Discussion paper series on investor impact mechanisms

Mechanism #5: send market signals

2i investing initiative

About 2° Investing Initiative

The 2° Investing Initiative (2DII) is an independent, non-profit think tank working to align financial markets and regulations with the Paris Agreement goals.

Globally focused with offices in Paris, New York and Berlin, 2DII coordinates some of the world's largest research projects on sustainable finance. Our team of finance, climate and risk experts develop research, tools, and policy insights to help financial institutions and regulators hasten and adapt to the energy transition.

In order to ensure our independence and the intellectual integrity of our work, we have a multi-stakeholder governance and funding structure, with representatives from a diverse array of financial institutions, governments and NGOs.

Author: Mickaël Mangot

Published on: March 2023

About our funder and the project: This project is funded by the EU's Horizon 2020 research and innovation program under Grant Agreement No 834345. LEVEL EEI aims at making the financial products contributing to energy efficiency and sustainable energy more competitive. This work reflects only the author's view and the funder is not responsible for any use that may be made of the information it contains.

The paper is part of the Retail Investing Research Program at 2DII which is one of the largest publicly funded research projects about the supply, demand, distribution and policy side of the retail investment market in Europe.

Mechanism #5: send market signals

Presenting the mechanism

Investors can send market and non-market signals that they are committed to impact. Market signals through investments and divestments based on sustainable screening contribute to change the conditions to access capital in financial markets for companies.

Market signaling builds on the idea that investors can modify companies' behaviors by affecting asset prices in financial markets via their own capital allocation. The transmission from asset prices to companies' behaviors and outcomes in the real economy operates through two pathways, as explained by Kölbel et al. (2020): "first by creating incentives to improve ESG practices and therefore the quality of company activities, and second by affecting growth and therefore the level of company activities."

The incentive pathway

The first pathway is grounded on the financial interest of asset owners. Capital allocation decisions by investors can increase or decrease asset prices and therefore increase or decrease the financial wealth of asset owners. If those are concerned with their financial wealth, they would logically be responsive to price changes and try to influence the company's decisions. This is true for stockholders and for bond holders. But the influence of stockholders is obviously larger thanks to their right to vote in general assemblies.

Within the group of shareholders, there is a specific subgroup with an even increased capacity to affect companies' decisions: companies' managers. Many of them are endowed with stocks as part of their compensation package. This could make them very responsive to the fluctuations of the stock price. This is in accordance with Edmans et al. (2012), who argue that when managerial incentives are tied to stock market value, managers will be sensitive to nonfundamental shifts in the share price of their corporation.

The growth pathway

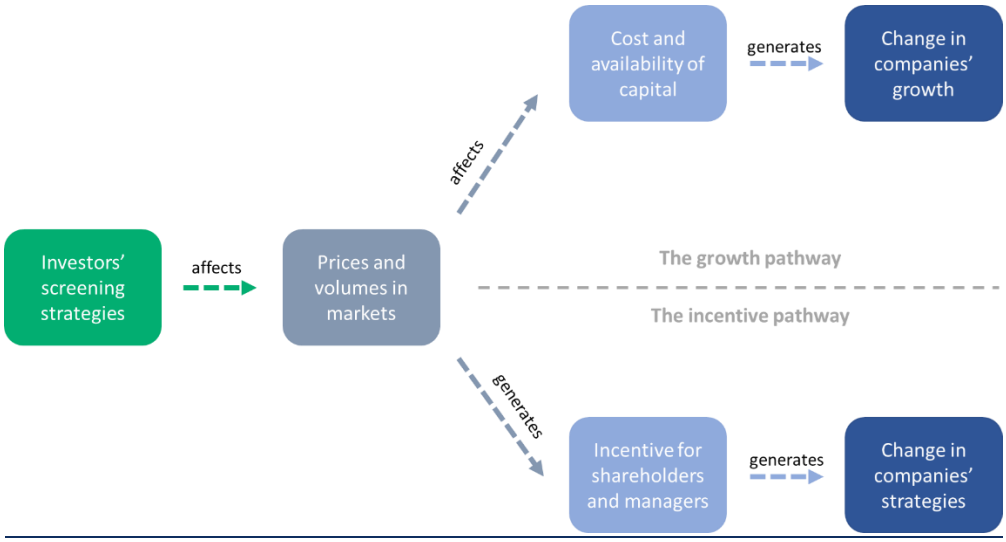
The second pathway builds on the need of companies to raise (equity or debt) capital to grow. By affecting prices in the primary or the secondary market, investors can increase the cost of capital for, respectively, present or future issuances. When cost of capital is higher, firms will be forced to abandon some investment projects. So, if ESG-concerned investors are successful in raising the cost of capital for low-ESG firms vs high-ESG firms, they will de facto lower the growth rate of the sooner vs the latter.

Investors can also send volume signals to companies. If an issuance is widely oversubscribed, it signals that the company has room to implement larger issuances in the future.

To summarize, through markets investors send price and volume signals that are prone to affect the price and size of future issuances and, consequently, influence the capacity of companies to grow.

The figure 1 displays the two pathways underlying the impact narrative of market signaling.

Figure 1: the two impact pathways of market signaling



Examples of products

Several types of sustainable capital allocations are commonly applied by asset managers and investors. Each of them has, at least in theory, a capacity to influence market prices.

Positive screening: this approach involves the selection of the best performing or most improved companies or assets as identified by ESG analysis, within a defined investment universe. This approach includes several variations, whether it selects the best companies in each sector (best-in-class), across sectors (best-in-universe) or that achieved the best progression (best-effort).

Negative screening: this approach consists in excluding from investment (or divesting) of certain companies because of their sectors or their business practices (e.g., involvement in controversies or violations of international norms).

Thematic screening: this approach implies an investment in certain sectors that contribute to providing solutions to ESG topics or SDGs.

Tilting: this approach revolves on a systematic reweighting of assets in portfolios (vs conventional benchmarks) based on ESG information.

Questioning the impact narrative

The theory behind the narrative

Many theoretical models have been developed by academic researchers to investigate the effects of various capital allocation strategies on i) asset prices and ii) real-life outcomes, as well in primary as in secondary markets.

Effects of capital allocation in primary markets

Several theoretical models have obtained that responsible capital allocation in primary markets led to real-world reductions in negative externalities[1]. For instance, Barnea et al. (2005) obtain that green investors can induce polluting firms to reform and that non-responsible industries receive less capital thereby inducing a lower level of investments from them.

[1] Hakenes and Schliephake (2022), Landier and Lovo (2020)

In a more nuanced way, Moisson (2020) questions the effectiveness of various sustainable financial approaches to lead to real achievements for impact-driven ("direct consequentialist") social investors. In his model, the economy is made of two competitive sectors, green and brown. Each sector is characterized by an installed base of plants and by an investment function for new plants. New investment reflects the price that investors are willing to pay for shares. He notably finds that the positive impact of divestment on the pollution level is partially mitigated by the endogeneity of prices: as the financial returns on the brown technology rise following the divestment decision, additional brown investments from non-divestors partially offset the divested ones.

In a similar vein, Green and Roth (2020) argue that the folk wisdom justifying "values-aligned" investing is misguided, and such investment strategies are an inefficient way to use asset allocation decisions to influence social value creation. To them, investors in search for real-life impact would be making a mistake in adopting values-aligned investment strategies. Their framework builds on the insight that an investor's true contribution to social value is not reflected in the social value of the companies in their portfolio, but rather by the additional social value created relative to if the investor did not exist at all. The distinction between these perspectives is driven by the fact that many companies that have high social value could attract investors with a purely financial objective. Therefore, socially motivated investors who finance these companies may not be contributing to social value creation. In fact, their behavior could even result in social value destruction if it displaces investors unconstrained by social considerations into financing socially harmful projects. They formalize this critique in an equilibrium model of capital allocation.

Effects of capital allocation in secondary markets

There are even more models addressing the effects of capital allocation in secondary markets on asset prices and real-world outcomes.

A great majority of theoretical models confirms that responsible strategies lead to the targeted variations in asset prices (see table below).

Exceptions include Gollier and Pauget (2014) who examine the conditions under which socially responsible investors (hereafter, SR investors) could induce corporations to behave more responsibly, i.e., choosing a responsible vs a non-responsible strategy. They show that the firm's share price is higher when the socially responsible strategy is adopted if and only if the proportion of responsible investors and the size of the externality are sufficiently high, and if the cost of implementing the pro-social strategy is low enough. Otherwise, the market value of the responsible firm is smaller.

In an often-cited paper, Pedersen et al. (2020) show how ESG might change investor portfolio optimization problem and equilibrium market prices. They consider three types of investors:

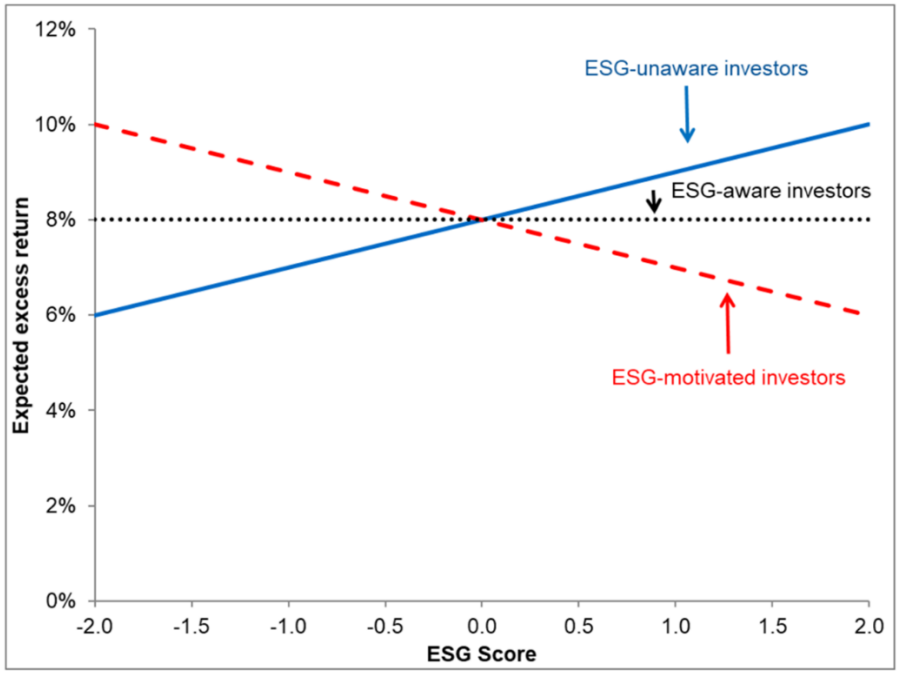
- "ESG-unaware" investors are unaware of ESG scores and simply seek to maximize their unconditional mean–variance utility.
- "ESG-aware" investors also have mean–variance preferences, but they use assets' ESG scores to update their views on risk and expected return.
- "ESG-motivated" investors use ESG information and also have preferences for high ESG scores. In other words, such investors seek a portfolio with an optimal tradeoff between a high expected return, low risk, and high average ESG score.

They derive the equilibrium security prices and returns. They show that expected returns are given by an ESG-adjusted CAPM, as seen in figure 2. When there are many ESG-unaware investors and when high ESG predicts high future profits, they show that high-ESG stocks deliver high expected returns. This is because high-ESG stocks are profitable, yet their prices are not bid up by ESG-unaware investors, leading to high future returns. In contrast, when the economy has many type-A investors, then these investors bid up the prices of high ESG stocks to exactly reflect their expected profits, thus eliminating the connection between ESG and expected returns. In other words, when a large fraction of investors are doing ESG integration with no other objective than maximizing their future risk-

adjusted return through the use of ESG information, ESG information is fully integrated into prices and there is no more connection between expected returns and ESG profile. Alternatively, if the economy has many ESG-motivated investors, then high-ESG stocks actually deliver low expected returns, because ESG-motivated investors are willing to accept a lower return for a higher ESG portfolio.

A wrap-up message is that, in secondary markets, equilibrium prices and returns ultimately depend on the relative sizes of the various types of investors.

Figure 2: the ESG-CAPM



The theoretical conclusions regarding real-world effects of sustainable capital allocations are also mostly positive. For instance, Broccardo et al. (2020) obtain that investor divestment like consumer boycotts cause the market value of a dirty firm to fall, leading some value-maximizing managers to switch to the clean technology. However, both exit strategies will curb pollution in a less than proportional way: if ten percent of agents divest/boycott, less than ten percent of firms become clean (an observation already made by Heinkel et al. (2001) in the divestment context). The reason is that purely selfish agents will partially offset the effects of divestment/boycotting by increasing their investment/purchases in companies shunned by socially responsible agents. In both these cases the magnitude of the response depends on the slope of the demand curve, which is driven by agents' risk tolerance for investors and by the utility of the good for consumers.

De Angelis et al. (2020) draw a model where green investing raises the cost of capital of polluting companies, yet uncertainty about future environmental externalities mitigates the latter's incentives to clean their production process, thus driving pollution from the most polluting firms upwards. This paper shows how green investing spurs companies to mitigate their carbon emissions by raising the cost of capital of the most carbon-intensive companies. The authors also provide empirical evidence supporting their results by focusing on United States stocks between 2004 and 2018 and using green fund holdings as a proxy for green investors' beliefs.

Table 1: overview of academic models covering effects of screening strategies on asset prices (AP) and on real-world outcomes (RW)

Name	Date	Markets	ESG Integration		Divestment		Exclusion		Best-in-class		Tilts		Thematic	
			AP	RW	AP	RW	AP	RW	AP	RW	AP	RW	AP	RW
Hakenes and Schliephake	2022	Primary												
Landier and Lovo	2020	Primary												
Green and Roth	2020	Primary												
Moisson	2020	Primary												
Barnea et al.	2005	Primary												
Berk and van Binsbergen	2022	Secondary												
Pedersen et al.	2020	Secondary												
Zerbib	2020	Secondary												
Fama and French	2007	Secondary												
Pastor et al.	2020	Secondary												
Broccardo et al.	2020	Secondary												
De Angelis et al.	2020	Secondary												
Luo and Balvers	2017	Secondary												
Gollier and Pauget	2014	Secondary												
Heinkel et al.	2001	Secondary												

Do flows really affect market prices?

Different views of the market

Two opposite logics prevalent in financial markets compete with each other to account for the effect of financial flows on market prices.

On the one hand, **the Equilibrium Logic** consider that market operators are rational and financial markets are efficient to incorporate fundamental information into prices. Therefore, market prices always reflect fundamental information. This being said, the effect on nonfundamental demand on prices is not consensual across advocates of the equilibrium logic. According to one view (the "market efficiency" view), uninformed shocks cannot have a long-lasting impact on prices due to the actions of arbitrageurs. It is the presence of highly reactive profit-maximizing arbitrageurs (like hedge funds) that is supposed to maintain market prices at their correct fundamental value.
According to another view within the Equilibrium logic, capital inflows from sustainable investors do affect prices as rational investors are asking for a compensation to hold a portfolio different from the market portfolio. The **portfolio-balance channel**, first discussed in the 1970s-80s, has been advocated in recent standard asset pricing models of Fama and French (2007) and Luo and Balvers (2017), which have confirmed that preference-neutral investors require a premium for balancing out the portfolio choices of investors who share a particular nonfinancial preference because this forces the preference-neutral investors to deviate from the market portfolio.

On the other hand, **the Flow logic** considers that market prices are just the reflection of capital flows. They increase in presence of strong capital inflows and decrease in case of significant capital outflows. Arbitrageurs can limit this mechanical link but not offset it. Therefore, a massive demand of sustainable securities by sustainable investors would mechanically lead to an increase in prices for those securities. The effect on prices of sustainable demand could even be augmented and prolongated via the decisions of non-sustainable **noise traders** acting on behavioral determinants, for instance if they buy winning stocks upon the beliefs that past market movements would tend to continue (i.e., displaying momentum expectations).

Elastic or inelastic markets?

In textbook theory, the micro elasticity of market prices is supposed to be very large, of the order of 1000 or above. It means that demand is super sensitive to changes in individual prices. This implies

that the micro multiplier (the inverse of the micro elasticity) is essentially zero and demand curves are virtually flat. Demand curves for stocks are kept flat by (quasi-)riskless arbitrage between perfect substitutes. It is the presence of highly reactive profit-maximizing arbitrageurs (like hedge funds) that is supposed to maintain infinite price elasticity of financial markets.

If demand is highly elastic, as implied by many standard models of beliefs and preferences, then the demand of a group of investors for a particular stock would only have a modest impact on prices, as other investors would quickly substitute from one stock to another.

In reality, individual stocks do not have perfect substitutes and the actual micro elasticity is most probably smaller than the most theoretical predictions. It is even more true for macro elasticity as entire asset classes have even less close substitutes. Therefore, in traditional, elastic asset pricing models the macro elasticity is around 10 to 20, leading to a multiplier around 0.1 to 0.05. A multiplier of 0.05 implies that if a sovereign wealth fund, for instance, were to buy 10% of the US aggregate stock market, prices would rise by only 50bp.

Conversely, in *inelastic* financial markets, differences in demand are reflected much more intensely in asset prices. In inelastic financial markets, more people attempting to buy a stock (or the market) will lead to price increases, and more people attempting to sell a stock will lead to price decreases. Second, the magnitude of these effects will increase with the desired amount of stock being purchased or sold. Finally, because price pressure is fundamentally about limited liquidity, **the inelastic financial markets theory** predicts that the effects on prices of a given amount of buying or selling will be greater in periods of lower liquidity.

In such a theory, price pressure is a general and largely mechanical prediction. It is to be confronted to the conceptual offsetting trades which are an economic prediction arising from particular models of how (rational) investors trade.

As for the logics that accounts for market prices, the beliefs regarding market elasticity are not consensual. Various views coexist and empirical tests are required. Two interesting surveys quoted by Gabaix and Koijen (2020) questioned academic researchers on the topic, asking for an estimate of the macro multiplier M. The survey question was the following: "*If a fund buys $1 billion worth of US equities (permanently; it sells bonds to finance that position), slowly over a quarter, how much does the aggregate market value of equities change?*" In both surveys, the median answer was M = 0. It appears that surveyed economists rely on the traditional asset pricing model in which prices are unperturbed by flows.

Evidence of price reactions to flows

What can empirical tests say about the price reactions to capital flows? The question whether demand curves for stocks actually slope down has a long tradition in the asset pricing literature. The empirical evidence so far comes from various event studies around index redefinitions (listings and delistings), dividend payments, changes in fund ratings, and fire sales by institutional investors[2].

As a recent example, Hartzmark and Solomon (2022) demonstrate that buying pressure from dividend payments predicts higher market returns (as dividend payments provide extra cash to investors that reinvest it in the market), with the returns on the top quintile of payment days four times higher than the lowest.

The 2007 quant crunch and other recurrent deleveraging spirals are also extreme consequences of the impact of order flow on prices[3], as well as the effect of governmental or Central Banks' interventions[4].

[2] Coval and Stafford (2007), Petajisto (2009), Schnitzler (2018)
[3] Khandani, A. E., & Lo, A. W. (2011), Brunnermeier, M. K., & Pedersen, L. H. (2009), Kyle, A. S., & Obizhaeva, A. A. (2016)
[4] Barbon and Gianinazzi (2019)

The general finding is that large non-fundamental trades have a significant but temporary price impact, even though there is considerably heterogeneous evidence on the speed and the extent of reversal. So it makes probable that preference-based demand for sustainable assets would also impact prices, at least in the short run.

Estimates of price elasticities and multipliers

Gabaix and Koijen (2020) provide an interesting summary of recent estimates of the micro multiplier, which is the percent change in prices when an investor purchases a certain fraction of the shares outstanding in a particular company, while controlling for movements in the aggregate market. While there is a range of estimates, the order of magnitude of the multiplier is around 1. That is, buying 1% of the shares outstanding of a given stock results makes its price increase by around 1%. In addition, other studies have looked at the "factor-level" multiplier, which is the price impact if an investor buys a fraction of the shares outstanding of a cross-sectional factor such as size or value. The studies report a multiplier that is substantially above 1 and closer to 5. They finally report recent estimates of the "macro multiplier" that applies at market level. Once again, the multiplier estimates are between 2 and 6. Equivalently, the macro elasticity, which is the inverse of the multiplier, is well below 1.

Table 2: overview of estimates of the multiplier

Panel A: Micro multiplier		
	Methodology	Multiplier
Chang, Hong and Liskovich (2014)	Index inclusion	0.7 to 2.5
Pavlova and Sikorskaya (2020)	Index inclusion	1.5
Schmickler (2020)	Dividend payouts	0.8
Frazzini et al. (2018), Bouchaud et al. (2018)	Trade-level permanent price impact	15
Panel B: Factor-level multiplier		
Ben-David, Li, Rossi and Song (2020a)	Morningstar ratings change	5.3
Peng and Wang (2021)	Fund flows	4.8
Li (2021)	Fund flows+SVAR	5.7
Panel C: Macro multiplier		
Da, Larrain, Sialm and Tessada (2018)	Pension fund rebalancing Chile	2.2
Li, Pearson and Zhang (2020b)	IPO restrictions in China	2.6-6.5

Source: Gabaix and Koijen (2020)

Using the recent method of granular instrumental variables, they themselves find that investing $1 in the stock market increases the market's aggregate value by about $5. If investors create a flow of 1% as a fraction of the total value of equities, the model implies that the value of the equity market goes up by 5%. In contrast, most rational or behavioral models would predict a very small impact, about 100 times smaller, and a price elasticity about 100 times larger.
The authors provide several explanations for such a rather high multiplier. First, asset class-specific mandates prevent market participants from being macro arbitrageurs. Second, even if a fund isn't formally tied to a benchmark, its manager may be compensated in part for performance relative to one and is likely to buy shares of the same underlying companies. These positions are often in large part passive and price insensitive.

Taken together, the existing evidence in the literature suggests a micro multiplier around 1 and a factor or macro multiplier that is between 2 and 6. Such estimates imply that a 1-billion-euro green equity fund that would only invest in listed stocks of green companies would lead to an increase in the segment market cap by 2 to 6 billion euros.

A time-varying price elasticity?

As said before, there is ongoing debate between researchers about the long-term effects of flows on market prices. Some consider the effect on prices to be transitory (reversible) while others expect it to be permanent.

If the price changes were due to flow effects only, no additional changes should be expected when nonfundamental flows stop. Arbitrageurs and diversified rational investors would even collude to reverse price changes as they would trade the price-inflated securities for cheaper substitutes. If the prices changes were due to portfolio-balance effects, then the price reversal would also occur for the same exact reasons.

A partial permanent effect is nevertheless possible in case arbitrageurs are too small or diversified rational investors are too passive or noise traders offset part of their actions.

Empirical studies generally obtain that it is only over very long time scales (several years) that some mean reversion around the fundamental value can be observed, as already sugested by the very famous paper by Black (1986) and substantiated in more recent contributions[5]. Gabaix and Koijen (2020) find no evidence of price reversal over one year. Looking at long-term effects of Bank of Japan's interventions, Barbon and Gianinazzi (2019) also find that price pressure effects are positive and persistent. They find no evidence of reversal over a 1-year window after policy announcements.

But this observation is not consensual. Looking at index inclusions and removals in the US, Patel and Welch (2016) finds evidence of full reversals within six months for short-run price pressures; that is, long-run price elasticities are infinite.

Another ongoing discussion is about the long-term change in market elasticity in relation with the changing profile of market investors. Are markets becoming more or less elastic due to the rise of passive index investing?

It is true that not all investors are similarly reactive to price changes. By definition, passive investors are less reactive than active investors. Truly passive investors have a "demand elasticity" of zero, that is they do not buy more of a stock if it becomes cheaper or less as it becomes more expensive.

Haddad (2022) investigated the impact on valuations of various market participants and confirmed that large, passive investment advisors and long-term investors, such as pension funds and insurance companies, have a relatively small impact on valuations with a multiplier below 0.5. Per dollar of assets managed, hedge funds and small, active investment advisors have the largest impact on valuations, with a ratio of repricing to AUM share of over 1.25. An increase in the share of passive investment should thus push the market's aggregate elasticity down.

Looking at long-term variations, Haddad (2022) obtains that the entire cross-sectional distribution of stock-level elasticity has decreased during that period, by 40%. Interestingly, the model attributes about equally this drop to two investor-specific sources of change. First, the fraction of passive investors has increased. Second, the investor-specific component of the elasticity of active investors has decreased. Markets are turning more inelastic due to the increasing weight of passive investors and less arbitrage by active investors. Therefore, there seems to be more room for sustainable investors to influence prices[6].

[5] Bouchaud, J. P. et al. (2018), Majewski et al. (2020)

[6] But, here again, observations by Patel and Welch (2016) are contrarian. Over the decades, the six-month portfolio response to being added into the S&P 500 seems to have declined. Nowadays, there seems to be no or very little permanent six-month effect. The prevailing two-day 2% announcement response seems to revert (almost) fully. Same is obtained for index removals. Solid evidence for reversion started to appear in the 2000s.

The price impact of ESG flows

The empirical evidence regarding the realized returns to ESG investing over the past two decades is dramatically mixed and tends to depend on the sustainability measure, time horizon, controls and asset universe under investigation.

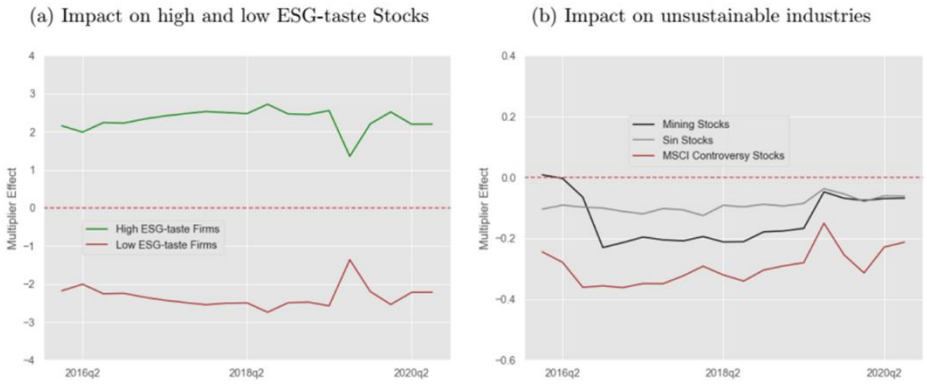
On the one hand, In et al. (2020) find that an ESG portfolio, which longs low emission and shorts high emission stocks earns a significantly positive annualized alpha of 3.5-5.4%. Gorgen et al. (2020) find that from 2010 to 2017 brown (high carbon) firms performed worse than green firms on average. Those observations are easily accounted by the positive flow dynamics for green listed companies in the last decade.

On the other hand, Bolton and Kacperczyk (2021) find evidence for a carbon premium, implying that high emission stocks have higher returns after controlling for known risk factors. Similarly, Hsu et al. (2022) find significant outperformance of high chemical emission stocks versus low ones. Those observations are in line with equilibrium models where market prices reflect higher (transition) risks for polluting companies.

To help understand the past relative performance of high ESG vs low ESG stocks, Van der Werk (2021) performed a decomposition of observed ESG returns into fundamental and demand-driven components.
He shows that the performance of ESG investments is strongly driven by price-pressure arising from flows towards sustainable funds, causing high realized returns that do not reflect high expected returns. The coefficient linking ESG flows and realized returns is the product of two factors: i) the deviation of green funds' portfolios from the market portfolio and ii) a flow multiplier matrix that is the inverse of the market's demand elasticity of substitution between stocks.
Empirically, **withdrawing 1 dollar from the market portfolio and investing it in the representative ESG fund increases the aggregate value of high ESG stocks by 2-2.5 dollars.** Under the absence of flow-driven price pressure, the aggregate ESG industry would have strongly underperformed the market from 2016 to 2021. Furthermore, the positive alpha of a long-short ESG portfolio becomes significantly negative.
The price pressure arising from quarterly flows of only $5 bn would have been sufficient to offset the fundamental underperformance of high ESG stocks vs the market portfolio in recent years. Thanks to an average of $ 20 bn of quarterly inflows, ESG funds significantly outperformed.

Van der Werk (2021) rightfully concluded that **one should be careful when using the realized outperformance of sustainable investments in recent years to judge their expected outperformance going forward.** Past performance of high ESG stocks was due to massive capital inflows and should not be interpreted as a long-term fundamental superiority.

Figure 3: multiplier effects of ESG flows



Source: Van der Werk (2021)

While the low aggregate elasticity of substitution is worrying for the overall stability and efficiency of equity markets, it supports the effectiveness of sustainable investing to affect prices and, potentially, companies' behavior. Flows towards green funds, that invest in inelastic stocks, may substantially reduce the cost of capital of the firms in the fund's portfolio.

Van der Werk (2021)'s framework allows differentiating sustainable funds according to their effect on market prices. A fund's multiplier is driven by its deviation from the market portfolio and by the extent to which the deviations are concentrated towards inelastic stocks. Flows towards funds with a large flow multiplier contribute positively (negatively) to green (brown) firms' realized returns and their cost of capital.

It appears that there is substantial heterogeneity in the price effect of different ESG mutual funds - both in terms of magnitude and even direction, as shown by table 3.

Table 3: multiplier effects of flows in various ESG funds

		Impact of 1$ Flow onto...			
	Deviation from S&P500	High Taste Stocks	Sin Stocks	MSCI Contr. Stocks	Mining Stocks
PARNASSUS CORE EQUITY	0.72	4.92	-0.07	-0.56	-0.14
VANGUARD FTSE SOCIAL	0.16	0.83	-0.07	-0.22	-0.11
ISHARES MSCI USA ESG	0.17	0.87	-0.06	0.03	-0.03
PARNASSUS MID-CAP FUND	0.98	5.56	-0.05	-0.47	-0.09
TIAA-CREF SOCIAL CHOICE	0.48	2.20	-0.07	-0.02	0.04
ISHARES MSCI USA SRI	0.77	5.01	-0.07	-0.39	-0.05
BROWN ADVISORY SUSTAINABLE	0.79	4.30	-0.06	-0.28	-0.10
DFA U.S.SUSTAINABILITY CORE	0.32	0.28	-0.05	-0.19	-0.12

Source: Van der Werk (2021)

A 1$ dollar flow to the iShares MSCI USA SRI fund raises the aggregate market equity of high ESG-taste stocks by 5 dollars and lowers the valuation of mining stocks by 5 cents. The same flow towards the DFA U.S. Sustainability Core Equity Portfolio would lead to a value increase of high taste stocks of only 28 cents.

Is it possible to affect cost of capital enough to alter companies' strategic decisions?

By definition, cost of capital is a company's calculation of the minimum return that would be necessary in order to justify undertaking a capital budgeting project, such as building a new factory.

On paper, it makes total sense to consider that the lower it is, the more projects can be undertaken. Economic textbooks tell us that business investment is negatively related to interest rates. Therefore, decreasing cost-of-capital through financial investments in secondary (debt or equity) markets in favor of green or virtuous companies should help them to expand their activities. Indeed, prices in secondary markets form reference points that are used by companies to price newly issued securities.

In practice, the effectiveness of capital allocation decisions to affect companies' behaviors via the cost-of-capital channel depends on the needs of invested companies to issue (debt or equity) capital to sustain their growth.

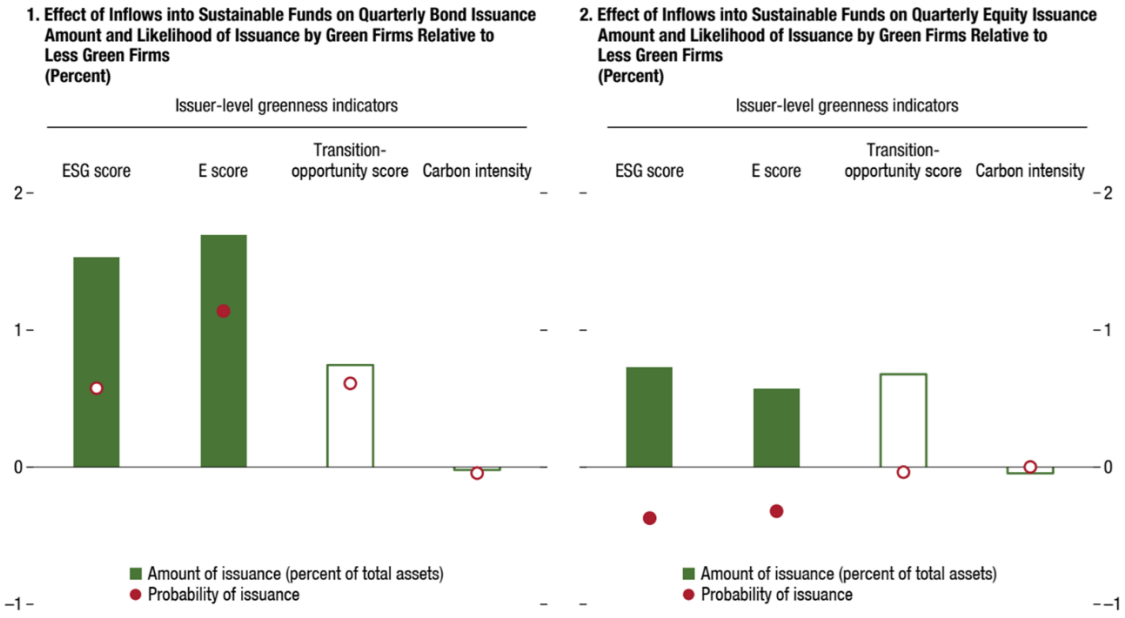
Regarding equity capital, it is clear that the harm from a higher cost of equity capital is limited by the frequency with which firms tap external equity markets. This frequency is actually low, especially for large mature companies. Most of the new equity sold by large firms is via manager or employee stock

purchase or stock option plans, not to finance development projects (excluding acquisitions). Debt issues are more frequent though.

Work by the IMF documents that flows into sustainable investment funds increase the availability of fresh private capital to firms with a more favorable sustainability rating. They analyzed securities issuance of a sample of 6,449 firms during the period 2010-2021. To establish a direct link between flows into sustainable funds and further security issuance, they considered issuance as a function of flow-driven buying pressure, building on Zhu (2021). Considering the stylized fact that mutual funds that hold a firm's existing bonds have a high propensity to acquire additional new issuances from the same firm, Zhu (2021) had investigated the issuance behavior of companies in relation with the flow-driven buying pressure. He obtained that firms that already have a solid base of existing bond investors are more likely to issue new bonds, enjoy lower yields, and substitute away from equity financing and bank loans.

Focusing on sustainable investment flows, the follow-up study by the IMF found that firms in transition-sensitive sectors with high ESG or environmental scores are more likely (relative to other firms) to issue bonds and in larger amounts when inflows into sustainable funds increase during a quarter. Similar results are true for equity issuance, where the amount of equity issued by firms with high ESG or environmental scores increases, even though they issue equity somewhat less frequently.[7]

Figure 4: effects of ESG inflows on securities issuance by green firms



Source: IMF (2021)

Unfortunately, the IMF study does not document whether the increased (amount of the) issuances by firms with high ESG or environmental scores is associated with a higher pace in decarbonization.

In terms of magnitude, change in asset prices in secondary markets may turn to be insufficient to affect companies' cost-of-capital enough to alter their investment plans.

Any market impact that would lead to a decrease in the cost of capital by less than 1 percentage point would most probably be insufficient to alter the course of investment plans and would look pale in

[7] Interestingly, similar effects are not evident in objective variables more closely aligned with the transition, such as the transition-opportunity score or carbon intensity. Taken together, this suggests that while sustainable funds have been boosting issuance of firms aligned with the funds' sustainability objective, they may lack the size or focus to foster issuance by firms actually supporting the transition.

comparison to yield movements associated to variations in central banks' policies or agents' expectations. Reaching such a (low) threshold is yet not an easy task.

> **Example #1:** let's consider a mature company with a cost of debt at 4% (i.e., the yield on its 10Y bonds) and a cost of equity at 8% (as given by the Dividend Capitalization Model[8]). An increase of market prices by 10%, due to the mobilization by responsible investors of adequate capital, would cause a reduction by 117bp and 27bp respectively for its cost of debt and equity (to respectively 2,83% and 7,73%). In this example, cost of debt is four times more sensitive to market prices than cost of equity. It requires an increase by 40% of equity prices to reduce cost of equity by 1 percentage point.
>
> **Example #2:** let's now consider a young and fast-growing company with a cost of debt at 6% (i.e., the yield on its 10Y bonds) and a cost of equity at 11% (as given by the Dividend Capitalization Model[9]). An increase of market prices by 10%, due to the mobilization by responsible investors, would cause a reduction by 128bp and 10bp respectively for its cost of debt and equity (to respectively 4,72% and 10,9%). In this second example, cost of debt is 13 times more sensitive to market prices than cost of equity. It requires an increase by 100% of equity prices to reduce cost of equity by 1 percentage point.

In the following table, we propose rough estimates of the necessary capital to decrease cost of equity of all constituents of various global green equity indices by 1 percentage point, considering various values for the multiplier. When M equals 2,5 (i.e., following Van der Werk (2021)), one requires between USD 28 billion to USD 224 billion. In all cases, this is far from being accessible by individual funds and would require coordination between many investment funds.

Table 4: necessary capital to decrease cost of capital by 1 pp

	MSCI Global Environment Index	MSCI Global Alternative Energy Index	MAC Global Solar Energy Index
Total market cap of portfolio constituents (USD bn)			
	1398	245	175
Capital to be deployed to decrease cost of equity of all constituents by 1 percentage point (USD bn)*			
M=5	112	20	14
M=2,5	**224**	**39**	**28**
M=1	559	98	70

*Following the above example for mature companies, we make the (conservative) hypothesis that an increase by 40% of equity prices is necessary to reduce cost of equity by 1 percentage point.

Berk and van Binsbergen (2022) studied the effect of a firm either being included or excluded from the FTSE USA 4 Good Select Index which is replicated by several index funds, especially the Vanguard FTSE Social Index Fund (the largest ESG index fund by market cap) to infer the impact of SRI funds

[8] We consider here that the company pays a 3% dividend yield and that the expected annual growth rate of the dividend is 5%.
[9] We consider here that the company pays a 1% dividend yield and that the expected annual growth rate of the dividend is 10%.

on cost of capital. They find that the difference in the cost of capital between firms that are targeted by SRI funds for their social or environmental costs and firms that are not is too small to meaningfully affect real investment decisions. They estimate that to affect by more than 1 pp the cost of equity capital of targeted firms, impact investors would need to make up more than 80% of all investable wealth.

The sensitivity of cost of capital to market prices being much higher for (finite maturity) debt than for (infinite maturity) equity, it would sound reasonable to conclude that mobilizing capital in the bond market is more impactful. Such a conclusion would nevertheless be too hasty as the multiplier effect is much smaller in the bond market than in the equity market due to the existence of closer substitutes for bond securities. For instance, some empirical studies in the bond market positioned multiplier effects between 0,003 and 0,03[10] only, which amounts between 3% and 3 thousandths of what has been observed for (individual) equity. As there are plenty of other bonds with the same characteristics (maturity and credit rating), sellers would rush to sell their bonds of targeted companies at higher prices. Therefore, it would require impact-motivated investors to deploy massive capital to be successful in raising bond prices of targeted companies.

Examples of massive interventions on the bond market come from asset purchases by central banks. Their effects on bond prices have drawn researchers' attention since they became a central component of monetary policy after the Great Financial Crisis. For instance, Arrata and Nguyen (2017) studied the impact of the Eurosystem's Public Sector Purchase Program (PSPP) on bond yields in the French bond market. Their results show that having purchased 10% of a bond outstanding correlates with a decrease in yield of about -13 bps to -26 bps on average in the first year of implementation of the program, with bigger effects in the most illiquid segments. They also provided a comparison table with other similar studies in the UK and the US.

Table 5: Overview of estimates of effects on bond prices of central banks' purchase programs

Authors	Prog.	Results (Stock effects rescaled for 10% of outstanding purchased)
D'Amico and King (2013)	US LSAP1	Stock effects: -100 bps Flow: -3.5 bps
Meaning and Zhu (2011)	US LSAP1&2	Stock effects: -32 bps Flow: -3.5 bps (LSAP1) -4.7 bps (LSAP2)
Meaning and Zhu (2011)	UK APF	Stock effects: -9.3 bps Flow: -1.5 bps
Joyce et al. (2010)	UK APF	Stock effects: -40 bps Flow: -2.5 bps
Andrade et al. (2016)	PSPP	Flow: no significant effect Stock (event study on announcement and implementation dates) -27 bps
Koijen et al. (2016)	PSPP	Stock (estimated on country-level purchases predicted by capital key): -35bps
Arrata and Nguyen	PSPP FR	Stock effects: -13 bps (average, OLS) -26 bps (IV) Flow effects: mostly inexistant

Source: Arrata and Nguyen (2017)

Effects of a cumulated purchase of 10% of the outstanding debt range from -9 to -100 bps for the different asset purchase programmes in the US and in UK while short-term supplemental flow effects prove to be very small at best.

[10] Albuquerque et al. (2022)

Across zones, most studies obtain estimates between 10bp and 40bp for stock effects. Those estimates tell us that **reducing yields on bonds by just 1 percentage point would most probably require purchasing between 25% and all of the outstanding debt targeted.**

Are managers sensitive to stock prices?

Part of the impact narrative of price signaling goes through providing right incentives to company managers. The effectiveness of such a channel is de facto highly dependent on the structure of the managers' compensation. If company managers have no stock-based compensation, then the incentive is pointless. If part of their compensation is stock-based, then affecting stock prices through capital allocations may turn effective… or counter-effective.

Against intuition, Davies and Van Wesep (2018) show that, as most managerial compensation contracts reward long-run profitability and stock returns, divestment can be ineffective at best, and perhaps counterproductive, rewarding managers who attract divestment campaigns.

In particular, divestment is…

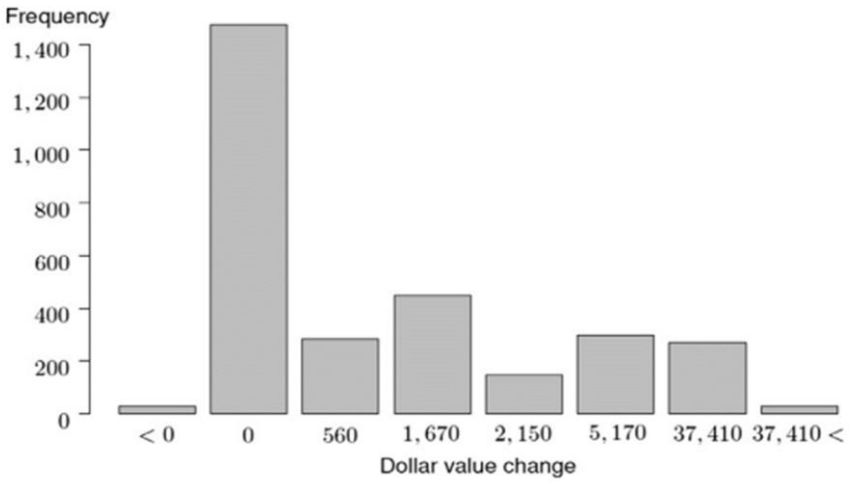
- **ineffective in case of performance bonuses**. Cash or equity bonuses that depend upon profitability measures such as return on assets, return on equity, or profit incent managers not to mitigate any negative externality
- **counterproductive in case of (some) stock grants**. Share grants usually specify a fixed number of shares. Increases or decreases in the share price have no direct effect on the number of shares that the manager receives. Other share grants specify a fixed value, which is divided by the share price on or near the grant date to determine the number of shares granted. For fixed-value grants, therefore, a lower share price has a positive effect on the number of shares granted.
- **counterproductive in case of stock options**. Stock options are typically granted at par and are most often offered either in fixed-value or fixed number plans. In either case, CEOs prefer low interim share prices. If executives instead receive a fixed value of options, then they benefit even more from divestment than under a fixed number plan. Not only does the value of each option increase with divestment, but the number granted increases as well.

In a quantification exercise, they show that the wealth of most executives running likely divestment targets would be unaffected by even large movements in share prices. Of those affected, a substantial majority would even benefit from divestment. The only compensation plans that align the interests of managers and campaigners are those that heavily emphasize near-term stock prices, not other performance measures such as long-run prices, profitability, or stock returns. This sort of plan is not common. Practice is moving in the other direction, with more restricted and long-vesting equity grants as a short-term focus on current prices is often viewed as myopic and contrary to long-run company success.

As the authors conclude, this is bad news for proponents of divestment. Still, they admit that managers of firms targeted in divestment campaigns are stigmatized, and social pressure can be as effective as financial pressure to make them choose a more sustainable course. This mechanism, however, suggests that making noise (i.e., a form of non-market signaling) is more important than having firms divest. Finally, it is no be noted that aligning corporate objectives with climate/ESG issues can be more directly and more effectively achieved via sustainability-related incentive mechanisms in managers' compensation schemes as suggested by various authors[11].

[11] Edmans et al. (2012), Aggarwal et al. (2020)

Figure 5: distribution of companies' managers wealth changes in case of a divestment campaign (of 1% of shares outstanding)



Source: Davies and Van Wesep (2018)

Will shareholders receive and act upon the signal?

A final channel that could connect market prices to companies' real-world decisions leverages the response by shareholders to abnormal equity returns. Here, the theory of change states that shareholders of low ESG/brown companies would react to disappointing returns (in case of sufficient market impact) by pressing the companies' management to opt for a more sustainable strategy using engagement and voting.

So, the narrative implies that i) shareholders get the right message from the price effect and ii) they react by engaging with the targeted companies and not by exiting.

Those two steps are not straightforward though. First, there could be many conflicting interpretations for disappointing returns leading some shareholders to push in favor of more sustainability and others towards less. Second, for shareholders engagement is a costlier response to disappointing returns than just selling stocks or bonds to redirect capital towards other securities with a better momentum.

When tapped in isolation, the shareholder channel of market signaling thus relies on uncontrollable factors. At least, a way to maximize its probable effect would be to combine it with explicit non-market signals. If media interventions make it clear that the price decrease is connected to a targeted campaign by market activists, then the shareholders can get the message more easily and, potentially, act upon it.

The observed outcomes

Several empirical studies, at micro or macro level, have investigated whether green or sustainable investment strategies in secondary equity markets had a real-world effect. Results are ambivalent.

At micro level, Roehleder et al. (2021) used an original methodology to identify decarbonization trades of mutual funds and associate them to firm-level carbon emissions. They calculated a metric of funds' decarbonization sell pressure (DSP) on stocks. They find that i) high DSP sustainably pressures stock prices downwards and ii) divested firms experiencing a stock price decline subsequently reduce their carbon emissions compared to non-divested firms.

In another micro-level study, Heath et al. (2022) found that SRI funds do not significantly change firm behavior. They developed an empirical design that exploits plausibly exogenous variation in the

amount of capital allocated to SRI funds in relation to the obtention of Morningstar globes. They found no evidence that SRI funds change the environmental behavior of firms (i.e., total pollution or investment in pollution abatement technologies) or their social behavior (i.e., employee well-being or board diversity). Their results show that SRI funds do select companies that behave in a relatively more environmentally and socially responsible manner, but they do not significantly improve the environmental or social conduct of their portfolio firms. SRI funds operate primarily as stock selectors, not as impact generators.

At macro level, De Angelis et al. (2020) provide empirical evidence of real-world impact of allocations to green funds by focusing on United States stocks between 2004 and 2018. They obtain that when the fraction of assets managed by green investors doubles, companies' overall carbon intensity drops by 4.9% over one year.

In another macro study, Choi et al. (2020) find that financial institutions around the world reduced their exposure to stocks of high-emission industries after 2015, especially for those located in high climate-awareness countries. In the presence of divestment, public high-emission firms in the same countries tend to experience lower price valuation ratios. They also increase capital expenditure, research and development (R&D) expenses, and green innovation activities, and reduce emissions resulting from their operations. They do not obtain the same results for private firms, opening the door to a potential leakage effect of green capital allocations where polluting companies or assets turn private.

Medias have warned against the risk caused by screening strategies of a massive transfer of unsustainable assets into private funds[12] in case of or sold into jurisdictions with, for example, lower environmental standards. In this way, "pure" portfolios become widespread in sustainability-concerned countries, but they have no real-life effect, and one could even argue that this approach worsens the situation.

Another leakage effect is presented by Cojoianu et al. (2020). On the one hand, they find that increasing oil & gas divestment pledges in a country are negatively related with new capital flows to domestic oil & gas companies. On the other hand, the divestment movement may have an unintended effect, insofar as domestic banks situated in countries with high divestment commitments and stringent environmental policies provide more finance to oil & gas companies abroad.

The moderators

Moderators of the effect of capital allocations to market prices

Research has shown that effects on market prices of allocating capital using sustainable screenings is highly context-dependent.

In particular, effects will depend on:

- **the deviation from conventional index of the sustainable allocations**[13]: sustainable funds can significantly affect prices only when their allocation significantly vary from the conventional benchmark,
- **the elasticity of stocks**: the more inelastic the stocks are, the more possible it is to influence prices. All else being equal, it is more effective for large stocks that are more inelastic than small caps (because passive investors hold them whatever happens)[14] and for stocks that lack substitutes. The effect of investors' screening approaches is likely to be higher for companies

[12] The Economist (2022)
[13] Van der Werk (2021)
[14] See Haddad (2022). It is noticeable that investing in small cap stocks suffers from the opposite pros and cons of investing in large caps. On the one hand, the lower market cap and daily volumes creates possibilities for stronger effects. On the other hand, the higher elasticity of demand to prices in the case of small cap stocks reduces the potential effect.

whose assets are not easily substitutable. The models of Heinkel et al. (2001) and Fama and French (2007) show that the capital allocation of sustainable investors has a stronger effect on the prices of assets whose returns are only weakly correlated with the market portfolio - that is, assets that are not easily substitutable. Counterbalancing sustainable investors' demand for those assets requires a higher deviation from an optimally diversified portfolio from neutral investors than is the case for stocks that have very close substitutes[15].

- **the size of the sustainable inflows or outflows vs the investment universe**: the effect is larger when capital is deployed/withdrawn on smaller segments of the market,
- **the concentration of trades by sustainable investment funds**: the more investment funds concentrate on a few holdings, the stronger the effect they can have on market prices.
- **the similarity of screening filters across sustainable funds:** the more homogeneous the screenings are, the more effective are investments/divestments of each fund in affecting market prices. If not homogeneous, the signals sent by individual funds have a high change to get lost. This advocates for a harmonization in screening criteria, as permitted by the introduction of regulations (like the EU taxonomy) or by the reliance on ETFs tracking the same sustainable indices.
- **the fraction of wealth commanded by sustainable investors:** equilibrium models[16] indicate that the total effect of screening approaches on asset prices, as well as the marginal effect per additional dollar involved, increases with the fraction of wealth commanded by investors that apply the same screening approach.

Moderators of the effect of market prices on companies' behaviors

Finally, a change in market prices due to a sustainable screening approach is more likely to cause companies to improve their ESG practices if **the costs for a company to implement the reforms required** (to conform to the requirements embodied in the screening) are low. The models of Heinkel et al. (2001) and Gollier and Pouget (2014) point out that whether changes in asset prices induced by sustainable investing provide an incentive for companies to improve their ESG practices depends on the cost of the necessary reforms.

Another condition is that companies have **necessity to raise more capital through markets** to develop.

Conclusion

The mechanism has attracted a lot of attention by researchers, but mostly on its capability to influence market prices. Unfortunately, the real-world effects have been much less scrutinized.

Still, it appears that **market signaling can deliver real-world effects only if multiple conditions are met**. Some of them are outside the control of sustainable investors, especially when they relate to the (opposite) behavior of conventional investors. Therefore, the mechanism implies a high impact risk (i.e., the risk of not delivering impact).

In any case, to maximize its chance to be effective, such an impact mechanism would require the deployment of massive capital by impact-motivated investors. Coordination, whether regulatory-led (through the EU taxonomy for instance) or market-led (through indices), seems to be crucial to make it possible.

[15] Accordingly, both Wurgler and Zhuravskaya (2002) and Ahern (2014) find empirical evidence that stocks with low substitutability exhibit a lower price elasticity.
[16] Such as those of Heinkel et al. (2001), Fama and French (2007), Gollier and Pouget (2014), and Luo and Balvers (2017)

Bibliography

Aggarwal, S., Dizon-Ross, R., and Zucker, A., (2020), "Incentivizing Behavioral Change: The Role of Time Preferences", CEPR Discussion Papers.

Albuquerque R., Cardoso-Costa, J. and Faias, J., (2022), "Price elasticity of demand and risk-bearing capacity in sovereign bond auctions", Working Paper.

Arrata, W. and Nguyen, B., (2017), "Price Impact of Bond Supply Shocks: Evidence from the Eurosystem's Asset Purchase Program", Banque de France Working Paper.

Barbon, A., and Gianinazzi, V., (2019), "Quantitative Easing and Equity Prices: Evidence from the ETF Program of the Bank of Japan", The Review of Asset Pricing Studies.

Berk, J. and van Binsbergen, J., (2022), "The Impact of Impact Investing", Stanford University Graduate School of Business Research Paper.

Black, F., (1986), "Noise", The Journal of Finance.

Bolton, P. and M. Kacperczyk (2021), "Do investors care about carbon risk?", Journal of Financial Economics.

Broccardo, E., Hart, O., and Zingales, L., (2020), "Exit versus Voice", Journal of Political Economy.

Brunnermeier, M. K., & Pedersen, L. H., (2009), "Market Liquidity and Funding Liquidity", Review of Financial Studies.

Choi, D., Gao, Z. and Jiang, W., (2020), "Global Carbon Divestment and Firms' Actions", Working Paper.

Cojoianu, T. F., Ascui, F., Clark, G. L., Hoepner, A. G. F., & Wójcik, D. (2020), "Does the fossil fuel divestment movement impact new oil and gas fundraising?", Journal of Economic Geography.

Coval, J., and Stafford, E., (2007), "Asset fire sales (and purchases) in equity markets", Journal of Financial Economics.

Davies, S. and Van Wesep, E., (2018), "The unintended consequences of divestments", Journal of Financial Economics.

De Angelis, T., Tankov, P., and Zerbib, O., (2020), "Climate Impact Investing", Working Paper.

Edmans, A., Gabaix, X., Sadzik, T., and Sannikov, Y., (2012), "Dynamic CEO Compensation", The Journal of Finance.

Fama, E., and French, K., (2007), "Disagreement, tastes, and asset prices", Journal of Financial Economics.

Gabaix, X., and Koijen, R., (2020), "In Search of the Origins of Financial Fluctuations: The Inelastic Markets Hypothesis", Swiss Finance Institute Research Paper.

Gollier, C., and Pouget, S. (2014), "The "washing machine": Investment strategies and corporate behavior with socially responsible investors", Working Paper.

Gorgen, M., A. Jacob, M. Nerlinger, R. Riordan, M. Rohleder, and M. Wilkens (2020), "Carbon risk", Working Paper.

Green, D., and Roth, B., (2020), "The Allocation of Socially Responsible Capital", Working Paper.

Haddad, V., Huebner, P., and Loualiche, E., (2022), "How Competitive is the Stock Market? Theory, Evidence from Portfolios, and Implications for the Rise of Passive Investing", Working Paper.

Hakenes, H., and Schliephake, E., (2022), "Responsible Investment and Responsible Consumption", CEPR Press Discussion Paper.

Hartzmark, S., and Solomon, D., (2022), "Predictable Price Pressure", NBER Working Paper.

Heath, D., Macciocchi, D., Michaely, R., and Ringgenberg M., (2022), "Does Socially Responsible Investing Change Firm Behavior?", ECGI Working Paper.

Heinkel R., Kraus, A., and Zechner, J., (2001), "The Effect of Green Investment on Corporate Behavior", The Journal of Financial and Quantitative Analysis.

Hsu, P.-H., K. Li, and C.-Y. Tsou (2020), "The pollution premium", The Journal of Finance.

IMF (2021), Investment funds: fostering the transition to a green economy.

In, S., Park, K., and Monk A., (2020), "Is 'being green' rewarded in the market? an empirical investigation of decarbonization risk and stock returns", International Association for Energy Economics.

Khandani, A. E., & Lo, A. W. (2011), "Illiquidity Premia in Asset Returns: An Empirical Analysis of Hedge Funds, Mutual Funds, and US Equity Portfolios", Quarterly Journal of Finance.

Kölbel, J., Heeb, F., Paetzold, F., Busch, T. (2020), "Can sustainable investing save the world? Reviewing the mechanisms of investor impact", Organization and Environment.

Kyle, A. S., and Obizhaeva, A. (2016), "Large bets and stock market crashes", Working Paper.

Landier, A. and Lovo, S., (2020), "ESG Investing: How to Optimize Impact?", Working Paper.

Luo, H. A., and Balvers, R. J. (2017), "Social screens and systematic investor boycott risk", Journal of Financial and Quantitative Analysis.

Moisson, P-H., (2020), "Ethics and Impact Investment", Working Paper.

Patel, N., and Welch, I., (2016), "Extended Stock Returns in Response to S&P 500 Index Changes", The Review of Asset Pricing Studies.

Pedersen, L. H., Fitzgibbons, S., & Pomorski, L. (2021), "Responsible investing: The ESG-efficient frontier", Journal of Financial Economics.

Petajisto, A., (2009), "Why Do Demand Curves for Stocks Slope Down?", Journal of Financial and Quantitative Analysis.

Rohleder, M., Wilkens, M., Zink, J., (2022), "The effects of mutual fund decarbonization on stock prices and carbon emissions", Journal of Banking and Finance.

Schnitzler, J., (2018), "S&P 500 inclusions and stock supply", Journal of Empirical Finance.

The Economist (2022), "The saviour complex".

Van der Werk, P., (2021), "Flow-Driven ESG Returns", Working Paper.

Zhu, Q., (2021), "Capital Supply and Corporate Bond Issuances: Evidence from Mutual Fund Flows", Journal of Financial Economics.