ethicalness

Investors' utility depends not only on asset payoffs, as customary in the asset pricing literature, but also on firms' *ethicalness*. This possibility has already been suggested by the existing literature to justify the return spread between sin and non-sin companies. For instance, [Beal, Goyen, and Philips \(2005\)](#), at p. 72, argue that "including the perceived level of ethicality of an investment in the investor's utility function" is one possible way to

⁴In the calibration exercise and empirical tests, we rely on the time-series of dividends paid by sin and non-sin companies.

incorporate ethicalness into a theoretical framework. [Fama and French \(2007\)](#), at p. 675, argue that socially responsible investors might get utility also from firm characteristics (such as social behavior), above and beyond the payoff provided by the asset, so that they might refuse, for example, to hold “stocks of tobacco companies or gun manufacturers”. [Bollen \(2007\)](#) suggests that investors might have a multi-attribute utility function: A standard attribute given by the asset payoff and non-standard attributes that depend on the firm’s social behavior.

If investors get utility from non-monetary payoffs, then stock prices and, in turn, returns, should depend on the investors’ subjective valuation of firms and not only on firms’ fundamentals. Consistently, [Statman, Fisher, and Anginer \(2008\)](#) use the *Fortune Magazine* rating to distinguish between “admired” and “spurned” stocks and find that spurned stocks pay higher returns than admired stocks. All in all, these results suggest that subjective (non-pecuniary) attributes may play a role in determining asset prices and should then be included in the investors’ utility function.

In our setting, we model such a multi-attribute utility function to study how the interaction between different attributes (payoff and ethicalness) influences investors’ desire of consumption-smoothing and how this, in turn, affects the return and volatility spreads between sin and non-sin stocks. We assume that the two firms are characterized by different perceived ethicalness, which is represented by the parameter π_i , with $i \in \{s, c\}$. Borrowing the terminology used in [Beal et al. \(2005\)](#), one can think of π_i as the firm’s *degree of ethicalness*. Consistently, we assume that $\pi_s < \pi_c$, i.e., the degree of ethicalness of sin companies is smaller than that of non-sin companies. Our definition of ethicalness can be framed within the general notion of corporate social responsibility. We focus on one facet of corporate social responsibility, namely the moral nature of a firm’s output. Companies involved in the business of alcoholic beverages, smoke products, and gaming are typically considered to be sinful because their businesses are intimately related to

the weaknesses of the human personality.⁵ Corporate social responsibility goes beyond the moral judgment on consumption goods produced by firms and comprises additional dimensions such as consumer protection, corporate governance, environmental attitude, and philanthropic behavior. Nonetheless, with this distinction in mind, our sin companies may represent an example of companies with poor corporate social responsibility.

3.4 Preferences

Investors derive utility not only from the two consumption goods $c_{i,t}$, $i \in \{s, c\}$ (i.e., the dividends paid by sin and non-sin firms) but also from the perceived degree of ethicalness of the two firms, π_i , with $i \in \{s, c\}$,

$$U(c_{s,t}, c_{c,t}) = \pi_s^\beta \frac{(c_{s,t})^{1-\gamma}}{1-\gamma} + \pi_c^\beta \frac{(c_{c,t})^{1-\gamma}}{1-\gamma}. \quad (4)$$

Here, γ represents the relative risk aversion of investors, while the parameter β governs the complementarity between ethicalness and consumption. If $\beta < 0$, ethicalness and dividends are substitute goods, which means that the marginal utility of consuming the firm's dividend is a decreasing function of π_i . In other words, a high degree of ethicalness produces the same qualitative effects as high consumption, i.e., it reduces the marginal utility of consuming the firm's dividend. If $\beta > 0$, ethicalness and dividends are complementary goods, that is an increase in the ethicalness perception has the same qualitative effect as low consumption, i.e., it increases the marginal utility of consuming the firm's dividend.⁶

⁵Think of the five thieves: Lust, rage, greed, attachment, conceit.

⁶The link between β and the dividend-ethicalness complementarity is given by their cross-derivative:

$$\frac{\partial^2 U}{\partial \pi_s \partial c_{s,t}} = \beta \pi_s^{\beta-1} c_{s,t}^{-\gamma}, \quad \frac{\partial^2 U}{\partial \pi_c \partial c_{c,t}} = \beta \pi_c^{\beta-1} c_{c,t}^{-\gamma},$$

and the sign of the derivatives above depends on β only.

3.5 *Individual investors vs. institutional investors*

Institutional investors (such as mutual funds, pension funds, and foundations) typically operate under specific guidelines that sometimes include the assessment of firms' ethical behavior that may lead to exclusion of unethical companies from their portfolios. Consistently, [Hong and Kacperczyk \(2009\)](#) find that institutional investors underweight sin stocks and, thus, shareholdings of sin stocks tend to be concentrated among individual investors.

We know little about how the behavior of individual investors affects the pricing mechanism of sin stocks relative to that of ethical stocks. [Hong and Kostovetsky \(2012\)](#) suggest that individual investors may dislike sin stocks for two reasons. First, they may shy away from companies producing goods they spurn (to some extent, this corresponds to a boycott behavior towards products they do not like). However, this argument abstracts from the trade-off between ethical behavior and cash flows: How much cash flows investors are willing to sacrifice for a higher degree of ethicalness? Moreover, [Fabozzi et al. \(2008\)](#) argue that although investors typically declare that they do not invest in unethical companies “the validity of the responses could be questioned because of the desire of those polled to respond in a politically correct fashion, and not necessarily putting their money where their mouths are (p. 83)”. [Lemieux \(2003\)](#) makes a similar point.

The second reason for which individual investors might display preferences for ethical companies concerns valuation bias. Investors may think that companies following principles inconsistent with their values are also less profitable. While this argument is appealing, it is not clear why individual investors do not learn from past performance and accordingly correct their bias, given that sin stocks do better on average than non-sin stocks.

To shed some light on how investors preferences for ethicalness affect asset prices, we need to endow consumers preferences with a sensitivity factor that captures the per-

ceived firms' ethicalness (parameter π_i in (4)). This characterization allows us to derive predictions for the equilibrium behavior of stock returns.

3.6 The competitive equilibrium

3.6.1 Optimal consumption

The representative investor maximizes utility subject to the supply constraints:

$$\begin{aligned} \max_{c_{s,t}, c_{c,t}} \mathbb{E} \int_0^\infty e^{-\rho t} \left[\pi_s^\beta \frac{(c_{s,t})^{1-\gamma}}{1-\gamma} + \pi_c^\beta \frac{(c_{c,t})^{1-\gamma}}{1-\gamma} \right] dt \\ \text{s.t. } c_{s,t} \leq D_{s,t} \quad \text{and} \quad c_{c,t} \leq D_{c,t}. \end{aligned} \quad (5)$$

In equilibrium, demand and supply of consumption and financial securities are equal to each other. This means that our representative agent has to hold the entire supply of risky assets and consume the total supply of consumption/dividend. Therefore, there is no room for boycotting assets or consumption goods of sin companies, and stock returns are only determined by the investor's preferences for ethical companies relative to unethical companies.

We solve the problem using the martingale method of [Karatzas, Lehoczky, and Shreve \(1987\)](#). The optimal consumption plan is determined by the first-order conditions

$$e^{-\rho t} \pi_s^\beta c_{s,t}^{-\gamma} = \lambda_t p_{s,t}, \quad e^{-\rho t} \pi_c^\beta c_{c,t}^{-\gamma} = \lambda_t p_{c,t}, \quad (6)$$

where λ_t is the state price density (i.e., the Arrow-Debreu price of one unit of the numeraire delivered at time t in state $\omega \in \Omega$), while $p_{i,t}$ is the relative price of good $i \in \{s, c\}$. The term $\lambda_t p_{i,t}$ represents the price of one unit of good i at time t in state $\omega \in \Omega$. Prices λ_t and $p_{i,t}$ are derived by imposing the market clearing conditions on consumption and are reported below.

Proposition 1. *In our economy with separable utility (4), the equilibrium state price density and relative prices are given by*

$$\begin{aligned}\lambda_t &= e^{-\rho t}[\alpha\pi_s^\beta D_{s,t}^{-\gamma} + (1-\alpha)\pi_c^\beta D_{c,t}^{-\gamma}], \\ p_{s,t} &= e^{-\rho t}\frac{\pi_s^\beta D_{s,t}^{-\gamma}}{\lambda_t}, \quad p_{c,t} = e^{-\rho t}\frac{\pi_c^\beta D_{c,t}^{-\gamma}}{\lambda_t}.\end{aligned}\tag{7}$$

Moreover, we have that

- If $\beta < 0$, $\frac{\partial p_{s,t}}{\partial(\pi_c/\pi_s)} > 0$ and $\frac{\partial p_{c,t}}{\partial(\pi_c/\pi_s)} < 0$;
- If $\beta > 0$, $\frac{\partial p_{s,t}}{\partial(\pi_c/\pi_s)} < 0$ and $\frac{\partial p_{c,t}}{\partial(\pi_c/\pi_s)} > 0$;
- $\frac{\partial p_{s,t}}{\partial(D_{s,t}/D_{c,t})} < 0$ and $\frac{\partial p_{c,t}}{\partial(D_{s,t}/D_{c,t})} > 0$.

Proof. See Appendix A. □

The price of each risky asset is computed as the present value of the dividend stream paid by the asset, discounted using the state-price density and the relative prices determined above. Formally, we have

$$\begin{aligned}S_{s,t} &= \mathbb{E}_t \int_t^\infty \left[\frac{\lambda_u}{\lambda_t} p_{s,u} D_{s,u} du \right] = p_{s,t} D_{s,t} \mathbb{E}_t \int_t^\infty \left[e^{-\rho(u-t)} \left(\frac{D_{s,u}}{D_{s,t}} \right)^{(1-\gamma)} \right] du, \\ S_{c,t} &= \mathbb{E}_t \int_t^\infty \left[\frac{\lambda_u}{\lambda_t} p_{c,u} D_{c,u} du \right] = p_{c,t} D_{c,t} \mathbb{E}_t \int_t^\infty \left[e^{-\rho(u-t)} \left(\frac{D_{c,u}}{D_{c,t}} \right)^{(1-\gamma)} \right] du.\end{aligned}\tag{8}$$

Under the assumption of a log-normal dividend process, the prices of sin and non-sin stocks are given in the proposition below.

Proposition 2. *Stock prices of sin and non-sin assets are given by*

$$S_{s,t} = \frac{p_{s,t} D_{s,t}}{\Gamma_s}, \quad S_{c,t} = \frac{p_{c,t} D_{c,t}}{\Gamma_c},$$

where Γ_1 and Γ_2 are defined by

$$\begin{aligned}\Gamma_s &:= \rho + (\gamma - 1) \left(\nu_s - \frac{\phi_s^2}{2} \right) - \frac{1}{2}(1 - \gamma)^2 \phi_s^2 \\ \Gamma_c &:= \rho + (\gamma - 1) \left(\nu_c - \frac{\phi_c^2}{2} \right) - \frac{1}{2}(1 - \gamma)^2 \phi_c^2.\end{aligned}$$

Proof. See Appendix A. □

Hong and Kacperczyk (2009) find that stocks of sin companies are cheaper than those of non-sin companies. They suggest that the reason for this result can be found in the responsible behavior of investors who underweight stocks of sin companies, thus reducing their price. Our model takes into account this aspect. Using the equilibrium prices in Proposition 2, in fact, we obtain

$$\begin{aligned}\log(S_{s,t}) - \log(S_{c,t}) &= \beta [\log(\pi_s) - \log(\pi_c)] + (1 - \gamma) [\log(D_{s,t}) - \log(D_{c,t})] \\ &\quad + \log(\Gamma_c) - \log(\Gamma_s).\end{aligned}\tag{9}$$

Equation (9) suggests that the price differential between sin and non-sin companies depends on current dividend payments (second term on the right-hand side) and dividend fundamentals (third term on the right-hand side). The first term on the right-hand side of equation (9) plays a key role in our analysis. To see why, note that by assumption, $\log(\pi_s) - \log(\pi_c) < 0$. Therefore, $\beta < 0$ implies that, ceteris paribus, sin companies are worth more than non-sin companies, while, conversely, $\beta > 0$ implies that non-sin companies are worth more than sin companies. The reason for this result lies in the implications of complementarity between ethicalness and consumption for the marginal utility of consumption. If $\beta > 0$, the marginal utility of consumption increases with the perceived degree of ethicalness π . Therefore, the consumption of dividends paid by

non-sin companies is worth more than that paid by sin companies, which implies that stocks of non-sin companies are more expensive than those of sin companies, all other things being equal.

However, seeking out for firms ethicalness is not the only determinant of stock prices. Risk aversion is also key and its magnitude determines the impact of dividend payments on stock prices. An increase in the dividend paid by sin companies (relative to that paid by non-sin companies) raises the expected cash-flow of sin companies (as compared to that of non-sin companies), and, at the same time, increases the discount rates applied to dividends of sin companies relative to that applied to dividends of non-sin companies (i.e., $p_{s,t}$ decreases and $p_{c,t}$ increases). For $\gamma > 1$, the discount rate rises faster than expected cash-flows, so the price of sin stocks declines relative to the price of non-sin stocks. When $\gamma = 1$, the effects from discount rate and cash-flow exactly offset each other and dividend payments do not affect stock prices.

The complementarity between dividend and ethicalness also has important implications for the conditional return spread between sin and non-sin stocks.

Proposition 3. *The prices of the risky assets are driven by the following dynamics*

$$\begin{aligned} \frac{dS_{s,t}}{S_{s,t}} &= \{ \nu_s - (1 - \alpha)\gamma p_{c,t}\Lambda_t - (1 - \alpha)p_{c,t}\gamma\phi_s^2 \} dt + [1 - (1 - \alpha)\gamma p_{c,t}]\phi_s dB_{s,t} \\ &\quad + (1 - \alpha)p_{c,t}\gamma\phi_c dB_{c,t} \\ \frac{dS_{c,t}}{S_{c,t}} &= [\nu_c + \alpha\gamma p_{c,t}\Lambda_t + \alpha p_{s,t}\gamma\phi_c^2] dt - \alpha\gamma p_{s,t}\phi_s dB_{s,t} + [1 + \alpha\gamma p_{s,t}]\phi_c dB_{s,t}, \end{aligned}$$

with

$$\Lambda_t := \nu_s - \nu_c + \phi_c^2 + \frac{1}{2}(\gamma - 1)(\phi_s^2 + \phi_c^2) - (1 - \alpha)\gamma p_{c,t}(\phi_s^2 + \phi_c^2).$$

Proof. See Appendix A.

□

Results in Proposition 3 allow us to derive the conditional expected returns and the return spread between sin and non-sin stocks.

Proposition 4. *The risk premia of the two risky assets are given by*

$$\begin{aligned}\mu_{s,t} - r_t &= (1 - \alpha)^2 p_{c,t}^2 \gamma^2 \phi_c^2 + \alpha p_{s,t} \gamma \phi_s^2 [1 - (1 - \alpha) \gamma p_{c,t}] \\ \mu_{c,t} - r_t &= \alpha^2 p_{s,t}^2 \gamma^2 \phi_s^2 + (1 - \alpha) p_{c,t} \gamma \phi_c^2 [1 - \alpha \gamma p_{s,t}],\end{aligned}$$

and the return spread between the two assets reads as

$$\mu_{s,t} - \mu_{c,t} = \gamma(1 - \gamma) [\alpha p_{s,t} \phi_s^2 - (1 - \alpha) p_{c,t} \phi_c^2].$$

Proof. See Appendix A.

□

The return spread between sin and non-sin stocks is a weighted average of the standard deviation of dividends' growth rates (ϕ_s^2 and ϕ_c^2), where the weights depend on the contribution of the stocks to the total value of the consumption basket (αp_s and $(1 - \alpha) p_c$). From Proposition 4, it follows that the value of each dividend decreases with its relative supply, and therefore the contribution of dividend risk (ϕ_s^2 and ϕ_c^2) to the return spread decreases as the dividend paid by the company increases. The impact of dividend payment on the return spread depends on the risk aversion. Given that $\frac{\partial p_{s,t}}{\partial (D_{s,t}/D_{c,t})} < 0$ and $\frac{\partial p_{c,t}}{\partial (D_{s,t}/D_{c,t})} > 0$, the return spread between sin and non-sin stocks decreases with $\frac{D_{s,t}}{D_{c,t}}$ when $\gamma < 1$, and increases otherwise. This result hinges on the trade-off between the discount rate channel and the cash-flow channel illustrated in equation (9). When $\gamma < 1$ ($\gamma > 1$), the price spread between sin and non-sin stocks increases (decreases) with $\frac{D_{s,t}}{D_{c,t}}$, and therefore the expected return spread has to decline (increase).

The conditional return spread between sin and non-sin stocks also depends on firms' ethicalness. To see how, assume first that the two companies are the same with respect to any attributes and also pay the same dividends. In this case, $\mu_{s,t} - \mu_{c,t} = 0$. What happens if the degree of ethicalness of one firm becomes larger than that of the other? One would expect that the return spread increases when π_c increases as compared to π_s , that is $\frac{\partial(\mu_{s,t} - \mu_{c,t})}{\partial(\pi_c/\pi_s)} > 0$. Results in Proposition 1 imply

$$\frac{\partial(\mu_{s,t} - \mu_{c,t})}{\partial(\pi_c/\pi_s)} = (1 - \gamma)\gamma \left[\alpha \frac{\partial p_{s,t}}{\partial(\pi_c/\pi_s)} \phi_s^2 - (1 - \alpha) \frac{\partial p_{c,t}}{\partial(\pi_c/\pi_s)} \phi_c^2 \right].$$

Therefore, the following cases may occur.

1. $\beta = 0$ and/or $\gamma = 1$: In this case, $\frac{\partial(\mu_{s,t} - \mu_{c,t})}{\partial(\pi_c/\pi_s)} = 0$ and the firms' ethicalness has no impact on stock returns.
2. $\beta < 0$: In this case, $\frac{\partial p_{s,t}}{\partial(\pi_c/\pi_s)} > 0$ and $\frac{\partial p_{c,t}}{\partial(\pi_c/\pi_s)} < 0$ (Proposition 1) and thus

$$\frac{\partial(\mu_{s,t} - \mu_{c,t})}{\partial(\pi_c/\pi_s)} \begin{cases} < 0 & \text{if } \gamma > 1 \\ > 0 & \text{if } \gamma \in (0, 1). \end{cases}$$

3. $\beta > 0$: In this case, $\frac{\partial p_{s,t}}{\partial(\pi_c/\pi_s)} < 0$ and $\frac{\partial p_{c,t}}{\partial(\pi_c/\pi_s)} > 0$ (Proposition 1) and thus

$$\frac{\partial(\mu_{s,t} - \mu_{c,t})}{\partial(\pi_c/\pi_s)} \begin{cases} < 0 & \text{if } \gamma \in (0, 1) \\ > 0 & \text{if } \gamma > 1. \end{cases}$$

In summary, expected returns decreases with the firm's degree of ethicalness if $\beta < 0 \wedge \gamma < 1$ or $\beta > 0 \wedge \gamma > 1$. To understand these results, we need to go back to the basic trade-off between ethicalness and dividend payment introduced in our framework. The total change in the utility function associated with changes in dividends and ethicalness

of firm i reads

$$\Delta U = \beta \pi_i^{\beta-1} \frac{(c_{i,t})^{1-\gamma}}{1-\gamma} \Delta \pi_i + \pi_i^\beta c_{i,t}^{-\gamma} \Delta c_i. \quad (10)$$

For $\Delta U = 0$, the desired marginal rate of substitution between dividend and ethicalness of firm i is thus given by

$$MRS_i = \frac{\Delta c_i}{\Delta \pi_i} = -\frac{\beta}{1-\gamma} \frac{c_{i,t}}{\pi_i} = A \frac{c_{i,t}}{\pi_i}. \quad (11)$$

The key point is the sign of the constant $A = -\frac{\beta}{1-\gamma}$. $A > 0$, when $\beta < 0 \wedge \gamma < 1$ or when $\beta > 0 \wedge \gamma > 1$. If this occurs, then investors would like to receive higher dividends when the degree of ethicalness increases, but they have no influence on firms' ethicalness and dividend payments, which are both decided by firms. Therefore, investors will ask for a premium as a reward for the risk of holding large dividends received from companies with a low degree of ethicalness. This explains why sin companies tend to pay, *ceteris paribus*, higher returns than non-sin companies when $\beta < 0 \wedge \gamma < 1$ or $\beta > 0 \wedge \gamma > 1$, and lower returns otherwise. This simple mechanism is also flexible. If $\beta < 0 \wedge \gamma > 1$ or $\beta > 0 \wedge \gamma < 1$, the model is capable of generating opposite predictions, that is, sin-stock will have on average lower returns than ethical stocks.

Unlike the existing literature on boycott risk, our model not only replicates the same return differential sign between sin and non-sin stocks that emerges under the assumption of indiscriminate aversion to non-ethical firms' behavior ([Hong and Kacperczyk, 2009](#); [Hong and Kostovetsky, 2012](#)), but it is also capable of capturing the reverse result that is observed in certain countries where investors' preferences may be driven by the presence of heterogeneous social norms. ([Durand et al., 2013](#); [Fauver and McDonald, 2014](#)). Here, we argue that social norms determine the investors' preferences for the degree of ethicalness and firm's dividends, and shape the individual utility function accordingly. However, we do not impose a priori restrictions on the specific trade-off between ethical-

ness and dividends. We, instead, study the model implications corresponding to different preference specifications and select the specification that provides the better fit to the data.

3.7 Quantitative implications

3.7.1 Calibration

To assess whether our framework is capable of providing a realistic description of the return spread between sin and non-sin stocks, we first need to calibrate the model. As a benchmark case, we consider a symmetric economy where the two firms have the same fundamentals (i.e., $\nu_s = \nu_c$ and $\phi_s = \phi_c$) and only differ in the realized dividend payments. To calibrate the dividend process, we use the average growth rate and the standard deviation of the total payout of sin and non-sin comparable companies (Table 1). Empirical estimates suggest that $\nu_s = 4 \times 0.010$, $\nu_c = 4 \times 0.006$, $\phi_s = \sqrt{4} \times 0.156$, and $\phi_c = \sqrt{4} \times 0.098$. To calibrate the symmetric economy, we take the mean of the above estimates, that is, we set $\nu_s = \nu_c = \frac{4 \times 0.010 + 4 \times 0.006}{2}$ and $\phi_s = \phi_c = \frac{\sqrt{4} \times 0.156 + \sqrt{4} \times 0.098}{2}$. In addition, we choose $\alpha = 1 - \alpha = 0.5$. Our results also depend on relative ethicalness $c_s = \frac{\pi_s}{\pi_s + \pi_c}$. The only restriction here is $\pi_s < \pi_c$, which implies $0 \leq c_s \leq 0.5$. Therefore, to analyze conditional moments, we consider three values of relative ethicalness $c_s = [0.1, 0.3, 0.5]$. When computing average returns, we use $c_s = 0.3$. Conditional returns are computed according to Proposition 4. The conditional standard deviation is also derived in closed form and reported in Appendix A. For robustness, we also consider an asymmetric economy in which the two companies differ in their fundamentals. In the asymmetric case, results are very similar and reported in Appendix B.

3.7.2 Properties of stock returns

Figure 1 and Figure 2 show the conditional return and volatility spreads between sin and non-sin stocks in the symmetric economy as a function of the dividend share of sin stocks, which we denote as $d_s = \frac{D_s}{D_s + D_c}$. As explained above, the dynamics of the conditional spreads is affected by investors' risk aversion. When investors are more risk averse than log utility, the discount factor rises faster than expected cash-flows, and therefore prices decrease when dividends increase. As a result, an increase in the dividend paid by sin stocks (relative to the dividend paid by non-sin stocks) reduces the current price of sin stocks relative to the price of non-sin stocks and, thus, raises future expected returns of sin stocks as compared to that of non-sin stocks. This mechanism implies that the conditional return volatility spreads between sin and non-sin stocks increase with the dividend share of sin stocks (Figure 1). When instead investors are less risk averse than log utility, the effect of an increase in dividend payments on expected cash-flows dominates the discount rate effect and, thus, prices increase following an increase in dividend payments. As a result, when the dividend share of sin stocks increases, the price of sin stock increases relative to the price of non-sin stocks, and the return spread between sin and non-sin stocks decreases (Figure 2). Results for the asymmetric economy are very similar and reported in Appendix B.

A novel aspect in our framework related to the effects of the perceived ethicalness, summarized by the relative variable $c_s = \frac{\pi_s}{\pi_s + \pi_c}$, on the return and volatility spreads between sin stocks and non-sin stocks. Consistently with the behavior of the return spread analyzed in Proposition 4, we observe that when $\beta < 0 \wedge \gamma < 1$ or $\beta > 0 \wedge \gamma > 1$, sin stocks are riskier than non-sin stocks (i.e., they exhibit higher standard deviation) and command higher return over most of the dividend share region.

The previous analysis clarifies the impact of dividend payments on the riskiness of sin stocks relative to that of non-sin stocks and the resulting compensation required by

investors to hold stocks that are perceived as sinful. However, the motivating evidence above refers to the average returns and standard deviation of sin stocks over a given period of time. Going one step further, we also study the implications of dividend/ethicalness complementarity and risk aversion for the average return and volatility differential between sin and non-sin stocks. To do so, we simulate 5000 trajectories of dividends, each of length 50 years, and we compute the return and standard deviation differentials along these trajectories⁷. The average return and standard deviation differentials are reported in Table 2. We observe that sin stocks are riskier than non-sin stocks and pay, on average, higher returns than non-sin stocks when (i) dividend and ethicalness are substitutes ($\beta < 0$) and the risk aversion is smaller than 1, or (ii) when dividend and ethicalness are complements ($\beta > 0$) and the risk aversion is larger than 1. This result depends on the interplay between risk aversion and dividend/ethicalness complementarity and its implications for the desired marginal rate of substitution between dividends and perceived ethicalness.

The existing literature has explained the return differential between sin and non-sin stocks using the concept of “boycott risk”: Responsible investors refuse to hold sin stocks (boycott), thus lowering their prices and increasing expected returns (see Heinkel et al., 2008; Luo and Balvers, 2017). In our model, investors are willing to hold both sin and non-sin stocks, and expected returns are the combined result of the perceived ethicalness and risk aversion. Investors command a premium to hold sin stocks to be compensated for the risk that their consumption basket might be biased toward sin products. This is in the spirit of Statman et al. (2008), who argue that expected returns should be higher when *objective* risk is high and also when *subjective* risk is high. In our framework, subjective risk is the risk of receiving large dividends from unethical firms.

⁷More precisely, for any value of simulated dividends $D_{1,t}$ and $D_{2,t}$, we compute the conditional returns and the conditional standard deviation. The unconditional return is given by the average of conditional returns. The same applies to the standard deviation.

From a theoretical point of view, the result above suggests that it is not necessary to assume that responsible investors boycott (refuse to hold) sin stocks to explain the differences in returns between sin and non-sin stocks.⁸ Relaxing the boycott assumption appears to be important on a theoretical ground. In fact, versions of CAPM based on boycott risk are generally derived by assuming that ethical investors are constrained from holding sin stocks, which implies that investors are unable to hold the market portfolio. As a result, investors estimate equilibrium returns using a “modified” variance-covariance matrix that depends on the proportion of restricted investors in the economy and the wealth they hold (Levy, 1978; Malkiel and Xu, 2006). Since the distribution of restricted/unrestricted investors is not directly observable, the empirical implications of restricted CAPM models are difficult to test directly because they require a proxy for the “modified” market portfolio. Moreover, when investors boycott sin stocks they do not receive any dividends from them, whereas we show that such cash flows are important to explain the conditional return and volatility spreads between sin and non-sin companies.

Finally, it is worth noting that when $\beta = 0$ or $\pi_c = \pi_s$, we are back to the standard case of power utility over multiple consumption goods, where the perceived ethicalness is irrelevant, and the only important risk component is the diversification risk. In the symmetric economy, the fundamentals of the two stocks are the same and the only thing that matters for expected returns is the payment of dividends, as evident from equation (9). As a result, firms that pay higher dividend will have higher (lower) expected returns when $\gamma > 1$ ($\gamma < 1$). In this case, the symmetric economy is silent about the impact of ethicalness because the two firms are ex-ante identical.⁹ To distinguish between sin and non-sin stock, we have to inspect the asymmetric economy where sin and non-sin stocks have different fundamentals. The expected growth rate and the standard devia-

⁸The fact that we have a representative agent is not relevant for this result. In an economy with multiple agents, the assumption $\pi_c > \pi_s \wedge \beta > 0$ does not imply that the optimal fraction of wealth invested in sin stocks is equal to zero.

⁹Formally, in this case we cannot even distinguish between sin and non-sin stocks.

tion of dividends are higher for sin stocks than for non-sin stocks. Under power utility of consumption, these discrepancies in fundamentals imply that when agents are more risk averse than log utility, sin stocks are worth more than non-sin stocks and, thus, command lower expected returns. These results imply that a standard model based on diversification risk only (i.e., a model where $\beta = 0$ or $\pi_c = \pi_s$) does not provide a realistic description of the stock return differential between sin and non-sin stocks. In other words, preferences for ethicalness matter for stock returns.

4 Empirical analysis

4.1 Empirical approach

Our prima facie evidence (Section 2), in line with the existing literature, suggests that sin stocks are characterized by higher return and volatility than non-sin comparable stocks. We formally test this prediction by looking at the average unconditional return and volatility spreads over different investment horizons.

Our model, however, generates positive unconditional return and volatility spreads between sin and non-sin stocks under two different preference specifications:

- i. Dividends and ethicalness are substitute goods and risk aversion is low (lower than log utility);
- ii. Dividends and ethicalness are complementary goods and risk aversion is sufficiently high (higher than log utility).

To empirically distinguish between these two cases, we look at their implications for conditional return and volatility spreads and estimate the following regression for the return spread over different investment horizons k

$$\sum_{j=1}^k (r_{s,t+j} - r_{c,t+j}) = b_0 + b_1 d_{s,t} + \mathbf{x}_t \mathbf{b} + \varepsilon_{t+k}. \quad (12)$$

$r_{i,t+j}$ is the one-period return for portfolio i at time $t + j$, where $i \in \{s, c\}$. $d_{s,t}$ is the current dividend share of sin companies. In additional tests, we include a vector of control variables \mathbf{x}_t , such as the three Fama-French factors, the momentum factor, the traded liquidity factor by [Pástor and Stambaugh \(2003\)](#), and the litigation risk differential across the two portfolios. We allow for serial correlation and heteroskedasticity in the error terms using Newey-West standard errors (four lags).

We estimate a similar regression specification for the volatility spread

$$\sigma_{s,t+k} - \sigma_{c,t+k} = b_0 + b_1 d_{s,t} + \mathbf{x}_t \mathbf{b} + \varepsilon_{t+k}, \quad (13)$$

where portfolio i 's return volatility is given by the sum of the absolute value of deviations from the unconditional mean return, i.e., $\sigma_{i,t+k} = \sum_{j=0}^k |r_{i,t+j} - \bar{r}_i|$ for $i \in \{s, c\}$, in line with [Bansal, Fang, and Yaron \(2005b\)](#). For robustness, we also use a measure based on squared deviations from the unconditional mean return, i.e., $\sigma_{i,t+k} = \sqrt{\sum_{j=0}^k (r_{i,t+j} - \bar{r}_i)^2}$ for $i \in \{s, c\}$.

The parameter of interest in equations (12) and (13) is b_1 . Under a model where dividends and ethicalness are substitute goods and investors have low risk aversion (case i.), we expect $b_1 < 0$. Conversely, under a model where dividends and ethicalness are complementary goods and investors have high risk aversion (case ii.), we expect $b_1 > 0$.

4.2 Data

We consider the universe of U.S. firms traded on NYSE, AMEX, and NASDAQ between 1926 and 2015. We obtain monthly total stock return data from the Center for Research in Security Prices (CRSP) and accounting data from Standard & Poor's Compustat. We require each firm to have traded ordinary shares (CRSP share code 10 or 11). We also obtain consumer price index (CPI) series from Federal Reserve Economic Data (FRED) of the St. Louis Federal Reserve Bank, risk factors (excess market return, small minus

big, high minus low, and momentum) from Kenneth French’s website, and the liquidity factor from Robert Stambaugh’s website.

Our sin portfolio includes companies producing alcoholic beverages, smoke products, and gaming. In addition, we construct an extended sin portfolio that also includes companies involved in the distribution of sin products. The non-sin comparable portfolio include companies operating in the food, soda, fun, and meals industries. The sin portfolio and the extended sin portfolio comprise 235 and 408 companies, respectively. The non-sin comparable portfolio contains 1,943 companies. We compute value-weighted real returns on these portfolios at quarterly frequency.¹⁰ For robustness, we also compute equally-weighted returns. We provide details on the portfolio construction procedure in Appendix C.

We conduct our baseline analysis over the period 1965Q1:2015Q4. Indeed, it was in 1965, amid growing health concerns about smoking, that the Congress passed the Federal Cigarette Labeling and Advertising Act, which substantially restricted cigarette packaging practices (Hong and Kacperczyk, 2009). This can be seen as a turning point in social norms about smoke products, after which companies operating in that industry can be unambiguously classified as sinful. We also conduct robustness tests using the whole sample period 1926Q3:2015Q4.

Our main variable of interest is the dividend share of sin companies (d_s). We construct our measure of dividend payments at monthly frequency from CRSP adjusting for stock repurchases (Bansal et al., 2005a). We then convert these dividend payments to quarterly frequency by summing monthly payments within each quarter. Moreover, to mitigate seasonal effects, we take the trailing four-quarter average as in Bansal et al. (2005a). Figure 3 shows the evolution of the dividend share of the sin portfolio (top graphs)

¹⁰In line with Bansal, Dittmar, and Lundblad (2005a) and Bansal et al. (2005b), we use data at quarterly frequency, which allows us to better remove seasonal patterns from the time-series of dividend payments.

and of the extended sin portfolio (bottom graphs) through time, both for repurchase-adjusted dividend payments (left graphs) and dividend-only payments (right graphs). For robustness, we also construct Compustat measures of payout following Skinner (2008).

In additional tests, we control for the factors of Fama and French (1993) and Fama and French (2015), the traded liquidity factor of Pástor and Stambaugh (2003), and litigation risk differential between the sin and comparable portfolio (ΔLIT). We compute the litigation risk of each portfolio-quarter as the fraction of non-missing after-tax settlement entries (Compustat item seta) among its constituent companies (Jagannathan and Wang, 1996; Luo and Balvers, 2017). Figure 4 plots ΔLIT for the sin (top graph) and the extended sin portfolio (bottom graph). While litigation risk is generally higher for sin companies than for comparable companies, we observe several periods in which the reverse holds.

4.3 Results

4.3.1 Unconditional tests

To test our model’s unconditional predictions, we compute the mean return and volatility spreads between the sin and the non-sin comparable portfolio over different investment horizons (one year, two years, and three years).

Table 3 presents the results of our unconditional tests. Line [a] considers our baseline case, namely return and volatility spreads between sin and comparable companies using value-weighted returns over the period 1965Q1:2015Q4. Line [b] relies on equally-weighted returns. Line [c] repeats the analysis using the extended sin portfolio. Line [d] extends the analysis to the whole sample period 1926Q3:2015Q4. Line [e] considers the same case as in line [a] but uses an alternative measure of volatility based on squared deviations from the unconditional mean return.¹¹ In each case, as expected, the

¹¹Clearly, the return spread is unaffected by the alternative volatility measure.

return and volatility differentials are positive at all horizons. While the return spread is in some instances insignificant (especially at shorter investment horizons for equally-weighted portfolios), the volatility spread is always statistically significant.

The observed positive return and volatility spreads suggest that the empirically relevant preference specifications are indeed $\beta < 0 \wedge \gamma < 1$ or $\beta > 0 \wedge \gamma > 1$. Our theory appears to capture volatility spreads especially well.

4.3.2 Conditional tests

We now study conditional spreads to distinguish between the two preference specifications that are able to generate positive unconditional return and volatility spreads within our theoretical framework. Motivated by our model, we regress return and volatility spreads on the sin portfolio dividend share d_s . Table 4 estimates equations (12) and (13) at different investment horizons. In Panel A, our baseline case, we consider return and volatility spreads between sin and comparable companies using value-weighted returns and repurchase-adjusted dividend share d_s over the period 1965Q1:2015Q4. In Panel B, we use equally-weighted returns. In Panel C, we use the extended sin portfolio. In Panel D, we rely on the whole sample period 1926Q3:2015Q4. In Panel E, we consider the same case as Panel A but use an alternative measure of volatility based on squared deviations from the unconditional mean return. The relation between both the return and the volatility spread, and the dividend share of the sin portfolio is invariably positive. Again, we find that the coefficient of d_s is always statistically significant for the volatility spread, whereas it is significant for the return spread only in the baseline case (i.e., value-weighted portfolios and dividend adjusted for stock repurchases) and using the extended sin portfolio.

Figure 5 plots the predicted spreads based on the coefficient estimates in Panel A over the empirically relevant range of d_s . Positive changes in d_s are associated with positive

and economically large changes in both spreads.¹² The linear predictions broadly match the patterns of our calibration exercise in Figure 1.

Taken together, these results suggest the existence of a positive link between both the return and volatility spreads between sin and non-sin stocks, and the dividend share of sin stocks. This positive relation is consistent with a model where dividends and ethicalness are complementary goods, and investors are more risk averse than log. We also note that the interplay between ethical and risk preferences seems to importantly feed back into volatilities.

Finally, the existing literature is to a large extent silent as to the explanation for the conditional returns of sin companies. An exception is [Salaber \(2009\)](#), who tests a conditional model that allows for time-varying risk premium and shows that several macroeconomic variables, such as the default spread, the term spread and the dividend yield help explain the return differential between sin and non-sin stocks. In a similar fashion, [Liston \(2016\)](#) shows that the conditional excess return and the conditional standard deviation of sin stocks are affected by investor sentiment.¹³ In comparison to the existing literature our model makes a step forward in understanding the conditional properties of stock returns of sin and non-sin stocks.

Other explanations. Table 5 re-estimates equations (12) and (13) controlling for well-known risk factors. Panel A controls for the three Fama-French factors and momentum. Panel B includes also the traded liquidity factor by [Pástor and Stambaugh \(2003\)](#) among

¹²The predictive power of the dividend share of sin stocks for the return spread between sin and non-sin stocks is consistent with the recent literature showing that forecasts of the dividends growth rate help predict future stock returns ([Lettau and Ludvigson, 2005](#); [Lacerda and Santa-Clara, 2010](#)). Indeed, the current dividend share of sin stocks contains information about the future path of dividends payments which, in turn, determines the future diversification risk and the return spread, depending on the complementarity between dividend and ethicalness and the investors' degree of risk aversion.

¹³There are two important difference in our paper with respect to [Liston \(2016\)](#). First, we analyze the conditional return differential between sin and non-sin stocks rather than the excess return of sin stocks with respect to the risk-free rate. Second, our empirical approach focuses on predictive regressions in the sense that we study the relation between risk factors at time t and returns at time $t + k$, whereas [Liston \(2016\)](#) analyzes the contemporaneous relation between investor sentiment and sin stock returns.

the control variables. This liquidity factor is available from 1968Q1. Our baseline results remain unchanged for both Panel A and Panel B. Note that the momentum factor also proxies for investor sentiment (Stambaugh, Yu, and Yuan, 2012). This reduces the concerns that the return and standard deviation spreads between sin and ethical stocks are driven by investor sentiment. Panel C, in the spirit of Luo and Balvers (2017), controls also for the litigation risk differential between sin and comparable industries (ΔLIT), which is available from 1996Q1. In this case, d_s exhibits a positive and statistically significant coefficient only at shorter investment horizons. By contrast, over longer horizons, d_s is at times insignificant. However, the rather short sample period may complicate inference. Finally, Blitz and Fabozzi (2017) suggest that the extra-performance of sin stocks with respect to the market can be explained by the profitability and investment factors of Fama and French (2015). In Panel D, we thus also control for the profitability and investment factors besides the traditional three Fama-French factors. Our results survive also in this case. It is important to note the profitability and investment factors are not statistically significant, which suggests that they affect sin and comparable stocks in the same way and, thus, do not affect their difference.

One may argue that the sin premium simply reflects sin stocks' higher exposure to risk not captured by the risk factors above. Yet, sin goods tend to exhibit a steady demand throughout the business cycle because of their addictive properties (Becker and Murphy, 1988). As a result, sin stocks may allow investors to reduce their exposure to market risk and receive steady cash flows in recessions, i.e., in periods of high marginal utility of consumption. Such a risk channel would thus be difficult to reconcile with a sin premium.

Alternative dividend measures. Table 6 re-estimates equations (12) and (13) using alternative dividend measures to compute the dividend share d_s . Panel A uses dividends alone, i.e., without repurchases (Bansal et al., 2005a). Again, we find a positive and

statistically significant association between both the return and volatility spread, and d_s . Panel B uses payouts from Compustat as defined by Skinner (2008). In this case, we find a positive and statistically significant association between the volatility spread and d_s at all horizons. By contrast, for the return spread, the estimated d_s coefficient is positive but insignificant.

Moreover, we note that the dividend share measures ($d_s = \frac{D_s}{D_s+D_c}$) used so far are computed from real payouts, i.e., payouts expressed in units of consumption of the CPI basket. Using the model notation, real payouts can be seen as dividends in terms of numeraire units, namely $p_i D_i$ for $i \in \{s, c\}$.

Therefore, we also construct the time series of relative prices p_s and p_c , and convert each portfolio’s payouts into the corresponding consumption streams (D_s, D_c). To this end, in the spirit of Ferson and Constantinides (1991), we use the sin (non-sin) components of the CPI to deflate sin (comparable) companies’ payouts.¹⁴ While the dividend share measure obtained in this way is the closest to the model, it is available only starting in 1986Q1 and arguably noisy. Because of this, with slight abuse of notation, we denote it as \tilde{d}_s rather than d_s . In Panel C of Table 6, we repeat our tests using \tilde{d}_s as explanatory variable. The relation between the volatility spread and \tilde{d}_s is positive and significant, whereas the relation is positive but insignificant for the return spread.

5 Conclusion

In this paper we propose a preference-based explanation for the return differential and the standard deviation differential between sin stocks and non-sin stocks. The key factor in our model is the marginal rate of substitution between dividends and ethicalness. When the marginal rate of substitution is positive investors would like to be compensated for the risk of consuming the “less preferred” dividends, i.e., the sin dividends. Therefore, they

¹⁴More details on the construction of these two price indices are provided in Appendix C.

require average higher returns to hold sin stocks in equilibrium. The positive marginal rate of substitution between dividends and ethicalness can be obtained in a model in which dividends and ethicalness are substitutes and investors are less risk-averse than log utility, or in a model in which dividends and ethicalness are complementary goods and investors are more risk-averse than log utility. However, only the latter can explain the dynamics of the conditional return and volatility spreads between sin and non-sin stocks, namely the fact that both these spreads are increasing in the dividend share of sin stocks, observed in U.S. data.

Although we focus on the U.S. market, our analysis helps to understand how the attitude of investors toward sin stocks affects prices and returns. The results provided also helps to explain the mixed evidence about the sin premium across countries ([Durand et al., 2013](#); [Fauver and McDonald, 2014](#)): While in European and American markets sin stocks tend to pay higher average returns than ethical stocks, in the Asia Pacific countries those differences are largely attenuated and, in some of these countries sin stocks pay lower risk-adjusted return even though institutional investors underweight sin stocks as postulated by the boycott theory. Our model suggests that differences in the degree of substitutability between dividends and firm's ethicalness are capable of reconciling these different results. These considerations call for further theoretical and empirical studies that we leave for future research.

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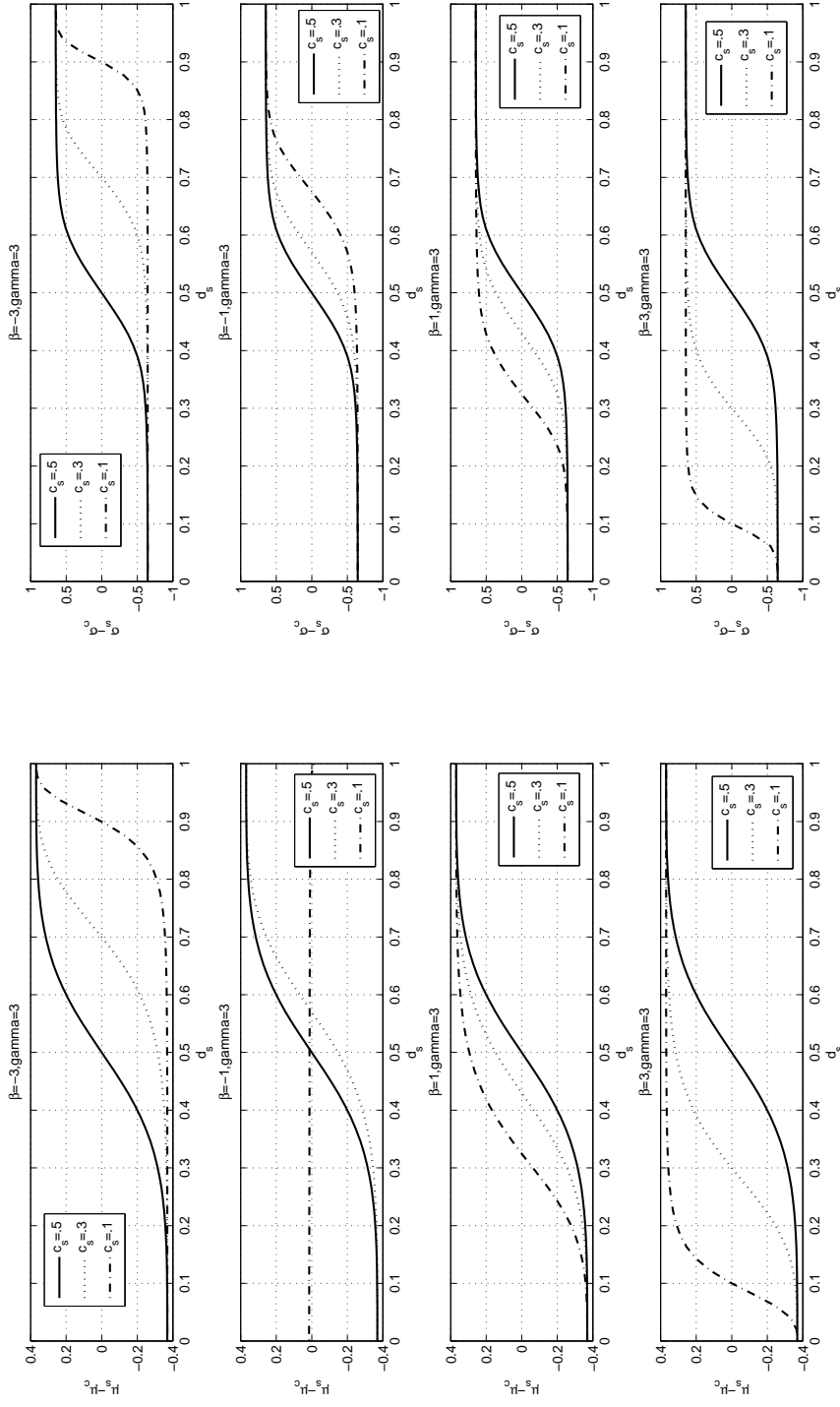


Figure 1: Conditional return and standard deviation spread between sin and non-sin stocks with high risk aversion (symmetric calibration). This figure plots the conditional return differential (left column) and the conditional volatility differential (right column) between the sin stock and the comparable stock as a function of the dividend share d_s .

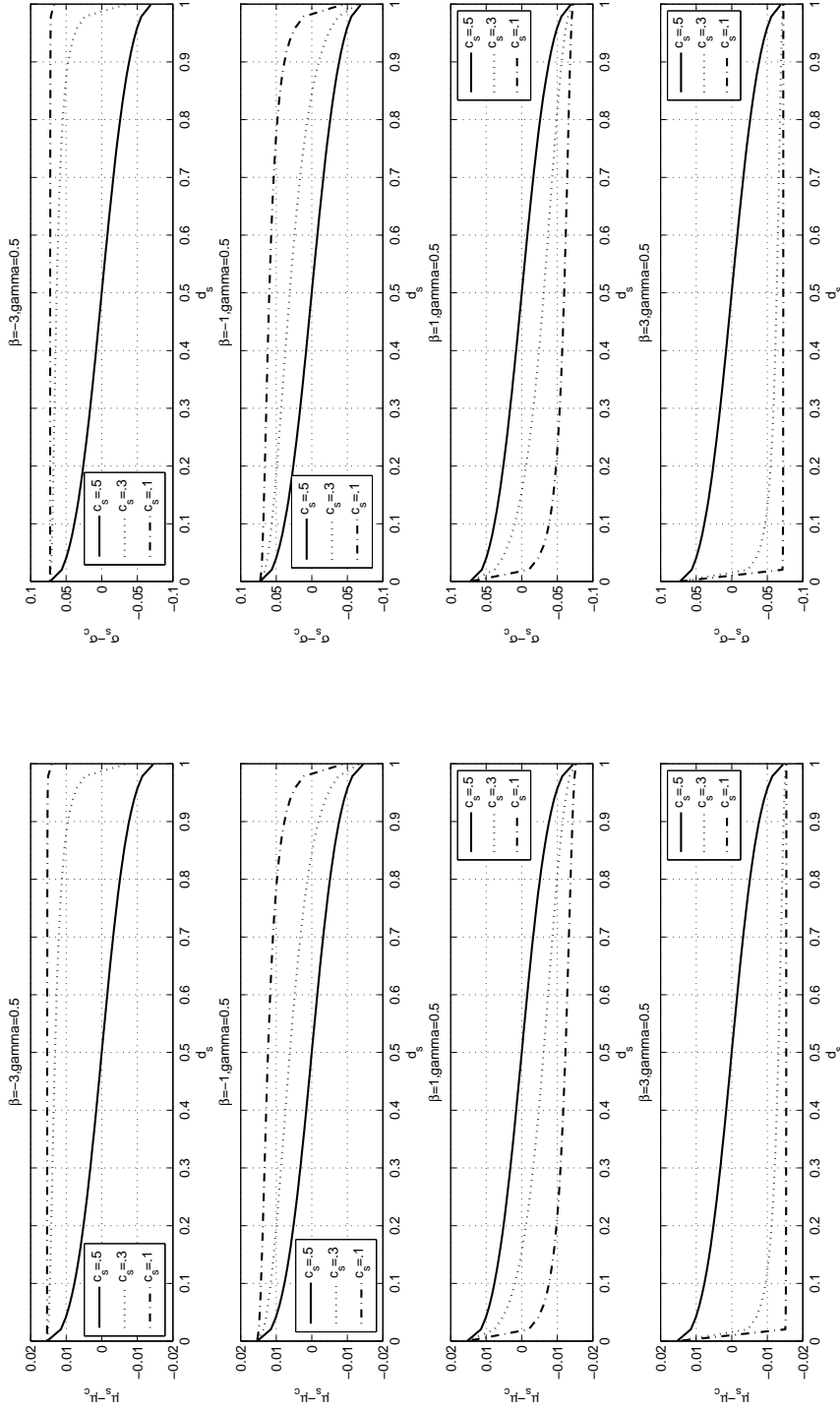


Figure 2: Conditional return and standard deviation spread between sin and non-sin stocks with low risk aversion (symmetric calibration). This figure plots the conditional return differential (left column) and the conditional volatility differential (right column) between the sin stock and the comparable stock as a function of the dividend share d_s .

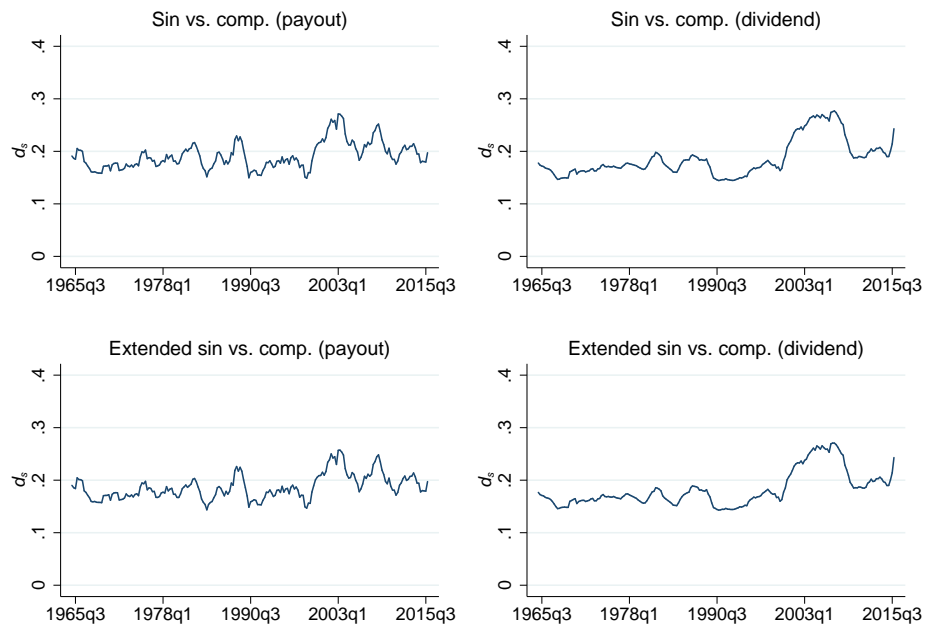


Figure 3: Dividend share of the sin portfolio. This figure plots the evolution of the dividend share of the sin portfolio (top graphs) and of the extended sin portfolio (bottom graphs) through time, both for repurchase-adjusted dividend payments (left graphs) and dividend-only payments (right graphs).

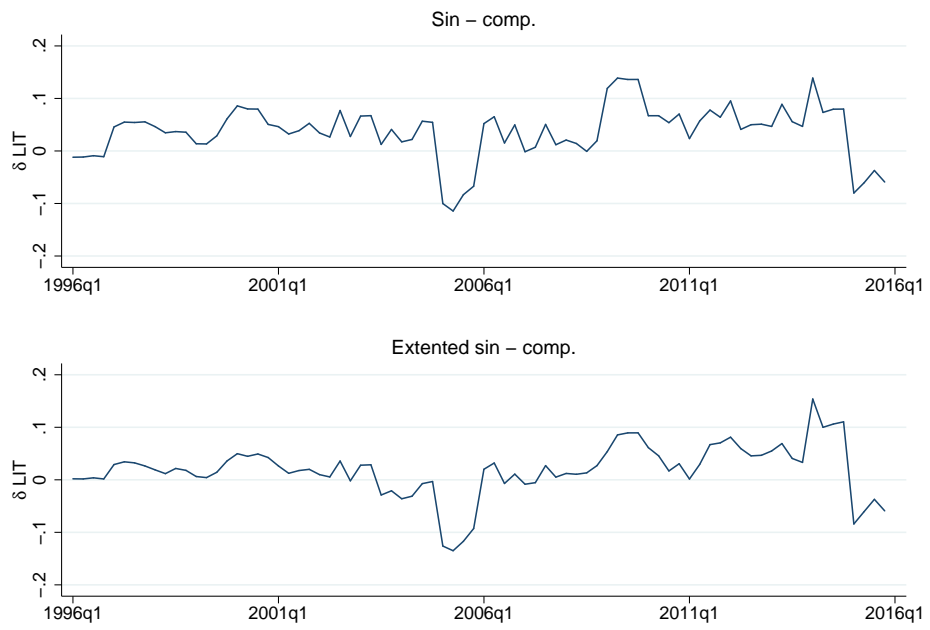


Figure 4: Litigation risk of the sin portfolio. This figure plots the litigation risk differential of the sin (top graph) and the extended sin portfolio (bottom graph) relative to the comparable portfolio (ΔLIT).

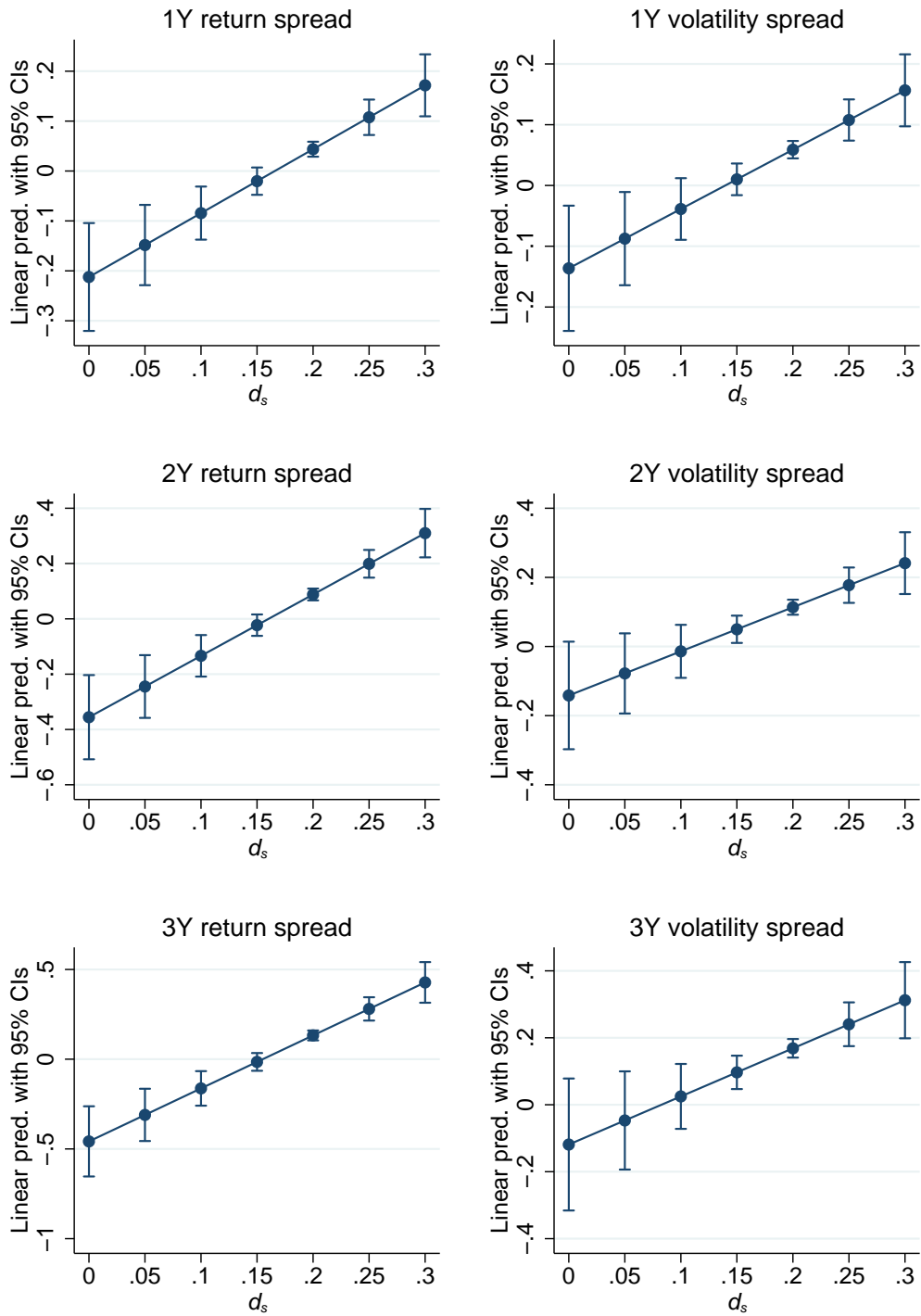


Figure 5: Predicted return and volatility spreads between sin and non-sin stocks. This figure plots the predicted return and volatility spreads between sin and non-sin stocks for given levels of the dividend share of the sin portfolio d_s . The linear predictions are based on the coefficient estimates of Table 4 (Panel A).

Table 1: Summary statistics

This table reports summary statistics for three stock portfolios. The sin portfolio includes companies involved in the production of alcoholic beverages, smoke products, and gaming (Panel A). The non-sin comparable portfolio includes companies operating in the food, soda, fun, and meals industries (Panel B). The extended sin portfolio adds to the sin portfolio firms involved in the distribution of sin products (Panel C). Refer to Appendix C.1 for details on portfolio construction. The baseline sample covers U.S. companies from CRSP and Compustat between 1965 and 2015. Value-weighted (VW) and equally-weighted (EW) portfolio excess returns are reported. *Payout yield* is computed from repurchase-adjusted dividend payments from CRSP (Bansal et al., 2005a). *Dividend yield* is computed from dividend-only payments from CRSP. *Payout yield (Compustat)* is computed from dividend payments and repurchases from Compustat (Skinner, 2008). *Litigation risk* is available from 1996Q1 and is computed as the fraction of non-missing after-tax settlement entries (Compustat item seta) among the portfolio's constituent companies (Jagannathan and Wang, 1996; Luo and Balvers, 2017). Panel D reports the summary statistics for the dividend share d_s of the sin and the extended sin portfolio based both on repurchase-adjusted dividend payments and dividend-only payments. All the variables are at quarterly frequency and are not annualized.

Panel A: Sin portfolio			
	Mean	Std. dev.	Obs.
VW excess return	0.038	0.096	204
EW excess return	0.023	0.120	204
Payout yield	0.009	0.003	204
Div. yield	0.005	0.003	204
Payout yield (Compustat)	0.007	0.002	204
Payout yield (growth rate)	0.010	0.156	204
Litigation risk	0.188	0.089	80

Panel B: Comparable portfolio			
	Mean	Std. dev.	Obs.
VW excess return	0.029	0.086	204
EW excess return	0.017	0.112	204
Payout yield	0.008	0.002	204
Div. yield	0.004	0.002	204
Payout yield (Compustat)	0.006	0.002	204
Payout yield (growth rate)	0.006	0.098	204
Litigation risk	0.151	0.080	80

Panel C: Extended sin portfolio			
	Mean	Std. dev.	Obs.
VW excess return	0.038	0.094	204
EW excess return	0.018	0.121	204
Payout yield	0.008	0.003	204
Div. yield	0.004	0.002	204
Payout yield (Compustat)	0.006	0.002	204
Payout yield (growth rate)	0.008	0.144	204
Litigation risk	0.170	0.085	80

Panel D: Cash flow share (d_s)			
	Mean	Std. dev.	Obs.
Payout (sin w.r.t. comp.)	0.192	0.025	204
Dividend (sin w.r.t. comp.)	0.187	0.035	204
Payout (extended sin w.r.t. comp.)	0.187	0.024	204
Dividend (extended sin w.r.t. comp.)	0.183	0.034	204

Table 2: Simulated unconditional return and volatility spreads

This table reports the simulated average return and volatility spreads between sin and non-sin stocks. The spreads in Panel A are obtained under the assumption that the dividend process of the two portfolios is governed by the same parameters (symmetric calibration). The spreads in Panel B are obtained under the assumption that the dividend process of the two portfolios is governed by different parameters (asymmetric calibration based on Panel D of Table 1). 5000 trajectories of dividends are simulated, each of length 50 years. The return and volatility spreads are computed along these trajectories.

Panel A: Symmetric calibration				
	$\mu_s - \mu_c$		$\sigma_s - \sigma_c$	
	(1) $\gamma = 0.5$	(2) $\gamma = 3$	(3) $\gamma = 0.5$	(4) $\gamma = 3$
$\beta = -20$	0.0153	-0.3598	0.0726	-0.6316
$\beta = -10$	0.0153	-0.2863	0.0724	-0.5096
$\beta = -3$	0.0108	-0.0949	0.0527	-0.1760
$\beta = -1$	0.0039	-0.0113	0.01973	-0.0211
$\beta = 0$	-0.0005	0.0317	-0.0027	0.0595
$\beta = 1$	-0.0049	0.0736	-0.0247	0.1373
$\beta = 3$	-0.0113	0.1491	-0.0552	0.2734
$\beta = 10$	-0.0153	0.3062	-0.0724	0.5433
$\beta = 20$	-0.0153	0.3626	-0.0726	0.6362

Panel B: Asymmetric calibration				
	$\mu_s - \mu_c$		$\sigma_s - \sigma_c$	
	(1) $\gamma = 0.5$	(2) $\gamma = 3$	(3) $\gamma = 0.5$	(4) $\gamma = 3$
$\beta = -20$	0.0224	-0.5279	0.1208	-0.6647
$\beta = -10$	0.0222	-0.4348	0.1203	-0.5252
$\beta = -3$	0.0105	-0.2000	0.0808	-0.1323
$\beta = -1$	0.0012	-0.1123	0.0390	0.0293
$\beta = 0$	-0.0025	-0.0707	0.0199	0.1058
$\beta = 1$	-0.0053	-0.03211	0.0054	0.1763
$\beta = 3$	-0.0083	0.0348	-0.0099	0.2970
$\beta = 10$	-0.0095	0.1717	-0.0167	0.5409
$\beta = 20$	-0.0096	0.2239	-0.0168	0.6328

Table 3: Analysis of unconditional return and volatility spreads

This table reports mean return and volatility spreads between the sin and the non-sin comparable portfolio. Columns 1 through 3 analyze the return spread. Columns 4 through 6 analyze the volatility spread. Columns 1 and 4 show results at the one-year investment horizon. Columns 2 and 5 show results at the two-year investment horizon. Columns 3 and 6 show results at the three-year investment horizon. Case [a] (the baseline) considers value-weighted (VW) returns of the sin portfolio over the period 1965Q1:2015Q4. Case [b] considers equally-weighted (EW) returns. Case [c] considers the extended sin portfolio. Case [d] considers the extended sample period 1926Q3:2015Q4. Case [e] considers the same case as [a] but uses a measure of volatility based on squared deviations from the unconditional mean return. All the variables are at quarterly frequency. The p -values are computed using Newey-West standard errors with four lags (in parentheses). Significance at the 10%, 5%, and 1% levels are indicated by *, **, ***, respectively. Refer to Appendix C.1 for details on portfolio construction.

	$\sum_{j=1}^k (r_{s,t+j} - r_{c,t+j})$			$\sigma_{s,t+k} - \sigma_{c,t+k}$		
	(1) $k=1Y$	(2) $k=2Y$	(3) $k=3Y$	(4) $k=1Y$	(5) $k=2Y$	(6) $k=3Y$
[a] VW	0.033** (0.010)	0.070*** (0.002)	0.107*** (0.000)	0.051*** (0.000)	0.103*** (0.000)	0.156*** (0.000)
[b] EW	0.020 (0.165)	0.043* (0.087)	0.069** (0.042)	0.026* (0.072)	0.054** (0.042)	0.082** (0.027)
[c] VW (extended)	0.030*** (0.007)	0.064*** (0.001)	0.098*** (0.000)	0.043*** (0.000)	0.088*** (0.000)	0.133*** (0.000)
[d] VW (1926Q3:2015Q4)	0.012 (0.323)	0.027 (0.182)	0.047* (0.068)	0.041*** (0.000)	0.081*** (0.000)	0.120*** (0.000)
[e] VW (alt. volatility)	0.033** 0.010	0.070*** 0.002	0.107*** 0.000	0.025*** 0.000	0.033*** 0.000	0.038*** 0.000

Table 4: Analysis of conditional return and volatility spreads

This table reports estimates from regressions of return and volatility spreads between the sin and the non-sin comparable portfolio on the dividend share of the sin portfolio d_s . d_s is computed from repurchase-adjusted dividend payments from CRSP (Bansal et al., 2005a). Columns 1 through 3 analyze the return spread. Columns 4 through 6 analyze the volatility spread. Columns 1 and 4 show results at the one-year investment horizon. Columns 2 and 5 show results at the two-year investment horizon. Columns 3 and 6 show results at the three-year investment horizon. Panel A (the baseline) considers value-weighted (VW) returns of the sin portfolio over the period 1965Q1:2015Q4. Panel B considers equally-weighted (EW) returns. Panel C considers the extended sin portfolio. Panel D considers the extended sample period 1926Q3:2015Q4. Panel E considers the same case as Panel A but uses an alternative measure of volatility based on squared deviations from the unconditional mean return. All the variables are at quarterly frequency. The t -statistics (in parentheses) are computed using Newey-West standard errors with four lags. Significance at the 10%, 5%, and 1% levels are indicated by *, **, ***, respectively. Refer to Appendix C.1 for details on portfolio construction.

Panel A: VW						
	$\sum_{j=1}^k (r_{s,t+j} - r_{c,t+j})$			$\sigma_{s,t+k} - \sigma_{c,t+k}$		
	(1) $k=1Y$	(2) $k=2Y$	(3) $k=3Y$	(4) $k=1Y$	(5) $k=2Y$	(6) $k=3Y$
Constant	-0.212*** (-2.83)	-0.356*** (-3.22)	-0.458*** (-2.78)	-0.136* (-1.75)	-0.142 (-1.17)	-0.119 (-0.74)
$d_{s,t}$	1.280*** (3.12)	2.219*** (3.92)	2.953*** (3.59)	0.976** (2.39)	1.276** (2.11)	1.437* (1.84)
Observations	200	196	192	201	197	193
\bar{R}^2	0.09	0.13	0.14	0.06	0.04	0.03

Panel B: EW						
	$\sum_{j=1}^k (r_{s,t+j} - r_{c,t+j})$			$\sigma_{s,t+k} - \sigma_{c,t+k}$		
	(1) $k=1Y$	(2) $k=2Y$	(3) $k=3Y$	(4) $k=1Y$	(5) $k=2Y$	(6) $k=3Y$
Constant	-0.060 (-0.56)	-0.067 (-0.32)	-0.144 (-0.54)	-0.188 (-1.61)	-0.356* (-1.97)	-0.475* (-1.96)
$d_{s,t}$	0.415 (0.74)	0.574 (0.54)	1.111 (0.81)	1.117* (1.84)	2.136** (2.35)	2.908** (2.46)
Observations	200	196	192	201	197	193
\bar{R}^2	0.00	0.00	0.01	0.06	0.09	0.10

Panel C: VW (extended)						
	$\sum_{j=1}^k (r_{s,t+j} - r_{c,t+j})$			$\sigma_{s,t+k} - \sigma_{c,t+k}$		
	(1) $k=1Y$	(2) $k=2Y$	(3) $k=3Y$	(4) $k=1Y$	(5) $k=2Y$	(6) $k=3Y$
Constant	-0.167** (-2.48)	-0.304*** (-3.06)	-0.394*** (-2.64)	-0.124 (-1.55)	-0.141 (-1.20)	-0.123 (-0.83)
$d_{s,t}$	1.057*** (2.79)	1.965*** (3.75)	2.636*** (3.44)	0.896** (2.07)	1.224* (1.96)	1.373* (1.77)
Observations	200	196	192	201	197	193
\bar{R}^2	0.07	0.12	0.13	0.06	0.05	0.04

(Continued)

Table 4: – *Continued*

Panel D: VW (1926Q3:2015Q4)						
	$\sum_{j=1}^k (r_{s,t+j} - r_{c,t+j})$			$\sigma_{s,t+k} - \sigma_{c,t+k}$		
	(1) $k=1Y$	(2) $k=2Y$	(3) $k=3Y$	(4) $k=1Y$	(5) $k=2Y$	(6) $k=3Y$
Constant	-0.048 (-0.82)	-0.081 (-0.86)	-0.094 (-0.77)	-0.039 (-1.02)	-0.059 (-0.90)	-0.076 (-0.90)
$d_{s,t}$	0.385 (1.15)	0.717 (1.33)	0.924 (1.30)	0.496** (2.26)	0.875** (2.34)	1.241*** (2.63)
Observations	351	347	343	352	348	344
\bar{R}^2	0.02	0.03	0.03	0.04	0.06	0.07

Panel E: VW (alternative volatility measure)						
	$\sum_{j=1}^k (r_{s,t+j} - r_{c,t+j})$			$\sigma_{s,t+k} - \sigma_{c,t+k}$		
	(1) $k=1Y$	(2) $k=2Y$	(3) $k=3Y$	(4) $k=1Y$	(5) $k=2Y$	(6) $k=3Y$
Constant	-0.212*** (-2.83)	-0.356*** (-3.22)	-0.458*** (-2.78)	-0.098** (-2.22)	-0.121** (-2.46)	-0.134** (-2.39)
d_s	1.280*** (3.12)	2.219*** (3.92)	2.953*** (3.59)	0.640*** (2.74)	0.802*** (3.26)	0.898*** (3.28)
Observations	200	196	192	201	197	193
\bar{R}^2	0.09	0.13	0.14	0.08	0.12	0.14

Table 5: Analysis of conditional return and volatility spreads (alternative explanations)

This table reports estimates from regressions of return and volatility spreads between the sin and the non-sin comparable portfolio on the dividend share of the sin portfolio d_s , controlling for several risk factors. d_s is computed from repurchase-adjusted dividend payments from CRSP (Bansal et al., 2005a). Columns 1 through 3 analyze the return spread. Columns 4 through 6 analyze the volatility spread. Columns 1 and 4 show results at the one-year investment horizon. Columns 2 and 5 show results at the two-year investment horizon. Columns 3 and 6 show results at the three-year investment horizon. Regression specifications in Panel A include the following risk factors as control variables (sample period 1965Q1:2015Q4): Excess market return ($R_m - R_f$), small minus big (SMB), high minus low (HML), and momentum (UMD). Regression specifications in Panel B control for the Pástor and Stambaugh (2003) traded liquidity factor (LIQ), which is available from 1968Q1. Regression specifications in Panel C control for the litigation risk differential between the sin and the non-sin comparable portfolio (ΔLIT), which is available from 1996Q1. Regression specifications in Panel D controls for the profitability (RMW) and investment (CMA) factors proposed by Fama and French (2015), together with the three traditional factors $R_m - R_f$, SMB , and SML . Portfolio returns are value-weighted. All the variables are at quarterly frequency. The t -statistics (in parentheses) are computed using Newey-West standard errors with four lags. Significance at the 10%, 5%, and 1% levels are indicated by *, **, ***, respectively. Refer to Appendix C.1 for details on portfolio construction.

Panel A: Fama-French and momentum factors						
	$\sum_{j=1}^k (r_{s,t+j} - r_{c,t+j})$			$\sigma_{s,t+k} - \sigma_{c,t+k}$		
	(1) $k=1Y$	(2) $k=2Y$	(3) $k=3Y$	(4) $k=1Y$	(5) $k=2Y$	(6) $k=3Y$
Constant	-0.183** (-2.31)	-0.327*** (-2.90)	-0.424*** (-2.61)	-0.129* (-1.71)	-0.150 (-1.33)	-0.141 (-0.94)
$d_{s,t}$	1.147*** (2.69)	2.106*** (3.66)	2.801*** (3.47)	0.963** (2.46)	1.367** (2.43)	1.611** (2.19)
$R_{m,t} - R_{f,t}$	-0.210** (-2.30)	-0.247* (-1.93)	-0.272 (-1.38)	-0.015 (-0.14)	0.095 (0.62)	0.196 (1.17)
SML_t	0.300* (1.82)	0.256 (0.99)	0.356 (0.91)	0.062 (0.36)	-0.188 (-0.72)	-0.483 (-1.22)
HML_t	-0.134 (-1.06)	-0.338 (-1.47)	-0.282 (-0.96)	-0.330*** (-2.64)	-0.562** (-2.49)	-0.401 (-1.53)
UMD_t	-0.074 (-0.49)	-0.087 (-0.52)	-0.035 (-0.18)	-0.089 (-0.76)	-0.136 (-0.96)	-0.242 (-1.52)
Observations	200	196	192	201	197	193
\bar{R}^2	0.10	0.14	0.14	0.08	0.08	0.05

Panel B: Liquidity factor						
	$\sum_{j=1}^k (r_{s,t+j} - r_{c,t+j})$			$\sigma_{s,t+k} - \sigma_{c,t+k}$		
	(1) $k=1Y$	(2) $k=2Y$	(3) $k=3Y$	(4) $k=1Y$	(5) $k=2Y$	(6) $k=3Y$
Constant	-0.198** (-2.58)	-0.343*** (-3.04)	-0.450*** (-2.87)	-0.113 (-1.54)	-0.147 (-1.29)	-0.122 (-0.79)
$d_{s,t}$	1.226*** (2.94)	2.185*** (3.83)	2.898*** (3.73)	0.916** (2.42)	1.403** (2.48)	1.546** (2.06)
$R_{m,t} - R_{f,t}$	-0.219** (-2.33)	-0.251* (-1.92)	-0.258 (-1.29)	-0.045 (-0.42)	0.055 (0.37)	0.163 (0.95)
SML_t	0.296 (1.65)	0.258 (0.91)	0.241 (0.58)	0.154 (0.80)	-0.143 (-0.50)	-0.402 (-0.94)
HML_t	-0.115 (-0.92)	-0.315 (-1.36)	-0.254 (-0.85)	-0.355*** (-2.82)	-0.601*** (-2.61)	-0.425 (-1.61)
UMD_t	-0.062 (-0.38)	-0.062 (-0.34)	-0.041 (-0.20)	-0.090 (-0.69)	-0.158 (-1.06)	-0.223 (-1.32)
LIQ_t	0.060 (0.68)	0.015 (0.09)	0.383** (1.98)	-0.271*** (-2.67)	-0.275** (-2.03)	-0.027 (-0.14)
Observations	188	184	180	189	185	181
\bar{R}^2	0.11	0.14	0.16	0.10	0.09	0.04

(Continued)

Table 5: – Continued

Panel C: Litigation risk						
	$\sum_{j=1}^k (r_{s,t+j} - r_{c,t+j})$			$\sigma_{s,t+k} - \sigma_{c,t+k}$		
	(1) $k=1Y$	(2) $k=2Y$	(3) $k=3Y$	(4) $k=1Y$	(5) $k=2Y$	(6) $k=3Y$
Constant	-0.289** (-2.35)	-0.452 (-1.66)	-0.385 (-0.97)	-0.107 (-1.10)	0.030 (0.14)	0.318 (1.35)
$d_{s,t}$	1.538*** (2.70)	2.627** (2.33)	2.625 (1.57)	0.900** (2.06)	0.667 (0.73)	-0.352 (-0.34)
$R_{m,t} - R_{f,t}$	-0.148 (-0.95)	-0.232 (-1.40)	-0.273 (-0.94)	-0.131 (-1.00)	-0.285 (-1.39)	-0.196 (-0.98)
SML_t	0.673 (1.62)	0.625 (0.95)	0.489 (0.55)	0.660** (2.20)	0.244 (0.54)	0.224 (0.44)
HML_t	0.015 (0.08)	-0.258 (-0.61)	-0.299 (-0.58)	-0.458*** (-2.74)	-0.886*** (-2.76)	-0.479* (-1.76)
UMD_t	0.118 (0.36)	0.130 (0.37)	0.223 (0.63)	0.082 (0.38)	-0.020 (-0.10)	0.060 (0.37)
LIQ_t	0.067 (0.35)	0.068 (0.23)	0.415 (1.05)	-0.513*** (-4.79)	-0.214 (-1.38)	0.002 (0.01)
ΔLIT_t	0.349 (0.63)	0.429 (0.48)	0.595 (0.77)	0.148 (0.51)	-0.057 (-0.16)	-0.018 (-0.04)
Observations	76	72	68	77	73	69
\bar{R}^2	0.14	0.15	0.10	0.30	0.12	-0.04

Panel D: Fama-French (five factors)						
	$\sum_{j=1}^k (r_{s,t+j} - r_{c,t+j})$			$\sigma_{s,t+k} - \sigma_{c,t+k}$		
	(1) $k=1Y$	(2) $k=2Y$	(3) $k=3Y$	(4) $k=1Y$	(5) $k=2Y$	(6) $k=3Y$
Constant	-0.182** (-2.52)	-0.323*** (-3.04)	-0.428*** (-2.75)	-0.129* (-1.71)	-0.146 (-1.28)	-0.141 (-0.94)
d_s	1.130*** (2.81)	2.071*** (3.79)	2.826*** (3.69)	0.946** (2.38)	1.310** (2.26)	1.537** (2.09)
$R_{m,t} - R_{f,t}$	-0.177* (-1.70)	-0.205 (-1.39)	-0.265 (-1.29)	0.036 (0.33)	0.186 (1.14)	0.341* (1.87)
SML_t	0.288** (2.20)	0.250 (1.16)	0.311 (0.84)	0.057 (0.39)	-0.168 (-0.69)	-0.430 (-1.15)
HML_t	-0.389* (-1.79)	-0.663* (-1.97)	-0.424 (-0.95)	-0.447* (-1.79)	-0.734** (-2.05)	-0.514 (-1.06)
RMW_t	-0.307 (-1.20)	-0.374 (-0.94)	-0.310 (-0.60)	-0.039 (-0.16)	0.041 (0.14)	0.248 (0.72)
CMA_t	0.507 (1.59)	0.670 (1.30)	0.241 (0.40)	0.298 (0.96)	0.518 (1.15)	0.554 (0.90)
Observations	200	196	192	201	197	193
\bar{R}^2	0.12	0.16	0.14	0.07	0.08	0.05

Table 6: Analysis of unconditional return and volatility spreads (alternative dividend share measures)

This table reports estimates from regressions of return and volatility spreads between the sin and the non-sin comparable portfolio on alternative measures of the dividend share of the sin portfolio d_s . Columns 1 through 3 analyze the return spread. Columns 4 through 6 analyze the volatility spread. Columns 1 and 4 show results at the one-year investment horizon. Columns 2 and 5 show results at the two-year investment horizon. Columns 3 and 6 show results at the three-year investment horizon. In Panel A (sample period 1965Q1:2015Q4), d_s is computed from dividend-only payments from CRSP. In Panel B (sample period 1965Q1:2015Q4), d_s is computed from dividend payments and repurchases from Compustat (Skinner, 2008). Panel C uses the quantity-based dividend share \tilde{d}_s , which is adjusted for the relative price of sin and non-sin comparable goods and is available from 1986Q1 (see Appendix C.2). Portfolio returns are value-weighted. All the variables are at quarterly frequency. The t -statistics (in parentheses) are computed using Newey-West standard errors with four lags. Significance at the 10%, 5%, and 1% levels are indicated by *, **, ***, respectively. Refer to Appendix C.1 for details on portfolio construction.

Panel A: Dividends only						
	$\sum_{j=1}^k (r_{s,t+j} - r_{c,t+j})$			$\sigma_{s,t+k} - \sigma_{c,t+k}$		
	(1) $k=1Y$	(2) $k=2Y$	(3) $k=3Y$	(4) $k=1Y$	(5) $k=2Y$	(6) $k=3Y$
Constant	-0.108* (-1.84)	-0.202** (-2.04)	-0.293** (-2.26)	-0.018 (-0.36)	-0.062 (-0.70)	-0.128 (-1.10)
$d_{s,t}$ (dividend)	0.757** (2.36)	1.465*** (2.76)	2.158*** (3.20)	0.370 (1.50)	0.887** (2.00)	1.531*** (2.69)
Observations	200	196	192	201	197	193
\bar{R}^2	0.06	0.11	0.14	0.01	0.04	0.08
Panel B: Compustat						
	$\sum_{j=1}^k (r_{s,t+j} - r_{c,t+j})$			$\sigma_{s,t+k} - \sigma_{c,t+k}$		
	(1) $k=1Y$	(2) $k=2Y$	(3) $k=3Y$	(4) $k=1Y$	(5) $k=2Y$	(6) $k=3Y$
Constant	-0.139 (-1.39)	-0.132 (-0.93)	-0.153 (-0.76)	-0.314*** (-4.17)	-0.286** (-2.20)	-0.260 (-1.45)
$d_{s,t}$ (Compustat)	0.898 (1.65)	1.056 (1.37)	1.365 (1.27)	1.908*** (4.80)	2.033*** (3.07)	2.181** (2.48)
Observations	200	196	192	201	197	193
\bar{R}^2	0.03	0.02	0.02	0.19	0.10	0.07
Panel C: Quantity-based						
	$\sum_{j=1}^k (r_{s,t+j} - r_{c,t+j})$			$\sigma_{s,t+k} - \sigma_{c,t+k}$		
	(1) $k=1Y$	(2) $k=2Y$	(3) $k=3Y$	(4) $k=1Y$	(5) $k=2Y$	(6) $k=3Y$
Constant	-0.026 (-0.40)	0.012 (0.13)	0.068 (0.47)	-0.051 (-1.11)	-0.020 (-0.24)	0.046 (0.42)
$\tilde{d}_{s,t}$	0.229 (1.02)	0.250 (0.77)	0.206 (0.43)	0.462*** (2.83)	0.655** (2.41)	0.721** (2.01)
Observations	116	112	108	117	113	109
\bar{R}^2	0.00	-0.00	-0.01	0.09	0.09	0.08

Appendix for “Pricing Sin Stocks: Ethical Preference vs. Risk Aversion”

A Proofs

Proof of Proposition 1. The maximization problem (5) implies

$$\left(\frac{\pi_s}{\pi_c}\right)^\beta \left(\frac{D_{s,t}}{D_{c,t}}\right)^{-\gamma} = \frac{p_{s,t}}{p_{c,t}}.$$

The numeraire, which is a basket $(\alpha D_{s,t}, (1-\alpha)D_{c,t})$ with $\alpha \in [0, 1]$, has unity price, i.e.

$$\alpha p_{s,t} + (1-\alpha)p_{c,t} = 1.$$

The two equations above give the results. □

Proof of Proposition 2. Given the expression of $S_{s,t}$ given in equation (8), we have

$$\begin{aligned} S_{s,t} &= p_{s,t} D_{s,t} \mathbb{E}_t \int_t^\infty \left[e^{-\rho(u-t)} \left(\frac{D_{s,u}}{D_{c,t}}\right)^{(1-\gamma)} \right] du \\ &= p_{s,t} D_{s,t} \int_t^\infty \mathbb{E}_t e^{[-\rho + (1-\gamma)(\nu_s - \frac{1}{2}\phi_s^2)](u-t) + (1-\gamma)\phi_s(B_{s,u} - B_{s,t})} du \\ &= p_{s,t} D_{s,t} \int_t^\infty e^{-[\rho - (1-\gamma)(\nu_s - \frac{1}{2}\phi_s^2) - \frac{1}{2}(1-\gamma)^2\phi_s^2](u-t)} du \\ &= \frac{p_{s,t} D_{s,t}}{\Gamma_s} \end{aligned}$$

with

$$\Gamma_s = \rho + (\gamma - 1) \left(\nu_s - \frac{\phi_s^2}{2} \right) - \frac{1}{2}(1-\gamma)^2\phi_s^2.$$

$S_{c,t}$ and Γ_c are obtained using the same procedure. □

Proof of Proposition 3. From Proposition 2 we have

$$\frac{dS_{i,t}}{S_{i,t}} = \frac{dp_{i,t}}{p_{i,t}} + \frac{dD_{i,t}}{D_{i,t}} + \frac{d[p_{i,t}D_{i,t}]}{p_{i,t}D_{i,t}}, \quad i = s, c. \quad (\text{A.1})$$

The equilibrium relative prices of consumption goods (7) can be rewritten as

$$\begin{aligned} p_{s,t} &= \frac{\pi_s^\beta D_{s,t}^{-\gamma}}{\alpha \pi_s^\beta D_{s,t}^{-\gamma} + (1-\alpha) \pi_c^\beta D_{c,t}^{-\gamma}} = \frac{1}{\alpha + (1-\alpha) x^\beta y_t^\gamma} \\ p_{c,t} &= \frac{x^\beta y_t^\gamma}{\alpha + (1-\alpha) x^\beta y_t^\gamma} = x^\beta y_t^\gamma p_{s,t}, \end{aligned} \quad (\text{A.2})$$

where we have used $x := \frac{\pi_c}{\pi_s}$ and $y_t := \frac{D_{s,t}}{D_{c,t}}$. Given (1) we have

$$dy_t = y_t(\nu_s - \nu_c + \phi_c^2)dt + y_t(\phi_s dB_{s,t} - \phi_c dB_{c,t}). \quad (\text{A.3})$$

Using the above results we can calculate $\frac{dp_{s,t}}{p_{s,t}}$:

$$\begin{aligned} dp_{s,t} &= p_{s,t} \left[-\frac{(1-\alpha)\gamma x^\beta y_t^{\gamma-1}}{\alpha + (1-\alpha)x^\beta y_t^\gamma} dy_t \right] \\ &\quad + \frac{1}{2} \left\{ p_{s,t} \left[-\frac{(1-\alpha)\gamma(\gamma-1)x^\beta y_t^{\gamma-2}}{\alpha + (1-\alpha)x^\beta y_t^\gamma} + \frac{2((1-\alpha)\gamma x^\beta y_t^{\gamma-1})^2}{(\alpha + (1-\alpha)x^\beta y_t^\gamma)^2} \right] (dy_t)^2 \right\} \\ &= -(1-\alpha)\gamma p_{s,t} p_{c,t} \frac{dy_t}{y_t} - \frac{1}{2} (1-\alpha)\gamma p_{s,t} p_{c,t} \left[(\gamma-1) - 2(1-\alpha)\gamma p_{c,t} \right] \frac{(dy_t)^2}{y_t^2}, \end{aligned} \quad (\text{A.4})$$

where the second-order infinitesimal term is $(dy_t)^2 = y_t^2(\phi_s^2 + \phi_c^2)dt$. Plugging this term and (A.3) in the expression above and rearranging we get

$$\frac{dp_{s,t}}{p_{s,t}} = (1-\alpha)p_{c,t}\gamma[-\Lambda_t dt - \phi_s dB_{s,t} + \phi_c dB_{c,t}], \quad (\text{A.5})$$

with

$$\Lambda_t := \nu_s - \nu_c + \phi_c^2 + \frac{1}{2}(\gamma-1)(\phi_s^2 + \phi_c^2) - (1-\alpha)\gamma p_{c,t}(\phi_s^2 + \phi_c^2).$$

Similarly for $\frac{dp_{c,t}}{p_{c,t}}$:

$$dp_{c,t} = \alpha\gamma p_{c,t} p_{s,t} \frac{dy_t}{y_t} + \frac{1}{2} \alpha\gamma p_{c,t} p_{s,t} \left[(\gamma-1) - 2(1-\alpha)\gamma p_{c,t} \right] \frac{(dy_t)^2}{y_t^2}$$

or equivalently

$$\frac{dp_{c,t}}{p_{c,t}} = \alpha\gamma p_{s,t} [\Lambda_t dt - \phi_s dB_{s,t} + \phi_c dB_{c,t}]. \quad (\text{A.6})$$

Hence, we have

$$\begin{aligned}\frac{d[p_{s,t}, D_{s,t}]}{p_{s,t}D_{s,t}} &= -(1-\alpha)p_{c,t}\gamma\phi_s^2 dt \\ \frac{d[p_{c,t}, D_{c,t}]}{p_{c,t}D_{c,t}} &= \alpha p_{s,t}\gamma\phi_c^2 dt.\end{aligned}\tag{A.7}$$

Replacing (A.7), (1), (A.5), and (A.6) into (A.1) gives us the desired expressions for $dS_{s,t}$ and $dS_{c,t}$. Matching equation 2 with the the dynamics of prices reported in Proposition 3 we obtain

$$\begin{aligned}\sigma_{s,t}^s &= [1 - (1-\alpha)\gamma p_{c,t}]\phi_s \\ \sigma_{c,t}^s &= (1-\alpha)p_{c,t}\gamma\phi_c \\ \sigma_{s,t}^c &= -\alpha\gamma p_{s,t}\phi_s \\ \sigma_{c,t}^c &= [1 + \alpha\gamma p_{s,t}]\phi_c\end{aligned}$$

and the instantaneous standard deviation of stocks is therefore

$$\begin{aligned}std_{s,t} &= \sqrt{(\sigma_{s,t}^s)^2 + (\sigma_{c,t}^s)^2} \\ std_{c,t} &= \sqrt{(\sigma_{s,t}^c)^2 + (\sigma_{c,t}^c)^2}\end{aligned}$$

□

Proof of Proposition 4. In our model markets are complete and by standard arguments we have

$$\mu_{i,t} - r_t = \mathbb{E}_t\left(\frac{dS_{i,t}}{S_{i,t}}\right) + \frac{p_{i,t}D_{i,t}}{S_{i,t}} - r dt = -\text{Cov}\left(\frac{dS_{i,t}}{S_{i,t}}, \frac{d\lambda_t}{\lambda_t}\right) \quad i = s, c,$$

where

$$\begin{aligned}\frac{d\lambda_t}{\lambda_t} &= \left[-\rho - \gamma\alpha p_{s,t}\nu_s - \gamma(1-\alpha)p_{c,t}\nu_c + \frac{1}{2}\gamma(\gamma+1)\left(\alpha p_{s,t}\phi_s^2 + (1-\alpha)p_{c,t}\phi_c^2\right) \right] dt \\ &\quad - \gamma\alpha p_{s,t}\phi_s dB_{s,t} - \gamma(1-\alpha)p_{c,t}\phi_c dB_{c,t}.\end{aligned}$$

The quantity $\text{Cov}\left(\frac{dS_{i,t}}{S_{i,t}}, \frac{d\lambda_t}{\lambda_t}\right)$ is computed by using the results of Proposition 3. The formula for the return spread uses the relationship

$$\alpha p_{s,t}(1-\alpha)p_{c,t} = \alpha p_{s,t}(1-\alpha p_{s,t}) = [1 - (1-\alpha)p_{c,t}](1-\alpha)p_{c,t},$$

which follows from the fact that $\alpha p_{s,t} + (1-\alpha)p_{c,t} = 1$.

□

B Alternative calibration

In Figure B.1 and Figure B.2, we report the results from an alternative calibration exercise, where we account for different fundamentals across the two firms in our model. In this case, we set the payout parameters to their empirically observed values, that is, $\nu_s = 4 \times 0.010$, $\nu_c = 4 \times 0.006$, $\phi_s = \sqrt{4} \times 0.156$, and $\phi_c = \sqrt{4} \times 0.098$. In addition, we set $\alpha = 0.192$, consistent with the observed average share of the total payout of sin companies (Panel D of Table 1).

C Data

C.1 Portfolio construction

We follow [Hong and Kacperczyk \(2009\)](#) and define sin companies as those operating in the following industries.

- Alcoholic beverages (Fama-French industry 4): SIC codes 2080-2085.¹⁵
- Smoke products (Fama-French industry 5): SIC codes 2100-2199.
- Gaming: NAICS codes 7132, 71321, 713210, 71329, 713290, 72112, and 721120.

For our extended sin portfolio, we include also companies active in the following industries.

- Distribution of alcoholic beverages: SIC codes 5180-5189, 5813, and 5921.
- Distribution of smoke products: SIC codes 5194 and 5993.

Non-sin comparable companies are those operating in the following industries.

- Food (Fama-French industry 2): SIC codes 2000-2009, 2010-2019, 2020-2029, 2030-2039, 2040-2046, 2050-2059, 2060-2063, 2070-2079, 2090-2092, 2095, and 2098-2099.
- Soda (Fama-French industry 3): SIC codes 2064-2068, 2086, 2087, 2096, and 2097.
- Fun (Fama-French industry 7): SIC codes 7800-7829, 7830-7833, 7840-7841, 7900, 7910-7911, 7920-7929, 7930-7933, 7940-7949, 7980, and 7990-7999.
- Meals (Fama-French industry 43, excluding drinking places): SIC codes 5800-5812, 5814-5819, 5820-5829, 5890-5899, 7000, 7010-7019, 7040-7049, and 7213-7213.

We identify companies operating in the industries above using both firm-level industry codes from CRSP, and primary and secondary segment-level industry codes from Compustat Segment files. Because Compustat Segment files are available only starting in 1976, we backfill segment industry codes over the pre-1976 period, in line with [Hong and Kacperczyk \(2009\)](#).

We manually checked the sin stocks obtained through this procedure and removed those that are not involved in sinful activities. This is the case of firms that are assigned the general SIC code for beverages 2080 but do not actually produce alcoholic beverages

¹⁵Fama-French industry groups refer to the 48-industry classification by [Fama and French \(1997\)](#).

(e.g., the Coca-Cola Bottling Company). Moreover, firms that operate both in the sin industries and non-sin comparable industries above are classified as sinful.

Finally, we checked our list of sin companies against the list made available by [Hong and Kacperczyk \(2009\)](#) for the period 1962-2003.¹⁶ Our algorithm is able to capture 178 out of the 184 companies included in their list. We manually added the remaining six companies to our sin portfolio.

C.2 Good-price adjustment

To compute the quantity-based dividend share measure \tilde{d}_s , we deflate repurchase-adjusted dividend payments of the sin and non-sin comparable portfolios using the price of the corresponding goods.

We use seasonally adjusted series on CPI components from FRED to compute the relative prices p_s and p_c of sin and non-sin comparable goods. The sin goods price index is computed as the average of the prices of the following CPI components:

- Alcoholic beverages (CUSR0000SAF116, available from 1967Q1);
- Tobacco and smoking products (CUSR0000SEGA, available from 1986Q1).

We are thus able to construct a time series of p_s starting in 1986Q1. The time series of prices of gaming products and services is not available.

The non-sin comparable goods price index is computed as the average of the prices of the following CPI components:

- Recreation (CPIRECSL, available from 1993Q1);
- Food at home (CUSR0000SAF11, available from 1952Q1);
- Food away from home (CUSR0000SEFV, available from 1953Q1);
- Lodging away from home (CUSR0000SEHB, available from 1998Q1).

We compute the time series of p_c starting in 1986Q1, and account for the different CPI components in the average as soon as they become available.

¹⁶See <http://www.columbia.edu/~hh2679/sinstocks.pdf>.

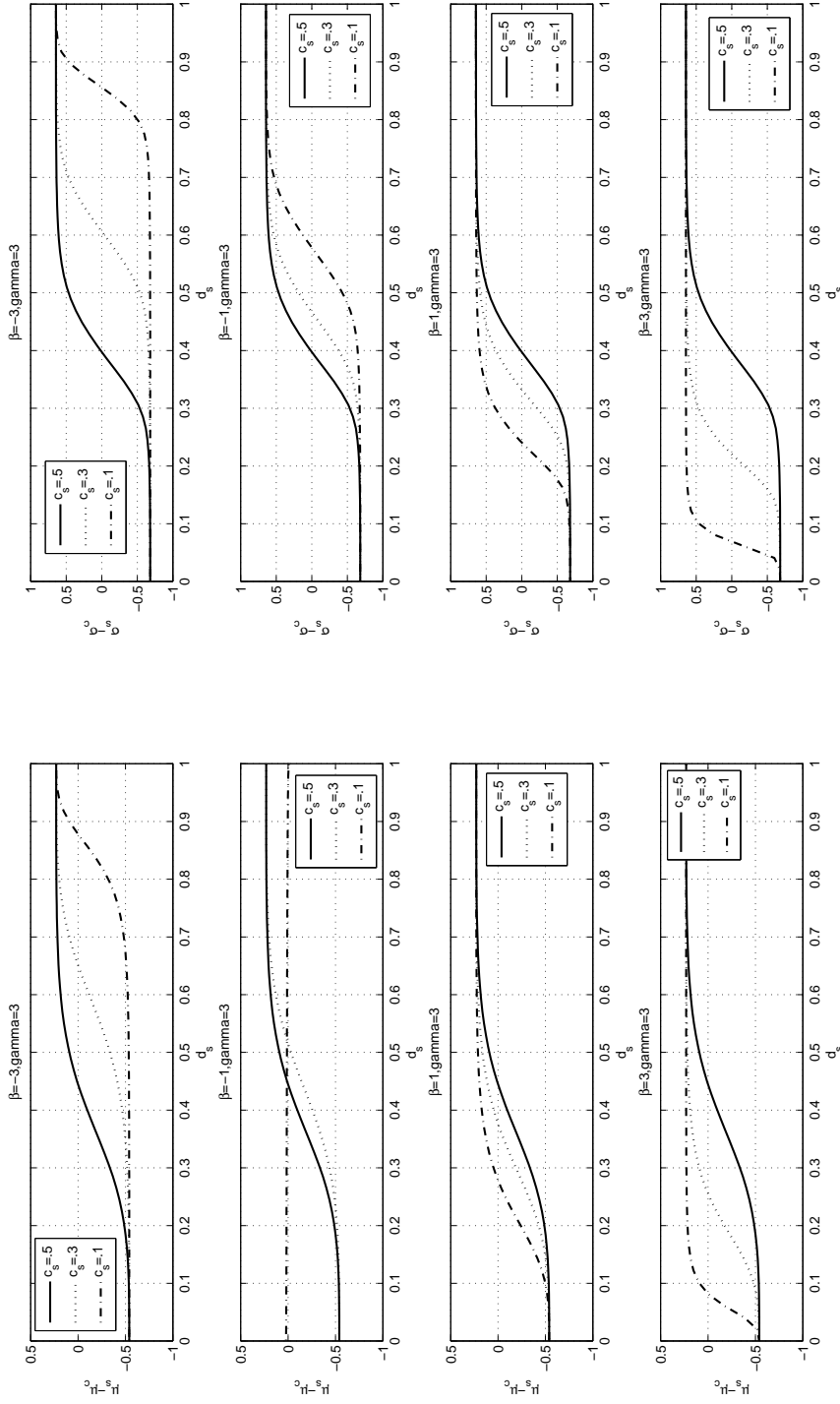


Figure B.1: Conditional return and standard deviation spread between sin and non-sin stocks with high risk aversion (asymmetric calibration).
 This figure plots the conditional return differential (left column) and the conditional volatility differential (right column) between the sin stock and the comparable stock as a function of the dividend share d_s .

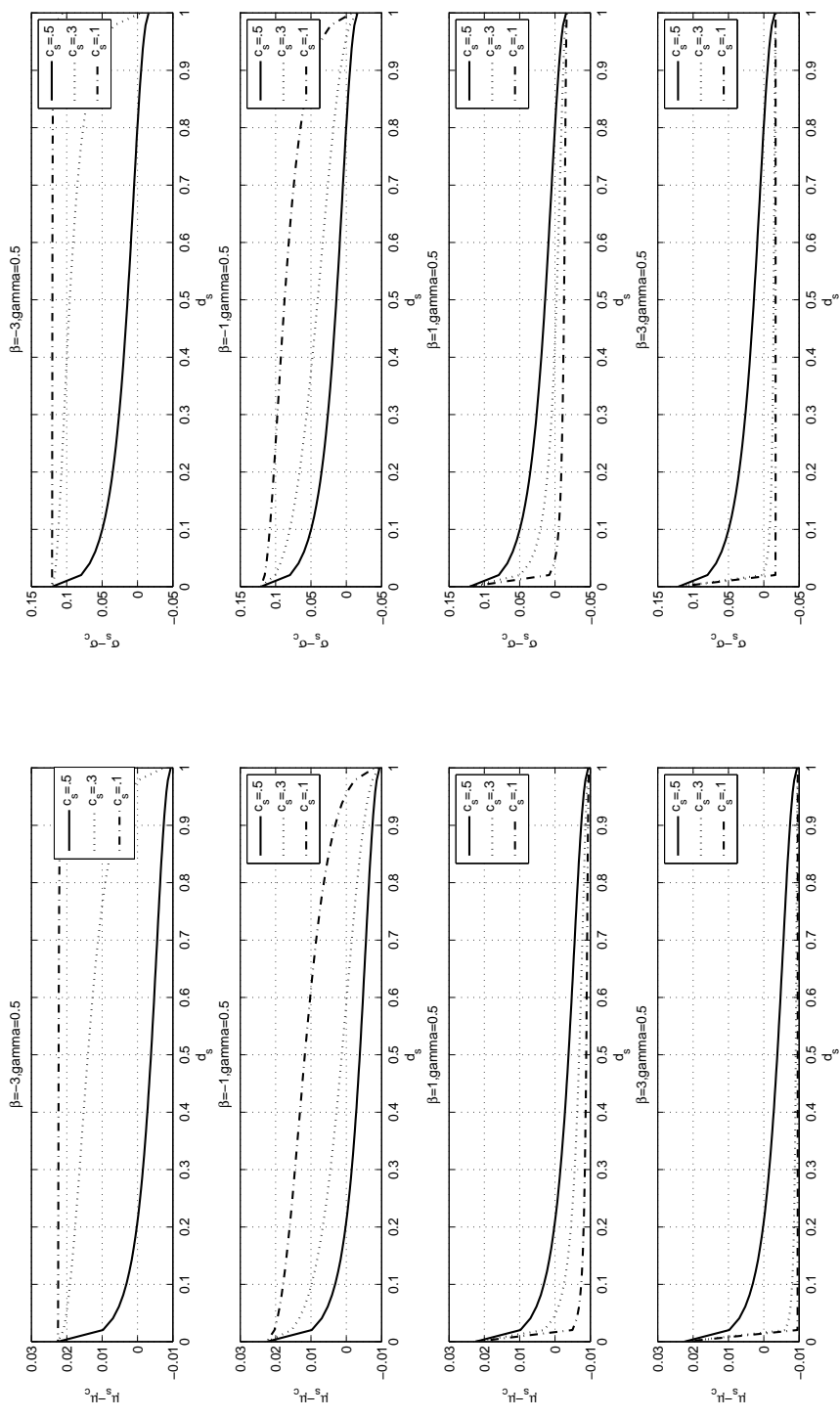


Figure B.2: Conditional return and standard deviation spread between sin and non-sin stocks with low risk aversion (asymmetric calibration). This figure plots the conditional return differential (left column) and the conditional volatility differential (right column) between the sin stock and the comparable stock as a function of the dividend share d_s .

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