A Sustainable Capital Asset Pricing Model (S-CAPM): Evidence from Green Investing and Sin Stock Exclusion

Olivier David Zerbib*
Tilburg University (CentER) and ISFA

First version: April 2019
This version: October 6, 2020
Link to the latest version

Abstract

This paper shows how sustainable investing affects asset returns through exclusionary screening and environmental, social, and governance (ESG) integration. I develop an asset pricing model with partial segmentation and heterogeneous preferences. I characterize two *taste premia* that clarify the relationship between ESG and financial performance and two *exclusion premia* generalizing Merton (1987)'s premium on neglected stocks. By using the holdings of 453 green funds investing in U.S. stocks between 2007 and 2019 to proxy for sustainable investors' tastes, I estimate the model applied to green investing and sin stock exclusion. The annual taste effect ranges from -1.12% to +0.14% for the different industries and the average exclusion effect is 1.43%.

Keywords: Sustainable finance; environmental finance; ESG; tastes; sin stocks; segmentation.
JEL codes: G12, G11.

---

*Email address: o.d.a.zerbib@tilburguniversity.edu. Tilburg University, Department of Finance (CentER), P.O. Box 90153, 5000 LE Tilburg, The Netherlands. Université de Lyon, Université Lyon 1, Institut de Sciences Financière et d'Assurances (ISFA), 50 avenue Tony Garnier, Lyon F-69007, France.
For their valuable comments and suggestions, I am grateful to Rob Bauer, Milo Bianchi, Claire Bonello, Marco Ceccarelli, Julio Crego, Patricia Crifo, Joost Driessen, Esther Eiling, Caroline Flammer, Olivier Guéant, James Guo, Ulrich Hege, Ying Jiao, Sonia Jimenez Garces, Frank de Jong, Nabil Kazi-Tani, Peter Kondor, Felix Kübler, Augustin Landier, Dong Lou, Valéry Lucas-Leclin, Sophie Moinas, Lionel Melin, Martin Oehmke, Sébastien Pouget, Kevin Ratsimiveh, Christian Robert, Bert Scholtens, Paul Smeets, Dimitri Vayanos, Michela Verardo, Alexander Wagner, workshop participants at the London School of Economics, Tilburg University, University of Zurich–SFI, Toulouse School of Economics, CREST (Ecole Polytechnique - ENSAE), Paris Dauphine University, University of Lille, University of Orléans, I Care, and ISFA.
I gratefully acknowledge financial support from the AXA Research Fund through the research initiative entitled *Climate risks in institutional asset allocation.*

Sustainable investing now accounts for more than one quarter of the total assets under management (AUM) in the United States (U.S.; US SIF, 2018) and more than half of those in Europe (GSIA, 2018).[1] Primarily motivated by ethical concerns, the two most widely used sustainable investment practices are *exclusionary screening* and *environmental, social, and governance (ESG) integration* (GSIA, 2018). Exclusionary screening involves the exclusion of certain assets from the range of eligible investments, while ESG integration involves underweighting assets with low ESG ratings and overweighting those with high ESG ratings. Exclusionary screening and ESG integration are distinct practices, which are generally implemented depending on the type of assets under consideration (e.g., many investors have exclusion policies for *sin stocks*) and the asset management style (e.g., benchmarked versus absolute return asset management). Their growing prevalence can create major supply and demand imbalances, thereby distorting market prices. This paper develops a theoretical framework and provides empirical evidence on how these two sustainable investing practices—separately and together—affect asset returns.

To reflect the dual practice of exclusion and ESG integration by sustainable investors, I develop a simple asset pricing model with partial segmentation and heterogeneous preferences. Specifically, I propose a single-period equilibrium model populated by three constant absolute risk aversion (CARA) investor groups: *regular investors* that invest freely in all available assets and have mean-variance preferences; *sustainable investors* practicing exclusionary screening (referred to as *excluders*) that exclude certain assets from their investment scope and have mean-variance preferences; *sustainable investors* practicing ESG integration (referred to as *integrators*) that invest freely in all available assets, but adjust their mean-variance preferences by internalizing a private cost of externalities in their expected returns.[2]

[1] Sustainable investing is also referred to as *socially responsible investing*, *responsible investing* and *ethical investing*. In the European Parliament legislative resolution of 18 April 2019 (COM(2018)0354 – C8-0208/2018 – 2018/0179(COD)), sustainable investments are defined as "investments in economic activities that contribute to environmental or social objectives as well [*sic*] their combination, provided that the invested companies follow good governance practices and the precautionary principle of "do no significant harm" is ensured, i.e. that neither the environmental nor the social objective is significantly harmed." In the U.S., the AUM in sustainable investing amounted to USD 12 trillion in 2018 and increased by 38% between 2016 and 2018 (US SIF, 2018).

[2] Benabou and Tirole (2010) describe the *delegated philanthropy* mechanism whereby sustainable investors integrate firm externalities into their investment decisions. In the continuation of this theory, Hart and Zingales (2017) and Morgan and Tumlinson (2019) argue that sustainable investors internalize externalities to maximize their welfare instead of solely maximizing market value of their investments.

I propose a unified pricing formula for all assets in the market; namely, the assets excluded by excluders (hereafter, *excluded assets*) and the assets in which they can invest (hereafter, *investable assets*). Two types of premia are induced by sustainable investors: two *taste premia* (*direct* and *indirect* taste premium) and two *exclusion premia* (*exclusion-asset* and *exclusion-market* premium).

The taste premia materialize through three effects. First, consistent with related literature, the *direct taste premium* is induced by integrators' tastes for assets owing to the cost of externalities that they internalize: this premium increases with the cost of externalities and the wealth share of integrators. Second, as a consequence, the market risk premium is also adjusted by the average direct taste premium. Third, a cross-effect arises through the *indirect taste premium* on excluded assets: to hedge their underweighting of investable assets with a high cost of externalities, integrators overweight the excluded assets that are most correlated with these investable assets.

Two exclusion premia affect excluded asset returns. The exclusion premia result from a reduction in the investor base, and are related to Errunza and Losq (1985)'s *super risk premium* and de Jong and de Roon (2005)'s *local segmentation premium*. I show that one of the two exclusion premia is a generalized form of the premium on neglected stocks characterized by Merton (1987). Both exclusion premia are structured similarly and reflect the dual hedging effect of investors who do not exclude and those who exclude assets: regular investors and integrators, who are compelled to hold the excluded market portfolio, value most highly the assets least correlated with this portfolio; simultaneously, excluders, who seek to replicate the hedging portfolio built from investable assets most closely correlated with excluded assets, value most highly the assets most correlated with this hedging portfolio. The *exclusion effect* is the sum of the two exclusion premia. Although the exclusion effect on asset returns is positive on average, as empirically assessed by Hong and Kacperczyk (2009) and Chava (2014), I show that this effect can be negative for an individual excluded asset, for example, when it is negatively correlated with the other excluded assets. Finally, a cross-effect of one of the two exclusion premia also drives investable asset returns.

I empirically validate the theoretical predictions by estimating the model using the U.S. stocks in the Center for Research in Security Prices (CRSP) database between December 2007 and December 2019. I use sin stocks to constitute the assets excluded by excluders and apply integrators' screening to their tastes for the stocks of *green firms*.[3]

Beyond the issue of the econometric specification, there are three main reasons for the mixed results in the empirical literature on the link between environmental and financial performances. First, identifying the environmental performance of a company through a particular environmental metric weakly proxies for the average tastes of sustainable investors for green firms: the various metrics used to assess the environmental impacts of assets lack a common definition, show low commensurability (Chatterji, Durand, Levine, and Touboul, 2016; Gibson, Krueger, Riand, and Schmidt, 2020), and are updated with a low frequency, typically on an annual basis. Second, these studies fail to capture the increase in the proportion of green investors over time. Third, by proxying expected returns by realized returns, these papers neglect to control the effect of the unexpected shifts in tastes on realized returns (Pastor, Stambaugh, and Taylor, 2020), which induces a critical omitted variable bias: if the proportion of green investors or their tastes for green companies unexpectedly increase, green assets may outperform brown assets while the former have a lower direct taste premium than the latter.

Therefore, I construct a proxy for the tastes of green investors that allows me to address the three issues raised. First, to circumvent the use of environmental metrics, I construct an agnostic *ex-post* instrument reflecting green investors' private costs of environmental externalities. I identify 453 green funds worldwide with investments in U.S. equities as of December 2019 and use the FactSet data to determine their holding history on a quarterly basis. For a given stock and on a given date, I define this instrument as the relative difference between the weight of the stock in the market portfolio and its weight in the U.S. allocation of the green funds. The higher the proxy is, the more the stock is underweighted by the green funds on that date, and vice versa when the proxy is negative. Second, I approximate the proportion of green investors' wealth as the proportion of assets managed by green funds relative to the market value of the investment universe. Third, I control for the unexpected shifts in green investors' tastes by constructing a proxy defined as the variation of green investors' tastes over time.

For investable stocks, the direct taste premium is significant from 2007 onwards, whether it

[3] A green firm can be defined as a firm with a low environmental impact according to an environmental metric, including, for example, environmental ratings and carbon footprints.

is estimated by constructing industry-sorted or industry-size double-sorted portfolios. The direct taste premium remains significant after controlling for the unexpected shifts in tastes, as well as for the small-minus-big (SMB), high-minus-low (HML) (Fama and French, 1993), and momentum (MOM) (Carhart, 1997) factors. The taste effect ranges from -1.12% to +0.14% for the different industries evaluated. Specifically, ESG integration significantly contributes toward modifying the expected returns of the industries most impacted by the ecological transition. For example, on average, between 2007 and 2019, green investors induced additional annual returns of 0.50% for the petroleum and natural gas industry when compared to the electrical equipment industry; this taste effect has steadily increased over time. I also find weak evidence supporting the cross-effect effect of sin stock exclusion on investable stock returns.

Regarding sin stocks, I find both exclusion premia and the indirect taste premium to be significant and to remain so when the SMB, HML, and MOM factors are included.[4] The ordinary least squares (OLS) adjusted-R^2 and generalized least squares (GLS) R^2 of the estimated model are substantially higher than those obtained under Carhart (1997)'s four-factor model. The annual average exclusion effect amounts to 1.43% over the period under consideration. Consistent with the theory, the exclusion effect is negative for 10 out of the 52 sin stocks analyzed.

Related literature. The results of this study contribute to two literature strands on asset pricing. First, they clarify the relationship between the environmental and financial performances of assets by building on the disagreement literature.[5] The empirical evidence regarding the effects of ESG integration on asset returns is mixed, as several studies point to the existence of a negative relationship between ESG performance and stock returns,[6] while others argue in favor of a

[4] The limited number of sin stocks does not allow to estimate the direct taste premium (induced by green funds) on sin stock returns. However, the direct taste premium is analyzed for investable assets, which constitute almost the entire investment universe.

[5] A vast literature has examined the effects of disagreement and differences of opinion on asset returns and prices, including Harris and Raviv (1993), Biais and Bossaerts (1998), Scheinkman and Xiong (2003), Fama and French (2007), Jouini and Napp (2007), David (2008), Dumas, Kurshev, and Uppal (2009), Banerjee and Kremer (2010), Bhamra and Uppal (2014), Carlin, Longstaff, and Matoba (2014), Baker, Hollifield, and Osambela (2016), Atmaz and Basak (2018) and Banerjee, Davis, and Gondhi (2019).

[6] See Brammer, Brooks, and Pavelin (2006), Renneboog, Ter Horst, and Zhang (2008) and Barber, Morse, and Yasuda (2019). Moreover, Sharfman and Fernando (2008), ElGhoul, Guedhami, Kowk, and Mishra (2011) and Chava (2014) show that the same effect applies to the expected returns. Bolton and Kacperczyk (2020), Hsu, Li, and Tsou (2019) and In, Park, and Monk (2019) show that companies emitting the most greenhouse gases earn higher stock returns than companies emitting the lowest levels.

positive effect,[7] or find no significant differentiating effects due to ESG integration.[8] Two independent works by Pedersen, Fitzgibbons, and Pomorski (2020) and Pastor et al. (2020) provide theoretical contributions on how ESG integration by sustainable investors affects asset returns.[9] Pedersen et al. (2020) show that when the market is populated by ESG-motivated, ESG-aware, and ESG-unaware investors, the optimal allocation satisfies four-fund separation and is characterized by an ESG-efficient frontier. The authors derive an asset pricing equation in the cases where all investors are ESG-motivated or ESG-unaware. Pastor et al. (2020) show that green assets have negative alphas and brown assets have positive alphas, and that the alphas of ESG-motivated investors are at their lowest when there is a large dispersion in investors' ESG tastes. Extending the conceptual framework laid out by Fama and French (2007), I contribute to this literature strand in two ways. First, from a theoretical viewpoint, I show that the taste effect on asset returns is transmitted through a direct and and indirect taste premium, which are adjusted by the taste effect on the market premium. Second and foremost, from an empirical viewpoint, this is the first paper in which the asset pricing specification is estimated using a microfounded proxy for sustainable investors' revealed tastes for green companies constructed from green fund holdings. In addition to offering a measure of the aggregate tastes of green investors on a monthly basis, this proxy allows to account for the increase in their proportion and to control for the effect of unexpected shifts in tastes. The significant estimates of the taste premia on investable and excluded stock returns highlight the value of using this *ex-post* monthly measure rather than a yearly environmental rating or a carbon footprint to proxy for sustainable investors' tastes.

The results of this study also contribute to the literature on exclusionary screening by bridging the gap with market segmentation. From a theoretical viewpoint, this article extends the analysis of Heinkel, Kraus, and Zechner (2001) by characterizing the risk factors associated with exclusionary screening. I show that the exclusion effect results from the sum of two exclusion premia, which are related to the premia identified by Errunza and Losq (1985) in the case of excluded assets and by

[7]See Derwall, Guenster, Bauer, and Koedijk (2005), Statman and Glushkov (2009), Edmans (2011), Eccles, Ioannou, and Serafeim (2014), Krüger (2015) and Statman and Glushkov (2016). Specifically, Krüger (2015) shows that investors react very negatively to negative Corporate Social Responsibility (CSR) news, particularly environmental news, and positively to positive CSR news concerning firms with known controversies.

[8]See Bauer, Koedijk, and Otten (2005) and Galema, Plantinga, and Scholtens (2008).

[9]Both papers focus on ESG integration and do not address exclusionary screening.

de Jong and de Roon (2005) as an indirect effect on investable assets. I show that both premia apply to all assets in the market and, thus, I identify the cross-effect of exclusion on investable stock returns. Moreover, I demonstrate that one of the two exclusion premia is a generalized form of Merton (1987)'s premium on neglected stocks. Compared to Merton (1987), this study emphasizes the importance of considering non-independent returns because the exclusion effect is mostly due to spillovers from other excluded assets. From an empirical viewpoint, the magnitude of the average annual exclusion effect I estimate for sin stocks is in line with the 2.5% obtained by Hong and Kacperczyk (2009) and is substantially lower than the 16% found by Luo and Balvers (2017). However, I show that this effect is negative for several sin stocks. Luo and Balvers (2017) characterize a boycott premium and claim that the exclusion effect is positively related to business cycles. I show that the exclusion effect fluctuates with business cycles because it is driven by conditional covariances, which increase with the multiple correlation among excluded assets.

The remainder of this paper is structured as follows. Section 1 presents the equilibrium equations of the model and characterizes the resulting premia. Section 2 describes the identification method used in the empirical analysis when the model is applied to sin stocks regarded as excluded assets and to green investments for characterizing investors' tastes for investable assets. Sections 3 and 4 present the empirical results on investable and excluded stocks' excess returns, respectively. Section 5 concludes the paper. The Appendix contains the main proofs and the Online Appendix provides additional proofs and details about the empirical analysis.

1 Asset pricing with partial segmentation and heterogeneous preferences

To reflect the dual practices of sustainable investing based on the exclusion and over- or underweighting of certain assets, I develop a simple asset pricing model with partial segmentation and heterogeneous preferences among investors. I show how the expected excess returns deviate from those predicted by the capital asset pricing model (CAPM) and identify two types of premia that occur in equilibrium: two taste premia and two exclusion premia. I also show that exclusion and taste premia have cross-effects on investable and excluded assets.

1.1 Model setup and assumptions

The economy is populated by three investor groups: one group of *regular* investors and two groups of *sustainable* investors—a group practicing exclusionary screening (referred to as *excluders*) and another practicing ESG integration (referred to as *integrators*). This setup does not lose generality compared to a model with several sustainable investors practicing either exclusion, ESG integration or both.[10] The model is based on the following assumptions.

Assumption 1 (Single-period model)**.** Agents operate in a single-period model from time t to $t+1$. They receive an endowment at time t, have no other source of income, trade at time t, and derive utility from their wealth at time $t+1$.

Assumption 2 (Gaussian returns)**.** The market is composed of $n_I + n_X$ risky assets, $I_1, ..., I_{n_I}$, $X_1, ..., X_{n_X}$, whose returns are normally distributed, and one risk-free asset.

Assumption 3 (Partial segmentation)**.** Regular investors and integrators invest freely in all assets in the market. Excluders restrict their risky asset allocation to the sub-market of *investable assets*, which is composed of assets $I_1, ..., I_{n_I}$, and exclude the sub-market of *excluded assets*, which is composed of assets $X_1, ..., X_{n_X}$. The proportion of excluded assets' market value is denoted by $q \in [0, 1]$. The wealth shares of excluders, integrators, and regular investors are p_e, p_i, and $1-p_e-p_i$, respectively.

Assumption 4 (Heterogeneous preferences)**.** Investors have mean-variance preferences, and their *relative* risk aversion is denoted by γ. However, contrary to regular investors and excluders, integrators have specific tastes for assets; they subtract a deterministic private cost of externalities, c_k, from the expected return on each asset $k \in \{I_1, ..., I_{n_I}, X_1, ...X_{n_X}\}$ in their mean-variance optimization program.[11] $C_I = (c_{I_1}, ..., c_{I_{n_I}})'$ and $C_X = (c_{X_1}, ..., c_{X_{n_X}})'$ are the vectors of stacked costs for investable assets $I_1, ..., I_{n_I}$ and excluded assets $X_1, ..., X_{n_X}$, respectively, where the prime symbol

[10] In this more general case, the equilibrium equations remain unchanged and the proportions of wealth are adjusted according to the wealth invested utilizing each of the two sustainable investment techniques.

[11] As detailed in the Appendix, regular investors and excluders have an exponential utility, while integrators adjust their exponential utility by internalizing a deterministic private cost of externalities as in Pastor et al. (2020).

stands for the transposition operator. The cost of externalities of the value-weighted portfolio of investable assets is denoted by c_{m_I} (see Figure 1).

Assumption 5 (Perfect market)**.** The market is perfect and frictionless.

Assumption 6 (Free lending and borrowing)**.** Investors can lend and borrow freely, without any constraint, at the same exogenous interest rate.

[Figure 1 about here]

The specific assumptions adopted in this model are those of a partially segmented market (assumption 3) in which investors have heterogeneous preferences (assumption 4). I do not consider the partial segmentation assumption as a limiting case of the heterogeneous preferences assumption with no-short-sales constraint because exclusionary screening and ESG integration correspond to distinct practices. First, sustainable investment practices generally depend on the type of assets under consideration: for example, sin stocks are subject to exclusionary policies for many sustainable investors, while companies' environmental footprint often induces a modulation of sustainable investors' exposure. Second, sustainable investment practices also depend on the asset management style: while benchmarked funds often favor over- and underweighting, absolute return funds tend to deviate more actively from benchmarks by implementing exclusionary policies. Therefore, since short-selling is not prohibited, integrators can short an asset with a high externality cost while an excluded asset is not accessible to excluders.

By characterizing sustainable investors' practices through both exclusion and ESG integration, the developed model subsumes two types of previous models. On the one hand, when the cost of externalities is zero (i.e., focusing on assumption 3), the present framework is reduced to that of segmentation models, such as the I-CAPM (Errunza and Losq 1985; de Jong and de Roon 2005),[12] and that used by Luo and Balvers (2017), who analyze the effects of excluding a specific set of assets. The assumptions of the present model generalize those of Merton (1987)'s model since I do not impose any particular specification on asset returns, and these are not independent.[13]

[12] As shown by de Jong and de Roon (2005), their model also generalizes Bekaert and Harvey (1995)'s model when investable and non-investable assets have similar characteristics in the absence of cross-country segmentation effects.

[13] However, it should be noted that Merton allows each stock to be neglected by a different number of investors, while, in the present model, all excluded stocks are excluded by the same proportion of total wealth p_e.

On the other hand, when the market is not segmented (i.e., focusing on assumption 4), the present model is reduced to a model of differences of opinion, in which sustainable investors adjust their expected returns on each available asset by internalizing a private cost of externalities.[14] The setup is related to that of Acharya and Pedersen (2005): the cost of illiquidity is replaced here by a deterministic cost of externalities, which is internalized only by a fraction of the investors. Unlike the illiquidity cost, which fluctuates daily, the cost of ESG externalities varies with high inertia and does not necessarily need to be modeled as a stochastic factor. The internalization of the cost of externalities, which is modeled here as a linear adjustment of the expected excess return, is consistent with other theoretical studies on ESG investing (Gollier and Pouget, 2014; Pastor et al., 2020; Pedersen et al., 2020). It is worth noting that the cost of externalities can have a negative value and reflect the internalization of positive externalities by integrators. This occurs for companies whose assets may benefit from enhanced returns in the future.

1.2 Premia induced by sustainable investing

Subscripts I and X are used here as generic indices, standing for the vectors of n_I investable assets and n_X excluded assets, respectively. To simplify the notation, the time subscripts are omitted and all the returns, r, are considered in excess of the risk-free rate. Therefore, the excess return on any asset k in the market is denoted by r_k. The vectors of excess returns on assets, $I = (I_1, ..., I_{n_I})$ and $X = (X_1, ..., X_{n_X})$, are denoted by r_I and r_X, respectively. I refer to the value-weighted portfolios of investable assets and of excluded assets as the *investable market* and *excluded market* portfolios, respectively. The excess returns on the investable market, excluded market, and market are denoted by r_{m_I}, r_{m_X}, and r_m, respectively. I use σ to denote the standard deviation of the excess returns on an asset and ρ for the correlation coefficient (or multiple correlation coefficient) between the excess returns on two assets (or between one asset and a vector of assets, respectively). Let β_{km_I} be the slope coefficient of the regression of the excess returns on asset $k \in \{I_1, ...I_{n_I}, X_1, ..., X_{n_X}\}$ on the excess returns on the investable market m_I, and a constant.

[14] As in Fama and French (2007), these tastes may be linked to either non-pecuniary motives (Riedl and Smeets, 2017; Hartzmark and Sussman, 2019) or lower financial risk expectations (Lins, Servaes, and Tamayo, 2017; Krüger, 2015; Battiston, Mandel, Monasterolo, Schutze, and Visentin, 2017; Krüger, Sautner, and Starks, 2020).

Let B_{kI} be the row vector of the slope coefficients in a multiple regression of asset k's excess returns on the excess returns on the investable assets $I_1, ..., I_{n_I}$ and a constant. $\mathbb{C}\text{ov}(r_k, r_{m_X}|r_I)$ and $\mathbb{C}\text{ov}(r_k, r_{m_X}|r_{m_I})$ refer to the conditional covariances between r_k and r_{m_X}, given the vector of returns r_I and return r_{m_I}, respectively.

Proposition 1 (S-CAPM)**.**

1. The expected excess return on any asset $k \in \{I_1, ...I_{n_I}, X_1, ..., X_{n_X}\}$ *is*

$$\mathbb{E}(r_k) = \beta_{km_I}\left(\mathbb{E}(r_{m_I}) - p_i c_{m_I}\right) + \underbrace{\frac{p_i}{1-p_e}c_k - \frac{p_i p_e}{1-p_e}B_{kI}C_I}_{\textit{Taste premia}} + \underbrace{\gamma\frac{p_e}{1-p_e}q\,\mathbb{C}\text{ov}(r_k, r_{m_X}|r_I) + \gamma q\,\mathbb{C}\text{ov}(r_k, r_{m_X}|r_{m_I})}_{\textit{Exclusion premia}}. \tag{1}$$

2. Particularly,

(i) the expected excess return on any investable asset I_k $(k \in \{1, ..., n_I\})$ *is*

$$\mathbb{E}(r_{I_k}) = \beta_{I_k m_I}\left(\mathbb{E}(r_{m_I}) - p_i c_{m_I}\right) + \underbrace{p_i c_{I_k}}_{\textit{Direct taste premium}} + \underbrace{\gamma q\,\mathbb{C}\text{ov}(r_{I_k}, r_{m_X}|r_{m_I})}_{\textit{Exclusion-market premium}}, \tag{2}$$

(ii) the expected excess return on any excluded asset X_k $(k \in \{1, ..., n_X\})$ *is*

$$\mathbb{E}(r_{X_k}) = \beta_{X_k m_I}\left(\mathbb{E}(r_{m_I}) - p_i c_{m_I}\right) + \underbrace{\frac{p_i}{1-p_e}c_{X_k}}_{\textit{Direct taste premium}} - \underbrace{\frac{p_i p_e}{1-p_e}B_{X_k I}C_I}_{\textit{Indirect taste premium}} + \underbrace{\gamma\frac{p_e}{1-p_e}q\,\mathbb{C}\text{ov}(r_{X_k}, r_{m_X}|r_I)}_{\textit{Exclusion-asset premium}} + \underbrace{\gamma q\,\mathbb{C}\text{ov}(r_{X_k}, r_{m_X}|r_{m_I})}_{\textit{Exclusion-market premium}}. \tag{3}$$

Proposition 1 shows that sustainable investors' exclusion and integration practices involve two types of additional premia in equilibrium: two exclusion premia[15]—the *exclusion-asset* and *exclusion-market* premia—and two taste premia—the *direct* and *indirect taste* premia. The presence of the exclusion-market premium on investable asset returns and the indirect taste premium

[15]The exclusion premia are not random variables but scalars because, for a multivariate normal distribution, the conditional covariance does not depend on the given values (see Lemma 1 in the Appendix).

on excluded asset returns reflects the cross effects of exclusion and integration practices. Compared to the previous papers on partially segmented markets (Errunza and Losq, 1985; de Jong and de Roon, 2005), I show that equilibrium returns can be expressed in a unified form for all assets in the market (Equation (1)). As in de Jong and de Roon (2005) and Eiling (2013), the expected excess returns are expressed with respect to those on the investable market, which is the largest investment universe accessible to all investors in a partially segmented market. The expected return on the investable market is lowered by the direct taste premium on this market, $p_i c_{m_I}$.

Three limiting cases can be considered. First, when sustainable investors do not exclude assets but have different tastes for investable assets from regular investors ($p_e = 0$ and $p_i > 0$), the exclusion premia disappear because $q = 0$ and only the direct taste premium remains. In addition, the investable market, m_I, and the market, m, coincide. Denoting the beta of asset k with respect to the market by β_{km} and the average cost of externalities in the market by c_m, the expected excess return on asset k is

$$\mathbb{E}(r_k) = \beta_{km} \left(\mathbb{E}(r_m) - p_i c_m\right) + p_i c_k. \tag{4}$$

Specifically, when the economy is only populated by integrators ($p_i = 1$), the equilibrium equation reduces to Acharya and Pedersen (2005)'s liquidity-adjusted CAPM with a deterministic illiquidity cost.

Second, when sustainable investors only practice exclusion and have similar tastes to those of regular investors ($p_e > 0$ and $p_i = 0$), the taste premia vanish ($\forall k \in \{I_1, ..., I_{n_I}, X_1, ..., X_{n_X}\}$, $c_k = 0$) and only the exclusion premia remain. Equation (2) reduces to the I-CAPM equilibrium equation for investable assets in de Jong and de Roon (2005):[16]

$$\mathbb{E}(r_{I_k}) = \beta_{I_k m_I} \, \mathbb{E}(r_{m_I}) + \gamma q \, \mathbb{C}\mathrm{ov}(r_{I_k}, r_{m_X} | r_{m_I}). \tag{5}$$

Equation (3) is also related to de Jong and de Roon (2005), who express the equilibrium equation for excluded assets' expected excess returns with respect to the vector of investable assets' expected returns, $\mathbb{E}(r_I)$. I extend their result to express the expected excess returns on excluded assets with

[16]The *local segmentation* premium in de Jong and de Roon (2005) can be expressed as a conditional covariance between asset returns (see Lemma 1 in the Appendix).

respect to those on the investable market, $\mathbb{E}(r_{m_I})$, as

$$\mathbb{E}(r_{X_k}) = \beta_{X_k m_I}\,\mathbb{E}(r_{m_I}) + \gamma\frac{p_e}{1-p_e}q\,\mathbb{C}\text{ov}(r_{X_k}, r_{m_X}|r_I) + \gamma q\,\mathbb{C}\text{ov}(r_{X_k}, r_{m_X}|r_{m_I}). \quad (6)$$

Finally, in the absence of sustainable investors ($p_e = 0$ and $p_i = 0$), there are no longer any excluded assets ($q = 0$, m_I and m coincide), and the model boils down to the CAPM.

1.2.1 Taste premia

Two taste premia induced by integrators' tastes arise in equilibrium: a direct taste premium, $p_i c_{I_k}$ and $\frac{p_i}{1-p_e}c_{X_k}$, for investable asset I_k and excluded asset X_k, respectively; an indirect taste premium, $-\frac{p_i p_e}{1-p_e}B_{X_k I}C_I$, for excluded asset X_k.

The direct taste premium is proportional to the cost of externalities: the higher the cost of externalities is, the higher will be the premium to incentivize integrators to acquire the asset under consideration, and vice versa when the cost of externalities is low. This finding is in line with the literature on differences of opinion[17] in which the assets' expected returns increase (or decrease) when a group of investors is pessimistic (or optimistic). It is also consistent with Pastor et al. (2020) who show that brown and green assets have positive and negative alphas, respectively. The direct taste premium also increases with the proportion of integrators, p_i, as shown by Fama and French (2007) and Gollier and Pouget (2014). Specifically, for excluded stocks, the direct taste premium also increases with the proportion of excluders, p_e.

The indirect taste premium is a hedging effect induced by integrators: as they underweight investable assets with a high cost of externalities, integrators hedge by overweighting the excluded assets that are most correlated with the investable assets having a high cost of externalities. Therefore, the indirect taste premium is a cross effect of investable assets on excluded asset returns. Here, this cross-effect only arises on excluded asset returns because the expected returns are expressed with respect to the expected returns on the investable market.[18]

Finally, by internalizing externalities on investable assets, integrators simultaneously adjust

[17] See, in particular, Jouini and Napp (2007) and Atmaz and Basak (2018).

[18] A cross effect of integrators' tastes for excluded assets on investable asset returns also arises in equilibrium when investable asset returns are expressed with respect to the market returns, r_m (see the proof of Proposition 2).

their total exposure to the investable market and impact the market premium through c_{m_I}. When they internalize a positive global cost of externalities ($c_{m_I} > 0$), they underweight the investable market and the market premium is negatively adjusted. The opposite effect applies when the global cost of externalities is negative. This effect does not arise in Pastor et al. (2020) because the authors assume that $c_{m_I} = 0$. Therefore, focusing on asset I_k, which has no indirect taste premium, the total *taste effect* caused by integrators' tastes is a relative effect:

$$\text{Taste effect for investable asset } I_k = \underbrace{p_i c_{I_k}}_{\text{Direct taste premium}} - \underbrace{\beta_{I_k m_I} p_i c_{m_I}}_{\text{Market effect}}.$$

Consequently, although the weighted average cost of externalities on the investable market, c_{m_I}, is not necessarily zero, the weighted average taste effect is zero.

1.2.2 Exclusion premia

Two exclusion premia arise in equilibrium on excluded assets' expected excess returns: the exclusion-asset premium, $\gamma \frac{p_e}{1-p_e} q\, \mathbb{C}\text{ov}(r_{X_k}, r_{m_X} | r_I)$, and the exclusion-market premium, $\gamma q\, \mathbb{C}\text{ov}(r_{X_k}, r_{m_X} | r_{m_I})$. As a cross effect, the exclusion-market premium, $\gamma q\, \mathbb{C}\text{ov}(r_{I_k}, r_{m_X} | r_{m_I})$, also arises in equilibrium on investable assets' expected excess returns, while the exclusion-asset premium is zero.

The exclusion-asset premium is the *super risk premium*, as characterized by Errunza and Losq (1985) for excluded assets in partially segmented markets.[19] The exclusion-market premium is the *local segmentation* premium that de Jong and de Roon (2005) identify for investable asset.[20]

As outlined in Corollary 1, the exclusion premia are induced by the joint hedging effect of regular investors and integrators compelled to hold excluded assets and excluders who cannot hold them.

[19] Using different levels of risk aversion, denoting regular investors and integrators' risk aversion by γ_r and the global risk aversion by γ, the exclusion-asset premium is $\left(\frac{\gamma_r}{1-p_e} - \gamma\right) q\, \mathbb{C}\text{ov}(r_k, r_{m_X} | r_I)$. Errunza and Losq (1985) use absolute risk aversions, while relative risk aversions are used in the present model.

[20] I show that both exclusion premia apply to all assets in the market; indeed, $\gamma \frac{p_e}{1-p_e} q\, \mathbb{C}\text{ov}(r_{I_k}, r_{m_X} | r_I) = 0$. However, when the expected returns on investable assets, $\mathbb{E}(r_{I_k})$, are expressed with respect to the expected market returns, $\mathbb{E}(r_m)$, the exclusion-asset premium is not zero (see the proof of Proposition 2).

Corollary 1 (Breakdown of the exclusion premia).

The exclusion premia can be expressed as the difference between a non-excluder effect and an excluder effect:

$$\gamma\frac{p_e}{1-p_e}q\,\mathbb{C}\mathrm{ov}(r_k, r_{m_X}|r_I) = \underbrace{\gamma\tfrac{p_e}{1-p_e}q\,\mathbb{C}\mathrm{ov}(r_k, r_{m_X})}_{\textit{Non-excluder effect}} - \underbrace{\gamma\tfrac{p_e}{1-p_e}q\,\mathbb{C}\mathrm{ov}\left(\mathbb{E}(r_k|r_I), \mathbb{E}(r_{m_X}|r_I)\right)}_{\textit{Excluder effect}}, \tag{7}$$

$$\gamma q\,\mathbb{C}\mathrm{ov}(r_k, r_{m_X}|r_{m_I}) = \underbrace{\gamma q\,\mathbb{C}\mathrm{ov}(r_k, r_{m_X})}_{\textit{Non-excluder effect}} - \underbrace{\gamma q\,\mathbb{C}\mathrm{ov}(\mathbb{E}(r_k|r_{m_I}), \mathbb{E}(r_{m_X}|r_{m_I}))}_{\textit{Excluder effect}}. \tag{8}$$

The former effect is induced by regular investors' and integrators' need for diversification: since they are compelled to hold the excluded market portfolio, they value most highly the assets that are the least correlated with this portfolio. The latter effect is related to the hedging need of excluders, who cannot hold excluded assets. As the second-best solution, they seek to purchase from regular investors and integrators the hedging portfolios most correlated with the excluded market and built from investable assets, with returns of $\mathbb{E}(r_{m_X}|r_I)$, and from the investable market portfolio, with returns of $\mathbb{E}(r_{m_X}|r_{m_I})$. As a result, excluders value most highly the hedging portfolios of asset k if they are highly correlated with the hedging portfolios of the excluded market.

The exclusion-asset premium is a generalized form of Merton (1987)'s premium on neglected stocks. Proposition 2 characterizes this by expressing the expected excess returns on excluded assets as a function of the market returns, r_m.

Proposition 2 (A generalized form of Merton (1987)'s premium on neglected stocks).
Let $\tilde{\beta}_{X_k m} = \frac{\mathbb{C}\mathrm{ov}(r_{X_k}, r_{m_I})}{\mathbb{C}\mathrm{ov}(r_m, r_{m_I})}$. When the expected excess returns on X_k are expressed with respect to those on the market portfolio, the exclusion-asset premium is

$$\gamma\frac{p_e}{1-p_e}q\,\mathbb{C}\mathrm{ov}(r_{X_k} - \tilde{\beta}_{X_k m} q r_{m_X}, r_{m_X}|r_I), \tag{9}$$

and is a generalized form of Merton (1987)'s premium on neglected stocks.

Therefore, the generalized form of Merton (1987)'s premium on neglected stocks is equal to $\gamma\frac{p_e}{1-p_e}q\,\mathbb{C}\mathrm{ov}(r_{X_k}, r_{m_X}|r_I)$, which is adjusted by factor $-\gamma\frac{p_e}{1-p_e}\tilde{\beta}_{X_k m}q^2\,\mathbb{V}\mathrm{ar}(r_{m_X}|r_I)$ to express the expected excess returns on excluded assets with respect to those on the market.

Hong and Kacperczyk (2009) and Chava (2014) empirically show that sin stocks have higher expected returns than otherwise comparable stocks. Although this finding is true on average, it is not always true for individual stocks (see Proposition 3).

Proposition 3 (Sign of the exclusion premia)**.**

(i) The exclusion premia on an excluded asset are not necessarily positive.

(ii) The exclusion premia on the excluded market portfolio are always positive or zero and equal to

$$\gamma q \, \mathbb{V}\mathrm{ar}(r_{m_X}) \left(\frac{p_e}{1 - p_e}(1 - \rho_{m_X I}) + (1 - \rho_{m_X m_I}) \right). \tag{10}$$

When an excluded asset is sufficiently decorrelated from the excluded market, the exclusion premia are likely to be negative.[21] In this case, regular investors and integrators are strongly incentivized to diversify their risk exposure by purchasing the excluded asset. However, although the exclusion effect on individual assets is not necessarily positive, the value-weighted average exclusion effect is always positive or zero.

2 Empirical analysis applied to sin stock exclusion and green investing: The identification strategy

I estimate the proposed model, treating sin stocks as excluded assets and applying the ESG integration process through the integrators' tastes for green firms. In this section, I describe the data used, the instrument developed for approximating integrators' tastes, and the identification method.

[21] Precisely, when the correlation of an excluded asset with the excluded market is lower than that of their replicating portfolios using investable assets, the exclusion premia are negative.

2.1 Data and instrument design

2.1.1 Sin stocks as excluded assets

Although the practice of exclusionary screening has previously targeted other objectives, such as the boycott of the South African state during the apartheid regime (Teoh, Ivo, and Paul, 1999), it is now mainly applied to sin stocks. However, there is no consensus on the scope of the sin industries to be excluded. Luo and Balvers (2017) provide a summary of the sin industries analyzed in the existing literature. The tobacco, alcohol, and gaming industries are always regarded as sin industries. Several authors include the defense industry, but Hong and Kacperczyk (2009) exclude it from U.S. data, noting that not all U.S. investors regard it as a controversial industry. Some studies also include the pornography and coal industries as sin stocks. I conduct an analysis on U.S. stocks and follow Hong and Kacperczyk (2009) by focusing on the *triumvirate of sins*, consisting of the tobacco, alcohol, and gaming industries. I check the validity of the results by performing a robustness test including the defense industry.

I start from all the common stocks (share type codes 10 and 11) listed on the New York Stock Exchange (NYSE), American Stock Exchange (AMEX), and National Association of Securities Dealers Automated Quotations exchange (NASDAQ; exchange codes 1, 2, and 3) in the CRSP database. I use the Standard Industrial Classification (SIC) to identify 48 different industries. The alcohol (SIC 4), tobacco (SIC 5), and defense (SIC 26) industries are directly identifiable from this classification. Since the classification does not distinguish gaming companies from those in the hotel and entertainment industries, in line with Hong and Kacperczyk (2009), I define a 49th industrial category consisting of gaming based on the North American Industry Classification System (NAICS). Gaming companies have the following NAICS codes: 7132, 71312, 713210, 71329, 713290, 72112, and 721120. Therefore, out of the 49 industries, I focus on the three sin industries of alcohol, tobacco, and gaming, which accounted for 52 stocks between December 31, 2007 and December 31, 2019. Over this period, the number of companies decreased and the market capitalization of all sin companies increased (Table 1).

I perform the empirical analysis from December 2007 because the data available on investors' tastes for green firms are too scarce to perform a sufficiently robust analysis before this date (see subsection 2.1.2). However, I carry out a robustness check between December 1999 and December 2019 on the model without heterogeneous preferences, that is, reduced to a single group of sustainable investors practicing exclusion.

[Table 1 about here]

2.1.2 Integrators' tastes for green firms

I apply integrators' preferences to their taste for the stocks of green firms. Climate change, which is the main selection factor for green investment, is the first ESG criterion considered by asset managers (US SIF, 2018); the assets to which this criterion is applied doubled between 2016 and 2018 in the United States, reaching USD 3 trillion.

Many empirical studies have investigated the effects of a company's environmental performance on its stocks' excess returns. However, the results differ significantly for at least three main reasons. First, this heterogeneity lies in the fact that identifying the environmental performance of a company through a particular environmental metric weakly proxies for sustainable investors' tastes for green firms. Indeed, several dozen environmental impact metrics are offered by various data providers, covering a wide range of themes, methods, and analytical scopes. These metrics lack a common definition and show low commensurability (Chatterji et al., 2016).[22] For instance, Gibson et al. (2020) show that the average correlation between the environmental impact metrics of six major ESG data providers was 42.9% between 2013 and 2017. Each available metric reflects specific information, and the average taste of all sustainable investors for green firms can hardly be captured by a single metric. Moreover, these metrics are generally only available on an annual basis and are liable to have several limitations, such as oversimplifying information (Mattingly and Berman, 2006) and providing low prospective content (Chatterji, Levine, and Toffel, 2009). The second reason for the heterogeneity of the results in the empirical studies is that these papers fail to capture the

[22]These metrics cover different environmental themes, such as greenhouse gas emissions, air quality, water management, waste treatment, impact on biodiversity, and thematic and global environmental ratings (e.g., KLD ratings). Even for greenhouse gas emissions, various metrics are available: carbon intensity, two-degree alignment, avoided emissions, green share, and emission scores, among others. Additionally, data providers often have their own methods of calculation and analysis scopes. The calculation is further complicated by the inconsistency of the data reported by companies, as well as by the differences in the treatment of data gaps and the benchmarking options chosen by data providers (Kotsantonis and Serafeim, 2019).

increase in the proportion of green investors and, thus, the growing impact of their tastes over time. The third reason is raised by Pastor et al. (2020): by proxying expected returns by realized returns, these papers omit to control the effect of the unexpected shifts in tastes on realized returns. If the proportion of green investors or their tastes for green companies unexpectedly increase, green assets may outperform brown assets while the former have a lower direct taste premium than the latter.

Therefore, I construct a proxy for the tastes of green investors that allows me to address the three issues raised. I circumvent the first two issues by approximating the shifts in tastes of green investors from a qualitative and quantitative point of view: I approximate both the cost of environmental externalities defined in the model, c_k, and green investors' wealth share, p_i, by using green fund holdings. Such a proxy for the direct taste premium allows me to address the third issue by constructing a proxy for the unexpected shifts in green investors' tastes (see Subsection 3.4).

Proxy for the cost of environmental externalities. In Proposition 4, we focus on investable assets and give a first order approximation of the cost of externalities.

Proposition 4 (Proxy for the cost of externalities)**.**
Let us denote integrators' optimal weight of I_k by w^*_{i,I_k} and the market weight of I_k by w_{m,I_k}. Let us assume that (i) integrators do not account for the correlations among assets when internalizing the cost of externalities of asset I_k, (ii) the share of integrators' wealth, p_i, is small, and (iii) the direct taste premium, $p_i c_{I_k}$, is small compared to the expected return, $\mathbb{E}(r_{I_k})$. The cost of environmental externalities, c_{I_k}, is approximated as

$$c_{I_k} \simeq \frac{w_{m,I_k} - w^*_{i,I_k}}{w_{m,I_k}} \mathbb{E}(r_{I_k}). \tag{11}$$

First, assuming that integrators account for the correlations between assets in estimating the cost of environmental externalities of a specific asset is pretty strong in practice; therefore, assumption (i) seems fairly plausible. Second, the share of wealth of all sustainable investors in the U.S. reached 25% in 2018; therefore, assumption (ii) focusing only on green investors between 2007 and 2019 is realistic. Finally, assumption (iii) seems also realistic as illustrated by the following example: assuming that the cost of environmental externalities internalized by green investors accounts for 10% of the expected return and that the share of green investors' wealth is 10%, $p_i c_{I_k}$ is 100 times lower than $\mathbb{E}(r_{I_k})$.

Therefore, I exclude the expected return, $\mathbb{E}(r_{I_k})$, in the approximation of Proposition 4 to avoid endogeneity bias, and I define the proxy for the cost of externalities of asset I_k, $\tilde{c}_{I_k}$, as

$$\tilde{c}_{I_k} = \frac{w_{m,I_k} - w^*_{i,I_k}}{w_{m,I_k}}. \tag{12}$$

The more integrators underweight I_k with respect to market weights, the higher $\tilde{c}_{I_k}$ is, and vice versa when they overweight I_k.

I compute the microfounded proxy, $\tilde{c}_{I_k}$, by using the holding history of all the listed green funds investing in U.S. equities. Specifically, among all funds listed by Bloomberg on December 2019, I select the 453 funds whose asset management mandate includes environmental guidelines ("environmentally friendly," "climate change," and "clean energy"), of which the investment asset classes are defined as "equity," "mixed allocation," and "alternative,"[23] with the geographical investment scope including the United States.[24] I retrieve the entire asset holding history of each of these funds on a quarterly basis (March, June, September, and December) via the data provider FactSet. The number of green funds exceeded 100 in 2010 and reached 200 in 2018. I aggregate the holdings of all green funds on a quarterly basis and focus on the U.S. stock investment universe in CRSP (referred to as the *US allocation*). Given the large number of stocks and the high sensitivity of $\tilde{c}_{I_k}$ when w_{m,I_k} is close to zero, I perform the analysis on industry-sorted portfolios. The investable market consists of 46 industries corresponding to the 49 industries from which the three sin industries have been removed. For every quarter t, I calculate the weight of each industry I_k in the U.S. allocation of the aggregated green fund to estimate w^*_{i,I_k} at date t. I estimate w_{m,I_k} as the weight of industry I_k in the investment universe. I construct instrument $\tilde{c}_{I_k}$ by substituting the estimates of w^*_{i,I_k} and w_{m,I_k} in equation (12). I then extend the value of the instrument over the next two months of the year in which no holding data are available. However, I do not approximate the cost of

[23] The last two categories include diversified funds that also invest in equities.

[24] The geographical areas selected are "Global," "International," "Multi," "North American Region," "Organisation for Economic Co-operation and Development countries," and "the U.S." (see the Online Appendix).

environmental externalities of the 52 sin stocks, c_{X_k}, because of the low number of sin stocks held by the 453 green funds.

This agnostic instrument proxies the revealed tastes of *green investors* by comparing green funds' asset allocations with the asset weights in the investment universe. It offers the dual advantage of covering a large share of the assets in the market (46% of the stocks at the end of 2019) and being constructed from a minimal fraction of the AUM (green funds' AUM accounted for only 0.12% of the market capitalization of the investment universe at the end of 2019).[25] Therefore, by using instrument $\tilde{c}_{I_k}$, I implicitly assume that all green investors have fairly similar tastes to those revealed by the aggregated 453 green funds, and I test this assumption by estimating the asset pricing model.[26]

In line with the gradual development of green investing during the 2000s and concomitantly with the enforcement of the U.S. Securities and Exchange Commission's (SEC's) February 2004 amendment requiring U.S. funds to disclose their holdings on a quarterly basis, the number of green funds reporting their holdings exceeded 50 as of 2007. Therefore, to construct sufficiently robust proxies for the taste premia, I start the analysis from December 2007. Table 2 summarizes the proxy for the cost of environmental externalities and the excess returns for the various investable industries in descending order of average cost, $\tilde{c}_{I_k}$, between December 2007 and December 2019.

[Table 2 about here]

This ranking shows that the industries least held by green funds include fossil energies (coal, petroleum, and natural gas), highly polluting manufacturing industries (defense, and printing and publishing), polluting transportation (aircraft and shipping containers), and mining (non-metallic and industrial mining and precious metals). However, to be able to overweight the least polluting companies, green investors not only underweight the most polluting companies, but also some of

[25]The AUMs of the 453 green funds account for only 0.12% of the total market capitalization of the investment universe for two main reasons: most green investments are made through the proprietary funds of institutional investors (pension funds, life insurers, etc.) rather than via open-ended funds; not all green funds worldwide are necessarily listed in Bloomberg and FactSet.

[26]Given that the list of green funds is not historically available, I acknowledge that the proposed instrument may introduce survivorship bias. However, given the massive and steady increase in green investments, the net creation of green funds can be assumed to be positive over the period. As a result, the number of closed green funds should be limited compared to the number of green funds still in operation. Additionally, it can be assumed that the average tastes of the closed funds do not differ significantly from the average tastes of the funds still in operation.

the largest market capitalizations. Particularly, they substantially underweight the largest companies in the investment universe, which belong to the entertainment (e.g., Time Warner and Walt Disney), retail (e.g., Walmart), communication (e.g., Verizon and CBS), banking (e.g., JP Morgan, Wells Fargo, and Citigroup), and insurance (e.g., Berkshire Hathaway, United Health, and AIG) industries. This is the reason these specific industries are at the top of the ranking in Table 2.

Proxy for the proportion of green integrators' wealth. To capture the shifts in tastes from a quantitative point of view, I construct a proxy for the proportion of green integrators' wealth, p_i. I estimate the proportion of assets managed following environmental guidelines as the market value of the 453 green funds divided by the market value of the investment universe at each considered date. The instrument is denoted by $\tilde{p}_i$ and defined as:

$$\tilde{p}_{i,t} = \frac{\text{Market value of green funds in } t}{\text{Total market capitalization in } t}. \tag{13}$$

Between December 2007 and December 2019, $\tilde{p}_i$ increased from 0.02% to 0.12% (see the Online Appendix).

Some of the green funds under consideration may also implement social (S) and governance (G) screens. Therefore, it should be noted that proxies $\tilde{c}$ and $\tilde{p}_i$ potentially include a limited bias towards S and G factors. However, this does not hamper the present analysis as the objective is to identify the impact of green integrators' tastes—rather than green screening exclusively—on asset returns.

2.2 Empirical method

I conduct the estimations based on the equations in Proposition 1 being applied to sin stocks for excluded assets and green investors' tastes—through $\tilde{c}_{I_k}$ and $\tilde{p}_i$—to reflect integrators' preferences. I assume that the cost of externalities is proportional to its proxy: $c_{I_k} = \kappa_c \tilde{c}_{I_k}$ and $C = \kappa_c \tilde{C}$ ($\kappa_c \in \mathbb{R}_+$) for investable stock I_k and the vector of investable stocks, I, respectively. Similarly, I assume that the share of integrators' wealth is proportional to its proxy: $p_i = \kappa_p \tilde{p}_i$ ($\kappa_p \in \mathbb{R}_+$).

Investable asset specification. For each investable asset I_k ($k \in \{1, ..., n_I\}$), equation (2) is written as:

$$\mathbb{E}(r_{I_k}) = (\mathbb{E}(r_{m_I}) - p_i c_{m_I})\beta_{I_k m_I} + \kappa_p \kappa_c \tilde{p}_i \tilde{c}_{I_k} + \gamma q \, \mathbb{C}\mathrm{ov}(r_{I_k}, r_{m_X} | r_{m_I}). \tag{14}$$

The three independent variables are the beta coefficient, $\beta_{I_k m_I}$, the proxy for the *direct taste factor*, $\tilde{p}_i \tilde{c}_{I_k}$, and the *exclusion-market factor*, $q \, \mathbb{C}\mathrm{ov}(r_{I_k}, r_{m_X} | r_{m_I})$. As shown in the correlation matrix reported in the Online Appendix, the correlations between all factors are low.

Excluded asset specification. For each excluded asset X_k ($k \in \{1, ..., n_X\}$), equation (3) is written as:

$$\begin{aligned}\mathbb{E}(r_{X_k}) = (\mathbb{E}(r_{m_I}) - p_i c_{m_I})\, \beta_{X_k m_I} - \frac{p_e}{1-p_e} \kappa_p \kappa_c \tilde{p}_i B_{X_k I} \tilde{C}_I \\ + \gamma \frac{p_e}{1-p_e} q \, \mathbb{C}\mathrm{ov}(r_{X_k}, r_{m_X} | r_I) + \gamma q \, \mathbb{C}\mathrm{ov}(r_{X_k}, r_{m_X} | r_{m_I}).\end{aligned} \tag{15}$$

The four independent variables of the estimation are the beta coefficient, $\beta_{X_k m_I}$, the proxy for the *indirect taste factor*, $\tilde{p}_i B_{X_k I} \tilde{C}_I$, the *exclusion-asset factor*, $q \, \mathbb{C}\mathrm{ov}(r_{X_k}, r_{m_X} | r_I)$, and the *exclusion-market factor*,[27] $q \, \mathbb{C}\mathrm{ov}(r_{X_k}, r_{m_X} | r_{m_I})$. It is worth noting two points regarding this specification. First, I do not proxy the proportion of excluders' wealth, p_e, because the funds that exclude sin stocks are not directly identifiable; furthermore, unlike green investment, sin stock exclusion is one of the oldest sustainable investment practices and is therefore likely to have grown at a moderate pace over the period studied. However, I perform a robustness check by using $\tilde{p}_i$ as a proxy for p_e. Second, I do not include the direct taste factor, c_{X_k}, because its proxy cannot be estimated for a sufficiently large number of stocks. However, the significance of the direct taste premium is already tested for investable assets, which constitute 99% of the investment universe. In the above specification, the correlations between all factors are low.

[27] The exclusion-asset and exclusion-market factors expressed as conditional covariances are easily computable from stacked excess returns as Schur complements in vector form (see Lemma 1 in the Appendix). I estimate the inverse of the investable asset covariance matrix by assuming that returns follow a one-factor model (Ledoit and Wolf, 2003).

Estimation method. I estimate specifications (14) and (15) by performing a two-stage cross-sectional regression (Fama and MacBeth, 1973). To account for conditional heteroskedasticity and serial correlation, the standard errors are adjusted in line with Newey and West (1987). Investable assets account for 5,660 stocks, and there are 52 sin stocks between December 2007 and December 2019. The estimates on the former are conducted on industry portfolios, while those on the latter are conducted on individual stocks. For investable assets, I take the value-weighted returns on the industry portfolios. All returns are in excess of the 1-month Treasury Bill (T-bill) rate. In the first pass, I compute the dependent and independent variables over a 3-year rolling period at monthly intervals, which yields a time series of 109 dates for each variable per stock (or portfolio).[28] Robustness tests are performed by repeating the analysis over a 5-year rolling period. In the second pass, I run the 109 cross-sectional regressions of the n_I and n_X dependent variables for portfolios I and stocks X, respectively, on a constant and the independent variables. The estimated loadings are equal to the average over the 109 dates. To evaluate and compare the models, I report the OLS adjusted-R^2 of the cross-sectional regressions. As suggested by Kandel and Stambaugh (1995) and Lewellen, Nagel, and Shanken (2010), I also report the GLS R^2 as an alternative measure of model fit because it is determined by the factor's proximity to the minimum-variance boundary.

To check for the robustness of the estimated effects and to benchmark the model, I also include the betas of the SMB, HML (Fama and French, 1992), and MOM (Carhart, 1997) factors with respect to the investable market in the estimations. The three factors are downloaded from Kenneth French's website.[29] Table 3 presents descriptive statistics on the dependent and independent variables.

[Table 3 about here]

The mean of the proxy for the direct taste factor, $\tilde{p}_i\tilde{C}_I$, is -2×10^{-4} and its median is 10^{-5}. The instrument reaches a maximum of 10^{-3} and the minimum is -7×10^{-3}. The exclusion factors are evenly distributed around a mean close to zero.

[28] The betas are estimated as univariate betas.

[29] The website address is `https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html`.

3 Stock returns with tastes for green firms

In this section, I empirically assess the effect of sustainable investors' tastes for green firms and that of their exclusion of sin stocks on investable stock excess returns. The direct taste premium significantly impacts excess returns. I find weak evidence supporting the effect of sin stock exclusion on investable stock returns.

3.1 Main estimation

I estimate the following three models. (i) The *S-CAPM* corresponds to equation (14):

$$\mathbb{E}(r_{I_k}) = \alpha + \delta_{mkt}\beta_{I_k m_I} + \delta_{taste}\tilde{p}_i\tilde{c}_{I_k} + \delta_{ex.mkt}q\,\mathbb{C}\mathrm{ov}(r_{I_k}, r_{m_X}|r_{m_I}); \quad (16)$$

(ii) the *four-factor S-CAPM* (denoted as *4F S-CAPM*) corresponds to the S-CAPM specification to which the SMB, HML, and MOM betas are added; and (iii) for benchmarking purposes, the *four-factor model* (denoted as *4F model*) corresponds to the CAPM specification with respect to the investable market returns to which the SMB, HML, and MOM betas are added.

Table 4 reports the estimates of the three specifications using industry-sorted portfolios between December 31, 2007 and December 31, 2019. Consistent with the model predictions, the direct taste premium is significant (t-statistic of 2.07) and its loading is positive ($\hat{\delta}_{taste} = 0.17$). When the SMB, HML, and MOM factors are included, this premium becomes highly significant (t-statistic of 5.55) and the loading increases to 0.49. The *annual* average market effect is $-\hat{\delta}_{taste}\tilde{p}_i\tilde{c}_{m_I} = 0.25$ basis point (bp).[30] Therefore, the market effect is negligible, and the taste effect is almost exclusively driven by the direct taste premium.

Although the exclusion-market premium—related to the indirect effect of the 52 excluded sin stocks on the 5,660 investable stocks—is positive and significant when considered individually, it is not significant in the S-CAPM specification.

[Table 4 about here]

[30] The proxies for the value-weighted average cost of externalities and the taste factor of the investable market, $\tilde{c}_{m_I}$ and $\tilde{p}_i\tilde{c}_{m_I}$, are −55 bps and −0.12 bps, respectively, over the period.

For each industry, Table 5 provides the average annual taste effect estimates using the main model. Compared to the industry ranking in Table 2 that only takes into account proxy $\tilde{c}_{I_k}$, Table 5 provides a ranking according to the taste effect, $\widehat{\delta}_{taste}\tilde{p}_i\tilde{c}_{I_k} + \widehat{\delta}_{taste}\tilde{p}_i\tilde{c}_{m_I}\beta_{I_k m_I}$, that includes the market effect, $\widehat{\delta}_{taste}\tilde{p}_i\tilde{c}_{m_I}\beta_{I_k m_I}$. The rankings differ because $\beta_{I_k m_I}$ is not sorted as $\tilde{c}_{I_k}$.

[Table 5 about here]

The taste effect ranges from -1.12% to +0.14% for the different industries. Specifically, the return differential between industries differently impacted by the ecological transition is substantial. For example, green investors induce additional annual returns of 0.50% for the petroleum and natural gas industry compared to the electrical equipment industry.

3.2 Alternative estimations

I conduct alternative estimations, the results of which are available in the Online Appendix. First, the estimate of the direct taste premium is robust to a first-pass regression using a 5-year rolling window, and its significance increases. Second, when using equally weighted returns, the direct taste premium is not significant, but the exclusion-market premium becomes significant and positive as predicted by the model. Third, I repeat the estimation using a set of 230 (= 46 × 5) industry-size portfolios double-sorted by industries and market capitalization quintiles. The direct taste premium is significant and consistent with the estimation using industry portfolios.

3.3 Reverse causality bias

The first concern is the risk of reverse causality bias through instrument $\tilde{c}$. In other words, is δ_{taste} significant because the return on industry I_k affects the relative weight differential between the market and integrators' asset allocation in this industry, $\frac{w_{m,I_k} - w^*_{i,I_k}}{w_{m,I_k}}$? I address this issue from theorical and empirical viewpoints. From a theoretical viewpoint, according to the model, investors rebalance their allocation at each period to adjust their asset weights to the optimal level. Therefore, the microfounded instrument should not depend on the current and past returns. However, it is likely that the effective asset weights do not necessarily correspond to the optimal weights predicted by the theory. Consequently, since the industry weights of green investors and those of the market vary slowly over time, I repeat the regression using proxy $\tilde{c}$ delayed by 3 years to ensure that the returns estimated in the first pass of the Fama MacBeth regression do not affect the instrument retroactively. The direct taste premium is highly significant (t-statistics of 3.09) and positive ($\hat{\delta}_{taste} = 0.47$). The estimate is robust to the inclusion of the SMB, HML, and MOM factors. Although the loading is higher than that of the main model, this estimation supports the significant effect of the direct taste premium on investable asset returns. The results are reported in the Online Appendix.

3.4 Unexpected shifts in tastes

As pointed out by Pastor et al. (2020), proxying the expected returns by the realized returns induces a critical omitted variable bias: the unexpected shifts in tastes between $t-1$ and t also affect the realized returns in t. As a consequence, when the tastes for green companies increase over a period, a green asset can have a negative direct taste premium and yet outperform brown assets. This effect can arise from both a shift in green investors' tastes (qualitative effect) and an increase in the share of their wealth (quantitative effect). The lack of consideration of the unexpected (qualitative and quantitative) shifts in tastes may partly explain why the results of the empirical analyses on the link between ESG and financial performance are mixed. Pastor et al. (2020) suggest using the in- and out-flows of ESG-tilted funds to proxy for this effect. The analysis of green fund holdings thus offers a dual advantage: (i) constructing a proxy for the unexpected shifts in green investors' tastes at a monthly frequency that is (ii) homogeneous with the proxy for the direct taste premium. Therefore, I define the proxy for the unexpected shifts in green investors' tastes for asset I_k between $t-1$ and t as the variation of the direct taste factor between these two dates:

$$\Delta \tilde{p}_{i,t} \tilde{c}_{I_k,t} = \tilde{p}_{i,t} \tilde{c}_{I_k,t} - \tilde{p}_{i,t-1} \tilde{c}_{I_k,t-1}, \tag{17}$$

and I perform a robustness check on the following augmented specification:

$$\mathbb{E}(r_{I_k}) = \alpha + \delta_{mkt} \beta_{I_k m_I} + \delta_{taste} \tilde{p}_i \tilde{c}_{I_k} + \delta_u \Delta \tilde{p}_i \tilde{c}_{I_k} + \delta_{ex.mkt} q \, \mathbb{C}\mathrm{ov}(r_{I_k}, r_{m_X} | r_{m_I}). \tag{18}$$

Table 6, Panel A, reports the estimates for all industries. Although the direct taste premium is not significant in the augmented S-CAPM, it becomes significant when controlling for the SMB, HML and MOM factors (referred to as the *augmented 4F S-CAPM* hereinafter). Its loading is in line with that estimated in the main specification. However, two industries have experienced massive divestments by green investors since 2012: the relative weights of the coal and construction industries in the portfolios of green investors relative to the market weights, $\tilde{c}$, have dropped from -48% to -93% and from +330% to +43%, respectively, between December 2012 and December 2019. Therefore, I repeat the estimation by removing these outliers. Panel B presents the estimates for all industries except coal. The direct taste premium is significant in the absence of the exclusion-market premium and remains significant for the augmented 4F S-CAPM. The estimates are in line with those of the main estimation. Panel C presents the estimates for all industries except coal and construction. The direct taste premium is highly significant for the augmented S-CAPM and the augmented 4F S-CAPM. The loading is twice as high for the augmented S-CAPM than for the S-CAPM but is similar for the augmented 4F S-CAPM and the 4F S-CAPM. In addition, the premium for the unexpected shifts in tastes becomes significant and, as expected, its effect is negative: an increase in the taste factor (e.g., the cost of environmental externalities increases) leads to a drop in the short-term returns. Finally, under the augmented S-CAPM, when the coal or the coal and construction industries are removed, the exclusion-market premium is weakly significant and positive as predicted by the model.

[Table 6 about here]

3.5 Taste effect over time

I analyze the dynamics of the direct taste premium by repeating the estimation over several sub-periods. Given the violent effect induced by the divestment from the coal industry between 2012 and 2019 and the short periods over which theses estimations are carried out, the latter are performed on all industries except coal in this subsection.

First, I repeat the estimation over three consecutive sub-periods between 2007 and 2019 (Table 6 in the Appendix). The significance of the direct taste premium increases over time to reach a t-statistic of 7.27 between 2013 and 2019.[31] In addition, although the average direct taste premium is constant over time, the difference in direct taste premium between the brown and green industries increases over time; this spread between the petroleum and natural gas industry and the electrical equipment industry increased from 50 bps between 2007 and 2013 to 1.23% between 2013 and 2019 (Table 7).[32]

[Table 7 about here]

Second, I repeat the estimation over 3-year rolling periods for the second pass. The dynamics depicted in Figure 2 show the steady increase in the taste effect spread between the petroleum and natural gas and electrical equipment industries.

[Figure 2 about here]

3.6 Measurement error bias

A measurement error in the proxy for the cost of environmental externalities reduces the estimate (because it is positive) as well as the t-statistics. Therefore, if the proxy is poor, the taste effect may appear weaker and less significant than it actually is. Consequently, to address the risk of measurement error, I compare the significance of the estimate to that where the cost of environmental externalities is approximated by the carbon intensity of the issuer, which is the environmental metric most used by green investors in their screening process (Krüger et al., 2020). To do so, I consider two approaches, the results of which are available in the Online Appendix.

First, I estimate the S-CAPM with industry portfolios using the carbon intensity of asset I_k as a proxy for c_{I_k}. Since this metric is reported annually, I consider it from the month following the month of the company's financial close and extend it over the following 12 months. Although the direct taste premium is negative and significant for the S-CAPM without controls, it is no longer significant once the SMB, HML and MOM betas are added. In the second approach, I analyze the alpha of the S-CAPM without taste premium by considering industry portfolios consisting of long

[31] Over this 6-year period, the first pass is carried out during the first 3 years and the second pass during the last 3 years.

[32] The taste effect is higher when the coal industry is removed compared to the entire period in the main estimation.

brown assets and short green assets. Specifically, I build portfolios that are long for the 20% most carbon-intensive assets and short for the 20% least carbon-intensive assets within each of the 46 industries. With or without the SMB, HML, and MOM betas, the alpha of the estimate is positive, but not significant.

Therefore, the use of carbon intensity does not allow us to identify a significant direct taste premium on 5,660 U.S. stocks between 2007 and 2019. These results suggest that the instrument constructed in this study using green fund holdings mitigates the measurement error compared to the metric most used by green investors in their environmental screening process.

4 Sin stock returns

I perform an empirical analysis to assess the effect of sustainable investors' exclusion of sin stocks and that of their tastes for green firms on sin stocks' excess returns. The exclusion premia significantly impact the excess returns. I also find evidence supporting the cross-effect of green tastes on sin stock returns via the indirect taste premium. Focusing on the exclusion effect, I analyze its dynamics and the spillover effects that contribute to it.

4.1 Main estimation

I estimate the following three models. (i) The *S-CAPM* corresponds to equation (15):

$$\begin{aligned}\mathbb{E}(r_{X_k}) = \alpha + \delta_{mkt}\beta_{X_k m_I} + \delta_{taste}\tilde{p}_i B_{X_k I}\tilde{C}_I \\ + \delta_{ex.asset} q\,\mathbb{C}\mathrm{ov}(r_{X_k}, r_{m_X}|r_I) + \delta_{ex.mkt} q\,\mathbb{C}\mathrm{ov}(r_{X_k}, r_{m_X}|r_{m_I});\end{aligned} \tag{19}$$

(ii) the *four-factor S-CAPM* (denoted as *4F S-CAPM*) corresponds to the S-CAPM specification to which the SMB, HML, and MOM betas are added; and (iii) for benchmarking purposes, the *four-factor model* (denoted as *4F model*) corresponds to the CAPM with respect to the investable market returns to which the SMB, HML, and MOM betas are added.

I work with 52 sin stocks during the period of interest, for an annual mean number of 40 stocks.[33] Given the substantial noise that occurs when performing regressions on a small number

[33] In the robustness check that includes the defense industry, I work with 67 sin stocks, giving an annual mean

of individual stocks, especially when several of them have extreme return variations, I winsorize the data by removing the lowest and highest excess returns in each cross-sectional regression.

Table 8 reports the estimates of the three specifications for sin stocks using industry-sorted portfolios of investable assets. The OLS adjusted-R^2 of 24% and GLS R^2 of 30% are much higher under the S-CAPM than under the 4F model (10% and 16%, respectively).

The estimation of the exclusion premia supports the model predictions. First, the loadings of the exclusion-asset and exclusion-market factors are positive ($\widehat{\delta}_{ex.asset} = 49$ and $\widehat{\delta}_{ex.index} = 196.9$, respectively) and significant (t-statistics of 2.32 and 3.88, respectively). Second, the indirect taste premium is negative ($\widehat{\delta}_{taste} = -0.41$) and significant (t-statistics of -2.14). The estimates are robust to the inclusion of the SMB, HML, and MOM factors.

[Table 8 about here]

The exclusion effect, which is the sum of the exclusion-asset and exclusion-market premia, is estimated at 1.43% per year for the 2007–2019 period. This effect is of a similar magnitude as the one estimated on U.S. sin stocks by Hong and Kacperczyk (2009) between 1965 and 2006 (2.5%). However, it is substantially lower than the annual 16% effect estimated by Luo and Balvers (2017) between 1999 and 2012 and based on the same modeling framework (in the absence of tastes for green firms). Additionally, consistent with Proposition 3, I find that the exclusion effect is positive on average, but it is negative for 10 out of 52 sin stocks (Figure 3). The indirect effect of green investors' taste on sin stock returns is limited to 3 bps per year between 2007 and 2019.

[Figure 3 about here]

Using $\widehat{\gamma\frac{p_e}{1-p_e}} = \widehat{\delta}_{ex.asset}$ and $\widehat{\gamma} = \widehat{\delta}_{ex.mkt}$, the proportion of AUM practicing sin stock exclusion between 2007 and 2019 is estimated at $\hat{p}_e = 20\%$. This estimate should be regarded with caution as it is based on the assumptions of this model, but it gives an order of magnitude that is consistent with the proportion of sustainably managed assets in the U.S. in 2018 (US SIF, 2018).

number of 50 stocks.

4.2 Alternative estimations

I perform additional analyses presented in this subsection and detailed in the Online Appendix. In all robustness tests, the S-CAPM has a higher OLS adjusted-R^2 and GLS R^2 than those of the 4F model. I repeat the estimation in three alternative cases: (i) using a 5-year rolling window for the first pass, (ii) using equally weighted returns, and (iii) including the defense industry among sin industries. In all three cases, the estimates are of a similar magnitude to those in the main estimation but only the exclusion-market premium is significant. The exclusion-asset premium is weak or not significant.

4.3 Exclusion effect over time

I repeat the estimation over three consecutive periods between 2007 and 2019.[34] In each period, at least one of the two exclusion factors is significant. The indirect taste premium becomes negative and significant from 2013 onwards.

I extend the analysis to assess the exclusion effect over a longer time period. I perform this estimation between 1999 and 2019 removing the indirect taste factor, which cannot be estimated with sufficient robustness before 2007. The loadings of the exclusion-asset and exclusion-market factors are still positive ($\widehat{\delta}_{ex.asset} = 92$ and $\widehat{\delta}_{ex.index} = 131.2$, respectively) and significant (t-statistics of 3.99 and 3.49, respectively). The average exclusion effect is 1.16% and 20 out of 77 sin stocks have a negative exclusion effect.

To highlight the dynamics of the exclusion effect, I repeat the second-pass estimation using a 3-year rolling window (i) between 2007 and 2019 based on the S-CAPM (blue line on Figure 4) and (ii) between 1999 and 2019 based on the S-CAPM without the indirect taste factor (dashed black line on Figure 4). The exclusion effect increased sharply during and after the 2008 financial crisis and collapsed by 2010. This effect is not due to a change in the strategy of sustainable investors (e.g., a shift from exclusionary screening to ESG integration) but is related to the multiple correlation in the excluded market as the exclusion premia are conditional covariances between the excluded assets and the excluded market. This can be observed by comparing the dynamics of the exclusion

[34] The second pass starts in 2010 because the variables are computed using a 3-year rolling window in the first pass.

effect with the dynamics of the implied correlation of the S&P500 (see Figure 4). Therefore, the higher the correlation between the sin stocks is, the greater will be the conditional covariances and the exclusion effect.

[Figure 4 about here]

4.4 Dynamics of excluders' wealth

In contrast to the taste factors that take into account the proportion of green investors' wealth, the exclusion-asset factor does not incorporate an approximation of the wealth share of excluders, p_e, in $\frac{p_e}{1-p_e}$. Although the wealth dynamics of investors excluding sin stocks and that of green investors are presumably different, I repeat the estimation by assuming that the proportion of excluders' wealth grows at a pace proportional to that of green investors: $p_e = \kappa_i p_i$. Since the proportion of excluders is small enough, I linearly approximate $\frac{p_e}{1-p_e}$ by assuming that $\frac{p_e}{1-p_e} = \kappa_e p_e$ ($\kappa_e \in \mathbb{R}_+$). Therefore, the new specification has the following form:

$$\begin{aligned}\mathbb{E}(r_{X_k}) = \alpha + \delta_{mkt}\beta_{X_k m_I} + \delta_{taste}\tilde{p}_i^2 B_{X_k I}\tilde{C}_I \\ + \delta_{ex.asset}\tilde{p}_i q\,\mathbb{C}\text{ov}(r_{X_k}, r_{m_X}|r_I) + \delta_{ex.mkt} q\,\mathbb{C}\text{ov}(r_{X_k}, r_{m_X}|r_{m_I}).\end{aligned} \tag{20}$$

The indirect taste factor is quadratic in $\tilde{p}_i$ and the exclusion-asset factor is linear in $\tilde{p}_i$.

Under the S-CAPM, the estimates are in line with those of the main specification: the loadings of the exclusion factors are significant and positive, and the loading of the indirect taste factor is significant and negative (see the Online Appendix). Consistent with the main estimation, the total exclusion effect is 1.49% between 2007 and 2019.

4.5 Spillover effects

In the first section, I broke down the exclusion premia into a non-excluder effect and an excluder effect. Here, I present another form of decomposition of the exclusion premia to highlight the spillover effects of all excluded assets (through r_{m_X}) into the expected excess returns on each excluded asset. These effects underline the point of relaxing the assumption of independence between returns made by Merton (1987).

Corollary 2 (Spillover effects)**.**

Let q_{X_k} be the proportion of the market value of asset X_k as a percentage of the market value of the investment universe.

(i) The spillover effect of asset X_j on the expected excess returns on asset X_k is

$$\gamma \frac{p}{1-p} q_{X_j} \, \mathbb{C}\text{ov}(r_{X_k}, r_{X_j}|r_I) + \gamma q_{X_j} \, \mathbb{C}\text{ov}(r_{X_k}, r_{X_j}|r_{m_I}). \tag{21}$$

(ii) The spillover effects of assets $(X_j)_{j \in \{1,...,n_X\} \setminus \{k\}}$ on the expected excess returns on asset X_k are additive, and the exclusion premia can be broken down into an own effect and a spillover effect:

$$\gamma \frac{p}{1-p} q \, \mathbb{C}\text{ov}(r_{X_k}, r_{m_X}|r_I) + \gamma q \, \mathbb{C}\text{ov}(r_{X_k}, r_{m_X}|r_{m_I}) =$$
$$\underbrace{q_{X_k} \left(\gamma \frac{p_e}{1-p_e} \, \mathbb{V}\text{ar}(r_{X_k}|r_I) + \gamma \, \mathbb{V}\text{ar}(r_{X_k}|r_{m_I}) \right)}_{\text{Own effect}} + \underbrace{\sum_{j=1, j \neq k}^{n_X} q_{X_j} \left(\gamma \frac{p_e}{1-p_e} \, \mathbb{C}\text{ov}(r_{X_k}, r_{X_j}|r_I) + \gamma \, \mathbb{C}\text{ov}(r_{X_k}, r_{X_j}|r_{m_I}) \right)}_{\text{Spillover effect}}. \tag{22}$$

The spillover effect of each excluded stock is induced by its conditional covariances with the other excluded stocks. The following question arises: what is the share of the spillover effect in the total exclusion effect? To address this issue, I define the share of the spillover effect in the exclusion premia as the ratio of the sum of the absolute values of the spillover effect to the sum of the absolute values of the own and spillover effects:

$$\frac{\sum_{j=1, j \neq k}^{n_X} |q_{X_j} \left(\gamma \frac{p_e}{1-p_e} \, \mathbb{C}\text{ov}(r_{X_k}, r_{X_j}|r_I) + \gamma \, \mathbb{C}\text{ov}(r_{X_k}, r_{X_j}|r_{m_I}) \right)|}{\sum_{j=1}^{n_X} |q_{X_j} \left(\gamma \frac{p_e}{1-p_e} \, \mathbb{C}\text{ov}(r_{X_k}, r_{X_j}|r_I) + \gamma \, \mathbb{C}\text{ov}(r_{X_k}, r_{X_j}|r_{m_I}) \right)|}.$$

To estimate this effect, I use the estimates of $\gamma \frac{p_e}{1-p_e}$ and γ from the previous subsection. On average, among the 52 sin stocks of interest, the spillover effect accounts for 92.5% of the exclusion effect. The heatmap in the Online Appendix offers a graphical depiction of the spillover effects.

5 Conclusion

In this paper, I develop an asset pricing model with partial segmentation and heterogeneous preferences to describe the effects of exclusionary screening and ESG integration practices by sustainable investors on expected asset returns. By estimating this model for green investing and sin stock exclusion, I show that the taste and exclusion premia significantly affect asset returns. I also find evidence for the cross effects of tastes and exclusion between investable and excluded stocks.

Whether through exclusionary screening or ESG integration, sustainable investing contributes toward the cost of capital increase of the least ethical or most environmentally risky companies. Both practices are thus effective means of pressure available to sustainable investors to encourage companies to reform. This study provides a comparison between the effects of green investing and sin stock exclusionary screening. The integration of environmental criteria by green investors impacts the different industries with an annual premium ranging from -1.12% for the most overweighted to +14 bps for the most underweighted industries, while the average annual exclusion effect of sin stocks is 1.43%.

The Online Appendix presents the derivation of the expected excess returns on investable assets in the case of several sustainable investors with different tastes and exclusion scopes. The result shows that the conclusions for the three groups of investors remain valid in a more general case. Future research may consider extending this model to a multiperiod framework by endogenizing companies' ESG profiles in response to regular and sustainable investors' optimal asset allocations. Therefore, by internalizing the responses of companies to their investments, sustainable investors can engage in ESG integration and exclusionary screening to have an impact on companies' practices.[35] However, the asset pricing equation may not remain tractable in this more refined modeling framework. This study can also be extended in the case where sustainable investors internalize a stochastic and non-Gaussian environment-related financial risk.

[35] Oehmke and Opp (2019), Landier and Lovo (2020), and Pastor et al. (2020) show that ESG investors push companies to partially internalize their social costs.

Appendix: Derivation of the S-CAPM and main proofs

Problem setup

We model regular investors, integrators and excluders on an aggregate basis: one generic regular investor (referred to using subscript r), one generic integrator (referred to using subscript i), and one generic excluder (referred to using subscript e).

Heterogeneous preferences. The three groups of investors maximize at time t the expected utility of their terminal wealth at time $t+1$. We denote by γ_j^a the absolute risk aversion of investors j ($j \in \{r, i, e\}$) and by $W_{j,t}$ and $W_{j,t+1}$ their wealth on t and $t+1$, respectively.

However, investors have heterogeneous preferences. On the one hand, regular investors and excluders $j \in \{r, e\}$ have an exponential utility. They select the optimal vector of weights of *risky assets*, w_j, corresponding to the solution of the following optimization problem:

$$\max_{w_j} \mathbb{E}\left(U_j(W_{j,t+1})\right) = \max_{w_j} \mathbb{E}\left(1 - e^{-\gamma_j^a W_{j,t+1}}\right).$$

On the other hand, integrators have specific tastes for assets; they adjust their exponential utility by internalizing a deterministic private cost of externalities as in Pastor et al. (2020). We denote by C^W the vector of private costs of externalities that integrators internalize in their utility function; C^W has the same unit as a wealth. Integrators' utility decreases when the cost of externalities increases; they select the optimal vector of weights of *risky assets*, w_i, corresponding to the solution of the following optimization problem:

$$\max_{w_i} \mathbb{E}\left(U_i(W_{i,t+1})\right) = \max_{w_i} \mathbb{E}\left(1 - e^{-\gamma_i^a W_{i,t+1} + w_i' C^W}\right)$$

In Pastor et al. (2020), investors internalize nonpecuniary benefits, which positively impact their utility. In the present paper, integrators internalize costs of externalities, which negatively impact their utility.

Partially segmented market. Investors can invest in a risk-free asset, the return on which is denoted by r_f, and in risky assets. Excluders can only invest in *investable* risky assets, the returns on which are denoted by the $n_I \times 1$ vector R_I, while integrators and regular investors can invest in *investable* and *excluded* risky assets, the returns on which are denoted by the $(n_I + n_X) \times 1$ vector $R = \begin{pmatrix} R_I & R_X \end{pmatrix}'$. We assume that risky asset returns are normally distributed.

Mean-Variance problems. Without loss of generality, we assume that investors have the same relative risk aversion, $\gamma = W_{j,t}\gamma_j^a$ ($j \in \{r, i, e\}$). We denote by $C = \frac{1}{\gamma}C^W$ the vector of private costs of environmental externalities per unit of relative risk aversion; C has the same unit as a return. We now work with vector C and refer to its entries as the *private costs of environmental externalities* (without referring to the normalization by the risk aversion). C is a $(n_I + n_X) \times 1$ vector that is broken down as $C = \begin{pmatrix} C_I & C_X \end{pmatrix}'$, where C_I and C_X are the $n_I \times 1$ and $n_X \times 1$ vectors of costs for investable and excluded assets, respectively. We denote by $r = R - r_f \mathbb{1}_{n_I+n_X}$, $r_I = R_I - r_f \mathbb{1}_{n_I}$, and $r_X = R_X - r_f \mathbb{1}_{n_X}$ the vectors of excess returns on all assets, investable assets, and excluded assets, respectively, where $\mathbb{1}_n$ is the vector of ones of length $n \in \mathbb{N}^*$.

All weights add up to one, including the weight of the risk-free asset. Since the wealth in $t+1$ is normally distributed and C^W is determinisitic, integrators' expected utility writes

$$\begin{aligned}\mathbb{E}(U_i(W_{i,t+1})) &= 1 - \mathbb{E}\left(e^{-\gamma_i^a W_{i,t}\left(1+w_i'R+\left(1-w_i'\mathbb{1}_{n_I+n_X}\right)r_f\right)+w_i'C^W}\right) \\ &= 1 - e^{-\gamma\left(1+r_f\right)}e^{-\gamma w_i'(\mathbb{E}(r)-C)+\frac{\gamma^2}{2}w_i'\mathbb{V}\mathrm{ar}(r)w_i}.\end{aligned}$$

Similarly, regular investors' expected utility is

$$\mathbb{E}(U_r(W_{r,t+1})) = 1 - e^{-\gamma\left(1+r_f\right)}e^{-\gamma w_r'\mathbb{E}(r)+\frac{\gamma^2}{2}w_r'\mathbb{V}\mathrm{ar}(r)w_r},$$

and the expected utility of excluders, who can only invest in investable assets, writes

$$\mathbb{E}(U_e(W_{e,t+1})) = 1 - e^{-\gamma\left(1+r_f\right)}e^{-\gamma w_{e,I}'\mathbb{E}(r_I)+\frac{\gamma^2}{2}w_{e,I}'\mathbb{V}\mathrm{ar}(r_I)w_{e,I}}.$$

Let us also denote the vectors $\mu_I = \mathbb{E}_t(r_I)$, $\mu_X = \mathbb{E}_t(r_X)$, and the matrices $\Sigma_{XX} = \mathbb{V}\mathrm{ar}_t(r_X)$,

$\Sigma_{II} = \mathbb{V}\text{ar}_t(r_I)$, $\Sigma_{XI} = \mathbb{C}\text{ov}_t(r_X, r_I)$, $\Sigma_{IX} = \mathbb{C}\text{ov}_t(r_I, r_X)$. Therefore:

- Regular investors choose their optimal asset allocation by solving the following problem:

$$\max_{(w_{r,I}, w_{r,X})} \begin{pmatrix} w_{r,I} \\ w_{r,X} \end{pmatrix}' \begin{pmatrix} \mu_I \\ \mu_X \end{pmatrix} - \frac{\gamma}{2} \begin{pmatrix} w_{r,I} \\ w_{r,X} \end{pmatrix}' \begin{pmatrix} \Sigma_{II} & \Sigma_{IX} \\ \Sigma_{XI} & \Sigma_{XX} \end{pmatrix} \begin{pmatrix} w_{r,I} \\ w_{r,X} \end{pmatrix}. \tag{1}$$

- Integrators choose their optimal asset allocation by solving the following problem:

$$\max_{(w_{i,I}, w_{i,X})} \begin{pmatrix} w_{i,I} \\ w_{i,X} \end{pmatrix}' \begin{pmatrix} \mu_I - C_I \\ \mu_X - C_X \end{pmatrix} - \frac{\gamma}{2} \begin{pmatrix} w_{i,I} \\ w_{i,X} \end{pmatrix}' \begin{pmatrix} \Sigma_{II} & \Sigma_{IX} \\ \Sigma_{XI} & \Sigma_{XX} \end{pmatrix} \begin{pmatrix} w_{i,I} \\ w_{i,X} \end{pmatrix}. \tag{2}$$

- Excluders choose their optimal asset allocation by solving the following problem:

$$\max_{w_{e,I}} \quad w'_{e,I}\mu_I - \frac{\gamma}{2} w'_{e,I}\Sigma_{II} w_{e,I}. \tag{3}$$

Notice that this single-period model where investors have heterogeneous preferences through C^W is equivalent to a single-period model where investors disagree about the expected returns through C (see Problem (2) compared to Problem (1)) because the private costs are deterministic.

First-order conditions. Denoting the inverse of the risk aversion by $\lambda = \frac{1}{\gamma}$, regular investors, integrators and excluders therefore solve the following first-order conditions:

$$\begin{cases} \lambda \begin{pmatrix} \mu_I \\ \mu_X \end{pmatrix} = \begin{pmatrix} \Sigma_{II} & \Sigma_{IX} \\ \Sigma_{XI} & \Sigma_{XX} \end{pmatrix} \begin{pmatrix} w_{r,I} \\ w_{r,X} \end{pmatrix}, \\[2ex] \lambda \begin{pmatrix} \mu_I - C_I \\ \mu_X - C_X \end{pmatrix} = \begin{pmatrix} \Sigma_{II} & \Sigma_{IX} \\ \Sigma_{XI} & \Sigma_{XX} \end{pmatrix} \begin{pmatrix} w_{i,I} \\ w_{i,X} \end{pmatrix}, \\[2ex] \lambda \mu_I = \Sigma_{II} w_{e,I}. \end{cases} \tag{4}$$

Proof of Proposition 1: S-CAPM

Lemma 1. ***Preliminary results.***

The covariance column vector between the vector of excess returns on investable assets, r_I, and the excess returns on the investable market, r_{m_I}, is denoted by σ_{Im_I}; $\sigma_{m_I I}$ refers to the covariance line vector between r_{m_I} and r_I. σ_{Xm_I} and $\sigma_{m_I X}$ are defined similarly.

We denote by q_X the weight vector of the excluded assets' market values as a fraction of the market value of the investment universe, and $q \in [0, 1]$ the share of the excluded market's value as a fraction of the market value of the investment universe.

Assuming that the returns are normally distributed, σ_{m_I} is non-zero and Σ_{II} is nonsingular, we have the following equalities:

1.(i) $\Sigma_{XX} - \frac{1}{\sigma^2_{m_I}}\sigma_{Xm_I}\sigma_{m_I X} = \mathbb{V}\text{ar}_t(r_X|r_{m_I})$,

(ii) $\Sigma_{IX} - \frac{1}{\sigma^2_{m_I}}\sigma_{Im_I}\sigma_{m_I X} = \mathbb{C}\text{ov}_t(r_I, r_X|r_{m_I})$,

(iii) $\Sigma_{XX} - \Sigma_{XI}\Sigma_{II}^{-1}\Sigma_{IX} = \mathbb{V}\text{ar}_t(r_X|r_I)$,

(iv) $\sigma_{Xm_X} - \Sigma_{XI}\Sigma_{II}^{-1}\Sigma_{Im_X} = \mathbb{C}\text{ov}_t(r_X, r_{m_X}|r_I)$.

2. $\mathbb{C}\text{ov}_t(r_I, r_X|r_{m_I})q_X = q\,\mathbb{C}\text{ov}_t(r_I, r_{m_X}|r_{m_I})$.

Proof. See the Online Appendix. □

From here on, the time subscripts will be omitted to simplify the notations.

Derivation of the expected excess returns on I. Multiplying the first, third and fifth rows of System (4) by the wealth of investors r, i, and e, respectively, we have

$$\lambda (W_r + W_i + W_e)\,\mu_I - \lambda W_i C_I = \Sigma_{II}\,(W_r w_{r,I} + W_i w_{i,I} + W_e w_{e,I}) + \Sigma_{IX}\,(W_r w_{r,X} + W_i w_{i,X})\,. \quad (5)$$

Dividing by the total wealth W, and noting that $\frac{W_i}{W} = p_i$, we obtain

$$\lambda\mu_I = \Sigma_{II}\left(\frac{W_r w_{r,I} + W_i w_{i,I} + W_e w_{e,I}}{W}\right) + \Sigma_{IX}\left(\frac{W_r w_{r,X} + W_i w_{i,X}}{W}\right) + \lambda p_i C_I. \quad (6)$$

Denoting by D_I and D_X the column vectors equal to the total demand for stocks I and X, respectively, we have $W_r w_{r,I} + W_i w_{i,I} + W_e w_{e,I} = D_I$ and $W_r w_{r,X} + W_i w_{i,X} = D_X$. Consequently,

$$\lambda \mu_I = \Sigma_{II} \frac{D_I}{W} + \Sigma_{IX} \frac{D_X}{W} + \lambda p_i C_I. \tag{7}$$

In equilibrium, the total demand of assets is equal to the total supply in the entire market (S). The same holds for the markets of investable (S_I) and excluded (S_X) assets: $W = S$, $D_I = S_I$ and $D_X = S_X$. The $(n_X \times 1)$ weight vector of the excluded assets' values as a fraction of the market value of the investment universe is denoted by $q_X = \frac{S_X}{S}$. Therefore,

$$\lambda \mu_I = \Sigma_{II} \frac{S_I}{S} + \Sigma_{IX} q_X + \lambda p_i C_I. \tag{8}$$

We denote by q the proportion of the excluded market's value as a fraction of the market value of the investment universe. The share of the investable market's value is $1 - q$. Let us denote by w_I the vector of market values of stocks $(I_k)_{k \in \{1,\ldots,n_I\}}$ as a fraction of the investable market's value. Therefore, we have $\frac{S_I}{S} = (1-q) w_I$, and equation (8) rewrites

$$\lambda \mu_I = (1-q)\, \Sigma_{II} w_I + \Sigma_{IX} q_X + \lambda p_i C_I. \tag{9}$$

Multiplying by $w_I{}'$, we obtain

$$\lambda w_I{}' \mu_I = (1-q)\, w_I{}' \Sigma_{II} w_I + w_I{}' \Sigma_{IX} q_X + \lambda p_i w_I{}' C_I \tag{10}$$

Since $w_I{}' \mu_I = \mu_{m_I}$ is the expected excess return on the investable market, and denoting $c_{m_I} = w_I{}' C_I$ and the row vector of covariances $\sigma_{m_I X} = w_I{}' \Sigma_{IX}$,

$$\lambda \mu_{m_I} = (1-q)\, \sigma^2_{m_I} + \sigma_{m_I X} q_X + \lambda p_i c_{m_I}. \tag{11}$$

Therefore, assuming $\sigma^2_{m_I} \neq 0$,

$$(1-q) = \frac{1}{\sigma^2_{m_I}} \left(\lambda \mu_{m_I} - \sigma_{m_I X} q_X - \lambda p_i c_{m_I}\right). \tag{12}$$

Substituting (12) into (9), and noting that the column vector of covariances is $\sigma_{Im_I} = \Sigma_{II} w_I$, we obtain

$$\mu_I = \left(\mu_{m_I} - p_i c_{m_I}\right) \frac{1}{\sigma^2_{m_I}} \sigma_{Im_I} + p_i C_I + \gamma \left(\Sigma_{IX} - \frac{1}{\sigma^2_{m_I}} \sigma_{Im_I} \sigma_{m_I X}\right) q_X. \tag{13}$$

Denoting by $\beta_{Im_I} = \frac{1}{\sigma^2_{m_I}} \sigma_{Im_I}$ the vector of slope of the regression of the excess returns on the investable assets, r_I, on the excess returns on the investable market, r_{m_I}, and a constant, and from Lemma 1, we rewrite the above equation as follows using vector notations:

$$\mathbb{E}(r_I) = \left(\mathbb{E}(r_{m_I}) - p_i c_{m_I}\right) \beta_{Im_I} + p_i C_I + \gamma q \, \mathbb{C}\text{ov}(r_I, r_{m_X} | r_{m_I}). \tag{14}$$

Derivation of the expected excess returns on X. Multiplying the second and fourth rows of System (4) by the wealth of investors r and i, respectively, we have

$$\lambda \left(W_r + W_i\right) \mu_X - \lambda W_i C_X = \Sigma_{XI} \left(W_r w_{r,I} + W_i w_{i,I}\right) + \Sigma_{XX} \left(W_r w_{r,X} + W_i w_{i,X}\right) \tag{15}$$

But, assuming that Σ_{II} is nonsingular, the first and third rows of System (4) yield

$$\begin{cases} w_{r,I} = \Sigma_{II}^{-1} \left(\lambda \mu_I - \Sigma_{IX} w_{r,X}\right) \\ w_{i,I} = \Sigma_{II}^{-1} \left(\lambda \left(\mu_I - C_I\right) - \Sigma_{IX} w_{i,X}\right) \end{cases} \tag{16}$$

Therefore, substituting $w_{r,I}$ and $w_{i,I}$ into Equation (15), and denoting $B_{XI} = \Sigma_{XI} \Sigma_{II}^{-1}$, we obtain

$$\begin{aligned} \lambda \left(W_r + W_i\right) \mu_X - \lambda W_i C_X = {} & \lambda B_{XI} \left(W_r + W_i\right) \mu_I - \lambda W_i B_{XI} C_I \\ & + \left(\Sigma_{XX} - \Sigma_{XI} \Sigma_{II}^{-1} \Sigma_{IX}\right) \left(W_r w_{r,X} + W_i w_{i,X}\right). \end{aligned} \tag{17}$$

Dividing the previous equation by W, knowing that $\frac{W_i}{W} = p_i$, $\frac{W_r+W_i}{W} = 1 - p_e$, and since that $\frac{(W_r w_{r,X}+W_i w_{i,X})}{W} = \frac{S_X}{S} = q_X$ in equilibrium, we get

$$\mu_X = B_{XI}\mu_I + \frac{p_i}{1-p_e}\left(C_X - B_{XI}C_I\right) + \frac{\gamma}{1-p_e}\left(\Sigma_{XX} - \Sigma_{XI}\Sigma_{II}^{-1}\Sigma_{IX}\right)q_X. \tag{18}$$

Substituting μ_I (Equation (13)) into the previous equation, and since $\sigma_{Im_I} = \Sigma_{II}w_I$ and $p_i B_{XI}C_I - \frac{p_i}{1-p_e}B_{XI}C_I = -\frac{p_i p_e}{1-p_e}B_{XI}C_I$,

$$\begin{aligned}\mu_X = &\left(\mu_{m_I} - p_i c_{m_I}\right)\frac{1}{\sigma_{m_I}^2}\Sigma_{XI}\Sigma_{II}^{-1}\Sigma_{II}w_I + \frac{p_i}{1-p_e}C_X - \frac{p_i p_e}{1-p_e}B_{XI}C_I \\ &+ \gamma\left(\Sigma_{XI}\Sigma_{II}^{-1}\Sigma_{IX} - \frac{1}{\sigma_{m_I}^2}\Sigma_{XI}\Sigma_{II}^{-1}\Sigma_{II}w_I\sigma_{m_I X}\right)q_X + \frac{\gamma}{1-p_e}\left(\Sigma_{XX} - \Sigma_{XI}\Sigma_{II}^{-1}\Sigma_{IX}\right)q_X.\end{aligned} \tag{19}$$

By adding and subtracting $\gamma\Sigma_{XX}q_X$ to the previous equation,

$$\begin{aligned}\mu_X = &\left(\mu_{m_I} - p_i c_{m_I}\right)\frac{1}{\sigma_{m_I}^2}\Sigma_{XI}\Sigma_{II}^{-1}\Sigma_{II}w_I + \frac{p_i}{1-p_e}C_X - \frac{p_i p_e}{1-p_e}B_{XI}C_I \\ &+ \gamma\left(\Sigma_{XI}\Sigma_{II}^{-1}\Sigma_{IX} - \Sigma_{XX}\right)q_X + \gamma\left(\Sigma_{XX} - \frac{1}{\sigma_{m_I}^2}\Sigma_{XI}\Sigma_{II}^{-1}\Sigma_{II}w_I\sigma_{m_I X}\right)q_X \\ &+ \frac{\gamma}{1-p_e}\left(\Sigma_{XX} - \Sigma_{XI}\Sigma_{II}^{-1}\Sigma_{IX}\right)q_X.\end{aligned} \tag{20}$$

We denote $\beta_{Xm_I} = \frac{1}{\sigma_{m_I}^2}\Sigma_{XI}w_I$; we notice that $\frac{\gamma}{1-p_e} - \gamma = \gamma\frac{p_e}{1-p_e}$; from Lemma 1, the previous equation is simplified as follows using vector notations:

$$\begin{aligned}\mathbb{E}(r_X) = &\left(\mathbb{E}(r_{m_I}) - p_i c_{m_I}\right)\beta_{Xm_I} + \frac{p_i}{1-p_e}C_X - \frac{p_i p_e}{1-p_e}B_{XI}C_I \\ &+ \gamma\frac{p_e}{1-p_e}q\,\mathbb{C}\mathrm{ov}(r_X, r_{m_X}|r_I) + \gamma q\,\mathbb{C}\mathrm{ov}(r_X, r_{m_X}|r_{m_I}).\end{aligned} \tag{21}$$

Derivation of the general pricing formula. For any investable asset I_k,

$$\mathbb{C}\mathrm{ov}(r_{I_k}, r_{m_X}|r_I) = \sigma_{I_k m_X} - \sigma_{I_k I}\Sigma_{II}^{-1}\sigma_{Im_X} = \sigma_{I_k m_X} - \sigma_{I_k m_X} = 0, \tag{22}$$

and

$$\frac{p_i}{1-p_e}c_{I_k} - \frac{p_i p_e}{1-p_e}B_{I_k I}C_I = \frac{p_i}{1-p_e}c_{I_k} - \frac{p_i p_e}{1-p_e}c_{I_k} = p_i c_{I_k} \tag{23}$$

Therefore, for any asset $k \in \{I_1, ...I_{n_I}, X_1, ..., X_{n_X}\}$,

$$\begin{aligned} \mathbb{E}(r_k) = \beta_{km_I} \left(\mathbb{E}(r_{m_I}) - p_i c_{m_I}\right) + \frac{p_i}{1-p_e} c_k - \frac{p_i p_e}{1-p_e} B_{kI} C_I \\ + \gamma \frac{p_e}{1-p_e} q \, \mathbb{C}\text{ov}(r_k, r_{m_X} | r_I) + \gamma q \, \mathbb{C}\text{ov}(r_k, r_{m_X} | r_{m_I}). \end{aligned} \tag{24}$$

Proof of Corollary 1: Expression of the exclusion premia as the difference between a regular investor effect and a sustainable investor effect

(i) From the law of total covariance, we express the expectation of the conditional covariance as a difference between two covariances:

$$\mathbb{E}(\mathbb{C}\text{ov}(r_k, r_{m_X} | r_I)) = \mathbb{C}\text{ov}(r_k, r_{m_X}) - \mathbb{C}\text{ov}(\mathbb{E}(r_k | r_I), \mathbb{E}(r_{m_X} | r_I)). \tag{25}$$

Since the conditional covariance of multivariate normal distributions is independent of the conditioning variable (see Lemma 1), $\mathbb{E}(\mathbb{C}\text{ov}(r_k, r_{m_X} | r_I)) = \mathbb{C}\text{ov}(r_k, r_{m_X} | r_I)$. By multiplying the previous equation by $\gamma \frac{p_e}{1-p_e} q$, we obtain the expected result.

(ii) The proof is analogous for the exclusion-market premium.

Proof of Proposition 2: A generalized form of Merton (1987)'s premium on neglected stocks

Derivation of the expected excess returns on I with respect to those on the market. Denoting by q_I and q_X the weight vectors of the market values of the investable and excluded assets in the total market, respectively, we have

$$\mu_m = q_I' \mu_I + q_X' \mu_X. \tag{26}$$

Substituting the expressions for the expected excess returns on I and X with respect to m_I (Proposition 1) in the above equation, and noting that $-\frac{p_i p_e}{1-p_e} B_{XI} C_I = (p_i - \frac{p_i}{1-p_e}) B_{XI} C_I$, we obtain

$$\begin{aligned}\mu_m =& q_I' \left((\mu_{m_I} - p_i c_{m_I}) \beta_{I m_I} + p_i C_I + \gamma q \, \mathbb{C}\text{ov}(r_I, r_{m_X} | r_{m_I}) \right) \\ &+ q_X' \Bigg((\mu_{m_I} - p_i c_{m_I}) \beta_{X m_I} + p_i B_{XI} C_I + \frac{p_i}{1-p_e} (C_X - B_{XI} C_I) \\ &+ \gamma \frac{p_e}{1-p_e} q \, \mathbb{C}\text{ov}(r_X, r_{m_X} | r_I) + \gamma q \, \mathbb{C}\text{ov}(r_X, r_{m_X} | r_{m_I}) \Bigg). \end{aligned} \tag{27}$$

By grouping together the terms representing the same effect, the equation yields

$$\begin{aligned}\mu_m =& (\mu_{m_I} - p_i c_{m_I}) \left(q_I' \beta_{I m_I} + q_X' \beta_{X m_I} \right) + p_i \left(q_I' + q_X' B_{XI} \right) C_I + \frac{p_i}{1-p_e} q_X' (C_X - B_{XI} C_I) \\ &+ \gamma \frac{p_e}{1-p_e} q q_X' \, \mathbb{C}\text{ov}(r_X, r_{m_X} | r_I) + \gamma q \left(q_I' \, \mathbb{C}\text{ov}(r_I, r_{m_X} | r_{m_I}) + q_X' \, \mathbb{C}\text{ov}(r_X, r_{m_X} | r_{m_I}) \right). \end{aligned} \tag{28}$$

However, since $q_I = (1-q) w_I$ and $q_X = q w_X$,

$$q_I' \beta_{I m_I} + q_X' \beta_{X m_I} = (1-q) w_I' \frac{\sigma_{I m_I}}{\sigma^2_{m_I}} + q w_X' \frac{\sigma_{X m_I}}{\sigma^2_{m_I}} = (1-q) \frac{\sigma^2_{m_I}}{\sigma^2_{m_I}} + q \frac{\sigma_{m_X m_I}}{\sigma^2_{m_I}} = \beta_{m m_I}, \tag{29}$$

and

$$\left(q_I' + q_X' B_{XI} \right) = \left(q_I' \Sigma_{II} \Sigma_{II}^{-1} + q_X' \Sigma_{XI} \Sigma_{II}^{-1} \right) = \left(q_I' \Sigma_{II} + q_X' \Sigma_{XI} \right) \Sigma_{II}^{-1} = \sigma_{mI} \Sigma_{II}^{-1} = B_{mI}, \tag{30}$$

and

$$q_X' (C_X - B_{XI} C_I) = q \left(w_X' C_X - w_X' \Sigma_{XI} \Sigma_{II}^{-1} C_I \right) = q \left(c_{m_X} - B_{m_X I} C_I \right), \tag{31}$$

where B_{mI} and $B_{m_X I}$ are the row vectors of slope coefficients of the regression of r_m and r_{m_X}, respectively, on the excess returns on the investable assets $(r_I)_{k \in \{1, \dots n_I\}}$ and a constant, w_X is the vector of weights of assets $X_1, ..., X_{n_X}$ in the excluded market, and $c_{m_X} = w_X' C_X$ is the cost of externalities of the excluded market.

Therefore, using Lemma 1, Equation (28) rewrites as follows:

$$\begin{aligned}\mu_m =&(\mu_{m_I} - p_i c_{m_I})\beta_{mm_I} + p_i B_{mI} C_I + \frac{p_i}{1-p_e} q\,(c_{m_X} - B_{m_X I} C_I) \\ &+\gamma \frac{p_e}{1-p_e} q^2\, \mathbb{V}\mathrm{ar}(r_{m_X}|r_I) + \gamma q\,((1-q)\,\mathbb{C}\mathrm{ov}(r_{m_I}, r_{m_X}|r_{m_I}) + q\,\mathbb{C}\mathrm{ov}(r_{m_X}, r_{m_X}|r_{m_I}))\,.\end{aligned} \tag{32}$$

By simplifying the last term of the above equation,

$$\begin{aligned}\mu_m =&(\mu_{m_I} - p_i c_{m_I})\beta_{mm_I} + p_i B_{mI} C_I + \frac{p_i}{1-p_e} q\,(c_{m_X} - B_{m_X I} C_I) \\ &+\gamma \frac{p_e}{1-p_e} q^2\, \mathbb{V}\mathrm{ar}(r_{m_X}|r_I) + \gamma q\,\mathbb{C}\mathrm{ov}(r_m, r_{m_X}|r_{m_I}).\end{aligned} \tag{33}$$

Consequently, the expected excess returns on the investable market are

$$\begin{aligned}\mu_{m_I} = &\frac{1}{\beta_{mm_I}}\Bigg(\mu_m + p_i \beta_{mm_I} c_{m_I} - p_i B_{mI} C_I - \frac{p_i}{1-p_e} q\,(c_{m_X} - B_{m_X I} C_I) \\ &- \gamma \frac{p_e}{1-p_e} q^2\, \mathbb{V}\mathrm{ar}(r_{m_X}|r_I) - \gamma q\,\mathbb{C}\mathrm{ov}(r_m, r_{m_X}|r_{m_I})\Bigg).\end{aligned} \tag{34}$$

Substituting μ_{m_I} into the expression for the excess returns on I (Proposition 1), we obtain

$$\begin{aligned}\mu_I = &\Bigg(\frac{1}{\beta_{mm_I}}\Bigg(\mu_m + p_i \beta_{mm_I} c_{m_I} - p_i B_{mI} C_I - \frac{p_i}{1-p_e} q\,(c_{m_X} - B_{m_X I} C_I) \\ &- \gamma \frac{p_e}{1-p_e} q^2\, \mathbb{V}\mathrm{ar}(r_{m_X}|r_I) - \gamma q\,\mathbb{C}\mathrm{ov}(r_m, r_{m_X}|r_{m_I})\Bigg) - p_i c_{m_I}\Bigg)\beta_{Im_I} + p_i C_I + \gamma q\,\mathbb{C}\mathrm{ov}(r_I, r_{m_X}|r_{m_I}).\end{aligned} \tag{35}$$

Denoting $\frac{1}{\beta_{mm_I}}\beta_{Im_I} = \frac{1}{\mathbb{C}\mathrm{ov}(r_m, r_{m_I})}\,\mathbb{C}\mathrm{ov}(r_I, r_{m_I}) = \tilde{\beta}_{Im}$, and by grouping the terms related to the same effect, we obtain the expected expression using vector notations:

$$\begin{aligned}\mathbb{E}(r_I) = &\Bigg(\,\mathbb{E}(r_m) - p_i\Bigg(B_{mI} C_I + \frac{q}{1-p_e}\,(c_{m_X} - B_{m_X I} C_I)\,\Bigg)\Bigg)\tilde{\beta}_{Im} + p_i C_I \\ &- \gamma \frac{p_e}{1-p_e} q^2\, \mathbb{V}\mathrm{ar}(r_{m_X}|r_I)\tilde{\beta}_{Im} + \gamma q\,\mathbb{C}\mathrm{ov}(r_I - r_m \tilde{\beta}_{Im}, r_{m_X}|r_{m_I}).\end{aligned} \tag{36}$$

Derivation of the expected excess returns on X with respect to those on the market. Similarly, substituting μ_{m_I} from Equation (34) into the expression for the excess returns on X

(Proposition 1), we obtain

$$\mu_X = \left(\frac{1}{\beta_{mm_I}}\left(\mu_m + p_i\beta_{mm_I}c_{m_I} - p_iB_{mI}C_I - \frac{p_i}{1-p_e}q\left(c_{m_X} - B_{m_XI}C_I\right) - \gamma\frac{p_e}{1-p_e}q^2\,\mathbb{V}\mathrm{ar}(r_{m_X}|r_I)\right.\right.$$
$$\left.\left. - \gamma q\,\mathbb{C}\mathrm{ov}(r_m, r_{m_X}|r_{m_I})\right) - p_ic_{m_I}\right)\beta_{Xm_I} + \frac{p_i}{1-p_e}C_X - \frac{p_ip_e}{1-p_e}B_{XI}C_I$$
$$+ \gamma\frac{p_e}{1-p_e}q\,\mathbb{C}\mathrm{ov}(r_X, r_{m_X}|r_I) + \gamma q\,\mathbb{C}\mathrm{ov}(r_X, r_{m_X}|r_{m_I}). \tag{37}$$

Denoting $\frac{1}{\beta_{mm_I}}\beta_{Xm_I} = \frac{1}{\mathbb{C}\mathrm{ov}(r_m, r_{m_I})}\,\mathbb{C}\mathrm{ov}(r_X, r_{m_I}) = \tilde{\beta}_{Xm}$, and by grouping the terms related to the same effect, we obtain the expected expression using vector notations:

$$\mathbb{E}(r_X) = \left(\mathbb{E}(r_m) - p_i\left(B_{mI}C_I + \frac{q}{1-p_e}\left(c_{m_X} - B_{m_XI}C_I\right)\right)\right)\tilde{\beta}_{Xm} + \frac{p_i}{1-p_e}C_X - \frac{p_ip_e}{1-p_e}B_{XI}C_I$$
$$+ \gamma\frac{p_e}{1-p_e}q\,\mathbb{C}\mathrm{ov}(r_X - qr_{m_X}\tilde{\beta}_{Xm}, r_{m_X}|r_I) + \gamma q\,\mathbb{C}\mathrm{ov}(r_X - r_m\tilde{\beta}_{Xm}, r_{m_X}|r_{m_I}). \tag{38}$$

Derivation of the general pricing formula with respect to the market expected excess returns. This subsection is not necessary to the proof but provides a general result. For any investable asset I_k,

$$\mathbb{C}\mathrm{ov}(r_{I_k}, r_{m_X}|r_I) = \sigma_{I_km_X} - \sigma_{I_kI}\Sigma_{II}^{-1}\sigma_{Im_X} = \sigma_{I_km_X} - \sigma_{I_km_X} = 0, \tag{39}$$

and

$$\frac{p_i}{1-p_e}c_{I_k} - \frac{p_ip_e}{1-p_e}B_{I_kI}C_I = \frac{p_i}{1-p_e}c_{I_k} - \frac{p_ip_e}{1-p_e}c_{I_k} = p_ic_{I_k} \tag{40}$$

Therefore, for any asset $k \in \{I_1, ...I_{n_I}, X_1, ..., X_{n_X}\}$,

$$\mathbb{E}(r_k) = \tilde{\beta}_{km}\left(\mathbb{E}(r_m) - p_i\left(B_{mI}C_I + \frac{q}{1-p_e}\left(c_{m_X} - B_{m_XI}C_I\right)\right)\right) + \frac{p_i}{1-p_e}c_k - \frac{p_ip_e}{1-p_e}B_{kI}C_I$$
$$+ \gamma\frac{p_e}{1-p_e}q\,\mathbb{C}\mathrm{ov}(r_k - \tilde{\beta}_{km}qr_{m_X}, r_{m_X}|r_I) + \gamma q\,\mathbb{C}\mathrm{ov}(r_k - \tilde{\beta}_{km}r_m, r_{m_X}|r_{m_I}). \tag{41}$$

A generalized form of Merton (1987)'s premium on neglected stocks.

a) On the one hand, *using Merton (1987)'s notation* and combining equations (26), (19) and (15) in his paper, the premium on the neglected stock k that the author finds is equal to

$$\alpha_k = \delta \frac{1 - q_k}{q_k} \sigma_k^2 x_k - \delta \beta_k \sum_{j=1}^{n} \frac{1 - q_j}{q_j} \sigma_j^2 x_j^2. \tag{42}$$

In Merton (1987), q_k accounts for the "fraction of all investors who know about security k", i.e., the fraction of investors that can invest in security k. In the present framework, this fraction is the share of regular investors and integrators' wealth, $1 - p_e$, which is the same for all excluded assets. Thus, taking $q_k = q$, Merton (1987)'s premium on neglected stocks is equal to

$$\alpha_k = \delta \frac{1 - q}{q} \left(\sigma_k^2 x_k - \beta_k \sum_{j=1}^{n} \sigma_j^2 x_j^2 \right). \tag{43}$$

Let us now reconcile Merton (1987)'s notation with those of this paper. Let us denote by $Q = (q_{I_1}, ..., q_{I_{n_I}}, q_{X_1}, ..., q_{X_{n_X}})'$ the $(n_I + n_X, 1)$ vector of weights of assets $I_1, ..., I_{n_I}, X_1, ..., X_{n_X}$ as a fraction of the market value of the investment universe, and $r = (r_{I_1}, ..., r_{I_{n_I}}, r_{X_1}, ..., r_{X_{n_X}})'$ the $(n_I + n_X, 1)$ vector of excess returns on assets $I_1, ..., I_{n_I}, X_1, ..., X_{n_X}$.

In Merton (1987), σ_k^2 is the variance of the idiosyncratic risk's (IR) excess returns that is denoted by $\mathbb{V}\text{ar}_{id}(r_{X_k})$ in this paper, δ is the risk aversion (γ in this paper), x_k is the proportion of the market portfolio invested in asset k (q_k in this paper), q is the proportion of investors that do not exclude assets ($1 - p_e$ in this paper), β_k is the beta of asset k with respect to the market portfolio m ($\tilde{\beta}_{X_k m}$ in this paper) and n is the number of assets in the market ($n_I + n_X$ in this paper). Rewritten with the notations of this paper, Merton (1987)'s premium on neglected stock X_k is

$$\alpha_k = \gamma \frac{p_e}{1 - p_e} \left(\mathbb{V}\text{ar}_{id}(r_{X_k}) q_{X_k} - \beta_{X_k m} \sum_{j=1}^{n_I + n_X} \mathbb{V}\text{ar}_{id}(r_j) q_j^2 \right). \tag{44}$$

b) On the other hand, when the cost of environmental externalities is zero as in Merton (1987)'s framework, equation (38) for stock X_k is expressed as follows:

$$\begin{aligned}\mathbb{E}(r_{X_k}) =& \tilde{\beta}_{X_k m}\,\mathbb{E}(r_m) + \underbrace{\gamma\frac{p_e}{1-p_e} q\,\mathbb{C}\mathrm{ov}(r_{X_k} - \tilde{\beta}_{X_k m} q r_{m_X}, r_{m_X}|r_I)}_{\text{Exclusion-asset premium}} \\ &+ \underbrace{\gamma q\,\mathbb{C}\mathrm{ov}(r_{X_k} - \tilde{\beta}_{X_k m} r_m, r_{m_X}|r_{m_I})}_{\text{Exclusion-market premium}}.\end{aligned} \tag{45}$$

The exclusion-asset premium of excluded asset X_k is equal to

$$\alpha_k = \gamma\frac{p_e}{1-p}\left(q\,\mathbb{C}\mathrm{ov}(r_{X_k}, r_{m_X}|r_I) - \tilde{\beta}_{X_k m} q^2\,\mathbb{V}\mathrm{ar}(r_{m_X}|r_I)\right). \tag{46}$$

However, from Lemma 1, 2.(i),

$$q\,\mathbb{C}\mathrm{ov}(r_X, r_{m_X}|r_I) = \mathbb{V}\mathrm{ar}(r_X|r_I) q_X, \tag{47}$$

and

$$q^2\,\mathbb{V}\mathrm{ar}(r_{m_X}|r_I) = q_X'\,\mathbb{V}\mathrm{ar}(r_X|r_I) q_X. \tag{48}$$

Therefore, denoting by $[\mathbb{V}\mathrm{ar}(r_X|r_I)]_{k,.}$ the kth row of matrix $\mathbb{V}\mathrm{ar}(r_X|r_I)$,

$$\alpha_k = \gamma\frac{p_e}{1-p_e}\left([\mathbb{V}\mathrm{ar}(r_X|r_I)]_{k,.} q_X - \tilde{\beta}_{X_k m} q_X'\,\mathbb{V}\mathrm{ar}(r_X|r_I) q_X\right). \tag{49}$$

We denote by $\mathbb{0}_{n,p}$ the $n \times p$ matrix of zeros. Since $\mathbb{V}\mathrm{ar}(r_I|r_I) = \mathbb{0}_{n_I,n_I}$ and $\mathbb{C}\mathrm{ov}(r_X, r_I|r_I) = \mathbb{0}_{n_X,n_I}$ (see Lemma 1),

$$q_X'\,\mathbb{V}\mathrm{ar}(r_X|r_I) q_X = Q'\,\mathbb{V}\mathrm{ar}(r|r_I) Q. \tag{50}$$

Consequently,

$$\alpha_k = \gamma\frac{p_e}{1-p_e}\left([\mathbb{V}\mathrm{ar}(r_X|r_I)]_{k,.} q_X - \tilde{\beta}_{X_k m} Q'\,\mathbb{V}\mathrm{ar}(r|r_I) Q\right). \tag{51}$$

is a *generalized form* of Merton (1987)'s premium on neglected stocks.

Nevertheless, it should be noted that taking Merton's stated assumptions, this premium does not boil down to the author's result for two reasons: 1) the beta is different $\tilde{\beta}_{X_k m} = \beta_{X_k m}\frac{\rho_{X_k,m_I}}{\rho_{X_k,m}\rho_{m,m_I}} \neq$

$\beta_{X_k m}$, consistent with a segmented market, and 2) $[\mathbb{V}\text{ar}(r_X|r_I)]_{k,.}$ is not necessarily equal to $(\mathbb{V}\text{ar}_{id}(r_{X_k}), 0, ...0)$.

Let us take a simple example with three assets X_k, X_j, I to prove that $[\mathbb{V}\text{ar}(r_X|r_I)]_{k,.}$ can differ from $(\mathbb{V}\text{ar}_{id}(r_{X_k}), 0, ...0)$. For each asset $i \in \{X_k, X_j, I\}$, we express the excess return as in Merton's paper as a sum of a common factor and an IR: $r_k = \mathbb{E}(R_k) + b_k Y + \sigma_k \epsilon_k - r_f$, where $\mathbb{E}(Y) = 0$, $\mathbb{E}(Y^2) = 1$, $\mathbb{E}(\epsilon_k|\epsilon_{-k}, Y) = 0$ and $\mathbb{V}\text{ar}(\epsilon_k) = 1$.[36] Therefore,

$$[\mathbb{V}\text{ar}(r_X|r_I)]_{k,.} = \left(\mathbb{V}\text{ar}(r_{X_k}|r_I), \mathbb{C}\text{ov}(r_{X_k}, r_{X_j}|r_I)\right) = \left(\sigma^2_{X_k}, b_{X_k} b_{X_j} - \frac{b_I^2}{b_I^2 + \sigma_I^2} b_{X_k} b_{X_j}\right). \tag{52}$$

Consequently, $(\mathbb{V}\text{ar}(r_{X_k}|r_I), \mathbb{C}\text{ov}(r_{X_k}, r_{X_j}|r_I)) = (\mathbb{V}\text{ar}_{id}(r_{X_k}), 0)$ only if one assumes that the IR of the investable asset—in Merton's framework, the asset that is not neglected by any investor—is zero: $\sigma_I = 0$. However, this type of assumption is not stated in Merton (1987). That is the reason why I refer to a *generalized form* and not to a generalization of Merton's result.

Proof of Proposition 3: Sign of the exclusion premia

(i) Let us focus on the exclusion-asset premium. Since $\gamma, q \geq 0$, and $p_e \in [0, 1]$, $\gamma \frac{p_e}{1-p_e} q$ is positive.

As shown in Lemma 1, the conditional covariance is equal to:

$$q\, \mathbb{C}\text{ov}(r_X, r_{m_X}|r_I) = \left(\Sigma_{XX} - \Sigma_{XI}\Sigma_{II}^{-1}\Sigma_{IX}\right) q_X. \tag{53}$$

When there is at least one excluded asset, i.e., $q > 0$ and $q_X \neq \mathbb{0}_{n_X}$, denoting by $w_X = \frac{1}{q} q_X > 0$ the vector of weights of assets X in the excluded market, we express the covariance matrix as the product of a Schur complement by a strictly positive vector of weights:

$$\mathbb{C}\text{ov}(r_X, r_{m_X}|r_I) = \left(\Sigma_{XX} - \Sigma_{XI}\Sigma_{II}^{-1}\Sigma_{IX}\right) \frac{1}{q} q_X = \left(\Sigma_{XX} - \Sigma_{XI}\Sigma_{II}^{-1}\Sigma_{IX}\right) w_X. \tag{54}$$

[36]This last assumption is not explicitely specified by Merton but is used in his calculations.

However, Σ_{II} is positive-definite (because it is nonsingular positive semidefinite) and with $\begin{pmatrix} \Sigma_{II} & \Sigma_{IX} \\ \Sigma_{XI} & \Sigma_{XX} \end{pmatrix}$ being positive semidefinite, Schur complement $\left(\Sigma_{XX} - \Sigma_{XI}\Sigma_{II}^{-1}\Sigma_{IX}\right)$ is positive semidefinite. Therefore, the exclusion-asset effects for assets X are the elements of the vector being the product of a semidefinite positive matrix by a strictly positive vector of weights. Consequently, not all elements of this vector are necessarily positive.

The same applies to the exclusion-market premium.

(ii) The expected excess return of the excluded market $\mathbb{E}(r_{m_X})$ is obtained by multiplying the vector of excluded assets' expected excess returns $\mathbb{E}(r_X)$ by their weight in the excluded market w'_X:

$$\begin{aligned} \mathbb{E}(r_{m_X}) =& (\mathbb{E}(r_{m_I}) - p_i c_{m_I}) w'_X \beta_{X m_I} + \frac{p_i}{1-p_e} w'_X C_X - \frac{p_i p_e}{1-p_e} w'_X B_{XI} C_I \\ &+ \gamma \frac{p_e}{1-p_e} q w'_X \,\mathbb{C}\mathrm{ov}(r_X, r_{m_X} | r_I) + \gamma q w'_X \,\mathbb{C}\mathrm{ov}(r_X, r_{m_X} | r_{m_I}) \end{aligned} \tag{55}$$

Since the covariance and the conditional covariance are bilinear, we have

$$\begin{aligned} \mathbb{E}(r_{m_X}) =& \beta_{m_X m_I}(\mathbb{E}(r_{m_I}) - p_i c_{m_I}) + \frac{p_i}{1-p_e} c_{m_X} - \frac{p_i p_e}{1-p_e} B_{m_X I} C_I \\ &+ \gamma \frac{p_e}{1-p_e} q \,\mathbb{V}\mathrm{ar}(r_{m_X} | r_I) + \gamma q \,\mathbb{V}\mathrm{ar}(r_{m_X} | r_{m_I}), \end{aligned} \tag{56}$$

where c_{m_X} is the cost of externalities of the excluded market, $B_{m_X I}$ is the row vector of regression coefficients in a regression of the excluded market excess returns on the investable assets' excess returns and a constant, and $\beta_{m_X m_I}$ is the slope of the regression of the excluded market excess returns on the investable market excess returns and a constant. Let $\rho_{m_X m_I}$ be the correlation coefficient between the excess returns on the excluded market, m_X, and those on the investable market, m_I, and $\rho_{m_X I}$ be the multiple correlation coefficient between the excess returns on the excluded market, m_X, and those on the vector of investable assets' excess returns, I. Since $\mathbb{V}\mathrm{ar}(r_{m_X}|r_I) = \mathbb{V}\mathrm{ar}(r_{m_X})\,(1-\rho_{m_X I})$ and $\mathbb{V}\mathrm{ar}(r_{m_X}|r_{m_I}) = \mathbb{V}\mathrm{ar}(r_{m_X})\,(1-\rho_{m_X m_I})$ (see Dhrymes, 1974, Theorem 2 (iv) p.24), the exclusion premia on the excluded market are equal to $\gamma q \,\mathbb{V}\mathrm{ar}(r_{m_X}) \left(\frac{p_e}{1-p_e}(1-\rho_{m_X I}) + (1-\rho_{m_X m_I})\right)$, and are always positive or zero. Indeed, since the

Schur complement is a positive semidefinite matrix, we have $w'_X \left(\Sigma_{XX} - \Sigma_{XI}\Sigma_{II}^{-1}\Sigma_{IX}\right) w_X \geq 0$ and $w'_X \left(\Sigma_{XX} - \frac{1}{\sigma_{m_I}^2}\sigma_{Xm_I}\sigma_{m_IX}\right) w_X \geq 0$.

Proof of Proposition 4: Cost of externalities

Let $w_{r,I}^*$ and $w_{r,X}^*$ be regular investors' optimal weight vector of investable and excluded assets, respectively. The optimal weights of integrators, $w_{i,I}^*$ and $w_{i,X}^*$, and excluders, $w_{e,I}^*$, are defined similarly.

Intuition of the proof. By substituting the first-order condition of integrators into the first-order condition of regular investors via risk aversion $\gamma = \frac{1}{\lambda}$ (using System of equations (4)), the cost of externalities of asset $k \in \{I_1, ..., I_{n_I}, X_1, ..., X_{n_X}\}$ is

$$c_k = \frac{\mathbb{C}\text{ov}(r_k, r'_I)(w_{r,I}^* - w_{i,I}^*) + \mathbb{C}\text{ov}(r_k, r'_X)(w_{r,X}^* - w_{i,X}^*)}{\mathbb{C}\text{ov}(r_k, r'_I)w_{r,I}^* + \mathbb{C}\text{ov}(r_k, r'_X)w_{r,X}^*} \mathbb{E}(r_k). \tag{57}$$

Proof. Let us focus on asset I_k. We assume that asset returns are independent (assumption (i)). Using the first, third and fifth rows of system (4):

$$w_{r,I_k}^* = \lambda \frac{\mathbb{E}(r_{I_k})}{\mathbb{V}\text{ar}(r_{I_k})}, \quad w_{i,I_k}^* = \lambda \frac{\mathbb{E}(r_{I_k}) - c_{I_k}}{\mathbb{V}\text{ar}(r_{I_k})}, \quad w_{e,I_k}^* = \lambda \frac{\mathbb{E}(r_{I_k})}{\mathbb{V}\text{ar}(r_{I_k})}. \tag{58}$$

But, the market weight of I_k is

$$w_{m,I_k} = (1 - p_i - p_e)\lambda \frac{\mathbb{E}(r_{I_k})}{\mathbb{V}\text{ar}(r_{I_k})} + p_i\lambda \frac{\mathbb{E}(r_{I_k}) - c_{I_k}}{\mathbb{V}\text{ar}(r_{I_k})} + p_e\lambda \frac{\mathbb{E}(r_{I_k})}{\mathbb{V}\text{ar}(r_{I_k})} = \lambda \frac{\mathbb{E}(r_{I_k})}{\mathbb{V}\text{ar}(r_{I_k})} - p_i\lambda \frac{c_{I_k}}{\mathbb{V}\text{ar}(r_{I_k})}.$$

Therefore,

$$\frac{w_{m,I_k} - w_{i,I_k}^*}{w_{m,I_k}} \mathbb{E}(r_{I_k}) = \frac{\lambda \frac{\mathbb{E}(r_{I_k})}{\mathbb{V}\text{ar}(r_{I_k})} - p_i\lambda \frac{c_{I_k}}{\mathbb{V}\text{ar}(r_{I_k})} - \lambda \frac{\mathbb{E}(r_{I_k}) - c_{I_k}}{\mathbb{V}\text{ar}(r_{I_k})}}{\lambda \frac{\mathbb{E}(r_{I_k})}{\mathbb{V}\text{ar}(r_{I_k})} - p_i\lambda \frac{c_{I_k}}{\mathbb{V}\text{ar}(r_{I_k})}} \mathbb{E}(r_{I_k}) \tag{59}$$

Simplifying the above expression,

$$\frac{w_{m,I_k} - w_{i,I_k}^*}{w_{m,I_k}} \mathbb{E}(r_{I_k}) = \frac{c_{I_k} - p_i c_{I_k}}{1 - \frac{p_i c_{I_k}}{\mathbb{E}(r_{I_k})}}. \tag{60}$$

Using the first order expansion $\frac{1}{1-\frac{p_i c_{I_k}}{\mathbb{E}(r_{I_k})}} \simeq 1 + \frac{p_i c_{I_k}}{\mathbb{E}(r_{I_k})}$, when $\frac{p_i c_{I_k}}{\mathbb{E}(r_{I_k})}$ is small (assumption (iii)),

$$\frac{w_{m,I_k} - w^*_{i,I_k}}{w_{m,I_k}} \mathbb{E}(r_{I_k}) \simeq \left(1 - p_i \left(1 - \frac{(1-p_i)c_{I_k}}{\mathbb{E}(r_{I_k})}\right)\right) c_{I_k}. \tag{61}$$

When p_i is small (assumption (ii)),

$$\frac{w_{m,I_k} - w^*_{i,I_k}}{w_{m,I_k}} \mathbb{E}(r_{I_k}) \simeq c_{I_k}. \tag{62}$$

Let us consider an illustrative example where $\mathbb{E}(r_{I_k}) = 1\%$, $c_{I_k} = 0.10\%$, and $p_i = 10\%$: $\left(1 - p_i \left(1 - \frac{(1-p_i)c_{I_k}}{\mathbb{E}(r_{I_k})}\right)\right) c_{I_k} = 0.09\% \simeq c_{I_k}$.

Proof of Corollary 2: Spillover effects

Denoting by w_X the vector of weights of assets X in the excluded market, we write the exclusion-asset premium as:

$$\gamma \frac{p_e}{1-p_e} q \,\mathbb{C}\text{ov}(r_{X_k}, r_{m_X} | r_I) = \gamma \frac{p_e}{1-p_e} q \,\mathbb{C}\text{ov}(r_{X_k}, r_X | r_I) w_X. \tag{63}$$

Since $q w_X = q_X$,

$$\gamma \frac{p_e}{1-p_e} q \,\mathbb{C}\text{ov}(r_{X_k}, r_{m_X} | r_I) = \gamma \frac{p_e}{1-p_e} \sum_{j=1}^{n_X} q_{X_j} \,\mathbb{C}\text{ov}(r_{X_k}, r_{X_j} | r_I). \tag{64}$$

The breakdown is done in the same way for the exclusion-market premium, and thus

$$\begin{aligned} \gamma \frac{p_e}{1-p_e} q \,\mathbb{C}\text{ov}(r_{X_k}, r_{m_X} | r_I) + \gamma q \,\mathbb{C}\text{ov}(r_{X_k}, r_{m_X} | r_{m_I}) = \sum_{j=1}^{n_X} q_{X_j} \Bigg(&\gamma \frac{p_e}{1-p_e} \,\mathbb{C}\text{ov}(r_{X_k}, r_{X_j} | r_I) \\ &+ \gamma \,\mathbb{C}\text{ov}(r_{X_k}, r_{X_j} | r_{m_I}) \Bigg). \end{aligned} \tag{65}$$

References

Acharya, V. V., Pedersen, L. H., 2005. Asset pricing with liquidity risk. Journal of Financial Economics 77, 375–410.

Atmaz, A., Basak, S., 2018. Belief dispersion in the stock market. Journal of Finance 73, 1225–1279.

Baker, S. D., Hollifield, B., Osambela, E., 2016. Disagreement, speculation, and aggregate investment. Journal of Financial Economics 119, 210–225.

Banerjee, S., Davis, J., Gondhi, N., 2019. Choosing to disagree in financial markets. Unpublished working paper. SSRN July 2019.

Banerjee, S., Kremer, I., 2010. Disagreement and learning: Dynamic patterns of trade. Journal of Finance 65, 1269–1302.

Barber, B. M., Morse, A., Yasuda, A., 2019. Impact investing. Unpublished working paper. NBER December 2019.

Battiston, S., Mandel, A., Monasterolo, I., Schutze, F., Visentin, G., 2017. A climate stress-test of the financial system. Nature Climate Change 7, 283–288.

Bauer, R., Koedijk, K., Otten, R., 2005. International evidence on ethical mutual fund performance and investment style. Journal of Banking and Finance 29, 1751–1767.

Bekaert, G., Harvey, C. R., 1995. Time-varying world market integration. Journal of Finance 50, 403–444.

Benabou, R., Tirole, J., 2010. Individual and corporate social responsibility. Economica 77, 1–19.

Bhamra, H., Uppal, R., 2014. Asset prices with heterogeneity in preferences and beliefs. Review of Financial Studies 27, 519–580.

Biais, B., Bossaerts, P., 1998. Asset prices and trading volume in a beauty contest. Review of Economic Studies 65, 307–340.

Bolton, P., Kacperczyk, M. T., 2020. Do investors care about carbon risk? Unpublished working paper. NBER .

Brammer, S., Brooks, C., Pavelin, S., 2006. Corporate social performance and stock returns: UK evidence from disaggregate measures. Financial management 35, 97–116.

Carhart, M. M., 1997. On persistence in mutual fund performance. Journal of Finance 52, 57–82.

Carlin, B. I., Longstaff, F. A., Matoba, K., 2014. Disagreement and asset prices. Journal of Financial Economics 114, 226–238.

Chatterji, A. K., Durand, R., Levine, D. I., Touboul, S., 2016. Do ratings of firms converge? Implication for managers, investors and strategy researchers. Strategic Management Journal 37, 1597–1614.

Chatterji, A. K., Levine, D. I., Toffel, Michael, W., 2009. How well do social ratings actually measure corporate social responsibility? Journal of Economics and Management Strategy 18, 125–169.

Chava, S., 2014. Environmental externalities and cost of capital. Management Science 60, 2223–2247.

David, A., 2008. Heterogeneous beliefs, speculation, and the equity premium. Journal of Finance 63, 41–83.

de Jong, F., de Roon, F. A., 2005. Time-varying market integration and expected returns in emerging markets. Journal of Financial Economics 78, 583–613.

Derwall, J., Guenster, N., Bauer, R., Koedijk, K., 2005. The eco-efficency premium puzzle. Financial Analysts Journal 61, 51–63.

Dhrymes, P. J., 1974. Econometrics. Springer-Verlag New York.

Dumas, B., Kurshev, A., Uppal, R., 2009. Equilibrium portfolio strategies in the presence of sentiment risk and excess volatility. Journal of Finance 64, 579–629.

Eccles, R. G., Ioannou, I., Serafeim, G., 2014. The impact of corporate sustainability on organizational processes and performance. Management Science 60, 2835–2857.

Edmans, A., 2011. Does the stock market fully value intangibles? Employee satisfaction and equity prices. Journal of Financial Economics 101, 621–640.

Eiling, E., 2013. Industry-specific human capital, idiosyncratic risk, and the cross-section of expected stock returns. Journal of Finance 68, 43–84.

ElGhoul, S., Guedhami, O., Kowk, C. C., Mishra, D. R., 2011. Does corporate social responsibility affect the cost of capital? Journal of Banking and Finance 35, 2388–2406.

Errunza, V., Losq, E., 1985. International asset pricing under mild segmentation: Theory and test. Journal of Finance 40, 105–124.

Fama, E. F., French, K. R., 1992. The cross-section of expected stock returns. Journal of Finance 47, 427–465.

Fama, E. F., French, K. R., 1993. Common risk factors in the returns on stocks and bonds. Journal of Financial Economics 33, 3–56.

Fama, E. F., French, K. R., 2007. Disagreement, tastes, and asset prices. Journal of Financial Economics 83, 667–689.

Fama, E. F., MacBeth, J. D., 1973. Risk, return and equilibrium: Empirical tests. Journal of Political Economy 81, 607–636.

Galema, R., Plantinga, A., Scholtens, B., 2008. The stocks at stake: Return and risk in socially responsible investment. Journal of Banking and Finance 32, 2646–2654.

Gibson, R., Krueger, P., Riand, N., Schmidt, P. S., 2020. ESG rating disagreement and stock returns. Unpublished working paper. SSRN June 2020.

Gollier, C., Pouget, S., 2014. The "washing machine":Investment strategies and corporate behavior with socially responsible investors. Unpublished working paper. Toulouse School of Economics January 2014.

GSIA, 2018. 2018 Global sustainable investment review. Tech. rep., Global Sustainable Investment Alliance.

Harris, M., Raviv, A., 1993. Differences of opinion make a horse race. Review of Financial Studies 6, 473–506.

Hart, O., Zingales, L., 2017. Companies should maximize shareholder welfare not market value. Journal of Law, Finance, and Accounting 2, 247–274.

Hartzmark, S., Sussman, A., 2019. Do investors value sustainability? A natural experiment examining ranking and fund flows. Journal of Finance 74, 2789–2837.

Heinkel, R., Kraus, A., Zechner, J., 2001. The effect of green investment on corporate behaviour. Journal of Financial and Quantitative Analysis 36, 377–389.

Hong, H., Kacperczyk, M., 2009. The price of sin: the effects of social norms on markets. Journal of Financial Economics 93, 15–36.

Hsu, P.-H., Li, K., Tsou, C.-Y., 2019. The pollution premium. Unpublished working paper May 2019.

In, S. Y., Park, K. Y., Monk, A. H. B., 2019. Is 'being green' rewarded in the market?: An empirical investigation of decarbonization and stock returns. Unpublished working paper. SSRN August 2019.

Jouini, E., Napp, C., 2007. Consensus consumer and intertemporal asset pricing with heterogeneous beliefs. Review of Economic Studies 74, 1149–1174.

Kandel, S., Stambaugh, R. F., 1995. Portfolio inefficiency and the cross-section of expected returns. Journal of Finance 50, 157–184.

Kotsantonis, S., Serafeim, G., 2019. Four things no one will tell you about ESG data. Journal of Applied Corporate Finance 31, 50–58.

Krüger, P., 2015. Corporate goodness and shareholder wealth. Journal of Financial Economics 115, 304–329.

Krüger, P., Sautner, Z., Starks, L., 2020. The importance of climate risk for institutional investors. Review of Financial Studies, 33, 1067–1111.

Landier, A., Lovo, S., 2020. ESG Investing: How to Optimize Impact? SSRN Working Paper .

Ledoit, O., Wolf, M., 2003. Improved estimation of the covariance matrix of stock returns with an application to portfolio selection. Journal of Empirical Finance 10, 603–621.

Lewellen, J., Nagel, S., Shanken, J., 2010. A skeptical appraisal of asset pricing tests. Journal of Financial Economics 96, 175–194.

Lins, K. V., Servaes, H., Tamayo, A., 2017. Social capital, trust, and firm performance: The value of corporate social responsibility during the financial crisis. Journal of Finance 72, 1785–1824.

Luo, H. A., Balvers, R. J., 2017. Social screens and systematic investor boycott risk. Journal of Financial and Quantitative Analysis 52, 365–399.

Mattingly, J. E., Berman, S. L., 2006. Measurement of corporate social action: Discovering taxonomy in the kinder lydenburg domini ratings data. Business and Society 45, 20–46.

Merton, R. C., 1987. A simple model of capital market equilibrium with incomplete information. Journal of Finance 42, 483–510.

Morgan, J., Tumlinson, J., 2019. Corporate provision of public goods. Management Science Published online in Articles in Advance.

Newey, W. K., West, K. D., 1987. A simple, positive semi-definite, heteroskedasticity and autocorrelation consistent covariance matrix. Econometrica 55, 703–708.

Oehmke, M., Opp, M., 2019. A Theory of Socially Responsible Investment. SSRN Working Paper .

Pastor, L., Stambaugh, R. F., Taylor, L. A., 2020. Sustainable investing in equilibrium. Forthcoming in the Journal of Financial Economics .

Pedersen, L. H., Fitzgibbons, S., Pomorski, L., 2020. Responsible investing: The ESG-efficient frontier. Unpublished working paper. SSRN .

Renneboog, L., Ter Horst, J., Zhang, C., 2008. The price of ethics and stakeholder governance: The performance of socially responsible mutual funds. Journal of Corporate Finance 14, 302–322.

Riedl, A., Smeets, P., 2017. Why do investors hold socially responsible mutual funds? Journal of Finance 72, 2505–2550.

Scheinkman, J. A., Xiong, W., 2003. Overconfidence and speculative bubbles. Journal of Political Economy 111, 1183–1219.

Sharfman, M., Fernando, C., 2008. Environmental risk management and the cost of capital. Strategic Management Journal 29, 569–592.

Statman, M., Glushkov, D., 2009. The wages of social responsibility. Financial Analysts Journal 65, 33–46.

Statman, M., Glushkov, D., 2016. Classifying and measuring the performance of socially responsible mutual funds. Journal of Portfolio Management 42, 140–151.

Teoh, S. H., Ivo, W., Paul, W., 1999. The effect of socially activist investment policies on the financial markets: Evidence from the south african boycott. Journal of Business 72, 35–89.

US SIF, 2018. Report on US sustainable, responsible and impact investing trends. Tech. rep., The Forum for Sustainable and Responsible Investment.

Tables and Figures

Table 1 Profile of the sin industries. This table reports the number of firms and the total market capitalization corresponding to the alcohol, tobacco, gaming and defense industries between December 31, 2007, and December 31, 2019.

	Number of firms				Average Market Capitalization ($ billion)			
	Alcohol	Tobacco	Gaming	Defense	Alcohol	Tobacco	Gaming	Defense
Dec. 2007 - Dec. 2011	15	9	10	21	1.8	26.9	4.7	2.5
Dec. 2011 - Dec. 2015	15	8	8	18	3.3	41.5	7	5.4
Dec. 2015 - Dec. 2019	13	8	10	9	6.4	53.6	13.8	8.1

Table 2 Descriptive statistics on the investable industries. This table reports the descriptive statistics for the proxy for the cost of environmental externalities $\tilde{c}$ and the monthly returns in excess of the 1-month T-Bill between December 31, 2007, and December 31, 2019, in each of the 46 investable industries (i.e., the 49 SIC industries from which the alcohol, tobacco and gaming industries have been excluded). The construction of the proxy for the cost of environmental externalities is described in section 2.1.2. In this table, the industries are ranked in descending order of the average proxy $\tilde{c}$.

	Environmnetal cost proxy					Returns				
Industry Name	Mean	Median	St dev.	Min.	Max.	Mean	Median	St dev.	Min.	Max.
Defense	0.87	0.83	0.08	0.72	0.96	0.021	0.018	0.011	-0.001	0.039
Aircraft	0.69	0.72	0.09	0.47	0.80	0.018	0.018	0.004	0.004	0.028
Precious metals	0.66	0.61	0.08	0.52	0.75	0.008	0.015	0.018	-0.026	0.043
Printing and publishing	0.58	0.58	0.05	0.43	0.66	0.017	0.017	0.009	0.000	0.039
Non-metallic and industrial metal mining	0.54	0.63	0.18	0.17	0.86	0.013	0.012	0.009	-0.007	0.038
Coal	0.52	0.53	0.25	0.32	0.99	-0.002	-0.006	0.018	-0.041	0.039
Agriculture	0.50	0.40	0.61	-1.58	1.00	0.017	0.018	0.011	-0.006	0.036
Entertainment	0.41	0.38	0.18	0.15	0.64	0.025	0.024	0.006	0.010	0.035
Personal services	0.38	0.38	0.04	0.29	0.46	0.016	0.017	0.005	0.004	0.025
Petroleum and natural gas	0.36	0.33	0.08	0.27	0.58	0.008	0.008	0.006	-0.005	0.023
Cand & Soda	0.36	0.32	0.10	0.28	0.57	0.010	0.010	0.003	0.005	0.018
Communication	0.32	0.27	0.09	0.24	0.49	0.014	0.013	0.005	0.005	0.025
Trading	0.32	0.30	0.09	0.22	0.50	0.014	0.014	0.005	0.002	0.026
Retail	0.29	0.28	0.11	0.15	0.47	0.015	0.015	0.005	0.006	0.024
Banking	0.27	0.27	0.07	0.19	0.44	0.012	0.012	0.005	-0.002	0.026
Pharmaceutical products	0.23	0.22	0.03	0.19	0.29	0.017	0.017	0.006	0.007	0.029
Insurance	0.22	0.18	0.20	0.04	0.57	0.015	0.014	0.004	0.005	0.025
Meals	0.19	0.18	0.09	0.10	0.41	0.017	0.016	0.004	0.010	0.032
Shipbuilding & Railroad equipment	0.19	0.10	1.12	-2.28	0.92	0.014	0.014	0.007	0.000	0.032
Chemicals	0.16	0.21	0.12	-0.26	0.25	0.015	0.015	0.005	0.007	0.033
Real estate	0.14	0.11	0.22	-0.13	0.50	0.017	0.017	0.009	0.003	0.044
Clothes apparel	0.13	0.24	0.21	-0.10	0.50	0.018	0.020	0.008	0.004	0.038
Transportation	0.11	0.15	0.17	-0.18	0.43	0.016	0.016	0.004	0.010	0.029
Recreation	0.10	0.09	0.18	-0.11	0.57	0.014	0.014	0.006	0.003	0.031
Steel works	0.08	0.06	0.49	-0.54	0.74	0.012	0.011	0.004	0.005	0.028
Business services	0.05	0.05	0.07	-0.01	0.23	0.019	0.019	0.003	0.011	0.029
Computers	0.02	0.05	0.14	-0.25	0.17	0.018	0.016	0.005	0.010	0.035
Automobiles and trucks	-0.05	-0.02	0.07	-0.16	0.05	0.016	0.013	0.010	0.003	0.050
Shipping containers	-0.08	0.30	0.52	-1.13	0.64	0.013	0.013	0.004	0.005	0.026
Consumer Goods	-0.10	-0.02	0.14	-0.38	0.09	0.010	0.009	0.004	0.003	0.021
Rubber and plastic products	-0.18	-0.12	0.54	-1.61	0.39	0.018	0.018	0.008	0.004	0.046
Healthcare	-0.22	-0.19	0.14	-0.39	0.04	0.014	0.015	0.006	0.002	0.026
Food products	-0.23	-0.21	0.10	-0.41	-0.05	0.014	0.015	0.005	0.003	0.021
Medical equipment	-0.26	-0.27	0.09	-0.46	-0.15	0.017	0.018	0.004	0.006	0.026
Fabricated products	-0.33	0.11	1.05	-3.44	0.66	0.014	0.016	0.010	-0.005	0.034
Chips	-0.40	-0.40	0.14	-0.73	-0.22	0.017	0.017	0.004	0.008	0.027
Textiles	-0.54	-0.69	0.64	-1.88	0.61	0.021	0.021	0.007	0.010	0.046
Wholesale	-0.57	-0.59	0.13	-0.71	-0.25	0.016	0.016	0.005	0.008	0.029
Utilities	-0.59	-0.50	0.28	-1.12	-0.27	0.010	0.010	0.003	0.001	0.018
Business supplies	-0.77	-0.62	0.42	-1.44	0.16	0.015	0.015	0.006	0.005	0.037
Machinery	-0.83	-0.77	0.37	-1.81	-0.40	0.012	0.010	0.006	0.002	0.036
Construction materials	-2.17	-1.97	0.63	-3.54	-1.45	0.018	0.017	0.005	0.008	0.038
Construction	-2.33	-2.95	1.44	-4.36	-0.44	0.016	0.015	0.005	0.005	0.027
Electrical equipment	-2.58	-2.43	0.43	-3.51	-2.06	0.013	0.013	0.005	0.003	0.030
Measuring and control equipment	-2.63	-2.57	0.28	-3.85	-2.29	0.019	0.018	0.004	0.012	0.031
Other	-6.62	-6.56	2.40	-11.93	-3.48	0.012	0.012	0.002	0.005	0.018
Investable market portfolio m_I	-0.02	-0.02	0.00	-0.02	-0.01	0.015	0.015	0.003	0.009	0.027
Excluded market portfolio m_X						0.017	0.016	0.007	0.002	0.038

Table 3 Summary statistics on the dependent and independent variables. This table provides the summary statistics on the dependent and independent variables in the estimations of the S-CAPM in the case of investable industry portfolios and excluded stocks between December 2007 and December 2019. The investable market corresponds to the 49 SIC industries from which the alcohol, tobacco and gaming industries have been excluded. The excluded market corresponds to the 52 stocks issued by the alcohol, tobacco and gaming industries. The statistics relate to the exclusion-market factors for investable industry portfolios ($q\,\mathbb{C}\text{ov}(r_I, r_{m_X}|r_{m_I})$) and excluded stocks ($q\,\mathbb{C}\text{ov}(r_X, r_{m_X}|r_{m_I})$), respectively; the exclusion-asset factor for excluded stocks ($q\,\mathbb{C}\text{ov}(r_X, r_{m_X}|r_I)$); the proxy for the direct taste factor for investable assets ($\tilde{p}_i\tilde{C}_I$); the proxy for the indirect taste factor in the case of excluded stocks ($\tilde{p}_i B_{XI}\tilde{C}_I$); the betas of the investable industry portfolios and excluded stocks with the Fama and French (1993) size and value factors ($\beta_{I.SMB}$, $\beta_{I.HML}$, $\beta_{X.SMB}$, $\beta_{X.HML}$) and the Carhart (1997) momentum factor ($\beta_{I.MOM}$, $\beta_{X.MOM}$), respectively. The statistics presented are the means, medians, standard deviations, minima, maxima and first-order autocorrelations (ρ_1) of the variables of interest based on monthly excess returns on the NYSE, AMEX and NASDAQ common stocks between December 31, 2007, and December 31, 2019.

	Mean	Median	Stdev	Min	Max	ρ_1
r_I	0.015	0.015	0.008	-0.041	0.05	0.347
β_{Im_I}	1.07	1.106	0.364	-0.338	2.296	0.271
$\tilde{p}_i\tilde{C}_I$	-2×10^{-4}	10^{-4}	10^{-3}	-7×10^{-3}	10^{-3}	0.018
$q\,\mathbb{C}\text{ov}(r_I, r_{m_X}\|r_{m_I})$	-2×10^{-7}	-3×10^{-7}	7×10^{-6}	-6×10^{-5}	3×10^{-5}	0.291
$\beta_{I.SMB}$	-0.11	-0.005	3.866	-39.247	16.100	0.441
$\beta_{I.MOM}$	-0.485	-1.351	6.064	-15.853	59.577	0.481
$\beta_{I.MOM}$	1.383	2.253	7.778	-57.340	30.540	0.504
r_X	0.014	0.017	0.035	-0.440	0.197	0.017
β_{Xm_I}	0.822	0.615	0.926	-4.120	5.943	0.201
$\tilde{p}_i B_{XI}\tilde{C}_I$	6×10^{-5}	-6×10^{-5}	6×10^{-3}	-4×10^{-2}	3×10^{-2}	-0.033
$q\,\mathbb{C}\text{ov}(r_X, r_{m_X}\|r_I)$	-5×10^{-6}	-10^{-6}	8×10^{-5}	-6×10^{-4}	9×10^{-4}	0.08
$q\,\mathbb{C}\text{ov}(r_X, r_{m_X}\|r_{m_I})$	10^{-5}	9×10^{-6}	5×10^{-5}	6×10^{-4}	10^{-3}	0.117
$\beta_{X.SMB}$	-1.151	-0.796	8.282	-50.964	56.431	0.004
$\beta_{X.HML}$	-2.458	-2.511	9.790	-88.123	55.329	0.014
$\beta_{X.MOM}$	0.297	0.021	14.101	-76.370	114.336	0.080

Table 4 Cross-sectional regressions for investable stock industry-sorted portfolios with tastes for green firms. This table presents the estimates of the S-CAPM on the value-weighted monthly returns in excess of the 1-month T-Bill for 46 investable stock industry-sorted portfolios between December 31, 2007, and December 31, 2019. The specification of the S-CAPM is written as follows: $\mathbb{E}(r_{I_k}) = \alpha + \delta_{mkt}\beta_{I_k m_I} + \delta_{taste}\tilde{p}_i\tilde{c}_{I_k} + \delta_{ex.mkt}q\,\mathbb{C}\text{ov}(r_{I_k}, r_{m_X}|r_{m_I})$, where r_{I_k} is the value-weighted excess return on industry portfolio I_k ($k = 1, ..., n_I$), $\beta_{I_k m_I}$ is the slope of an OLS regression of r_{I_k} on r_{m_I}; $\tilde{p}_i$ is the proxy for the proportion of integrators' wealth; $\tilde{c}_{I_k}$ is the proxy for the cost of environmental externalities of industry I_k; q is the proportion of the excluded assets' market value in the market, and $\mathbb{C}\text{ov}(r_{I_k}, r_{m_X}|r_{m_I})$ is the covariance of the excess return on portfolio I_k with that of the excluded market, the excess returns on the investable market being given. This specification is compared with two other specifications: (i) the 4F S-CAPM is the S-CAPM to which the betas of the Fama and French (1993) size and value factors and the Carhart (1997) momentum factor are added, and (ii) the 4F model is the CAPM with respect to the investable market returns to which the betas of the Fama and French (1993) size and value factors and the Carhart (1997) momentum factor are added: $\mathbb{E}(r_{I_k}) = \alpha + \delta_{mkt}\beta_{I_k m_I} + \delta_{SMB}\beta_{I_k SMB} + \delta_{HML}\beta_{I_k HML} + \delta_{MOM}\beta_{I_k MOM}$. These specifications are estimated using the Fama and MacBeth (1973) procedure. First, the variables are estimated portfolio-by-portfolio in a 3-year rolling window at monthly intervals. In the second pass, a cross-sectional regression is performed month-by-month on all the portfolios. The estimated parameter is the average value of the estimates obtained on the 109 months during the period. t-values, estimated following Newey and West (1987) with three lags, are reported between parentheses. The last column reports the average OLS adjusted-R^2 and the GLS R^2 on the row underneath. The 95% confidence intervals are shown in brackets.

	α	δ_{mkt}	δ_{taste}	$\delta_{ex.mkt}$	δ_{SMB}	δ_{HML}	δ_{MOM}	Adj. OLS/GLS R^2
Estimate	0.0143	0.0004						0.05 [0.03,0.07]
t-value	(13)	(0.44)						0.07 [0.05,0.09]
Estimate	0.0149		0.174					-0.02 [-0.02,-0.01]
t-value	(24.16)		(2.2)					0.01 [0,0.01]
Estimate	0.0149			119.2				0.06 [0.04,0.08]
t-value	(26.22)			(2.15)				0.08 [0.06,0.1]
Estimate	0.0144	0.0004	0.1922					0.03 [0.02,0.05]
t-value	(12.95)	(0.44)	(2.55)					0.08 [0.06,0.1]
Estimate	0.0137	0.0012	0.1737	56.1				0.08 [0.06,0.11]
t-value	(10.51)	(1.13)	(2.07)	(0.77)				0.14 [0.12,0.17]
Estimate	0.0148	0.0024	0.491	-105.7	0.0001	0.0005	0.000	0.22 [0.19,0.26]
t-value	(14.54)	(2.71)	(4.55)	(-1.94)	(0.36)	(2.26)	(0.09)	0.33 [0.3,0.36]
Estimate	0.0139	0.0028			0.000	0.0004	0.000	0.23 [0.19,0.27]
t-value	(14.81)	(3.14)			(0.14)	(2.14)	(0.15)	0.3 [0.26,0.33]

Table 5 Annual environmental taste effect estimates by industry. For all 46 investable SIC industries, this table reports the estimates of the annual taste effect $\widehat{\delta}_{taste}\tilde{p}_i\tilde{c}_{I_k} + \widehat{\delta}_{taste}\tilde{p}_i\tilde{c}_{m_I}\beta_{I_k m_I}$, which is the sum of the direct taste premium and the market effect. The market effect, $\widehat{\delta}_{taste}\tilde{p}_i\tilde{c}_{m_I}\beta_{I_k m_I}$, accounts for only 0.25 basis points in the total taste effect. The industries are ranked in descending order of their taste effect.

Industry name	Annual taste effect (in %)
Defense	0.14
Aircraft	0.12
Coal	0.12
Printing and publishing	0.1
Precious metals	0.1
Non-metallic and industrial metal mining	0.09
Agriculture	0.07
Entertainment	0.07
Personal services	0.07
Cand & Soda	0.06
Petroleum and natural gas	0.06
Communication	0.06
Trading	0.06
Retail	0.05
Banking	0.05
Pharmaceutical products	0.04
Meals	0.04
Insurance	0.04
Clothes apparel	0.03
Chemicals	0.03
Steel works	0.03
Real estate	0.03
Recreation	0.02
Transportation	0.02
Business services	0.01
Computers	0.01
Automobiles and trucks	0
Shipping containers	0
Consumer Goods	-0.02
Fabricated products	-0.02
Healthcare	-0.03
Food products	-0.04
Medical equipment	-0.04
Rubber and plastic products	-0.05
Textiles	-0.05
Chips	-0.06
Shipbuilding & Railroad equipment	-0.07
Wholesale	-0.09
Utilities	-0.1
Business supplies	-0.1
Machinery	-0.13
Construction materials	-0.37
Construction	-0.37
Measuring and control equipment	-0.43
Electrical equipment	-0.44
Other	-1.12

Table 6 Cross-sectional regressions for investable stock industry-sorted portfolios with tastes for green firms and unexpected shifts in tastes. This table presents the estimates of the *augmented S-CAPM* with unexpected shifts in tastes on the value-weighted monthly returns in excess of the 1-month T-Bill for 46 investable stock industry-sorted portfolios between December 31, 2007, and December 31, 2019. Panel A, B, and C, present the estimates on all industries, all industries without the coal industry, and all industries without the coal and construction industries, respectively. The specification is written as follows: $\mathbb{E}(r_{I_k}) = \alpha + \delta_{mkt}\beta_{I_k m_I} + \delta_{taste}\tilde{p}_i\tilde{c}_{I_k} + \delta_u \Delta\tilde{p}_i\tilde{c}_{I_k} + \delta_{ex.mkt} q\,\mathbb{C}\text{ov}(r_{I_k}, r_{m_X}|r_{m_I})$, where r_{I_k} is the value-weighted excess return on industry portfolio I_k ($k = 1, ..., n_I$), $\beta_{I_k m_I}$ is the slope of an OLS regression of r_{I_k} on r_{m_I}; $\tilde{p}_i$ is the proxy for the proportion of integrators' wealth; $\tilde{c}_{I_k}$ is the proxy for the cost of environmental externalities of industry I_k; $\Delta\tilde{p}_i\tilde{c}_{I_k}$ is the proxy for the unexpected shifts in tastes; q is the proportion of the excluded assets' market value in the market, and $\mathbb{C}\text{ov}(r_{I_k}, r_{m_X}|r_{m_I})$ is the covariance of the excess return on portfolio I_k with that of the excluded market, the excess returns on the investable market being given. This specification is compared with the *augmented 4F S-CAPM*, which is the augmented S-CAPM to which the betas of the Fama and French (1993) size and value factors and the Carhart (1997) momentum factor are added. These specifications are estimated using the Fama and MacBeth (1973) procedure. First, the variables are estimated portfolio-by-portfolio in a 3-year rolling window at monthly intervals. In the second pass, a cross-sectional regression is performed month-by-month on all the portfolios. The estimated parameter is the average value of the estimates obtained on the 109 months during the period. t-values, estimated following Newey and West (1987) with three lags, are reported between parentheses. The last column reports the average OLS adjusted-R^2 and the GLS R^2 on the row underneath. The 95% confidence intervals are shown in brackets.

	α	δ_{mkt}	δ_{taste}	δ_u	$\delta_{ex.mkt}$	δ_{SMB}	δ_{HML}	δ_{MOM}	Adj. OLS/GLS R^2
Panel A: All industries									
Estimate	0.0144	0.0004	0.1922						0.03 [0.02,0.05]
t-value	(12.95)	(0.44)	(2.55)						0.08 [0.06,0.1]
Estimate	0.0145	0.0003		-8.9					0.04 [0.03,0.06]
t-value	(12.98)	(0.31)		(-1.33)					0.09 [0.07,0.11]
Estimate	0.0145	0.0003	-0.1562	-18.5					0.03 [0.01,0.05]
t-value	(12.94)	(0.31)	(-1.05)	(-2.22)					0.1 [0.08,0.11]
Estimate	0.014	0.001	-0.1977	-14.9	46.3				0.08 [0.06,0.11]
t-value	(10.67)	(0.96)	(-1.44)	(-1.78)	(0.62)				0.16 [0.14,0.18]
Estimate	0.015	0.0022	0.2496	-9.3	-113.6	0.0001	0.0004	0.000	0.22 [0.18,0.26]
t-value	(14.91)	(2.43)	(1.69)	(-1.27)	(-2.01)	(0.39)	(2.1)	(-0.17)	0.34 [0.31,0.37]
Panel B: All industries without the coal industry (SIC 29)									
Estimate	0.0135	0.0016	0.3931						0.03 [0.01,0.05]
t-value	(16.54)	(1.94)	(9.25)						0.08 [0.05,0.1]
Estimate	0.0135	0.0016		-2.3					0.04 [0.02,0.06]
t-value	(16.67)	(1.88)		(-0.42)					0.08 [0.06,0.1]
Estimate	0.0136	0.0015	0.1879	-8.8					0.02 [0,0.05]
t-value	(16.68)	(1.84)	(1.66)	(-1.32)					0.09 [0.07,0.11]
Estimate	0.0132	0.0021	0.0983	-8.3	82.1				0.03 [0.01,0.06]
t-value	(18.39)	(2.53)	(0.89)	(-1.19)	(1.57)				0.12 [0.1,0.14]
Estimate	0.014	0.002	0.2704	-8.7	15.9	0.0002	0.0001	0.0002	0.13 [0.09,0.16]
t-value	(19.46)	(2.13)	(1.87)	(-1.27)	(0.3)	(1.96)	(0.62)	(2.09)	0.27 [0.24,0.29]
Panel C: All industries without the coal (SIC 29) and construction (SIC 18) industries									
Estimate	0.0135	0.0015	0.4527						0.03 [0.01,0.05]
t-value	(15.98)	(1.81)	(7.44)						0.08 [0.06,0.1]
Estimate	0.0136	0.0015		-6.6					0.04 [0.02,0.06]
t-value	(16.44)	(1.78)		(-1.13)					0.09 [0.07,0.11]
Estimate	0.0137	0.0014	0.3642	-13.2					0.03 [0,0.05]
t-value	(16.35)	(1.68)	(3.08)	(-1.94)					0.09 [0.07,0.11]
Estimate	0.0132	0.002	0.2947	-12.7	80.4				0.03 [0.01,0.06]
t-value	(17.64)	(2.42)	(2.39)	(-1.77)	(1.54)				0.12 [0.1,0.15]
Estimate	0.0141	0.0019	0.546	-12.7	9.8	0.0003	0.0001	0.0002	0.13 [0.1,0.16]
t-value	(18.83)	(1.9)	(3.06)	(-1.68)	(0.19)	(2.08)	(0.61)	(2.13)	0.27 [0.24,0.3]

Table 7 Average taste premium over time. This table presents the average direct taste premium for the investable market ($\hat{\delta}_{taste}\tilde{p}_i\tilde{c}_{m_I}$), the petroleum and natural gas industry ($\hat{\delta}_{taste}\tilde{p}_i\tilde{c}_{\text{P.\&N.G.}}$), and the electrical equipment industry ($\hat{\delta}_{taste}\tilde{p}_i\tilde{c}_{\text{Elec}}$) estimated without the coal industry over three consecutive periods between 2007 (2010 for the second pass) and 2019. The former industry is underweighted by integrators ($\tilde{c}_{\text{P.\&N.G.}} = 0.49$ between Dec. 2007 and Dec. 2019) while the latter industry is overweighted by integrators ($\tilde{c}_{\text{Elec.}} = -0.63$ between Dec. 2007 and Dec. 2019). Finally, the spread between the average direct taste premia of the two industries under consideration is presented.

First pass First and second pass	2010-2013 2007-2013	2013-2016 2010-2016	2016-2019 2013-2019
Average direct taste premium (%)	-0.07	-0.10	-0.09
Petrol. and Nat. Gas average direct taste premium (%) (a)	0.08	0.11	0.12
Elec. Equip. average direct taste premium (%) (b)	-0.42	-0.87	-1.11
Taste spread (%) (a-b)	0.50	0.98	1.23

Table 8 Cross-sectional regressions on sin stocks' excess returns. This table provides the estimates obtained with the S-CAPM on the value-weighted monthly returns in excess of the 1-month T-Bill for 52 sin stocks between December 31, 2007, and December 31, 2019. The specification is written as follows: $\mathbb{E}(r_{X_k}) = \alpha + \delta_{mkt}\beta_{X_k m_I} + \delta_{taste}\tilde{p}_i B_{X_k I}\tilde{C}_I + \delta_{ex.asset} q \,\mathbb{C}\text{ov}(r_{X_k}, r_{m_X}|r_I) + \delta_{ex.mkt} q \,\mathbb{C}\text{ov}(r_{X_k}, r_{m_X}|r_{m_I})$, where r_{X_k} is the value-weighted excess return on stock X_k ($k = 1, ..., n_X$), and $\beta_{X_k m_I}$ is the slope of an OLS regression of r_{X_k} on r_{m_I}; $\tilde{p}_i B_{X_k I}\tilde{C}_I$ is the proxy for the indirect taste factor and $\tilde{p}_i$ is the proxy for the proportion of integrators' wealth; q is the proportion of the excluded assets' market value in the market, and $\mathbb{C}\text{ov}(r_{X_k}, r_{m_X}|r_I)$ (and $\mathbb{C}\text{ov}(r_{X_k}, r_{m_X}|r_{m_I})$) are the covariances of the excess returns on stock X_k with those on the excluded market, the excess returns on the investable market (and the vector of investable assets, respectively) being given. The investable assets are analyzed using 46 industry-sorted portfolios. The S-CAPM specification is compared with two other specifications: (i) the 4F S-CAPM is the S-CAPM to which the betas of the Fama and French (1993) size and value factors and the Carhart (1997) momentum factor have been added, and (ii) the 4F model is the CAPM with respect to the investable market to which the betas of the Fama and French (1993) size and value factors and the Carhart (1997) momentum factor have been added: $\mathbb{E}(r_{X_k}) = \alpha + \delta_{mkt}\beta_{X_k m_I} + \delta_{SMB}\beta_{X_k SMB} + \delta_{HML}\beta_{X_k HML} + \delta_{MOM}\beta_{X_k MOM}$. These specifications are estimated using the Fama and MacBeth (1973) procedure. First, the variables are estimated, stock-by-stock, in a 3-year rolling window, at monthly intervals. In the second pass, a cross-sectional regression is performed on a monthly basis on all the stocks. The data are winsorized: the two stocks giving the highest and lowest excess returns every month are removed from the second pass. The estimated parameter is the average value of the estimates obtained on all months during the period of interest. t-values, estimated following Newey and West (1987) with three lags, are reported between parentheses. The last column reports the average OLS adjusted-R^2 and the GLS R^2 on the row underneath. The 95% confidence intervals are shown in brackets.

	α	δ_{mkt}	δ_{taste}	$\delta_{ex.asset}$	$\delta_{ex.mkt}$	δ_{SMB}	δ_{HML}	δ_{MOM}	Adj. OLS/GLS R^2
Estimate	0.0114	0.0041							0.03 [0.02,0.05]
t-value	(10.18)	(4.35)							0.05 [0.04,0.07]
Estimate	0.0153		-0.4434						0.07 [0.05,0.09]
t-value	(16.54)		(-1.99)						0.07 [0.05,0.08]
Estimate	0.0152			-12.5					0.08 [0.06,0.11]
t-value	(19.13)			(-0.49)					0.08 [0.06,0.1]
Estimate	0.0134				162.3				0.18 [0.15,0.21]
t-value	(14.93)				(2.79)				0.14 [0.11,0.17]
Estimate	0.0136			50.2	211.7				0.2 [0.17,0.23]
t-value	(14.58)			(2.7)	(3.95)				0.21 [0.18,0.24]
Estimate	0.0116	0.0015		56	230.3				0.21 [0.18,0.25]
t-value	(8.4)	(1.3)		(2.74)	(4.17)				0.25 [0.22,0.28]
Estimate	0.0124	0.0005	-0.4093	49	196.9				0.24 [0.21,0.28]
t-value	(9.14)	(0.42)	(-2.14)	(2.32)	(3.88)				0.3 [0.27,0.33]
Estimate	0.0115	0.0014	-0.8344	42.3	219.3	0.0001	-0.0003	0.0002	0.31 [0.27,0.35]
t-value	(8.25)	(0.97)	(-2.59)	(1.92)	(3.97)	(0.58)	(-2.68)	(1.67)	0.42 [0.39,0.44]
Estimate	0.0115	0.0039				0.0000	0.0000	0.0001	0.1 [0.08,0.13]
t-value	(9.93)	(3.24)				(0.04)	(-0.29)	(0.72)	0.16 [0.14,0.18]

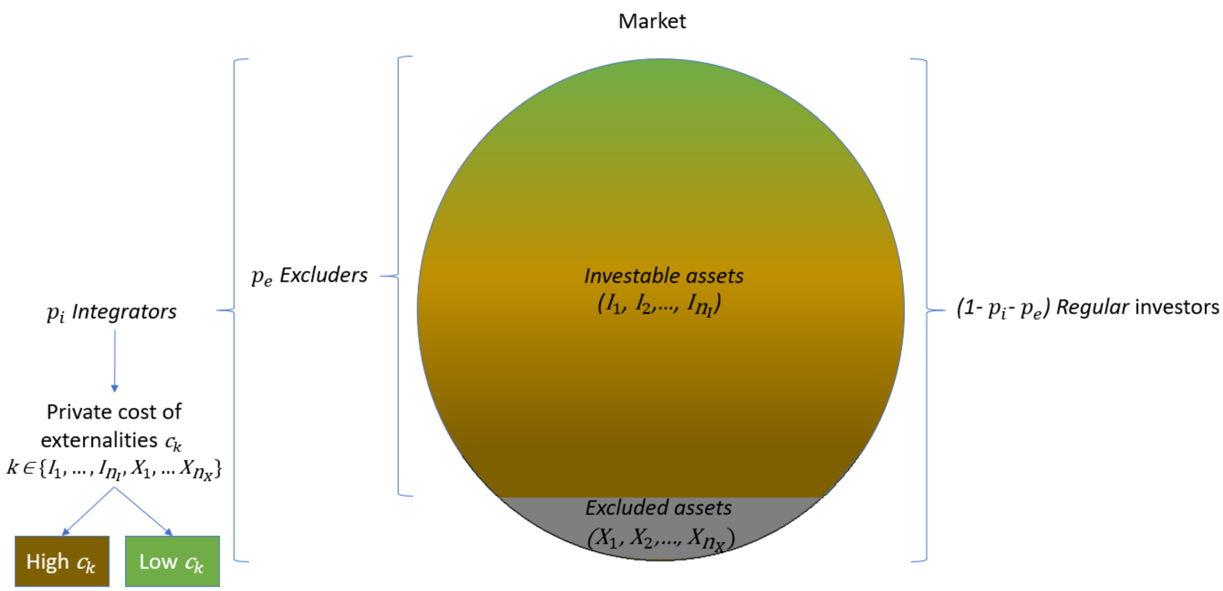


Figure 1. Graphical overview of the financial setup. This graph depicts the three types of investors involved (integrators, excluders and regular investors), their scope of eligible assets and the tastes of integrators through their private cost of externalities c_k.

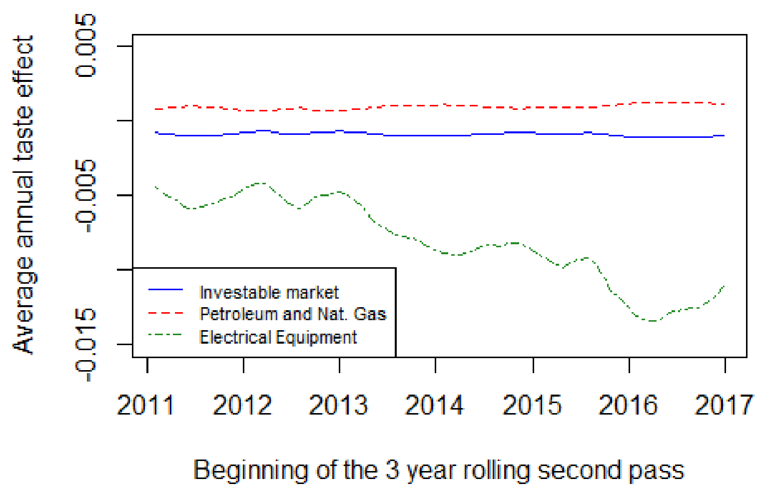


Figure 2. Evolution of the taste effect This figure shows the evolution of the taste effect for the investable market, the petroleum and natural gas industry, and the electrical equipment industry between December 2007 and December 2019. The first and second pass are both estimated over 3-year rolling periods.

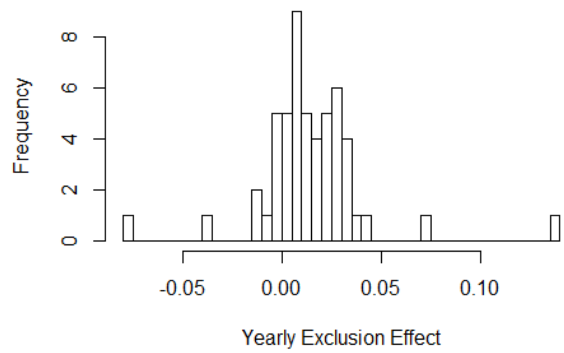


Figure 3. Distribution of the annual exclusion effect. This figure shows the distribution of the annual exclusion effect, $\widehat{\delta}_{ex.asset} q\,\mathbb{C}\text{ov}_t(r_X, r_{m_X}|r_I) + \widehat{\delta}_{ex.mkt} q\,\mathbb{C}\text{ov}_t(r_X, r_{m_X}|r_{m_I})$, over all sin stocks estimated between December 31, 2007, and December 31, 2019.

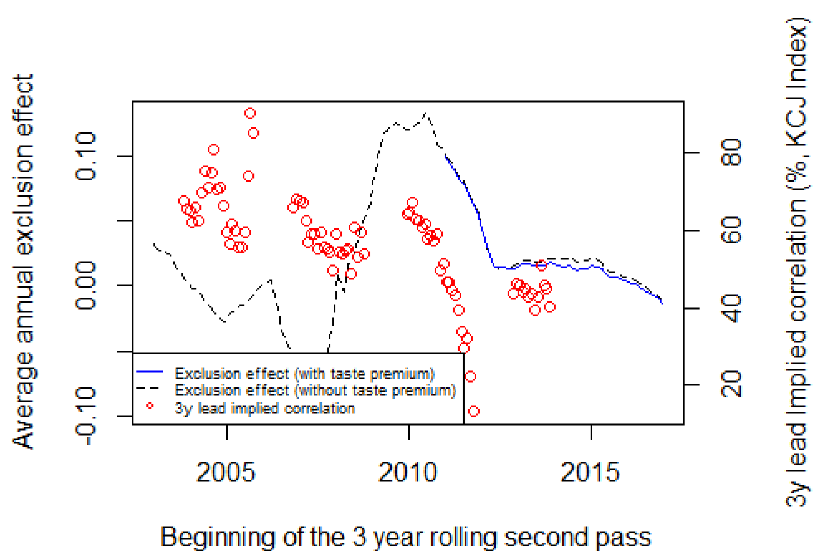


Figure 4. Evolution of the exclusion effect. This figure shows the evolution of the exclusion effect, $\widehat{\delta}_{ex.asset} q\,\mathbb{C}\text{ov}(r_X, r_{m_X}|r_I) + \widehat{\delta}_{ex.mkt} q\,\mathbb{C}\text{ov}(r_X, r_{m_X}|r_{m_I})$, between December 2007 and December 2019. The first and second pass are both estimated over 3-year rolling periods. This rolling estimation is based on winsorized data, where the lowest and highest excess returns in each cross-sectional regression have been removed. The 3-year lead S&P 500 implied correlation (KCJ Index) is also plotted.

Online Appendix for

"A Sustainable Capital Asset Pricing Model (S-CAPM): Evidence from green investing and sin stock exclusion"

Olivier David Zerbib

Abstract

This document provides additional proofs, including a generalization of the S-CAPM with several different sustainable investors. This appendix also provides a geometric interpretation of the exclusion premia, a factor correlation matrix, as well as details about the SEC's February 2004 amendment, and the funds used to construct instrument $\tilde{C}_I$. Finally, this document presents tables for the robustness tests for investable and excluded asset returns.

Table of contents

A Geometric interpretation of the exclusion premia

The exclusion premia can be interpreted from a geometric perspective. By assimilating the standard deviation to the norm of a vector and the correlation coefficient to the cosine of the angle between two vectors, the conditional covariance of the exclusion-asset premium can be associated with the following difference between two scalar products:

$$\mathbb{C}\text{ov}(r_{X_k}, r_{m_X}|r_I) \sim ||X_k||\,||m_X||\,cos(\alpha) - ||\,\mathbb{E}(X_k|I)||\,||\,\mathbb{E}(m_X|I)||\,cos(\alpha'),$$

where $\alpha = \widehat{X_k, m_X}$ and $\alpha' = \widehat{\mathbb{E}(X_k|I), \mathbb{E}(m_X|I)}$. The same applies to the exclusion-market premium. This effect is presented graphically in Figure 1: the better the hedge for sustainable investors is (i.e., the closer the vectors X_k and m_X are to space $(I_1, ..., I_{n_I})$), the lower the exclusion-asset premium will be.

B SEC's February 2004 amendment

The proxy is built as detailed in section 2.1.2 of the paper. Given the low reporting frequency of many funds until 2007 (the funds mainly reported their holdings in June and December), the proxy becomes robust from 2007 onwards. This period is notably subsequent to the entry into force of the SEC's February 2004 amendment requiring U.S. funds to disclose their holdings on a quarterly basis (Figure 2).

C Proof of Lemma 1

To lighten the writing in this proof, I remove notation r referring to the returns.

- Let us prove 1.(iii): $\Sigma_{XX} - \Sigma_{XI}\Sigma_{II}^{-1}\Sigma_{IX} = \mathbb{V}\text{ar}(X|I)$.
  Let $\begin{pmatrix} X \\ I \end{pmatrix}$ follow a multivariate normal distribution with mean $\begin{pmatrix} \mu_X \\ \mu_I \end{pmatrix}$ and covariance matrix $\begin{pmatrix} \Sigma_{XX} & \Sigma_{XI} \\ \Sigma_{IX} & \Sigma_{II} \end{pmatrix}$.
  Assuming that all the random variables (I_k) are not perfectly correlated, Σ_{II} is invertible and the conditional distribution of X given I is multivariate normal with mean vector $\mu_X + \Sigma_{XI}\Sigma_{II}^{-1}(I - \mu_I)$ and covariance matrix $\Sigma_{XX} - \Sigma_{XI}\Sigma_{II}^{-1}\Sigma_{IX}$.

Indeed, the joint distribution $\begin{pmatrix} X - \Sigma_{XI}\Sigma_{II}^{-1}I \\ I \end{pmatrix}$ is multivariate normal with mean $\begin{pmatrix} \mu_X - \Sigma_{XI}\Sigma_{II}^{-1}\mu_I \\ \mu_I \end{pmatrix}$ and covariance matrix $\begin{pmatrix} \Sigma_{XX} - \Sigma_{XI}\Sigma_{II}^{-1}\Sigma_{IX} & 0 \\ 0 & \Sigma_{II} \end{pmatrix}$.

Therefore, $X - \Sigma_{XI}\Sigma_{II}^{-1}I$ is independent of I, and hence its conditional distribution given I is equal to its unconditional distribution. Consequently, the covariance matrix of X given I is equal to $\Sigma_{XX} - \Sigma_{XI}\Sigma_{II}^{-1}\Sigma_{IX}$, and it does not depend on the value of I.

- Let us prove 1.(iv): $\sigma_{Xm_X} - \Sigma_{XI}\Sigma_{II}^{-1}\Sigma_{Im_X} = \mathbb{C}\text{ov}(X, m_X|I)$.

  Since 1.(iii) is true for any vector X, we can define $\bar{X} = \begin{pmatrix} X \\ m_X \end{pmatrix}$, and

  $\mathbb{V}\text{ar}(\bar{X}|I) = \begin{pmatrix} \mathbb{V}\text{ar}(X|I) & \mathbb{C}\text{ov}(X, m_X|I) \\ \mathbb{C}\text{ov}(m_X, X|I) & \mathbb{V}\text{ar}(m_X|I) \end{pmatrix}$. We are looking for the upper-right corner of this matrix.

  Let us define $\Sigma_{\bar{X}\bar{X}} = \begin{pmatrix} \Sigma_{X,X} & \sigma_{X,m_X} \\ \sigma_{m_X,X} & \sigma^2_{m_X} \end{pmatrix}$, $\Sigma_{\bar{X}I} = \begin{pmatrix} \Sigma_{X,I} \\ \sigma_{m_X,I} \end{pmatrix}$, and $\Sigma_{I\bar{X}} = \begin{pmatrix} \Sigma_{X,I} & \sigma_{m_X,I} \end{pmatrix}$.

  Substituting these into the first equation yields:

$$\begin{aligned} \mathbb{V}\text{ar}(\bar{X}|I) &= \begin{pmatrix} \Sigma_{X,X} & \sigma_{X,m_X} \\ \sigma_{m_X,X} & \sigma^2_{m_X} \end{pmatrix} - \begin{pmatrix} \Sigma_{X,I} \\ \sigma_{m_X,I} \end{pmatrix} \Sigma_{II}^{-1} \begin{pmatrix} \Sigma_{X,I} & \sigma_{m_X,I} \end{pmatrix} \\ &= \begin{pmatrix} \Sigma_{X,X} & \sigma_{X,m_X} \\ \sigma_{m_X,X} & \sigma^2_{m_X} \end{pmatrix} - \begin{pmatrix} \Sigma_{XI}\Sigma_{II}^{-1}\Sigma_{IX} & \Sigma_{XI}\Sigma_{II}^{-1}\sigma_{Im_X} \\ \sigma_{m_XI}\Sigma_{II}^{-1}\Sigma_{IX} & \sigma_{m_XI}\Sigma_{II}^{-1}\sigma_{Im_X} \end{pmatrix} \end{aligned} \tag{C.1}$$

  The upper-right corner is $\sigma_{X,m_X} - \Sigma_{XI}\Sigma_{II}^{-1}\sigma_{Im_X}$.

- Equations 1.(i) and 1.(ii) are proved similarly when one conditions by a random variable m_I instead of a random vector I.

- Let us prove 2. We know from 1.(ii) that $\mathbb{C}\text{ov}(I, X|m_I) = \Sigma_{IX} - \frac{\sigma_{Im_I}}{\sigma^2_{m_I}}\sigma_{m_IX}$.

Let w_X be the weight vector of assets $(X_k)_k$ in the excluded market. Noting that $q_X = qw_X$, we have

$$\begin{aligned}\mathbb{C}\text{ov}(I, X|m_I)q_X =& q\left(\Sigma_{IX} - \frac{\sigma_{Im_I}}{\sigma^2_{m_I}}\sigma_{m_I X}\right) w_X \\ & q\left(\sigma_{Im_X} - \frac{\sigma_{Im_I}}{\sigma^2_{m_I}}\sigma_{m_I m_X}\right).\end{aligned} \tag{C.2}$$

Consequently, from 1.(ii), we obtain

$$\mathbb{C}\text{ov}(I, X|m_I)q_X = q\,\mathbb{C}\text{ov}(I, m_X|m_I). \tag{C.3}$$

Similarly, we can also prove that

$$\mathbb{C}\text{ov}(X, X|I)q_X = q\,\mathbb{C}\text{ov}(X, m_X|I). \tag{C.4}$$

D Generalization of the S-CAPM for investable assets with $N+1$ types of sustainable investors and N types of excluded assets

This section derives the pricing formula for investable assets in the presence of $N+1$ sustainable investors with different exclusion scopes and different levels of disagreement regarding the assets in which they invest.

Let us consider a group of $N+1$ sustainable investors $(s_0, s_1, s_2, ..., s_N)$. The group of investors s_0 can only invest in assets I and penalizes these assets via the vector of cost of externalities $C_{0.0}$. The group of sustainable investors s_1 can only invest in assets I and X_1 and penalizes assets I and X_1 via the vectors of cost of externalities $C_{1.0}$ and $C_{1.1}$, respectively. This is the case up to N, and the group of sustainable investors s_N invests in assets $I, X_1, ..., X_N$ and penalizes these assets via the vectors of cost of externalities $C_{N,0}, C_{N,1}, ..., C_{N,N}$, respectively. Finally, the group of regular investors can invest in all assets (like investors s_N) but does not charge any environmental externality costs.

Sustainable and regular investors maximize their wealth. They solve the following first-order conditions:

$$
\begin{cases}
\lambda(\mu_I - C_{00}) = \Sigma_{II} w_{s_0 I} \\
\\
\lambda \begin{pmatrix} \mu_I - C_{10} \\ \mu_{X_1} - C_{11} \end{pmatrix} = \begin{pmatrix} \Sigma_{II} & \Sigma_{IX_1} \\ \Sigma_{X_1 I} & \Sigma_{X_1 X_1} \end{pmatrix} \begin{pmatrix} w_{s_1 I} \\ w_{s_1 X_1} \end{pmatrix} \\
\vdots \\
\\
\lambda \begin{pmatrix} \mu_I - C_{N0} \\ \mu_{X_1} - C_{N1} \\ \vdots \\ \mu_{X_N} - C_{NN} \end{pmatrix} = \begin{pmatrix} \Sigma_{II} & \Sigma_{IX_1} & ... & \Sigma_{IX_N} \\ \Sigma_{X_1 I} & \Sigma_{X_1 X_1} & ... & \Sigma_{X_1 X_N} \\ \vdots & \vdots & \ddots & \vdots \\ \Sigma_{X_N I} & \Sigma_{X_N X_1} & ... & \Sigma_{X_N X_N} \end{pmatrix} \begin{pmatrix} w_{s_N I} \\ w_{s_N X_1} \\ \vdots \\ w_{s_N X_N} \end{pmatrix} \\
\lambda \begin{pmatrix} \mu_I \\ \mu_{X_1} \\ \vdots \\ \mu_{X_N} \end{pmatrix} = \begin{pmatrix} \Sigma_{II} & \Sigma_{IX_1} & ... & \Sigma_{IX_N} \\ \Sigma_{X_1 I} & \Sigma_{X_1 X_1} & ... & \Sigma_{X_1 X_N} \\ \vdots & \vdots & \ddots & \vdots \\ \Sigma_{X_N I} & \Sigma_{X_N X_1} & ... & \Sigma_{X_N X_N} \end{pmatrix} \begin{pmatrix} w_{rI} \\ w_{rX_1} \\ \vdots \\ w_{rX_N} \end{pmatrix}.
\end{cases}
\tag{D.5}
$$

Multiplying the first row of each first-order condition by $\frac{W_{s_0}}{W}, \frac{W_{s_1}}{W}, ..., \frac{W_{s_N}}{W}, \frac{W_r}{W}$, respectively, and summing up the terms, we have

$$
\begin{aligned}
& \lambda \left(\frac{W_{s_0}}{W} + ... + \frac{W_{s_N}}{W} + \frac{W_r}{W} \right) \mu_I - \lambda \left(\frac{W_{s_0}}{W} C_{00} + ... + \frac{W_{s_N}}{W} C_{N0} \right) \\
= \quad & \frac{W_{s_0}}{W} \Sigma_{II} w_{s_0 I} \\
& + \frac{W_{s_1}}{W} \Sigma_{II} w_{s_1 I} + \frac{W_{s_1}}{W} \Sigma_{IX_1} w_{s_1 X_1} \\
& + ... \\
& + \frac{W_{s_N}}{W} \Sigma_{II} w_{s_N I} + \frac{W_{s_N}}{W} \Sigma_{IX_1} w_{s_N X_1} + ... + \frac{W_{s_N}}{W} \Sigma_{IX_N} w_{s_N X_N} \\
& + \frac{W_r}{W} \Sigma_{II} w_{rI} + \frac{W_r}{W} \Sigma_{IX_1} w_{rX_1} + ... + \frac{W_r}{W} \Sigma_{IX_N} w_{rX_N}.
\end{aligned}
\tag{D.6}
$$

Denoting $p = \frac{W_{s_0}}{W} + ... + \frac{W_{s_N}}{W}$, and the intermediate value theorem, there exists C such that

$$
\frac{W_{s_0}}{W} C_{00} + ... + \frac{W_{s_N}}{W} C_{N0} = pC, \tag{D.7}
$$

Therefore, rearranging equation (D.6),

$$
\begin{aligned}
\lambda\mu_I = {} & \Sigma_{II}\left(\frac{W_{s_0}}{W}w_{s_0I} + \frac{W_{s_1}}{W}w_{s_1I} + ... + \frac{W_{s_N}}{W}w_{s_NI} + \frac{W_r}{W}w_{rI}\right) \\
& + \Sigma_{IX_1}\left(\frac{W_{s_1}}{W}w_{s_1X_1} + ... + \frac{W_{s_N}}{W}w_{s_NX_1} + \frac{W_r}{W}w_{rX_1}\right) \\
& + ... \\
& + \Sigma_{IX_N}\left(\frac{W_{s_N}}{W}w_{s_NX_N} + \frac{W_r}{W}w_{rX_N}\right) \\
& + \lambda pC.
\end{aligned}
\tag{D.8}
$$

In equilbibrium the demand of assets is equal to the supply of assets on all the markets. Denoting by $q_I, q_{X_1}, ..., q_{X_N}$ the vectors of weights of assets $I, X_1, ..., X_N$ in the market, respectively, we obtain

$$
\lambda\mu_I = \Sigma_{II}q_I + \Sigma_{IX_1}q_{X_1} + ... + \Sigma_{IX_N}q_{X_N} + \lambda pC. \tag{D.9}
$$

Let us denote by w_I the vector of weights of assets I held by all investors $s_0, ..., s_N, r$, and for each asset X_k, $q_{X_k} = (q_{k1}, ..., q_{kn_i})'$. Therefore,

$$
q_I = \left(1 - \sum_{i=1}^{N}\sum_{j=1}^{n_i} q_{ij}\right) w_I. \tag{D.10}
$$

Consequently, equation (D.9) is rewritten as

$$
\lambda\mu_I = \left(1 - \sum_{i=1}^{N}\sum_{j=1}^{n_i} q_{ij}\right) \Sigma_{II}w_I + \Sigma_{IX_1}q_{X_1} + ... + \Sigma_{IX_N}q_{X_N} + \lambda pC. \tag{D.11}
$$

Multiplying by $w_I{}'$, we obtain

$$
\lambda w_I{}'\mu_I = \left(1 - \sum_{i=1}^{N}\sum_{j=1}^{n_i} q_{ij}\right) w_I{}'\Sigma_{II}w_I + \sum_{i=1}^{N} w_I{}'\Sigma_{IX_k}q_{X_k} + p\lambda \underbrace{w_I{}'C}_{c_{m_I}}, \tag{D.12}
$$

$$
\lambda\mu_{m_I} = \left(1 - \sum_{i=1}^{N}\sum_{j=1}^{n_i} q_{ij}\right) \sigma^2_{m_I} + \sum_{i=1}^{N} \sigma_{m_IX_k}q_{X_k} + p\lambda c_{m_I}. \tag{D.13}
$$

Substituting $\left(1-\sum_{i=1}^{N}\sum_{j=1}^{n_i} q_{ij}\right)$ in (D.11), we obtain

$$\lambda\mu_I = \frac{1}{\sigma^2_{m_I}}\left(\lambda\mu_{m_I} - \sum_{i=1}^{N}\sigma_{m_I X_k} q_{X_k} - p\lambda c_{m_I}\right)\Sigma_{II} w_I + \Sigma_{IX_1} q_{X_1} + ... + \Sigma_{IX_N} q_{X_N} + \lambda p C. \quad \text{(D.14)}$$

Denoting by $\beta_{Im_I} = \frac{1}{\sigma^2_{m_I}}\sigma_{Im_I}$ the vector of betas of investable assets with respect to the investable market, and by $q_{\Omega_{X_k}}$ the weight of the excluded market of assets X_k in the total market, we can rewrite the previous equation as

$$\begin{aligned}\mu_I &= \left(\mu_{m_I} - pc_{m_I}\right)\beta_{Im_I} + \gamma\sum_{i=1}^{N}\left(\Sigma_{IX_k} - \beta_{Im_I}\sigma_{m_I X_k}\right) q_{X_k} + pC \\ &= \left(\mu_{m_I} - pc_{m_I}\right)\beta_{Im_I} + \gamma\sum_{i=1}^{N} q_{\Omega_{X_k}}\,\mathbb{C}\text{ov}(r_I, r_{m_{X_k}}|r_{m_I}) + pC.\end{aligned} \quad \text{(D.15)}$$

Therefore, we can write the above equation as follows:

$$\mathbb{E}(r_I) = \left(\mathbb{E}(r_{m_I}) - pc_{m_I}\right)\beta_{Im_I} + \gamma\sum_{j=1}^{N} q_{\Omega_{X_j}}\,\mathbb{C}\text{ov}(r_I, r_{m_{X_j}}|r_{m_I}) + pC, \quad \text{(D.16)}$$

which yields for each asset I_k ($k \in \{1, ..., n_I\}$):

$$\mathbb{E}(r_{I_k}) = \beta_{I_k m_I}\left(\mathbb{E}(r_{m_I}) - pc_{m_I}\right) + \gamma\sum_{j=1}^{N} q_{\Omega_{X_j}}\,\mathbb{C}\text{ov}(r_{I_k}, r_{m_{X_j}}|r_{m_I}) + pc_{I_k}. \quad \text{(D.17)}$$

E Green and conventional funds used to construct instruments $\tilde{C}_I$ and $\tilde{p}_i$

To construct the proxy for the cost of environmental externalities $\tilde{C}_I$, I consider the 453 green funds identified in Bloomberg as of December 2019 whose mandate includes environmental guidelines (flagged as "Environmentally friendly", "Climate change" or "Clean Energy"), and of which the geographical investment scope includes the United States (flagged as "Global", "International", "Multi", "North American Region", "OECD countries", and "U.S.", see Table 1). As shown in Figure 3a, the number of funds has grown steadily from over 50 funds in 2007 to 100 funds in 2010, reaching 200 funds in 2018. The number of stocks held by these green funds has naturally increased, from approximately 2000 in 2007 to over 6000 in 2019 (Figure 3b). Figure 4 shows the dynamics of $\tilde{C}_I$ for the two industries—coal and construction—that experienced the strongest divestment by green funds between 2012 and 2019.

I also construct a proxy capturing the proportion of integrators, $\tilde{p}_i$, by using green fund holdings, as detailed in Section 2.1.2 of the paper. Figure 5 depicts the dynamics of $\tilde{p}_i$.

F Factor correlation matrix

Table 2 shows the correlation matrix between the regression factors for both investable and excluded assets.

G Robustness tests for investable assets

I perform several alternative regressions to test the robustness of the pricing formula for investable assets. Two premia are analyzed: the direct taste premium, which carries the effect related to integrators' preferences for green firms, and the exclusion-market premium, which reflects the effect of market partial segmentation on the return on investable assets.

In addition to the main case detailed in the paper, the direct taste premium remains significant:

- using industry-size portfolios (Table 3);
- when the proxy for the direct taste premium is lagged by three years (Table 4);
- when using a 5-year window in the first pass of the Fama and MacBeth (1973) regression (Table 5);
- over three consecutive periods between December 2007 and December 2019 (Table 6)

The exclusion-market premium is significant when considering equally weighted returns of industry-sorted portfolios (Table 7).

Finally, when using the carbon intensity as a proxy for green investors' tastes, the taste effect is not significant (Table 8).

H Empirical analysis for sin stocks as excluded assets

H.1 Robustness tests

I perform alternative regressions to test the robustness of the pricing formula for excluded assets applied to sin stocks. Three factors are analyzed: the exclusion-asset factor and the exclusion-market factor, which carry the effect related to excluders' practice; the indirect taste factor, which reflects the effect of integrators' tastes for green firms on sin stocks.

The two exclusion premia are significant:

- From December 1999 to December 2019 (Table 9);
- Using $\tilde{p}_i$ as a proxy for p_e (Table 14).

At least one of the two exclusion premia is significant:

- when using equally weighted excess returns (Table 10);
- when using a 5-year rolling window in the first-pass regression (Table 11);
- when adding the defense industry to the gaming, alcohol and tobacco industries (Table 12);
- during the sub-periods between December 2007 and December 2019 (Table 13).

The indirect taste premium is significant:

- when using equally weighted excess returns (Table 10);
- when adding the defense industry to the gaming, alcohol and tobacco industries (Table 12);
- Using $\tilde{p}_i$ as a proxy for p_e (Table 14).

H.2 Spillovers

Figure 6 shows the distribution of the share of the spillover effect in the exclusion premia. This metric is defined in subsection 4.5 of the paper. For a given stock, on average, 92.5% of the exclusion premia is induced by the interaction with other sin stocks. The share of spillovers in the exclusion premia is most often between 90% and 100%.

The heatmap presented in Figure 7 offers a graphical depiction of the spillover effects of every sin stock (in columns) on each sin stock of interest (in rows) and illustrates two findings. First, although most of the spillover effects are positive, some can be negative (in green on the graph). Second, some stocks exert strong spillover effects on all the sin stocks under consideration (red columns).

References

Fama, Eugene F., and Kenneth R. French, 1992, The cross-section of expected stock returns, *Journal of Finance* 47, 427-465.

Fama, Eugene F., and James D. MacBeth, 1973, Risk, return and equilibrium: Empirical tests, *Journal of Political Economy* 81, 607-636.

Harrison, H. and Kacperczyk, M., 2009, The price of sin: the effects of social norms on markets, *Journal of Financial Economics* 93, 15-36.

Lewellen, Jonathan, Stefan Nagel, and Shanken Jay, 2010, A skeptical appraisal of asset pricing tests, *Journal of Financial Economics* 96, 175-194.

Tables and Figures

Table 1 Geographical distribution of green funds. This table reports the geographical distribution of the green funds that are allowed to invest in the United States as of December 2019. These areas are: Global, International, U.S., Multi, OECD countries, North American Region.

Geographical zone	Number of funds
Global	313
International	63
U.S.	48
OECD Countries	14
Multi	12
North American Region	3
Total	453

Table 2 Correlation matrix. This table reports the correlation matrix between the factors involved in the S-CAPM and the 4F S-CAPM pricing models. $\beta_{I.SMB}$, $\beta_{I.HML}$ and $\beta_{I.MOM}$ are the slopes of the regression of the excess returns on the industry-sorted investable portfolios on the SMB, HML (Fama and French, 1993) and MOM (Carhart, 1997) factors, respectively. $\beta_{X.SMB}$, $\beta_{X.HML}$ and $\beta_{X.MOM}$ are the slopes of the regression of the excluded stocks' excess returns on the SMB, HML, and MOM factors, respectively. $\tilde{p}_i\tilde{C}_I$ is the direct taste factor for investable assets and $\tilde{p}_iB_{XI}\tilde{C}_I$ is the indirect taste factor for excluded assets. $q\,\mathbb{C}\text{ov}_t(r_I, r_{m_X}|r_{m_I})$ and $q\,\mathbb{C}\text{ov}_t(r_X, r_{m_X}|r_{m_I})$ are the exclusion-market factors for portfolios I and stocks X, respectively. $q\,\mathbb{C}\text{ov}_t(r_X, r_{m_X}|r_I)$ is the exclusion-asset factor for stocks X. $***$, $**$, and $*$ denote significance at the 1%, 5%, and 10% levels, respectively.

	$\tilde{p}_i\tilde{C}_I$	$q\,\mathbb{C}\text{ov}(r_I, r_{m_X}\|r_{m_I})$	$\beta_{I.SMB}$	$\beta_{I.HML}$
$q\,\mathbb{C}\text{ov}(r_I, r_{m_X}\|r_{m_I})$	-0.01			
$\beta_{I.SMB}$	-0.14***	-0.19***		
$\beta_{I.HML}$	0.08***	-0.34***	0.04***	
$\beta_{I.MOM}$	0.01	-0.17***	0.28***	-0.58***

	$\tilde{p}_iB_{XI}\tilde{C}_I$	$q\,\mathbb{C}\text{ov}(r_X, r_{m_X}\|r_I)$	$q\,\mathbb{C}\text{ov}(r_X, r_{m_X}\|r_{m_I})$	$\beta_{X.SMB}$	$\beta_{X.HML}$
$q\,\mathbb{C}\text{ov}(r_X, r_{m_X}\|r_I)$	0.09***				
$q\,\mathbb{C}\text{ov}(r_X, r_{m_X}\|r_{m_I})$	-0.15***	-0.16***			
$\beta_{X.SMB}$	0.09***	0.26***	-0.22***		
$\beta_{X.HML}$	-0.07***	0.10***	-0.1***	0.14***	
$\beta_{X.MOM}$	0.31***	0.35***	-0.3***	0.2***	-0.35***

Table 3 Cross-sectional regressions for investable stock portfolios with tastes for green firms using industry-size portfolios. This table presents the estimates of the S-CAPM on the value-weighted monthly returns in excess of the 1-month T-Bill for industry-size portfolios between December 31, 2007, and December 31, 2019. The specification of the S-CAPM is written as follows: $\mathbb{E}(r_{I_k}) = \alpha + \delta_{mkt}\beta_{I_k m_I} + \delta_{taste}\tilde{p}_i\tilde{c}_{I_k} + \delta_{ex.mkt}q\,\mathbb{C}\text{ov}(r_{I_k}, r_{m_X}|r_{m_I})$, where r_{I_k} is the value-weighted excess return on industry-size portfolio I_k ($k = 1, ..., n_I$), $\beta_{I_k m_I}$ is the slope of an OLS regression of r_{I_k} on r_{m_I}; $\tilde{p}_i$ is the proxy for the proportion of integrators' wealth; $\tilde{c}_{I_k}$ is the proxy for the cost of environmental externalities of portfolio I_k; q is the proportion of the excluded assets' market value in the market, and $\mathbb{C}\text{ov}(r_{I_k}, r_{m_X}|r_{m_I})$ is the covariance of the excess return on portfolio I_k with that of the excluded market, the excess returns on the investable market being given. This specification is compared with two other specifications: (i) the 4F S-CAPM is the S-CAPM to which the betas of the Fama and French (1993) size and value factors and the Carhart (1997) momentum factor are added, and (ii) the 4F model is the CAPM with respect to the investable market returns to which the betas of the Fama and French (1993) size and value factors and the Carhart (1997) momentum factor are added: $\mathbb{E}(r_{I_k}) = \alpha + \delta_{mkt}\beta_{I_k m_I} + \delta_{SMB}\beta_{I_k SMB} + \delta_{HML}\beta_{I_k HML} + \delta_{MOM}\beta_{I_k MOM}$. These specifications are estimated using the Fama and MacBeth (1973) procedure. First, the variables are estimated portfolio-by-portfolio in a 3-year rolling window at monthly intervals. In the second pass, a cross-sectional regression is performed month-by-month on all the portfolios. The estimated parameter is the average value of the estimates obtained on all months during the period. t-values, estimated following Newey and West (1987) with three lags, are reported between parentheses. The last column reports the average OLS adjusted-R^2 and the GLS R^2 on the row underneath. The 95% confidence intervals are shown in brackets.

	α	δ_{mkt}	δ_{taste}	$\delta_{ex.mkt}$	δ_{SMB}	δ_{HML}	δ_{MOM}	Adj. OLS/GLS R^2
Estimate	0.0133	0.003						0.06 [0.04,0.08]
t-value	(11.96)	(2.55)						0.06 [0.04,0.08]
Estimate	0.0173		0.4165					0 [0,0]
t-value	(16.97)		(5.01)					0.01 [0.01,0.01]
Estimate	0.0169			38				0.03 [0.02,0.05]
t-value	(17.54)			(0.62)				0.04 [0.03,0.05]
Estimate	0.0135	0.0029	0.324					0.06 [0.04,0.08]
t-value	(12.39)	(2.52)	(5.57)					0.06 [0.04,0.08]
Estimate	0.0133	0.0032	0.2369	28.2				0.08 [0.06,0.1]
t-value	(13.78)	(2.86)	(2.9)	(0.48)				0.09 [0.07,0.11]
Estimate	0.0129	0.0044	0.3127	-66.4	0.0001	-0.0002	-0.0005	0.16 [0.14,0.18]
t-value	(13.8)	(3.65)	(3.66)	(-0.88)	(0.64)	(-1.81)	(-5.69)	0.18 [0.16,0.2]
Estimate	0.0127	0.0046			0.0001	0.000	-0.0004	0.13 [0.11,0.15]
t-value	(12.41)	(3.99)			(0.47)	(-0.17)	(-5.91)	0.14 [0.12,0.17]

Table 4 Cross-sectional regressions for investable stock industry-sorted portfolios with tastes for green firms where proxy $\tilde{p}_i\tilde{c}$ is lagged by 3 years. This table presents the estimates of the S-CAPM on the value-weighted monthly returns in excess of the 1-month T-Bill for 46 investable stock industry-sorted portfolios between December 31, 2007, and December 31, 2019. The proxy for the direct taste premium, $\tilde{p}_i\tilde{c}$, is lagged by 3 years. The specification of the S-CAPM is written as follows: $\mathbb{E}(r_{I_k}) = \alpha + \delta_{mkt}\beta_{I_k m_I} + \delta_{taste}\tilde{p}_i\tilde{c}_{I_k} + \delta_{ex.mkt} q\, \mathbb{C}\text{ov}(r_{I_k}, r_{m_X}|r_{m_I})$, where r_{I_k} is the value-weighted excess return on industry portfolio I_k ($k = 1, ..., n_I$), $\beta_{I_k m_I}$ is the slope of an OLS regression of r_{I_k} on r_{m_I}; $\tilde{p}_i$ is the proxy for the proportion of integrators' wealth; $\tilde{c}_{I_k}$ is the proxy for the cost of environmental externalities of industry I_k; q is the proportion of the excluded assets' market value in the market, and $\mathbb{C}\text{ov}(r_{I_k}, r_{m_X}|r_{m_I})$ is the covariance of the excess return on portfolio I_k with that of the excluded market, the excess returns on the investable market being given. This specification is compared with two other specifications: (i) the 4F S-CAPM is the S-CAPM to which the betas of the Fama and French (1993) size and value factors and the Carhart (1997) momentum factor are added, and (ii) the 4F model is the CAPM with respect to the investable market returns to which the betas of the Fama and French (1993) size and value factors and the Carhart (1997) momentum factor are added: $\mathbb{E}(r_{I_k}) = \alpha + \delta_{mkt}\beta_{I_k m_I} + \delta_{SMB}\beta_{I_k SMB} + \delta_{HML}\beta_{I_k HML} + \delta_{MOM}\beta_{I_k MOM}$. These specifications are estimated using the Fama and MacBeth (1973) procedure. First, the variables are estimated portfolio-by-portfolio in a 3-year rolling window at monthly intervals. In the second pass, a cross-sectional regression is performed month-by-month on all the portfolios. The estimated parameter is the average value of the estimates obtained on all months during the period. t-values, estimated following Newey and West (1987) with three lags, are reported between parentheses. The last column reports the average OLS adjusted-R^2 and the GLS R^2 on the row underneath. The 95% confidence intervals are shown in brackets.

	α	δ_{mkt}	δ_{taste}	$\delta_{ex.mkt}$	δ_{SMB}	δ_{HML}	δ_{MOM}	Adj. OLS/GLS R^2
Estimate	0.0159	-0.0018						0.03 [0.02,0.05]
t-value	(14.25)	(-1.83)						0.05 [0.04,0.07]
Estimate	0.0138		0.0893					-0.02 [-0.02,-0.02]
t-value	(24.83)		(0.95)					0 [0,0.01]
Estimate	0.0134			-95.8				0.03 [0.02,0.04]
t-value	(27.73)			(-1.49)				0.05 [0.04,0.07]
Estimate	0.016	-0.0018	0.1526					0.02 [0,0.03]
t-value	(13.95)	(-1.86)	(1.53)					0.06 [0.05,0.07]
Estimate	0.0188	-0.005	0.4652	-308.9				0.1 [0.08,0.12]
t-value	(11.54)	(-3.28)	(3.09)	(-2.63)				0.16 [0.14,0.18]
Estimate	0.0179	-0.0028	0.4921	-483.6	-0.0008	0.0004	-0.0007	0.27 [0.24,0.3]
t-value	(13.36)	(-2.13)	(1.93)	(-5.94)	(-3.65)	(2.22)	(-4.17)	0.37 [0.34,0.39]
Estimate	0.0148	-0.0005			-0.0008	0.0003	-0.0006	0.21 [0.18,0.24]
t-value	(13.43)	(-0.42)			(-3.2)	(1.97)	(-4.48)	0.28 [0.25,0.3]

Table 5 Cross-sectional regressions for 46 industry-sorted portfolios of investable stocks with tastes for green firms, using a 5-year rolling window for the first-pass estimates. This table presents the estimates of the S-CAPM on the value-weighted monthly returns in excess of the 1-month T-Bill for 46 investable stock industry-sorted portfolios between December 31, 2007, and December 31, 2019. The specification of the S-CAPM is written as follows: $\mathbb{E}(r_{I_k}) = \alpha + \delta_{mkt}\beta_{I_k m_I} + \delta_{taste}\tilde{p}_i\tilde{c}_{I_k} + \delta_{ex.mkt}q\,\mathbb{C}\text{ov}(r_{I_k}, r_{m_X}|r_{m_I})$, where r_{I_k} is the value-weighted excess return on industry portfolio I_k $(k = 1, ..., n_I)$, $\beta_{I_k m_I}$ is the slope of an OLS regression of r_{I_k} on r_{m_I}; $\tilde{p}_i$ is the proxy for the proportion of integrators' wealth; $\tilde{c}_{I_k}$ is the proxy for the cost of environmental externalities of industry I_k; q is the proportion of the excluded assets' market value in the market, and $\mathbb{C}\text{ov}(r_{I_k}, r_{m_X}|r_{m_I})$ is the covariance of the excess return on portfolio I_k with that of the excluded market, the excess returns on the investable market being given. This specification is compared with two other specifications: (i) the 4F S-CAPM is the S-CAPM to which the betas of the Fama and French (1993) size and value factors and the Carhart (1997) momentum factor are added, and (ii) the 4F model is the CAPM with respect to the investable market returns to which the betas of the Fama and French (1993) size and value factors and the Carhart (1997) momentum factor are added: $\mathbb{E}(r_{I_k}) = \alpha + \delta_{mkt}\beta_{I_k m_I} + \delta_{SMB}\beta_{I_k SMB} + \delta_{HML}\beta_{I_k HML} + \delta_{MOM}\beta_{I_k MOM}$. These specifications are estimated using the Fama and MacBeth (1973) procedure. First, the variables are estimated portfolio-by-portfolio in a 5-year rolling window at monthly intervals. In the second pass, a cross-sectional regression is performed month-by-month on all the portfolios. The estimated parameter is the average value of the estimates obtained on all months during the period. t-values, estimated following Newey and West (1987) with three lags, are reported between parentheses. The last column reports the average OLS adjusted-R^2 and the GLS R^2 on the row underneath. The 95% confidence intervals are shown in brackets.

	α	δ_{mkt}	δ_{taste}	$\delta_{ex.mkt}$	δ_{SMB}	δ_{HML}	δ_{MOM}	Adj. OLS/GLS R^2
Estimate	0.0133	0.0003						0.03 [0.02,0.04]
t-value	(14.18)	(0.36)						0.05 [0.04,0.06]
Estimate	0.0137		0.1812					-0.02 [-0.02,-0.02]
t-value	(21.12)		(3.27)					0 [0,0.01]
Estimate	0.0137			117.9				0.04 [0.03,0.05]
t-value	(22.49)			(2.93)				0.06 [0.05,0.07]
Estimate	0.0134	0.0002	0.173					0.01 [0,0.02]
t-value	(14.38)	(0.28)	(3.78)					0.05 [0.04,0.07]
Estimate	0.0119	0.0018	0.1938	78.5				0.07 [0.05,0.09]
t-value	(10.07)	(1.87)	(3.68)	(1.36)				0.13 [0.11,0.15]
Estimate	0.0129	0.0001	0.4156	-124.2	-0.0001	-0.0003	-0.0001	0.31 [0.27,0.35]
t-value	(14.07)	(0.12)	(10.31)	(-3.29)	(-2.35)	(-1.51)	(-0.98)	0.4 [0.36,0.43]
Estimate	0.0116	0.0012			-0.0001	-0.0003	-0.0001	0.31 [0.27,0.35]
t-value	(14.55)	(1.56)			(-2.65)	(-1.63)	(-0.83)	0.38 [0.34,0.41]

Table 6 Cross-sectional regressions for investable stock industry-sorted portfolios with tastes for green firms over three consecutive periods between December 2007 and December 2019. This table presents the estimates of the S-CAPM on the value-weighted monthly returns in excess of the 1-month T-Bill for 46 investable stock industry-sorted portfolios between December 31, 2007, and December 31, 2019. The specification of the S-CAPM is written as follows: $\mathbb{E}(r_{I_k}) = \alpha + \delta_{mkt}\beta_{I_k m_I} + \delta_{taste}\tilde{p}_i\tilde{c}_{I_k} + \delta_{ex.mkt}q\,\mathbb{C}\text{ov}(r_{I_k}, r_{m_X}|r_{m_I})$, where r_{I_k} is the value-weighted excess return on industry portfolio I_k ($k = 1, ..., n_I$), $\beta_{I_k m_I}$ is the slope of an OLS regression of r_{I_k} on r_{m_I}; $\tilde{p}_i$ is the proxy for the proportion of integrators' wealth; $\tilde{c}_{I_k}$ is the proxy for the cost of environmental externalities of industry I_k; q is the proportion of the excluded assets' market value in the market, and $\mathbb{C}\text{ov}(r_{I_k}, r_{m_X}|r_{m_I})$ is the covariance of the excess return on portfolio I_k with that of the excluded market, the excess returns on the investable market being given. This specification is compared with two other specifications: (i) the 4F S-CAPM is the S-CAPM to which the betas of the Fama and French (1993) size and value factors and the Carhart (1997) momentum factor are added, and (ii) the 4F model is the CAPM with respect to the investable market returns to which the betas of the Fama and French (1993) size and value factors and the Carhart (1997) momentum factor are added: $\mathbb{E}(r_{I_k}) = \alpha + \delta_{mkt}\beta_{I_k m_I} + \delta_{SMB}\beta_{I_k SMB} + \delta_{HML}\beta_{I_k HML} + \delta_{MOM}\beta_{I_k MOM}$. These specifications are estimated using the Fama and MacBeth (1973) procedure. First, the variables are estimated portfolio-by-portfolio in a 3-year rolling window at monthly intervals. In the second pass, a cross-sectional regression is performed month-by-month on all the portfolios. The estimated parameter is the average value of the estimates obtained on the 109 months during the period. t-values, estimated following Newey and West (1987) with three lags, are reported between parentheses. The last column reports the average OLS adjusted-R^2 and the GLS R^2 on the row underneath. The 95% confidence intervals are shown in brackets.

	α	δ_{mkt}	δ_{taste}	$\delta_{ex.mkt}$	Adj. OLS/GLS R^2
Panel A: Dec. 2010 - Dec. 2013 (second pass) / Dec. 2007 - Dec. 2013 (first pass and second pass)					
Estimate	0.0123	0.0044	0.2306	117.8	0.1 [0.03,0.16]
t-value	(8.28)	(3.73)	(2.19)	(2.49)	0.16 [0.1,0.22]
Panel B: Dec. 2013 - Dec. 2016 (second pass) / Dec. 2009 - Dec. 2013 (first pass and second pass)					
Estimate	0.0144	0.0013	0.4036	231.5	0.02 [-0.01,0.04]
t-value	(10.07)	(0.74)	(4.54)	(2.22)	0.08 [0.06,0.11]
Panel C: Dec. 2016 - Dec. 2019 (second pass) / Dec. 2013 - Dec. 2019 (first pass and second pass)					
Estimate	0.0125	0.0006	0.2988	-82.5	0 [-0.01,0.02]
t-value	(34.38)	(1.48)	(7.27)	(-1.39)	0.07 [0.06,0.08]

Table 7 Cross-sectional regressions for 46 industry-sorted portfolios of investable stocks with tastes for green firms, using equally weighted returns. This table presents the estimates of the S-CAPM on the equally weighted monthly returns in excess of the 1-month T-Bill for 46 investable stock industry-sorted portfolios between December 31, 2007, and December 31, 2019. The specification of the S-CAPM is written as follows: $\mathbb{E}(r_{I_k}) = \alpha + \delta_{mkt}\beta_{I_k m_I} + \delta_{taste}\tilde{p}_i\tilde{c}_{I_k} + \delta_{ex.mkt} q\,\mathbb{C}\text{ov}(r_{I_k}, r_{m_X}|r_{m_I})$, where r_{I_k} is the value-weighted excess return on industry portfolio I_k ($k = 1, ..., n_I$), $\beta_{I_k m_I}$ is the slope of an OLS regression of r_{I_k} on r_{m_I}; $\tilde{p}_i$ is the proxy for the proportion of integrators' wealth; $\tilde{c}_{I_k}$ is the proxy for the cost of environmental externalities of industry I_k; q is the proportion of the excluded assets' market value in the market, and $\mathbb{C}\text{ov}(r_{I_k}, r_{m_X}|r_{m_I})$ is the covariance of the excess return on portfolio I_k with that of the excluded market, the excess returns on the investable market being given. This specification is compared with two other specifications: (i) the 4F S-CAPM is the S-CAPM to which the betas of the Fama and French (1993) size and value factors and the Carhart (1997) momentum factor are added, and (ii) the 4F model is the CAPM with respect to the investable market returns to which the betas of the Fama and French (1993) size and value factors and the Carhart (1997) momentum factor are added: $\mathbb{E}(r_{I_k}) = \alpha + \delta_{mkt}\beta_{I_k m_I} + \delta_{SMB}\beta_{I_k SMB} + \delta_{HML}\beta_{I_k HML} + \delta_{MOM}\beta_{I_k MOM}$. These specifications are estimated using the Fama and MacBeth (1973) procedure. First, the variables are estimated portfolio-by-portfolio in a 3-year rolling window at monthly intervals. In the second pass, a cross-sectional regression is performed month-by-month on all the portfolios. The estimated parameter is the average value of the estimates obtained on all months during the period. t-values, estimated following Newey and West (1987) with three lags, are reported between parentheses. The last column reports the average OLS adjusted-R^2 and the GLS R^2 on the row underneath. The 95% confidence intervals are shown in brackets.

	α	δ_{mkt}	δ_{taste}	$\delta_{ex.mkt}$	δ_{SMB}	δ_{HML}	δ_{MOM}	Adj. OLS/GLS R^2
Estimate	0.0185	-0.0075						0.18 [0.15,0.21]
t-value	(8.91)	(-3.46)						0.2 [0.17,0.22]
Estimate	0.0108		-0.4386					0 [0,0]
t-value	(10.29)		(-2.55)					0.02 [0.02,0.03]
Estimate	0.0109			412.4				0.18 [0.14,0.21]
t-value	(10.71)			(5.43)				0.19 [0.16,0.23]
Estimate	0.0184	-0.0076	-0.2301					0.17 [0.15,0.2]
t-value	(8.91)	(-3.51)	(-1.74)					0.21 [0.18,0.24]
Estimate	0.0156	-0.0047	-0.1776	290.9				0.26 [0.22,0.3]
t-value	(8.71)	(-2.63)	(-1.25)	(4.41)				0.31 [0.27,0.34]
Estimate	0.0136	-0.0017	-0.0911	256.8	0.0002	-0.0001	-0.0009	0.34 [0.3,0.38]
t-value	(9.43)	(-1.35)	(-0.54)	(3.48)	(0.85)	(-0.2)	(-5.34)	0.43 [0.39,0.47]
Estimate	0.015	-0.0028			0.0004	0.0003	-0.0006	0.3 [0.26,0.35]
t-value	(8.37)	(-1.82)			(1.86)	(0.88)	(-4.78)	0.37 [0.33,0.41]

Table 8 Cross-sectional regressions for investable stock industry-sorted portfolios with carbon intensity as a proxy for green investors' tastes. Panel A presents the estimates of the S-CAPM using the carbon intensity as a proxy for green investors' tastes and based on the value-weighted monthly returns in excess of the 1-month T-Bill for 46 investable stock industry-sorted portfolios between December 31, 2007, and December 31, 2019. The specification estimated is written as follows: $\mathbb{E}(r_{I_k}) = \alpha + \delta_{mkt}\beta_{I_k m_I} + \delta_{carbon.intensity} CARB_{I_k} + \delta_{ex.mkt} q\, \mathbb{C}\text{ov}(r_{I_k}, r_{m_X}|r_{m_I})$. Panel B presents the estimates of the S-CAPM without taste factor based on the value-weighted monthly returns in excess of the 1-month T-Bill for 46 investable stock long-short industry-sorted portfolios between December 31, 2007, and December 31, 2019. The industry portfolios are long the 20% assets that have the highest carbon intensity and short the 20% assets that have the lowest carbon intensity. The specification estimated is written as follows: $\mathbb{E}(r_{I_k}) = \alpha + \delta_{mkt}\beta_{I_k m_I} + \delta_{ex.mkt} q\, \mathbb{C}\text{ov}(r_{I_k}, r_{m_X}|r_{m_I})$. In the specifications, r_{I_k} is the value-weighted excess return on industry portfolio I_k ($k = 1, ..., n_I$), $\beta_{I_k m_I}$ is the slope of an OLS regression of r_{I_k} on r_{m_I}; $CARB_{I_k}$ is the carbon intensity of industry I_k; q is the proportion of the excluded assets' market value in the market, and $\mathbb{C}\text{ov}(r_{I_k}, r_{m_X}|r_{m_I})$ is the covariance of the excess return on portfolio I_k with that of the excluded market, the excess returns on the investable market being given. To these specifications, the betas of the Fama and French (1993) size and value factors and the Carhart (1997) momentum factor are added for robustness analysis. These specifications are estimated using the Fama and MacBeth (1973) procedure. First, the variables are estimated portfolio-by-portfolio in a 3-year rolling window at monthly intervals. In the second pass, a cross-sectional regression is performed month-by-month on all the portfolios. The estimated parameter is the average value of the estimates obtained on the 109 months during the period. t-values, estimated following Newey and West (1987) with three lags, are reported between parentheses. The last column reports the average OLS adjusted-R^2 and the GLS R^2 on the row underneath. The 95% confidence intervals are shown in brackets.

	α	δ_{mkt}	$\delta_{carbon.intensity}$	$\delta_{ex.mkt}$	δ_{SMB}	δ_{HML}	δ_{MOM}	Adj. OLS/GLS R^2
Panel A: Industry portfolios								
Estimate	0.0143	0.0004						0.05 [0.03,0.07]
t-value	-13	(0.44)						0.07 [0.05,0.09]
Estimate	0.0153		0.000					-0.01 [-0.03,0.02]
t-value	(24.76)		(-5.13)					n.a.
Estimate	0.0149			119.2				0.06 [0.04,0.08]
t-value	(26.22)			(2.15)				0.08 [0.06,0.1]
Estimate	0.0153	0.000	0.000					0.04 [0,0.08]
t-value	(17.13)	(-0.02)	(-5.04)					n.a.
Estimate	0.0125	0.0026	0.000	225.8				0.06 [0.02,0.11]
t-value	(10.6)	(1.84)	(-5.06)	(2.7)				n.a.
Estimate	0.0176	0.0036	0.000	-349.2	0.0008	0.0007	0.0003	0.15 [0.02,0.28]
t-value	(8.25)	(1.88)	(-1.62)	(-1.6)	(1.04)	(1.5)	(1.32)	n.a.
Panel B: Long high carbon-intensity and Short low carbon-intensity industry portfolios								
Estimate	0.0002	-0.0015						-0.01 [-0.01,-0.01]
t-value	(0.1)	(-0.06)						0 [0,0]
Estimate	0.0002	0.012		-27.1				0.18 [0.12,0.24]
t-value	(0.14)	(0.46)		(-1.59)				0.2 [0.14,0.25]
Estimate	0.001	0.0187		7	0.0004	0.0001	0.0001	0.46 [0.39,0.53]
t-value	(0.55)	(0.99)		(0.32)	(1.06)	(0.96)	(0.83)	0.49 [0.42,0.56]

Table 9 Cross-sectional regressions on sin stocks' excess returns between December 1999 and December 2019. This table provides the estimates obtained with the S-CAPM without ESG integration on the value-weighted monthly returns in excess of the 1-month T-Bill for 52 sin stocks between December 31, 1999, and December 31, 2019. The specification is written as follows: $\mathbb{E}(r_{X_k}) = \alpha + \delta_{mkt}\beta_{X_k m_I} + \delta_{taste}\tilde{p}_i B_{X_k I}\tilde{C}_I + \delta_{ex.asset} q\,\mathbb{C}\text{ov}(r_{X_k}, r_{m_X}|r_I) + \delta_{ex.mkt} q\,\mathbb{C}\text{ov}(r_{X_k}, r_{m_X}|r_{m_I})$, where r_{X_k} is the value-weighted excess return on stock X_k ($k = 1, ..., n_X$), and $\beta_{X_k m_I}$ is the slope of an OLS regression of r_{X_k} on r_{m_I}; $\tilde{p}_i B_{X_k I}\tilde{C}$ is the proxy for the indirect taste factor and $\tilde{p}_i$ is the proxy for the proportion of integrators' wealth; q is the proportion of the excluded assets' market value in the market, and $\mathbb{C}\text{ov}(r_{X_k}, r_{m_X}|r_I)$ (and $\mathbb{C}\text{ov}(r_{X_k}, r_{m_X}|r_{m_I})$) are the covariances of the excess returns on stock X_k with those on the excluded market, the excess returns on the investable market (and the vector of investable assets, respectively) being given. The investable assets are analyzed using 46 industry-sorted portfolios. The S-CAPM specification is compared with two other specifications: (i) the 4F S-CAPM is the S-CAPM to which the betas of the Fama and French (1993) size and value factors and the Carhart (1997) momentum factor have been added, and (ii) the 4F model is the CAPM with respect to the investable market to which the betas of the Fama and French (1993) size and value factors and the Carhart (1997) momentum factor have been added: $\mathbb{E}(r_{X_k}) = \alpha + \delta_{mkt}\beta_{X_k m_I} + \delta_{SMB}\beta_{X_k SMB} + \delta_{HML}\beta_{X_k HML} + \delta_{MOM}\beta_{X_k MOM}$. These specifications are estimated using the Fama and MacBeth (1973) procedure. First, the variables are estimated, stock-by-stock, in a 3-year rolling window, at monthly intervals. In the second pass, a cross-sectional regression is performed on a monthly basis on all the stocks. The data are winsorized: the two stocks giving the highest and lowest excess returns every month are removed from the second pass. The estimated parameter is the average value of the estimates obtained on all months during the period of interest. t-values, estimated following Newey and West (1987) with three lags, are reported between parentheses. The last column reports the average OLS adjusted-R^2 and the GLS R^2 on the row underneath. The 95% confidence intervals are shown in brackets.

	α	δ_{mkt}	$\delta_{ex.asset}$	$\delta_{ex.mkt}$	δ_{SMB}	δ_{HML}	δ_{MOM}	Adj. OLS/GLS R^2
Estimate	0.0104	0.0034						0.03 [0.02,0.04]
t-value	(8.23)	(3.73)						0.04 [0.03,0.05]
Estimate	0.0127		17.3					0.05 [0.04,0.06]
t-value	(9.05)		(0.96)					0.06 [0.05,0.07]
Estimate	0.0112			121.4				0.1 [0.08,0.12]
t-value	(8.43)			(3.74)				0.09 [0.08,0.11]
Estimate	0.0114		70.1	124.2				0.12 [0.1,0.14]
t-value	(8.25)		(3.54)	(3.62)				0.15 [0.13,0.17]
Estimate	0.0104	0.001	92	131.2				0.14 [0.11,0.16]
t-value	(7.52)	(0.76)	(3.99)	(3.49)				0.19 [0.16,0.21]
Estimate	0.0107	0.0017	99.3	120.1	-0.0001	-0.0002	0.0005	0.22 [0.19,0.25]
t-value	(7.96)	(1.26)	(3.88)	(2.93)	(-0.64)	(-1.02)	(2.43)	0.33 [0.31,0.35]
Estimate	0.0107	0.0034			-0.0002	-0.0001	0.0004	0.11 [0.09,0.13]
t-value	(8.76)	(3.27)			(-1.26)	(-0.9)	(2.19)	0.19 [0.17,0.21]

Table 10 Cross-sectional regressions for sin stocks with equally weighted returns. This table provides the estimates obtained with the S-CAPM on the equally weighted monthly returns in excess of the 1-month T-Bill for 52 sin stocks between December 31, 2007, and December 31, 2019. The specification is written as follows: $\mathbb{E}(r_{X_k}) = \alpha + \delta_{mkt}\beta_{X_k m_I} + \delta_{taste}\tilde{p}_i B_{X_k I}\tilde{C}_I + \delta_{ex.asset} q\,\mathbb{C}\text{ov}(r_{X_k}, r_{m_X}|r_I) + \delta_{ex.mkt} q\,\mathbb{C}\text{ov}(r_{X_k}, r_{m_X}|r_{m_I})$, where r_{X_k} is the value-weighted excess return on stock X_k ($k = 1, ..., n_X$), and $\beta_{X_k m_I}$ is the slope of an OLS regression of r_{X_k} on r_{m_I}; $\tilde{p}_i B_{X_k I}\tilde{C}$ is the proxy for the indirect taste factor and $\tilde{p}_i$ is the proxy for the proportion of integrators' wealth; q is the proportion of the excluded assets' market value in the market, and $\mathbb{C}\text{ov}(r_{X_k}, r_{m_X}|r_I)$ (and $\mathbb{C}\text{ov}(r_{X_k}, r_{m_X}|r_{m_I})$) are the covariances of the excess returns on stock X_k with those on the excluded market, the excess returns on the investable market (and the vector of investable assets, respectively) being given. The investable assets are analyzed using 46 industry-sorted portfolios. The S-CAPM specification is compared with two other specifications: (i) the 4F S-CAPM is the S-CAPM to which the betas of the Fama and French (1993) size and value factors and the Carhart (1997) momentum factor have been added, and (ii) the 4F model is the CAPM with respect to the investable market to which the betas of the Fama and French (1993) size and value factors and the Carhart (1997) momentum factor have been added: $\mathbb{E}(r_{X_k}) = \alpha + \delta_{mkt}\beta_{X_k m_I} + \delta_{SMB}\beta_{X_k SMB} + \delta_{HML}\beta_{X_k HML} + \delta_{MOM}\beta_{X_k MOM}$. These specifications are estimated using the Fama and MacBeth (1973) procedure. First, the variables are estimated, stock-by-stock, in a 3-year rolling window, at monthly intervals. In the second pass, a cross-sectional regression is performed on a monthly basis on all the stocks. The data are winsorized: the two stocks giving the highest and lowest excess returns every month are removed from the second pass. The estimated parameter is the average value of the estimates obtained on all months during the period of interest. t-values, estimated following Newey and West (1987) with three lags, are reported between parentheses. The last column reports the average OLS adjusted-R^2 and the GLS R^2 on the row underneath. The 95% confidence intervals are shown in brackets.

	α	δ_{mkt}	δ_{taste}	$\delta_{ex.asset}$	$\delta_{ex.mkt}$	δ_{SMB}	δ_{HML}	δ_{MOM}	Adj. OLS/GLS R^2
Estimate	0.0131	0.0007							0.03 [0.01,0.04]
t-value	(12.83)	(0.44)							0.04 [0.03,0.05]
Estimate	0.014		0.0067						0.03 [0.02,0.05]
t-value	(15.69)		(0.03)						0.05 [0.04,0.07]
Estimate	0.0147			-63.8					0.03 [0.02,0.05]
t-value	(17.66)			(-2.85)					0.09 [0.07,0.11]
Estimate	0.0137				135.6				0.17 [0.14,0.19]
t-value	(15.5)				(2.56)				0.14 [0.12,0.17]
Estimate	0.0136			-8	130.9				0.17 [0.14,0.2]
t-value	(15.26)			(-0.42)	(2.47)				0.2 [0.17,0.23]
Estimate	0.0126	-0.001		-6.4	139.5				0.2 [0.17,0.23]
t-value	(9.37)	(-0.51)		(-0.33)	(2.55)				0.24 [0.21,0.26]
Estimate	0.0117	-0.0011	-0.3533	15.2	148.8				0.22 [0.18,0.25]
t-value	(9.88)	(-0.56)	(-1.77)	(0.64)	(2.74)				0.27 [0.24,0.29]
Estimate	0.0117	-0.0018	-0.5973	-36.2	152.4	0.0006	-0.0004	0.0002	0.3 [0.26,0.34]
t-value	(8.7)	(-0.68)	(-2.56)	(-1.02)	(2.49)	(2.33)	(-1.72)	(1.15)	0.39 [0.36,0.41]
Estimate	0.0128	0.0018				0.0001	0.0000	0.0002	0.1 [0.07,0.13]
t-value	(11.51)	(0.87)				(0.23)	(0.06)	(1.07)	0.15 [0.13,0.17]

Table 11 Cross-sectional regressions on sin stocks' excess returns, using a 5-year rolling window for the first pass. This table provides the estimates obtained with the S-CAPM on the value-weighted monthly returns in excess of the 1-month T-Bill for 52 sin stocks between December 31, 2007, and December 31, 2019. The specification is written as follows: $\mathbb{E}(r_{X_k}) = \alpha + \delta_{mkt}\beta_{X_k m_I} + \delta_{taste}\tilde{p}_i B_{X_k I}\tilde{C}_I + \delta_{ex.asset} q\,\mathbb{C}\text{ov}(r_{X_k}, r_{m_X}|r_I) + \delta_{ex.mkt} q\,\mathbb{C}\text{ov}(r_{X_k}, r_{m_X}|r_{m_I})$, where r_{X_k} is the value-weighted excess return on stock X_k ($k = 1, ..., n_X$), and $\beta_{X_k m_I}$ is the slope of an OLS regression of r_{X_k} on r_{m_I}; $\tilde{p}_i B_{X_k I}\tilde{C}_I$ is the proxy for the indirect taste factor and $\tilde{p}_i$ is the proxy for the proportion of integrators' wealth; q is the proportion of the excluded assets' market value in the market, and $\mathbb{C}\text{ov}(r_{X_k}, r_{m_X}|r_I)$ (and $\mathbb{C}\text{ov}(r_{X_k}, r_{m_X}|r_{m_I})$) are the covariances of the excess returns on stock X_k with those on the excluded market, the excess returns on the investable market (and the vector of investable assets, respectively) being given. The investable assets are analyzed using 46 industry-sorted portfolios. The S-CAPM specification is compared with two other specifications: (i) the 4F S-CAPM is the S-CAPM to which the betas of the Fama and French (1993) size and value factors and the Carhart (1997) momentum factor have been added, and (ii) the 4F model is the CAPM with respect to the investable market to which the betas of the Fama and French (1993) size and value factors and the Carhart (1997) momentum factor have been added: $\mathbb{E}(r_{X_k}) = \alpha + \delta_{mkt}\beta_{X_k m_I} + \delta_{SMB}\beta_{X_k SMB} + \delta_{HML}\beta_{X_k HML} + \delta_{MOM}\beta_{X_k MOM}$. These specifications are estimated using the Fama and MacBeth (1973) procedure. First, the variables are estimated, stock-by-stock, in a 5-year rolling window, at monthly intervals. In the second pass, a cross-sectional regression is performed on a monthly basis on all the stocks. The data are winsorized: the two stocks giving the highest and lowest excess returns every month are removed from the second pass. The estimated parameter is the average value of the estimates obtained on all months during the period of interest. t-values, estimated following Newey and West (1987) with three lags, are reported between parentheses. The last column reports the average OLS adjusted-R^2 and the GLS R^2 on the row underneath. The 95% confidence intervals are shown in brackets.

	α	δ_{mkt}	δ_{taste}	$\delta_{ex.asset}$	$\delta_{ex.mkt}$	δ_{SMB}	δ_{HML}	δ_{MOM}	Adj. OLS/GLS R^2
Estimate	0.009	0.0035							0.02 [0.01,0.03]
t-value	(7.09)	(4.34)							0.03 [0.03,0.04]
Estimate	0.0119		-0.6269						0.09 [0.07,0.11]
t-value	(9.27)		(-1.83)						0.08 [0.07,0.09]
Estimate	0.0118			0.1041					0.01 [0,0.02]
t-value	(9.8)			(0.01)					0.05 [0.04,0.06]
Estimate	0.0096				222.6				0.13 [0.1,0.16]
t-value	(7.47)				(8.77)				0.13 [0.11,0.15]
Estimate	0.0099			13.1	220.8				0.15 [0.11,0.18]
t-value	(7.56)			(0.64)	(7.5)				0.16 [0.14,0.18]
Estimate	0.0103	-0.001		10.2	237.3				0.16 [0.12,0.19]
t-value	(7.65)	(-1.01)		(0.45)	(7.27)				0.18 [0.16,0.21]
Estimate	0.0109	-0.0015	-0.3364	9.7	203.1				0.2 [0.16,0.24]
t-value	(8.35)	(-1.33)	(-1.26)	(0.36)	(7.08)				0.24 [0.22,0.27]
Estimate	0.0104	-0.0006	-0.1025	-12.3	204.9	-0.0005	0.0000	0.0003	0.24 [0.2,0.28]
t-value	(7.31)	(-0.35)	(-0.41)	(-0.41)	(6.8)	(-4.82)	(0.24)	(2.45)	0.31 [0.28,0.33]
Estimate	0.0092	0.0037				-0.0007	0.0002	0.0000	0.1 [0.08,0.13]
t-value	(6.58)	(2.45)				(-7.1)	(1.29)	(-0.18)	0.13 [0.11,0.14]

Table 12 Cross-sectional regressions for sin stocks including the stocks of the defense industry. This table provides the estimates obtained with the S-CAPM on the value-weighted monthly returns in excess of the 1-month T-Bill for 67 sin stocks, including the stocks in the defense industry (i.e., all the stocks in the tobacco, alcohol, gaming and defense industries) between December 31, 2007, and December 31, 2019. The specification is written as follows: $\mathbb{E}(r_{X_k}) = \alpha + \delta_{mkt}\beta_{X_k m_I} + \delta_{taste}\tilde{p}_i B_{X_k I}\tilde{C}_I + \delta_{ex.asset} q\,\mathbb{C}\text{ov}(r_{X_k}, r_{m_X}|r_I) + \delta_{ex.mkt} q\,\mathbb{C}\text{ov}(r_{X_k}, r_{m_X}|r_{m_I})$, where r_{X_k} is the value-weighted excess return on stock X_k ($k = 1, ..., n_X$), and $\beta_{X_k m_I}$ is the slope of an OLS regression of r_{X_k} on r_{m_I}; $\tilde{p}_i B_{X_k I}\tilde{C}_I$ is the proxy for the indirect taste factor and $\tilde{p}_i$ is the proxy for the proportion of integrators' wealth; q is the proportion of the excluded assets' market value in the market, and $\mathbb{C}\text{ov}(r_{X_k}, r_{m_X}|r_I)$ (and $\mathbb{C}\text{ov}(r_{X_k}, r_{m_X}|r_{m_I})$) are the covariances of the excess returns on stock X_k with those on the excluded market, the excess returns on the investable market (and the vector of investable assets, respectively) being given. The investable assets are analyzed using 46 industry-sorted portfolios. The S-CAPM specification is compared with two other specifications: (i) the 4F S-CAPM is the S-CAPM to which the betas of the Fama and French (1993) size and value factors and the Carhart (1997) momentum factor have been added, and (ii) the 4F model is the CAPM with respect to the investable market to which the betas of the Fama and French (1993) size and value factors and the Carhart (1997) momentum factor have been added: $\mathbb{E}(r_{X_k}) = \alpha + \delta_{mkt}\beta_{X_k m_I} + \delta_{SMB}\beta_{X_k SMB} + \delta_{HML}\beta_{X_k HML} + \delta_{MOM}\beta_{X_k MOM}$. These specifications are estimated using the Fama and MacBeth (1973) procedure. First, the variables are estimated, stock-by-stock, in a 3-year rolling window, at monthly intervals. In the second pass, a cross-sectional regression is performed on a monthly basis on all the stocks. The data are winsorized: the two stocks giving the highest and lowest excess returns every month are removed from the second pass. The estimated parameter is the average value of the estimates obtained on all months during the period of interest. t-values, estimated following Newey and West (1987) with three lags, are reported between parentheses. The last column reports the average OLS adjusted-R^2 and the GLS R^2 on the row underneath. The 95% confidence intervals are shown in brackets.

	α	δ_{mkt}	δ_{taste}	$\delta_{ex.asset}$	$\delta_{ex.mkt}$	δ_{SMB}	δ_{HML}	δ_{MOM}	Adj. OLS/GLS R^2
Estimate	0.0114	0.0044							0.03 [0.01,0.04]
t-value	(8.76)	(5.19)							0.04 [0.03,0.05]
Estimate	0.0152		-0.3536						0.05 [0.04,0.07]
t-value	(13.28)		(-1.78)						0.06 [0.04,0.07]
Estimate	0.0153			-36.3					0.05 [0.04,0.07]
t-value	(14.53)			(-1.63)					0.06 [0.05,0.08]
Estimate	0.0136				162.4				0.11 [0.09,0.13]
t-value	(13.36)				(4.11)				0.12 [0.09,0.14]
Estimate	0.0142			16.5	193.5				0.14 [0.12,0.17]
t-value	(14.36)			(0.73)	(5.28)				0.17 [0.15,0.2]
Estimate	0.0119	0.0025		19	195.4				0.15 [0.12,0.18]
t-value	(8.42)	(2.34)		(0.77)	(5.22)				0.21 [0.18,0.24]
Estimate	0.0124	0.0019	-0.2493	28.9	180.7				0.17 [0.15,0.2]
t-value	(8.9)	(1.88)	(-1.61)	(1.13)	(4.95)				0.24 [0.21,0.27]
Estimate	0.0116	0.0014	-0.6497	31	190.5	-0.0001	-0.0003	0.0001	0.21 [0.18,0.23]
t-value	(8.55)	(1.15)	(-2.67)	(1.2)	(5.1)	(-0.78)	(-2.66)	(1.94)	0.33 [0.3,0.36]
Estimate	0.0114	0.0039				-0.0001	-0.0001	0.0000	0.06 [0.04,0.08]
t-value	(8.75)	(3.36)				(-1.03)	(-0.95)	(0.06)	0.11 [0.1,0.13]

Table 13 Cross-sectional regressions for sin stocks over three consecutive periods between December 2007 and December 2019. This table provides the estimates obtained with the S-CAPM on the value-weighted monthly returns in excess of the 1-month T-Bill for 52 sin stocks between December 31, 2007, and December 31, 2019 over three consecutive periods. The specification is written as follows: $\mathbb{E}(r_{X_k}) = \alpha + \delta_{mkt}\beta_{X_k m_I} + \delta_{taste}\tilde{p}_i B_{X_k I}\tilde{C}_I + \delta_{ex.asset} q\,\mathbb{C}\mathrm{ov}(r_{X_k}, r_{m_X}|r_I) + \delta_{ex.mkt} q\,\mathbb{C}\mathrm{ov}(r_{X_k}, r_{m_X}|r_{m_I})$, where r_{X_k} is the value-weighted excess return on stock X_k ($k = 1, ..., n_X$), and $\beta_{X_k m_I}$ is the slope of an OLS regression of r_{X_k} on r_{m_I}; $\tilde{p}_i B_{X_k I}\tilde{C}_I$ is the proxy for the indirect taste factor and $\tilde{p}_i$ is the proxy for the proportion of integrators' wealth; q is the proportion of the excluded assets' market value in the market, and $\mathbb{C}\mathrm{ov}(r_{X_k}, r_{m_X}|r_I)$ (and $\mathbb{C}\mathrm{ov}(r_{X_k}, r_{m_X}|r_{m_I})$) are the covariances of the excess returns on stock X_k with those on the excluded market, the excess returns on the investable market (and the vector of investable assets, respectively) being given. The investable assets are analyzed using 46 industry-sorted portfolios. This specification is estimated using the Fama and MacBeth (1973) procedure. First, the variables are estimated, stock-by-stock, in a 3-year rolling window, at monthly intervals. In the second pass, a cross-sectional regression is performed on a monthly basis on all the stocks. The data are winsorized: the two stocks giving the highest and lowest excess returns every month are removed from the second pass. The estimated parameter is the average value of the estimates obtained on all months during the period of interest. t-values, estimated following Newey and West (1987) with three lags, are reported between parentheses. The last column reports the average OLS adjusted-R^2 and the GLS R^2 on the row underneath. The 95% confidence intervals are shown in brackets.

Panel A: Dec. 2010 - Dec. 2013 (second pass) / Dec. 2007 - Dec. 2013 (first pass and second pass)						
	α	δ_{mkt}	δ_{taste}	$\delta_{ex.asset}$	$\delta_{ex.mkt}$	Adj. OLS/GLS R^2
Estimate	0.0046	0.0063	0.4618	11.9	311.4	0.26 [0.2,0.31]
t-value	(2.37)	(3.49)	(3.21)	(0.5)	(6.7)	0.36 [0.32,0.4]
Panel B: Dec. 2013 - Dec. 2016 (second pass) / Dec. 2009 - Dec. 2013 (first pass and second pass)						
	α	δ_{mkt}	δ_{taste}	$\delta_{ex.asset}$	$\delta_{ex.mkt}$	Adj. OLS/GLS R^2
Estimate	0.0162	-0.0014	-1.2	4.9	278.7	0.16 [0.1,0.21]
t-value	(16.23)	(-1.03)	(-4.26)	(0.23)	(5.18)	0.23 [0.18,0.27]
Panel C: Dec. 2016 - Dec. 2019 (second pass) / Dec. 2013 - Dec. 2019 (first pass and second pass)						
	α	δ_{mkt}	δ_{taste}	$\delta_{ex.asset}$	$\delta_{ex.mkt}$	Adj. OLS/GLS R^2
Estimate	0.0166	-0.0034	-0.4444	132.7	-4.5	0.33 [0.27,0.38]
t-value	(14.33)	(-1.96)	(-1.76)	(3.27)	(-0.04)	0.32 [0.26,0.38]

Table 14 Cross-sectional regressions on sin stocks' excess returns where $\tilde{p}_i$ is a proxy for p_e. This table provides the estimates obtained with the S-CAPM on the value-weighted monthly returns in excess of the 1-month T-Bill for 52 sin stocks between December 31, 2007, and December 31, 2019. In the exclusion-asset and the indirect taste factors, p_i is used as a proxy for p_e. The specification is written as follows: $\mathbb{E}(r_{X_k}) = \alpha + \delta_{mkt}\beta_{X_k m_I} + \delta_{taste}\tilde{p}_i^2 B_{X_k I}\tilde{C}_I + \delta_{ex.asset}\tilde{p}q\,\mathbb{C}\text{ov}(r_{X_k}, r_{m_X}|r_I) + \delta_{ex.mkt}q\,\mathbb{C}\text{ov}(r_{X_k}, r_{m_X}|r_{m_I})$, where r_{X_k} is the value-weighted excess return on stock X_k ($k = 1, ..., n_X$), and $\beta_{X_k m_I}$ is the slope of an OLS regression of r_{X_k} on r_{m_I}; $\tilde{p}_i B_{X_k I}\tilde{C}_I$ is the proxy for the indirect taste factor and $\tilde{p}_i$ is the proxy for the proportion of integrators' wealth; q is the proportion of the excluded assets' market value in the market, and $\mathbb{C}\text{ov}(r_{X_k}, r_{m_X}|r_I)$ (and $\mathbb{C}\text{ov}(r_{X_k}, r_{m_X}|r_{m_I})$) are the covariances of the excess returns on stock X_k with those on the excluded market, the excess returns on the investable market (and the vector of investable assets, respectively) being given. The investable assets are analyzed using 46 industry-sorted portfolios. The S-CAPM specification is compared with two other specifications: (i) the 4F S-CAPM is the S-CAPM to which the betas of the Fama and French (1993) size and value factors and the Carhart (1997) momentum factor have been added, and (ii) the 4F model is the CAPM with respect to the investable market to which the betas of the Fama and French (1993) size and value factors and the Carhart (1997) momentum factor have been added: $\mathbb{E}(r_{X_k}) = \alpha + \delta_{mkt}\beta_{X_k m_I} + \delta_{SMB}\beta_{X_k SMB} + \delta_{HML}\beta_{X_k HML} + \delta_{MOM}\beta_{X_k MOM}$. These specifications are estimated using the Fama and MacBeth (1973) procedure. First, the variables are estimated, stock-by-stock, in a 3-year rolling window, at monthly intervals. In the second pass, a cross-sectional regression is performed on a monthly basis on all the stocks. The data are winsorized: the two stocks giving the highest and lowest excess returns every month are removed from the second pass. The estimated parameter is the average value of the estimates obtained on all months during the period of interest. t-values, estimated following Newey and West (1987) with three lags, are reported between parentheses. The last column reports the average OLS adjusted-R^2 and the GLS R^2 on the row underneath. The 95% confidence intervals are shown in brackets.

	α	δ_{mkt}	δ_{taste}	$\delta_{ex.asset}$	$\delta_{ex.mkt}$	δ_{SMB}	δ_{HML}	δ_{MOM}	Adj. OLS/GLS R^2
Estimate	0.0114	0.0041							0.03 [0.02,0.05]
t-value	(10.18)	(4.35)							0.05 [0.04,0.07]
Estimate	0.0153		-474.7						0.07 [0.05,0.09]
t-value	(16.54)		(-1.62)						0.07 [0.05,0.08]
Estimate	0.0152			-33487.3					0.08 [0.06,0.11]
t-value	(19.13)			(-1.19)					0.08 [0.06,0.1]
Estimate	0.0134				162.3				0.18 [0.15,0.21]
t-value	(14.93)				(2.79)				0.14 [0.11,0.17]
Estimate	0.0136			51849.7	211.7				0.2 [0.17,0.23]
t-value	(14.58)			(2.52)	(3.95)				0.21 [0.18,0.24]
Estimate	0.0116	0.0015		60221	230.3				0.21 [0.18,0.25]
t-value	(8.4)	(1.3)		(2.62)	(4.17)				0.25 [0.22,0.28]
Estimate	0.0124	0.0005	-465.2	49515.9	196.9				0.24 [0.21,0.28]
t-value	(9.14)	(0.42)	(-1.81)	(2.1)	(3.88)				0.3 [0.27,0.33]
Estimate	0.0115	0.0014	-1028.8	40277.1	219.3	0.0001	-0.0003	0.0002	0.31 [0.27,0.35]
t-value	(8.25)	(0.97)	(-2.3)	(1.52)	(3.97)	(0.58)	(-2.68)	(1.67)	0.42 [0.39,0.44]
Estimate	0.0115	0.0039				0.0000	0.0000	0.0001	0.1 [0.08,0.13]
t-value	(9.93)	(3.24)				(0.04)	(-0.29)	(0.72)	0.16 [0.14,0.18]

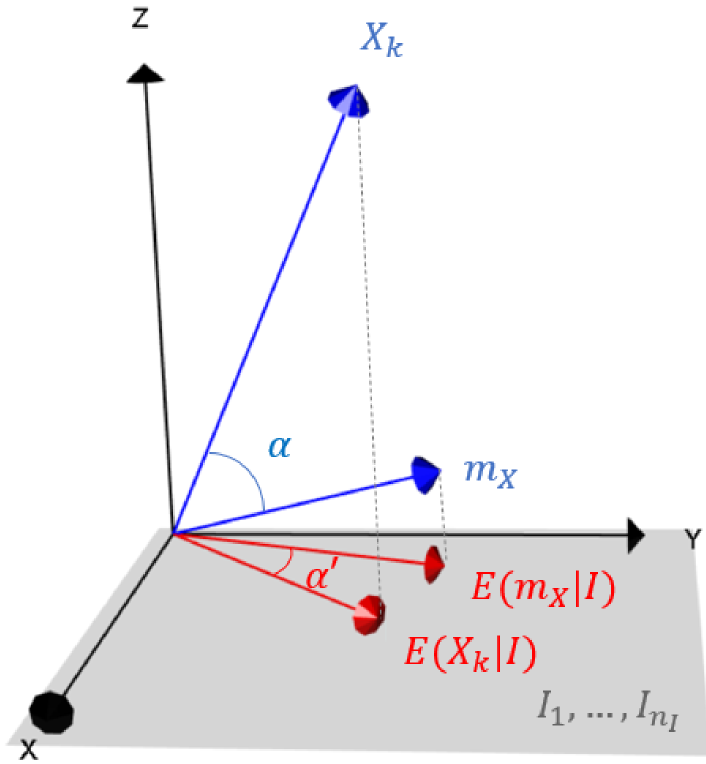


Figure 1. Geometric representation of the exclusion-asset premium. This figure provides a geometric picture of the conditional covariance $\mathbb{C}\text{ov}(r_{X_k}, r_{m_X}|r_I)$, which, after being multiplied by factor $\gamma\frac{p_e}{1-p_e}q$, forms the exclusion-asset premium on asset X_k. In the graph, the standard deviation of the excess returns on an asset is depicted by the norm of the associated vector, and the correlation coefficient between the excess returns on two assets is depicted by the cosine of the angle between the two vectors. The total market is depicted by the space $\mathbb{R}^3$, and the assets in the investable market $(I_1, ..., I_{n_I})$ is depicted by plane (X, Y). Asset X_k and the excluded market, m_X, projected onto the space of investable assets offer a graphic depiction of the conditional expectations, $\mathbb{E}(X_k|I)$ and $\mathbb{E}(m_X|I)$, respectively. $\mathbb{C}\text{ov}(r_{X_k}, r_{m_X}|r_I)$ is therefore depicted geometrically as the difference between the cosines of the two angles α and α', both of which are normalized by the norms of vectors generating them: $\mathbb{C}\text{ov}(r_{X_k}, r_{m_X}|r_I) \sim ||X_k||\,||m_X||\,cos(\alpha) - ||\,\mathbb{E}(X_k|I)||\,||\,\mathbb{E}(m_X|I)||\,cos(\alpha')$.

Home > News & Statements > Press Releases

About the SEC
Filings (EDGAR)
Regulatory Actions
Staff Interps
Investor Info
News & Statements
News Digest
Press Releases
What's New
Upcoming Events
Speeches
Testimony
Special Studies
Complaint Data
Open Meetings
Other Webcasts
Litigation
Information for...
Divisions

SEC Adopts Enhanced Mutual Fund Expense and Portfolio Disclosure; Proposes Improved Disclosure of Board Approval of Investment Advisory Contracts and Prohibition on the Use of Brokerage Commissions to Finance Distribution

FOR IMMEDIATE RELEASE
2004-16

Washington, D.C. Feb. 11, 2004 -- The Securities and Exchange Commission took the following actions today at its open meeting:

Shareholder Reports and Quarterly Portfolio Disclosure by Funds

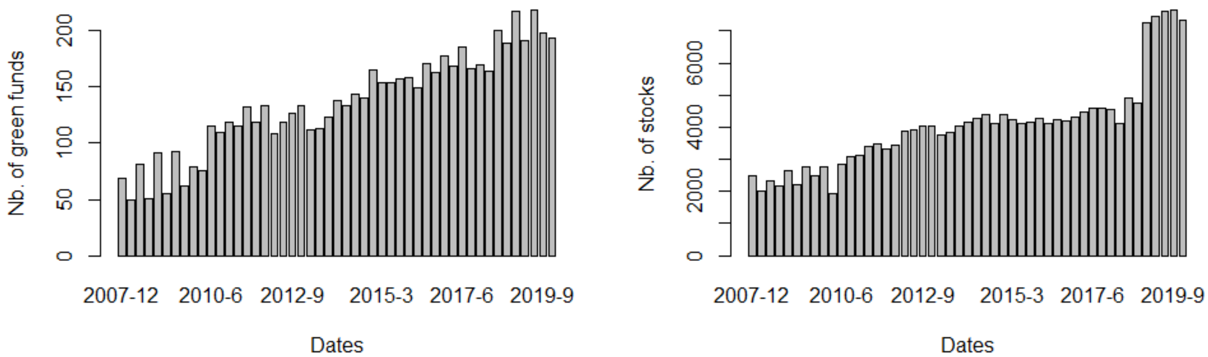
The Commission adopted several amendments to its rules and forms that are intended to improve significantly the periodic disclosure that mutual funds and other registered management investment companies provide to their shareholders about their costs, portfolio investments, and performance.

The amendments include the following:

- **Enhanced Mutual Fund Expense Disclosure in Shareholder Reports.** The amendments will require open-end management investment companies (mutual funds) to disclose fund expenses borne by shareholders during the reporting period in their shareholder reports. Shareholder reports will be required to include: (i) the cost in dollars associated with an investment of $1,000, based on the fund's actual expenses for the period; and (ii) the cost in dollars, associated with an investment of $1,000, based on the fund's actual expense ratio for the period and an assumed return of 5 percent per year. The first figure is intended to permit investors to estimate the actual costs, in dollars, that they bore over the reporting period. The second figure is intended to provide investors with a basis for comparing the level of current period expenses of different funds. The expense disclosure will also be required to include the fund's expense ratio and the account values as of the end of the period for an initial investment of $1,000.

- **Quarterly Disclosure of Fund Portfolio Holdings.** The amendments will require a registered management investment company (fund) to file its complete portfolio holdings schedule with the Commission on a quarterly basis. These filings will be publicly available through the Commission's Electronic Data Gathering, Analysis, and Retrieval System (EDGAR). This amendment is intended to enable interested investors, through more frequent access to portfolio information, to monitor whether, and how, a fund is complying with its stated investment objective.

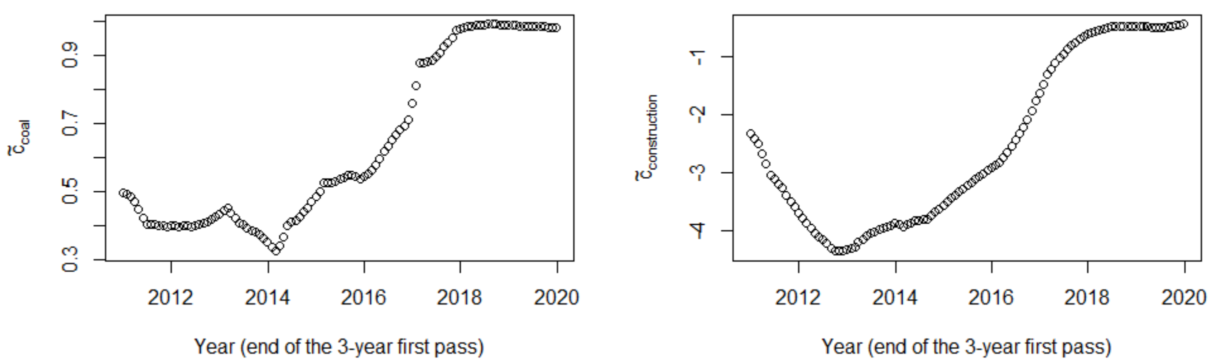
Figure 2. U.S. funds holdings disclosure. This figure shows the text of the SEC's February 2004 amendment requiring U.S. funds to disclose their holdings on a quarterly basis.



(a) Number of green funds

(b) Number of stocks in the green funds

Figure 3. Green funds' holdings. This figure shows, quarter-by-quarter, the number of green funds for which the composition has been retrieved in FactSet (a), and the number of stocks held by all these green funds (b).



(a) Coal industry

(b) Construction industry

Figure 4. This figure depicts the dynamics of the proxy for the cost of environmental externalities, $\tilde{c}$, for the coal (Figure (a)) and the construction (Figure (b)) industries. For industry I_k, $\tilde{c}_{I_k} = \frac{w_{m,I_k} - w^*_{i,I_k}}{w_{m,I_k}}$, where w_{m,I_k} is the market weight of industry I_k and w^*_{i,I_k} is the proxy for the weight of industry I_k in green investors portfolios.

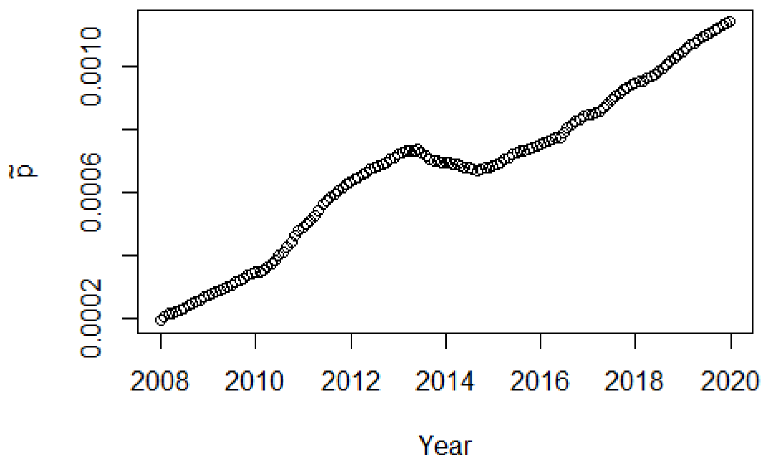


Figure 5. Dynamics of proxy $\tilde{p}_i$. This figure depicts the dynamics of the proxy for the proportion of integrators, $\tilde{p}_i = \frac{\text{Market value of green funds in } t}{\text{Total market capitalization in } t}$, between December 31, 2007 and December 31, 2019.

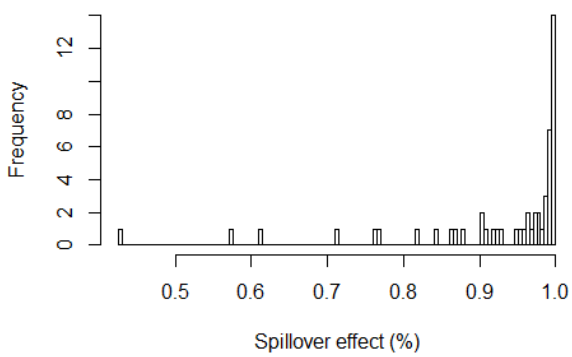


Figure 6. Distribution of the share of the spillover effect. This figure shows the distribution of the share of the spillover effect in the exclusion effect, $\left(\frac{\sum_{j=1,j\neq k}^{n_X} |q_{X_j}\left(\widehat{\delta}_{ex.asset}\,\mathbb{C}\mathrm{ov}(r_{X_k},r_{X_j}|r_I)+\widehat{\delta}_{ex.mkt}\,\mathbb{C}\mathrm{ov}(r_{X_k},r_{X_j}|r_{m_I})\right)|}{\sum_{k=1}^{n_X} |q_{X_j}\left(\widehat{\delta}_{ex.asset}\,\mathbb{C}\mathrm{ov}(r_{X_k},r_{X_j}|r_I)+\widehat{\delta}_{ex.mkt}\,\mathbb{C}\mathrm{ov}(r_{X_k},r_{X_j}|r_{m_I})\right)|}\right)_k$, over all sin stocks estimated between December 31, 2007, and December 31, 2019.

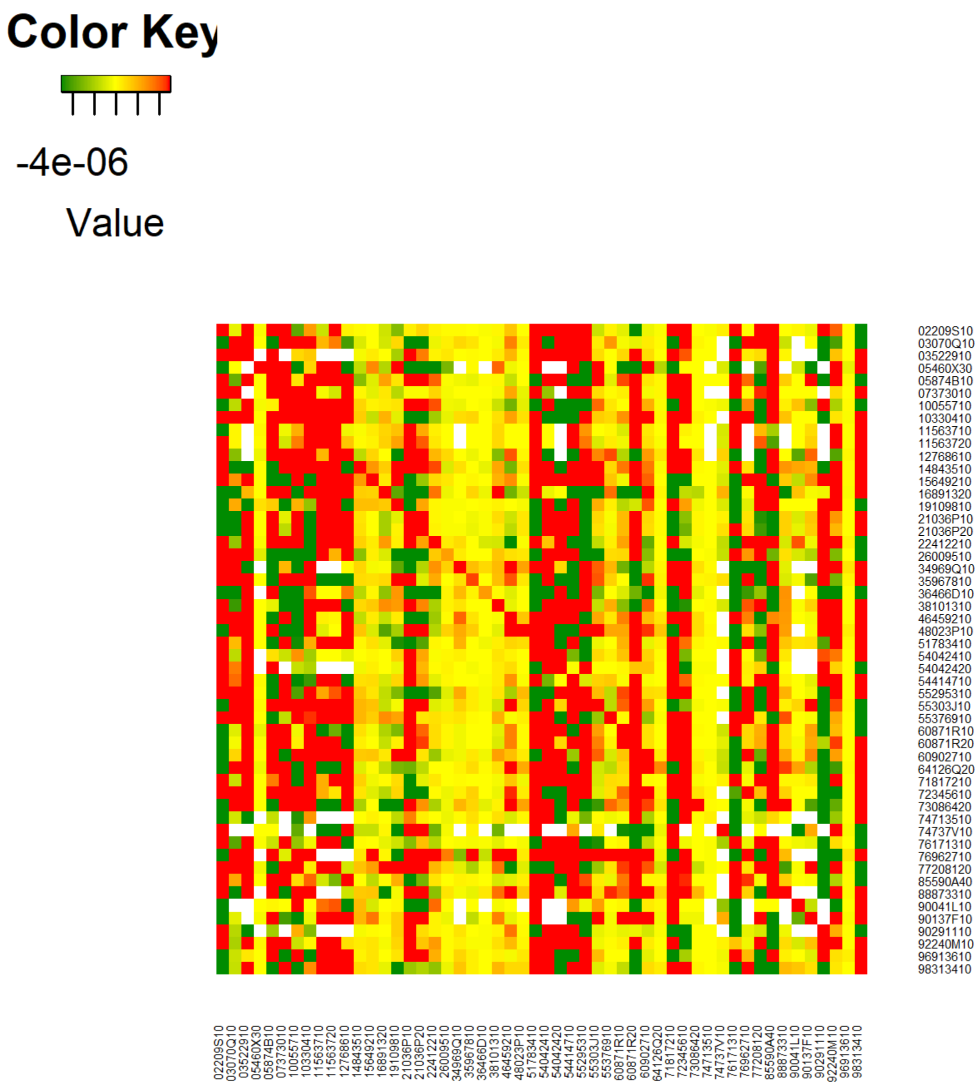


Figure 7. Heatmap of the spillover effects. This figure shows, for each sin stock X_k (presented in rows), the estimated spillover effects of the other sin stocks $(X_j)_{j\in\{1,\ldots,n_X\}}$ (presented in columns), estimated as $\widehat{\delta}_{ex.asset}q_{X_j}\,\mathbb{C}\text{ov}(r_{X_k}, r_{X_j}|r_I) + \widehat{\delta}_{ex.mkt}q_{X_j}\,\mathbb{C}\text{ov}(r_{X_k}, r_{X_j}|r_{m_I})$. The positive effects are shown in red, and the negative effects are shown in green. The first diagonal gives the own effects, which all have a positive or zero estimated value.