Can Investor Activism Facilitate the Green Transition?*

Sebastian Gryglewicz[†] Simon Mayer[‡] Erwan Morellec[§]

July 3, 2024

Abstract

We develop a model of investor activism where activists contribute to a firm's green transition by exerting effort and contracting with management. Due to moral hazard, only skilled activists can effectively facilitate this transition. However, if the acquisition price of their equity stake accounts for the value of activism, reflecting a free-rider problem, skilled activists cannot profitably invest. Combined, moral hazard and the free-rider problem imply that investor activism hinders the green transition unless activists derive substantial non-pecuniary benefits from transitioning. While non-pecuniary benefits foster entry and engagement, carbon taxation and investment subsidies impede them, thus obstructing effective impact activism.

Keywords: Activism, agency conflicts, contracting, sustainable finance, environmental policies

*We are grateful for helpful comments from Bruno Biais, Patrick Blonien, Jérôme Detemple, Thomas Geelen, Vincent Glode, Brent Glover, Maxi Guennewig, Johan Hombert, Ivan Ivanov, Lars Kuehn, Augustin Landier, Lakshmi Naaraayanan, Jacques Olivier, Marcus Opp, Ali Shourideh, Chris Telmer, Ernst Ludwig von Thadden, Felipe Varas, Paul Voss, Lucy White, Ariel Zetlin-Jones, and seminar participants at Boston University, Carnegie Mellon University, Erasmus University Rotterdam, HEC Paris, and the 2024 FTG Summer meetings in Barcelona.

[†]Erasmus University Rotterdam. Email: gryglewicz@ese.eur.nl

[‡]Tepper School of Business, Carnegie Mellon University. E-mail: simonmay@andrew.cmu.edu.

[§]EPF Lausanne, Swiss Finance Institute, and CEPR. E-mail: erwan.morellec@epfl.ch.

There is widespread consensus that a green transition in production technologies is necessary to address climate change (Acemoglu, Akcigit, Hanley, and Kerr, 2016; Besley and Persson, 2023). Over the past few years, financial markets have sought to foster the green transition by directing companies toward environmental objectives through both passive and active investment strategies. Passive strategies involve investing in "clean" firms and divesting from "dirty" firms so as to influence their cost of capital and incentivize investment in green transition. In active strategies, investors exercise their control rights to impact firm outcomes, such as through board representation, management oversight, strategy development, or voting on proposals. Recent research suggests that passive strategies, despite their popularity, may have little impact on firm behavior (Heath, Macciocchi, Michaely, and Ringgenberg, 2021; Berk and Van Binsbergen, 2022; Pedersen, 2024) and could even have adverse environmental effects (Hartzmark and Shue, 2023). Investor activism is thus increasingly being advocated as the preferred and more effective approach to sustainable finance (Krueger, Sautner, and Starks, 2020; Broccardo, Hart, and Zingales, 2022; Saint-Jean, 2023).

Our objective in this paper is to understand whether and when investor activism can facilitate a green transition in production technologies. To do so, we develop a parsimonious model of investor activism with endogenous activist entry and engagement, where an activist may foster a firm's green transition both by providing effort and by contracting with management. Using this model, we investigate how investor activism influences the green transition rate and the role of environmental policies in shaping shareholder engagement.

In our model, activism increases the green transition rate under first best, but two frictions limit its effectiveness. First, the green transition rate depends on the efforts of both the activist and management, which are costly and unobserved, giving rise to a (double-sided) moral hazard problem. Due to moral hazard, only sufficiently skilled activists can effectively foster the green transition. Second, due to a free-rider problem, the activist cannot fully capture the financial gains from activism, because these gains are incorporated into the acquisition price of its equity stake, which deters entry by skilled activists. The activist's sustainability preferences increase engagement both on the extensive margin by mitigating the free-rider problem and incentivizing entry by high-skill activists, and on the intensive margin by increasing efforts post-entry. Combined, moral hazard and free-rider problems make impactful activism unfeasible and lead to activism that harms the green transition unless the activist's sustainability preferences are strong. Carbon taxes increase the financial gains of a green transition and exacerbate the free rider problem, ultimately impeding impact activism. Green investment subsidies crowd out activist effort, hindering an activist's impact on the green transition.

To capture the key determinants of environmental activism, we consider a firm with a polluting production technology that can invest to transition toward a clean/green production technology, which we refer to as a *green transition*. Transitioning to a cleaner technology generates financial benefits arising from factors such as carbon taxation and increased consumer demand. However, the transition process is uncertain and costly, and potentially has a negative net present value. The probability of a successful green transition increases with the effort of the firm's management, broadly representing key personnel and executives that affect firm outcomes. As effort is unobservable, costly, and subject to moral hazard, firm owners provide management with incentives to exert effort by making their compensation sensitive to the outcome of the transition process.

While the firm is initially owned by passive investors, an activist may acquire an ownership stake by purchasing shares. The activist and passive investors differ in two dimensions. First, unlike passive investors, the activist exerts private and costly effort which, in addition to managerial effort, contributes to the green transition. The activist's effort captures its engagement with the firm, for instance, by monitoring management, appointing key personnel and board members, developing strategies, or voting on proposals. Second, the activist has sustainability or pro-environmental preferences and derives non-pecuniary (i.e., non-financial) benefits that depend on the impact of its actions, in particular, whether the firm succeeds in transitioning or not. That is, the activist is a warm-glow agent as in Broccardo et al. (2022) or a values-aligned investor as in Landier and Lovo (2023).[1]

We first show that while activism activism is valuable and accelerates the green transition in first best with observable efforts, it also introduces a double moral hazard problem that distorts incentives, which is not present under passive ownership. Specifically, the incentives

[1]Empirical evidence on such preferences for sustainable investing is provided by Riedl and Smeets (2017), Bonnefon, Landier, Sastry, and Thesmar (2022), and Heeb, Kölbel, Paetzold, and Zeisberger (2023).

for both the activist and management to exert effort are intertwined through a double-sided moral hazard problem (Holmström, 1982; Bhattacharyya and Lafontaine, 1995). Because its effort is unobservable, the activist cannot commit to a specific effort level and instead responds to incentives shaped by its equity stake and sustainability preferences. These incentives are tied to the sensitivity of equity to the transition outcome. However, this sensitivity is not independent of management's incentives, as equity is a residual claim. Part of the transition surplus is allocated to management through its incentive contract, with the remaining surplus accruing to equity, thus shaping the activist's incentives. Consequently, the effort incentives provided to management diminish the activist's effort, making the efforts of the activist and management function as substitutes. Because the activist's and management's effort incentives are interconnected, they generally cannot be set efficiently. As a result, the efforts of the activist and management, as well as the green transition rate, fall below their respective first-best levels. When this double moral hazard problem is sufficiently severe, activism decreases the green transition rate compared to passive investors owning the firm, giving rise to "bad activism." Notably, our analysis implies that activists with high cost of effort have negative or negligible impact on the transition process whereas high-skill activists, with sufficiently low cost of effort, improve the green transition rate.

In the model, the activist improves firm value through private and costly effort. However, if this value creation is fully reflected in the price at which the activist acquires a stake in the firm, the activist cannot capture the gains from activism and hence cannot profitably invest. That is, activist entry is subject to a free-rider problem that reduces the activist's incentives to invest in the first place (Grossman and Hart, 1980; Shleifer and Vishny, 1986). We first show that, because of this free-rider problem, activists do not invest and activism cannot facilitate a green transition in the absence of sustainability preferences. These preferences generate non-pecuniary benefits to the activist upon successful transition, motivating entry even without financial returns. As a result, sustainability preferences (i.e., non-pecuniary benefits of transition) improve impact activism via two separate channels: First, through the extensive margin, by allowing more skilled activists to enter and second, through the intensive margin, by increasing activist engagement and managerial effort post-entry. Weaker sustainability preferences intensify the free-rider problem, leading to a decrease in the skills of activists who invest and to a decrease in managerial effort and activist engagement.

In combination, the double moral hazard and free-rider problems make impactful activism unfeasible unless the activist has sufficiently strong sustainability preferences. The double moral hazard problem implies that only sufficiently skilled activists can effectively foster the green transition, while the free-rider problem deters entry by these high-skill activists. In other words, precisely when activism is valuable, it cannot emerge due to the free-rider problem. Instead, activists only engage if their impact is minimal. They target firms that can transition independently and exert minimal effort, acting almost like passive investors. In essence, the free-rider problem implies an endogenous exclusion mechanism whereby activists tilt their portfolio towards "greener" firms that can transition independently at low cost. Double moral-hazard then implies that activists reduce the transition rate of these firms, relative to passive investors owning the firm.

We next use our model to examine the impact of two prevalent environmental policies—carbon taxes and green investment subsidies—on the rate of the green transition and the effectiveness of activism. We demonstrate that carbon taxation crowds out active sustainable finance, making them substitutes. Essentially, carbon taxes increase the activist's post-entry impact and the value generated by activism, which strengthens the free-rider problem and disincentivizes entry, especially by skilled activists. In particular, for any given level of activists' skills, there exists a unique level of carbon taxes above which activists do not invest. In addition, due to the double moral hazard, activists reduce the transition rate relative to passive investors when the ratio of non-pecuniary to financial benefits of transitioning is low and carbon taxes are high. Specifically, there exists a unique level of carbon taxes above which activism always reduces the green transition rate. In sum, carbon taxes impede impactful activism both on the extensive margin by preventing entry of skilled activists and on the intensive margin by reducing activists' post-entry engagement.

We also investigate how investment subsidies, like those outlined in the U.S. Inflation Reduction Act, influence the green transition rate. Such subsidies lower the cost of investment at the firm level and make it optimal to incentivize higher managerial effort. However, this also requires increased incentive compensation for management, which diminishes the incentives for activist effort, thereby crowding it out. Our findings indicate that this crowding-out effect makes investor activism more likely to negatively affect the green transition rate when firm-level investment subsidies are in place. Furthermore, these subsidies lessen the importance of activist effort in the transition process, mitigating the free-rider problem associated with activist involvement. Consequently, as investor activism tends to hinder the green transition rate in the presence of investment subsidies, this crowding-in effect ultimately impedes the transition process.

In further analysis, we examine the impact of activism on the green transition when managerial contracts are established by passive investors rather than activists. Under these circumstances, the double moral hazard problem arising from the unobservability of efforts becomes more severe and activism is more likely to reduce the green transition rate. Because passive investors neither have sustainability preferences nor internalize the activist's private cost of effort, they incentivize low managerial effort. To offset this effect, the activist optimally exerts more effort, resulting in a higher private cost of transitioning and in a lower likelihood of activist entry. Our findings thus emphasize that for activism to effectively promote the green transition, it is crucial for activists to have the authority to influence managerial compensation, especially by integrating sustainability objectives into it.

Activists can typically acquire substantial ownership stakes before publicly revealing their investments in public companies, and they may possess considerable bargaining power when investing in private companies. Consequently, we also explore the implications of allowing activists to capture a portion of the value gains from their activism. Our analysis shows that while the possibility for activists to extracts more benefit from the transition mitigates the free-rider problem, it has no bearing on double moral hazard and the effects of activism on the green transition rate, assuming the activists' skills remain constant.

Finally, while our baseline assumes that the activist acquires a predetermined ownership stake, we also explore the implications of allowing the activist to decide the size of this stake. In this case, an activist with sustainability preferences always enters but with a stake that can be arbitrarily small. As in the baseline model, activism increases the green transition rate if sustainability preferences are sufficiently strong. However, in general, the activist ends up with an inefficiently low stake, reducing their efforts and slowing the green transition process. In addition, in line with our prior results, the activist acquires larger stakes in firms that can more easily transition independently, as captured by their lower cost of effort.

There is a vast literature on shareholder activism in which the activist affects firm performance via its own effort (see, e.g., Admati, Pfleiderer, and Zechner (1994), DeMarzo and Urošević (2006), and Back, Collin-Dufresne, Fos, Li, and Ljungqvist (2018)). Our main contribution with respect to this literature is to develop a tractable model of investor activism with endogenous entry, optimal contracting with management, and endogenous engagement. Because our activists derive non-pecuniary benefits from a clean transition, our model also relates to Grossman and Hart (1988) and Stulz (1988)'s analysis of private benefits of control. A key difference with these models is that the likelihood of enjoying these benefits depends on the activist's effort and the manager's contract, both of which are endogenous. In particular, a key takeaway of our analysis is that non-pecuniary benefits affect impact activism not only via the extensive margin but also via the intensive margin.

We apply our framework to study the role of activist investors in the green transition and to assess how environmental policies affect green activism. Thus, our paper relates to the growing theoretical literature on sustainable finance (see, e.g., Heinkel, Kraus, and Zechner (2001), Albuquerque, Kroskinen, and Zhang (2019), Green and Roth (2021), Hong, Wang, and Yang (2023), Gupta, Kopytov, and Starmans (2022), Edmans, Levit, and Schneemeier (2023), Huang and Kopytov (2023), Landier and Lovo (2023), Biais and Landier (2023), Allen, Barbalau, and Zeni (2023)). We contribute to this literature by investigating whether investor activism can foster the green transition in a model with moral hazard and endogenous activist entry. In this literature, our paper is most closely related to Broccardo et al. (2022), Jagannathan, Kim, McDonald, and Xia (2022), and Oehmke and Opp (2024). The first two papers study the effectiveness of exit and voice strategies in reducing firms' negative externalities. In Oehmke and Opp (2024), an entrepreneur raises capital from financial or socially responsible investors under moral hazard. Our model differs from existing models in several key dimensions. First, both the activist's and management's efforts contribute to the green transition, leading to a double moral hazard problem that impedes impact. Second, the activist influences firm performance through the cash flow channel rather than the discount rate channel. Third, a free-rider problem hampers activist entry, leading to novel implications for environmental regulation and policies.

Our focus on investor activism is motivated by growing empirical evidence that shareholder engagement and environmental activism can facilitate the green transition (Dimson, Karakaş, and Li, 2015; Kölbel, Heeb, Paetzold, and Busch, 2020; Wiedemann, 2023). According to a recent survey by Krueger et al. (2020), institutional investors consider engagement rather than divestment as a more effective approach to address climate risks. Akey and Appel (2020), Naaraayanan, Sachdeva, and Sharma (2023), and Azar, Duro, Kadach, and Ormazabal (2021) show that engagements by hedge funds, pension funds, and large asset managers respectively cause targeted firms to reduce their emissions. Bellon (2022); Kumar (2023); Cole, Jeng, Lerner, Rigol, and Roth (2023) study the effects on private equity on green transition and sustainable investing in private markets.

1 A Model of Investor Activism and Green Transition

We present a model of investor activism in which an activist decides whether to invest in a firm to transform its production technology into a more sustainable one, a process we refer to as a *green transition*. In this model, the activist investor supports this transition by putting in private effort and designing an optimal contract that encourages the management to contribute their efforts. The activist may represent a hedge fund, a pension fund, a private equity fund, or other types of active investors, such as wealthy individuals or philanthropists.[2] The manager, or management more broadly, represents the firm's key personnel and executives who are able to influence firm outcomes. The activist's private effort captures its engagement with the firm, for instance, by appointing key personnel and board members, developing strategies and proposals, providing industry connections, or voting on proposals.

Timing and Technology. We consider an economy with three dates, $t = 0, 1, 2$, and no discounting. There are three types of risk-neutral agents: an activist investor, a continuum of passive investors, and a manager. We consider a single firm run by the manager. The firm is all equity-financed with a number of outstanding shares normalized to one. It is initially fully owned by competitive and dispersed passive investors. The activist decides at $t = 0$

[2]Hedge funds and private equity funds often actively engage with their portfolio companies to influence outcomes (Brav, Jiang, Partnoy, and Thomas, 2008; Kaplan and Strömberg, 2009).

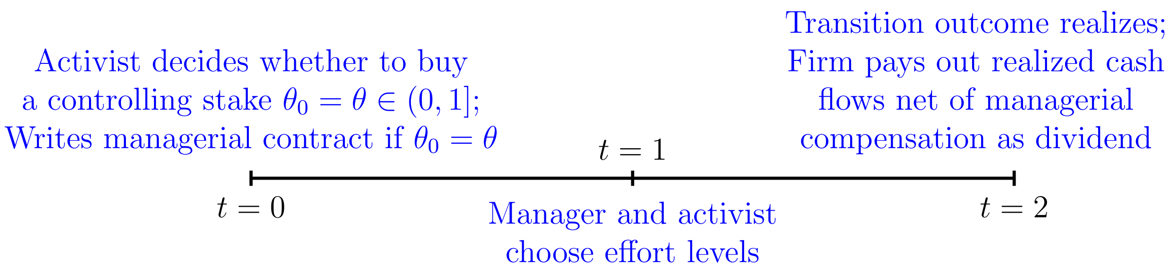

Figure 1: **Timeline of the model.**

whether to buy a controlling stake $\theta_0 = \theta \in (0, 1]$; if the activist does not enter, then $\theta_0 = 0$.

The firm's production technology is initially dirty, but the firm can reduce its environmental damage (e.g., carbon emissions) by transitioning to a clean production technology. The outcome of this green transition is captured by a state $\omega \in \{G, B\}$ that is realized and publicly observed at $t = 2$. The probability of a green transition depends on both the activist's effort a, provided the activist has invested in the firm and $\theta_0 = \theta$, and the manager's effort m, both of which are chosen at $t = 1$. With probability $a + m$, state $\omega = G$ realizes, and the firm becomes clean. With probability $1 - a - m$, state $\omega = B$ realizes, and the firm's technology remains dirty. To ensure that the probability of transitioning is well-defined, we impose that a and m are bounded from above by $\overline{a}$ and $\overline{m}$ respectively and that parameters are such that optimal efforts are interior, in that $a \in (0, \overline{a})$ and $m \in (0, \overline{m})$.

The firm produces cash flows $X_\omega > 0$ at $t = 2$ and pays out all cash flows net of managerial compensation as dividends. We consider that a carbon taxation or cap-and-trade scheme is in place, which requires the firm to pay $T \geq 0$ dollars if $\omega = B$. More broadly, T may represent a pecuniary penalty or cost for causing environmental damage. That is, the firm's post-tax cash flows are X_G in state G and $X_B - T$ in state B, where the difference $X_G - X_B$ in pre-tax cash flows across states captures any gross financial payoff associated with a green transition. Such payoff may arise from a variety of sources including consumer preferences for green products (see, e.g., Meier, Servaes, Wei, and Xiao (2023) for direct evidence) or the level of legal liability that a company faces if it hurts stakeholders' welfare with polluting projects (see, e.g., Bellon (2022)). We define $\Delta := X_G - X_B + T$ as the total financial gain from transition, including the carbon tax. We assume that $\Delta \geq 0$.

When $\Delta = 0$, the green transition has negative net financial payoff, i.e., negative net present value, due to the costly effort required in the transition process. Under these circumstances, the transition cannot be achieved under passive ownership, since passive investors, unlike activists, only care about financial payoffs, as specified later. Then, activism is necessary for the green transition. We abstract from the case $\Delta < 0$, i.e., the green transition has both a negative financial benefit and a financial cost—this case is analogous to the case $\Delta = 0$, also leading to a negative net present value. When $\Delta < 0$ and the activist's sustainability preferences are sufficiently strong (as defined below), the activist always enters and exerts positive effort, boosting the green transition rate relative to passive ownership.[3]

Moral Hazard and Optimal Contracting. The activist (respectively the manager) chooses effort $a \geq 0$ (respectively effort $m \geq 0$) against quadratic costs $\frac{\phi_a a^2}{2}$ (respectively $\frac{\phi_m m^2}{2}$), where $\phi_a, \phi_m > 0$ are positive constants. Efforts at time $t = 1$ are unobservable and non-contractible, leading to an agency problem. To deal with this agency problem, the controlling shareholder—either the activist (if $\theta_0 = \theta$) or the passive investor (if $\theta_0 = 0$)—writes at $t = 1$ (before efforts are chosen), a contract (C, R) to incentivize management. This contract stipulates a payment C to the manager in state B and a payment $C + R$ in state G. These payments are made out of the firm's cash flows, leading to net cash flows $X_G - C - R$ in state G and $X_B - C - T$ in state B. Given the contract and anticipating activist effort $\hat{a}$ (which equals zero if the activist has not invested and $\theta_0 = 0$), the manager maximizes

$$\max_{m \in [0, \overline{m}]} \left(C + (\hat{a} + m)R - \frac{\phi_m m^2}{2} \right), \tag{1}$$

leading to the incentive constraint (under optimal interior effort)

$$m = \frac{R}{\phi_m}. \tag{2}$$

We denote by $W \geq 0$ the manager's outside option. Under the optimal contract that maxi-

[3] We view this case as both less interesting and less practically relevant. Our assumption that $\Delta \geq 0$ is consistent with the findings in the study by Derrien, Landier, Krueger, and Yao (2023), which documents significant downward revisions of earnings forecasts following the occurrence of negative ESG incidents. These downward revisions are due to negative revisions of future sales, suggesting that analysts expect consumers to react negatively to deteriorating ESG performance. They also find that analysts who downward adjust forecasts decrease forecast error compared to those who do not. Relatedly, Meier et al. (2023) use granular barcode-level sales data from retail stores to show that E&S ratings positively relate to local sales.

mizes the controlling shareholders' value, the manager breaks even so that its participation constraint binds and

$$W = C + (\hat{a} + m)R - \frac{\phi_m m^2}{2}. \tag{3}$$

Payoffs. Conditional on entering, the activist's expected payoff at the beginning of period $t = 1$ equals

$$V = \max_{a \geq 0, (C,R)} \left\{ \big(1 - (a + m)\big)\theta(X_B - C - T) + (a + m)\theta\big(X_G - C - R + \pi\big) - \frac{\phi_a a^2}{2} \right\}, \tag{4}$$

subject to (2) and (3). We assume that the activist derives a non-pecuniary (i.e., non-financial) benefit $\theta\pi \geq 0$ in case the firm successfully transitions toward a green technology. This positive payoff reflects sustainability preferences, arising from (non-pecuniary) warm-glow preferences (Andreoni, 1990; Pástor, Stambaugh, and Taylor, 2022; Landier and Lovo, 2023) or a green investment mandate making it desirable to hold green stocks (Hong et al., 2023). Intuitively, the activist internalizes part of the positive externality of transitioning, giving rise to a non-pecuniary benefit associated with the green transition. As a consequence, the activist may push for a green transition, even when $\Delta = 0$ and the green transition generates negative financial payoff due to the cost of effort. Riedl and Smeets (2017), Bonnefon et al. (2022), and Heeb et al. (2023) provide empirical evidence on such preferences.

The activist and passive investors thus differ in two dimensions. First, the activist exerts private effort to foster change, while passive investors do not. Second, the activist has sustainability preferences, in that it realizes a utility $\theta_0\pi \geq 0$ in state G. One can view passive investors as an activist with $\phi_a \to \infty$ (prohibitively costly effort) and $\pi = 0$. Importantly, our main objective in the paper is to determine if and when an activist with sustainability preferences can help firms transition towards cleaner technologies. For our analysis only the difference between active and passive investors' sustainability-related preferences matters, so we do not explicitly model any sustainability preferences for passive investors.

The firm's stock price at time $t = 1$, that is, passive investors' valuation for the firm, depends on whether the activist enters and $\theta_0 = \theta$ (i.e., active ownership) or not and $\theta_0 = 0$ (i.e., passive investor ownership). Under activist ownership, the fair time-1 stock price from passive investors' perspective, anticipating the activist's and manager's efforts (a, m), equals

$$P = \big(1 - (a+m)\big)\big(X_B - C - T\big) + (a+m)\big(X_G - C - R\big). \tag{5}$$

If the activist does not enter and $\theta_0 = 0$, then $a = 0$ and passive investors are in control of the firm and choose the manager's contract (C, R) to maximize firm value, i.e.,

$$P_0 = \max_{(C,R)} \left\{ \big(1 - m\big)(X_B - C - T) + m(X_G - C - R) \right\}, \tag{6}$$

subject to (2) and (3). P_0 is also the firm's stock price under passive investor ownership. Section 5.3 examines the impact of activism on the green transition when managerial contracts are established by passive investors rather than activists.

Activist Entry and the Free-Rider Problem. The activist increases firm value through private and costly effort. A standard result in financial economics is that if this value creation is fully reflected in the price at which it acquires an initial stake in the firm, the activist cannot capture the gains from activism and thus has no incentive to invest in the first place, causing a free-rider problem (Grossman and Hart, 1980; Shleifer and Vishny, 1986). In our analysis, we consider that the activist must acquire a stake $\theta \in (0, 1]$ to be able to exert control and influence firm outcomes, e.g., via monitoring or voice. In the baseline model, the activist's endogenous stake in the firm θ_0 can only take two values, 0 or θ, where $\theta \in (0, 1)$ is an exogenous parameter. Section 5.1 relaxes this assumption and shows how endogenous ownership undermines impact activism.

Since there is no discounting, the activist acquires its ownership stake at time $t = 0$ at the fair stock price P, reflecting the gains from activism. As a result, the activist enters and $\theta_0 = \theta$ if and only if

$$V - \theta P \geq 0, \tag{7}$$

where we normalize the value of the activist's outside option to zero.

In our setting, activism can reduce passive investors' valuation of the firm, in that we can have $P < P_0$ (see Corollary 1). As will become clear, we always have $V - \theta P_0 \geq 0$, so that the activist always enters when $P \leq P_0$, since there is no-free rider problem. Importantly, our findings remain the same if we assume that the activist must acquire its stake at price $\max\{P, P_0\}$, i.e., the larger of the stock price under passive ownership P_0 and the stock price under active ownership P.[4]

2 Solution

2.1 First-best active and passive ownership benchmark

Before solving the full model, we study two benchmarks, i.e., passive ownership and first-best active ownership. We characterize efforts a and m and the rate of green transition, equal to total effort $a + m$, in both benchmarks.

First, consider first-best active ownership. That is, suppose that the firm is owned by the activist, but there is no moral hazard, in that the activist's and manager's efforts are observable and contractible. Then, efforts are chosen to maximize the total surplus generated from the green transition from the activist's perspective (who holds a fraction θ of the firm), so that

$$(a^{FB}, m^{FB}) = \arg\max_{(a,m)} \left\{ \theta(\Delta + \pi)(a + m) - \frac{\phi_a a^2 + \theta \phi_m m^2}{2} \right\}, \tag{8}$$

where $\Delta + \pi$ is the activist's payoff per unit of ownership in case of a successful transition.

Second, suppose that the activist does not enter and $\theta_0 = 0$, in which case the firm is owned by passive investors. In this case, there is no activist effort and managerial effort solves $m^P = \arg\max_m \left\{ \Delta m - \frac{\phi_m m^2}{2} \right\}$. The following proposition characterizes the manager's effort and, thus, the rate of transition both under first-best active ownership and passive ownership.

Proposition 1 (Benchmarks)**.** *Under first-best active ownership, optimal efforts are*

$$a^{FB} = \frac{\theta(\Delta + \pi)}{\phi_a} \quad \text{and} \quad m^{FB} = \frac{\Delta + \pi}{\phi_m}.$$

The manager's effort and the firm's stock price under passive ownership satisfy

$$m = m^P = \frac{\Delta}{\phi_m}.$$

[4] Proposition 10 implies that $V - \theta P_0 \geq 0$. $V - \theta P \geq 0$ is equivalent to $V - \theta \max\{P_0, P\} \geq 0$. When $P > P_0$, the equivalence is immediate as $\max\{P, P_0\} = P$. When $P \leq P_0$, we have that $V - \theta P \geq V - \theta P_0 \geq 0$.

First-best efforts a^{FB} and m^{FB} increase with the non-pecuniary benefit of transitioning π and decrease with effort cost. The activist's effort also increases with its ownership stake θ, reflecting that, even absent moral hazard, the activist only internalizes part of the benefits of the transition yet incurs the full cost. The rate of transition in first best, i.e., $a^{FB} + m^{FB}$, increases with the activist's ownership stake θ. In particular, it exceeds the transition rate that would prevail under passive ownership, $m^P = \frac{\Delta}{\phi_m}$. Intuitively, absent moral hazard, activist and manager efforts complement each other in the transition process so that activism unambiguously fosters the green transition.

Interestingly, the manager's effort under passive ownership equals m^P irrespective of whether there is moral hazard. The reason is that since the manager is risk-neutral and there are no further frictions, optimal contracting can fully resolve the moral hazard problem under passive ownership. As will become clear later, this changes under active ownership.

2.2 Optimal Effort and Double Moral Hazard

Suppose that the activist has invested in the firm, in that $\theta_0 = \theta$. When choosing its own effort a, the activist takes the contract (C, R) and thus the manager's effort m as given. The first-order condition with respect to a in the activist's objective (4) yields

$$a = \frac{\theta(\Delta + \pi - R)}{\phi_a}, \tag{9}$$

where $\Delta + \pi$ is the payoff per unit of ownership that the activist realizes in case of a successful transition. This payoff consists of a financial (pecuniary) component Δ and a non-pecuniary component π, both of which increase engagement. Note that according to the activist's incentive condition (9), the activist's and manager's effort incentives arise as substitutes. Higher effort incentives provided to the manager through larger payment R reduces the activist's payoff upon transformation, thus curbing the activist's effort a.

Having characterized the activist's effort a, we can now derive the optimal contract (C, R) that maximizes the activist's payoff V in (4) subject to (3), (2), and (9). Using (3), we obtain $C = W - (a+m)R + \frac{\phi_m m^2}{2}$. Inserting C in (4), we can characterize the choice of the contract as follows

$$\max_R \left\{ -\left(\frac{\phi_a a^2 + \phi_m m^2}{2} \right) + \theta(a+m)(\Delta + \pi - R) \right\},$$

subject to (2) and (9). This yields the following result:

Proposition 2 (Investor activism and the green transition rate)**.** *Define the activist's relative cost of effort parameter per unit of ownership as*

$$\xi := \frac{\phi_a}{\theta \phi_m}.$$

Optimal efforts with activist entry satisfy:

$$a = \frac{\Delta + \pi}{\phi_m} \left(\frac{1}{\xi(1+\xi)} \right) \quad \textit{and} \quad m = \frac{\Delta + \pi}{\phi_m} \left(\frac{\xi}{1+\xi} \right), \tag{10}$$

with $a < a^{FB}$ and $m < m^{FB}$ for $\xi \in (0, \infty)$.

Proposition 2 shows that we can characterize an activist's impact on the green transition in terms of the relative costs of effort $\xi = \frac{\phi_a}{\theta \phi_m}$, inversely capturing the activist's ability to speed up transition via its own effort. Keeping ϕ_a constant, we have $\xi \to 0$ when $\phi_m \to +\infty$ and the firm cannot transform without the activist, implying that the activist is key for transition. On the other hand, the activist plays no role in the transition process when $\xi \to \infty$, i.e., when $\theta \phi_m \to 0$ or $\phi_a \to \infty$.

Importantly, activism introduces a double moral hazard problem that distorts incentives, which is not present under passive ownership. Specifically, the incentives for both the activist and management to exert effort are intertwined through a two-sided (i.e. double) moral hazard problem. Because the activist's effort is unobservable, it cannot commit to a specific effort level and instead responds to incentives shaped by its equity stake and sustainability preferences. These incentives are tied to the sensitivity of equity to the transition outcome. However, this sensitivity is not independent of management's incentives, as equity is a residual claim. Part of the transition surplus is allocated to management through its incentive contract, with the remaining surplus accruing to equity. Consequently, the effort incentives provided to management diminish the activist's effort, so that an activist's incentives to exert effort are reduced relative to the first-best case (i.e., $a < a^{FB}$).

Due to double moral hazard, efforts a and m endogenously arise as substitutes. Increasing m requires a higher compensation R, thus lowering a, and vice versa. Consequently, the optimal contract incentivizes managerial effort below the first-best level, in that $m < m^{FB}$. Put differently, due to the double moral hazard problem, the activist's and management's effort incentives are interconnected, so they generally cannot be set efficiently in that effort levels and the transition rate lie below their respective first-best levels. In essence, the double moral hazard problem reduces the transition rate, with the extent of this distortion depending on the relative significance of activist effort in the transition process.

2.3 Activist Entry and the Free-Rider Problem

The activist improves firm value through private and costly effort. However, if this value creation is fully reflected in the price at which it can acquire a stake, the activist cannot capture the gains from activism and thus has no incentive to invest in the first place. As we show next, this free-rider problem implies that activism cannot drive a green transition if the activist does not derive non-pecuniary benefits from transitioning. Notably, using the closed-form expressions for the activist's value function and the firm's stock price (reported in Appendix A.2), we can characterize the activist's entry decision in terms of its skill ξ and the ratio of non-pecuniary and financial benefits to transitioning $\frac{\pi}{\Delta}$.

Proposition 3 (Sustainability preferences are necessary for impact)**.** *The activist enters if and only if the ratio of non-pecuniary and financial benefits to transitioning satisfies*

$$\frac{\pi}{\Delta} \geq \frac{1}{1 + 2\xi(1 + \xi + \xi^2)}, \tag{11}$$

where we set with some slight abuse of notation $\frac{\pi}{\Delta} := +\infty$ *if* $\Delta = 0$.

Entry condition (11) states that the activist enters if and only if the non-pecuniary benefits to transitioning π are large relative to the financial payoff of transitioning Δ. In particular, when activism generates financial returns, in that $\Delta > 0$, an activist will not invest to facilitate the green transition in the absence of sustainability preferences (i.e., for $\pi = 0$). That is, sustainability preferences are necessary for impact. Such preferences make the activist internalize the negative production externality of the firm. Thus, engaging with the firm and speeding up the transition generates positive non-pecuniary utility to the activist and may motivate entry, notably, even if the financial gains from engaging with the firm are negative or zero for the activist. In short, the sustainability preferences of activists relax the entry condition, thereby incentivizing activist entry, similar to the effects of private benefits of control in Grossman and Hart (1988); Stulz (1988).

Another implication of Proposition 3 is that the absence of a financial gain associated with transition, i.e., $\Delta = 0$, is a sufficient condition for entry. In this case, there is no free-rider problem as the green transition does not generate a financial payoff. In fact, since transition requires costly effort, investment in the green transition has negative net present value for passive owners. When the activist enters the firm and takes control, it pushes for green transition via its own effort and by allocating firm cash flows to implement firm-level efforts. As such, activist entry reduces the stock price and there is no free-rider problem. The following corollary generalizes this insight.

Corollary 1. *Activism reduces the stock price relative to passive ownership, in that $P \leq P_0$, if and only if*

$$\frac{\pi}{\Delta} \geq \frac{\xi^2 + \sqrt{(\xi+1)^2\left(2\xi^2+1\right)} + \xi + 1}{\xi^3}.$$

3 Can Investor Activism Foster the Green Transition?

3.1 Activist Skill and Impact: Intensive Margin

This section shows that due to moral hazard and the free-rider problem, activism generally hinders the green transition. Indeed, when an activist has relatively low skill (i.e., when ξ is high), the transition rate under active ownership is lower than under passive ownership, due to double moral hazard. On the other hand, when an activist has high skills and can have a significant impact on a firm's green transition, activism fails to emerge due to the free-rider problem. Consequently, activists enter and engage with firms when their impact on the green transition rate is limited or even negative.

We start our analysis by characterizing the effects of activism on the rate of green transition (conditional on activist entry), defined as the sum of efforts, i.e., $\lambda(\theta_0) = a + m$. The rate of green transition is a function of the activist's stake $\theta_0 \in \{0, \theta\}$ and, thus, of its entry decision. The intensive margin effect of activism on the green transition—relative to passive ownership—is characterized by the ratio of the transition rates with and without activism. Using Propositions 1 and 2, we can derive this ratio as:

$$\frac{\text{Green transition rate with activism}}{\text{Green transition rate without activism}} = \frac{\lambda(\theta)}{\lambda(0)} = \frac{a+m}{m^P} = \frac{1+\xi^2}{\xi+\xi^2}\left(1+\frac{\pi}{\Delta}\right). \tag{12}$$

When $\frac{\lambda(\theta)}{\lambda(0)} > 1$, i.e., $\lambda(\theta) > \lambda(0)$, activism fosters the green transition, in that it leads to a higher transition rate than passive ownership. We refer to this scenario as "good activism." When $\frac{\lambda(\theta)}{\lambda(0)} < 1$, i.e., $\lambda(\theta) < \lambda(0)$, activism hinders the green transition and leads to a lower transition rate than passive ownership. We refer to this scenario as "bad activism."

Equation (12) demonstrates that the intensive margin effect of activism in the green transition is fully characterized by (i) the activist's relative skill ξ and (ii) the ratio of non-pecuniary to pecuniary benefits of transitioning $\frac{\pi}{\Delta}$. As shown by the equation, activism can increase the green transition rate as non-pecuniary benefits of transitioning induce higher managerial effort and activist engagement. On the other hand, the first factor on the right hand side of the equation suggests that activism can reduce the transition rate, notably when the activists has low skills (and ξ is above one), due to double moral hazard. The following proposition formalizes this intuition by showing that an activist's impact on green transition can be positive or negative depending on its relative skills ξ.

Proposition 4 (Skills and the green transition rate)**.** *Activism hampers transition and leads to a lower transition rate than passive ownership, in that $\lambda(\theta) < \lambda(0)$, whenever $\xi \in (\xi_-, \xi_+)$, where*

$$\xi_\pm = \frac{\Delta \pm \sqrt{\Delta^2 - 4(\Delta+\pi)\pi}}{2\pi}, \tag{13}$$

with $\xi_- \geq 1$ and $\xi_+ > \xi_-$. Otherwise, activism fosters green transition, in that $\lambda(\theta) > \lambda(0)$. In the limit as $\pi \to 0$, we have $\xi_- \to 1$ and $\xi_+ \to \infty$.

Proposition 4 shows that while activism fosters the green transition under first best, this is not always the case under moral hazard. In particular, the transition rate $\lambda(\theta_0)$ is larger under passive ownership than under active ownership for intermediate values of ξ, i.e., for $\xi \in (\xi_-, \xi_+)$. The underlying reason is that the activist's and management's efforts are unobserved, causing a double moral hazard problem. As argued earlier in Section 2.2, due to this double moral hazard problem, the activist's and management's efforts function as substitutes. As such, activism introduces an additional moral hazard problem that is not present under passive ownership. Holding everything else equal, the moral hazard problem is most severe when ξ takes intermediate values, that is, when both the activist and manager are important for the transition process. Under these circumstances, activism can lead to a lower transition rate than passive ownership.

When ϕ_a and ξ are large, the activist's effort is unimportant relative to the manager's effort. As such, optimal contracting focuses on addressing the manager's moral hazard. In the limit $\phi_a \to \infty$, i.e., $\xi \to \infty$, the activist exerts no effort at all, and optimal contracting is able to fully resolve the moral hazard. Then, the activist's and manager's efforts coincide with the respective first-best levels. Likewise, when ξ is low, managerial effort is unimportant relative to the activist's effort, analogously implying mild moral hazard; in the limit $\xi \to 0$, (a, m) converge to first-best levels.

In sum, when ξ is sufficiently low or high, activism increases the transition rate relative to passive investors owning the firm, i.e., $\lambda(\theta) > \lambda(0)$, giving rise to "good activism." However, for intermediate levels of $\xi \in (\xi_-, \xi_+)$, both the activist's and manager's efforts are important for the transition process. Then, the double moral hazard problem is severe and activism reduces the transition rate, i.e., $\lambda(\theta) < \lambda(0)$, giving rise to "bad activism."

Finally, when the activist's sustainability preferences are weak (i.e., $\pi \to 0$), then $\xi_- \to 1$ while $\xi_+ \to \infty$. Then, activism improves the green transition rate if and only if $\xi < 1$. Note that $\xi \leq 1$ is equivalent to $\phi_a \leq \frac{\phi_m}{\theta}$, where θ is the size of the activist's stake. Empirical estimates of activists' stakes suggest that these are generally below 20% (see, e.g., Brav et al. (2008), Greenwood and Schor (2009), and Collin-Dufresne, Fos, and Muravyev (2017)). Thus, for the activist to have a positive impact on the green transition, it must be that $\phi_a < \frac{\phi_m}{5}$, meaning the activist should be at least five times as efficient as management in fostering the transition. This back-of-the-envelope calculation shows that without strong sustainability preferences, activism is unlikely to foster the green transition. Importantly, this line of argument only focuses on the intensive margin of activism and ignores the endogenous entry decision (i.e., the extensive margin). As we show below, the free-rider problem associated with activist entry deters these high-skill activists from entering.

3.2 Activist Skill and Impact: Extensive Margin

So far our analysis has focused on the intensive margin of activism, examining activist impact conditional on entry. Using the entry condition, we can establish the following result regarding activist entry, i.e., the extensive margin of activism.

Proposition 5 (Skills and entry incentives)**.** *An activist's incentives to enter increase as its relative skills worsen, i.e., as ξ increases. Provided that $\pi > 0$ and $\Delta \geq 0$, there exists unique ξ_E such that the activist enters if and only if $\xi \geq \xi_E$.*

Proposition 5 shows that an activist's incentives to enter increase as its relative skills worsen. The reason is that, holding everything else equal, higher ξ reduces the activist's effort and impact, thereby mitigating the free-rider problem associated with activist entry. Hence, relatively less skilled activists, characterized by high ξ and ϕ_a, are more likely to invest, but these activists exert low effort. According to Proposition 4, lower relative activist skill, i.e. higher ξ or ϕ_a, may reduce $\frac{\lambda(\theta)}{\lambda(0)}$ and lead to bad activism. That is, higher ξ boosts activism on the extensive margin, while reducing it on the intensive margin.

The differential effects of ξ on the intensive and extensive margin of activism, therefore, highlight a tension, which arises due to the combination of the moral hazard and the free-rider problem. Due to the free-rider problem, the most skilled activists, who would have a large and positive impact on the transition process, do not enter. Instead, only less skilled activists enter and engage with firms. However, due to moral hazard, these less skilled activists have limited or even negative impact on the transition process. Together, the double moral hazard and the free-rider problem hamper impactful activism.

Note that $\xi = \frac{\phi_a}{\theta \phi_m}$ increases with the activist's cost of effort ϕ_a, but decreases with its ownership stake θ and the manager's cost of effort ϕ_m. In particular, lower θ facilitates entry and boosts activism on the extensive margin, but reduces activist effort and engagement on the intensive margin. That is, Proposition 5 suggests that we should observe relatively low ownership stakes by activists, which is associated with low activist effort. We explore this issue in Section 5.1 where we endogenize the activist's choice of the ownership stake θ.

Additionally, the model predicts that activists tend to enter "relatively green" firms characterized by low ϕ_m, which can transition on their own at low cost. When the activist invests in a low-ϕ_m firm, it exerts relatively low effort as shown in Proposition 2, mitigating the free-rider problem. In other words, higher ϕ_m is associated with more activist effort and impact conditional on entry, but a more severe free-rider problem at entry.

Finally, our model also sheds light on which firms activists choose to invest in. Suppose that an activist with given cost of effort ϕ_a can invest in firms with different levels of ϕ_m, say on some range $[\underline{\phi}_m, \overline{\phi}_m]$. If the activist invests in a firm with high ϕ_m, which struggles to transition without the activist, the activist's effort plays a key role in transition and activism fosters transition. In contrast, if the activists invests a firm characterized by low ϕ_m, which could easily transition on its own, the activist's role in the green transition is diminished and activism may in fact hamper the green transition (as ξ is high). The following corollary shows that the activist's payoff from investing in a firm, i.e., $V - \theta P$, decreases in ϕ_m. As a consequence, the activist's payoff is maximized for the lowest possible value of ϕ_m.

Corollary 2. *The activist's payoff from entering a firm $V - \theta P$ in (7) decreases in ϕ_m.*

Corollary 2 shows that activists endogenously select firms that can transition independently and adopt a passive approach with low engagement. This suggests an *endogenous exclusion mechanism* whereby activists tilt their portfolio towards "greener" firms, i.e., firms that can transition on their own at a low cost. The economic force underlying the endogenous exclusion is the free-rider problem: Greener, low-ϕ_m firms require less activist effort in the green transition and thus suffer from a less severe free-rider problem. Given the selection of relatively greener firms, the activist exerts relatively low effort, adopting a relatively passive investment approach. Further, low ϕ_m implies high ξ, potentially leading to $\lambda(\theta) < \lambda(0)$, so that the activist's endogenous investment choice hinders the green transition.

3.3 Sustainability Preferences, Carbon Taxes, and Impact

As shown in Proposition 3, sustainability preferences—that is, non-priced benefits of transitioning π—are necessary for activist entry. The following proposition shows that sustainability preferences in fact favor activism both by increasing entry incentives (extensive margin) and by increasing activist engagement (intensive margin). By contrast, any increase in the financial benefits of transitioning (due, e.g., to an increase in carbon taxes), hampers activism by hindering entry and reducing effort incentives relative to passive investing.

Proposition 6. *An increase in the ratio of the non-pecuniary to financial benefits of transitioning $\frac{\pi}{\Delta}$ facilitates impact activism on the:*

1. *Extensive margin, i.e., the activist enters if and only if $\frac{\pi}{\Delta} \geq \Gamma_E := \frac{1}{1+2\xi(1+\xi+\xi^2)}$ or, equivalently, $\xi \geq \xi_E$ where the entry threshold ξ_E decreases with $\frac{\pi}{\Delta}$.*
2. *Intensive margin, i.e., $\frac{\lambda(\theta)}{\lambda(0)}$ increases in $\frac{\pi}{\Delta}$, with $\frac{\lambda(\theta)}{\lambda(0)} \gtreqless 1$ if and only if $\frac{\pi}{\Delta} \gtreqless \Gamma_G := \frac{\xi-1}{1+\xi^2}$.*

Proposition 6 implies that, depending on the level of $\frac{\pi}{\Delta}$, three cases can arise with respect to the effects of activism on the green transition. First, for $\frac{\pi}{\Delta} < \Gamma_E$, there is no activist entry. Second, for $\frac{\pi}{\Delta} \in (\Gamma_E, \Gamma_G)$, the activist enters but reduces the transition rate relative to passive ownership, giving rise to bad activism. Third, when $\frac{\pi}{\Delta} \geq \max\{\Gamma_E, \Gamma_G\}$, the activist enters and increases the transition rate relative to passive ownership, giving rise to good activism. Notably, when $\Gamma_E \geq \Gamma_G$, activism, if it emerges, unambiguously fosters the green transition. This case prevails when ξ is sufficiently low, for instance, when $\xi \leq 1$ (which implies $\Gamma_G \leq 0$).

Figure 2 illustrates the findings in Proposition 6. The left panel plots the entry threshold ξ_E (solid red line) and the skill levels ξ_+ (dashed black line) and ξ_- (dashed blue line) over and below which activism improves the green transition rate as functions of the ratio $\frac{\pi}{\Delta}$ of non-pecuniary to financial benefits of transitioning. A decrease in sustainability preferences or an increase in the financial benefits of transitioning hampers impact both by decreasing the quality of activists that invest (i.e. by increasing ξ_E) and by increasing the range $\xi_+ - \xi_-$ over which activism hampers transition. For sufficiently low $\frac{\pi}{\Delta}$, activism unambiguously reduces the transition rate. The right panel plots the ratio $\frac{\lambda(\theta)}{\lambda(0)}$ of the transition rate with activism to the transition rate without activism when $\xi = 2$, showing that it increases in $\frac{\pi}{\Delta}$. When $\xi = 2$, there exist three regions: No activism, bad activism, and good activism.

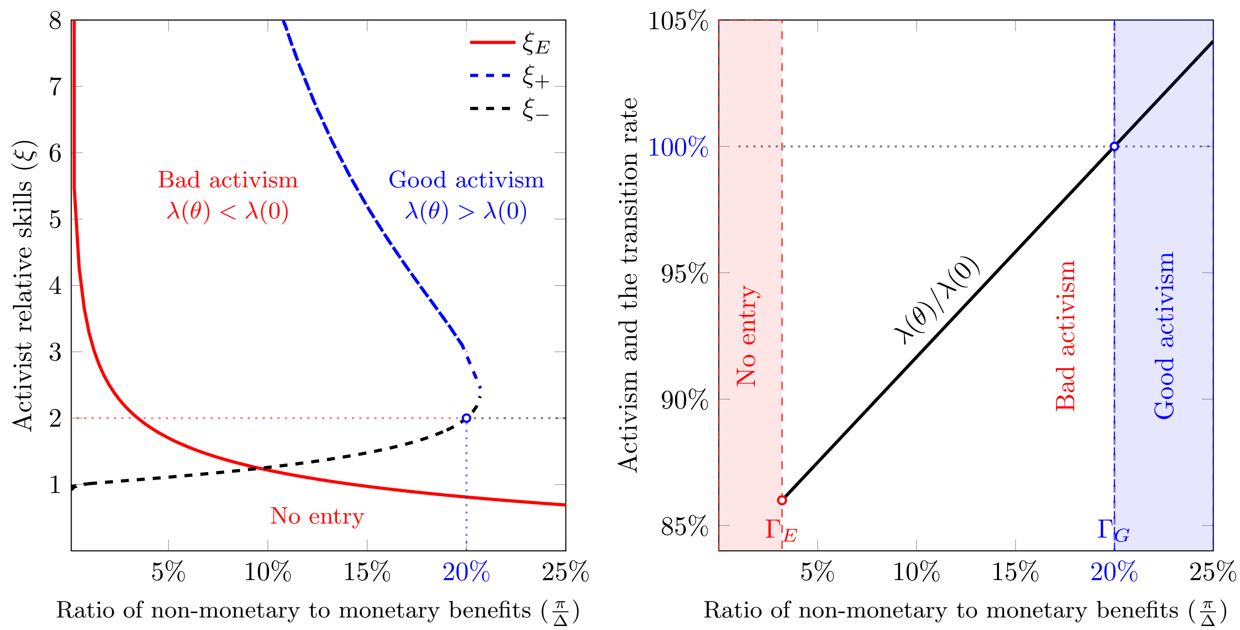

Figure 2: **Preferences, skills, and impact**: The left panel plots the entry threshold ξ_E and the skill levels ξ_+ and ξ_- over and below which activism improves the green transition rate as functions of the ratio of non-pecuniary to financial benefits of transitioning $\frac{\pi}{\Delta}$. The right panel plots the ratio of transition rates with and without activism as a function of the ratio of non-pecuniary to financial benefits of transitioning for $\xi = 2$.

3.3.1 The Effects of Sustainability Preferences

According to Proposition 6, sustainability preferences π favor impact activism both on the extensive and the intensive margin. First, they mitigate the free-rider problem associated with activist entry and increase activists' entry incentives (extensive margin). Second, sustainability preferences stimulate activist efforts and impact conditional on entry (intensive margin). To understand this result, first note that larger π mitigates the free-rider problem associated with activist entry. Indeed, larger π increases the activist's valuation for the firm and, holding all else equal, the payoff from entering. Moreover, larger π increases both the activist's and the manager's efforts, thereby increasing the intensive margin effect of activism. As a result, stronger sustainability preferences make it more likely that activism, if it emerges, raises the transition rate relative to passive ownership. However, since passive investors do not derive non-pecuniary payoffs from transitioning, they do not fully price-in the higher transition rate. As such, an increase in π increases the activist's valuation for the firm more than passive investors' valuation, which facilitates entry.

Finally, observe that, quite surprisingly, sustainability preferences have an ambiguous effect on the actual rate of transition $\lambda(\theta_0)$. In fact, an increase in sustainability preferences can lead to a decrease in the transition rate. To see this, recall that when $\frac{\pi}{\Delta} < \Gamma_E$, the activist does not enter, while for $\frac{\pi}{\Delta} \in (\Gamma_E, \Gamma_G)$, the activist enters, but hampers the transition process. Consequently, an increase in π, moving $\frac{\pi}{\Delta}$ from below Γ_E into the region (Γ_E, Γ_G) inevitably triggers a decrease in the transition rate.

3.3.2 Carbon Taxation and Crowding-Out of Sustainable Finance

Carbon taxation and sustainable finance are two potential ways to facilitate the green transition. Are they substitutes or complements in fostering the green transition? Proposition 6 suggests that higher carbon taxes, by increasing Δ and decreasing $\frac{\pi}{\Delta}$, may hinder activism. In other words, carbon taxes crowd out active sustainable financing, making carbon taxes and active sustainable finance substitutes. The following corollary formalizes this intuition:

Corollary 3. *An increase in carbon taxes hinders impact activism on the:*

1. *Extensive margin in that the activist enters if and only if* $T \leq T_E := \pi\left[1 + 2\xi(1 + \xi + \xi^2)\right] - (X_G - X_B)$*, where* T_E *increases in* ξ.

2. *Intensive margin in that* $\frac{\lambda(\theta)}{\lambda(0)}$ *decreases in* T. *When* $\xi > 1$, $\frac{\lambda(\theta)}{\lambda(0)} \geq 1$ *if and only if* $T \leq T_G := \frac{1+\xi^2}{\xi-1}\pi - (X_G - X_B)$. *For* $\xi \leq 1$, $\frac{\lambda(\theta)}{\lambda(0)} \geq 1$.

By increasing the financial benefits of transitioning, carbon taxes increase efforts as well as the extent to which they are reflected in the stock price. Consequently, carbon taxes strengthen the free-rider problem and reduce entry incentives. Accordingly, there exists a carbon tax level T_E above which there is no activist entry.

Moreover, a carbon tax reduces the effects of activism on the intensive margin as captured by $\frac{\lambda(\theta)}{\lambda(0)}$. An increase in carbon taxes increases the financial benefits of transitioning and thus the transition rate, both with activism $\lambda(\theta)$ and without activism $\lambda(0)$, with the transition rate $\lambda(0)$ rising more strongly. Because carbon taxes enhance the transition rate for passively held firms, they naturally diminish the importance of impact activism in the transition process. When $\xi > 1$, there exists a cutoff level T_G for carbon taxes above which activism, if it arises, always reduces the green transition rate. As a consequence, carbon taxes also favor the emergence of bad activism, hampering the transition relative to passive ownership. These effects are illustrated in Figure 2, where the entry threshold ξ_E and the regions over which activism does not arise or hinders the transition increase as the financial benefits of transitioning Δ increase and $\frac{\pi}{\Delta}$ decreases. In particular, when $\frac{\pi}{\Delta}$ is sufficiently low, activism, if it emerges, is always detrimental to the transition rate, giving rise to bad activism.

Taken together, when carbon taxes are sufficiently low and $T \leq \min\{T_E, T_G\}$, the activist enters and fosters transition relative to passive ownership. For $T \in (T_G, T_E)$, the activist enters but hampers the transition process. Finally, there is no activist entry for $T > T_E$. A direct consequence of our analysis is that an increase in carbon taxes can decrease the transition rate $\lambda(\theta_0)$. In particular, when $T_E < T_G$, raising the tax above T_E facilitates the emergence of bad activism, hampering the transition process. When $T_E \geq T_G$, activism, if it emerges, unambiguously fosters the transition. Then, an increase of the carbon tax above T_E precludes activist entry and good activism, thereby reducing the transition rate $\lambda(\theta_0)$. In the instances when the carbon tax does not affect activist entry, an increase in carbon taxation boosts the transition rate $\lambda(\theta_0)$ by increasing Δ, raising a and m in (10).

4 Green Investment Subsidies

The key take-way of our analysis so far is that impact activism fails to emerge, precisely when it would have impact. Carbon taxes cannot solve this problem, as they further crowd-out activism by preventing relatively impactful activists from entering. We now investigate an alternative to carbon taxes, namely green investment subsidies. Policymakers often subsidize green capital investment; for instance, a firm may receive direct subsidies or a tax advantage for investing in transformation. An illustrative instance of this is the Investment Tax Credit (ITC), which is offered under the Inflation Reduction Act to encourage green investments in the United States.[5] As utility is in financial terms and there are no capital constraints, we can, without loss in generality, interpret the managerial costs of effort as financial investment

[5] Likewise, in the European Union and, notably Germany, firms may receive tax credits or subsidies for transforming their production toward sustainability, for instance, by reducing carbon emissions.

costs at the firm level, with effort representing investment. A firm-level subsidy s will be based on the anticipated (or contracted) effort $\hat{m}$, which may differ from actual effort m upon deviation. In optimum, we have $m = \hat{m}$ and a subsidy implies a transfer to the firm proportional to the cost of effort, in that the firm-level subsidy raises firm cash flows by $\frac{s\phi\hat{m}^2}{2}$. That is, a fraction $s \in [0, \overline{s}]$ of the investment costs are subsidized. To ensure optimal interior effort and to sharpen our analytical findings (which obtain under the sufficient condition $s \leq \frac{1}{2}$), we stipulate $\overline{s} < \min\{\frac{1}{2}, \frac{\phi_m}{\phi_a}\}$.

Since the subsidy is based on anticipated effort $\hat{m}$, the activist and the manager take the subsidy as given when choosing actual efforts a and m. In particular, the manager's optimization problem remains unchanged and follows (1) for a given contract (C, R). Consequently, for $\theta_0 = \theta$, the activist's value function and optimization reads

$$V = \max_{a \geq 0, (C,R)} \left\{ \theta \left(X_G - C + \frac{\phi_m \hat{m}^2 s}{2} \right) + (a+m)\theta\big(\Delta + \pi\big) - \frac{\phi_a a^2}{2} \right\}, \tag{14}$$

subject to the manager's incentive and participation constraints, i.e., (2) and (3). The activist takes the subsidy $\frac{\phi\hat{m}s^2}{2}$ (of which it receives fraction θ) as given, when choosing the contract (C, R) and its own effort. As such, the activist's incentive constraint (9) applies. Under active ownership, i.e., $\theta_0 = \theta$, the firm's stock price at time $t = 1$ is

$$P = \big(1 - (a+m)\big)\big(X_B - C - T\big) + (a+m)\big(X_G - C - B\big) + \frac{\phi\hat{m}s^2}{2}. \tag{15}$$

As in the baseline, the activist enters and $\theta_0 = \theta$ if and only if the entry condition (7) is satisfied. The following proposition characterizes the effects of investment subsidies.

Proposition 7 (Investment subsidies and the transition rate)**.** *We have that*

1. *Under active ownership, efforts satisfy*

$$a = \frac{\Delta + \pi}{\phi_m} \left(\frac{1 - \xi s}{\xi\left(\xi(1-s)+1\right)} \right) \quad \text{and} \quad m = \frac{\Delta + \pi}{\phi_m} \left(\frac{\xi}{\xi(1-s)+1} \right). \tag{16}$$

   Under passive ownership, the manager's effort is $m = m^P = \frac{\Delta}{\phi_m(1-s)}$.

2. *The transition rate satisfies* $\frac{\partial\lambda(\theta)}{\partial s} \gtreqless 0$ *if and only if* $\xi \gtreqless 1$. *In addition,* $\frac{\lambda(\theta)}{\lambda(0)}$ *decreases*

in s and satisfies $\frac{\lambda(\theta)}{\lambda(0)} \gtreqless 1$ *if and only if* $\frac{\pi}{\Delta} \gtreqless \Gamma_G^s$*, where* Γ_G^s *increases in s and*

$$\Gamma_G^s := \frac{\xi - 1 + s(1 + \xi(1-s))}{(1-s)(1 + \xi(\xi - s))}. \tag{17}$$

3. *The activist enters if and only if* $\frac{\pi}{\Delta} \geq \Gamma_E^s$*, where* Γ_E^s *decreases in s for sufficiently small* $s \geq 0$ *and*

$$\Gamma_E^s := \frac{(1-\xi s)^2}{1 + 2\xi(1 + \xi + \xi^2)(1-s) + \xi^2 s^2} \tag{18}$$

Proposition 7 shows that a firm-level investment subsidy crowds out activist effort and engagement. Conditional on activist entry $\theta_0 = \theta$, an increase in the investment subsidy s reduces activist effort a and its relative contribution to transition $\frac{a}{a+m} = \frac{1-\xi s}{1+\xi^2}$, while increasing the manager's effort m. Intuitively, a firm-level subsidy makes it optimal to increase the manager's effort m, which requires a higher payment R to incentivize the manager. This, in turn, decreases the activist's effort incentives, reflecting that activist and managerial efforts are substitutes in the presence of moral hazard.

Consequently, an investment subsidy reduces the intensive margin effect of activism on the green transition, relative to passive ownership, in that $\frac{\lambda(\theta)}{\lambda(0)}$ decreases with s. Intuitively, with investment subsidies, activism becomes more likely to hamper the transition process, giving rise to bad activism. For activism to increase the transition rate relative to passive ownership, sustainability preferences must be sufficiently strong or the financial payoff from transitioning must be sufficiently low, i.e., $\frac{\pi}{\Delta} \geq \Gamma_G^s$. As Γ_G^s increases in s, investment subsidies make good activism, fostering transition relative to passive ownership, less likely and bad activism, hampering transition, more likely.

Figure 3 graphically illustrates these effects. The left panel shows that Γ_G^s increases while Γ_E^s decreases in s, thereby expanding the bad activism region. The right panel shows that the intensive margin effect of activism (relative to passive ownership), captured $\frac{\lambda(\theta)}{\lambda(0)}$ decreases with s. Input parameter values are such that activism has a positive effect on the transition rate absent investment subsidies (good activism). But the introduction of investment subsidies decreases engagement, eventually leading to bad activism.

Importantly, because investment subsidies diminish the role of activist effort in the tran-

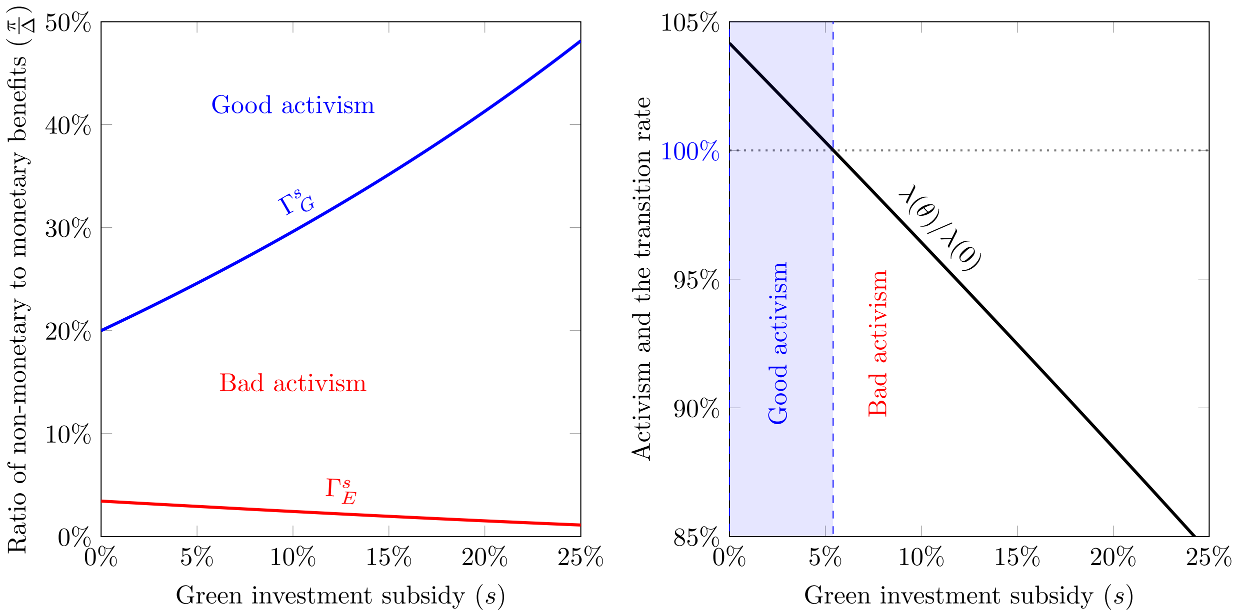

Figure 3: **Green investment subsidies and impact**: The left panel plots the ratio of non-pecuniary to financial benefits Γ_E^s over which there is entry and the ratio of non-pecuniary to financial benefits Γ_G^s over which activism improves the green transition rate as functions of the green investment subsidies s. The right panel plots the ratio of transition rates with and without activism as a function of green investment subsidies for $\xi = 2$ and $\frac{\pi}{\Delta} = 25\%$, ensuring that activism has a positive effect on the transition rate absent subsidies.

sition process, they also mitigate the free-rider problem, thereby fostering activism on the extensive margin. Taken together, while subsidies crowd out activism on the intensive margin, they crowd in activism on the extensive margin. However, since subsidies give rise to bad activism, the crowding-in effect on the extensive margin hinders the transition process.

5 Robustness and Other Results

This section considers three variations from our baseline model. In subsection 5.1, we endogenize the stake size of the activist. In subsection 5.2, we modify our assumptions regarding activist entry to account for activist bargaining power. In subsection 5.3, we allow passive investors to set managerial contracts and show that this further impairs activism.

5.1 Endogenous Ownership Stake

Our analysis so far has assumed that the stake θ of activist investors was exogenous. We now endogenize the choice of θ and solve for the optimal activist stake

$$\theta^* = \arg\max_{\theta\in[0,1]} \{V - \theta P\}.$$

Since $\theta \mapsto V - \theta P$ is zero for $\theta = 0$ and increases in a neighborhood of zero, we have that $\theta^* > 0$, i.e., the activist always enters the firm in this model variant, but its stake can be arbitrarily small. One could impose that the activist must acquire a minimum stake in the firm to be able to exert control, but for the sake of simplicity, we abstract from such an assumption here as the qualitative findings would remain unchanged. We define the maximum ownership the activist could profitably acquire as

$$\overline{\theta} := \max\{\theta \in [0,1] : V - \theta P \geq 0\}.$$

Clearly, we also have that $\overline{\theta} \geq \theta^*$. Solving the activist optimization problem yields the following results when θ^* is interior, where a sufficient condition for interior θ^* is $\frac{\phi_a}{\phi_m} \leq \xi_E$.

Proposition 8 (Activism and the transition rate with endogenous ownership)**.** *Define* $\Gamma^* = \frac{3\sqrt{5}}{10} - \frac{1}{2}$*. When* $\theta^* \in (0,1)$*, we have that:*

1. *When* $\frac{\pi}{\Delta} \geq \Gamma^*$*, then* $\lambda(\theta^*) > \lambda(0)$*.*
2. *When* $\frac{\pi}{\Delta} < \Gamma^*$*, then* $\lambda(\theta^*) < \lambda(0)$ *and* $\lambda(\theta^*) < \lambda(\overline{\theta})$*.*
3. *There exists* $\varepsilon > 0$ *such that* $\lambda(\theta^*) < \lambda(0) < \lambda(\overline{\theta})$ *for* $\frac{\pi}{\Delta} \in (\Gamma^* - \varepsilon, \Gamma^*)$*.*

Proposition 8 shows that when the ratio of non-pecuniary to financial benefits of transitioning is sufficiently large, i.e. when $\frac{\pi}{\Delta} \geq \Gamma^*$ (≈ 0.17), activism always improves the green transition rate. When sustainability preferences are such that this constraint is not satisfied (i.e. $\frac{\pi}{\Delta} < \Gamma^*$), the activist acquires an inefficiently low ownership stake θ^*, thereby hampering transition in that $\lambda(\theta^*) < \lambda(0)$. Strikingly, for intermediate levels of sustainability preferences π, we have $\lambda(\theta^*) < \lambda(0) < \lambda(\overline{\theta})$, so that the activist could in principle enter and foster transition, if it bought a large stake. In this case, the activist's entry and the acquisition of a too low stake θ^* hampers entry, although the activist would be capable of profitably fostering transition through the acquisition of a larger stake $\overline{\theta}$.

Next, we perform comparative statics in the endogenous ownership stake.

Proposition 9. *Suppose that θ^* is interior, i.e., $\theta^* \in (0,1)$. Then, θ^* decreases in ϕ_m, increases in ϕ_a, increases in π, and decreases in Δ.*

The above proposition highlights that upon entering, skilled activists, characterized by lower ϕ_a, tend to acquire smaller ownership stakes. Moreover, an activist acquires a larger ownership stake, when ϕ_m is low and the firm could more easily transition on its own. Last, the ownership stake θ^* is larger when the activist has stronger sustainability preferences or the financial gains to transitioning are lower, resulting into less severe free-rider problem.

Finally, we can jointly endogenize the choice of the ownership stake θ and the firm characterized by $\phi_m \in [\underline{\phi}_m \overline{\phi}_m]$, maximizing $V - \theta P$. The following corollary shows that the activist, as before, excludes investment in less green firms characterized by high ϕ_m. Instead, the activist invests in relatively green firms characterized by the lowest possible ϕ_m (i.e., $\phi_m = \underline{\phi}_m$). In light of Proposition 9, the activist selects a relatively large stake in such firms. In conclusion, we find that the activist tends to acquire large stakes in relatively green firms that can transition on their own at relatively low cost, while it excludes investment in less green firms where it could have more impact.

Corollary 4. *The choice $\phi_m = \underline{\phi}_m$ solves $\max_{\theta \in [0,1], \phi_m \in [\underline{\phi}_m, \overline{\phi}_m]} V - \theta P$.*

5.2 Entry Incentives, Free-Rider Problem, and Bargaining Power

Activists can typically acquire substantial ownership stakes before publicly revealing their investments in public companies,[6] and they may possess considerable bargaining power when investing in private companies. Consequently, we explore in this section the implications of allowing activists to capture a portion of the value gains from their activism. To do so, we

[6] In the U.S., for example, Section 13(d) of the 1934 Act and Regulation 13D requires owners of more than 5% of the equity of a public firm to file a report with the SEC, at which point the identity of an activist gets revealed and the price adjusts to reflect this information.

consider that the activist can acquire a fraction $1-\eta \in [0,1]$ of its stake θ at the price P_0, defined in (6), that would prevail under passive ownership. The remaining fraction η is bought at a price P, defined in (5), that reflects the gains from activism. The activist then pays

$$K := \theta P_0 + \eta\theta(P - P_0) \tag{19}$$

to acquire ownership stake θ, where P_0 is the firm's stock price under passive investor ownership as in the baseline model. The activist enters if and only if

$$V - K \geq 0, \tag{20}$$

where, as in the baseline model, the activist has an outside option normalized to zero. The baseline obtains upon setting $\eta = 1$.

Relative to the baseline, the new acquisition price affects activist entry, but leaves all other model outcomes (conditional on the entry decision) unchanged. Thus, in this model variant, efforts of the activist and the manager are the same as in the baseline model so that Propositions 1, 2, 4, and 6 still obtain. That is, the double moral hazard problem leads to underinvestment by the activist and the manager and activism hinders the green transition and leads to a lower transition rate than passive ownership, in that $\lambda(\theta) < \lambda(0)$, whenever $\xi \in (\xi_-, \xi_+)$. Equation (20) implies that the activist enters if and only if

$$V - \underbrace{\theta P_0}_{\substack{\text{Cost without} \\ \text{Price Impact}}} - \underbrace{\eta\theta(P - P_0)}_{\substack{\text{Rents of Passive} \\ \text{Investors}}} \geq 0. \tag{21}$$

The following proposition uses this condition to characterize the activist's entry decision.

Proposition 10 (Bargaining Power and Entry)**.** *We have that*

1. *The activist enters, i.e.,* $V - \theta P_0 \geq 0$, *if and only if* $E \geq 0$ *with*

$$E := (\Delta+\pi)^2\left[\xi(1-\eta)+1-2\eta\right]+2(\Delta+\pi)\pi(1+\xi)\left[\eta+\xi(1-\eta)+\xi^2\right]-\pi^2(1-\eta)\xi(1+\xi)^2.$$

2. *The activist's incentives to enter increase as its relative skills worsen in that* $\frac{\partial E}{\partial \xi} > 0$.

There exists unique $\xi_B \in (0, \frac{2\eta-1}{1-\eta})$ *such that* $E(\xi) \geq 0$ *if and only if* $\xi \geq \xi_B$.

3. *Sustainability preferences foster entry in that* $\frac{\partial E}{\partial \pi} > 0$. *There exists unique* $\pi_B \geq 0$ *such that an activist enters if and only if* $\pi \geq \pi_B$.

The key findings are similar to those in the baseline analysis, which is obtained upon setting $\eta = 1$. In particular, the activist's entry incentives increase with its sustainability preferences π and ξ, i.e., they decrease with its skills. Thus, only activists who do not contribute much via their own effort and are characterized by $\xi \geq \xi_B$ have incentives to enter. Likewise, only activists with sufficiently strong sustainability preferences enter. Hence, our key findings are generally robust to relaxing the free-rider problem by allowing for $\eta < 1$.

Proposition 10 shows that when the bargaining power of activists is sufficiently strong, i.e. when $\eta \leq \frac{1}{2}$, activists always enter in that $V - \theta P \geq 0$. That is, the activist's bargaining power fosters entry, suggesting that we should more activism in markets where activists have larger bargaining power vis-a-vis passive owners, such as in private capital markets.

In particular, when $\eta = 0$ and the activist can acquire the (entire) ownership stake θ at the stock price prevailing under passive ownership P_0, there is no free-rider problem and the activist always enters. That is, Proposition 10 readily implies $V - \theta P_0 \geq 0$. Recall that in our setting (see Corollary 1), activism can reduce the stock price relative to passive ownership, leading to $P < P_0$. In this case, the entry condition (21) is always satisfied due to $V - \theta P_0 \geq 0$. Moreover, our findings (regarding entry) would remain unchanged, if we assumed that the activist must pay the maximum of $K = \theta P_0 + \eta\theta(P - P_0)$ or θP_0. In other words, $V - K \geq 0$ is equivalent to $V - \max\{K, \theta P_0\} \geq 0$.

5.3 Managerial Contract Set by Passive Investors

So far, we have considered that activists contribute to a firm's green transition by exerting effort and contracting with management. Assume now that the contract of the manager is set by passive investors rather than activists. As in the baseline model, incentive conditions (2) and (9) apply as well as the participation constraint (3). Passive investors choose the contract (C, R) to maximize the firm's stock price, in that

$$P = \max_{C,R} \left\{ \big(1 - (a+m)\big)\big(X_B - C - T\big) + (a+m)\big(X_G - C - R\big) \right\}.$$

The activist enters and $\theta_0 = \theta$ if and only if entry condition (7) is satisfied. The following proposition characterizes optimal efforts and the activist entry condition when passive investors set the contract of the manager.

Proposition 11 (Passive investors control)**.** *When passive investors set the contract of the manager, we have that:*

1. *Efforts satisfy* $a = \frac{1}{\phi_m}\frac{\Delta+\pi\xi}{\xi^2}$ *and* $m = \frac{\Delta}{\phi_m}\frac{\xi-1}{\xi}$ *when relative skills are such that* $\xi > 1$*; and* $a = \frac{\Delta+\pi}{\phi_m}\frac{1}{\xi}$ *and* $m = 0$ *when* $\xi \leq 1$.

2. *Investor activism improves the green transition rate in that* $\frac{\lambda(\theta)}{\lambda(0)} > 1$ *if and only if* $\xi \leq 1$ *or* $\frac{\pi}{\Delta} > \Gamma_G^p = \frac{\xi-1}{\xi}$ *when* $\xi > 1$.

3. *The activist enters if and only if* $\frac{\pi}{\Delta} \geq \Gamma_E^p$*, where*

$$\Gamma_E^p = 1 - \xi + \sqrt{\xi^2 - 2\xi + 1 + \xi^{-2}} \tag{22}$$

   when $\xi > 1$ *and* $\Gamma_E^p = 1$ *when* $\xi \leq 1$.

To analyze the role of passive investors control of the managerial contract, we compare the results in Proposition 11 to corresponding quantities in the baseline model under activist control of the managerial contract, provided in Propositions 2 and 6.

Corollary 5. *When managerial contracts are set by passive investors rather than activists:*

1. *The activist's effort* a *is higher and the manager's effort* m *is lower, compared to the baseline levels from* (10).

2. *Impact activism is negatively affected on the intensive margin for* $\xi > 1$ *in that the transition rate is lower than in the baseline and* $\Gamma_G^p > \Gamma_G$*. For* $\xi \leq 1$*, we have* $\Gamma_G, \Gamma_G^p \leq 0$ *and activism improves the transition rate in either scenario.*

3. *Impact activism is negatively affected on the extensive margin in that* $\Gamma_E^p \geq \Gamma_E$.

Corollary 5 shows that when passive investors set the managerial contract, the manager exerts lower effort and the activist exerts higher effort than in the baseline with the activist setting the contract. To understand this result, recall that due to the double moral hazard problem, and specifically incentive constraints (2) and (9), the activist's and the manager's efforts function as substitutes. Because passive investors' payoff (the firm's stock price) does not directly reflect the activist's private cost of effort, it is cheap for them to provide incentives to the activist. This effect results in lower incentives provided to management, when compared to the activist setting management's contract. Moreover, passive investors do not have sustainability preferences and only care about the financial value of the firm. Consequently, the activist's sustainability preferences are not directly incorporated into management's incentive contract, further reducing managerial effort.

Corollary 5 demonstrates that the impact of passive investors' control over the managerial contract on the transition rate $\lambda = a + m$ is influenced by the activist's relative skills. When $\xi > 1$ and the relative skill of the activist is low, higher a and lower m result in a lower transition rate, relative to the baseline. This is because the contract designed by passive investors prioritizes the less efficient activist over the manager. Conversely, when $\xi \leq 1$, the activist is more efficient than the manager. The contract set by passive investors puts more weight on the more efficient party, thereby achieving a higher transition rate.

Crucially, the effect of passive investor control over the managerial contract on the extensive margin is unambiguously negative. As shown in Corollary 5, activists are less likely to enter in that the entry threshold increases under passive investor control. Similarly to in the baseline model, the extensive margin interacts with the intensive margin: in cases when the activist could foster the transition effectively, the activist does not enter. In particular, when $\xi \leq 1$, the activist is sufficiently skilled and its engagement improves the transition rate, regardless of who determines the terms of the manager's contract. However, Proposition 11 shows that in this case the activist only enters when the non-pecuniary benefits of activism exceed its financial benefits in that entry occurs if and only if $\frac{\pi}{\Delta} \geq 1$. Moreover, $\xi \leq 1$ is equivalent to $\phi_a \leq \frac{\phi_m}{\theta}$, where θ is the size of the activist' stake. Empirical estimates of activists' stakes suggest that these are generally below 20%, implying that the activist should be five times as efficient as management in fostering the transition for activism to improve the green transition rate.

Combining all cases, our findings suggest that for activism to effectively promote the green transition, it is beneficial for activists to have the authority to influence managerial compensation, especially by integrating sustainability objectives into it.

These results are graphically illustrated in Figure 4. The top panel plots the ratio of non-pecuniary to financial benefits over which activism improves the green transition rate when the managerial contract is set by the activist (Γ_G; blue line) and by passive investors (Γ_G^p , red line) as functions of the activist's skills ξ. The figure also plots the entry thresholds Γ_E (solid black line) and Γ_E^p (dashed black line) when the managerial contract is set by the activist and passive investors respectively. The plot shows that activism becomes more likely to reduce the transition rate when the contract is set by passive investors and that extreme values of non-pecuniary benefits of transitioning are required to obtain good activism.

The bottom panel plots the ratio of transition rates with and without activism as a function of the ratio of non-pecuniary to financial benefits $\frac{\pi}{\Delta}$ for $\xi = 2$, when the managerial contract is set by the activist (blue line) or by passive investors (red line). In the dark red region, there is no activist entry. In the light red region, activists enter *only* if they set managerial contracts. In this region, activism hinders the green transition. In the white region, the activist always enters and hinders the transition. In the grey region, the activist enters but hinders the transition only if the contract is set by passive investors. In the blue region, the activist enters and facilitates the transition independently of who sets the managerial contract. The value of $\frac{\pi}{\Delta}$ triggering entry is larger when passive investors set the contract of the manager in that $\Gamma_E^p = 11.8\% > \Gamma_E = 3.2\%$. When passive investors set the managerial contract, the ratio of non-pecuniary to financial benefits of transitioning has to exceed $\Gamma_G^p = 50\%$ for activism to improve the green transition rate.

6 Conclusion

This paper develops a model of investor activism with endogenous entry and engagement, in which activists foster a firm's green transition by providing effort and contracting with

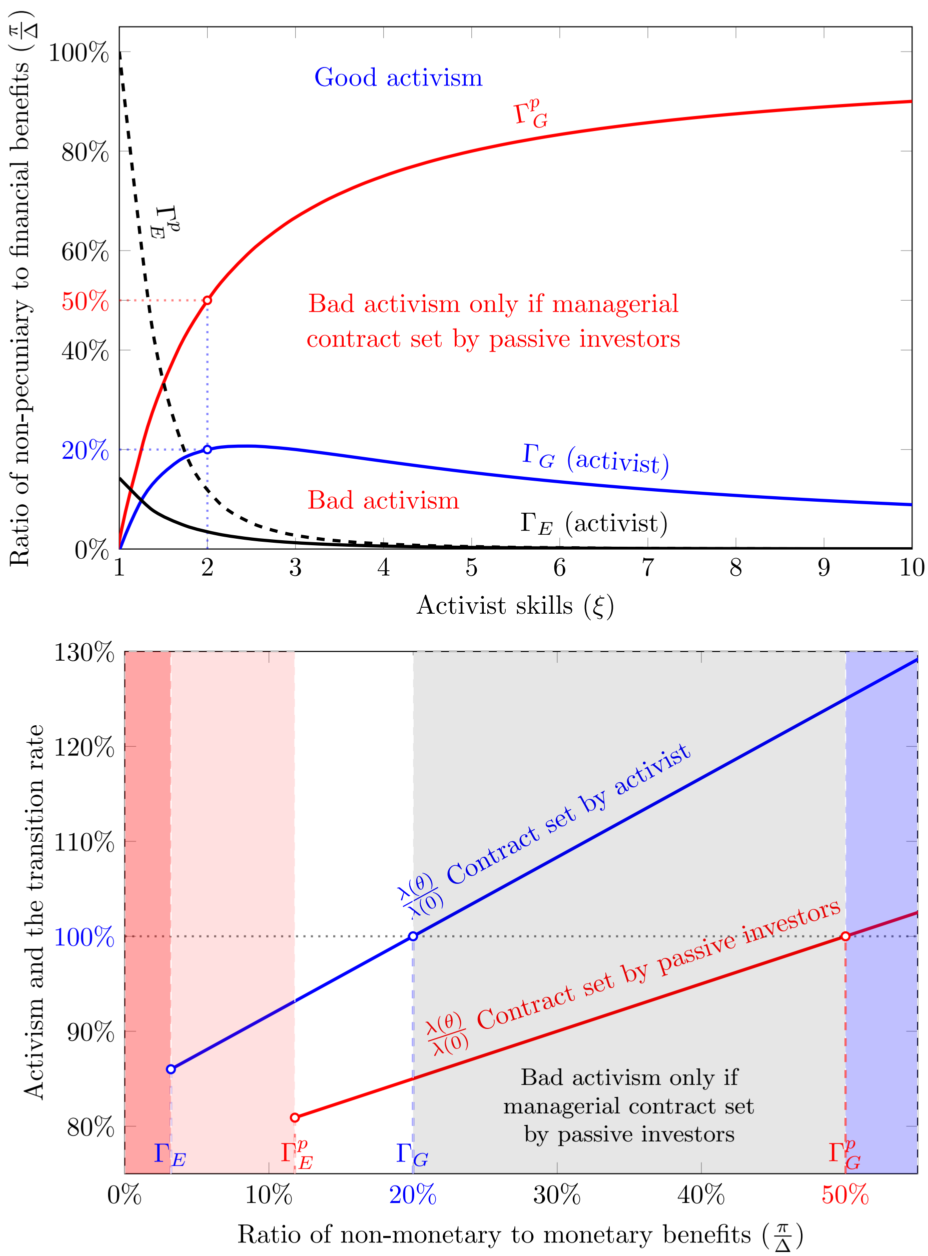

Figure 4: **Manager contract and activism**: The top panel plots the ratio of non-pecuniary to financial benefits over which activism improves the green transition rate when the manager contract is set by the activist (blue line) and by passive investors (red line) as functions of the activist's skills ξ. The figure also plots the entry thresholds Γ_E (solid black line) and Γ_E^p (dashed black line). The bottom panel plots the ratio of transition rates with and without activism as a function of the ratio of non-pecuniary to financial benefits $\frac{\pi}{\Delta}$ for $\xi = 2$, when the managerial contract is set by the activist (blue line) or by passive investors (red line).

management. Using this model, we investigate how investor activism influences the pace of the green transition and the role of environmental policies in shaping shareholder engagement. In our model, activism increases the green transition rate under first best, but two frictions limit its effectiveness. First, the green transition rate depends on the efforts of both the activist and management, which are costly, unobserved, and subject to moral hazard. Second, activist investors cannot fully capture the gains of activism since existing, passive shareholders free-ride on their efforts.

Our analysis uncovers several new findings. Firstly, we demonstrate that, in the presence of moral hazard, the efforts of the activist and management endogenously arise as substitutes and lie below first-best efforts. As a result, activism can either increase or decrease the green transition rate compared to passive investors owning the firm. Secondly, we highlight that due to the free-rider problem, activism alone cannot drive a green transition without sustainability preferences. These preferences cause activists to account for the firm's negative externalities, thereby enhancing impact activism through two mechanisms: by encouraging entry and by increasing both activist engagement and managerial effort. We also show that when sustainability preferences are sufficiently weak, the free-rider problem leads to a counter-intuitive outcome: activists engage only if their impact is negligible, targeting firms that would transition under passive ownership and exerting minimal effort. In this scenario, activism always reduce the green transition rate. Thirdly, we show that carbon taxes and green investment subsidies, by increasing the net financial benefits of transitioning, worsen the free-rider problem and reduce activist engagement, thereby hindering impact activism. Lastly, we show that when managerial contracts are established by passive investors rather than activists, the activist's sustainability preferences play a lesser role in the transition process and activism becomes more likely to reduce the green transition rate.

An important takeaway from our analysis is that the contracting space is a key determinant of the effectiveness of impact activism, due to the double moral hazard problem. Public firms, in which activists can essentially engage by buying an equity stake as in our model, are unlikely to lend themselves to effective impact activism. In contrast, private firms, which typically have more complex contractual arrangements, may provide a more conducive environment for impact activism.

References

Acemoglu, D., U. Akcigit, D. Hanley, and W. Kerr (2016). Transition to a clean technology. *The Journal of Political Economy 124*(1), 52–104.

Admati, A. R., P. Pfleiderer, and J. Zechner (1994). Large shareholder activism, risk sharing, and financial market equilibrium. *The Journal of Political Economy 102*(6), 1097–1130.

Akey, P. and I. Appel (2020). Environmental externalities of activism. *Working Paper University of Toronto*.

Albuquerque, R., Y. Kroskinen, and C. Zhang (2019). Corporate social responsibility and firm risk: Theory and empirical evidence. *Management Science 65*, 4451–4469.

Allen, F., A. Barbalau, and F. Zeni (2023). Reducing carbon using regulatory and financial market tools. *Working Paper Imperial College London*.

Andreoni, J. (1990). Impure altruism and donations to public goods: a theory of warm-glow giving. *The Economic Journal 100*, 464–477.

Azar, J., M. Duro, I. Kadach, and G. Ormazabal (2021). The Big Three and corporate carbon emissions around the world. *The Journal of Financial Economics 142*(2), 674–696.

Back, K., P. Collin-Dufresne, V. Fos, T. Li, and A. Ljungqvist (2018). Activism, strategic trading, and liquidity. *Econometrica 86*(4), 1431–1463.

Bellon, A. (2022). Does private equity ownership make firms cleaner? The role of environmental liability risks. *Working Paper University of North Carolina*.

Berk, J. and J. H. Van Binsbergen (2022). The impact of impact investing. *Working Paper Stanford University*.

Besley, T. and T. Persson (2023). The political economics of green transitions. *The Quarterly Journal of Economics 138*(3), 1863–1906.

Bhattacharyya, S. and F. Lafontaine (1995). Double-sided moral hazard and the nature of share contracts. *RAND Journal of Economics 26*(4), 761–781.

Biais, B. and A. Landier (2023). Emission caps and investment in green technologies. *Working Paper HEC Paris*.

Bonnefon, J.-F., A. Landier, P. Sastry, and D. Thesmar (2022). The moral preferences of investors: Experimental evidence. Working Paper 29647, National Bureau of Economic Research.

Brav, A., W. Jiang, F. Partnoy, and R. Thomas (2008). Hedge fund activism, corporate governance, and firm performance. *The Journal of Finance 63*(4), 1729–1775.

Broccardo, E., O. Hart, and L. Zingales (2022). Exit versus voice. *The Journal of Political Economy 130*(12), 3101–3145.

Cole, S., L. Jeng, J. Lerner, N. Rigol, and B. N. Roth (2023). What do impact investors do differently? Working Paper 31898, National Bureau of Economic Research.

Collin-Dufresne, P., V. Fos, and D. Muravyev (2017). Informed trading in the stock market and option price discovery. *The Journal of Financial and Quantitative Analysis 56*(6), 1945–1984.

DeMarzo, P. M. and B. Urošević (2006). Ownership dynamics and asset pricing with a large shareholder. *The Journal of Political Economy 114*(4), 774–815.

Derrien, F., A. Landier, P. Krueger, and T. Yao (2023). ESG news, future cash flows, and firm value. *Working Paper HEC Paris*.

Dimson, E., O. Karakaş, and X. Li (2015). Active ownership. *The Review of Financial Studies 28*(12), 3225–3268.

Edmans, A., D. Levit, and J. Schneemeier (2023). Socially responsible divestment. *Working Paper London Business School*.

Green, D. and B. Roth (2021). The allocation of socially responsible capital. *Working Paper Harvard Business School*.

Greenwood, R. and M. Schor (2009). Investor activism and takeovers. *The Journal of Financial Economics 92*, 362–375.

Grossman, S. and O. Hart (1988). One share-one vote and the market for corporate control. *The Journal of Financial Economics 20*, 175–202.

Grossman, S. J. and O. D. Hart (1980). Takeover bids, the free-rider problem, and the theory of the corporation. *The Bell Journal of Economics*, 42–64.

Gupta, D., A. Kopytov, and J. Starmans (2022). The pace of change: Socially responsible investing in private markets. *Working Paper John Hopkins University*.

Hartzmark, S. and K. Shue (2023). Counterproductive sustainable investing: The impact elasticity of brown and green firms. *Working Paper Yale University*.

Heath, D., D. Macciocchi, R. Michaely, and M. C. Ringgenberg (2021). Does socially responsible investing change firm behavior? *The Review of Finance* (762).

Heeb, F., J. Kölbel, F. Paetzold, and S. Zeisberger (2023). Do investors care about impact? *The Review of Financial Studies 36*(5), 1737–1787.

Heinkel, R., A. Kraus, and J. Zechner (2001). The effect of green investment on corporate behavior. *The Journal of Financial and Quantitative Analysis 36*, 431–449.

Holmström, B. (1982). Moral hazard in teams. *Bell Journal of Economics 13*, 324–340.

Hong, H., N. Wang, and J. Yang (2023). Welfare consequences of sustainable finance. *The Review of Financial Studies 36*(12), 4864–4918.

Huang, S. and A. Kopytov (2023). Sustainable finance under regulation. *Working Paper University of Rochester*.

Jagannathan, R., S. Kim, R. McDonald, and S. Xia (2022). Environmental activism, endogenous risk, and stock prices. *Working Paper Northwestern University*.

Kaplan, S. N. and P. Strömberg (2009). Leveraged buyouts and private equity. *The Journal of Economic Perspectives 23*(1), 121–146.

Kölbel, J. F., F. Heeb, F. Paetzold, and T. Busch (2020). Can sustainable investing save the world? Reviewing the mechanisms of investor impact. *Organization & Environment 33*(4), 554–574.

Krueger, P., Z. Sautner, and L. Starks (2020). The importance of climate risk for institutional investors. *The Review of Financial Studies 33*(3), 1067–1111.

Kumar, M. (2023). Getting dirty before you get clean: Institutional investment in fossil fuels and the green transition. *Working Paper University of Michigan*.

Landier, A. and S. Lovo (2023). ESG investing: How to optimize impact? *The Review of Financial Studies*.

Meier, J.-M., H. Servaes, J. Wei, and S. C. Xiao (2023). Do consumers care about ESG? Evidence from barcode-level sales data. *European Corporate Governance Institute–Finance Working Paper* (926).

Naaraayanan, L., K. Sachdeva, and V. Sharma (2023). The real effects of environmental activist investing. *Working Paper London Business School*.

Oehmke, M. and M. M. Opp (2024). A theory of socially responsible investment. *Review of Economic Studies*.

Pedersen, L. (2024). Carbon taxes versus green finance. *Working Paper Copenhagen Business School*.

Pástor, L., R. Stambaugh, and L. Taylor (2022). Dissecting green returns. *The Journal of Financial Economics 146*, 403–424.

Riedl, A. and P. Smeets (2017). Why do investors hold socially responsible mutual funds? *The Journal of Finance 72*(6), 2505–2550.

Saint-Jean, V. (2023). Exit or voice? Divestment, activism, and corporate social responsibility. *Working Paper Sciences Po*.

Shleifer, A. and R. Vishny (1986). Large shareholders and corporate control. *The Journal of Political Economy 94*(3), 461–488.

Stulz, R. (1988). Managerial control of voting rights: Financial policies and the market for corporate control. *The Journal of Financial Economics 20*, 25–54.

Wiedemann, M. (2023). Green stewards: Responsible institutional investors foster green capex. *Working Paper Imperial College London*.

Appendix

A Proofs

A.1 Proof of Proposition 1

To solve for (a^{FB}, m^{FB}), take the first order conditions with respect to a and m in (8), that is $\theta(\Delta+\pi)-\phi_a a = 0$ and $\theta(\Delta+\pi)-\theta\phi_m m = 0$, to solve for $a = a^{FB}$ and $m = m^{FB}$. Clearly, the second order condition is satisfied.

To solve for m^P and the optimization problem in (6), insert (2) and (3) into (6) to obtain (for $\hat{a}=0$):

$$\begin{aligned}
P_0 &= \max_{(C,R)} \big\{ (1-m)(X_B - C - T) + m(X_G - C - R) \big\} \\
&= \max_{R} \left\{ X_B - W + mR - \frac{\phi_m m^2}{2} + m(\Delta - R) \right\} \\
&= \max_{m} \left\{ X_B - W - \frac{\phi_m m^2}{2} + m\Delta \right\},
\end{aligned}$$

where we used $\Delta = X_G - X_B + T$. Due to (2), we can optimize with respect to m. The first-order condition with respect to m becomes $\Delta - \phi_m m = 0$ which we can solve for $m^P = \frac{\Delta}{\phi_m}$.

Under optimal effort $m = m^P$, the stock price under passive ownership becomes

$$P_0 = X_G - \Delta - W + \frac{\Delta}{2\phi_m}. \tag{A.1}$$

A.2 Proof of Proposition 2

To prove Proposition 2, we solve the optimization problem in (4) subject to (2), (3), and (9). For this sake, we insert (3) into (4) to rewrite the activist's optimization as

$$\begin{aligned}
V &= \max_{R} \left\{ \theta\big[X_B - W + (a+m)R - \frac{\phi_m m^2}{2} + (a+m)(\Delta+\pi-R)\big] - \frac{\phi_a a^2}{2} \right\} \\
&= \max_{R} \left\{ \theta\big[X_B - W - \frac{\phi_m m^2}{2} + (a+m)(\Delta+\pi)\big] - \frac{\phi_a a^2}{2} \right\},
\end{aligned}$$

subject to (2) and (9). Next, we use (2), i.e., $R = \phi_m m$, to rewrite (9) as $a = \frac{\theta(\Delta+\pi-\phi_m m)}{\phi_a}$. We insert this expression for a into the activist's optimization above to obtain:

$$V = \max_{m} \left\{ \theta \left[X_B - W - \frac{\phi_m m^2}{2} + \left(\frac{\theta(\Delta+\pi-\phi_m m)}{\phi_a} + m \right)(\Delta+\pi) \right] - \frac{\theta^2(\Delta+\pi-\phi_m m)^2}{2\phi_a} \right\}.$$

The first-order condition with respect to m becomes

$$\frac{\partial V}{\partial m} = 0 \quad \Longleftrightarrow \quad -\phi_m m + (\Delta+\pi)\left[1 - \frac{\theta\phi_m}{\phi_a}\right] + \frac{\phi_m\theta(\Delta+\pi-\phi_m m)}{\phi_a} = 0.$$

Thus,

$$\frac{\Delta+\pi}{\phi_m}\left(1-\frac{\theta\phi_m}{\phi_a}+\frac{\theta\phi_m}{\phi_a}\right)=m\left[1+\frac{\theta\phi_m}{\phi_a}\right].$$

Using $\xi=\frac{\phi_a}{\theta\phi_m}$, we therefore obtain

$$m=\frac{\Delta+\pi}{\phi_m}\left(\frac{1}{1+1/\xi}\right)=\frac{\Delta+\pi}{\phi_m}\left(\frac{\xi}{1+\xi}\right).$$

Inserting this expression for a into (9), we obtain

$$a=\frac{\theta(\Delta+\pi-\phi_m m)}{\phi_a}=\frac{\theta(\Delta+\pi)(1-\frac{\xi}{1+\xi})}{\phi_a}=\frac{\Delta+\pi}{\phi_m}\left(\frac{1}{\xi(1+\xi)}\right).$$

Efforts (a,m) lie below their first-best levels from Proposition 1. As $\frac{\xi}{1+\xi}<1$ for $\xi>0$, we have $m<m^{FB}$. Next, rewrite $a^{FB}=\frac{\Delta+\pi}{\phi_m\xi}$, implying $a<a^{FB}$ for $\xi>0$.

Finally, we can solve for the activist's value function and the firm's stock price in closed-form (under optimal efforts) as follows:

$$V=\frac{\theta\left(1+\xi+\xi^2\right)(\Delta+\pi)^2}{2\xi(\xi+1)\phi_m}+\theta(X_G-\Delta-W) \tag{A.2}$$

$$P=\frac{(\Delta+\pi)\left[(2+2\xi+2\xi^2+\xi^3)\Delta-\xi^3\pi\right]}{2\xi(\xi+1)^2\phi_m}+X_G-\Delta-W. \tag{A.3}$$

A.3 Proof of Proposition 3

Under optimal efforts, one can express the stock price as

$$P=\frac{(\Delta+\pi)\left((2+\xi(2+\xi(2+\xi)))\Delta-\xi^3\pi\right)}{2\xi(\xi+1)^2\phi_m}+X_G-\Delta-W.$$

Analogously, the activist's value function becomes

$$V=\frac{(\Delta+\pi)\left[(2+2\xi+2\xi^2+\xi^3)\Delta-\xi^3\pi\right]}{2\xi(\xi+1)^2\phi_m}+X_G-\Delta-W.$$

Accordingly, the entry objective can be written as

$$V-\theta P=\frac{\theta(\Delta+\pi)\left((2\xi^3+2\xi^2+2\xi+1)\,\pi-\Delta\right)}{2\xi(\xi+1)^2\phi_m}$$

Thus, as desired, the entry condition becomes

$$\frac{\pi}{\Delta}\geq\frac{1}{1+2\xi(1+\xi+\xi^2)}.$$

A.4 Proof of Corollary 1

Using the closed-form expressions for P (see (A.2)) and $P_0 = \frac{\Delta}{2\phi_m} - \Delta + X_G$ (see (A.1)), it is immediate to show that $P \leq P_0$ is equivalent to

$$\frac{\pi}{\Delta} \geq \frac{\xi^2 + \sqrt{(\xi+1)^2 (2\xi^2+1)} + \xi + 1}{\xi^3}.$$

A.5 Proof of Proposition 4

We solve $\frac{\lambda(\theta)}{\lambda(0)} = 1$, that is:

$$\lambda(\theta) = \lambda(0) \quad \Longleftrightarrow \quad (1+\xi^2)(\Delta + \pi) = (\xi + \xi^2)\Delta \quad \Longleftrightarrow \quad \xi^2 \pi - \xi\Delta + \Delta + \pi = 0.$$

for ξ. This quadratic equation has maximally two real roots. Provided their existence, i.e., for $\Delta^2 \geq 4(\Delta+\pi)\pi$, these roots are

$$\xi_{\pm} = \frac{\Delta \pm \sqrt{\Delta^2 - 4(\Delta+\pi)\pi}}{2\pi}$$

In the limit $\xi \to 0$, we have $\lim_{\xi \to 0} a = +\infty$. Thus, $\frac{\lambda(\theta)}{\lambda(0)}$ is U-shaped in ξ, so that $\lambda(\theta) < \lambda(0)$ if and only if $\xi \in (\xi_-, \xi_+)$. For $\xi \notin [\xi_-, \xi_+]$, we therefore have $\lambda(\theta) > \lambda(0)$.

In the limit, $\pi \to 0$, we get $\lim_{\pi \to 0} \xi_+ = \lim_{\pi \to 0} \frac{\Delta + \sqrt{\Delta^2 - 4(\Delta+\pi)\pi}}{2\pi} = +\infty$. In addition, by L'Hopital's rule:

$$\lim_{\pi \to 0} \xi_- = \lim_{\pi \to 0} \frac{\Delta - \sqrt{\Delta^2 - 4(\Delta+\pi)\pi}}{2\pi} = \lim_{\pi \to 0} \left(\frac{4(\Delta + 2\pi)}{4\sqrt{\Delta^2 - 4(\Delta+\pi)\pi}} \right) = 1.$$

A.6 Proof of Proposition 5

Suppose $\pi > 0$ and $\Delta > 0$. Recall that the activist enters if and only if

$$\frac{\pi}{\Delta} \geq \frac{1}{1 + 2\xi(1 + \xi + \xi^2)}.$$

The right-hand-side decreases in ξ, with $\lim_{\xi \to +\infty} \frac{1}{1+2\xi(1+\xi+\xi^2)} = 0$ and $\lim_{\xi \to 0} \frac{1}{1+2\xi(1+\xi+\xi^2)} = 1$. Define

$$\xi_E := \inf \left\{ \xi \geq 0 : \frac{\pi}{\Delta} \geq \frac{1}{1 + 2\xi(1+\xi+\xi^2)} \right\}.$$

When $\pi \geq \Delta$, then $\xi_E = 0$. When $\Delta = 0 < \pi$, then $\xi_E = 0$. When $\pi = 0 \leq \Delta$, then $\xi_E = +\infty$. Otherwise, for $\pi, \Delta > 0$, ξ_E is the unique solution on $(0, \infty)$ to

$$\frac{\pi}{\Delta} = \frac{1}{1 + 2\xi_E(1 + \xi_E + \xi_E^2)}.$$

A.7 Proof of Corollary 2

The entry objective can be written as

$$V - \theta P = \frac{\theta(\Delta + \pi)\left((2\xi^3 + 2\xi^2 + 2\xi + 1)\,\pi - \Delta\right)}{2\xi(\xi+1)^2\phi_m}.$$

One can calculate (noting that $\xi = \frac{\phi_a}{\phi_m \theta}$):

$$\frac{\partial(V - \theta P)}{\partial \phi_m} = -\left(\frac{\theta(\Delta + \pi)(\xi(\xi(\xi+3)+1)\pi + \Delta)}{(\xi+1)^3\phi_m^2}\right) < 0.$$

Thus, the activist's ex-ante payoff $V - \theta P$ decreases in ϕ_m and, in particular, is maximized on $[\underline{\phi}_m, \overline{\phi}_m]$ for $\phi_m = \underline{\phi}_m$.

A.8 Proof of Proposition 6

Most claims follow from the previous results. If

$$\xi_E := \inf\left\{\xi \geq 0 : \frac{\pi}{\Delta} \geq \frac{1}{1 + 2\xi(1 + \xi + \xi^2)}\right\}.$$

satisfies $\xi_E \in (0, \infty)$, then it solves

$$\frac{\pi}{\Delta} = \frac{1}{1 + 2\xi_E(1 + \xi_E + \xi_E^2)}.$$

The left-hand-side increases in $\frac{\pi}{\Delta}$ while the right-hand-side decreases in ξ_E. As such, ξ_E decreases with $\frac{\pi}{\Delta}$.

Next, expression (12) readily implies that $\frac{\lambda(\theta)}{\lambda(0)}$ increases with $\frac{\pi}{\Delta}$. We solve $\frac{\lambda(\theta)}{\lambda(0)} = 1$ for $\frac{\pi}{\Delta}$ to obtain

$$(1+\xi^2)\left(1 + \frac{\pi}{\Delta}\right) = \xi + \xi^2 \quad \Longleftrightarrow \quad \frac{\pi}{\Delta} = \frac{\xi + \xi^2}{1+\xi^2} - 1 = \frac{\xi - 1}{1 + \xi^2}.$$

Consequently, $\frac{\lambda(\theta)}{\lambda(0)} \gtrless 1$ if and only if $\frac{\pi}{\Delta} \gtrless \Gamma_G := \frac{\xi-1}{1+\xi^2}$.

A.9 Proof of Corollary 3

Recall that the activist enters if and only if

$$\frac{\pi}{\Delta} \geq \frac{1}{1 + 2\xi(1+\xi+\xi^2)} \quad \Longleftrightarrow \quad \Delta = T + X_G - X_B \leq \pi\big[1 + 2\xi(1 + \xi + \xi^2)\big].$$

Thus, the activist enters if and only if $T \leq T_E := \pi\big[1 + 2\xi(1+\xi+\xi^2)\big] - (X_G - X_B)$.

As $\frac{\lambda(\theta)}{\lambda(0)}$ decreases with Δ, it also decreases with T. Recall that $\lambda(\theta) \geq \lambda(0)$ if and only if $\frac{\pi}{\Delta} \geq \frac{\xi-1}{1+\xi^2}$. When $\xi \leq 1$, this inequality is always satisfied. Suppose that $\xi > 1$. Then, $\lambda(\theta) > \lambda(0)$ if and only if $\Delta < \pi\frac{1+\xi^2}{\xi-1}$, that is, if and only if $T \leq T_G := \frac{1+\xi^2}{\xi-1}\pi - (X_G - X_B)$.

A.10 Proof of Proposition 7

To solve for efforts, we solve the optimization problem in (14) subject to (2), (3), and (9). For this sake, we insert (3) into (4) to rewrite the activist's optimization as

$$\begin{aligned} V &= \max_{R} \left\{ \theta \big[X_B - W + (a+m)R - \frac{\phi_m m^2(1-s)}{2} + (a+m)(\Delta + \pi - R) \big] - \frac{\phi_a a^2}{2} \right\} \\ &= \max_{R} \left\{ \theta \big[X_B - W - \frac{\phi_m m^2(1-s)}{2} + (a+m)(\Delta + \pi) \big] - \frac{\phi_a a^2}{2} \right\}, \end{aligned}$$

subject to (2) and (9).

Next, we use (2), i.e., $R = \phi_m m$, to rewrite (9) as $a = \frac{\theta(\Delta+\pi-\phi_m m)}{\phi_a}$. We insert this expression for a into the activist's optimization problem above to obtain:

$$V = \max_{m} \left\{ \theta \left[X_B - W - \frac{\phi_m m^2(1-s)}{2} + \left(\frac{\theta(\Delta+\pi-\phi_m m)}{\phi_a} + m \right) (\Delta+\pi) \right] - \frac{\theta^2(\Delta+\pi-\phi_m m)^2}{2\phi_a} \right\}.$$

The first-order condition with respect to m becomes

$$\frac{\partial V}{\partial m} = 0 \iff -\phi_m m(1-s) + (\Delta+\pi)\left[1 - \frac{\theta\phi_m}{\phi_a}\right] + \frac{\phi_m \theta(\Delta+\pi-\phi_m m)}{\phi_a} = 0.$$

Thus,

$$m = \frac{\Delta+\pi}{\phi_m}\left(1 - s - \frac{\theta\phi_m}{\phi_a} + \frac{\theta\phi_m}{\phi_a}\right) = m\left[1 - s + \frac{\theta\phi_m}{\phi_a}\right].$$

Using $\xi = \frac{\phi_a}{\theta\phi_m}$, we therefore obtain

$$m = \frac{\Delta+\pi}{\phi_m}\left(\frac{1}{1-s+1/\xi}\right) = \frac{\Delta+\pi}{\phi_m}\left(\frac{\xi}{1+\xi(1-s)}\right).$$

Inserting this expression for a into (9), we obtain

$$a = \frac{\Delta+\pi}{\phi_m}\left(\frac{1-\xi s}{\xi\left(\xi(1-s)+1\right)}\right).$$

Finally, the effort level under passive ownership is obtained by taking the limit $\phi_a \to \infty, \pi \to 0$; $\phi \to \infty$ implies $\xi \to \infty$ so that in that $m^P = \lim_{\pi\to,\xi\to\infty} m = \frac{\Delta}{\phi_m(1-s)}$.

Next, calculate

$$\frac{\lambda(\theta)}{\lambda(0)} = \frac{a+m}{m^{FB}} = \frac{(1+\xi^2-\xi s)(1-s)}{\xi\left(\xi(1-s)+1\right)}\left(1+\frac{\pi}{\Delta}\right)$$

Clearly, $\frac{\lambda(\theta)}{\lambda(0)}$ increases in $\frac{\pi}{\Delta}$. We can solve $\frac{\lambda(\theta)}{\lambda(0)} = 1$ for $\frac{\pi}{\Delta}$ to obtain $\frac{\pi}{\Delta} = \Gamma_G^s$ with

$$\Gamma_G^s = \frac{\xi - 1 + s(1+\xi(1-s))}{(1-s)(1+\xi(\xi-s))}.$$

Thus, $\lambda(\theta) \gtrless \lambda(0)$ if and only if $\frac{\pi}{\Delta} \gtrless \Gamma_G^s$.

We can calculate

$$\frac{\partial \Gamma_G^s}{\partial s} = \frac{\xi(\xi(1-2s) + \xi^2(s^2 - 2s + 2) + 1)}{(1-s)^2(\xi^2 - \xi s + 1)^2}.$$

As $s \leq \frac{1}{2}$, we have $\frac{\partial \Gamma_G^s}{\partial s} > 0$. Furthermore, we can calculate

$$\frac{\partial \lambda(\theta)}{\partial s} = \frac{\Delta + \pi}{\phi_m} \left(\frac{\xi\ (\xi - 1)}{(\xi(1-s)+1)^2} \right),$$

Thus, $\frac{\partial \lambda(\theta)}{\partial s} \gtrless 0$ if and only if $\xi \gtrless 1$.

The closed-form expression for the activist's value function and the stock price become

$$P = \frac{(\Delta + \pi) \left\{ \Delta \left[\xi \left(\xi^2(1-s) + 2\xi((s-1)s+1) + 4s - 2 \right) + 2 \right] - \xi^3(1-s)\pi \right\}}{2\xi \phi_m (\xi(1-s)+1)^2} + X_G - \Delta - W$$

and

$$V = \frac{\theta \left(\xi^2 + \xi - \xi s + 1 \right) (\Delta + \pi)^2}{2\xi \phi_m (\xi(1-s)+1)} + \theta(X_G - \Delta - W).$$

Finally, we can solve the entry condition $V - \theta P \geq 0$ for $\frac{\pi}{\Delta}$ to obtain

$$\frac{\pi}{\Delta} \geq \Gamma_E^s := \frac{1 + \xi s(\xi s - 2)}{1 + 2\xi \big(1 + \xi(1-s) + \xi^2(1-s)\big) + \xi s(\xi s - 2)}.$$

We can calculate

$$\frac{\partial \Gamma_E^s}{\partial s} = -\frac{2\xi^2(\xi + \xi^2(s^2 - 2s + 2) + \xi^3(s-2)s - 2\xi s + 1)}{\xi^2(s^2 - 2s + 2) - 2\xi^3(s-1) - 2\xi(s-1) + 1)^2},$$

which has the *opposite* sign as

$$\gamma := \xi(1-2s) + \xi^2(s^2 + 2(1-s)) + \xi^3(s-2)s - 2\xi s + 1.$$

Note that when $s \geq 0$ is sufficiently small, then $\gamma > 0$ and, therefore, $\frac{\partial \Gamma_E^s}{\partial s} < 0$.

A.11 Proof of Proposition 8

Under the optimal interior $\theta = \theta^*$, let $\xi = \frac{\phi_a}{\phi_m \theta} = \frac{\phi_a}{\phi_m \theta^*}$ and $\overline{\xi} = \frac{\phi_a}{\phi_m \overline{\theta}}$.. By definition, $\overline{\xi} = \xi_E$. If $\pi \geq \Delta$, then $\xi_E = 0$. Otherwise, $\overline{\xi} = \xi_E$ is the unique solution to

$$\frac{\pi}{\Delta} = \frac{1}{1 + 2\xi_E(1 + \xi_E + \xi_E^2)}.$$

When choosing the size of its stake, the objective of the activist is to maximize

$$V - \theta P = \frac{\theta(\Delta + \pi)\left((2\xi^3 + 2\xi^2 + 2\xi + 1)\,\pi - \Delta\right)}{2\xi(\xi+1)^2\phi_m}$$

If $\theta^* \in (0,1)$, then $\theta = \theta^*$ solves the first-order condition $\frac{\partial(V-\theta P)}{\partial\theta} = 0$, which we can calculate as

$$\pi\left[1 + \xi(1+\xi)(3+\xi^2)\right] = \Delta(1+2\xi) \quad\Longleftrightarrow\quad \frac{\pi}{\Delta} = \frac{1+2\xi}{1+\xi(1+\xi)(3+\xi^2)}. \tag{A.4}$$

Under $\theta = \theta^*$, we have $\lambda(\theta) \gtrless \lambda(0)$ if and only if $\frac{\pi}{\Delta} \gtrless \frac{\xi-1}{1+\xi^2}$. Thus, $\lambda(\theta^*) > \lambda(0)$ if and only if

$$\frac{\pi}{\Delta} = \frac{1+2\xi}{1+\xi(1+\xi)(3+\xi^2)} \geq \frac{\xi-1}{1+\xi^2}.$$

Next, define the function

$$F(\xi) := \frac{1+2\xi}{1+\xi(1+\xi)(3+\xi^2)} - \frac{\xi-1}{1+\xi^2}.$$

Notice that $\lambda(\theta^*) > \lambda(0)$ if and only if $F(\xi) > 0$ under the optimal $\theta = \theta^*$.

Crucially, the function $F(\xi)$ has precisely five (complex or real) roots. One can guess and verify that $F(\xi)$ has the following five roots: $\xi = -1$, $\xi \pm i\sqrt{2}$, and $\xi = \frac{1}{2}(1 \pm \sqrt{5})$. In particular, the only positive, real root is $\xi = \frac{1}{2}(1+\sqrt{5})$.

For $\xi = \frac{1}{2}(1+\sqrt{5})$, we have that $\frac{1+2\xi}{1+\xi(1+\xi)(3+\xi^2)} = \frac{\xi-1}{1+\xi^2} = \frac{3\sqrt{5}}{10} - \frac{1}{2} =: \Gamma^*$. Note that $F(0) > 0$, implying that $0 \gtrless F(\xi)$ for $\xi \gtrless \frac{1}{2}(1+\sqrt{5})$. Additionally, we can calculate

$$\frac{\partial}{\partial\xi}\left(\frac{1+2\xi}{1+\xi(1+\xi)(3+\xi^2)}\right) = -\frac{(1+6\xi+9\xi^2+8\xi^3+6\xi^4)}{(1+3\xi+3\xi^2+\xi^3+\xi^4)^2} < 0.$$

Because $\frac{1+2\xi}{1+\xi(1+\xi)(3+\xi^2)} = \Gamma^*$ for $\xi = \frac{1}{2}(1+\sqrt{5})$ $\frac{1+2\xi}{1+\xi(1+\xi)(3+\xi^2)} = \Gamma^*$, it follows that $\frac{\pi}{\Delta} > \Gamma^*$ implies $\xi < \frac{1}{2}(1+\sqrt{5})$ for $\theta = \theta^*$. Consequently, $\frac{\pi}{\Delta} > \Gamma^*$ implies $\frac{\pi}{\Delta} > \frac{\xi-1}{1+\xi^2}$ and therefore $\lambda(\theta^*) > \lambda(0)$. By contrast, for $\frac{\pi}{\Delta} < \Gamma^*$, we obtain $\frac{\pi}{\Delta} < \frac{\xi-1}{1+\xi^2}$ and so $\lambda(\theta^*) < \lambda(0)$.

Next, define the function

$$G(\xi) = \frac{1}{1+2\xi(1+\xi+\xi^2)} - \frac{1+2\xi}{1+\xi(1+\xi)(3+\xi^2)}$$

This function has precisely four roots. One can guess and verify that these roots are $\xi = -1$, $\xi = 0$, $\xi = -\frac{1}{3}i(\sqrt{2} - i)$, and $\xi = \frac{1}{3}i(\sqrt{2}+i)$. In particular, the function $G(\xi)$ does not possess any positive, real root. As can be checked, this implies that $G(\xi) < 0$ for $\xi \in (0,\infty)$.

Because $\frac{1}{1+2\xi_E(1+\xi_E+\xi_E^2)}$ clearly decreases in ξ_E and $\frac{\pi}{\Delta} = \frac{1}{1+2\xi_E(1+\xi_E+\xi_E^2)} = \frac{1+2\xi}{1+\xi(1+\xi)(3+\xi^2)}$, it follows that $\xi_E < \xi$, i.e., $\overline{\theta} > \theta^*$.

Further, calculate

$$\frac{\partial}{\partial \xi}\left(\frac{\xi-1}{1+\xi^2}\right)=\frac{(-\xi^2+2\xi+1)}{(1+\xi^2)^2}.$$

Note that $\frac{\partial}{\partial\xi}\left(\frac{\xi-1}{1+\xi^2}\right)>0$ for $\xi<1+\sqrt{2}$.

For $\frac{\pi}{\Delta}=\Gamma^*$, we have under the optimal $\theta=\theta^*$ that $\xi=\frac{1}{2}(1+\sqrt{5})<1+\sqrt{2}$. Thus,

$$\frac{\pi}{\Delta}=\frac{\xi-1}{1+\xi^2}>\frac{\xi_E-1}{1+\xi_E^2},$$

where we used $\xi_E<\xi<1+\sqrt{2}$ and that $\frac{1+2\xi}{1+\xi(1+\xi)(3+\xi^2)}$ increases in ξ for all $\xi<1+\sqrt{2}$. Since $\frac{\pi}{\Delta}<\Gamma^*$ implies $\frac{\pi}{\Delta}<\frac{\xi-1}{1+\xi^2}$ and thus $\lambda(\theta^*)<\lambda(0)$, there exists, by continuity, $\varepsilon>0$ such that for $\frac{\pi}{\Delta}\in(\Gamma^*-\varepsilon,\Gamma^*)$ it holds $\frac{\xi-1}{1+\xi^2}>\frac{\pi}{\Delta}>\frac{\xi_E-1}{1+\xi_E^2}$ as well as $\lambda(\theta^*)<\lambda(0)<\lambda(\overline{\theta})$.

Finally, calculate $\frac{\partial\lambda(\theta)}{\partial\theta}\gtreqless 0$ if and only if $\xi\gtreqless 1+\sqrt{2}$. Recall that for $\frac{\pi}{\Delta}<\Gamma^*$, we have $\xi_E<\xi<1+\sqrt{2}$, as well as $\overline{\theta}>\theta^*$. As a result, $\lambda(\overline{\theta})>\lambda(\theta^*)$ for $\frac{\pi}{\Delta}<\Gamma^*$.

A.12 Proof of Proposition 9

The objective function is

$$V-\theta P=\frac{\theta(\Delta+\pi)\left((2\xi^3+2\xi^2+2\xi+1)\,\pi-\Delta\right)}{2\xi(\xi+1)^2\phi_m}$$

If $\theta^*\in(0,1)$, then $\theta=\theta^*$ solves the first-order condition $\frac{\partial(V-\theta P)}{\partial\theta}=0$, which we can calculate as

$$\frac{\pi}{\Delta}=\frac{1+2\xi}{1+\xi(1+\xi)(3+\xi^2)}. \tag{A.5}$$

Calculate

$$\frac{\partial}{\partial\xi}\left(\frac{1+2\xi}{1+\xi(1+\xi)(3+\xi^2)}\right)=-\frac{(1+6\xi+9\xi^2+8\xi^3+6\xi^4)}{(1+3\xi+3\xi^2+\xi^3+\xi^4)^2}<0.$$

Thus, as $\frac{\pi}{\Delta}$ increases, the right-hand-side of the first-order condition (A.5) must increase, which requires ξ to decrease under the optimal $\theta=\theta^*$. Due to $\xi=\frac{\phi_a}{\phi_m\theta}$, this requires $\theta=\theta^*$ to increase. Consequently, θ^* increases with π but decreases with Δ.

Moreover, a change in ϕ_a or ϕ_m leaves the left-hand-side of the first-order condition (A.5) unchanged. Thus, the right-hand-side must remain unchanged too. Due to $\xi=\frac{\phi_a}{\phi_m\theta}$, it therefore must be that $\frac{d}{dx}\left(\frac{\phi_a}{\phi_m\theta}\right)$ remains constant under optimal $\theta=\theta^*$. Thus, θ^* increases in ϕ_a but decreases in ϕ_m.

A.13 Proof of Corollary 4

Corollary 2 shows that for any θ, the payoff $V-\theta P$ decreases in ϕ_m and, therefore, is maximized on $[\underline{\phi}_m,\overline{\phi}_m]$ for $\phi_m=\underline{\phi}_m$. Thus, $\phi_m=\underline{\phi}_m$ maximizes $V-\theta P$ under the optimal choice of θ, i.e., under $\theta=\theta^*$.

A.14 Proof of Proposition 10

By the proof of Proposition 3, we recall (A.2), that is,

$$V = \frac{\theta\left(1+\xi+\xi^2\right)(\Delta+\pi)^2}{2\xi(\xi+1)\phi_m} + \theta(X_G - \Delta - W)$$
$$P = \frac{(\Delta+\pi)\left[(2+2\xi+2\xi^2+\xi^3)\Delta - \xi^3\pi\right]}{2\xi(\xi+1)^2\phi_m} + X_G - \Delta - W.$$

The stock price under passive ownership becomes (see (A.1)):

$$P_0 = X_G - \Delta - W + \frac{\Delta}{2\phi_m}.$$

With $\Phi_A = \phi_a/\theta$, the entry condition $V - \theta P_0 - \eta\theta(P - P_0) \geq 0$ becomes

$$(\Delta+\pi)^2\left(\frac{\phi_m\left[\Phi_a(1-\eta)+\phi_m(1-2\,\eta)\right]}{2\,\Phi_a\left(\Phi_a+\phi_m\right)^2}\right) - \frac{\pi^2(1-\eta)}{2\phi_m} + \frac{\pi(\Delta+\pi)\eta(\phi_m-\Phi_a)}{\Phi_a(\Phi_a+\phi_m)} + \frac{\pi\Delta}{\phi_m} \geq 0.$$

Multiply both sides by $2\Phi_a\ (\Phi_a+\phi_m)^2$. Then, divide both sides by ϕ_m^2 and use $\xi = \Phi_a/\phi_m$ to obtain

$$(\Delta+\pi)^2\left[\xi(1-\eta)+1-2\,\eta\right] + 2\pi(\Delta+\pi)\eta(1-\xi^2) + 2\pi\Delta\xi\ (1+\xi)^2 - \pi^2(1-\eta)\xi\ (1+\xi)^2 \geq 0.$$

Collecting terms yields, we can rewrite above inequality to $E \geq 0$ with

$$E := (\Delta+\pi)^2\left[\xi(1-\eta)+1-2\eta\right] + 2(\Delta+\pi)\pi(1+\xi)\left[\eta+\xi(1-\eta)+\xi^2\right] - \pi^2(1-\eta)\xi(1+\xi)^2.$$

Next, calculate for $1-\eta>0$:

$$\begin{aligned}
\frac{\partial E}{\partial \xi} &= (\Delta+\pi)^2(1-\eta) + 2(\Delta+\pi)\pi\left[\eta+\xi(1-\eta)+\xi^2\right] \\
&\quad + 2(\Delta+\pi)\pi(1+\xi)\left[1-\eta+2\xi\right] - \pi^2(1-\eta)(1+\xi)^2 - 2\pi^2(1-\eta)\xi(1+\xi) \\
&> 2\pi^2(1+\xi)\left[1-\eta+2\xi\right] - \pi^2(1-\eta)(1+\xi)^2 - 2\pi^2(1-\eta)\xi(1+\xi) \\
&\propto 1 + \frac{4\xi}{1-\eta} - (1+\xi) - 2\xi > \xi \geq 0.
\end{aligned}$$

The sign "$\propto$" means that the third and fourth line have the same sign, where the fourth line is obtained is upon dividing the third line by $\pi^2(1+\xi)(1-\eta)>0$. Note that when $\Delta>0$ or $\pi>0$, $\lim_{\xi\to\infty} E = +\infty$. Thus, there exists unique $\xi_E \geq 0$ such that $E \geq 0$ and the activist enters if and only if $\xi \geq \xi_E$.

Furthermore, it follows that

$$2(\Delta+\pi)\pi(1+\xi)\left[\eta+\xi(1-\eta)+\xi^2\right] - \pi^2(1-\eta)\xi(1+\xi)^2 \geq 0,$$

Therefore, a necessary condition for $E<0$ is that $\xi(1-\eta)+1-2\,\eta<0$, i.e., $\xi < \frac{2\eta-1}{1-\eta}$. This implies that $\xi_E \in \left[0, \frac{2\eta-1}{1-\eta}\right]$.

Finally, we calculate

$$\begin{aligned}\frac{\partial E}{\partial \pi} &= 2(\Delta+\pi)\big[\xi(1-\eta)+1-2\eta\big] \\ &\quad + (2\Delta\pi+4\pi)(1+\xi)\big[\eta+\xi(1-\eta)+\xi^2\big] - 2\pi(1-\eta)\xi(1+\xi)^2 > 0.\end{aligned}$$

Thus, there exists π_E such that the activist enters if and only if $\pi \geq \pi_E$.

A.15 Proof of Proposition 11

When passive investors determine the manager's contract, the incentive conditions (2) and (9) apply, as well as the participation constraint (3). Then, passive investors maximize

$$\begin{aligned}P &= \max_{C,R} \left\{\big(1-(a+m)\big)\big(X_B - C - T\big) + (a+m)\big(X_G - C - R\big)\right\} \\ &= \max_{m} \left\{X_B - W - \frac{\phi_m m^2}{2} + \left(\frac{\theta(\Delta+\pi-\phi_m m)}{\phi_a} + m\right)\Delta\right\}.\end{aligned}$$

The first-order condition with respect to m becomes

$$-\phi_m m + \Delta\left(1 - \frac{1}{\xi}\right) = 0.$$

When $m > 0$ is interior, then

$$m = \frac{\Delta}{\phi_m}\frac{\xi - 1}{\xi}.$$

When $\xi \leq 1$, then $m = 0$. For $\xi > 1$, we can insert above expression for m into (9) to obtain

$$a = \frac{\theta(\Delta+\pi-\phi_m m)}{\phi_a} = \frac{\theta(\Delta/\xi+\pi)}{\phi_a} = \frac{1}{\phi_m}\frac{\Delta+\pi\xi}{\xi^2}.$$

For $\xi \leq 1$, we have $a = \frac{\Delta+\pi}{\phi_m}\frac{1}{\xi} > m^P = \frac{\Delta}{\phi_m}$. When $\xi > 1$, then

$$a + m = \frac{\Delta}{\phi_m}\left(1 - \frac{\xi-1}{\xi^2}\right) + \frac{\pi}{\phi_m \xi},$$

and, therefore,

$$a + m - m^P = \frac{1-\xi}{\xi^2}\frac{\Delta}{\phi_m} + \frac{\pi}{\phi_m \xi}. \tag{A.6}$$

This implies $\lambda(\theta) = a + m \geq \lambda(0) = m^P$ if and only if

$$\frac{\pi}{\Delta} \geq \Gamma_G^p := \frac{\xi - 1}{\xi}.$$

When $\xi \leq 1$, then

$$a + m = \frac{\Delta\pi}{\phi_m \xi},$$

and

$$a + m - m^P = \frac{1-\xi}{\xi}\frac{\Delta}{\phi_m} + \frac{\pi}{\phi_m \xi} \geq 0.$$

In this case, the activism improves the transition rate for all parameter values.

Using the effort levels calculated above, we can characterize the stock price under the optimal contract set by passive investors:

$$P = \frac{\Delta\left(2\xi\pi + \xi^2\Delta + \Delta\right)}{2\xi^2\phi_M} + X_G - \Delta - W$$

if $\xi > 1$ and

$$P = \frac{\Delta(\Delta+\pi)}{\xi\phi_M} + X_G - \Delta - W$$

if $\xi \leq 1$. The activist's value function becomes

$$V = \frac{\theta\left(\xi^2\pi^2 + \left(\xi^3 + \xi - 1\right)\Delta^2 + 2\xi^3\Delta\pi\right)}{2\xi^3\phi_m} + \theta(X_G - \Delta - W)$$

if $\xi > 1$ and

$$V = \frac{\theta(\Delta+\pi)^2}{2\xi\phi_m} - \theta(X_G - \Delta - W)$$

if $\xi \leq 1$. Rearranging the entry condition $V - \theta P$ and simplifying, we obtain that the activist enters and $V - \theta P \geq 0$ if and only if

$$\frac{\pi}{\Delta} \geq \Gamma_E^p := 1 - \xi + \sqrt{\xi^2 - 2\xi + 1 + \xi^{-2}} = 1 - \xi + \sqrt{(1-\xi)^2 + \xi^{-2}}.$$

A.16 Proof of Corollary 5

First, we start by showing that the activist's is higher and the manager's effort is lower than in the baseline. For $\xi \leq 1$, we have $m = 0$ (when passive investors set the contract, and it is clear that the manager's effort is lower than in the baseline. Moreover, $a = \frac{\Delta+\pi}{\phi_m}\frac{1}{\xi}$ clearly exceeds $\frac{\Delta+\pi}{\phi_m}\frac{1}{\xi(1+\xi)}$, i.e., the activist's effort in the baseline. Second, consider $\xi > 1$, so $m = \frac{\Delta}{\phi_m}\frac{\xi-1}{\xi} \leq \frac{\Delta+\pi}{\phi_m}\frac{\xi-1}{\xi}$. Next, note that $\frac{\xi-1}{\xi} \gtrless \frac{\xi}{1+\xi} \iff \xi^2 - 1 \gtrless \xi^2$. Thus, $\frac{\xi-1}{\xi} < \frac{\xi}{1+\xi}$, so managerial effort is lower than in the baseline. The activist's effort is $a = \frac{\Delta+\pi\xi}{\phi_m}\frac{1}{\xi^2} > \frac{\Delta+\pi}{\phi_m}\frac{1}{\xi^2}$. Clearly, $\frac{1}{\xi^2} > \frac{1}{\xi(1+\xi)}$, so the activist's effort is higher than in the baseline.

Second, we compare the transition rates both when passive investors set the contract and activist sets the contract. When $\xi < 1$, we have $\lambda(\theta) = a = \frac{\Delta+\pi}{\phi_m}\frac{1}{\xi}$. The transition rate from the baseline equals $\frac{\Delta+\pi}{\phi_m}\frac{1+\xi^2}{\xi(1+\xi)} < \frac{\Delta+\pi}{\phi_m}\frac{1+\xi}{\xi(1+\xi)} = \lambda$ where we used $\xi < 1$. For $\xi > 1$, the transition rate becomes $\lambda = \frac{1}{\phi_m}\frac{\Delta+\pi\xi+\Delta\xi(\xi-1)}{\xi^2} < \frac{\Delta+\pi}{\phi_m}\frac{1+\xi-1}{\xi} =< \frac{\Delta+\pi}{\phi_m}\frac{1+\xi}{\xi(1+\xi)}$. This is smaller, due to $\xi > 1$, than the transition rate from the baseline, i.e., $\frac{\Delta+\pi}{\phi_m}\frac{1+\xi^2}{\xi(1+\xi)}$.

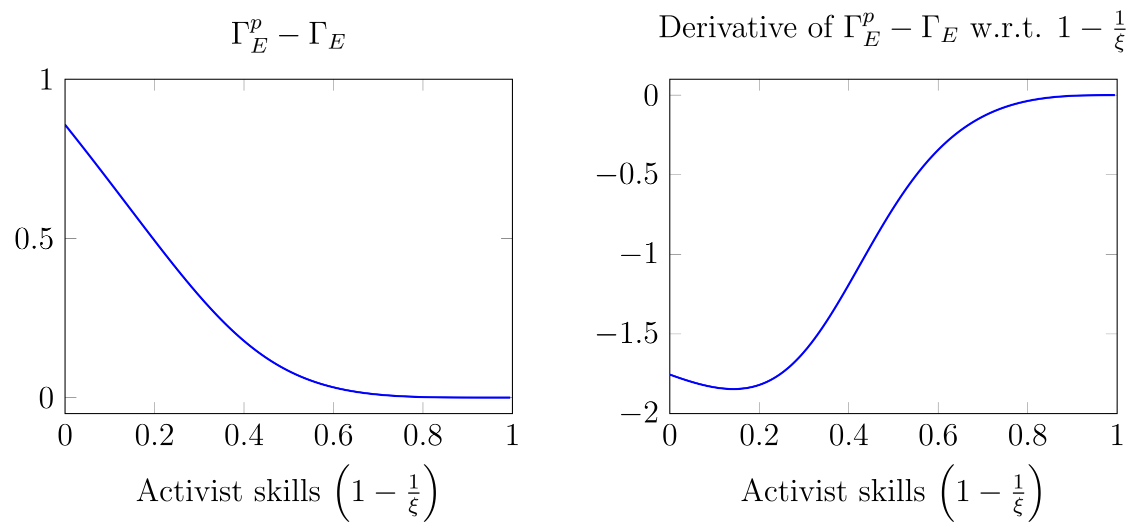

Figure A.1: $\Gamma_E^p - \Gamma_E$: The figure plots the difference $\Gamma_E^p - \Gamma_E$ between the entry threshold when the managerial contract is set by passive investors and the entry threshold when the managerial contract is set by activists in the case of $\xi > 1$. Both thresholds only depend on ξ. To show the whole unbounded domain of ξ in $[1, \infty)$, the figure uses a monotonic increasing function $1 - \frac{1}{\xi}$ to transform the domain to a bounded interval on $[0, 1)$. The right panel plots the derivative of $\Gamma_E^p - \Gamma_E$ with respect to $1 - \frac{1}{\xi}$.

When active (passive) investors design the managerial contract, then $\lambda(\theta) \geq \lambda(0)$ if and only if $\frac{\pi}{\Delta} \geq \Gamma_G$ ($\frac{\pi}{\Delta} \geq \Gamma_G^p$. For $\xi > 1$, we have

$$\Gamma_G^p - \Gamma_G = \frac{\xi - 1}{\xi} - \frac{\xi - 1}{1 + \xi^2} > 0.$$

for $\xi \leq 1$, activism improves transition rate and $\lambda(\theta) \geq \lambda(0)$ regardless of whether active or passive investors design the managerial contract, i.e., $\Gamma_G, \Gamma_G^p \leq 0$.

Third, recall $\Gamma_E = \frac{1}{1+2\xi(1+\xi+\xi^2)}$, while $\Gamma_E^p = 1 - \xi + \sqrt{\xi^2 - 2\xi + 1 + \xi^{-2}}$ for $\xi \geq 1$ and $\Gamma_E^p = 1$ for $\xi < 1$. It is immediate that for $\xi \leq 1$, we have $\Gamma_E^p > \Gamma_E$ for $\xi \geq 1$. Finally, we verify that

$$\Gamma_E^p - \Gamma_E = 1 - \xi + \sqrt{\xi^2 - 2\xi + 1 + \xi^{-2}} - \frac{1}{1 + 2\xi(1 + \xi + \xi^2)}$$

exceeds zero also for $\xi > 1$. We can readily show that $\lim_{\xi \to \infty}(\Gamma_E^p - \Gamma_E) = 0$, but otherwise $\Gamma_E^p - \Gamma_E$ is analytically fairly intractable on the whole domain. Since $\Gamma_E^p - \Gamma_E$ is a function of one variable ξ that does not involve any other model parameters, we use numerical evaluation to assess its sign. To evaluate $\Gamma_E^p - \Gamma_E$ on the whole unbounded domain of ξ in $(1, \infty)$, we use a monotonic increasing function $1 - \frac{1}{\xi}$ to transform the domain to a bounded interval on $(0, 1)$. Figure A.1 shows that $\Gamma_E^p - \Gamma_E$ is monotonically decreasing and positive on the whole domain, confirming the claim that $\Gamma_E^p - \Gamma_E$ is positive for $\xi > 1$.