Pricing Sin Stocks: Ethical Preference vs. Risk Aversion*

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Abstract

We develop a tractable model that explains the average return and volatility spread between sin stocks and non-sin comparable stocks. We endow agents' preferences with a sensitivity factor to firms' ethicalness. We show that a positive marginal rate of substitution between dividends and ethicalness is key to explain the higher average returns that sin stocks exhibit over non-sin comparable stocks. This result can be obtained either when (*i*) dividends and ethicalness are substitute goods and investors are less risk-averse than log utility, or (*ii*) when dividends and ethicalness are complementary goods and investors are more risk-averse than log utility. We empirically show that only the latter case can explain the patterns of the conditional return and volatility spreads between sin and non-sin comparable stocks.

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1 Introduction

There is ample empirical evidence that sin stocks yield, on average, higher returns than non-sin comparable stocks. The existing literature explains this evidence 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, diversification risk may not play an important role in the pricing of sin stocks.

In this paper, we present a different approach. We assume that investors are willing to hold all stocks. They receive dividends from both sin and non-sin companies, and evaluate dividend payments according to their preferences for the firm's ethicalness. Here, 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 substitutes, i.e., the marginal utility of an additional unit of the sin dividend is higher than that of an additional unit of the ethical dividend.

The relation between marginal utilities of dividends and ethicalness is not the only determinant of the return differential between sin and non-sin stocks. What really matters in our framework is the marginal rate of substitution between dividends and ethicalness. This is given by the interaction between dividend-ethicalness complementarity and risk aversion.

[1] The 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.

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 substitutes 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.

To empirically distinguish between the two preference specifications above, we look at their implications for the conditional return and volatility spreads between sin and non-sin companies. Our model suggests that 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.

Using data on U.S. public companies, we provide evidence consistent with the latter preference specification. 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 potentially explain the observed patterns in the unconditional (and conditional) return and volatility spread between sin and non-sin comparable stocks. In particular, our model appears to perform remarkably well at capturing the volatility differential between these two groups of stocks.

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. A different theoretical approach 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, providing evidence consistent with the presence of socially responsible investors. To the best of our knowledge, our model is the first to investigate how this premium relates to the dividend payments of sin companies and investors' preferences.

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-goods general equilibrium model where agents' preferences account for the perceived ethicalness of the consumed goods (i.e., 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 (VW) 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 producing sin products but not those involved in their distribution. We build an extended sin portfolio that includes also these companies (Panel C). In this case, the difference between the quarterly returns of sin and non-sin stocks is smaller for equally-weighted portfolios (1.8% vs. 1.7%), but of the same magnitude for 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 on sin stocks of about 11% with respect to the market over the period 1970-2007. Similarly, Statman and Glushkov (2009) find that sin stocks pay an excess return of about 3.3% with respect to the CAPM

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

and of about 2.6% with respect to the Fama-French three-factor model, over the period 1991-2007. Similar evidence for the presence of a sin premium exists for Europe (Salaber, 2007) and the Pacific region (Durand, Koh, and Tan, 2013).

Overall, this analysis suggests that 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 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

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

[3] We use the terms "non-sin" and "non-sin comparable" interchangeably to refer to "c" firms.

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 our pure-exchange economy, $D_{i,t}$ represents both the supply of consumption good and the dividend of firm i.

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

$$dS_{i,t} + p_{i,t} D_{i,t} dt = S_{i,t} \mu_{i,t} dt + S_{i,t} \sum_{j \in \{s,c\}} \sigma^i_{i,t} dB_{j,t}. \tag{2}$$

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

$$S_{0,t} = e^{\int_0^t r_s ds} \tag{3}$$

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

3.3 Ethicalness

Investors get utility not only from asset payoffs, as customary in the asset pricing literature, but also from supporting investments that are perceived as non-sinful (*ethicalness*). This possibility has already been suggested by the existing literature to justify the differential returns 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 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 social behavior. 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 perception of 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.[4] 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.

[4]Think of the five thieves: Lust, rage, greed, attachment, conceit.

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 $i \in \{s, c\}$,

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

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, which means that 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.[5]

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

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

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

3.5 The competitive equilibrium

3.5.1 Optimal consumption

The representative investor maximizes preferences subject to the supply constraints:

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

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

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

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*

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

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.

□

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 that

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

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*

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

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 sought 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

$$\begin{aligned}\log\left(S_{s,t}\right)-\log\left(S_{c,t}\right)=&\beta\left[\log\left(\pi_{s}\right)-\log\left(\pi_{c}\right)\right]+(1-\gamma)\left[\log\left(D_{s,t}\right)-\log\left(D_{c,t}\right)\right]\\&+\log\left(\Gamma_{c}\right)-\log\left(\Gamma_{s}\right).\end{aligned}\tag{9}$$

Equation (9) suggests that the price differential between sin and non-sin companies depends on current dividend payments (second component on the right-hand side) and dividend fundamentals (third component on the right-hand side), as expected. The novelty, instead, is represented by the first term on the right-hand side of equation (9), and it plays a key role in our analysis. To see why, notice that by assumption, $\log\left(\pi_{s}\right)-\log\left(\pi_{c}\right)<0$. 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 on the implications of complementarity between ethicalness and consumption for the marginal utility of consumption. When $\beta>0$ 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. The opposite holds when $\beta<0$.

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) rises 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 dividend 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 as compared to the price of non-sin stocks. When $\gamma = 1$, the discount rate effect and cash-flow effect 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*

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

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

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

Proof. See Appendix A.

$\square$

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 by equation (9) above. 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_s decreases as compared to π_c, 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, $\dfrac{\partial(\mu_{s,t} - \mu_{c,t})}{\partial(\pi_c/\pi_s)} = 0$ 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

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

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

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

In summary, the conditional expected return decreases with the firm's degree of ethicalness when $\beta < 0 \wedge \gamma < 1$ or when $\beta > 0 \wedge \gamma > 1$. 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

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

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

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

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, investors would like to consume more dividends from non-sin companies, and the more they do so, the lower π becomes. Investors, however, 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.

3.6 Quantitative implications

3.6.1 Calibration

To assess whether our framework is capable to provide 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 $c_s = 0.3$. 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.

3.6.2 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, discount prices rise faster than expected cash-flows and therefore prices decreases 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 the 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 trajectories. 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 intimately depends on the interplay between risk aversion and dividend/ethicalness complementarity and on their 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. From a theoretical point of view, this 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.[6]

[6]The 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.

Finally, it is worth noting that when $\beta = 0$, 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): Since the two dividends are described as geometric Brownian motions, $\log\left(\frac{D_s}{D_c}\right)$ tends to increase over time and therefore sin stocks are, on overage, underpriced (overpriced) with respect to non-sin stocks when $\gamma > 1$ ($\gamma < 1$). In the asymmetric economy, sin and non-sin stocks have different fundamentals: The expected growth rate and the standard deviation 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. As a result, a standard model based on diversification risk only 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

The discussion above, 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. Case i. (ii.) predicts that the return and volatility spreads between sin and non-sin stocks are decreasing (increasing) in the dividend share of sin stocks. Consistently, we estimate the following regression for the return spread over different investment horizons k

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

$r_{i,t+j}$ 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

$$\sigma_{s,t+k} - \sigma_{c,t+k} = b_0 + b_1 d_{s,t} + \mathbf{x}_t \mathbf{b} + \varepsilon_t, \tag{13}$$

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).

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 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. 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, Dittmar, and Lundblad, 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) 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 three factors of Fama and French (1993), 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. In each case, as expected, the return and volatility differentials are positive at all horizons. While the return spread is in some instances insignificant (especially at shorter investment horizons), 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. 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 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. 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.

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 the control variables. This liquidity factor is available from 1968Q1. Our baseline results remain unchanged for both Panel A and Panel B. 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.

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.[7] 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.

4.3.3 Price/dividend ratio tests

To shed more light on the economic mechanism, we test the implications for the price differential between sin and non-sin stocks. Equation (9) suggests that, when investors

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

are more risk averse than log, the price differential between sin and non-sin stocks should decrease in the difference of dividend payments. Rearranging equation (9) for the price differential in terms of price/dividend ratios, we obtain

$$\log\left(\frac{S_{s,t}/D_{s,t}}{S_{c,t}/D_{c,t}}\right) = \beta\left(\frac{\pi_s}{\pi_c}\right) + \log\left(\frac{\Gamma_c}{\Gamma_s}\right) - \gamma\log\left(\frac{d_{s,t}}{1-d_{s,t}}\right). \tag{14}$$

We thus estimate the following regression specification

$$\log\left(\frac{S_{s,t}/D_{s,t}}{S_{c,t}/D_{c,t}}\right) = b_0 + b_1\log\left(\frac{d_{s,t}}{1-d_{s,t}}\right) + \epsilon_t. \tag{15}$$

By comparing equations (14) and (15), we can see that the slope coefficient b_1 only reflects investors' risk aversion ($-\gamma$). In other words, it can provide some guidance as to the magnitude of γ. By contrast, the interpretation of the intercept coefficient b_0 is complicated by the presence of several different parameters. Indeed, b_0 ends up capturing $\beta\left(\frac{\pi_s}{\pi_c}\right) + \log\left(\frac{\Gamma_c}{\Gamma_s}\right)$, where $\Gamma_i := \rho + (\gamma-1)\left(\nu_i - \frac{\phi_i^2}{2}\right) - \frac{1}{2}(1-\gamma)^2\phi_i^2$ and $i \in \{s, c\}$.

Table 7 reports results from estimating specification (15). In column 1, we use $\log\left(\frac{d_s}{1-d_s}\right)$ as explanatory variable. In column 2, we also include the Fama-French factors and a momentum factor. In both cases, the estimated coefficient is negative and statistically insignificant, and its absolute magnitude (≈ 0.35) does not square with higher than log utility risk aversion. Hence, to bring our testing ground closer to the model, in columns 3 and 4, we use the quantity-based dividend share to compute the explanatory variable $\log\left(\frac{\tilde{d}_s}{1-\tilde{d}_s}\right)$. The quantity-based dividend share allows us to directly look at the consumption streams provided by the two portfolios. After this adjustment, we obtain a negative and statistically significant coefficient. Moreover, its absolute magnitude increases to a level consistent with higher than log utility risk aversion (≈ 1.23).

In conclusion, the tests on conditional moments and price/dividend ratios suggest that although it is theoretically possible that the average return and volatility spreads are explained by a model in which dividends and ethicalness are substitute goods and investors are less risk averse than log, this model does not match the data. It is more likely that investors marginal utility from consuming dividend paid by firms increases with firm's ethicalness and they and require higher expected returns to be compensated for the risk that their dividend basket is biased toward sin companies.

5 Conclusion

Why are sin companies underpriced with respect to non-sin companies or, to put it differently, why do sin companies pay on average higher returns than non-sin companies? We provide a simple answer based on the marginal rate of substitution between dividends and ethicalness. When the marginal rate of substitution is positive investors would like to be compensate for the risk of having to consume the "less preferred" dividends, i.e., the sin dividends. Therefore, they 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 model can explain the dynamics of the conditional return and volatility spreads between sin and non-sin stocks that we document, namely the fact that both these spreads are increasing in the dividend share of sin stocks.

Our analysis points to an important role of non-pecuniary preferences for asset pricing. In addition, we suggest that also the diversification risk associated with the dividend payments of sin and non-sin companies may have important pricing effects that interact with non-pecuniary preferences for ethicalness in determining the relative price of sin stocks.

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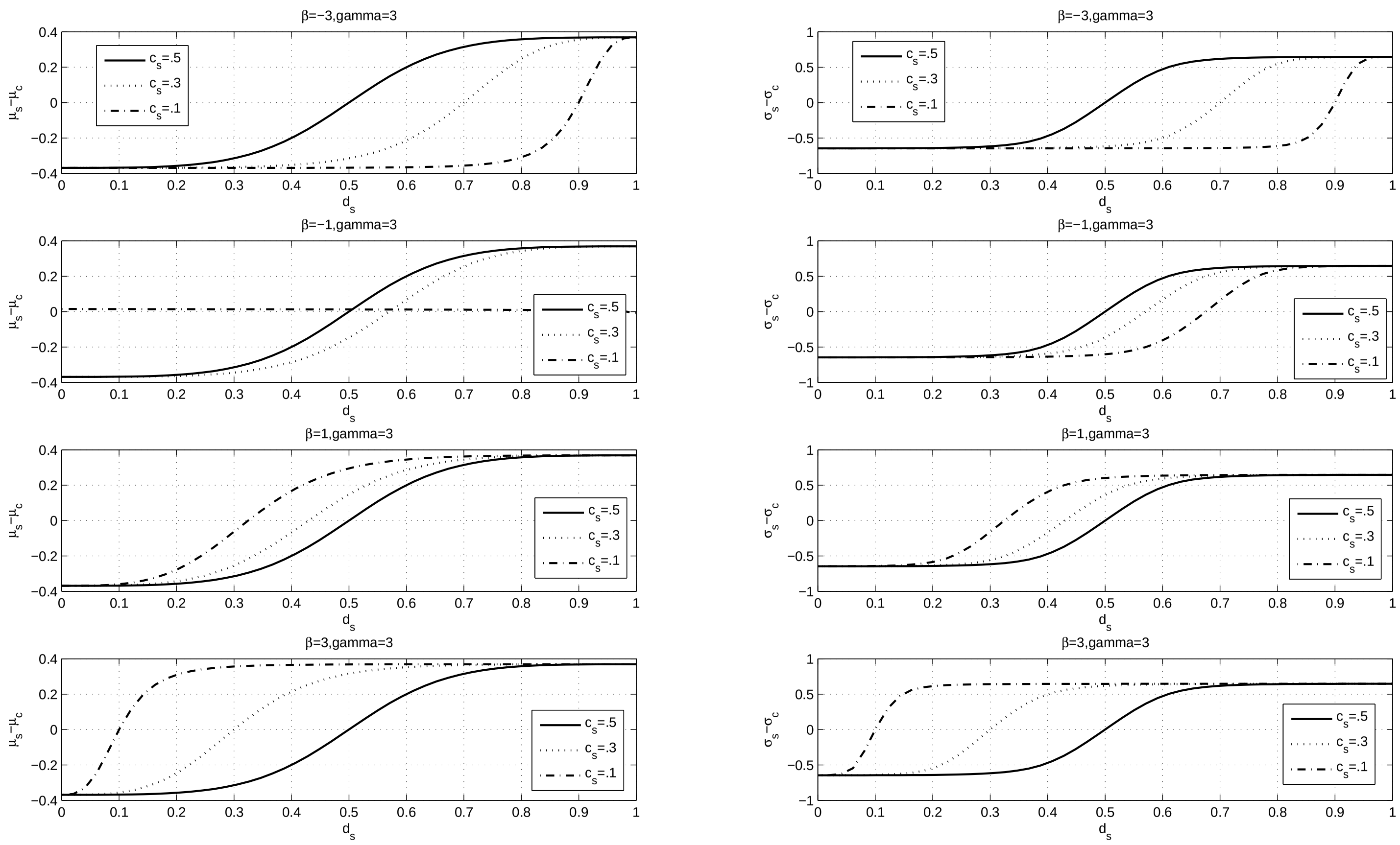

Figure 1: Conditional return and standard deviation spread between sin and non-sin stocks with high risk aversion (symmetric calibration). This figure plots the conditional return differential (left column) and the conditional volatility differential (right column) between the sin stock and the comparable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

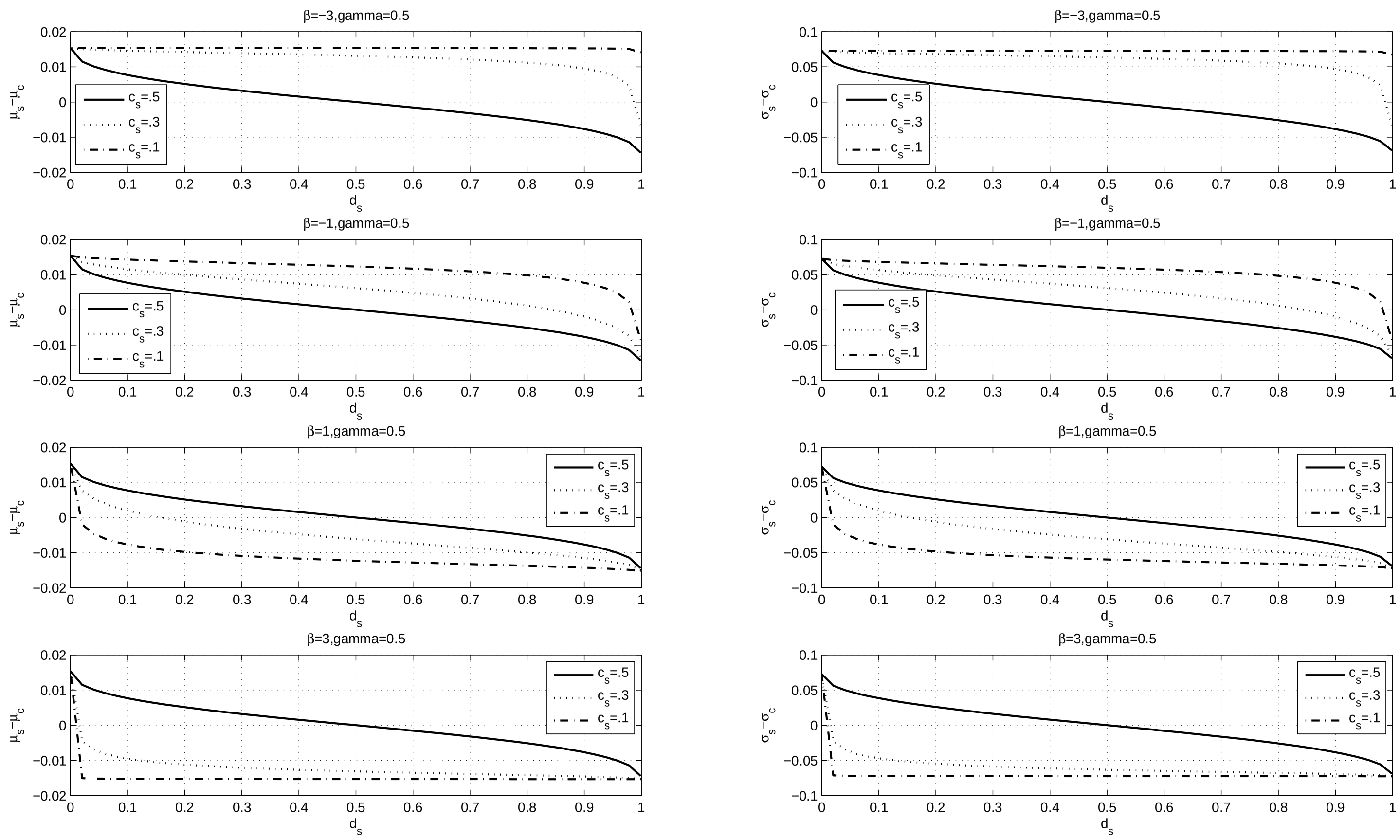

Figure 2: Conditional return and standard deviation spread between sin and non-sin stocks with low risk aversion (symmetric calibration). This figure plots the conditional return differential (left column) and the conditional volatility differential (right column) between the sin stock and the comparable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

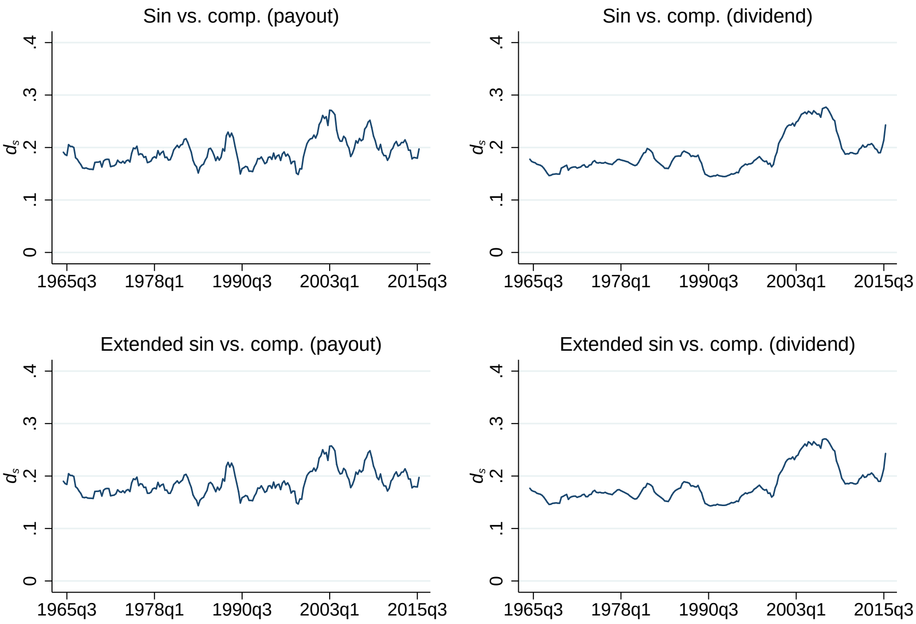

Figure 3: Dividend share of the sin portfolio. This figure plots the evolution of the dividend share of the sin portfolio (top graphs) and of the extended sin portfolio (bottom graphs) through time, both for repurchase-adjusted dividend payments (left graphs) and dividend-only payments (right graphs).

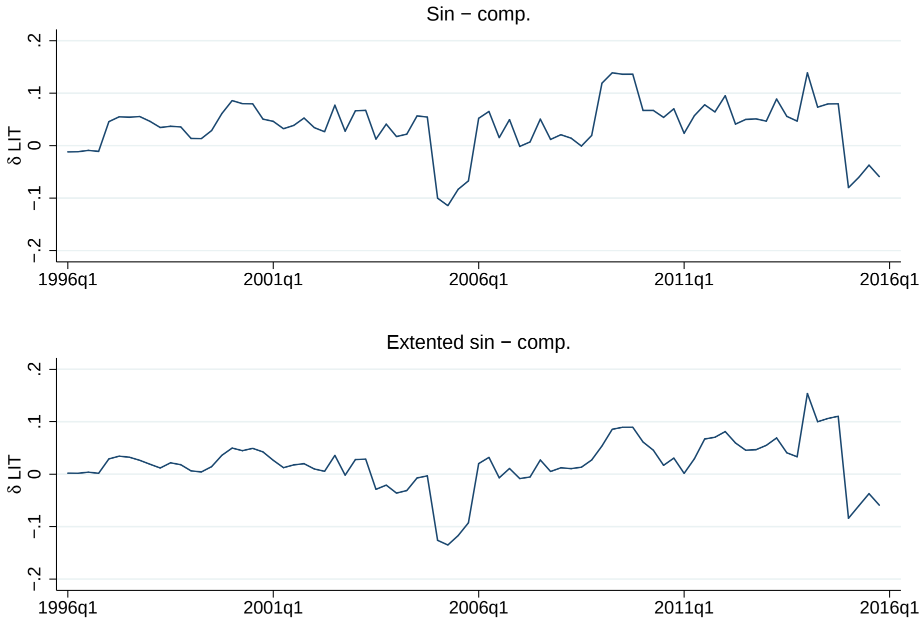

Figure 4: Litigation risk of the sin portfolio. This figure plots the litigation risk differential of the sin (top graph) and the extended sin portfolio (bottom graph) relative to the comparable portfolio (ΔLIT).

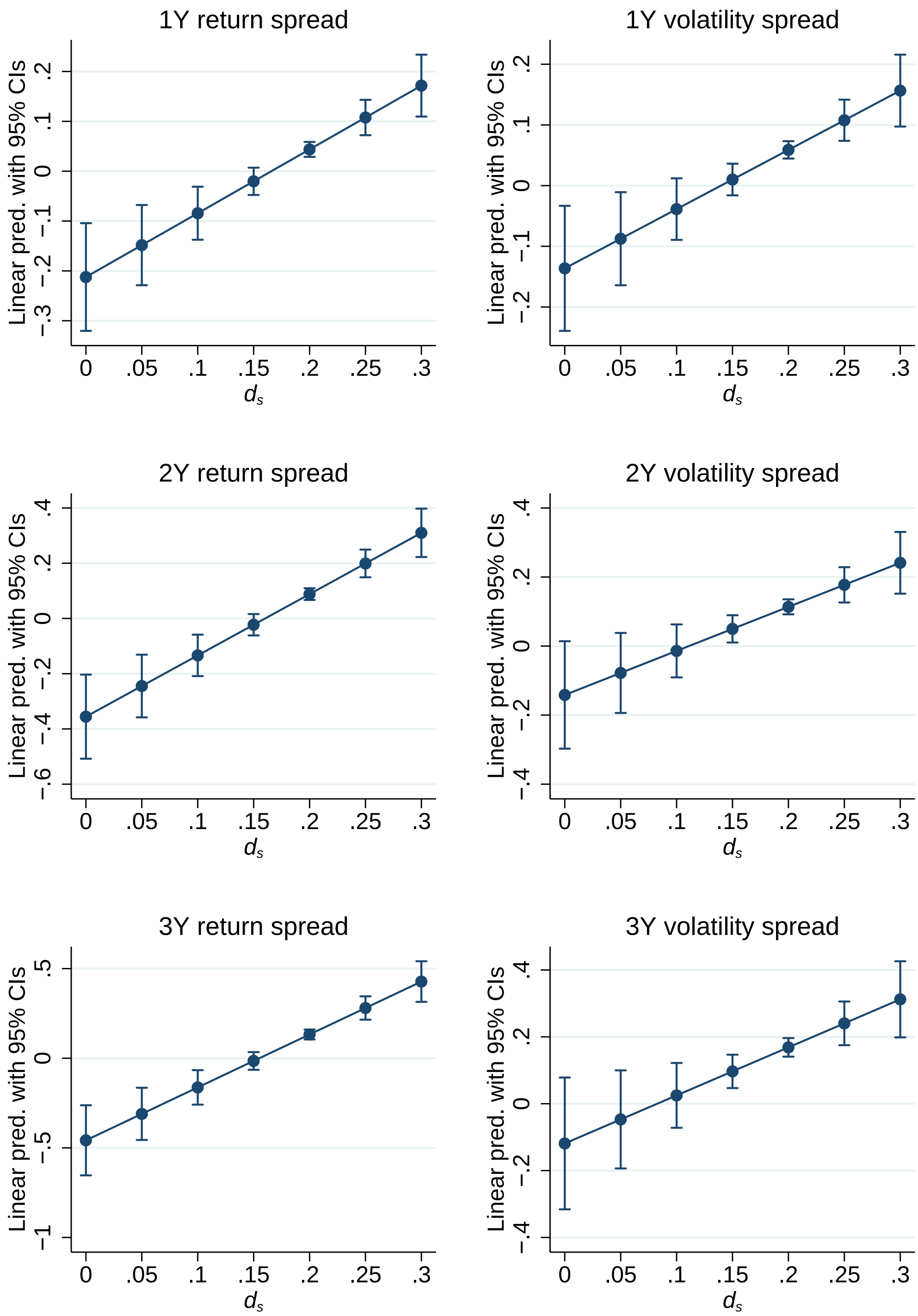

Figure 5: Predicted return and volatility spreads between sin and non-sin stocks. This figure plots the predicted return and volatility spreads between sin and non-sin stocks for given levels of the dividend share of the sin portfolio d_s. The linear predictions are based on the coefficient estimates 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-weigthed (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 porfolio'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. 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**	0.070***	0.107***	0.051***	0.103***	0.156***
	(0.010)	(0.002)	(0.000)	(0.000)	(0.000)	(0.000)
[b] EW	0.020	0.043*	0.069**	0.026*	0.054**	0.082**
	(0.165)	(0.087)	(0.042)	(0.072)	(0.042)	(0.027)
[c] VW (extended)	0.030***	0.064***	0.098***	0.043***	0.088***	0.133***
	(0.007)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
[d] VW (1926Q3:2015Q4)	0.012	0.027	0.047*	0.041***	0.081***	0.120***
	(0.323)	(0.182)	(0.068)	(0.000)	(0.000)	(0.000)

Table 4: Analysis of unconditional 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. All the variables are at quarterly frequency. The t-statistics (in parentheses) are computed 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***	-0.356***	-0.458***	-0.136*	-0.142	-0.119
	(-2.83)	(-3.22)	(-2.78)	(-1.75)	(-1.17)	(-0.74)
$d_{s,t}$	1.280***	2.219***	2.953***	0.976**	1.276**	1.437*
	(3.12)	(3.92)	(3.59)	(2.39)	(2.11)	(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	-0.067	-0.144	-0.188	-0.356*	-0.475*
	(-0.56)	(-0.32)	(-0.54)	(-1.61)	(-1.97)	(-1.96)
$d_{s,t}$	0.415	0.574	1.111	1.117*	2.136**	2.908**
	(0.74)	(0.54)	(0.81)	(1.84)	(2.35)	(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**	-0.304***	-0.394***	-0.124	-0.141	-0.123
	(-2.48)	(-3.06)	(-2.64)	(-1.55)	(-1.20)	(-0.83)
$d_{s,t}$	1.057***	1.965***	2.636***	0.896**	1.224*	1.373*
	(2.79)	(3.75)	(3.44)	(2.07)	(1.96)	(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	-0.081	-0.094	-0.039	-0.059	-0.076
	(-0.82)	(-0.86)	(-0.77)	(-1.02)	(-0.90)	(-0.90)
$d_{s,t}$	0.385	0.717	0.924	0.496**	0.875**	1.241***
	(1.15)	(1.33)	(1.30)	(2.26)	(2.34)	(2.63)
Observations	351	347	343	352	348	344
$\bar{R}^2$	0.02	0.03	0.03	0.04	0.06	0.07

Table 5: Analysis of unconditional 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 (SML), 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. Portfolio returns are value-weighted. All the variables are at quarterly frequency. The t-statistics (in parentheses) are computed 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**	-0.327***	-0.424***	-0.129*	-0.150	-0.141
	(-2.31)	(-2.90)	(-2.61)	(-1.71)	(-1.33)	(-0.94)
$d_{s,t}$	1.147***	2.106***	2.801***	0.963**	1.367**	1.611**
	(2.69)	(3.66)	(3.47)	(2.46)	(2.43)	(2.19)
$R_{m,t} - R_{f,t}$	-0.210**	-0.247*	-0.272	-0.015	0.095	0.196
	(-2.30)	(-1.93)	(-1.38)	(-0.14)	(0.62)	(1.17)
SML_t	0.300*	0.256	0.356	0.062	-0.188	-0.483
	(1.82)	(0.99)	(0.91)	(0.36)	(-0.72)	(-1.22)
HML_t	-0.134	-0.338	-0.282	-0.330***	-0.562**	-0.401
	(-1.06)	(-1.47)	(-0.96)	(-2.64)	(-2.49)	(-1.53)
UMD_t	-0.074	-0.087	-0.035	-0.089	-0.136	-0.242
	(-0.49)	(-0.52)	(-0.18)	(-0.76)	(-0.96)	(-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**	-0.343***	-0.450***	-0.113	-0.147	-0.122
	(-2.58)	(-3.04)	(-2.87)	(-1.54)	(-1.29)	(-0.79)
$d_{s,t}$	1.226***	2.185***	2.898***	0.916**	1.403**	1.546**
	(2.94)	(3.83)	(3.73)	(2.42)	(2.48)	(2.06)
$R_{m,t} - R_{f,t}$	-0.219**	-0.251*	-0.258	-0.045	0.055	0.163
	(-2.33)	(-1.92)	(-1.29)	(-0.42)	(0.37)	(0.95)
SML_t	0.296	0.258	0.241	0.154	-0.143	-0.402
	(1.65)	(0.91)	(0.58)	(0.80)	(-0.50)	(-0.94)
HML_t	-0.115	-0.315	-0.254	-0.355***	-0.601***	-0.425
	(-0.92)	(-1.36)	(-0.85)	(-2.82)	(-2.61)	(-1.61)
UMD_t	-0.062	-0.062	-0.041	-0.090	-0.158	-0.223
	(-0.38)	(-0.34)	(-0.20)	(-0.69)	(-1.06)	(-1.32)
LIQ_t	0.060	0.015	0.383**	-0.271***	-0.275**	-0.027
	(0.68)	(0.09)	(1.98)	(-2.67)	(-2.03)	(-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**	-0.452	-0.385	-0.107	0.030	0.318
	(-2.35)	(-1.66)	(-0.97)	(-1.10)	(0.14)	(1.35)
$d_{s,t}$	1.538***	2.627**	2.625	0.900**	0.667	-0.352
	(2.70)	(2.33)	(1.57)	(2.06)	(0.73)	(-0.34)
$R_{m,t} - R_{f,t}$	-0.148	-0.232	-0.273	-0.131	-0.285	-0.196
	(-0.95)	(-1.40)	(-0.94)	(-1.00)	(-1.39)	(-0.98)
SML_t	0.673	0.625	0.489	0.660**	0.244	0.224
	(1.62)	(0.95)	(0.55)	(2.20)	(0.54)	(0.44)
HML_t	0.015	-0.258	-0.299	-0.458***	-0.886***	-0.479*
	(0.08)	(-0.61)	(-0.58)	(-2.74)	(-2.76)	(-1.76)
UMD_t	0.118	0.130	0.223	0.082	-0.020	0.060
	(0.36)	(0.37)	(0.63)	(0.38)	(-0.10)	(0.37)
LIQ_t	0.067	0.068	0.415	-0.513***	-0.214	0.002
	(0.35)	(0.23)	(1.05)	(-4.79)	(-1.38)	(0.01)
ΔLIT_t	0.349	0.429	0.595	0.148	-0.057	-0.018
	(0.63)	(0.48)	(0.77)	(0.51)	(-0.16)	(-0.04)
Observations	76	72	68	77	73	69
$\bar{R}^2$	0.14	0.15	0.10	0.30	0.12	-0.04

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 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*	-0.202**	-0.293**	-0.018	-0.062	-0.128
	(-1.84)	(-2.04)	(-2.26)	(-0.36)	(-0.70)	(-1.10)
$d_{s,t}$ (dividend)	0.757**	1.465***	2.158***	0.370	0.887**	1.531***
	(2.36)	(2.76)	(3.20)	(1.50)	(2.00)	(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	-0.132	-0.153	-0.314***	-0.286**	-0.260
	(-1.39)	(-0.93)	(-0.76)	(-4.17)	(-2.20)	(-1.45)
$d_{s,t}$ (Compustat)	0.898	1.056	1.365	1.908***	2.033***	2.181**
	(1.65)	(1.37)	(1.27)	(4.80)	(3.07)	(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	0.012	0.068	-0.051	-0.020	0.046
	(-0.40)	(0.13)	(0.47)	(-1.11)	(-0.24)	(0.42)
$\tilde{d}_{s,t}$	0.229	0.250	0.206	0.462***	0.655**	0.721**
	(1.02)	(0.77)	(0.43)	(2.83)	(2.41)	(2.01)
Observations	116	112	108	117	113	109
$\bar{R}^2$	0.00	-0.00	-0.01	0.09	0.09	0.08

Table 7: Analysis of price-dividend ratios

This table reports estimates from regressions of the price-dividend ratio of the sin portfolio relative to that of the non-sin comparable portfolio. The variable of interest is $\log(d_s/(1-d_s))$, where d_s is the dividend share of the sin portfolio. Odd columns do not include control variables. Even columns include the following risk factors as control variables: Excess market return $(R_m - R_f)$, small minus big (SMB), high minus low (SML), and momentum (UMD). In columns 1 and 2, d_s is computed from repurchase-adjusted dividend payments from CRSP (Bansal et al., 2005a). In columns 3 and 4, the quantity-based dividend share $\tilde{d}_s$ is used. $\tilde{d}_s$ is adjusted for the relative price of sin and non-sin comparable goods and is available from 1986Q1 (see Appendix C.2). All the variables are at quarterly frequency. The t-statistics (in parentheses) are computed 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.

	$\log\left(\frac{S_{s,t}/D_{s,t}}{S_{c,t}/D_{c,t}}\right)$		$\log\left(\frac{S_{s,t}/\tilde{D}_{s,t}}{S_{c,t}/\tilde{D}_{c,t}}\right)$	
	(1)	(2)	(3)	(4)
Constant	-0.695**	-0.628*	-1.714***	-1.712***
	(-2.01)	(-1.79)	(-22.32)	(-22.04)
$\log\left(\frac{d_{s,t}}{1-d_{s,t}}\right)$	-0.375	-0.333		
	(-1.61)	(-1.41)		
$\log\left(\frac{\tilde{d}_{s,t}}{1-\tilde{d}_{s,t}}\right)$			-1.230***	-1.237***
			(-15.33)	(-15.70)
$R_{m,t} - R_{f,t}$		0.223		-0.316
		(1.07)		(-1.02)
SML_t		-0.826*		0.175
		(-1.95)		(0.24)
HML_t		0.007		0.214
		(0.02)		(0.43)
UMD_t		-0.125		-0.210
		(-0.57)		(-0.82)
Observations	204	204	120	120
$\bar{R}^2$	0.05	0.06	0.76	0.76

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 or $S_{s,t}$ 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

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

The equilibrium prices (7) can be rewritten as

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

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

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

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

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

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

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

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, we have derive $\dfrac{dp_{c,t}}{p_{c,t}}$:

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

or equivalently

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

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 result.

□

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

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

where

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

The quantity $\mathrm{Cov}\left(\frac{dS_{i,t}}{S_{i,t}}, \frac{d\lambda_t}{\lambda_t}\right)$ 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.[8]
- 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 (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.[9] 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:

[8]Fama-French industry groups refer to the 48-industry classification by Fama and French (1997).
[9]See http://www.columbia.edu/~hh2679/sinstocks.pdf.

- 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.

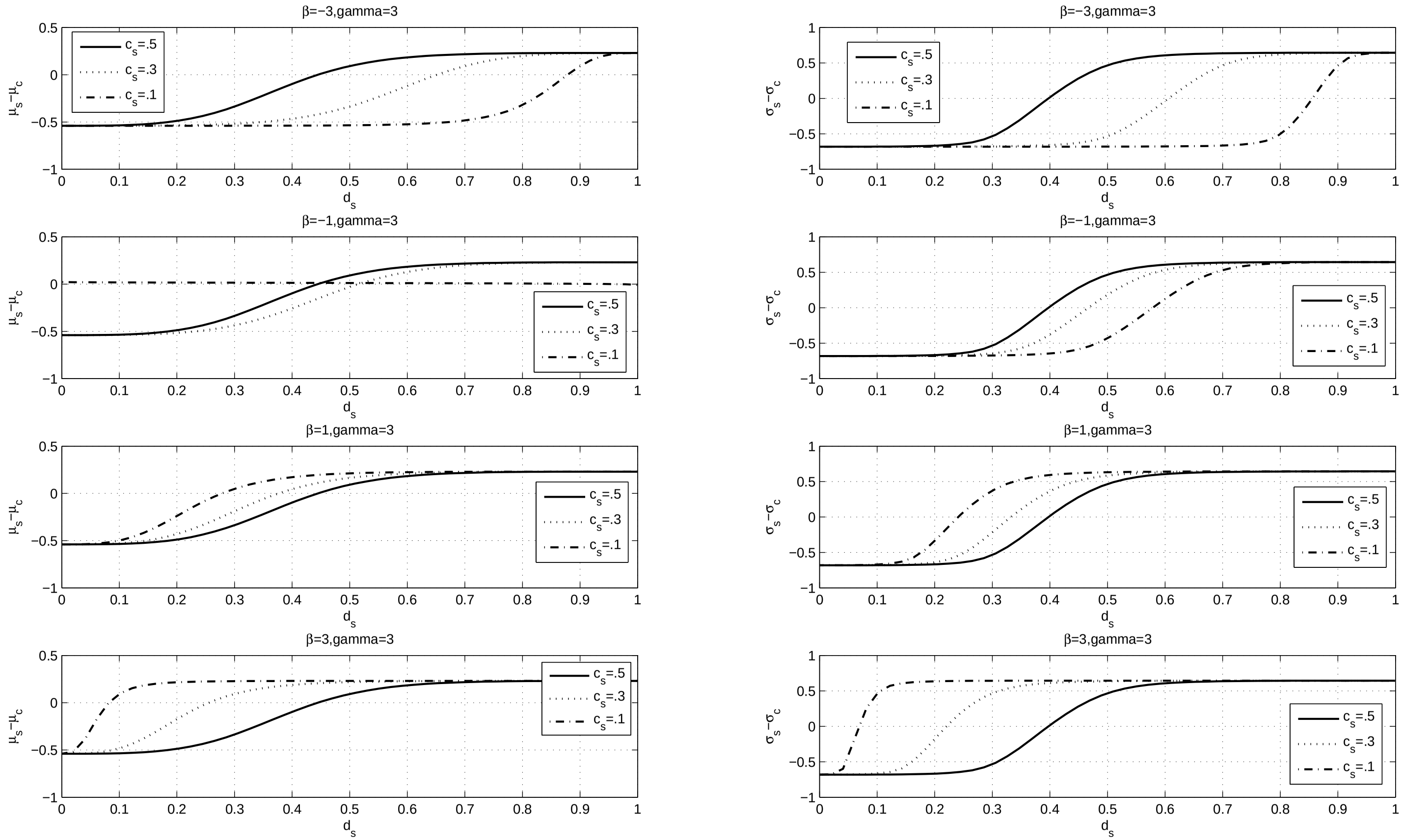

Figure B.1: Conditional return and standard deviation spread between sin and non-sin stocks with high risk aversion (asymmetric calibration). This figure plots the conditional return differential (left column) and the conditional volatility differential (right column) between the sin stock and the comparable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

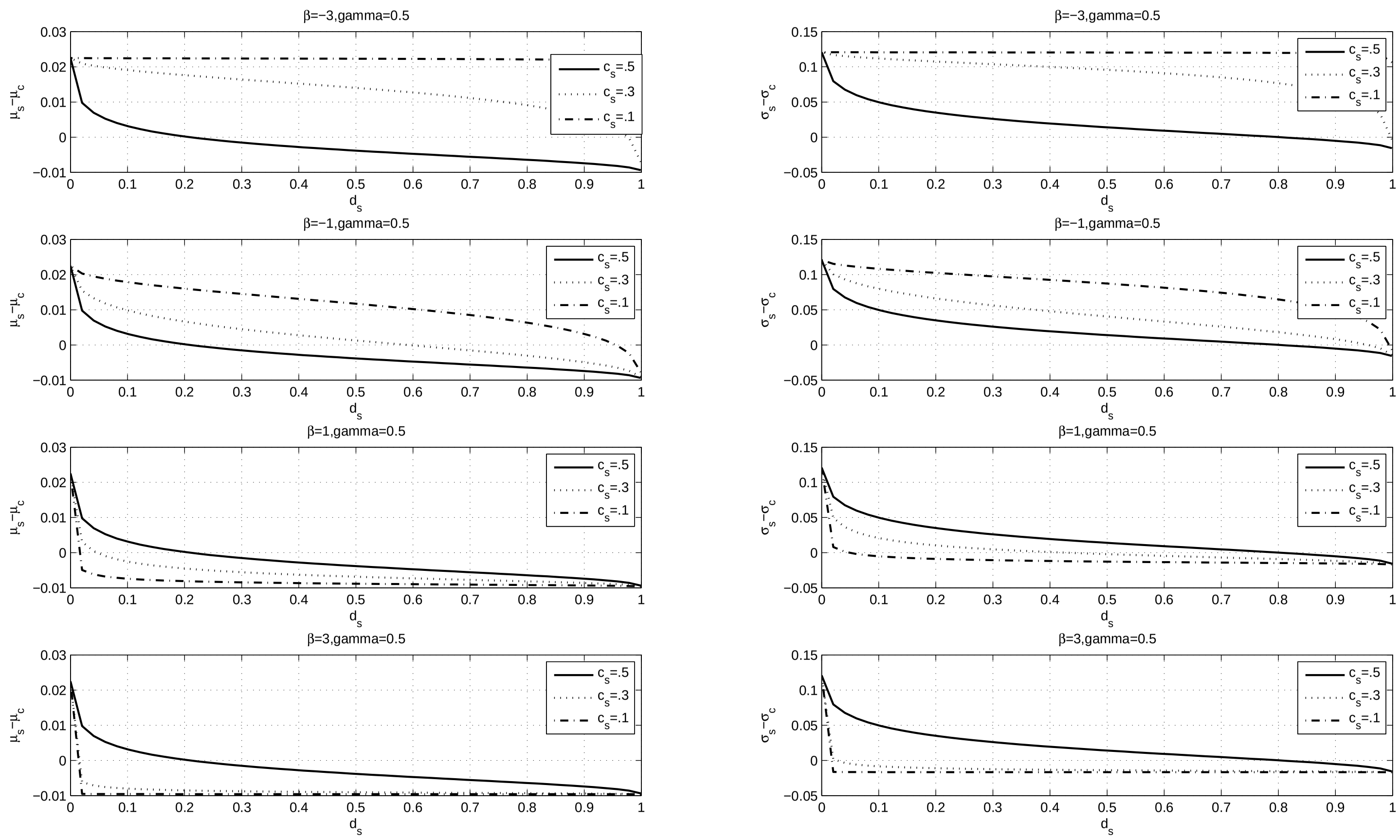

Figure B.2: Conditional return and standard deviation spread between sin and non-sin stocks with low risk aversion (asymmetric calibration). This figure plots the conditional return differential (left column) and the conditional volatility differential (right column) between the sin stock and the comparable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