AMCs as Sectoral Policy Tools: Application to the Green Bond Market

Angela Zha*

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Abstract

This paper assesses how an Asset Management Company (AMC) can act as a sector-targeted policy instrument that intervenes in a specific market where private incentives diverge from social welfare. I apply this to the market for green bonds, where "greenness" is difficult to verify and adverse selection can suppress genuine green bond issuance. In my model, a climate AMC commits to purchase greenwashed bonds from the bank *ex post*, hence changing the bank's problem *ex ante* and lowering the green lending rate in general equilibrium. The AMC imposes penalties on firms caught greenwashing and is funded by household taxes. Calibrating the model to EU data from 2016–2024, I find that the AMC compresses the green lending spread, raises green bond issuance, and reduces greenwashing risk, but the effectiveness depends critically on penalty enforcement intensity. Subject to AMC intervention, welfare increases in consumption-equivalent terms, reflecting the combined gains from lower financing frictions and higher aggregate activity.

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*University of Oxford, Saïd Business School. Email: angela.zha.dphil@said.oxford.edu

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1 Introduction

In 2024, green bonds accounted for only $2.9 trillion of the $145.1 trillion global bond market, despite a decade of efforts to mobilise capital for the climate transition (Demski et al., 2025; SIFMA Research, 2025). If green investment yields large social returns and debt markets are meant to channel capital toward high-return uses, why does green debt remain such a small segment of fixed income markets? One explanation is that the green label is valuable but imperfectly verifiable. In practice, investors and intermediaries must price a bond before they can verify whether its proceeds will finance genuinely environmentally beneficial projects. Greenwashing then pools genuinely green issuers with firms making opportunistic or misleading claims. The result is a classic "lemons" problem: prices reflect expected average quality, raising the cost of capital for genuinely green borrowers and suppressing socially desirable issuance.

This paper studies whether a public balance-sheet instrument can mitigate that distortion. I argue that an asset management company (AMC) is a tractable institutional policy that combines ex post greenwashing risk absorption with centralised enforcement. In the canonical crisis-resolution setting, AMCs are statutory entities that purchase and manage impaired or illiquid assets to alleviate credit risk on bank balance sheets, mitigate fire sales, and restore financial intermediation (Brei et al., 2020; Cerruti & Neyens, 2016; Fernandez et al., 2024). The economic logic, however, extends beyond crisis management. More generally, an AMC is a mandate-driven buyer that can be deployed when private financial contracts fail to internalise a wedge between private returns and social welfare because information frictions or weak enforceability prevent decentralised pricing. I therefore reinterpret the AMC as a *sector-targeted* policy instrument that intervenes in a specific asset market where private financial claims embed socially costly hidden risk.

Climate finance provides a natural application. Climate change poses material risks to financial stability: physical and transition risks raise borrowing costs (Acharya et al., 2022; Boitan & Marchewka-Bartkowiak, 2022; Goldsmith-Pinkham et al., 2023), impair borrower repayability (Capelle-Blancard et al., 2019; Cevik & Jalles, 2022b; D'Orazio, 2025; Hübel, 2022; Naifar, 2023), and weaken bank capitalisation (Jung et al., 2025). At the same time, greenwashing and weak reporting undermine the credibility of green finance (Sangiorgi & Schopohl, 2021; Yu et al., 2020). In green debt markets, "greenness" is costly to verify and imperfectly enforced (Bolton et al., 2023; Curtis et al., 2023), so intermediaries price green-labelled bonds on the basis of expected average quality. This creates adverse selection in the spirit of Akerlof (1978): the more favourable the terms attached to the green label, the stronger the incentive for low-quality borrowers to mimic high-quality ones, and the less informative the label becomes. The underdevelopment of green bond markets may therefore reflect not only limited climate ambition, but an equilibrium failure in credit allocation.

I propose a climate-focused AMC (a *climate AMC*) as a specialised institution that purchases mislabelled (greenwashed) assets from banks ex post The AMC operates through two channels. The first is a *balance-sheet insurance effect*: by committing to purchase greenwashed bonds, the AMC removes residual greenwashing risk from bank balance sheets and changes banks' pricing problem ex ante. Banks no longer need to embed an adverse selection premium in the green lending rate, because the expected loss from holding a mislabelled bond is transferred to the AMC. The second is a *deterrence effect*: as a government-backed institution with statutory enforcement powers, the AMC imposes penalties on detected greenwashers, raising the private cost of mislabelling. These channels interact. Cheaper green-labelled financing strengthens the incentive to greenwash, while stricter penalties offset it. The paper's main results characterise when their combination improves welfare.

A central concern is whether a public buyer that insures intermediaries against ex post greenwashing can improve market functioning. I show that the answer depends critically on enforcement. Above a threshold level of penalties imposed on greenwashers, the balance-sheet insurance effect dominates: the climate AMC lowers green borrowing costs, expands genuine green issuance, and raises welfare. Below that threshold, moral hazard prevails and firms have strengthened incentives to greenwash. Enforcement capacity therefore emerges as a sufficient statistic for the effectiveness of sector-targeted AMC interventions. This delivers the paper's main conceptual contribution: AMCs can act as not just crisis-resolution devices, but also vehicles that complete markets in sectors where eligibility labels matter for pricing, social and private returns diverge, and decentralised verification is too weak to sustain efficient credit allocation.

The paper proceeds in two steps. First, I build a static model inspired by the canonical "market for lemons" model of Akerlof (1978). In my setting, adverse selection can imply that no green assets are issued in equilibrium. The key novelty is the brown firm's endogenous decision to greenwash, driven by the profit differential between truth-telling and mislabelling. Because the bank cannot observe greenwashing, a climate AMC that purchases greenwashed bonds from banks insures them against this risk and lowers the ex ante lending rates they charge. This expands the set of equilibria supporting a green pooling outcome in which all firm types seek green lending.

Next, I embed the same mechanism in a dynamic general equilibrium environment, building on the RBC model of Martin et al. (2026), in which an AMC purchases corporate loans to insure banks against firm default risk. Here, greenwashing is a continuous choice determined by the spread between brown and green bond rates and an enforcement penalty on environmental misconduct. I show that an AMC that buys greenwashed bonds from banks lowers the green borrowing rate, expands green credit, and encourages more firms to become green, while also intensifying greenwashing incentives. I calibrate the model to Euro-area data for 2016–2024 and find that an economy with a climate AMC

achieves better real and financial outcomes. At the deterministic steady state, the AMC compresses the green lending spread by about 330 basis points, increases green bond issuance by 4.4%, reduces greenwashing risk by 32%, and raises total output by 0.54%. A central comparative statics result is that the AMC reduces greenwashing unambiguously only above an enforcement crossover threshold. Below it, the moral hazard effect of cheaper green-labelled borrowing dominates, so the AMC increases mislabelling relative to the no-AMC baseline. Using consumption-equivalent measures, I show that the AMC regime is welfare-improving in the calibrated economy. Conditional on introduction at the deterministic steady state, welfare rises by 2.790%, driven by a narrower adverse selection wedge and lower emissions-related welfare losses from greenwashing.

While I apply the AMC framework to climate finance, the same mechanism extends to settings in which access to cheaper funding relies on imperfect labels or eligibility criteria and misrepresentation is difficult to prevent ex ante, such as energy-efficiency finance, targeted SME lending, and supply-chain compliance. This sector-targeted interpretation differs from proposals for "climate bad banks," which focus on stranded assets and transition risks (Daumas & Salin, 2021; Kedward et al., 2022), and from portfolio-rebalancing approaches that shift brown assets to specialised investors (Fanizza & Cerami, 2023). Instead, I study how a mandate-driven public buyer that absorbs ex post low-quality claims reshapes intermediaries' ex ante pricing, thereby relaxing the adverse selection wedge while introducing a countervailing moral hazard margin. Consistent with the model, the net effect depends on enforcement: complementary policies such as stronger penalties or improved monitoring are required to ensure that the adverse selection correction dominates.

Related literature. This paper sits at the intersection of the AMC literature and the branch of climate finance focused on greenwashing. The crisis-resolution literature characterises AMCs as tools to remove distressed assets from bank balance sheets, mitigate fire sales, and restore credit growth (Brei et al., 2020; Cerruti & Neyens, 2016; Fernandez et al., 2024). Empirically, AMCs reduce NPLs and support lending, especially when paired with public funds (Balgova et al., 2017; Park et al., 2022), while theory emphasises their role in alleviating pecuniary externalities (Martin et al., 2026). I depart from this literature by interpreting the AMC as a *sector-targeted* instrument rather than a general crisis-management tool, and by embedding public ex post risk absorption and enforcement in a calibrated general equilibrium model with endogenous greenwashing.

On the climate side, a large literature documents that physical and transition risks raise yields, increase default risk, and weaken financial stability (Acharya et al., 2022; Boitan & Marchewka-Bartkowiak, 2022; Cevik & Jalles, 2022a, 2022b; Hübel, 2022; Jung et al., 2024; Naifar, 2023). A related strand shows that weak verification undermines the credibility of green labels, with greenwashing raising costs of capital and impairing

firm performance (Attig et al., 2025; Curtis et al., 2023; Ehlers & Packer, 2017; Flammer, 2021; Galletta et al., 2025; Jucá et al., 2024; Peng & Xie, 2024; Shi et al., 2023; Wang et al., 2022). I contribute by modelling greenwashing as an endogenous firm choice, which generates a policy-relevant trade-off between adverse selection and moral hazard.

This paper is also related to the directed technical change literature, which studies how policy shapes clean versus dirty innovation (Acemoglu et al., 2012; Aghion et al., 2016; Fried, 2018; Lemoine, 2024). In contrast, I abstract from technology adoption and focus on firms' *financing regime choice* between green and conventional debt. The key friction is financial rather than real: an adverse selection wedge in green bond pricing driven by unverifiable "greenness."

A growing literature applies lemons-type models to green debt markets. Schmittmann and Gao (2022) and Henide (2021) show how asymmetric information undermines voluntary labelling regimes, while empirical and policy work emphasise disclosure and certification (Martinez, 2025; Pfaff et al., 2023). I complement this approach by introducing an institutional, mandate-driven *ex post* buyer that absorbs low-quality claims and thereby alters intermediaries' *ex ante* pricing. Crucially, the mechanism I study is not the AMC institution per se, but the combination of balance-sheet risk absorption and centralised enforcement.

Finally, my analysis relates to policy proposals that aim to reconcile environmental and financial objectives. Work on SRI funds shows that private mandates can affect portfolio allocation but may have limited real effects (Heath et al., 2023; Oehmke & Opp, 2025). Green Banks mobilise capital at the project level but do not directly alter bank balance-sheet incentives (Lyons & White, 2025; Tandon et al., 2025). Proposals for "climate bad banks" or portfolio rebalancing focus on stranded assets and risk transfer (Daumas & Salin, 2021; Fanizza & Cerami, 2023). The closest institutional neighbours to the climate AMC are public guarantee schemes and centralised auditing authorities. A public guarantee on green bonds would deliver a similar balance-sheet insurance effect, but without the enforcement dimension. A centralised auditing authority could deliver deterrence, but without removing the adverse selection wedge from bank balance sheets. The AMC bundles both functions under a single mandate. The framework therefore identifies the sufficient condition for welfare improvement: balance-sheet insurance combined with enforcement intensity above the crossover threshold. To my knowledge, this is the first paper to embed such an instrument in a calibrated general equilibrium model with endogenous greenwashing and to identify enforcement as the key condition for policy effectiveness.

The remainder of this paper is structured as follows. Section 2 motivates the choice and design of a climate AMC vehicle. Section 3 presents the static model. Section 4 extends the framework to general equilibrium, with numerical results in Section 5. Section 6 discusses welfare implications, and Section 7 concludes.

2 Motivation: Why a Climate AMC?

2.1 The "Lemons" Problem in the Green Bond Market

The green bond market exhibits suboptimal investment due to incomplete internalisation of environmental externalities (Flammer, 2021). Despite efforts to mobilise climate finance, capital allocation remains limited by greenwashing and credibility concerns (Yu et al., 2020). This generates a classic "lemons" problem (Akerlof, 1978): "greenness" is costly to verify, so the green label pools genuinely green and disingenuous claims (Bolton et al., 2023; Curtis et al., 2023). Investors cannot perfectly observe environmental performance ex ante, giving brown firms incentives to mimic green firms (Henide, 2021). Banks therefore price based on expected pool composition, creating an adverse selection wedge that raises borrowing costs for genuinely green issuers. Greenness becomes a noisy signal, increasing risk premia and potentially crowding out high-quality firms.

Standard remedies in the lemons literature include guarantees and reputation building (Akerlof, 1978), intermediaries (Biglaiser & Friedman, 1994), government guarantees (Philippon & Skreta, 2012), and trading restrictions (Fuchs & Skrzypacz, 2015). These mitigate adverse selection but do not ensure type separation. In practice, disclosure frameworks such as the EU Taxonomy and CSRD improve information quality but cannot eliminate misreporting (Liu et al., 2025). Third-party certification affects pricing (Flammer, 2020, 2021; Hyun et al., 2020; Simeth, 2022), but coverage is incomplete due to its voluntary and costly nature, and certifiers face their own incentives (Bouvard & Levy, 2018; Zhu et al., 2024). Moreover, recent evidence suggests certification may not improve environmental outcomes and can induce strategic behaviour (Sun & Hao, 2025). Detailed verification is often prohibitively costly for individual lenders, especially given supply-chain complexity.

Policy alternatives such as public guarantees, interest rate subsidies, or centralised auditing address only part of the problem. A public guarantee provides balance-sheet insurance but lacks an enforcement channel. Interest rate subsidies reduce financing costs but empirically increase greenwashing by subsidising labels rather than outcomes (Liu et al., 2025). A centralised auditor can deter misreporting, but without transferring risk off bank balance sheets, lending rates still reflect expected pool composition. The adverse selection wedge therefore persists as long as labels remain imperfect. The climate AMC addresses both frictions jointly; this bundling, rather than the AMC label itself, constitutes the innovation. The model identifies the sufficient conditions—balance-sheet relief combined with sufficiently strong enforcement—independent of institutional form.

Mandatory, government-enforced oversight provides stronger deterrence. Evidence shows that more climate regulation reduces firms' propensity to greenwash (Mateo-Márquez et al., 2022). This motivates designing the AMC as a government-backed institution with

statutory enforcement powers. The tax evasion literature demonstrates that higher audit probability and penalties deter non-compliance (Advani et al., 2023; Allingham & Sandmo, 1972; Bergolo et al., 2023), suggesting similar effects for environmental enforcement (Henide, 2021).

The AMC also benefits from an information advantage. With access to public data and interministerial resources, it can perform delegated monitoring on behalf of banks. Ex ante, banks assess unverifiable, forward-looking indicators—business plans, projected emissions, and intended use of proceeds—which are easily manipulated. Ex post, verification relies on observable outcomes such as emissions, energy use, and regulatory filings. For example, the EU ETS mandates verified emissions reporting under penalty, allowing cross-referencing of use-of-proceeds disclosures with realised emissions. This shifts verification from intent to outcomes and, through centralisation, spreads fixed monitoring costs across the system.

The green bond market is therefore a natural laboratory: a valuable label because of environmental externalities, combined with noisy verification. Together, these generate an Akerlof-style adverse selection wedge that standard policies address only partially.

2.2 Asset Management Companies: Structure and Logic

An AMC is a specialised, typically public entity that purchases and manages problematic assets from financial institutions. In crisis settings, these include non-performing loans or illiquid claims. By removing such assets from balance sheets, AMCs reduce solvency uncertainty, relax constraints, and prevent fire sales, thereby restoring credit intermediation. Unlike a "bad bank," which is carved out of an existing institution, an AMC is a standalone purchaser operating under a legal mandate, typically funded by government-backed instruments and governed to limit political interference and moral hazard.

Three features are central. First, centralisation enables expertise in valuation, enforcement, and monitoring that would be costly to replicate (Klingebiel, 2000). Second, AMCs are operationally feasible even for narrow asset classes, as illustrated by Ireland's NAMA and Spain's Sareb.[1] Third, a public balance sheet is essential. Private investors would only purchase mislabelled assets at steep discounts, undermining the insurance effect (Beck, 2017; Fanizza & Cerami, 2023). Public backing allows risk pooling across taxpayers and removes the requirement of market returns, enabling compression of the green lending spread rather than mere repricing.

2.3 Existing Climate Finance Proposals and Their Limitations

Recent proposals advocate "climate bad banks" to align finance with climate goals (Giraud & Nicol, 2021; Reynolds, 2025; Tett, 2021; Vaccaro & Barmes, 2021). Fanizza and Cerami

[1] See Appendix A for a list of historical AMCs implemented in practice.

(2023) show that transferring brown assets to green investors can mobilise capital by offloading exposures and expanding investment opportunities. Daumas and Salin (2021) identify key design challenges, including costs, moral hazard, and governance. These proposals target transition risk in existing brown assets—i.e. default risk from future carbon repricing—rather than informational distortions in newly issued green debt. By contrast, if the green label itself is noisy, this raises financing costs for genuinely green firms. This informational friction is the focus of the climate AMC.

2.4 How the Climate AMC Addresses Adverse Selection

The climate AMC addresses informational frictions through two sequential channels. The first is a balance-sheet insurance effect. Rather than purchasing bonds at issuance, the AMC acquires green-labelled bonds later revealed to be mislabelled. By absorbing greenwashing risk ex post, it alters banks' ex ante pricing: the adverse selection wedge is no longer priced into green lending rates, compressing spreads and expanding credit. The second is a deterrence effect. The AMC penalises detected greenwashers, increasing the cost of mislabelling and reducing its equilibrium incidence.[2] These channels interact: cheaper green financing strengthens incentives to greenwash, partially offsetting deterrence. The enforcement crossover threshold defines the minimum penalty at which deterrence dominates; above it, greenwashing falls relative to the no-AMC baseline, while below it, moral hazard dominates.

Three features distinguish the mechanism. First, it is *ex post and state-contingent*: intervention is triggered by verified mislabelling, limiting moral hazard and avoiding unconditional subsidies. Second, it embeds *enforcement power*: as a public institution with access to administrative data, it can conduct delegated monitoring and impose penalties, a channel absent in asset-transfer proposals. Third, it is *publicly backed*: private operation is infeasible without a fiscal backstop (Beck, 2017; Fanizza & Cerami, 2023). Risk pooling across taxpayers allows the AMC to operate at the margin of the market, with fines partially offsetting costs and any residual funded through lump-sum taxation.

The climate AMC is therefore a market-completing institution that absorbs a specific, verifiable informational risk from bank balance sheets, eliminating the need for lending rates to reflect the average quality of a noisy pool. The paper shows that combining ex post risk absorption with sufficiently strong enforcement is sufficient for welfare gains under empirically relevant parameter values.

[2]Many jurisdictions now impose penalties for misleading environmental claims, including fines tied to firm turnover, e.g. in the EU, UK, and Canada (Competition and Markets Authority, 2024; European Commission, 2024; Parliament of Canada, 2024).

3 Static Model

I build on and adapt the "market for lemons" model of Akerlof (1978). The model features two types of firms, a joint bank-household, and an asset management company (AMC). The bank prefers to finance green bonds, and offers a green lending rate that is lower than the conventional lending rate.[3] The share of green firms is s_g while the share of brown firms is $1 - s_g$, and all firms decide whether or not to obtain intratemporal bonds from the bank to fund investment projects. s_g is common knowledge and known to all agents. All firms can label their bond as "green", which enables them to take advantage of the green interest rate offered by the bank. However, investing in green projects incurs fixed costs,[4] so a brown firm prefers to greenwash by labelling its bond as green while using the proceeds to invest in brown projects. I assume that brown firms care only about financial returns and do not have altruistic preferences to be green, so the decision to greenwash is contingent on brown firm profits.[5] For tractability in the static model, which is intended to illustrate how the green bonds market poses a lemons problem, the brown firms' choice is between issuing a green-labelled bond (greenwashing), or not issuing bonds (remaining truthful). In Section 4, I explore the brown firms' decision between issuing a green- versus a brown-labelled bond.

The bank buys bonds from firms and consumes firm output, however there is information asymmetry in the market so that no other private agent observes firm types. Ex ante, the bank charges a higher green interest rate than otherwise given it anticipates greenwashing behaviour.

A climate AMC is a specialised institution that can conduct delegated climate monitoring of the firms, and can identify ex post true firm types. It then buys greenwashed bonds from the bank while keeping genuine green bonds on bank balance sheets. In this way, the AMC removes greenwashing risk from bank balance sheets and encourages banks to keep lending rates low, enhancing green credit extension and encouraging greater financial stability. AMC losses are funded by environmental fines imposed on brown firms.

The AMC's ex post verification advantage reflects a fundamental asymmetry in the timing and nature of the information required. Ex ante, a lending bank must assess environmental quality before a bond is issued and before any production has occurred, by evaluating business plans, projected emissions, certification claims, and intended use of proceeds — all of which are forward-looking, unverifiable, and easily manipulated. The

[3] This reflects findings from the greenium literature that green bonds attract higher prices and lower interest rates (Baker et al., 2018; Caramichael & Rapp, 2024; Ehlers & Packer, 2017; Hachenberg & Schiereck, 2018; Kapraun et al., 2021; Pástor et al., 2025; Zerbib, 2019). Other empirical studies show that banks with green awareness offer cheaper loans to greener firms (Degryse et al., 2023; Demetriades & Politsidis, 2025).

[4] E.g., due to obtaining certification, separate reporting, and management of proceeds as outlined in Hyun et al. (2020).

[5] Hartzmark and Shue (2022) find that brown firms increase emissions as cost of capital rises.

verification problem is compounded by the fact that the bank must assess each borrower independently at scale, without specialised environmental expertise or access to regulatory data. Ex post, the verification problem by the AMC is easier. After production has taken place, actual emissions, energy usage, and environmental outcomes are observable by a government institution wich access to records from environmental and energy ministries, pollution permits, and mandatory emissions registries. Verification shifts from assessing intent to assessing outcomes, which is a fundamentally lower-dimensional problem. A centralised, government-backed AMC can accumulate and share this outcome-based information across the banking system at lower average cost than each individual bank would incur screening borrowers independently, generating economies of scale in environmental monitoring that are unavailable to decentralised private certifiers.

3.1 Bank

The bank extends lending to firms to finance investment projects. I assume that banks have pro-environmental preferences, hence the bank incurs a pecuniary externality proportional to the share of brown firms.[6] Here, I focus on the financial decision when firms seek financing from the bank for the first time, so that relationship lending factors are not at play. The bank sets the green interest rate i_g. Assume bond volumes are 1, because the focus here is on the decision of firms whether to issue a bond or not given the bank's lending rate. The individual rationality (IR) condition of the bank is that its payoff must be no less than its outside option — here, a fixed risk-free interest rate (set exogenously by the government) it can earn on its liquid assets plus a risk premium proportional to the share of brown firms in the economy $\nu(1 - s_g)$:

$$i_g \geq r + \nu(1 - s_g), \quad \nu \in (0, 1) \tag{3.1}$$

Under perfect competition, the bank's IR binds at $r + \nu(1 - s_g)$, ensuring zero profits. The second term $\nu(1 - s_g)$ represents the bank's pecuniary loss due to greenwashing risk, creating a wedge between the risk-free interest rate r and the bank's net rate of repayment on bonds. A higher share of brown firms $1 - s_g$ increases the bank's interest rate wedge due to suspected greenwashing and hence the pooled green borrowing rate, worsening financing conditions for all green-labelled issuers. With no AMC in the market, the bank sets a higher required interest rate than optimal. Thus, information asymmetries create an adverse selection problem.

[6]This follows results from various empirical studies that confirm investors have non-pecuniary sustainability motives (Fatica et al., 2021; Hartzmark & Sussman, 2019; Zerbib, 2019). Interview evidence motivates this by finding that investors often buy green bonds for branding purposes (Maltais & Nykvist, 2020). Empirical analysis further finds that extending green credit boosts bank competitiveness and delivers reputation benefits (Wu, 2025).

3.2 Firms

There are two types of firms, s_g true green firms who could issue truly green bonds, and $1 - s_g$ brown firms who could pretend to be green and issue a green-labelled bond but use the proceeds to invest in brown projects. Both firms could also decide to not issue bonds at all, in which case no trade occurs in the financial market. Let $p \in \{0, 1\}$ be the indicator function for the event that the green firm issues debt to fund investment in clean technologies, i.e., $p = 1$ if the green firm issues bonds and $p = 0$ otherwise. Analogously, the brown firm's decision to issue green-labelled debt takes the discrete values $q = 1$ (greenwashing) or $q = 0$ (honest).[7] A green firm will always prefer to invest in green technologies (given green preferences, investor mandates, or costly switching from green to brown projects), and it does so if the bank offers a lending rate that is low enough so that the green firm at least breaks even. The green firm incurs fixed costs $\kappa > 0$ proportional to the size of bond issuance. This setup echoes that of Oehmke and Opp (2025), in which firms face a choice between a cleaner technology with higher upfront costs and a brown technology requiring lower capital expenditure. If a brown firm greenwashes, it takes advantage of the green borrowing rate i_g and avoids incurring fixed costs κ given it operates brown production. However, it faces detection probability $\psi \in (0, 1)$, and in the event it is caught, it pays a penalty $\chi\psi > 0$ where $\chi > 0$ is the intensity of the greenwashing penalty. The financial penalty arises due to expected regulatory penalties, stranded asset risk, other transition costs, and reputational damage (Cosma et al., 2025; ESMA, 2023; Karpoff et al., 2005). The bank cannot distinguish between the two types of firms and the bonds they are issuing.

Firms can obtain intraperiod bonds of unit 1 from the bank and repay interest at the rate i_g. Without debt financing, the status quo level of income earned by both firms is $\bar{y}$. Given bank lending, the green firm earns y_g while the brown firm earns $y_b > y_g$ (reflecting that brown firms tend to be well-established incumbents with larger size and higher average market capitalisation (Fliegel, 2025)).

The profit of the green firm is:

$$\Pi_g = \begin{cases} y_g - i_g - \kappa & \text{if issue debt} \quad (p = 1) \\ \bar{y} & \text{if no debt} \quad (p = 0) \end{cases} \tag{3.2}$$

The profit of the brown firm is:

$$\Pi_b = \begin{cases} y_b - i_g - \chi\psi & \text{if issue debt} \quad (q = 1) \\ \bar{y} & \text{if no debt} \quad (q = 0) \end{cases} \tag{3.3}$$

[7] For simplicity, in the static model I let the greenwashing choice be a binary variable. In Section 4 I model a continuous greenwashing probability.

The IR conditions of the green and brown firms (so that they can afford to repay the bank at the required rate of return) are, respectively:

$$\text{Green firm:} \quad p = 1 \iff i_g \leq y_g - \bar{y} - \kappa \tag{3.4}$$

$$\text{Brown firm:} \quad q = 1 \iff i_g \leq y_b - \bar{y} - \chi\psi \tag{3.5}$$

Given $y_b > y_g$ and assuming $\kappa > \chi\psi$ (so that the cost of investing in green technologies exceeds the potential penalty paid if a brown firm is caught greenwashing), (3.4) and (3.5) imply that i_g needs to be even lower for the green firm compared to the brown firm for the IR condition to be satisfied. Furthermore, the brown firm's greenwashing decision q is Bernoulli with respect to y_b and $\psi\chi$. If detection probability is lower, the penalty is less stringent, or if greenwashing behaviour leads to a larger profit differential, there exists a larger parameter space where $q = 1$, increasing greenwashing risk.

The economy could end up in one of three potential regions:

No firm seeks bank lending ($p = 0$, $q = 0$) if

$$i_g \geq y_b - \bar{y} - \chi\psi \tag{3.6}$$

All firms (green and brown) seek bank lending ($p = 1$, $q = 1$) if

$$i_g \leq y_g - \bar{y} - \kappa \tag{3.7}$$

Only brown firms seek bank lending ($p = 0$, $q = 1$) if

$$y_g - \bar{y} - \kappa < i_g < y_b - \bar{y} - \chi\psi \tag{3.8}$$

Intuitively, if the bank's reservation rate is too high, the economy ends up in an equilibrium where no firms seeks bond financing because it is too expensive. Due to asymmetric information, the bank cannot distinguish between brown and green firms ex ante, and must charge the same interest rate to all bonds that are labelled as green. If the share of brown firms is too large, banks know it faces a higher probability that the money it lends will be used for brown purposes, which lowers the bank's utility given its intrinsic green preferences. Thus, the bank charges everyone who sells a green debt instrument a higher interest rate. If green firms cannot afford to pay this higher interest rate given additional fixed costs associated with being green and for brown firms the high interest rate defeats any purpose of greenwashing intended to take advantage of the preferential green lending rate, no bank lending is extended and we end up in a lemons situation.

On the other hand, the interest rate charged by the bank could be low enough to induce both types of firms to seek bank financing. This occurs if the share of brown firms in the economy is small, so the bank faces a low risk of lending to a greenwasher firm.

In this case, it charges a low interest rate to everyone, and all firms find it profitable to obtain bank financing for their investment projects.

If the bank sets the interest rate in between the two types of firms' reservation profits, we end up in a separating equilibrium where the green firm finds it unprofitable to obtain bond financing given the fixed costs it faces from investing in green projects, but brown firms find it still profitable to borrow from the bank.

3.3 Asset Management Company (AMC)

Now, suppose there is an AMC in the market that can identify which firms are green versus brown. It buys all greenwashed bonds off bank balance sheets ex post after the greenwashing decision has been observed and before bond repayment from the firms. Genuine green bonds are left in place on the bank's balance sheet. Hence, the bank offloads all greenwashing risk to the AMC, implying it no longer faces a pecuniary loss from greenwashing risk ν, and it can afford to offer a low lending rate given the bank's risk neutral objective function. The firm then faces a lower effective repayment rate on its green bonds.

With an AMC, the bank's IR condition now becomes:

$$i_g^{AMC} \geq r \tag{3.9}$$

Note that the right-hand side of (3.9), r, is smaller in magnitude than the reservation rate the bank requires in the case without an AMC (the right-hand side of (3.1), $r + \nu(1 - s_g)$), given $\nu > 0$ and $s \in (0, 1)$.

Hence, the presence of an AMC lowers the bank lending rate. The existence of an AMC ensures we are more likely to end up in a green pooling equilibrium where banks extend credit to green firms. This works because banks effectively become risk-neutral towards the risk of greenwashing since all risk is 'sold' to the AMC, thus banks become more inclined to expand lending to fund green bonds. For both firms, faced with a reduction in borrowing costs, they demand a greater quantity of bonds, which banks are happy to meet the supply of. Thus, an AMC resolves the supply-demand gap in green asset markets that arise due to greenwashing concerns.

3.4 Subgame Perfect Nash Equilibrium (SPNE)

A strategy profile (i_g^*, p^*, q^*) is a *subgame perfect Nash equilibrium (SPNE)* if:

1. $\forall\ i_g$, each firm's action p^* and q^* respectively maximises its payoff given its type $\theta \in \{g, b\}$;

2. The bank's choice i_g^* maximises its expected profits given the firms' strategies and prior s_g;

3. These strategies are mutual best responses in every subgame.

Given that the only proper subgames begin after the bank sets i_g, I proceed to solve for the SPNE by backward induction.

Firms' best responses. Given $1 + i_g$, firms' borrowing conditions are:

$$\text{Green firm: } p = 1 \iff i_g \leq y_g - \bar{y} - \kappa$$
$$\text{Brown firm: } q = 1 \iff i_g \leq y_b - \bar{y} - \chi\psi$$

Bank's problem (no AMC case). The bank anticipates these responses and chooses i_g subject to its IR condition

$$i_g \geq r + \nu(1 - s_g)$$

Assuming perfect competition, the bank sets the *lowest* rate consistent with zero profits, i.e., $i_g^* = r + \nu(1 - s_g)$. Substituting this into firms' thresholds yields three potential SPNE:

1. No-trade SPNE if $r + \nu(1 - s_g) > y_b - \bar{y} - \chi\psi$: no firm borrows.

2. Separating SPNE if $y_g - \bar{y} - \kappa < r + \nu(1 - s_g) \leq y_b - \bar{y} - \chi\psi$: only brown firms borrow.

3. Pooling SPNE if $r + \nu(1 - s_g) \leq y_g - \bar{y} - \kappa$: both firm types borrow.

Bank's problem (AMC case). With an AMC, the bank can offload greenwashed bonds ex post. Its participation condition becomes

$$i_g^{AMC} \geq r$$

Hence, the AMC lowers the bank's reservation rate such that $i_g^{*AMC} = r$. Then, repeating the backward-induction logic gives:

1. No-trade SPNE if $r > y_b - \bar{y} - \chi\psi$

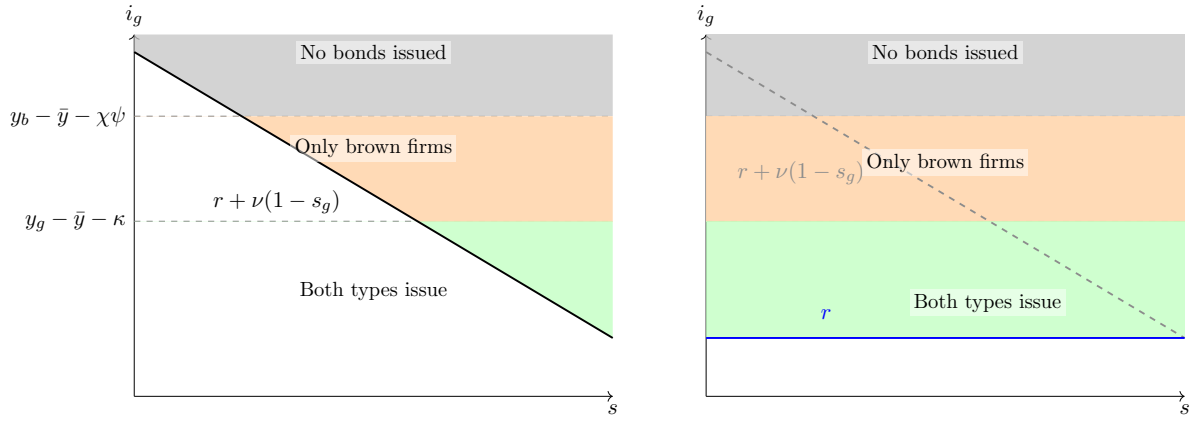
2. Separating SPNE if $y_g - \bar{y} - \kappa < r \leq y_b - \bar{y} - \chi\psi$

3. Pooling SPNE if $r \leq y_g - \bar{y} - \kappa$

Figure 3.1 graphically depicts potential equilibria in the economy under a particular calibration that imposes $r + \nu > y_b - \bar{y} - \chi\psi$ (y-intercept where $s = 0$) and $r < y_g - \bar{y} - \kappa$

(where $s = 1$) using $\psi = 0.1$, $\chi = 5$, and $\nu = 0.03$ (these are the same parameter values I use in my calibration in Section 5). These inequalities are for illustrative purposes; different parameter orderings would yield a different set of thresholds and region boundaries. Panel A shows the case without an AMC and Panel B shows the case with an AMC. Across both panels, the region where $i_g \geq y_b - \bar{y} - \chi\psi$ is shaded in grey, indicating that the interest rate is too high for both types of firms so that trade breaks down altogether. The orange region where $y_g - \bar{y} - \kappa < i_g < y_b - \bar{y} - \chi\psi$ is where the interest rate is too expensive for the genuine green firm but not for the brown firm because the brown firm does not pay fixed costs κ of investing in green projects. The green region where $i_g \leq y_g - \bar{y} - \kappa$ shows the pooling equilibrium where both types of firms are willing to access bank capital. In Panel A, the black downward-sloping line shows the bank's required interest rate i_g: the region above the line is where bank lending to firms is profitable as returns are higher than the bank's outside option $r + \nu(1 - s_g)$, whereas the white region below the black line is where $i_g \leq r + \nu(1 - s_g)$ and the bank is unwilling to extend any credit. In Panel B, the bank's required rate of return from firms is lowered to r given the AMC de-risks the bank's balance sheet. Now, the bank's interest rate schedule does not rely on s_g and becomes horizontal at the point where the black dotted line meets $s = 1$. This institutional mechanism is analogous to a reputational guarantee to counteract adverse selection and to sustain trade in a market plagued by quality uncertainty. This expands the regions in which the bank is willing to lend, and as a consequence enlarges the size of the green region in which both types of firms obtain access to bank funding. While the size of the 'no bonds' and 'only brown firms' regions are also enlarged, the key result here is that an AMC alters bank incentives to invest in green-labelled debt instruments. While moral hazard is not removed in this setup, AMC-style interventions are successful in mobilising greater financial capital toward genuine green activities and in overcoming the slow growth of the green fixed income market that has been held back by greenwashing concerns.

Figure 3.1: Possible equilibria in the economy



(A) No AMC **(B) With AMC**

Notes: Panel (A): parts of the coloured regions that lie above the black reservation curve are shaded to indicate bank is willing to lend; coloured regions indicate where the two types of firms are willing to access bank lending. Panel (B): parts of the coloured regions that lie above the blue reservation curve are shaded to indicate bank is willing to lend; coloured regions indicate where the two types of firms are willing to access bank lending. AMC intervention shifts the reservation curve downward and makes it horizontal, expanding the amount of green lending.

Comparison to Akerlof's lemons problem. Following the logic of Akerlof (1978), the presence of asymmetric information implies that equilibrium may fail to exist. This result is driven by a fixed point in endogenous composition, where the set of goods (and hence average quality) that are sold is itself a function of the offered price because high-quality sellers optimally withdraw when the price does not compensate them for relinquishing their outside option. In Akerlof (1978)'s example, the average quality conditional on trade, moves with price in exactly the direction that erodes willingness-to-pay. This feedback is sufficiently strong such that there exists no price (in the provided range) at which buyers' valuation of the endogenously selected pool meets sellers' supply incentives, so trade unravels even though mutually beneficial trades exist ex ante. The mechanism is a self-confirming degradation of the traded good induced by adverse selection.

In comparison, I embed an intermediated credit market. In this section, the object being priced is not a durable good sold by privately informed owners, but a green-labelled financial claim intermediated by banks. The informational friction enters banks' pricing via a reduced-form expected-loss wedge associated with greenwashing risk. This wedge moves with the primitive s_g and enters the bank's participation constraint as a premium over the benchmark risk-free interest rate. Hence, the equilibrium question is no longer whether the market can find a price that sustains a self-consistent traded quality, but whether firm fundamentals can clear an intermediation constraint that is tightened by green label uncertainty. As a result, pooling trade can exist for a non-trivial set of parameters. In other words, when green firm profits are sufficiently high (or the bank pricing wedge sufficiently small), the competitive pooled interest rate implied by the bank constraint remains compatible with borrowers' participation constraints.

The introduction of a climate AMC further alters these equilibrium dynamics. By committing to purchase greenwashed bonds ex post, the AMC effectively provides a secondary market for low-quality "lemon" assets. This institutional mechanism is analogous to the reputational or guarantee structures proposed by Akerlof (1978) to counteract adverse selection and sustain trade in markets with quality uncertainty.

3.5 Propositions

Proposition 1 (Equilibrium green lending rate)**.** *In the no-AMC economy, the equilibrium green lending rate is*

$$i_g^\star \;=\; r + \nu(1 - s_g)$$

In the AMC economy, the equilibrium green lending rate is

$$i_g^{*AMC} \;=\; r$$

The presence of an AMC lowers the green lending rate and expands the set of parameters supporting a green pooling equilibrium where $p = 1$. This increases green bond issuance at the extensive margin.

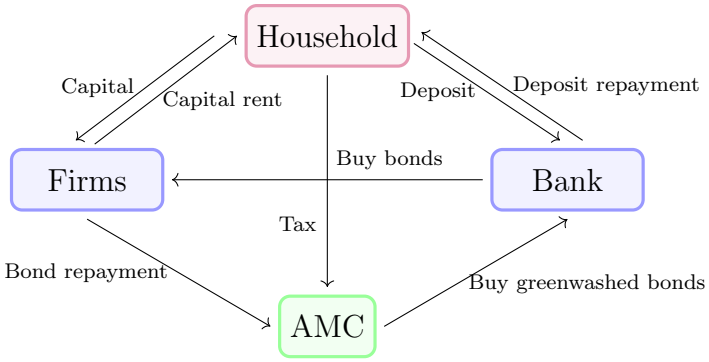
Proof. See Appendix B.

4 General Equilibrium

I extend the previous analysis into a general equilibrium model, building on and adapting the closed economy setup of Martin et al. (2026). The model features discrete time periods and infinite horizons. It includes a representative household, firms, banking sector, and an asset management company (AMC). All firms issue bonds to fund production. In the model, the bank collects deposits from the household and extends credit to firms. A climate AMC is a specialised institution that can observe greenwashing activity. If an AMC exists, it buys greenwashed bonds from the bank, removing greenwashing risk from the bank's balance sheet. The AMC is financed through lump-sum taxes imposed on the household. All agents and their interactions are shown in Figure 4.1.

There are three key distinctions with Section 3: (i) the greenwashing decision q_t is a continuous choice variable that takes values between 0 and 1, (ii) there is a separation between 'light' brown and 'dark' brown firms where light brown firms have the option of switching to green whereas dark brown firms are permanently brown, and (iii) the AMC plays an active role in maximising social welfare subject to its profit equation. It does so by choosing an optimal value for χ_t, given the previous section showed that the enforcement intensity impacts the equilibrium greenwashing decision q_t. Green firms issue green bonds $l_{g,t}$ while brown firms issue brown bonds $l_{b,t}$ and $l_{bb,t}$.

Figure 4.1: Agents in the model economy



Notes: The figure shows agents within the economy. Arrows represent financial flows between agents.

I consider a sequential game to explore the strategic interactions between agents. Different to the static model, the economy is now populated by three types of firms: green, light brown, and dark brown ($\theta \in \{g, b, bb\}$), which captures firm heterogeneity and reflects that not all brown firms have the capacity to transition their financing to the green bond market. A mass $s_b \in (0, 1)$ of *dark brown* firms are technologically locked in to a carbon-intensive production process; their share is fixed and taken as given throughout the analysis, reflecting the difficulty for hard-to-abate sectors to decarbonise and obtain transition finance (Pfaff et al., 2024). The remaining mass $1 - s_b$ consists of firms that are eligible to switch between two financing regimes: issuing green-labelled bonds at rate $i_{g,t}$, or issuing conventional brown bonds at rate $i_{l,t}$. Within this switchable population, let $s_{g,t} \in (0, 1)$ denote the share of *green* firms in period t, so that $1 - s_{g,t}$ is the corresponding share of *light brown* firms.

The shares of each firm type — green, light brown, and dark brown — are common knowledge to all agents. However, the identity of any individual firm approaching the bank for financing is not observable: the bank but cannot verify, at the point of bond issuance, which type a particular borrower belongs to. It observes only the label on the bond. This is the key information friction: a brown firm issuing a green-labelled bond is observationally indistinguishable from a genuine green firm at the point of lending, since both present green-labelled instruments and the bank lacks the environmental monitoring capacity to verify claims at origination. Only the AMC, with its interministerial resources and ex post verification technology, can determine which green-labelled bonds were genuinely issued by green firms and which were mislabelled, and it does so only after production has taken place and environmental outcomes are observable.

4.1 Evolution of green firm share

A key feature of the model is that $s_{g,t}$ evolves endogenously over time, as firms within the switchable population $(1-s_b)$ periodically reassess which financing regime generates higher profits. Following the timing convention of Calvo (1983), in each period a randomly selected fraction $\xi \in (0,1)$ of firms within the switchable population receives the opportunity to reassess their financing regime choice. The remaining fraction $1-\xi$ retains the financing method employed in the previous period. This staggered re-optimisation structure captures the feature that switching financing regimes involves adjustment frictions — regulatory approval lags, certification costs, or organisational restructuring — that prevent all firms from continuously re-optimising at once. The parameter ξ governs the speed of aggregate adjustment.

Firms that receive a re-optimisation opportunity compare the profits available under each financing regime. Following the discrete-choice framework of Brock and Hommes (1997), each reoptimising firm draws an idiosyncratic preference shock $\varepsilon_{\theta,t}$ for each regime $\theta \in \{g, b\}$, independently and identically distributed as a Type-I Extreme Value (Gumbel) random variable with scale parameter $\frac{1}{\phi}$, where $\phi \geq 0$ governs the precision of the financing regime selection. The firm selects the green financing regime if and only if

$$\Pi_{g,t} + \varepsilon_{g,t} > \Pi_{b,t} + \varepsilon_{b,t} \tag{4.1}$$

where $\Pi_{g,t}$ and $\Pi_{b,t}$ denote period-t profits of a representative green and light brown firm within the switchable population. The idiosyncratic shocks capture privately observed factors that affect the net benefit of each financing regime: differences in managerial beliefs about future energy prices, access to green finance, or compatibility of operations with green certification requirements. By the properties of the Type-I Extreme Value distribution (McFadden, 1974), aggregating over the continuum of reoptimising firms via the law of large numbers yields a closed-form logistic switching probability. The fraction of reoptimising firms that select the green financing regime is

$$\lambda_{g,t} = \frac{e^{\phi \Pi_{g,t}}}{e^{\phi \Pi_{g,t}} + e^{\phi \Pi_{b,t}}} \tag{4.2}$$

As $\phi \to 0$, idiosyncratic shocks dominate and firms randomise uniformly between regimes regardless of relative profitability. As $\phi \to \infty$, selection becomes perfectly sharp and all reoptimising firms choose the higher-profit regime. For interior values of ϕ, the model interpolates between these extremes, capturing empirically relevant heterogeneity in firms' responsiveness to profit incentives. Combining the Calvo timing with the logit switching probability, the law of motion for the green firm share within the switchable population is

$$s_{g,t} = (1-\xi) s_{g,t-1} + \xi \lambda_{g,t} \tag{4.3}$$

The first term reflects pure inertia: firms that do not receive a re-optimisation draw retain their existing financing regime. The second term governs the evolution of the adoption frontier. When green financing is more profitable than brown, $\lambda_{g,t} > \frac{1}{2}$ and the green share rises above the baseline set by inertia alone. In steady state, $s_g = \lambda_{g,t}$, so the long-run green share is determined solely by the logistic transform of the steady-state profit differential and does not depend on ξ. The adoption friction affects only transition dynamics, not the long-run composition of the economy. This paper departs from the directed technical change literature (Acemoglu et al., 2012; Fried, 2018; Lemoine, 2024) in modelling the extensive-margin decision of incumbent firms over their *financing regime* rather than their physical production technology. The switching margin here is entirely financial: firms that switch to the green regime bear certification costs κ and accept AMC monitoring, but do not alter their underlying production process, given the focus on the paper is to address the adverse selection problem present in firm greenwashing behaviour.

4.2 Greenwashing risk

Similar to Section 3, green firms always choose to issue green bonds given reputational advantages and alignment with the green preferences of the bank, but face fixed costs $\kappa > 0$ per unit of bond issuance. Light brown firms may engage in greenwashing at endogenous probability q_t, where the firm issues a green-labelled bond but then uses the proceeds to invest in brown projects in order to avoid paying κ. The trade-off is that greenwashing may be detected, and if so, then the greenwashing firm pays a penalty term $\frac{\chi_t}{2}\psi l_{b,t} q_t^2$ from its profits (where $\chi > 0$ captures the extent to which the greenwashing penalty increases with scale given firm bond issuances are no longer of a fixed volume like in Section 3, and the quadratic form ensures an interior solution as well as reflects that larger-scale or frequent greenwashing becomes disproportionately costly). Dark brown firms always greenwash but, being technologically locked in and operating outside the regulatory perimeter of green bond markets, are assumed to face no enforceable penalty; this assumption is maintained throughout the analysis.[8]

The bank has rational expectations and knows the shares $s_{g,t}$ and s_b, but it cannot observe at any point whether the bond it buys is issued by a green or brown firm — specifically, the bank cannot observe the greenwashing decision q_t ex ante. As the period progresses, firm types are revealed to the AMC, who has more information on the environmental performance of each firm's investment and production activities. If there is greenwashing, the AMC buys greenwashed bonds from the bank, keeping the genuine

[8]This reflects the institutional reality that enforcement of green bond standards applies to firms that voluntarily access the labelled green bond market, rather than to firms that make no claim of environmental alignment. Dark brown firms issue green-labelled bonds in the model because the bank cannot distinguish labels from types ex ante, but they are not subject to the same compliance obligations as switchable firms that actively choose the green financing regime.

green bonds on the bank's balance sheet.

The timeline of events and agent decisions at each subgame are presented in Figure 4.2. The deterministic growth rate along the balanced growth path is γ. In describing each agent's problem below I use the following notation:

H: Household

F: Firm

B: Bank

g: Green firm/bond

b: Light brown firm/bond

bb: Dark brown firm/bond

4.3 Household

The household maximises the value of consumption c_t, invests in capital $x_{\theta,t}$ (which is then rented out to firms of each type θ), and deposits savings $d_{H,t}$ in the bank. Investments fund capital that is uniform in terms of quality, the difference between firms arise in the quantity of capital demanded by each firm and the emissions generated in the production process. Deposits generate intraperiod net return of $i_{d,t}$ but their principal is only paid the following period. The household receives a standardised capital rent at net rate $r_{k,t}$ from any firm that engages its capital. The household owns the firms and bank so receives profits from them every period, denoted

$$\Pi_t \equiv \Pi_{F,t} + \Pi_{B,t} \equiv (1 - s_b)\left[s_{g,t}\Pi_{g,t} + (1 - s_{g,t})\Pi_{b,t}\right] + s_b\Pi_{bb,t} + \Pi_{B,t} \tag{4.4}$$

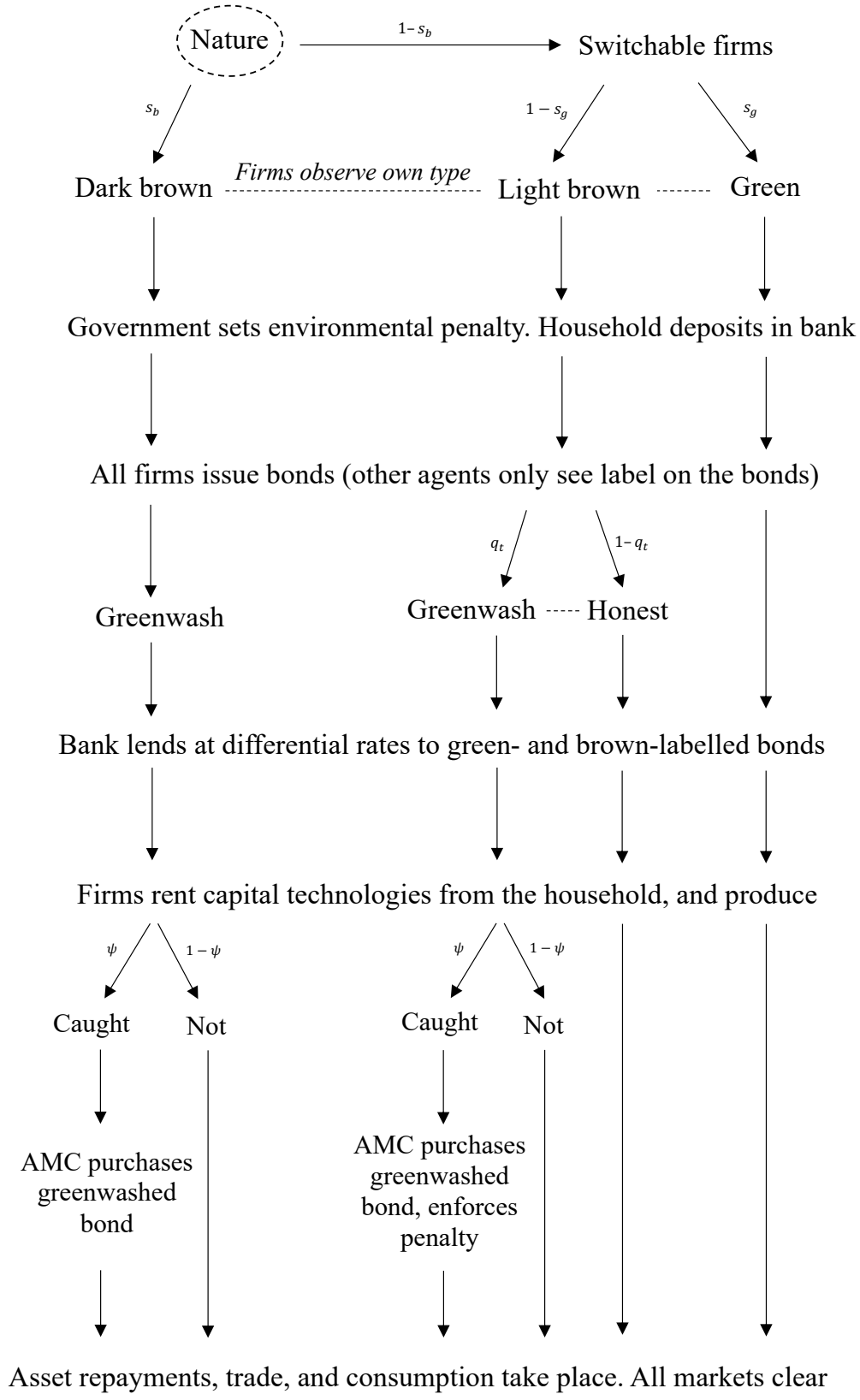
If an AMC exists, the government levies a lump-sum tax on the household to fund AMC losses/expenditure $\Pi_{AMC,t}$.

When renting capital to firms, the household does not observe the greenwashing decision q_t, only the quantity of capital demanded by each firm. Firm-level production decisions and their environmental consequences are revealed to the household ex post following production. Following Golosov et al. (2014), I introduce emissions into the household's utility function directly. Each unit of output produced by a brown firm generates emissions proportional to output, with emission intensity e_θ, where I normalise $e_g = 0$ for green firms and $e_b = e_{bb} = 1$ for brown firms of both types. Total economy-wide emissions in period t are therefore

$$E_t = (1 - s_b)(1 - s_{g,t})y_{b,t} + s_b y_{bb,t} \tag{4.5}$$

Note that greenwashing does not reduce actual emissions: a light brown firm that mislabels its bond still produces brown output and emits at rate $e_b = 1$. This cleanly separates the real externality — emissions from brown production — from the financial externality —

Figure 4.2: Timeline of events in the economy within a given period



Notes: The figure shows the timeline of events in the economy within a given period.

mislabelling risk in bond markets — and provides two distinct policy motivations for the AMC. The household dislikes emissions but cannot act on them directly, as firm production decisions are taken as given. This is the same information structure as in Golosov et al. (2014) and Acemoglu et al. (2012), where households internalise environmental damages in utility but cannot contract on firm-level abatement decisions. Formally, the household chooses consumption c_t to maximise lifetime utility

$$U_H = \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left[\frac{c_t^{1-\sigma}}{1-\sigma} - \omega_e E_t \right], \quad \beta \in (0,1),\ \sigma > 0 \tag{4.6}$$

where $\omega_e > 0$ is the social cost of emissions per unit of brown output. The household's optimality conditions are unchanged relative to a model without emissions, because E_t depends on firms' production decisions which are taken as given by the household in competitive equilibrium. The planner, however, internalises the full welfare cost of emissions and therefore has a genuine reason to care about $s_{g,t}$: a higher green share directly reduces $(1 - s_{g,t})y_{b,t}$ and hence E_t, lowering the social cost of production. This differs from Golosov et al. (2014) and Acemoglu et al. (2012), who focus on optimal carbon taxation and directed R&D subsidies as instruments to internalise emissions.

The household is subject to the flow budget constraint (in real terms)

$$c_t + x_t = r_{k,t} k_{H,t} + \Pi_t + \Pi_{AMC,t} + i_{d,t} d_{H,t} \tag{4.7}$$

Denote the household's respective expected total investment and capital rented to firms of each type in a given period as

$$x_t \equiv (1 - s_b)\left[s_{g,t} x_{g,t} + (1 - s_{g,t}) x_{b,t}\right] + s_b x_{bb,t} \tag{4.8}$$

$$k_{H,t} \equiv (1 - s_b)\left[s_{g,t} k_{g,t} + (1 - s_{g,t}) k_{b,t}\right] + s_b k_{bb,t} \tag{4.9}$$

Capital accumulation follows the equation

$$\gamma k_{H,t+1} = x_t + (1 - \delta) k_{H,t} \tag{4.10}$$

where $\delta \in (0,1)$ is the capital depreciation rate.

The household's optimality conditions are given below.

- Capital Euler equation:

$$\gamma c_t^{-\sigma} = \beta \mathbb{E}_t \left[c_{t+1}^{-\sigma} \left(r_{k,t+1} + 1 - \delta \right) \right] \tag{4.11}$$

- Deposit Euler equation:

$$\gamma c_t^{-\sigma} (1 - i_{d,t}) = \beta \mathbb{E}_t \left[c_{t+1}^{-\sigma} \right] \tag{4.12}$$

4.4 Firms

There are three types of infinitely-lived firms: green ($\theta = g$), light brown ($\theta = b$), and dark brown ($\theta = bb$). Green firms will always choose to issue green bonds given reputational advantages and alignment with green preferences of the bank, but face fixed costs $\kappa > 0$ per unit of bond issuance. Light brown firms may engage in greenwashing at endogenous probability q_t, where the firm issues a green-labelled bond but then uses the proceeds to invest in brown projects in order to avoid paying κ. The trade-off is that greenwashing may be detected, and if so, then the greenwashing firm pays a penalty term $\frac{\chi_t}{2}\psi l_{b,t}q_t^2$ from its profits (where $\chi > 0$ captures the extent to which the greenwashing penalty increases with scale given firm bond issuances are no longer of a fixed volume like in Section 3, and the quadratic form ensures an interior solution as well as reflects that larger-scale or frequent greenwashing becomes disproportionately costly). Dark brown firms always greenwash and face no enforceable penalty. Green firms issue green bonds $l_{g,t}$ while brown firms issue brown bonds $l_{b,t}$ and $l_{bb,t}$. A tilde superscript denotes the label on the bond which may not match the true type of the bond, so that other agents only observe $l_{\tilde{g},t} \equiv (1 - s_b)[s_{g,t}l_{g,t} + (1 - s_{g,t})q_t l_{b,t}] + s_b l_{bb,t}$ or $l_{\tilde{b},t} \equiv (1 - s_b)(1 - s_{g,t})(1 - q_t)l_{b,t}$. The principal on bonds is repaid in the same period and the net interest rate $i_{g,t}$ (on green-labelled bonds) and $i_{l,t}$ (on conventional bonds) is repaid on the outstanding bond value next period.

Each firm produces output using the following decreasing returns to scale production function, taking as input capital rented from the household

$$y_{\theta,t} = a_{\theta,t}k_{\theta,t}^{\alpha} \tag{4.13}$$

where $a_{\theta,t}$ is total factor productivity (TFP) and $\alpha \in (0, 1)$ is factor loading on capital. Following Acemoglu et al. (2012), productivity levels differ between green and brown firms, which reflects differing technological capabilities across firm sizes and industries. TFP evolves according to the autoregressive (AR) process

$$\log a_{\theta,t} = (1 - \rho_a)\log\bar{a}_\theta + \rho_a \log a_{\theta,t-1} + \varepsilon_{a,t} \tag{4.14}$$

The AR coefficient $\rho_a \in [0, 1)$ captures persistence in TPF. $\varepsilon_{a,t}$ are shocks with mean 0 and standard deviation σ_a.

Furthermore, firms face a working capital constraint, where a fraction μ of the cost of capital per period must be financed by debt

$$l_{\theta,t} \geq \mu r_{k,t}k_{\theta,t} \tag{4.15}$$

The profit functions of the firms are respectively:

$$\Pi_{g,t} = y_{g,t} - r_{k,t}k_{g,t} - i_{g,t}l_{g,t} - \kappa l_{g,t} \tag{4.16}$$

$$\Pi_{b,t} = y_{b,t} - r_{k,t}k_{b,t} - [q_t i_{g,t} + (1-q_t)i_{l,t}]l_{b,t} - \frac{\chi_t}{2}\psi l_{b,t}q_t^2 \tag{4.17}$$

$$\Pi_{bb,t} = y_{bb,t} - r_{k,t}k_{bb,t} - i_{g,t}l_{bb,t} \tag{4.18}$$

Combining the working capital constraints (assumed binding in equilibrium) with the profit (4.16) and (4.17) and taking the derivative with respect to capital, the optimality conditions for firms are, respectively:

$$\alpha a_{g,t}k_{g,t}^{\alpha-1} = r_{k,t}[1 + \mu(i_{g,t} + \kappa)] \tag{4.19}$$

$$\alpha a_{b,t}k_{b,t}^{\alpha-1} = r_{k,t}\left\{1 + \mu\left[q_t i_{g,t} + (1-q_t)i_{l,t} + \frac{\chi_t}{2}\psi q_t^2\right]\right\} \tag{4.20}$$

$$\alpha a_{bb,t}k_{bb,t}^{\alpha-1} = r_{k,t}(1 + \mu i_{g,t}) \tag{4.21}$$

The greenwashing optimality condition for the light brown firm, derived from the first-order condition of $\Pi_{b,t}$ with respect to q_t, is

$$q_t = \frac{i_{l,t} - i_{g,t}}{\chi_t \psi} \tag{4.22}$$

where the positive greenium $i_{l,t} > i_{g,t}$ is maintained as a standing assumption, consistent with the calibrated steady state and the empirical evidence on green bond pricing. The probability of greenwashing rises as the interest rate spread between brown and green-labelled securities $i_{l,t} - i_{g,t}$ widens (so that the greenium increases), reflecting the setup in Schmittmann and Gao (2022). q_t also rises as the probability of being caught ψ falls, or the penalty intensity for greenwashing χ_t falls.

4.5 Commercial Bank

The bank plays a critical role in mediating funds between the household and the non-financial sector. Banks are equipped with a technology that allows for the creation of credit using household deposits as input.

At the start of each period, the representative bank receives deposits from the household $d_{B,t}$, observes firm bond issuances $l_{B,\tilde{g},t}$ and $l_{B,\tilde{b},t}$, and then extends credit to firms at interest rates $i_{g,t}$ and $i_{l,t}$ respectively. The principal is paid as the period progresses, while the net interest repayment is collected the subsequent period. Before each period concludes, the bank repays the household with interest on deposits at net rate $i_{d,t}$. The

bank faces lending constraints on its two asset portfolios

$$l_{B,\tilde{g},t} \leq s_{g,t}\eta d_{B,t} \tag{4.23}$$

$$l_{B,\tilde{b},t} \leq (1 - s_{g,t})\eta d_{B,t} \tag{4.24}$$

with $\eta < 1$. Both lending constraints are assumed to bind in equilibrium, so that the cost of deposits is lower than the required return on bonds. Assume the banking sector is perfectly competitive so profits are zero in equilibrium.

While the bank observes $s_{g,t}$ — the share of firms in the switchable population that are genuinely green — it cannot observe q_t, the probability that any given green-labelled bond in the pool was in fact issued by a light brown firm. The bank therefore prices the entire pool of green-labelled bonds based on the expected composition of that pool, which depends on $s_{g,t}$ but not on q_t directly. This is the adverse selection wedge at the heart of the model. The bank's sensitivity to potential greenwashing ν scales with the total volume of green-labelled bonds on its balance sheet, $l_{\tilde{g},t}$, since it is precisely this pool that contains the hidden mislabelling risk. Formally, the profit function of the bank is given by

$$\Pi_{B,t} = i_{g,t}l_{B,\tilde{g},t} + i_{l,t}l_{B,\tilde{b},t} - i_{d,t}d_{B,t} - \nu(1 - s_{g,t})l_{B,\tilde{g},t} \tag{4.25}$$

where $\nu > 0$ is a sensitivity parameter that shows how the bank's payoff declines with its suspicion that the green-labelled bond is issued by a brown firm and thus will be subject to greenwashing risk. One interpretation is that the bank is owned by the household, who faces a utility loss that scales with the level of aggregate emissions. Alternatively, the bank's sensitivity with respect to potential greenwashing can also be motivated financially; e.g. Cosma et al. (2025) show that environmental controversies are associated with higher default risk which reduces bank profits. The term $\nu(1 - s_{g,t})$ captures the bank's expected loss per unit of green-labelled lending: a fraction $1 - s_{g,t}$ of the green-labelled pool originates from the light brown population, and the bank prices this risk even though it cannot identify which individual bonds are mislabelled.

Substituting the binding lending constraints into the profit function yields

$$\Pi_{B,t} = [i_{g,t}s_{g,t} + i_{l,t}(1 - s_{g,t}) - \nu(1 - s_{g,t})s_{g,t}]\eta d_{B,t} - i_{d,t}d_{B,t} \tag{4.26}$$

Taking first order conditions with respect to deposits $d_{B,t}$, the bank's optimal lending schedule is given by

$$i_{g,t} = \frac{\frac{1}{\eta}i_{d,t} + \nu(1 - s_{g,t})s_{g,t} - i_{l,t}(1 - s_{g,t})}{s_{g,t}} \tag{4.27}$$

This shows the positive relationship between the lending rate and the deposit rate as

well as the wedge introduced by the bank's preference for green lending arising from its sensitivity to potential greenwashing.

4.6 Asset Management Company (AMC)

The AMC has resources to conduct environmental monitoring on behalf of the banking sector, and can detect ex post which firms are green and which are brown — specifically, it can observe the realised greenwashing decision q_t after production has taken place. If greenwashing occurs, it buys the portion of green-labelled bonds from banks that turn out to be issued by brown firms, by essentially paying ν per unit of greenwashing exposure. Then, the bank offloads all greenwashing risk to the AMC, such that it no longer faces the pecuniary cost of holding greenwashed bonds. This transaction is equivalent to AMCs subsidising the green credit market. Any light brown firm that is detected to engage in greenwashing pays a penalty directly to the AMC. The net expenditure of the AMC is financed by tax revenue raised from the household.

The bank chooses credit extension to maximise its adjusted profit equation

$$\Pi_{B,t} = i_{g,t} l_{B,\tilde{g},t} + i_{l,t} l_{B,\tilde{b},t} - i_{d,t} d_{B,t} \tag{4.28}$$

Hence the bank's new lending schedule is

$$i_{g,t}^{\text{AMC}} = \frac{\frac{1}{\eta} i_{d,t} - i_{l,t}(1 - s_{g,t})}{s_{g,t}} \tag{4.29}$$

$i_{d,t}$ is pinned down by the household's Euler equation for deposits, η is a parameter, and $s_{g,t}$ evolves endogenously via (4.3). Hence, the presence of an AMC lowers the lending rate such that $i_{g,t}^{\text{AMC}} < i_{g,t}^{\text{Baseline}}$. In other words, given the bank can offload all greenwashing risk to the AMC, it becomes risk-neutral with regard to greenwashing, and this induces it to reduce the interest rate required for firms.

Facing a lower repayment rate ex ante, this alleviates credit frictions in the green asset market on the extensive margin and makes a green pooling equilibrium more likely to occur, mitigating the lemons problem created by adverse selection. Furthermore, if the threat of environmental penalties on greenwashing is credible and severe enough, the AMC could reduce the risk of firms mislabelling their debt.

The AMC acts as a social planner and, in each period, myopically maximises household utility less costs, taking prices and quantities as given.[9] In doing so, it internalises the emissions externality that the household faces but cannot act upon in competitive equilibrium — households dislike emissions from brown production but cannot contract

[9]The per-period formulation reflects an institutional design in which the AMC adjusts its enforcement penalty χ_t based on current-period conditions, subject to an adjustment cost that penalises large discrete changes.

on firm-level greenwashing decisions. The AMC can act on this externality indirectly by choosing χ_t: a higher penalty deters greenwashing, lowers $i_{g,t}$, raises $s_{g,t}$ via (4.3), and reduces total emissions E_t. The planner chooses χ_t to maximise its objective

$$\frac{c_t^{1-\sigma}}{1-\sigma} - \omega_e E_t - \frac{\omega_\chi}{2}(\chi_t - \chi_{t-1})^2 \tag{4.30}$$

where $\omega_e > 0$ is the weight placed on the social cost of emissions shared with the household's utility function, and $\omega_\chi > 0$ captures sluggishness in adjusting the regulatory framework due to operating and political costs.

The profit (loss) of the AMC is given by

$$\Pi_{AMC,t} = -\nu(1 - s_{g,t}) l_{B,\tilde{g},t} + (1 - s_{g,t}) s_b \frac{\chi_t}{2} \psi l_{b,t} q_t^2 \tag{4.31}$$

Hence, the AMC internalises the pecuniary greenwashing loss to the bank by transferring greenwashed bonds onto its own balance sheet (where it receives repayment from firms and pays the bank the same monetary amount as the bond repayment), and it also receives the penalty levied from greenwashing light brown firms who are caught. Dark brown firms, consistent with the assumption above, contribute to AMC bond purchases but not to penalty revenue. If the AMC is in a net loss, this is transferred to households via lump-sum taxes.

4.7 Market Clearing and Competitive Equilibrium

Let the aggregate state vector be $\Omega_t = (k_{H,t}, s_{g,t}, s_b, a_{g,t}, a_{b,t}, a_{bb,t})$ and let prices be $\mathcal{P}_t = (r_{k,t}, i_{d,t}, i_{g,t}, i_{l,t})$.

A *competitive equilibrium* is a sequence of allocations $\{c_t, x_t, k_{H,t+1}, d_{B,t}, k_{\theta,t}, l_{\theta,t}, q_t\}_{t=0}^{\infty}$ for $\theta \in \{g, b, bb\}$, together with a sequence of prices $\{r_{k,t}, i_{d,t}, i_{g,t}, i_{l,t}\}_{t=0}^{\infty}$, such that, given initial conditions, stochastic processes for $\{a_{\theta,t}\}$ and the law of motion for $s_{g,t}$, we have the following:

1. Given prices, the representative household solves

$$\max_{\{c_t, x_t, k_{H,t+1}, d_{H,t}\}} \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left[\frac{c_t^{1-\sigma}}{1-\sigma} - \omega_e E_t \right]$$

subject to

$$c_t + x_t = r_{k,t} k_{H,t} + \Pi_t + i_{d,t} d_{H,t}$$

$$\gamma k_{H,t+1} = x_t + (1 - \delta) k_{H,t}$$

2. For each firm type $\theta \in \{g, b, bb\}$, given prices:

Green firms maximise profits by solving

$$\max_{\{k_{g,t},l_{g,t}\}} \Pi_{g,t} = a_{g,t}k_{g,t}^{\alpha} - r_{k,t}k_{g,t} - (i_{g,t} + \kappa)l_{g,t}$$

subject to $\mu r_{k,t}k_{g,t} \leq l_{g,t}$.

Light brown firms maximise profits by solving

$$\max_{\{k_{b,t},l_{b,t},q_t\}} \Pi_{b,t} = a_{b,t}k_{b,t}^{\alpha} - r_{k,t}k_{b,t} - [q_t i_{g,t} + (1-q_t)i_{l,t}]l_{b,t} - \frac{\chi_t}{2}\psi l_{b,t}q_t^2$$

subject to $\mu r_{k,t}k_{b,t} \leq l_{b,t}$.

Dark brown firms maximise profits by solving

$$\max_{\{k_{bb,t},l_{bb,t}\}} \Pi_{bb,t} = a_{bb,t}k_{bb,t}^{\alpha} - r_{k,t}k_{bb,t} - i_{g,t}l_{bb,t}$$

subject to $\mu r_{k,t}k_{bb,t} \leq l_{bb,t}$.

3. The commercial bank maximises profits by solving

$$\max_{\{l_{B,\tilde{g},t},l_{B,\tilde{b},t},d_{B,t}\}} \Pi_{B,t} = i_{g,t}l_{B,\tilde{g},t} + i_{l,t}l_{B,\tilde{b},t} - i_{d,t}d_{B,t} - \nu(1-s_{g,t})l_{B,\tilde{g},t}$$

subject to

$$l_{B,\tilde{g},t} \leq s_{g,t}\eta d_{B,t}, \quad l_{B,\tilde{b},t} \leq (1-s_{g,t})\eta d_{B,t}$$

and zero profit under perfect competition.

4. The AMC chooses enforcement penalty to maximise social welfare

$$\max_{\{\chi_t\}} \frac{c_t^{1-\sigma}}{1-\sigma} - \omega_e E_t - \frac{\omega_\chi}{2}(\chi_t - \chi_{t-1})^2$$

subject to

$$\Pi_{AMC,t} = -\nu(1-s_{g,t})l_{B,\tilde{g},t} + (1-s_{g,t})s_b\frac{\chi_t}{2}\psi l_{b,t}q_t^2$$

5. All markets clear:

Capital:

$$k_{H,t} = (1-s_b)\left[s_{g,t}k_{g,t} + (1-s_{g,t})k_{b,t}\right] + s_b k_{bb,t}$$

Deposits:

$$d_{H,t} = d_{B,t}$$

Bonds:

$$l_{\tilde{g},t} = (1-s_b)[s_{g,t}l_{g,t} + (1-s_{g,t})q_t l_{b,t}] + s_b l_{bb,t}$$

$$l_{\tilde{b},t} = (1 - s_b)(1 - s_{g,t})(1 - q_t)l_{b,t}$$

Goods:

$$y_t = c_t + x_t$$

4.8 Propositions

This section establishes propositions of the general equilibrium model. Proofs are relegated to the Appendix.

Proposition 2 (Green Lending Rate)**.** *In any competitive equilibrium with an active green bond market, the presence of an AMC strictly lowers the equilibrium green lending rate:*

$$i_{g,t}^{*\,\text{AMC}} < i_{g,t}^{*\,\text{Baseline}}$$

This result holds for all admissible values of $s_{g,t} \in (0, 1)$*,* $i_{d,t} > 0$*, and* $i_{l,t} > 0$*.*

Proposition 3 (Positive Equilibrium Greenwashing)**.** *In any competitive equilibrium in which the green bond market is active, the light brown firm's optimal greenwashing intensity satisfies* $q_t > 0$ *whenever* $i_{l,t} > i_{g,t}$*,* $\chi_t > 0$*, and* $\psi \in (0, 1)$*. Furthermore,* q_t^* *is strictly increasing in the greenium* $i_{l,t} - i_{g,t}$ *and strictly decreasing in both enforcement intensity* χ_t *and detection probability* ψ*.*

A central modelling assumption is that the AMC can identify greenwashing ex post with positive probability after production has taken place. The present model does not require perfect detection. plausibility of the monitoring technology deserves scrutiny. First, the model assumes the AMC purchases only bonds it identifies to be greenwashed. While this is costly and time-consuming to achieve in practice, greenwashing in the form of proceeds misallocation (which Shi et al. (2023) and Curtis et al. (2023) document empirically as the primary mechanism through which green bond issuers underdeliver on environmental commitments) can be verifiable given a comparison of disclosed use-of-proceeds against actual capital expenditure records and production data. Second, it is possible that the AMC mistakenly classifies a genuinely green bond as greenwashed, in which case the balance-sheet insurance effect is diluted because the bank retains residual uncertainty about whether its genuine green bonds will also be purchased. However, if the probability of a false positive is small relative to the probability of detecting genuine greenwashing, the qualitative results of the Propositions survive. A full treatment of monitoring error is left for future work, but this paper's core result establishes that the AMC's institutional advantage lies in reducing greenwashing risk relative to what a decentralised bank could achieve through ex ante screening, by concentrating verification in an entity with access to outcome-based environmental data.

5 Quantitative Analysis

In this section, I solve the model numerically using calibrated values and simulated responses to a productivity shock under the no-AMC and AMC regimes.

5.1 Calibration

Table 5.1: Baseline Parameter Values

Parameter	Description	Value	Source / Reason
β	Discount factor	0.98	Calibrated to match target deposit rate
σ	CRRA risk aversion	2	Standard RBC parameter value
α	Capital share	0.33	King and Rebelo (1999)
δ	Capital depreciation	0.025	King and Rebelo (1999)
ρ_a	Persistence of TFP shock	0.979	King and Rebelo (1999)
$\bar{a}_g$	Steady state TFP of green firm	1	Normalisation
$\bar{a}_b$	Steady state TFP of light brown firms	1.05	Higher than $\bar{a}_g$ following Acemoglu et al. (2012)
$\bar{a}_{bb}$	Steady state TFP of dark brown firms	0.97	Lower than $\bar{a}_b$, reflecting locked-in inefficiency
σ_a	Volatility of TFP shock	0.01	King and Rebelo (1999)
ψ	Probability of greenwashing detected	0.10	Conservative; lower than Leung et al. (2022)
η	Bank loan-to-deposit ratio	0.62	Martin et al. (2026)
ν	Bank greenwashing risk wedge	0.06	European Banking Authority et al. (2024)
μ	Firm working capital constraint	0.90	Martin et al. (2026)
κ	Cost of green certification	0.000514	CBI (2025); White (2002)
s_b	Share of dark brown (locked-in) firms	0.02	Hard-to-abate sectors (Pfaff et al., 2024)
ϕ	Logit precision	2	Sensitivity of regime switching to profit differential
ξ	Calvo reoptimisation probability	0.10	Implies average financing regime duration of 10 quarters
i_l	Interest rate on brown bonds	0.06	Upper range of EU high yield index; FRED (2025)
γ	Deterministic (gross) growth rate	1.0042	World Bank (2025)
ω_e	Welfare weight on emissions	3.5	Calibrated to match reduction in q under AMC
ω_χ	Cost of adjusting greenwashing penalty	0.001	Reflects modest regulatory adjustment costs

Notes: Parameter values are in quarterly terms.

I obtain green bonds data from the Luxembourg Green Exchange (LGX) — the world's first dedicated exchange for green bonds listing and trading. As of 2024, LGX covered almost the entire universe of listed sustainable debt instruments (Hamon, 2024). Given its data starts from 2016, calibration for my model is based on data between 2016–2024. Given my empirical analysis examined the effect of the ECB's CSPP, here I calibrate the model to European data.

Table 5.1 reports the baseline parameter values. The coefficient of relative risk aversion σ follows standard values in the RBC literature (e.g., Kydland & Prescott, 1982). The quarterly growth rate is set to 0.42%, consistent with an average annual Euro-area growth rate of approximately 1.695% (World Bank, 2025). Combined with a discount factor of $\beta = 0.98$, this generates a quarterly deposit rate of $i_d \approx 2.4\%$, which matches the overnight bank deposit rate from households in the EU (European Central Bank [ECB], 2026). In line with standard macroeconomic models (e.g., King & Rebelo, 1999), I set $\alpha = 0.33$ and $\delta = 0.025$, implying an annual capital depreciation rate of 10%. Brown firms are assumed to be more productive in transforming capital into output than green firms, following Acemoglu et al. (2012), and I let light brown firms — larger and more mature incumbents — exhibit higher TFP than dark brown firms. Autoregressive coefficients on TFP are set

at $\rho_a = 0.979$, consistent with King and Rebelo (1999). The working capital parameter μ and the bank leverage constraint parameter η are chosen following Martin et al. (2026).

The greenwashing risk wedge $\nu = 0.06$ is calibrated using the bank loss rate under the baseline transition-risk scenario from the Euro-area's "Fit-For-55" climate stress test (European Banking Authority et al., 2024). For tractability, I fix the brown lending rate at $i_l = 6\%$, matching the upper range of returns on the Euro high yield corporate bond index over the calibration period (Federal Reserve Bank of St. Louis [FRED], 2025), so that movements in i_g directly reflect changes in the spread between brown and green bonds.

The Calvo reoptimisation probability $\xi = 0.10$ implies an average financing regime duration of ten quarters, capturing the adjustment frictions discussed in Section 4 on financing regime choice. This is consistent with empirical evidence on the pace of corporate financing adjustments: Flannery and Rangan (2006) estimate annual capital structure adjustment speeds of approximately 34.4% (10% quarterly), and Faulkender et al. (2012) find annual adjustment speeds of 29.8–56.4% (8.47–18.74% quarterly) depending on firm leverage. The logit precision parameter $\phi = 2$ generates empirically plausible sensitivity of regime switching to profit differentials: firms respond to relative financing costs but not perfectly. The dark brown firm share is set to $s_b = 0.02$, representing the fraction of firms structurally locked out of clean production due to sector, scale, or liquidity constraints. This is consistent with evidence that firms in hard-to-abate sectors — steel, cement, chemicals, and extractives — account for approximately 2% of green and sustainability bond issuers (Pfaff et al., 2024).

The certification cost κ is set to 5.14 basis points (bps), based on the Climate Bond Initiative (CBI)'s variable certification fee of 0.1 bp of bond value (CBI, 2025), augmented by an additional 3–5 bps for external green assessment (White, 2002). In terms of the detection probability ψ, Leung et al. (2022) find that approximately one-third of green bond issuers exhibit deteriorating environmental performance following issuance. I set ψ at the lower value of 0.1 to reflect the difficulty in detecting if greenwashing took place and the associated costs.

The welfare weight on emissions ω_e is not mapped directly to the social cost of carbon, because the focus of this paper is on the financial market friction — the adverse selection wedge in green bond pricing generated by greenwashing — rather than on the real-economy externality of brown production. Hence, I calibrate ω_e as a reduced-form welfare weight anchored directly to empirical evidence on greenwashing incidence, treating it as a parameter that governs how strongly the planner values reductions in q. The empirical anchor is Leung et al. (2022), who find that comprehensive environmental disclosure requirements reduce the likelihood of greenwashing by approximately 21 pp, providing a lower bound on the deterrence achievable through centralised enforcement. I use this to discipline ω_e, targeting an approximate 30% reduction in greenwashing risk

in the AMC case. The regulatory adjustment cost $\omega_\chi = 0.001$ reflects that the political and operational costs of tightening the enforcement penalty are modest but non-trivial, consistent with the institutional costs of regulatory reform documented in the AMC governance literature (Klingebiel, 2000).

5.2 Results

I compare two scenarios: a baseline economy without an AMC and one with an operational AMC. The steady states of both regimes are displayed in Table 5.2. The introduction of an AMC induces systematic changes across real, financial, and distributional variables.

Steady state. The most immediate effect operates through the green lending rate. In the no-AMC column, $i_g = 4.4\%$, reflecting the bank's required compensation for greenwashing exposure embedded in the adverse selection wedge $\nu(1 - s_g)$. Under the AMC, i_g falls to 1.1% — a compression of approximately 330 basis points — as the bank offloads greenwashing risk ex post and no longer prices the adverse selection premium into its lending schedule. This compression is the central transmission channel in general equilibrium.

The decline in i_g relaxes the working capital constraint for all green-labelled bond issuers. For green firms, whose effective marginal cost of capital is $r_k[1 + \mu(i_g + \kappa)]$, the fall in i_g directly reduces the cost of capital. Consequently, green firm capital demand rises from $k_g = 15.910$ to 16.615, and green bond issuance increases from $l_g = 0.712$ to 0.743 — a 4.4% gain. Green firm profits rise from 1.670 to 1.694, reflecting higher scale of production at lower financing cost, though the increase is moderated by proportionally higher certification costs κ.

The price effect also benefits dark brown firms, who always issue green-labelled bonds and mechanically gain from the lower i_g. Dark brown capital increases from 15.213 to 15.888, and dark brown bond issuance rises from 0.680 to 0.711. Light brown firms face a more nuanced trade-off. Although the fall in i_g widens the greenium $i_l - i_g$ and would, ceteris paribus, strengthen the incentive to greenwash, the AMC simultaneously sets an optimal enforcement intensity $\chi^* \approx 4.509$. Through the greenwashing optimality condition $q = \frac{i_l - i_g}{\chi\psi}$, the rise in χ more than offsets the mechanical greenium effect: greenwashing falls from $q = 0.159$ in the no-AMC baseline to $q = 0.109$ under the AMC, a 32% reduction. The AMC therefore resolves the adverse selection distortion on the intensive margin even as it expands credit on the extensive margin. Light brown firm profits remain virtually unchanged across regimes at 1.786: the gains from cheaper green-labelled borrowing are offset by the expected penalty payments under the optimal χ^*.

The green firm share rises from $s_g = 0.414$ to 0.431, as lower financing costs under the AMC shift the profit differential in favour of the green financing regime, inducing a share

of reoptimising firms to switch. The effect on s_g is limited by the Calvo friction ξ, hence the majority of firms retain their existing regime in any given period.

The expansion in firm-level capital translates into higher aggregate investment and output. Investment rises from 0.479 to 0.488 and output from 2.589 to 2.603, a 0.54% increase. Both gains are modest, reflecting the relatively small size of the green bond market in the calibration and the numerical dominance of dark brown and light brown firm types. With an AMC, there is a net improvement in allocative efficiency as capital is reallocated toward projects that were previously marginal due to financing frictions rather than low productivity.

On the liability side of the banking sector, deposits rise from 1.184 to 1.206. The deposit rate and return on capital remain unchanged at 2.4% and 5.0% respectively, so the general equilibrium adjustment operates entirely through quantities rather than through prices on the household side. Bank profits remain at zero in both regimes under perfect competition. The AMC records a steady state loss of approximately -0.012, financed via lump-sum taxes on the household.

Household consumption increases from 2.100 to 2.104, a 0.19% rise. The muted response reflects the fiscal incidence of AMC operations: higher firm dividends and expanded economic activity raise household income, but these gains are partially offset by the tax burden from AMC financing. The net effect on consumption is modest relative to the movements in financial variables, consistent with the AMC operating primarily as a market-completing institution rather than a direct transfer mechanism.

Taken together, the steady state comparison confirms that the AMC operates through a balance-sheet channel that compresses the green lending spread, expands credit, and disciplines greenwashing through endogenous enforcement penalties. The primary distortion in the baseline is the adverse selection wedge embedded in i_g; removing this wedge yields meaningful real and financial effects even after accounting for enforcement costs and general equilibrium feedbacks.

Impulse response functions. Figure 5.1 reports impulse responses to a one-standard-deviation positive TFP shock in the competitive equilibrium without an AMC (dashed blue line) and under the AMC regime (solid red line). All variables are expressed as percentage deviations from their respective steady states. Across both regimes, the productivity shock generates standard RBC dynamics. Output and investment rise sharply on impact — output peaks at approximately 1.00% above steady state around quarter 10, and investment spikes by over 2.5% on impact — as the marginal product of capital increases. Consumption responds in a characteristic hump-shaped manner, peaking near quarter 20 as households smooth the income gain over time, before reverting smoothly to steady state. As productivity gradually reverts, capital accumulation sustains elevated output before the economy converges. The impulse

Table 5.2: Steady State Values of Model Economy

Variable	Description	No AMC	AMC
c	Consumption	2.100	2.104
x	Investment	0.479	0.488
y	Output	2.589	2.603
d	Deposits	1.184	1.206
k_g	Green firm capital	15.910	16.615
k_b	Light brown firm capital	16.804	16.834
k_{bb}	Dark brown firm capital	15.213	15.888
l_g	Green firm bonds	0.712	0.743
l_b	Light brown firm bonds	0.752	0.753
l_{bb}	Dark brown firm bonds	0.680	0.711
i_d	Deposit interest rate	0.024	0.024
i_g	Green lending rate	0.044	0.011
r_k	Return on capital	0.050	0.050
s_g	Green firm share	0.414	0.431
q	Greenwashing probability	0.159	0.109
χ	Intensity of greenwashing penalty	—	4.509
Π_g	Green firm profit	1.670	1.694
Π_b	Light brown firm profit	1.786	1.786
Π_{bb}	Dark brown firm profit	1.596	1.619
Π_{Bank}	Bank profit	0.000	0.000
Π_{AMC}	AMC profit (loss)	—	−0.012

Notes: The table compares steady state values between the no-AMC baseline case and the AMC case of the general equilibrium model.

responses for c, y, x, k, l_b, and l_{bb} are nearly identical across regimes, with the two lines tracking close to each other. This is consistent with the modest steady state differences in real variables documented in Table 5.2, where the AMC operates primarily through the financial channel. The response of l_g exhibits a small but visible divergence, with the AMC regime generating slightly higher green bond issuance throughout the horizon, reflecting the persistently lower baseline financing cost for green firms.

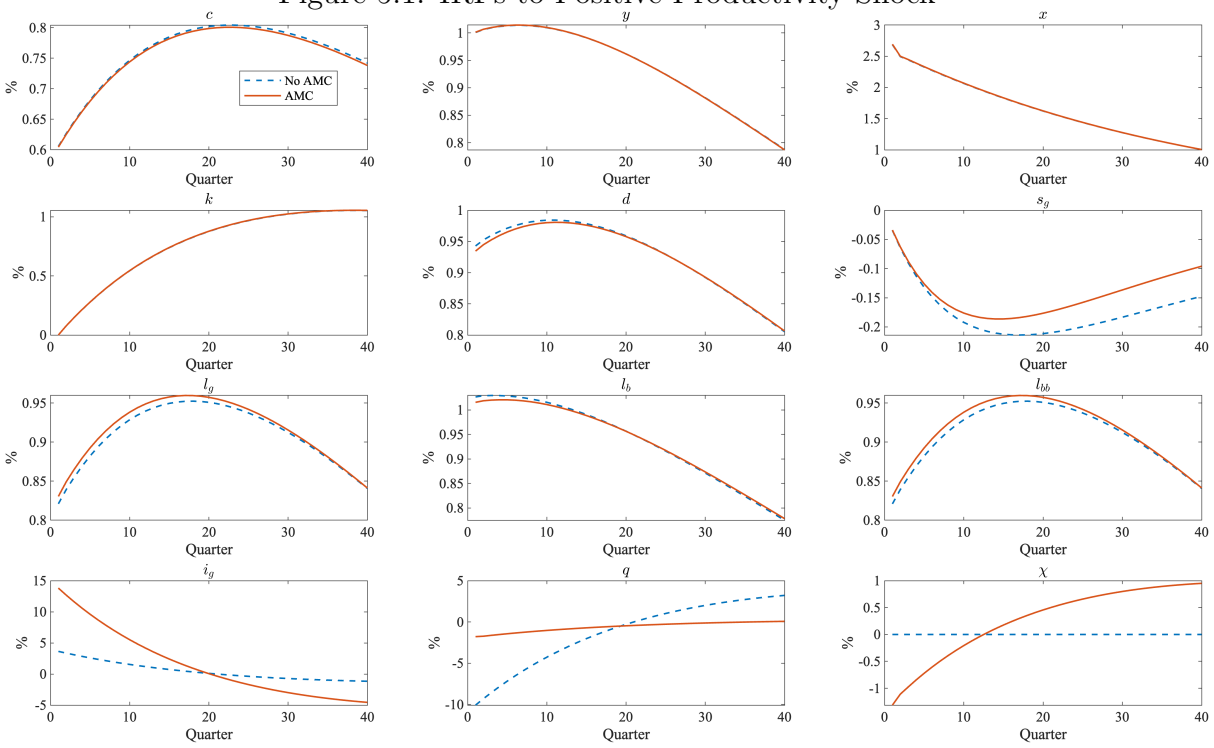
The most visible differences between regimes appear in the financial variables in Figure 5.1. The green firm share s_g falls under both regimes following the productivity shock, reflecting that higher TFP raises brown firm profitability proportionally more than green firm profitability through the scale effect, thereby compressing the profit differential that drives switching. The no-AMC regime exhibits a deeper and more prolonged decline: s_g troughs at approximately -0.20% around quarter 15 before beginning a slow recovery. Under the AMC regime, the decline is shallower — troughing at approximately -0.15% — because the AMC's persistent downward pressure on i_g partially offsets the erosion of the green financing advantage by keeping the cost of the green financing regime relatively low even during the boom. Both regimes follow a broadly similar recovery path thereafter, though the AMC regime converges from above by the end of the 40-quarter horizon. This

dynamic reflects the interaction between Calvo staggering — which limits the speed at which any advantage in regime profitability can be exploited — and the AMC's financial stabilising effect.

The green lending rate i_g rises sharply on impact under the AMC regime by approximately 13% above its steady state, compared with approximately 3% in the no-AMC case. This pronounced asymmetry arises mechanically: the AMC steady state features a substantially lower i_g (1.1% versus 4.4%), so the same absolute increase in financing demand following the productivity shock represents a far larger percentage deviation from the AMC baseline. As capital accumulates and the marginal product of capital falls back toward steady state, i_g declines in both regimes and eventually undershoots, reflecting the amplified credit response as the productivity gain lifts collateral values and eases the working capital constraint. The AMC case exhibits a substantially deeper undershoot, falling to approximately -5% below its steady state by quarter 40 compared with approximately -1% in the no-AMC case, consistent with the greater quantity sensitivity of green credit demand to interest rate movements in an economy with a lower baseline financing cost.

The greenwashing probability q displays the starkest divergence between regimes. In the no-AMC case, q falls sharply to approximately -10% below its steady state on impact as the productivity shock raises brown firm profits, compressing the relative benefit of mislabelling and reducing the incentive to greenwash. As the boom fades and the greenium $i_l - i_g$ gradually widens in the long run, reflecting the downward overshoot of i_g. The no-AMC q reverses course and rises progressively above its steady state, reaching approximately $+4\%$ by quarter 40. This means that in the no-AMC economy, the short-run deterrence effect of a positive productivity shock is temporary and is ultimately succeeded by greater greenwashing pressure as the interest rate spread widens in the long run. In contrast, under the AMC regime, the response of q is markedly smoother. The initial fall is only approximately -1% on impact because the planner simultaneously reduces χ in response to the shock, absorbing the change in the greenwashing margin rather than allowing it to translate mechanically into a large fall in q. χ falls by approximately -1% on impact as the planner lowers enforcement intensity when firms have reduced incentives to greenwash following the productivity gain. As the greenium begins to widen in the transition, the planner raises χ above its steady state, crossing zero at approximately quarter 15 and reaching approximately $+1\%$ by quarter 40, offsetting the rising incentive to mislabel. Consequently, q under the AMC regime rises only gradually and remains well below the no-AMC long-run path throughout the horizon. This countercyclical adjustment of χ is a distinctive feature of the policy, where the AMC acts as an automatic stabiliser in the green bond market, tightening enforcement when the incentive to greenwash is strongest and relaxing it when greenwashing pressure is low, thereby smoothing fluctuations in q across the business cycle without sacrificing long-run fiscal discipline.

Figure 5.1: IRFs to Positive Productivity Shock



Notes: The figure shows percentage deviations of variables from the regime-specific steady state of the model, following a one-standard-deviation positive TFP shock. The dashed blue line shows the no-AMC baseline and the solid red line shows the AMC (Ramsey) case. c is consumption, y is output, x is aggregate investment, k is aggregate capital, d is deposits, s_g is the green firm share, l_g, l_b, l_{bb} are green, light brown, and dark brown bond issuances respectively, i_g is the green lending rate, q is the greenwashing probability, and χ is the AMC enforcement penalty.

Comparative statics. Figure 5.2 presents four panels that jointly characterise the main trade-offs in the model. The top-left panel plots the optimal greenwashing penalty enforcement χ^* as a function of the social cost of emissions ω_e. The relationship is concave and strictly increasing: as the planner places greater weight on the social cost of brown output, it optimally responds by setting a higher enforcement intensity to deter greenwashing, raise s_g, and reduce emissions. However, the returns to stricter enforcement diminish as ω_e rises, since each additional unit of penalty deters proportionally less greenwashing once the most elastic greenwashers have already been deterred. At $\omega_e = 0$ the planner has no emissions motive, while at $\omega_e = 10$ the optimal penalty reaches approximately 6.3. The calibrated $\omega_e = 3.5$ therefore places the economy in an intermediate region of the curve where the planner responds meaningfully to the emissions externality without exhausting the marginal deterrence effect of enforcement.

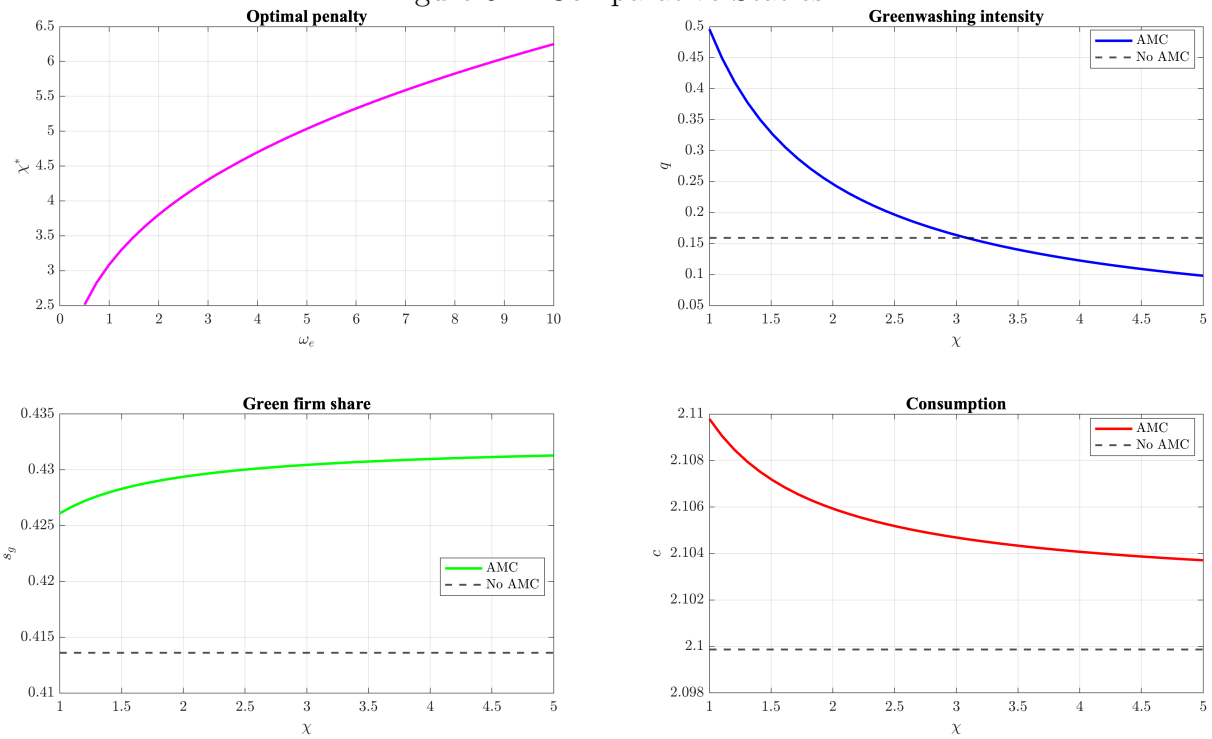
The top-right panel shows the hyperbolic relationship between χ and q for the AMC economy, alongside the no-AMC baseline (dashed line). As the enforcement penalty rises from $\chi = 1$ to $\chi = 5$, greenwashing falls monotonically from approximately 0.49 to 0.10 with sharply diminishing marginal returns. At low values of χ, the AMC lowers i_g without sufficiently deterring mislabelling, so greenwashing substantially exceeds the no-AMC

baseline of approximately 0.159. The crossover point — where the AMC regime begins to deliver lower greenwashing than the no-AMC equilibrium — occurs at approximately $\chi \approx 3.0$. This crossover defines the minimum enforcement threshold below which the moral hazard cost of AMC intervention dominates its adverse-selection-reducing benefit. At the optimal $\chi^* \approx 4.509$, greenwashing reaches $q \approx 0.109$, a 32% reduction relative to the no-AMC baseline. The planner therefore sets enforcement comfortably above the crossover threshold, ensuring the net effect on greenwashing is unambiguously favourable.

The bottom-left panel shows the corresponding response of the green firm share s_g to changes in χ. As enforcement tightens and greenwashing falls, the lower effective cost of the green financing regime shifts the profit differential in favour of genuinely green operation, inducing a gradual increase in s_g from approximately 0.426 at $\chi = 1$ to 0.432 at $\chi = 5$. The response is concave and modest, reflecting the Calvo friction that limits how quickly firms can switch financing regimes in any given period. Importantly, s_g under the AMC regime lies strictly above the no-AMC baseline of 0.414 for all values of $\chi \geq 1$: even when enforcement is weak and greenwashing is high, the lower i_g induced by the AMC's balance-sheet intervention is sufficient to make the green financing regime more attractive at the margin, raising the steady-state green share.

The bottom-right panel completes the picture by showing how household consumption c varies with χ. Consumption peaks at approximately 2.110 when χ is low, reflecting that at moderate enforcement levels the gains from lower green borrowing costs flow through to household income before the fiscal cost of enforcement becomes binding. As χ rises, consumption declines monotonically, since the household bears increasing lump-sum taxes to finance AMC monitoring and enforcement activity, partially offsetting the income gains from the credit channel. However, consumption under the AMC regime lies strictly above the no-AMC baseline of approximately 2.099 across the entire range of χ values shown, confirming that the household benefits from AMC intervention at any enforcement intensity. This implies that the AMC generates a Pareto improvement in consumption terms relative to the no-AMC equilibrium, regardless of how aggressively the planner chooses to enforce. The interior optimum at $\chi^* \approx 4.509$ therefore reflects the point at which the marginal fiscal cost of further enforcement — borne by the household through lump-sum taxation — exactly equals the marginal social benefit of reducing the adverse selection wedge in green credit markets. Together, the four panels of Figure 5.2 reveal that the central policy design challenge is not whether to introduce an AMC, but how to calibrate enforcement intensity: too little enforcement amplifies moral hazard and leaves the greenwashing problem largely unresolved, while too much enforcement erodes household welfare through fiscal incidence even though the output externality from the credit channel remains positive throughout.

Figure 5.2: Comparative Statics



Notes: Top-left: optimal enforcement penalty χ^* as a function of the welfare weight on emissions ω_e. Top-right: greenwashing probability q as a function of enforcement intensity χ under the AMC (solid blue) and no-AMC baseline (dashed black). Bottom-left: green firm share s_g as a function of χ. Bottom-right: household consumption c as a function of χ. In all panels, solid curves show the AMC case and dashed black lines show the no-AMC baseline.

6 Welfare

Does it make economic sense for the government to maintain a climate AMC, given the higher tax burden on the household and the moral hazard it creates? I evaluate this question from the perspective of the representative household, who owns the firms and the bank. The household's lifetime utility is

$$V^j = \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left[\frac{c_t^{1-\sigma}}{1-\sigma} - \omega_e E_t \right] \tag{6.1}$$

where $E_t = (1 - s_b)(1 - s_{g,t})y_{b,t} + s_b y_{bb,t}$ is total economy-wide emissions from brown production and $\omega_e > 0$ is the social cost of emissions. Three forces shape welfare under the AMC. First, an *interest rate effect*: removing the adverse selection wedge lowers i_g, expands green capital, and raises household income through higher firm dividends. Second, a *moral hazard effect*: cheaper green-labelled borrowing raises the private return to mislabelling, requiring a countervailing enforcement penalty. Third, a *fiscal effect*: AMC bond purchases and monitoring costs are financed through lump-sum taxes, directly reducing contemporaneous consumption. The AMC, acting as a social planner, balances these forces through the optimal choice of χ_t.

To quantify the net effect I use the consumption-equivalent welfare (CEW) metric: the constant proportional change in the household's baseline consumption path that makes it indifferent between the two regimes. Formally,

$$\text{CEW} = \left(\frac{V^{\text{AMC}}}{V^{\text{Baseline}}} \right)^{\frac{1}{1-\sigma}} - 1 \tag{6.2}$$

where V^j is computed from the full per-period utility including the emissions damage term.[10] A positive CEW means the household would willingly give up CEW percent of its consumption each period rather than forgo the AMC. Welfare is evaluated at the deterministic steady state derived in Section 5.

Table 6.1 reports simulated moments and welfare gains from 1,000 replications of 500 quarters, across a range of values for the welfare weight on emissions $\omega_e \in \{1, \ldots, 6\}$. As the planner places greater weight on the social cost of emissions, it optimally responds by setting a more stringent enforcement penalty χ, which in turn drives greenwashing q progressively below the no-AMC baseline (though note that at $\omega = 1$, the effect on steady state q is positive). The compressive effect on the green lending rate i_g is largely invariant to ω_e, remaining at approximately -330 basis points across all columns because the AMC's balance-sheet channel operates independently of the planner's emissions motive. In contrast, the distributional consequences vary more sharply. Green firm capital k_g and bond issuance l_g decline slightly with ω_e, reflecting higher enforcement costs borne by light brown firms as χ rises, which compresses light brown profits Π_b. The pattern for aggregate real variables mirrors the steady-state comparison in Table 5.2: output y and investment x deviate proportionally less at higher ω_e, as the rising fiscal incidence of enforcement partially crowds out the real gains from cheaper green credit.

Across all values of ω_e, consumption-equivalent welfare gains are positive and increasing, rising from 2.108% at $\omega_e = 1$ to 2.937% at $\omega_e = 6$. The CEW at my chosen calibration of $\omega_e = 3.5$ is 2.790%, reflecting how an AMC unambiguously enhances welfare. However, welfare gains accelerate at a diminishing rate with ω_e due to the trade-off faced by the planner: the largest increment occurs between $\omega_e = 1$ and $\omega_e = 2$ (an increase of 0.470 percentage points), while successive increments shrink as the emissions dividend from further tightening χ becomes smaller. This concavity mirrors the top-left panel of Figure 5.2: the emissions deterrence function is concave in the social cost of emissions, so the marginal welfare benefit of stricter enforcement diminishes as the most elastic greenwashers are already deterred. In summary, Table 6.1 confirms the robustness of the main result: the AMC generates a Pareto improvement in welfare across the full empirically plausible range of ω_e, with the magnitude of the gain sensitive to the planner's emissions motive.

[10] The CEW formula is exact for pure CRRA utility. With the additive emissions term, equation (6.2) provides an approximation: it correctly ranks regimes whenever $V^{\text{AMC}} > V^{\text{Baseline}}$, and since both welfare levels are computed from the full utility function by simulation, the sign and approximate magnitude remain valid under standard calibrations.

Table 6.1: Policy effects on simulated moments and welfare (1000 replications)

Variable	$\omega_e = 1$	$\omega_e = 2$	$\omega_e = 3$	$\omega_e = \mathbf{3.5}$	$\omega_e = 4$	$\omega_e = 5$	$\omega_e = 6$
c	0.220	0.199	0.188	0.184	0.181	0.176	0.172
x	2.038	1.981	1.952	1.942	1.934	1.921	1.910
y	0.559	0.538	0.528	0.524	0.521	0.516	0.513
k_g	4.442	4.436	4.433	4.432	4.431	4.430	4.429
k_b	0.339	0.243	0.196	0.180	0.166	0.144	0.127
k_{bb}	4.444	4.438	4.435	4.434	4.433	4.432	4.431
l_g	4.379	4.373	4.370	4.369	4.368	4.366	4.365
l_b	0.279	0.183	0.136	0.120	0.106	0.084	0.067
l_{bb}	4.505	4.499	4.496	4.495	4.494	4.492	4.491
d	1.981	1.923	1.895	1.885	1.876	1.863	1.853
i_g	-3.308	-3.304	-3.302	-3.301	-3.300	-3.299	-3.299
s_g	1.650	1.689	1.708	1.715	1.720	1.729	1.736
q	0.008	-3.005	-4.506	-5.031	-5.467	-6.168	-6.704
χ	3.086	3.803	4.302	4.509	4.697	5.034	5.327
Π_g	1.424	1.422	1.421	1.420	1.420	1.420	1.419
Π_b	0.058	0.027	0.011	0.006	0.001	-0.006	-0.011
Π_{bb}	1.432	1.430	1.429	1.429	1.429	1.428	1.428
Π_{AMC}	-0.012	-0.012	-0.012	-0.012	-0.012	-0.012	-0.012
Welfare gain	2.108	2.578	2.738	2.790	2.831	2.892	2.937

Notes: The table reports changes relative to the baseline. ω_e determines the sensitivity of the AMC to emissions and the intensity of its enforcement penalty χ. Real variables are percentage deviations from the baseline. Interest rates are annualised percentage-point changes. Welfare is defined by the consumption equivalent calculation in equation (6.2) and is computed from 1,000 simulations of 500 quarters initialised at the deterministic no-AMC steady state; calibrated values follow Table 5.1. Financial and real variables are first-order simulated deviations from the no-AMC baseline, while welfare calculations second-order simulations.

Crucially, the welfare case for a climate AMC rests on enforcement. At low levels of χ (e.g., $\omega = 1$), the AMC amplifies greenwashing, eroding the channel gain from lower interest rates. As χ increases, the CEW rises until the marginal fiscal cost of enforcement begins to bind. The optimal χ^* ensures that the benefits of the interest rate channel dominate the greenwashing effect, while still keeping the tax burden manageable. A pure "volume-based" AMC that provides liquidity in green-labelled markets without tightening enforcement would therefore deliver substantially lower welfare gains by increasing greenwashing risk, leaving the household worse off than the no-AMC baseline.

7 Conclusion

This paper reframes AMCs as *sector-targeted* policy instruments to address socially undesirable externalities. In my application to climate finance, brown bond issuers can masquerade their securities as green such that a green label on corporate bonds becomes an imperfect signal of environmental quality. The bank then prices green-labelled bonds on

the expected composition of the pool, generating an Akerlof-style adverse selection wedge that can suppress genuine green bond issuances because the interest rate is inefficiently high.

My novel contribution is to propose a government-backed climate AMC that commits to purchase greenwashed bonds from the bank ex post after greenwashing is revealed. By shifting greenwashing exposure off bank balance sheets and onto a publicly backed balance sheet, the AMC changes the bank's payoff structure when it sets green lending rates ex ante. In the static model, this expands the set of parameters supporting a green pooling equilibrium. In general equilibrium, the same balance sheet channel lowers the green lending spread by approximately 330 basis points and raises green credit extension to genuinely green firms, increasing green bond issuance by 4.4% and aggregate output by 0.54%. Given that AMC operating costs are transferred to households via lump-sum taxes, the AMC chooses the optimal enforcement penalty to manage this trade-off.

Calibrating to European data from 2016–2024, I find that the AMC regime raises steady-state green bond issuance and output. The optimal enforcement penalty is sufficient to reduce greenwashing risk by 32% relative to the no-AMC baseline, more than offsetting the mechanical increase in the incentive to mislabel that arises from cheaper green-labelled borrowing. The welfare analysis confirms that the AMC is unambiguously welfare-improving under both metrics in the calibrated economy. Conditional on introduction at the deterministic steady state, welfare rises by 2.790% in consumption-equivalent terms, driven by the compression of the adverse selection wedge and an immediate reduction in emissions-related welfare losses.

These results have direct implications for policy design. A pure "volume-based" climate AMC intervention that expands liquidity in green-labelled assets without tightening discipline amplifies incentives to mislabel: at low enforcement levels, greenwashing under the AMC exceeds the no-AMC baseline. Conversely, excessively stringent enforcement erodes household utility through lump-sum taxation even as the credit channel remains beneficial throughout. This necessitates a policy mix in which the AMC's mandate is coupled with strong disclosure requirements that improve the informational advantage of the AMC and reduce its monitoring costs, thereby lowering the fiscal burden of achieving any given deterrence target.

Several extensions are natural. First, while I proxy climate damages through a flow disutility from brown output, future work could incorporate an explicit emissions block and damages function to connect policy design more directly to climate and transition paths. Second, heterogeneity in intermediaries could matter, as some banks may specialise in green lending, underwrite labelled securities, or face reputational and relationship-lending incentives that interact with AMC intervention (Giannetti et al., 2023). These extensions would sharpen the mapping from the sector-targeted AMC framework to real-world policy design and help characterise when AMC interventions are most effective as part of a

broader sustainable finance roadmap.

Finally, the sector-targeted AMC interpretation is intended to be broader than climate. The same logic applies whenever (i) there is a sector that is privately valuable but socially costly because it generates negative externalities, and (ii) investors or intermediaries attempt to steer capital using imperfect labels or screening. In such settings, an AMC-style vehicle can absorb ex post verification risk and relax the ex ante pricing wedge faced by genuinely compliant issuers. Green versus brown production is a leading application because environmental quality is hard to verify and incentives to misrepresent are salient. The mechanism can also speak to other contexts in which a targeted buyer with a mandate changes intermediary pricing in the presence of quality uncertainty and strategic mislabelling. Natural applications include energy-efficiency and retrofit finance, targeted small business financing or innovation credit programmes with eligibility uncertainty, as well as supply-chain compliance finance.

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A Historical examples of AMCs

Ireland (NAMA). Ireland's National Asset Management Agency (NAMA) acquired property-related loans with a face value of approximately €74 billion from participating institutions, purchasing them for roughly €32 billion (Department of Finance (Ireland), 2022). The core motivation was that the removal of these assets materially de-risked bank balance sheets and reduced uncertainty about the valuation of legacy real-estate exposures. NAMA later completed repayment of its outstanding senior debt, illustrating that under favourable asset recoveries and governance, an AMC can unwind without open-ended fiscal support.

Korea (KAMCO). Korea's Asset Management Corporation (KAMCO), operating through its NPL Resolution Fund, acquired NPLs at a very large scale in the aftermath of the Asian financial crisis. By November 2002, the agency had acquired NPLs with a face value of about KRW 110.2 trillion (purchased for KRW 39.8 trillion) (He, n.d.). This episode shows how an AMC can accelerate system-wide NPL resolution when secondary markets are thin and private buyers demand extreme discounts.

Malaysia (Danaharta). Malaysia's Danaharta is another prominent AMC case. By end-1999 it had acquired and was managing NPLs with loan rights on the order of tens of billions of ringgit, with public documentation emphasising recovery targets and realised recoveries as central performance metrics. A recurring lesson from the Danaharta design is that resolution powers (legal authority, foreclosure and restructuring tools, and credible governance) are at least as important as funding scale in determining effectiveness (Dreyer, 2021).

Spain (SAREB). Spain's SAREB acquired assets valued around €50.8 billion, but sustained losses and slow disposition illustrate that AMCs are not mechanically successful. Rather, outcomes depend on acquisition pricing, macro conditions, and the asset mix. This heterogeneity is consistent with the broader empirical conclusion that AMCs can improve asset recovery and credit conditions, but their effectiveness is state-contingent and sensitive to institutional design (Tam & Fulmer, 2021).

B Proofs

Proof of Proposition 1. Under perfect competition the bank posts the lowest rate consistent with zero profits, i.e. the rate at which its participation constraint binds. Without an AMC, constraint (3.1) binds, giving $i_g^* = r + \nu(1 - s)$. With an AMC the

bank offloads all greenwashing risk ex post, so constraint (3.9) binds instead, giving $i_g^{*\,AMC} = r < r + \nu(1-s)$ since $\nu > 0$ and $s \in (0,1)$. □

Proof of Proposition 2. The bank operates under perfect competition, so its equilibrium lending rate is determined by the binding participation constraint.

Without an AMC, the bank's profit function is (4.25), whose first-order condition with respect to deposits $d_{B,t}$ yields the lending schedule

$$i_{g,t}^{\text{Baseline}} = \frac{\frac{1}{\eta}\, i_{d,t} + \nu(1-s_{g,t}) - i_{l,t}(1-s_{g,t})}{s_{g,t}} \tag{B.1}$$

The term $\nu(1-s_{g,t}) > 0$ reflects the bank's expected pecuniary loss per unit of green-labelled lending, arising because a share $1-s_{g,t}$ of the green-labelled pool originates from light brown firms whose bonds generate greenwashing risk.

With an AMC, the bank's adjusted profit function (4.29) removes the greenwashing-risk term from the bank's objective, because greenwashed bonds are purchased by the AMC ex post. The first-order condition with respect to deposits then yields

$$i_{g,t}^{AMC} = \frac{\frac{1}{\eta}\, i_{d,t} - i_{l,t}(1-s_{g,t})}{s_{g,t}} \tag{B.2}$$

Taking the difference:

$$i_{g,t}^{\text{Baseline}} - i_{g,t}^{AMC} = \frac{\nu(1-s_{g,t})}{s_{g,t}}$$

Since $\nu > 0$ and $s_{g,t} \in (0,1)$, this difference is strictly positive for all admissible parameter values and all possible equilibrium values of $s_{g,t}$. Hence $i_{g,t}^{*\,\text{AMC}} < i_{g,t}^{*\,\text{Baseline}}$ in any competitive equilibrium.

Note that this conclusion does not require holding $s_{g,t}$ fixed: even though $s_{g,t}$ adjusts endogenously in general equilibrium through the law of motion (4.3), the inequality $\nu(1-s_{g,t}) > 0$ holds strictly for every $s_{g,t} \in (0,1)$, so the ranking of the two lending rates is preserved at any equilibrium value of the endogenous green firm share. □

Proof of Proposition 3. The light brown firm's profit (4.17) is

$$\Pi_{b,t} = y_{b,t} - r_{k,t}k_{b,t} - \big[q_t i_{g,t} + (1-q_t) i_{l,t}\big] l_{b,t} - \tfrac{\chi_t}{2}\psi\, l_{b,t}\, q_t^2$$

The profit function is concave in q_t, so the first-order condition is both necessary and sufficient:

$$(i_{l,t} - i_{g,t})\, l_{b,t} - \chi_t \psi\, l_{b,t}\, q_t = 0 \implies \max[0, q_t^*] = \frac{i_{l,t} - i_{g,t}}{\chi_t \psi}$$

Since $i_{l,t} > i_{g,t}$, $\chi_t > 0$, and $\psi \in (0,1)$, we have $q_t^* > 0$, establishing the first claim.

Comparative statics follow by direct differentiation:

$$\frac{\partial q_t^*}{\partial(i_{l,t} - i_{g,t})} = \frac{1}{\chi_t \psi} > 0, \qquad \frac{\partial q_t^*}{\partial \chi_t} = -\frac{i_{l,t} - i_{g,t}}{\chi_t^2 \psi} < 0, \qquad \frac{\partial q_t^*}{\partial \psi} = -\frac{i_{l,t} - i_{g,t}}{\chi_t \psi^2} < 0 \qquad \square$$