Klima 2.0

The Dark Sole Enterprise Ltd
ds@darksole.vip

With contributions from scott@klimadao.finance

April 16, 2025

An **Autonomous Asset Manager** incorporating Asset pricing, Liquidity and Bond Markets powered by a Dual Token structure designed for efficient and rational decentralised liquidity within the carbon credit asset class.

Version 1.43

Contents

1 Prologue

Klima 2.0 constitutes an autonomous capital system for the Carbon asset class. It is neither a conventional token nor a traditional protocol, but rather a continuously adaptive financial structure governed entirely by endogenous signals and risk-weighted economic inputs.

The system is based on a dual-token architecture: `KLIMA`, representing capital and asset exposure, and `KlimaX`, reflecting systemic risk preferences. Together, these tokens structure the internal market dynamics without the need for oracles or discretionary oversight. This architecture enables the system to:

- Systematically select and price tokenised Carbon credits,
- Construct and maintain a forward-yield curve derived from on-chain capital commitments,
- Govern portfolio allocation, liquidity provisioning, and incentive distribution through deterministic smart contract logic.

All token-holder actions – staking, selection, and locking – serve as inputs to a reflexive coordination mechanism. `KLIMA` governs the allocation of capital to carbon assets, while `KlimaX` parametrises the system's risk assumptions and pricing capacity. This interaction defines a synthetic balance sheet where capital value, risk spread, and yield formation emerge from collective participation.

The platform consists of three interdependent components: the **Portfolio Manager**, which acquires and retires Carbon assets; the **Bond Market**, which generates a time-structured synthetic yield curve; and the **Liquidity Market**, which facilitates price discovery and capital flow across `KLIMA`, `KlimaX`, and external currencies. These mechanisms are interlocked by design, enabling the system to continuously seek equilibrium.

Klima 2.0 abstracts complex market operations into a formal economic structure that integrates asset management, governance, and liquidity within a single protocol. `KLIMA` offers structured exposure to carbon markets through tokenised yield and asset ownership, while `KlimaX` modulates this exposure in response to endogenous risk metrics.

In this model, staking constitutes an economic vote; liquidity provision informs portfolio capacity; and yield is an emergent function of structural configuration. The system is designed to operate without exogenous intervention, maintaining equilibrium through adaptive incentive distribution and real asset correlation.

Klima 2.0 is a closed-form capital system with embedded governance and economic reflexivity, capable of continuously modelling and adjusting its internal state through its own token dynamics.

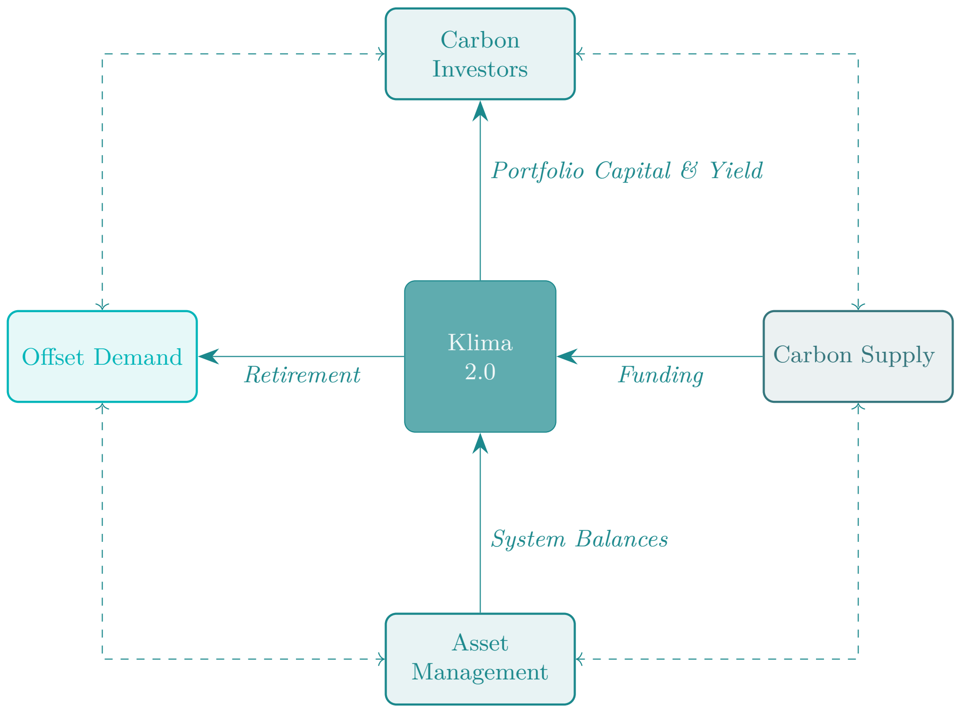
2 Klima 2.0

KlimaDAO was originally launched to create market infrastructure driving seamless liquidity for **Carbon** monetisation and Carbon retirement. It has been constructed using decentralised architecture with a token system 'KLIMA' for dynamic economic governance. Whilst it has been successful in brand and customer acquisition, as well as ownership of real Carbon assets, the current token model and processes are unwieldy and will not allow the product to scale to its potential given the opportunity of this market.

Hence we present **Klima 2.0** as an **Autonomous Asset Manager** (AAM) with the new **Risk-Balanced Asset**(RBA) token `KLIMA` that:

- Selects and purchases Carbon credits on a spot and forward basis for its own **Portfolio**.
- Retires its credits by issuing **Offset** certificates to buyers.
- Continuously **Yields** Carbon from its Portfolio.
- Enables investors to:
  - Hold a true *passive* exposure to Carbon markets, spreads and dislocations via the new `KLIMA` token.
  - *Actively* reflect their risk appetite collectively to optimise Portfolio selection and capacity.
  - Determine the proportion of Yield distribution vs capital retention allowing cyclical expansions and contractions and de facto price modelling of the `KLIMA` token.

Figure 1: Klima 2.0 Design



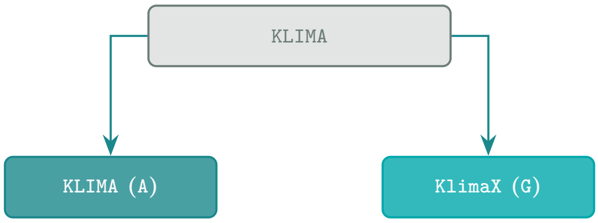
Klima 2.0 provides a fundamental capital, liquidity and execution layer for wholesale Carbon trading, capturing spreads and structural pricing across the asset class. It employs rational adaptive financial models to reflect token-holders' collective risk-reward preferences, produced solely through native smart contract balances from staking and liquidity functions allowing price discovery and harmonious functions to govern the stability and risk of the RBA token `KLIMA`.

The RBA model grants clean *look-through* economic ownership of tokenised Carbon assets to `KLIMA` token-holders, as well as self-governance for risk and reward allowing maximum flexibility in this hybrid capital instrument for growth and distribution.

2.1 Dual Utility tokens

In addition to the KLIMA token, Klima 2.0 introduces a second **Risk Governance** token KlimaX. This token is responsible for modelling risk across the ecosystem by responding to the KLIMA token's core selections and adding essential derivative parameters that manage adverse selection and pricing capacity.

Figure 2: Token Replacement

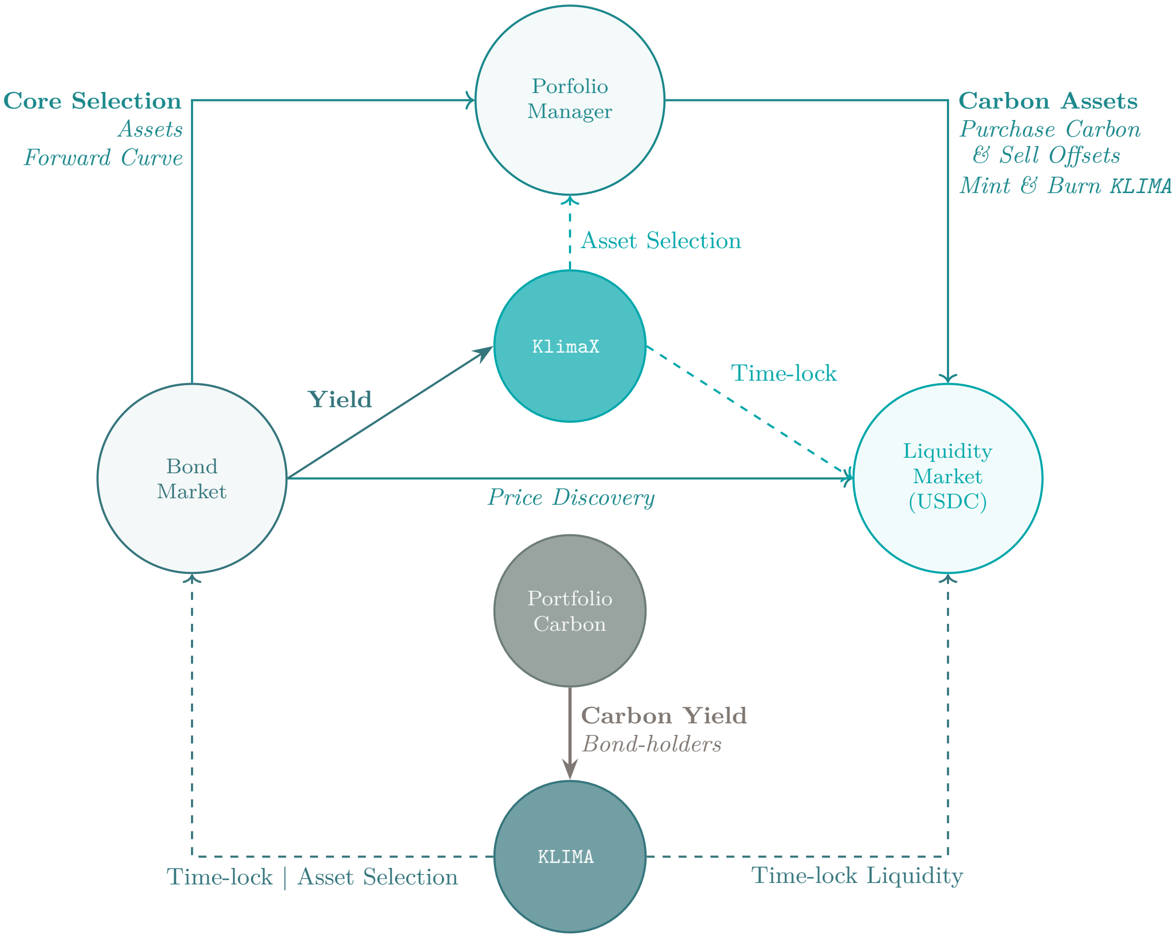


KLIMA tokens have the beneficial ownership of the Portfolio and set core allocation choices, whereas KlimaX acts as the *risk-seeking* gauge for the portfolio construction.

KlimaX is formally compensated with KLIMA tokens hence the two tokens' interests are fully aligned and together perform dynamic Portfolio optimisation as a result of collective owner utility-function.

2.2 High level Architecture

Figure 3: Klima 2.0 Architecture



Three economic pillars support the Klima 2.0 AAM:

1. **Portfolio Manager**:
   - Accumulates Carbon credits for the Portfolio by minting `KLIMA`.
   - Sells Carbon Offset certificates from the Portfolio by buring `KLIMA`.
   - Prices **Spot** and **Forward** delivery Carbon using the system generated curve.
2. **Bond Market**:
   - `KLIMA` holders **Stake** irreversibly for a fixed time period.
   - Those Staking are able to *select* Carbon assets for the Portfolio.
   - The Staking pattern over time creates a `KLIMA` Yield curve, which is distributed to Bond-holders. This is utilised for Forward delivery pricing in the Portfolio Manager and weightings for Bond-holders in governance and for their Spot Carbon Yield distribution.
3. **Liquidity Market**:
   - `KLIMA` and `KlimaX` holders are able to pair their tokens together, or in the case of `KLIMA` with `USDC`, in order to generate liquidity fees.
   - Locking Liquidity (Staking LP tokens) generates a share of the `KLIMA` Yield.
   - Locked `KLIMA:KlimaX` liquidity participates in general governance alongside Bond-holders.

Noting that *Staking* and *Locking* are used interchangeably throughout the paper and for this model are identical functions where asset-transfers are disabled for the period specified.

2.3 Economics and Incentives

2.3.1 `KLIMA` Synthetic Yield

`KLIMA` emits a continuous Yield rewarding:

1. `KLIMA` Bond-holders.
2. `KlimaX` Staking.
3. Both `KLIMA` and `KlimaX` Liquidity Provders (LPs).

The proportions and quantities are dynamic depending on the system state.

2.3.2 `KlimaX` Incentives

The expansion of the `KlimaX` token supply is allocated to stakeholders below in varying quantities depending on system balances.

1. `KLIMA` Bond-holders.
2. `KlimaX` Staking.
3. Both `KLIMA` and `KlimaX` Liquidity Provders (LPs).

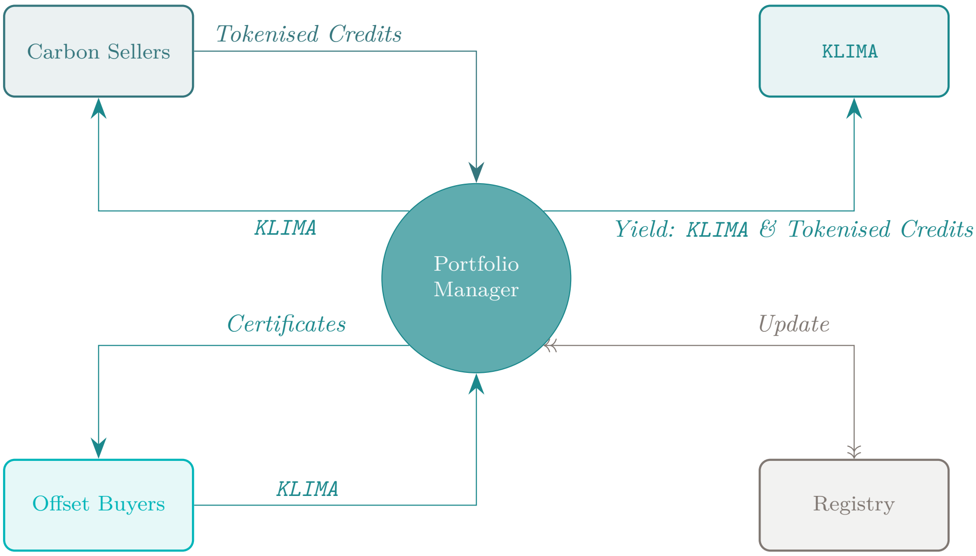
2.3.3 Carbon Yield

Assuming the Portfolio holds spot Carbon credits, the Portfolio Manager emits a continuous Carbon Yield to `KLIMA` **Bond-holders only** with the proportion a function of the system state.

2.4 Portfolio Manager

At the core of the platform, the Portfolio Manager accumulates, trades and distributes its Carbon Portfolio driven by parameters determined from collective token-holder actions (and inaction).

Figure 4: Klima 2.0 Portfolio Manager



The AAM **purchases** Carbon credits and **sells** Offset certificates by pre-defined classification ('Class'). It does <u>not</u> sell Carbon credits as those are issued through the Portfolio Yield function.

Token-holders collectively set the risk parameters for pricing of each Class by defining:

- Portfolio weighting.
- Capacity curve and spreads.

Additional **global** parameters are similarly determined:

- Forward-delivery discount rates.
- Synthetic yield curve creating incentives for Portfolio selection, liquidity provision and risk management contributions.
- Proportion of Liquid Carbon credit yield released for `KLIMA` to token-holders.

There are no oracles or external inputs required for Klima 2.0 as it is fully autonomous and responds to its own native state of token balances.

2.5 Tokens

2.5.1 Carbon Registry

Holders of physical Carbon credits can create tokenised representation of their assets through the Registry function. Here, physical assets are swapped for their respective '`C`' tokens, based on the Registry's classification system and the delivery schedule.

Once `C` tokens are created they can be sold to the AAM, or retired back at the Registry to create the offset certificates (denoted `C`*).

2.5.2 Risk Balanced Asset Token: `KLIMA`

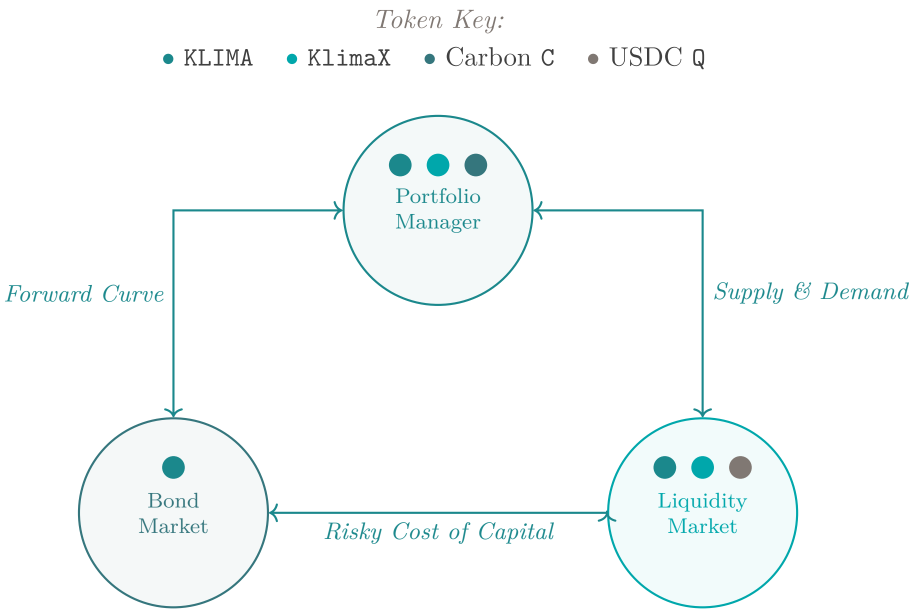
`KLIMA` represents core ownership of the Portfolio assets, and is designed to flex between asset and growth value drivers depending on token-holder activity.

`KLIMA` has no maximum supply but inflates upon Carbon credit accumulation, and contracts upon issuance of Offset certificates.

- When **Locked** for fixed maturities:
  - *Option* to select Carbon classes for Portfolio weighting and pricing ('Active').
  - Sets the Forward discount rate for Carbon Portfolio acquisition from collective Staking pattern over time.
  - Generates a **Synthetic yield** of `KLIMA` based on Forward curve and a **real Carbon yield** based on Active selection ratio.
  - Participates in governance for whitelisting Carbon assets.
- **Transactional** usage:
  - **Mint**: New `KLIMA` issued by the Portfolio Manager to purchase new Carbon credits for the Portfolio.
  - **Burn**: `KLIMA` are Purchased by the Portfolio Manager to issue Offset certificates.
- **Locked** Liquidity:
  - Generates a time-based relative share of the `KLIMA` Synthetic Yield, reflecting the risks taken to support the price of platform capital.

Noting that the tokens can delegate utility as required.

Figure 5: AAM Token Utility



2.5.3 Risk Governance Token: `KlimaX`

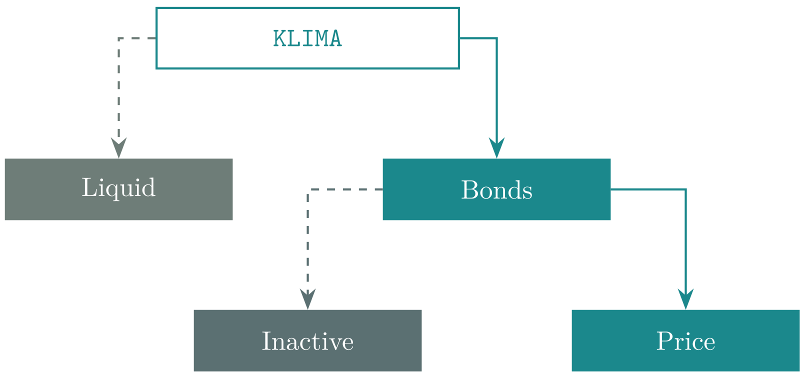
`KlimaX` is a fixed-supply token issued programmatically over time with a dynamic allocation for **Incentives**.

- When **Locked**:
  - Shapes the pricing curve and spread of `KLIMA`.
  - Determines risk premia for LPs.
  - Generates a share of Synthetic Yield.
  - Receives `KlimaX` Incentives.
- **Locked** Liquidity:
  - Generates a share of Synthetic Yield
  - Participates in governance.
  - Receives `KlimaX` incentives.

2.5.4 Staking functions

The `A` token has 2 staking functions which are not independent:

Figure 6: `KLIMA` Staking



1. **Bonds:** The `KLIMA` token is locked for a specific period of time representing a liquidity preference for the holder in return for Yield. This part of the stake cannot be amended.
2. **Price:** Collective selection of Carbon classes by `KLIMA` staking determines the **instantaneous** price ratio for `KLIMA` token issuance. This selection can be amended and withdrawn at any time to allow price modulation for the platform of its Carbon assets.

The `KlimaX` token has a single staking function that also optionally selects Carbon classes. This determines the rate of issuance or price curve of `KLIMA` for the specified Carbon, as well as the retirement burning rate.

Both tokens facilitate the Klima Carbon market to function efficiently with the `KLIMA` token responsible for Portfolio selection and pricing, and the `KlimaX` token modulating capacity and risk.

2.6 Initialisation of the KLIMA Token

The Klima Protocol has approximately **20 million tonnes** of Carbon credits in its Treasury as assets, which will be used to create the initial issuance of KLIMA tokens upon launch of Klima 2.0.

Table 1: Token Summary

Token	Amount	Notes
KLIMA A Token	20 million	Supply expands and contracts perpetually. 87.5% of initial supply available to existing KLIMA holders. Initially created on 1:1 basis with Carbon Tonnes held. Issues on Carbon received, and Burns on Carbon retired.
KlimaX G Token	100 million	Fixed supply 40% put into programmatic issuance as incentive yield over time. 40% for existing KLIMA holders

2.7 End Users

1. **Carbon Credit Sellers**

   Those wishing to monetise spot or forward delivery classes of Carbon.

   Portfolio Manager: *Continuously acquires C tokens using an autonomous pricing strategy, based on class, delivery and token balances, issuing new KLIMA tokens as consideration to build the C Portfolio.*

2. **Offset Buyers**

   Those wishing to obtain the offset certificate by retiring Carbon credits from the Portfolio.

   Portfolio Manager: *Continuously sells offset certificates, by Burning KLIMA tokens and issuing the Offset certificate C^*, by retiring the C token quantity in the Registry.*

3. **Investors**

   Those who wish to own a liquid, or yielding locked fixed-maturity financial exposure, to a basket of Carbon assets.

   Bond Market: *Provides a daily time-based yield on for those Staking KLIMA tokens, comprised of both a synthetic and real Portfolio carbon C component.*

4. **Liquidity Providers**

   Those who wish to generate liquidity fees on their portfolio of Klima 2.0 Assets coupled together or with USDC

   Liquidity Market: *LPs are incentivised by the Synthetic Yield calculated from system metrics to compensate them for risk.*

5. **Active Portfolio Optimisation**

   KlimaX and KLIMA Asset Selection: The Staking Incentives and allocations are designed for those who wish to participate in overall risk management to collectively resolve for the optimal Portfolio risks.

2.8 AAM Highlights

- **Decentralised Architecture:**

  The AAM is smart contract based, fully autonomous as to pricing and distribution of its assets with governance power held by risk-based capital.

- **Adverse Selection:**

  The AAM does not permit the direct purchase of Carbon credit `C` tokens from its Portfolio (Offsets only), but rather yields `C` tokens on a Portfolio basis over time.

- **`C` Tokens:**

  Users with `C` tokens can always access offset certificates through the Registry, hold the specific `C` token or sell back to the AAM if required. Secondary markets and utility for `C` tokens may emerge over time.

- **Implied Spreads:**

  The AAM purchases `C` tokens at relative discounts based on capacity pricing and forward discount curves folding natural returns into the Portfolio capital.

- **Dual Tokens:**

  Whilst the `KLIMA` token reflects asset economics, the `KlimaX` token is essential for optimising pricing capacity in return **maximising risk-adjusted spreads** for the Portfolio. Since its earnings power is a function of the `KLIMA` token value, its role as this spread optimiser is truly economically aligned and as such fundamental values of `KLIMA` and `KlimaX` are highly correlated.

- **Hybrid Asset Model**

  The rate of `C` token yield for `KLIMA` generated from the underlying Portfolio is derived from the system state of the `KLIMA` token balances.

  - This enables investors collectively to model capital <u>and</u> yield proportions, allowing the price of the capital token to discover its **equilibrium** value with respect to the combination of **current** and **projected** underlying Portfolio value.
  - This flexibility enables a ‘Pull to par’ effect as growth expectations lower, whilst not limiting price appreciation potential in high growth projection markets.
  - The hybrid model incorporates both **asset stabilisation** plus **equity-like** returns.

  Critically this approach enables the `KLIMA` token to act as a true <u>medium of exchange</u> for the Carbon trading activity of the users, propagating the feedback loops to both the `KLIMA` and `KlimaX` tokens.

3 Core Economic Pillars

In this Section we refer to `KLIMA` and `KlimaX` tokens as `A` and `G` respectively.

The three tenets of Klima 2.0 enable the model to find equilibrium through continuous dynamic feedback loops and system balances. There is no oversight or centralised management entity with discretionary powers.

1. **Bond Market**: `A` token holders stake tokens until a set expiry to create floating yield Bonds and have the ability to select Carbon Classes for Portfolio weighting.

    - The collective temporal staking pattern produces a **Synthetic Yield** curve in `A` tokens to reward Bond-holders, as well as price the forward curve for the AAM.
    - A **real yield** of spot-delivery `C` tokens is issued continuously from the Portfolio to Bond-holders depending on the participation in Portfolio weightings.
    - Only `A` tokens participate in the Bond Market.

2. **Portfolio Manager**: The Portfolio Manager swaps its own token `A` for Carbon `C` (in) or Carbon offset certificates $\mathtt{C}^*$(out) to build a Portfolio of Carbon credits.

    - Both **Locked** `A` and `G` are used in the Portfolio Manager whereby `A` Staking determines the pricing of any given Carbon class, and `G` determines the rate of acquisition (disposal).

      Only Bond-holders (Time-locked `A`) can participate in Portfolio weighting although it is not mandatory.
    - Forward-delivery Carbon (for a set of fixed dates out to 10 years) is transacted simultaneously with spot liquid Carbon.

3. **Liquidity Market**: Here the tokens are traded in 2 core liquidity pairs with various incentives available to Liquidity Provider token holders (**LPs**), including a **Risky Yield** generated by the Bond Market Synthetic Yield.

    - $\overline{\mathtt{AG}}$: Native token swap `A` and `G`.
    - $\overline{\mathtt{AQ}}$: The asset token `A` with USDC `Q`.

    The Liquidity Market provides the complementary facility to the Bond Market and the critical relationship between the native tokens and the hard currency of `USDC`.

The Klima 2.0 system enables each participant in the various economic pillars to act in the interests of their own capital and utility, which through the harmonic model, enables price discovery, liquidity and stability for Carbon trading which creates positive reinforcement cycles as catalysts for growth and scale.

3.1 Bond Market

Holders of `A` can Stake (select) a Bond maturity from the set of **Standard maturities**. Bonds expire every 90 days on a rolling basis. There are always 40 maturities extending out to approximately 10 years for Bond staking.

- **Forward Curve**: Aggregate Bond-staking determines the shape of the discount curve of the `A` token with regards to its purchasing rate of forward-delivery Carbon.
- **Synthetic Yield**: Bond-holders receive a floating yield of new `A` tokens on their stake following the shape of this discount curve. Yield is calculated daily and accumulates to the principal stake.
- **Real Carbon Yield**: Liquid Carbon in `C` token form is emitted to Bond-holders on a daily basis assuming the portfolio holds spot Carbon assets. The emission rate responds to Bond-holders staking for Portfolio pricing and up to ~22% per quarter is released.
- **Liquidity**: There is no early unlocking; all principal and accumulated yield is released only at Bond maturity.

`G` Tokens are <u>not</u> involved in the Bond market. The forward curve is agnostic to Carbon class although only Bond-holders can select Carbon classes for Portfolio pricing.

3.1.1 Synthetic Yield and Forward-delivery Curve

Defining:

S: Total `A` tokens staked for Bonds expressed as a proportion of outstanding supply of `A`.

S_t: Total `A` tokens staked for Bond maturity bucket t, expressed as a proportion of outstanding supply of `A`, where $\sum S_t = S$, and t is the index of standard maturities $t \in \{1, 2, 3, \ldots, 40\}$.

E_t: Time to expiry expressed in years.

Calculating curve parameters D, C:

$$D = \frac{1}{S} \sum_{t=1}^{40} S_t \, E_t \tag{1}$$

$$C = \frac{1}{S} \sum_{t=1}^{40} S_t \, E_t^2 \tag{2}$$

The shape of the yield curve is produced:

$$\gamma_t = \max\left(\frac{E_t}{D} - \frac{E_t^2}{2\,C}, 0\right) \tag{3}$$

Normalising γ_t to $\hat{\gamma}_t$:

$$\hat{\gamma}_t = \frac{\gamma_t}{\sum_{t=1}^{40} \gamma_t} \tag{4}$$

With the cumulative sum of the normalised values expressed as Γ_t:

$$\Gamma_t = \sum_{i=1}^{t} \hat{\gamma}_i \quad \text{for } t = 1, \ldots, 40 \tag{5}$$

The zero coupon yield curve Z_t is solved:

$$Z_t = (1 - S)\,\frac{\Gamma_t}{E_t} \tag{6}$$

Whereupon, the Bond discount rate B_t that forms the Forward delivery curve is derived:

$$B_t = \exp(-Z_t \, E_t) \tag{7}$$

The yield due on `A` Bonds is calculated daily and added to staked principal, hence the daily yield for each time bucket is calculated as Y_t:

$$Y_t = \exp\left(\frac{Z_t}{365}\right) - 1 \tag{8}$$

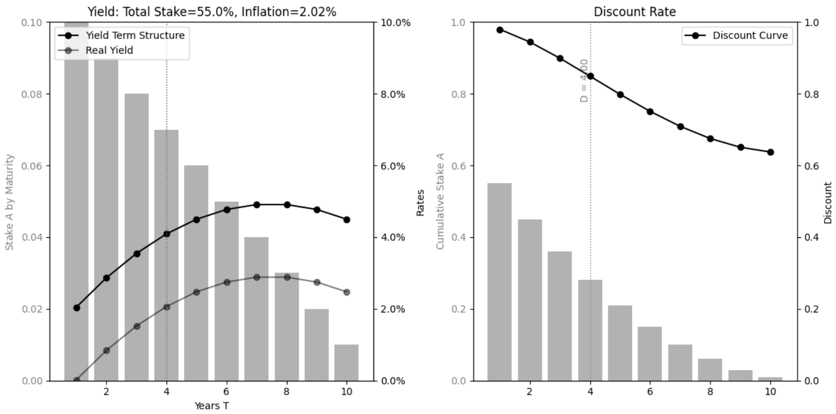
Hence, any bond stake A_t will increase by ΔA_t:

$$\Delta A_t = A_t \, Y_t \tag{9}$$

With the total `A` tokens created on a daily basis for Bond inflation as R:

$$R = \sum_{t=1}^{40} \Delta A_t \tag{10}$$

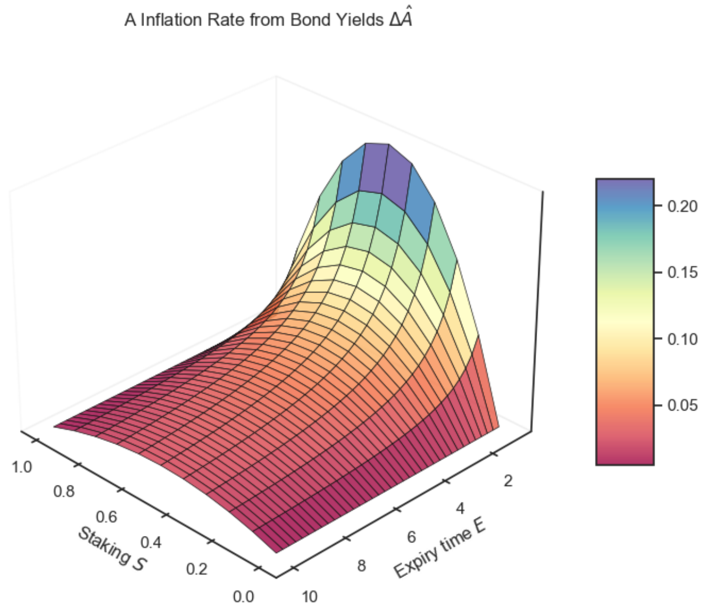
Figure 7: Example of Bond Market State



See Appendix A for further outputs.

For visualising the sensitivity of `A` overall inflation rates with respect to staking and duration, Figure 8 assumes a single maturity over the staking range to provide an approximation of inflation $\Delta A \approx Z\,S$.

Figure 8: Range of A Inflation



3.1.2 Governance Weightings

Governance rights, for example the whitelisting (blacklisting) of Carbon classes, and any other matter requiring token stakeholder voting, are allocated to two cohorts:

1. Bond staking: S_t
2. Locked liquidity in the `A-G` pair $\overline{\texttt{AG}}$ (see Section 3.3) defined here as A_{Gt}, representing the quantity of `A` tokens held in the liquidity pool expressed as a proportion of circulating supply.

Voting power is allocated by time and applied to the respective balance of `A`:

1. Initial voting weights for Bonds v_t:

$$v_t = Z_t\, S_t \tag{11}$$

2. Initial voting weights for LPs w_t:

$$w_t = Z_t\, A_{Gt} \tag{12}$$

1. Final voting weights for Bonds V_t:

$$V_t = \frac{v_t}{\sum_{j=1}^{40}(v_j + 2w_j)} \tag{13}$$

2. Final voting weights for LPs W_t:

$$W_t = \frac{w_t}{\sum_{j=1}^{40}(\frac{1}{2}v_j + w_j)} \tag{14}$$

3.1.3 Real Carbon Yield

Defining:

> A: Total `A` tokens Staked for pricing of Carbon classes, expressed as a proportion of outstanding supply of `A` Tokens.

With μ as the daily emission factor applied to the Portfolio holding spot delivery `C` tokens:

$$\mu = \frac{A\,(1 - A)}{90} \tag{15}$$

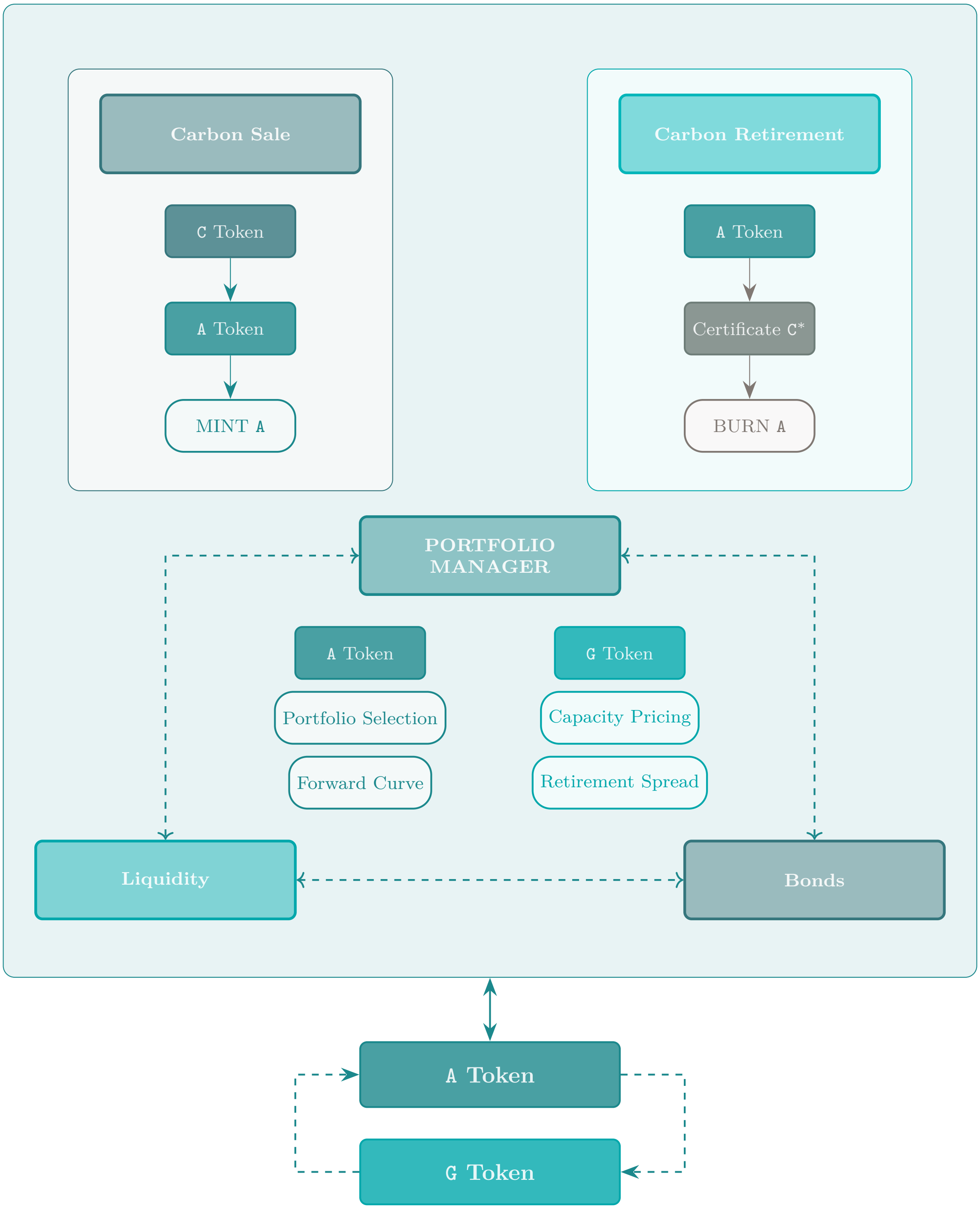
Carbon Yield is allocated to Bond-holders using (normalising) the *initial voting weight* v_t determined in Equation (11).

3.2 Portfolio Manager

The Portfolio Manager role of swapping `A` for Carbon is managed through a set of smart contracts driven by Staking choices from the token system, the balances of assets held, and the discount curves generated by the Bond market.

The combined staking of `A` and `G` Tokens creates a dynamic pricing matrix by class of Carbon, and by time, enabling spot and forward trading of Carbon.

Figure 9: Klima 2.0: Portfolio Manager



3.2.1 Purchase Carbon

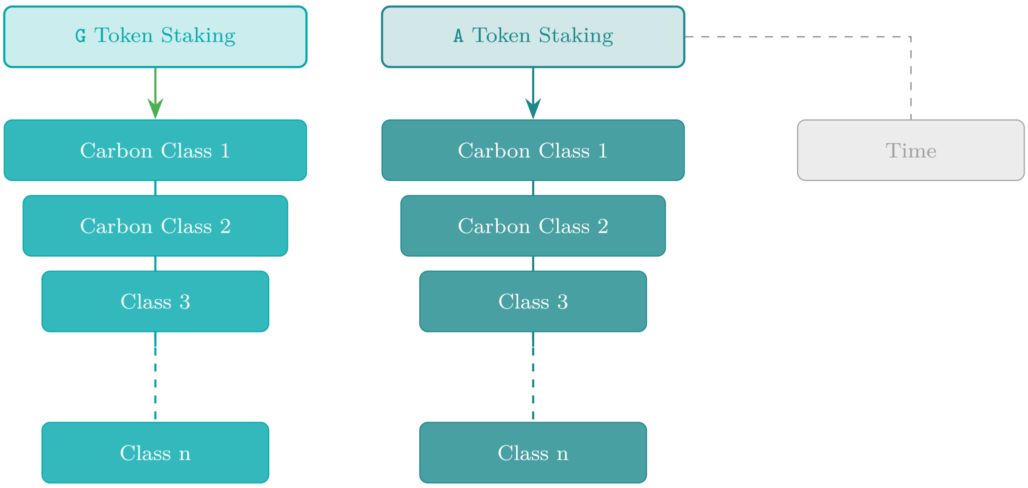
Users swap `C` for `A`

Existing Carbon in the Portfolio

Carbon classes $i \in \{1, 2, 3, ..., n\}$ are whitelisted through governance by the `A` token and the $\overline{\texttt{AG}}$ LP holders (see Section 3.1.2).

For Carbon pricing, both the `A` tokens and the `G` tokens may stake for specific Carbon classes i and these are independent stakes between the two token systems.

Figure 10: Token Staking Class Structure



For a Carbon class quantity to be sold to the AAM, it must have a strictly positive quantity of `A` tokens staked for that Carbon class, otherwise there is no price, and the Carbon cannot be sold.

Defining:

C_i: Total tonnes of Carbon class i currently held in the Portfolio.

A_i: `A` tokens staked for Carbon class i expressed as a proportion of outstanding supply of `A` Tokens where $\sum A_i = A$.

G_i: `G` tokens staked for class i expressed as a proportion of outstanding supply of `G` Tokens.

C_{it}: The quantity of Carbon class i held in the AAM deliverable per maturity t where C_{i0} reflects the liquid quantity.

In order to determine the present-value quantity of Carbon, $\bar{C}_i$, we apply the discount curve from Equation (7) to the liquidity schedule and sum the discounted holdings:

$$\bar{C}_i = C_{i0} + \sum_{t=1}^{40} B_t \, C_{it} \tag{16}$$

Similarly, taking ΔC_{it} as the quantity of Carbon i to be sold with a specific maturity index t:

$$\Delta\bar{C}_i = \Delta C_{i0} + \sum_{t=1}^{40} B_t \, \Delta C_{it} \tag{17}$$

Once standardised by the discount curve, trades can be aggregated in the same class for the defined trade or auction period.

Where $\Delta\bar{C}_i$ is expressed as the relative increment to its respective pool balance, the amount of `A` tokens issued to pay for Carbon, ΔA, expressed as a proportion of current supply, is determined as:

$$\ln(1+\Delta A) = \left(A_i - \frac{A_i^2(1-G_i)^2}{2}\right)\ln(1+\Delta\bar{C}_i) \tag{18}$$

Denoting the expression on the right hand side of Equation (18) as RHS:

$$\Delta A = \exp(\text{RHS}) - 1 \tag{19}$$

Finally, ΔA is applied to the outstanding supply of `A` to solve for token quantities.

Figure 11 illustrates the `G` token capacity to maintain the initial Portfolio pricing of the `A` token. The data has been normalised in Figure 12 to $\Delta\bar{C}_i\, A_i$

Figure 11: `A` Price Curves (ΔA) when $\Delta\bar{C}_i = 1$

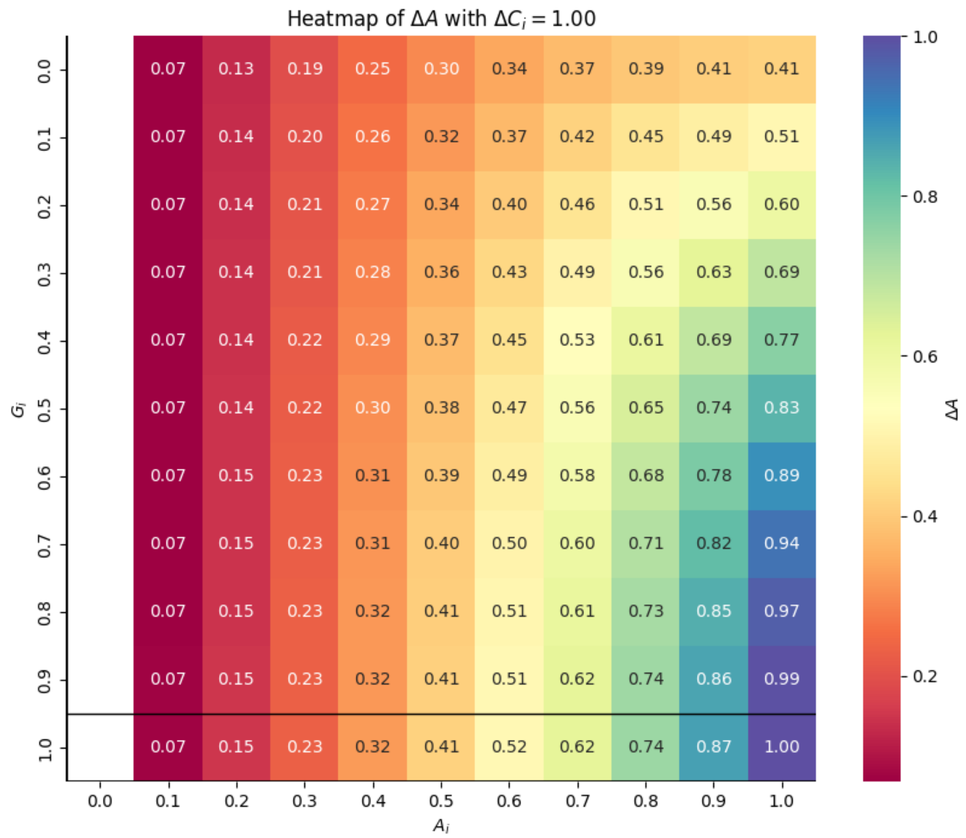
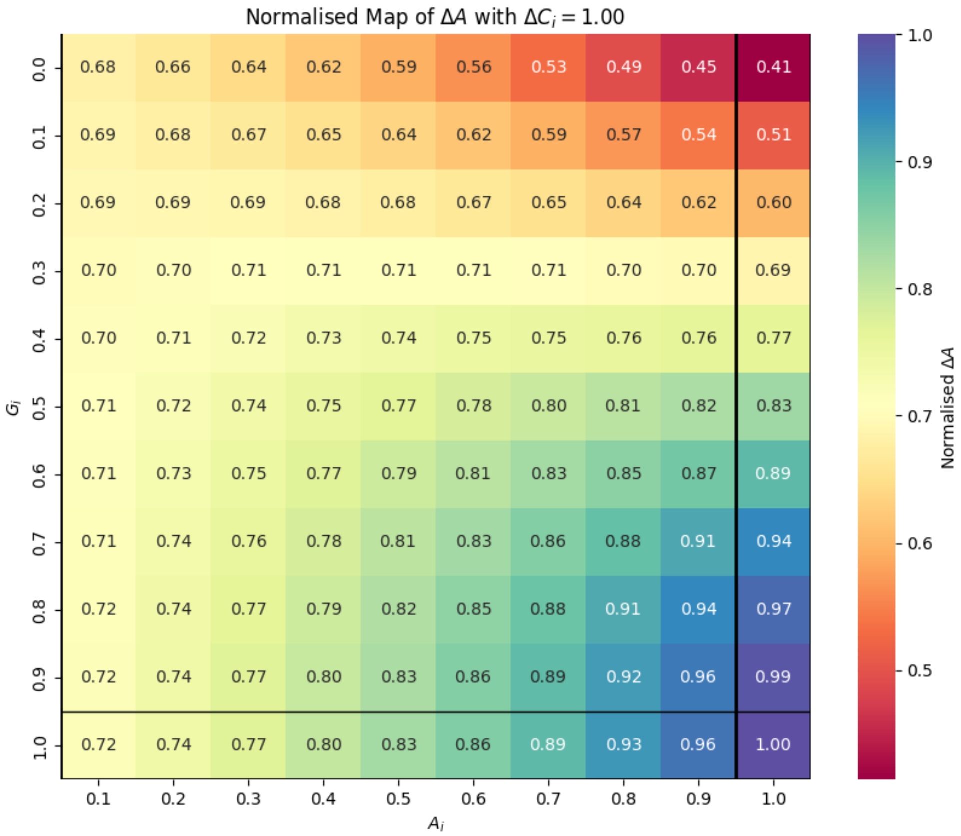


Figure 12: Normalised A Price Curves (ΔA) when $\Delta \bar{C}_i = 1$



Noting that the sensitivity to G_i increases as A_i increases and the effects become more pronounced as $\Delta \bar{C}_i$ increases.

Examples can be seen in Appendix B.

Zero Carbon Scenario

There are circumstances when there is zero Carbon held in the Portfolio for a particular class, i.e. $C_i = 0$, which invalidates the calculation of $\Delta\bar{C}_i$ and a different approach is required.

Taking $\Delta\bar{C}_\emptyset$ as the tonnes of Carbon tokens (implying an existing balance of 1 tonne), adjusted for forward discounting, to be sold for any Carbon class that has a strictly positive `A` stake $A_\emptyset$, together with `G` stake $G_\emptyset$:

$$\Delta A = \frac{\Delta\bar{C}_\emptyset}{1 + \Delta\bar{C}_\emptyset} \left(A_\emptyset - \frac{A_\emptyset^2 (1 - G_\emptyset)^2}{2} \right)^2 \tag{20}$$

Figure 13: `A` Price Curves (ΔA) when $\Delta\bar{C}_\emptyset = 100$ tCO2eq

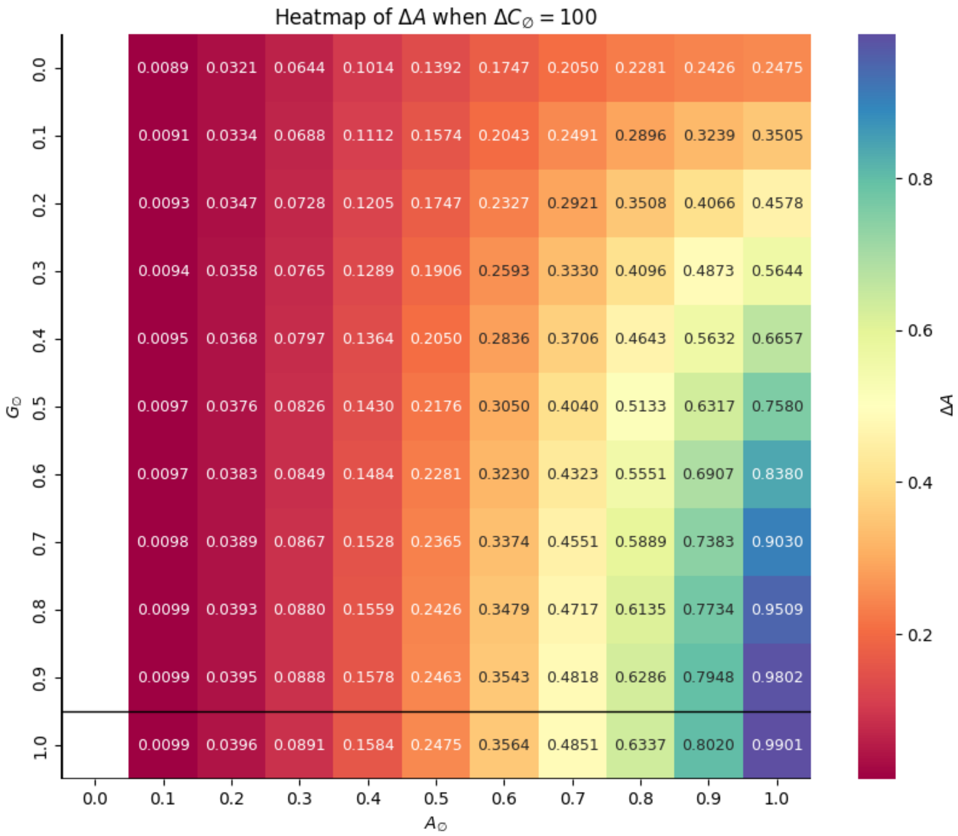
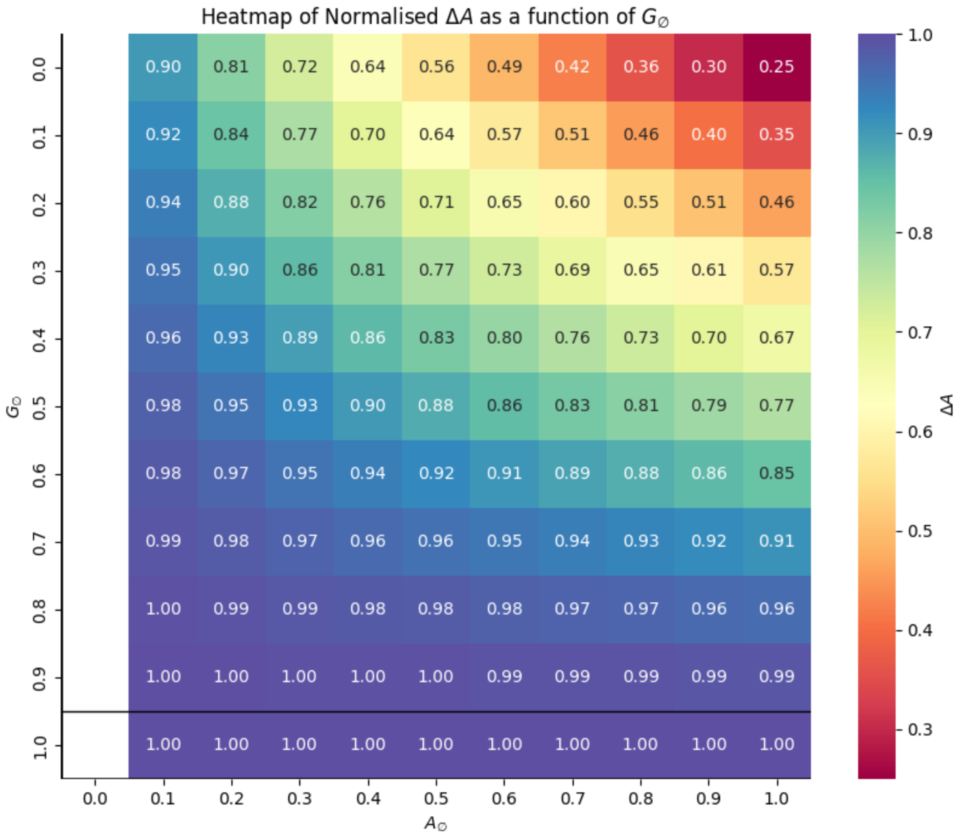


Figure 14: Normalised A Price Curves (ΔA) when $\Delta\bar{C_\emptyset} = 100$ tCO2eq



3.2.2 Sell Offset Certificates

Users swap `A` *for* `C*`

Weighted Carbon Class

For retiring Carbon that is *weighted*, that is there is a strictly positive `A` token stake for that class, an `A` token holder can extract the Carbon class offset of their choice C_i but the available pool is only the liquid balance, namely the element C_{i0}:

$$\ln\left(1 + \Delta C_i\right) = \frac{-\ln(1 + \Delta A)}{A_i + \frac{1}{2}A_i^2(1 - G_i)^2} \tag{21}$$

As before denoting the expression on the right hand side of Equation (21) as RHS:

$$\Delta C_i = \exp(\text{RHS}) - 1 \tag{22}$$

Figure 15: Proportion of Carbon Retired when $\Delta A = 0.10$

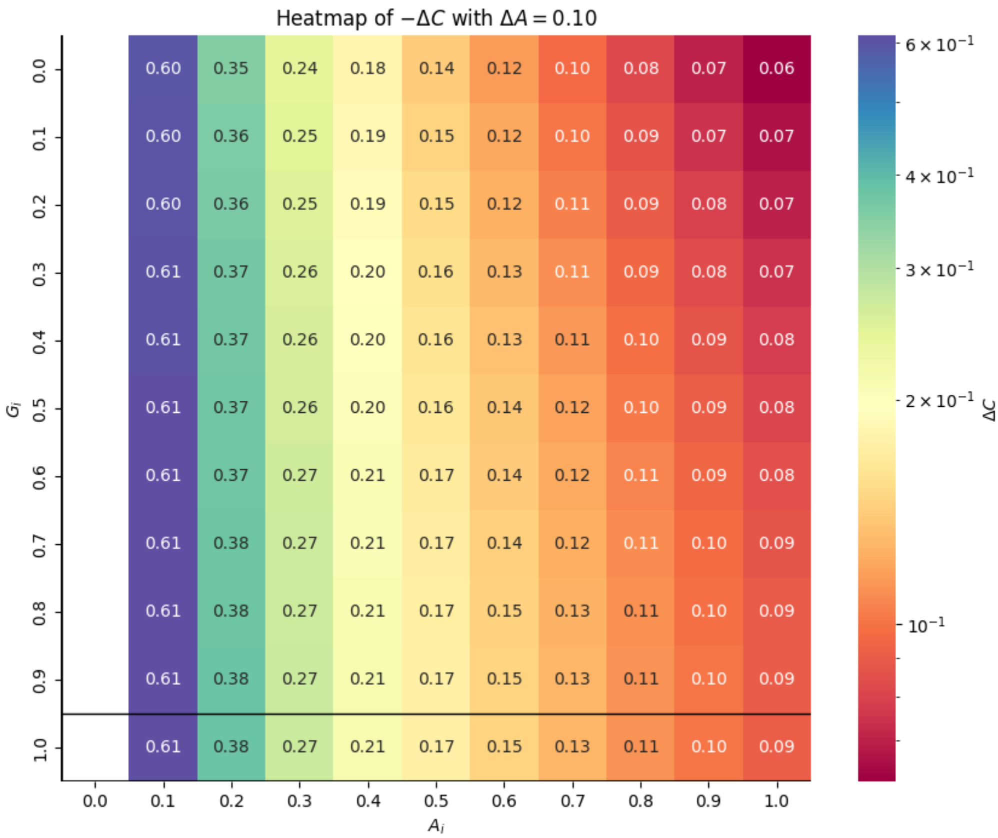


Figure 15 shows the cost of Carbon increasing with A_i and decreasing on G_i.

More examples are in Appendix C.

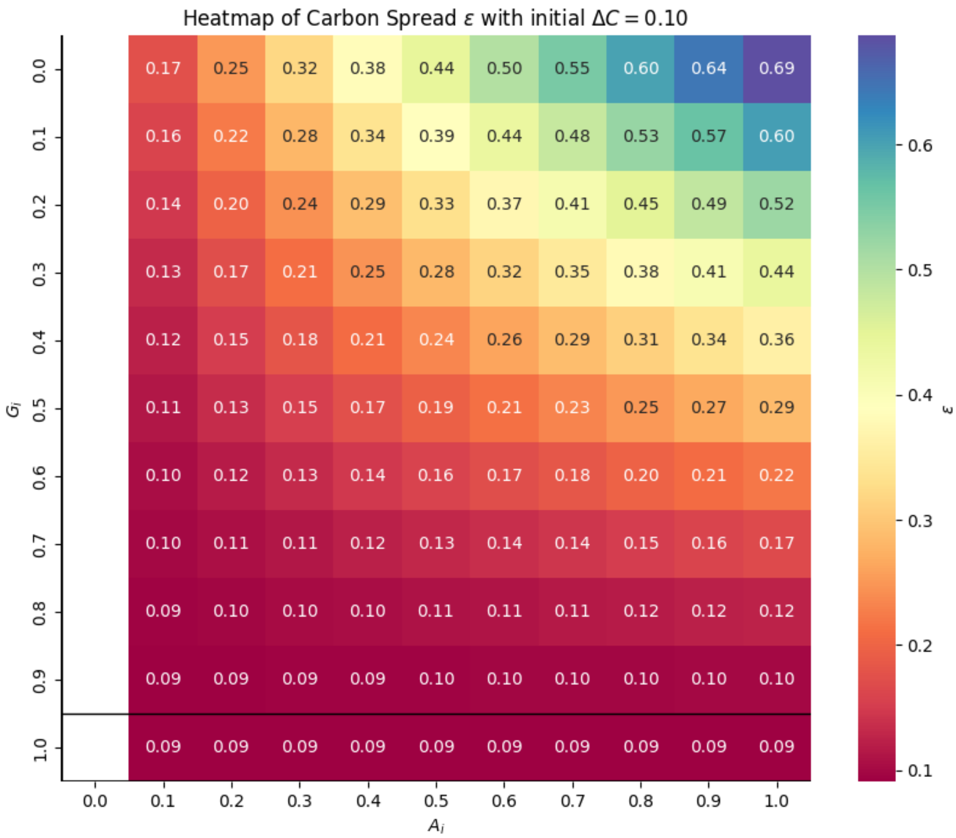
Unweighted Carbon Class

An offset for Carbon class with a zero `A` stake cannot be extracted from the portfolio by swapping in `A` tokens. However, it is part of the Portfolio yield detailed in Section 3.1.3.

Liquidation: $\Delta A = 1$

In the event that 100% of `A` tokens are placed into the burn mechanism for Carbon Offsets, the balances of all Carbon held in the Portfolio post-trade are distributed to all `G` holders.
Figure 16 below shows the spread captured on a 'Round trip' by the system where ε is the proportion retained:

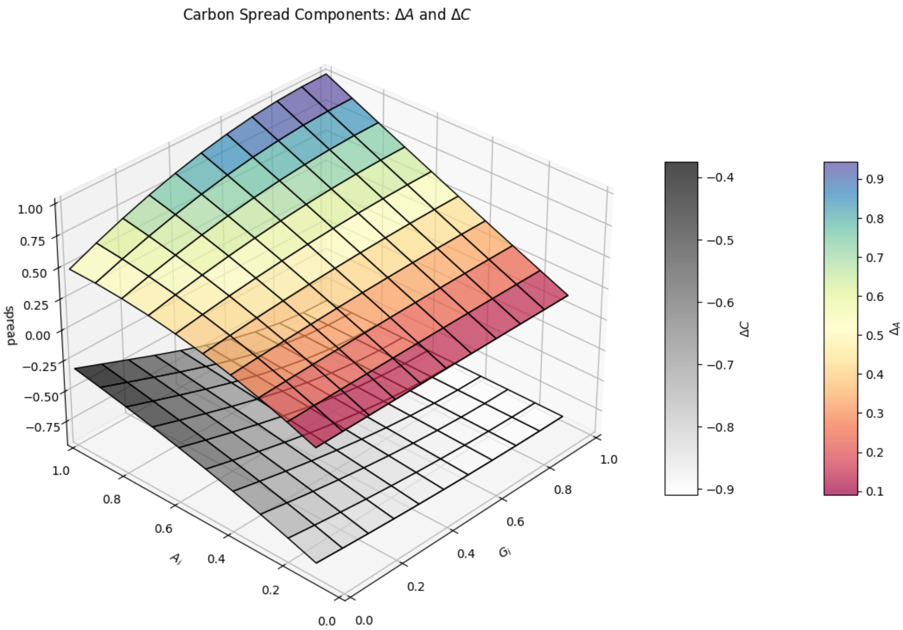
Figure 16: Carbon 'Spread'



G_i \ A_i	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
0.0		0.17	0.25	0.32	0.38	0.44	0.50	0.55	0.60	0.64	0.69
0.1		0.16	0.22	0.28	0.34	0.39	0.44	0.48	0.53	0.57	0.60
0.2		0.14	0.20	0.24	0.29	0.33	0.37	0.41	0.45	0.49	0.52
0.3		0.13	0.17	0.21	0.25	0.28	0.32	0.35	0.38	0.41	0.44
0.4		0.12	0.15	0.18	0.21	0.24	0.26	0.29	0.31	0.34	0.36
0.5		0.11	0.13	0.15	0.17	0.19	0.21	0.23	0.25	0.27	0.29
0.6		0.10	0.12	0.13	0.14	0.16	0.17	0.18	0.20	0.21	0.22
0.7		0.10	0.11	0.11	0.12	0.13	0.14	0.14	0.15	0.16	0.17
0.8		0.09	0.10	0.10	0.10	0.11	0.11	0.11	0.12	0.12	0.12
0.9		0.09	0.09	0.09	0.09	0.10	0.10	0.10	0.10	0.10	0.10
1.0		0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09

Figure 17 shows the component 'Spread' contributions on a Carbon sale and purchase of offset round trip.

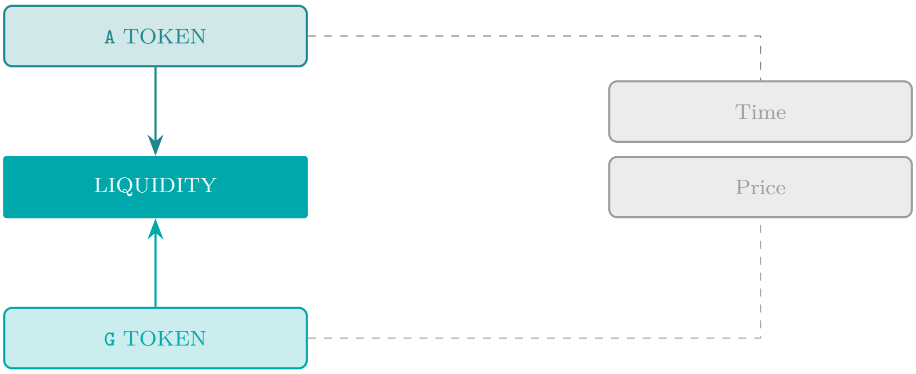
Figure 17: Carbon 'Spread' Components



3.3 Liquidity Markets

Both `A` and `G` tokens can be used independently of price (and time) staking for providing liquidity.

Figure 18: Token Liquidity and Pricing Structure



There are two core liquidity pools:

1. An AMM 50:50 pairing of `A` and `G` tokens; pool $\overline{\texttt{AG}}$.
2. A hard currency `USDC` denoted as `Q` paired with `A`; pool $\overline{\texttt{AQ}}$.

3.3.1 Liquidity Fees

The $\overline{\texttt{AQ}}$ pool will have its own set of fees in the normal way[1].

The $\overline{\texttt{AG}}$ pool has different economics as the assets are highly correlated since they represent the same economy. For this reason, the fees are extremely low.

By locking liquidity (LP tokens) to the **standard maturities**, both pools may receive a distribution of `A` tokens determined from the Risky Yield calculation below. This is an additional primary issuance to the Bond Synthetic Yields already discussed.

[1]Note the development of LP pricing functionality may be applicable.

3.3.2 Risky Yield: Beta Determination

We can consider the Bond market yield as the system *risk-free* rate. In addition to this mechanism, a *risky* spread is determined that is ultimately paid to the liquidity providers of the `A` and `G` tokens as compensation for the risk levels assumed.

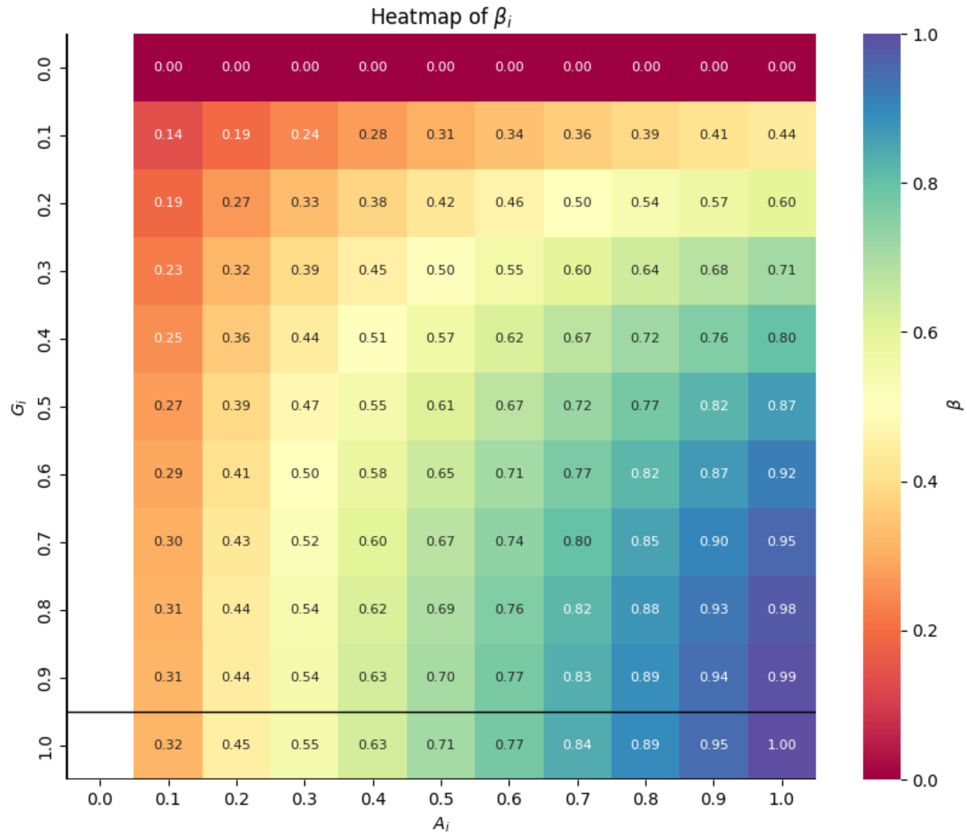
As we have seen, the `G` token has an impact on risk-pricing of `A`. As `G` staking increases, the relationship between the Carbon class selected under G_i and the Portfolio token `A` strengthens. We can consider G_i staking as an estimate of residual or idiosyncratic risk in the carbon-class and this allows us to calculate a Portfolio beta β from the implied betas of each carbon class i.

$$\beta = \sqrt{\sum_{i=1}^{n} A_i - A_i(1 - G_i)^2} \tag{23}$$

The Portfolio β determines a yield factor for the liquidity pools of A to compensate for the implied risk levels.

For intuition, the map in Figure 19 shows the various outputs of the function per Class.

Figure 19: Range of β_i



The table and figure below show an example of the effects on β on allocating large G_i values to small A_i values where the shift in G_i results in a lower β (0.27 from 0.55) with no change to total G and A staking.

Table 2: Effect on β from outsized G Staking

Class	1	2	3	4	β
A_i	0.50	0.20	0.10	0.05	
G_i	0.30	0.10	0.05	0.01	
β_i^2	0.2550	0.0380	0.0098	0.0010	0.5511
New G_i	0.01	0.05	0.10	0.30	
ΔG_i	(0.29)	(0.05)	0.05	0.29	
β_i^2	0.0100	0.0195	0.0190	0.0255	0.2719
$\Delta\beta_i^2$	(0.2451)	(0.0185)	0.0092	0.0245	

Figure 20: Example of G Stake on β

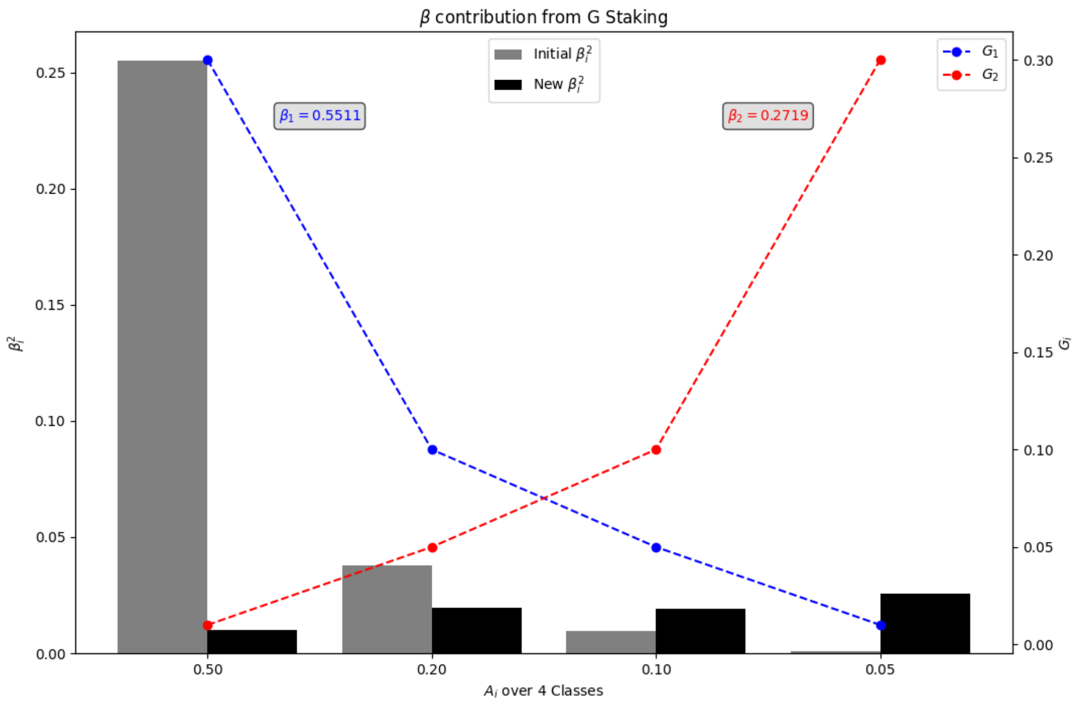
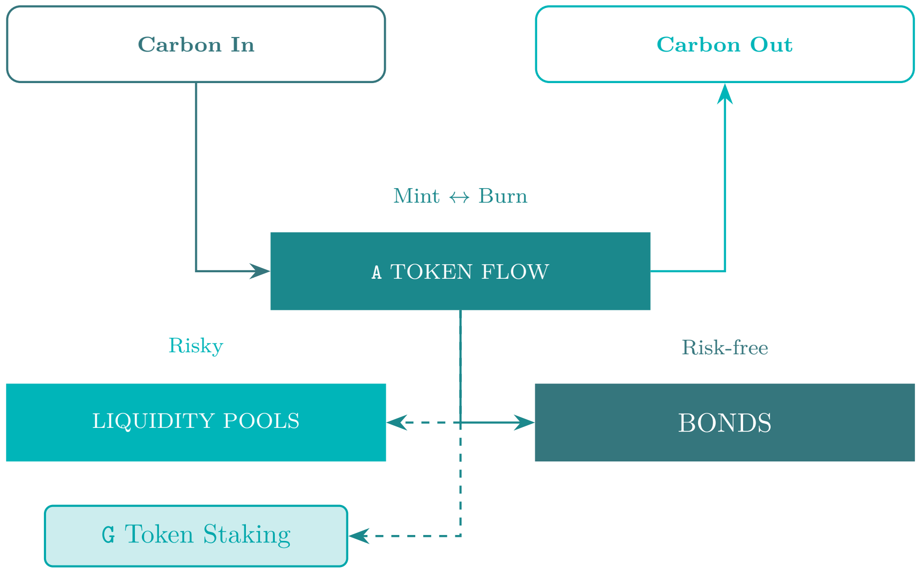


Figure 20 shows the β sensitivity to G staking as a function of A stake; that is to say that a large G_i stake on a small A_i stake has limited effects (notwithstanding other consequential factors).

3.3.3 Allocation of Risk Premium

The full issuance of `A` tokens is depicted below including now the risky premium for the liquidity pools accordingly.

Figure 21: `A` Token Flow Structure



3.3.4 Share of Risky Premium

The risky premium allocation is shared between G staking, $\overline{\texttt{AG}}$ and $\overline{\texttt{AQ}}$ pools with shares λ_{GG}, λ_G and λ_Q respectively.

Defining:

G_G: Total G tokens in the $\overline{\texttt{AG}}$ pool, expressed as a proportion of outstanding supply of G.

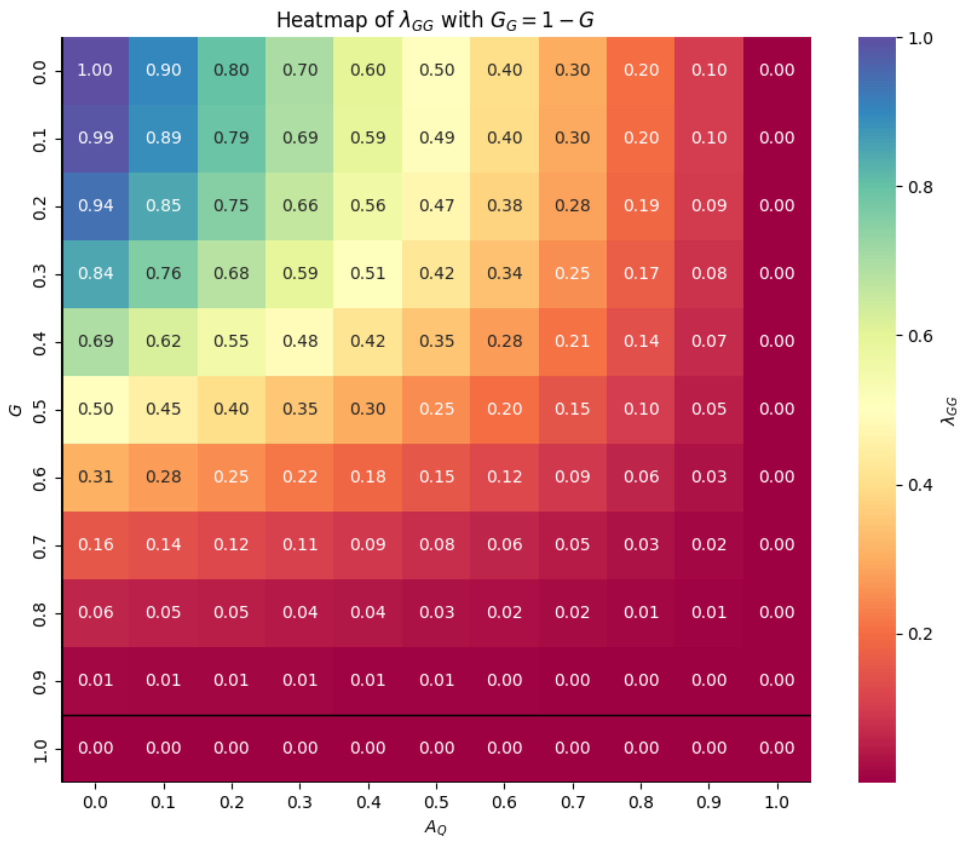
A_G: Total A tokens in the $\overline{\texttt{AG}}$ pool, expressed as a proportion of outstanding supply of A.

A_Q: Total A tokens in the $\overline{\texttt{AQ}}$ pool, expressed as a proportion of outstanding supply of A.

The allocation to G token staking, λ_{GG}:

$$\lambda_{GG} = \frac{1 - A_Q}{1 + \left(\frac{G_i}{G_G}\right)^2} \tag{24}$$

Figure 22: G Stake Allocation (assuming $G_G = 1 - G_i$)



Noting the relationship between G and β, and particularly if $G = 0$, $\beta = 0$.

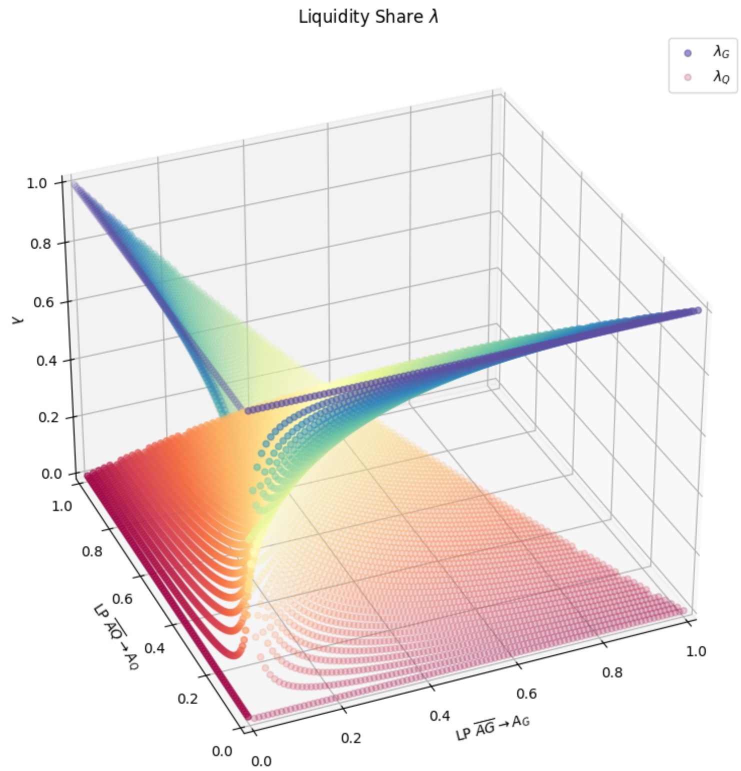
The residual share, $1 - \lambda_{GG}$, is split between the liquidity pools:

$$\lambda_G = \frac{2A_G}{2A_G + A_Q\sqrt{2}} \tag{25}$$

For completeness:

$$\lambda_Q = 1 - \lambda_G \tag{26}$$

Figure 23: Liquidity Pool Split λ_G, λ_Q



3.3.5 Risky Premium Distribution

For $\lambda_{GG}, \lambda_G, \lambda_Q$ we apply β:

$$\Lambda_X = \lambda_X \, \beta, \quad \text{for } X \in \{GG, G, Q\} \tag{27}$$

Taking b as a discount parameter:

$$b = \frac{\sum_1^{40} Z_t \, S_t \, B_t}{\sum_1^{40} Z_t \, S_t} \tag{28}$$

The total Risky Yield tokens R_λ:

$$R_\lambda = b \, R \, (\Lambda_{GG} + \Lambda_G + \Lambda_Q) \tag{29}$$

The allocations of R_λ are pro-rata to $\Lambda_{GG}, \Lambda_G, \Lambda_Q$ and thereafter:

1. Locked `G`: Λ_{GG} in proportion to `G`.
2. Locked $\overline{\texttt{AG}}$, $\overline{\texttt{AQ}}$ tokens are allocated a weighting G_t, Q_t depending on their time bucket t:

$$G_t = \frac{Z_t \, L_{Gt} \, B_t}{\sum Z_t \, L_{Gt} \, B_t} \tag{30}$$

$$Q_t = \frac{Z_t \, L_{Qt} \, B_t}{\sum Z_t \, L_{Gt} \, B_t} \tag{31}$$

   Where L_{Gt}, L_{Qt} are the proportion of all liquidity locked in each time bucket for $\overline{\texttt{AG}}$ and $\overline{\texttt{AQ}}$ respectively.

   Thereafter each time bucket allocation is proportionate to LP holdings.

4 Klima 2.0 Token Distribution

4.1 Planned Allocations

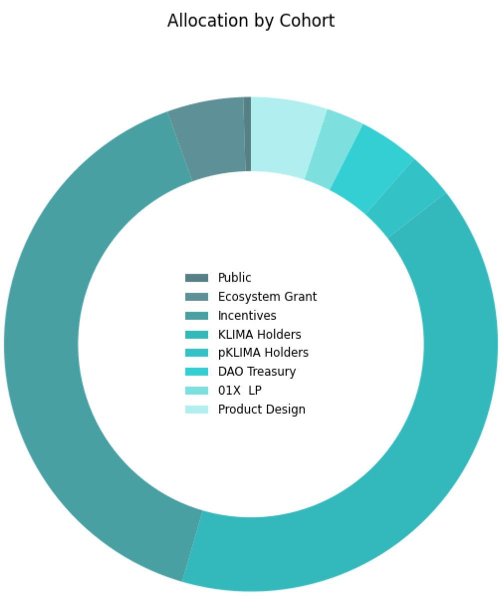
Table 3: KLIMA Token

Cohort	Proportion	Quantity (m)
Klima Holders	87.5%	17.5
DAO / Treasury	10%	2.0
01X	2.5%	0.5
Total		20

Table 4: KlimaX Token

Cohort	Proportion	Quantity (m)	Liquidity
Klima Holders	40%	40	Logistic Vesting 48 months
Ecosystem Grant	5%	5	Logistic Vesting 48 months
Programmatic Incentives	40%	40	Incentive Curve
pKlima Holders	3.0%	3	Logistic Vesting 48 months
DAO / Treasury	4.5%	4.5	24 month locked LP of $\overline{\texttt{AG}}$
01X	2.5%	2.5	24 month locked LP of $\overline{\texttt{AG}}$
Product design and development	5%	5	Logistic Vesting 48 months
Total		100	

Figure 24: Allocations: KlimaX Token



4.2 Programmatic Incentive Curve

The incentive issuance is built on a logistic function, P to generate total proportion of supply in issue. It is calibrated from the initial supply at TGE, P_0 and the inflection point time T where 50% of G token incentives have been released.

Setting x_0 from the initial supply parameter:

$$x_0 = \ln\left(\frac{P_0}{1 - P_0}\right) \tag{32}$$

With x_t at time point $t \in (0, \infty)$:

$$x_t = x_0\left(1 - \frac{t}{T}\right) \tag{33}$$

Giving supply function $\mathrm{P}(t)$ as:

$$\mathrm{P}(t) = \frac{\exp(x_t)}{\exp(x_t) + 1} \tag{34}$$

P_0 set at 7.0% and T at 24 months:

Figure 25: Incentive Issuance

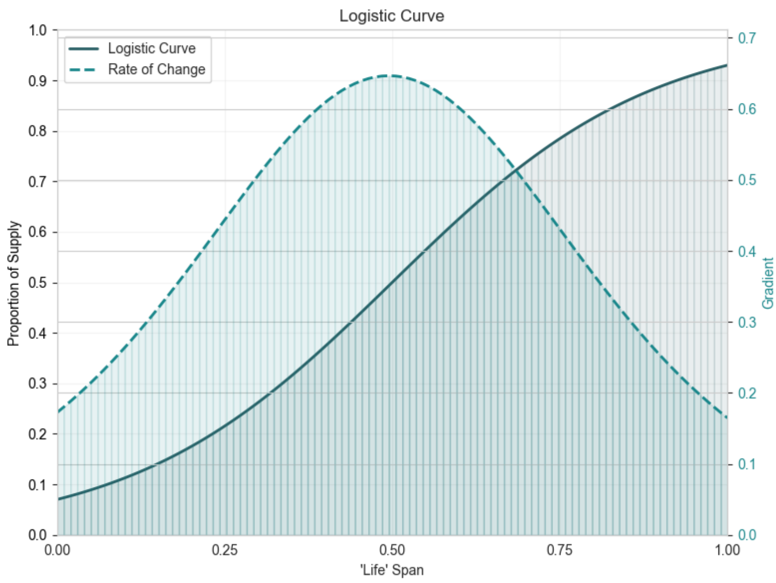


Figure 26: `KlimaX` Token Supply Over Time

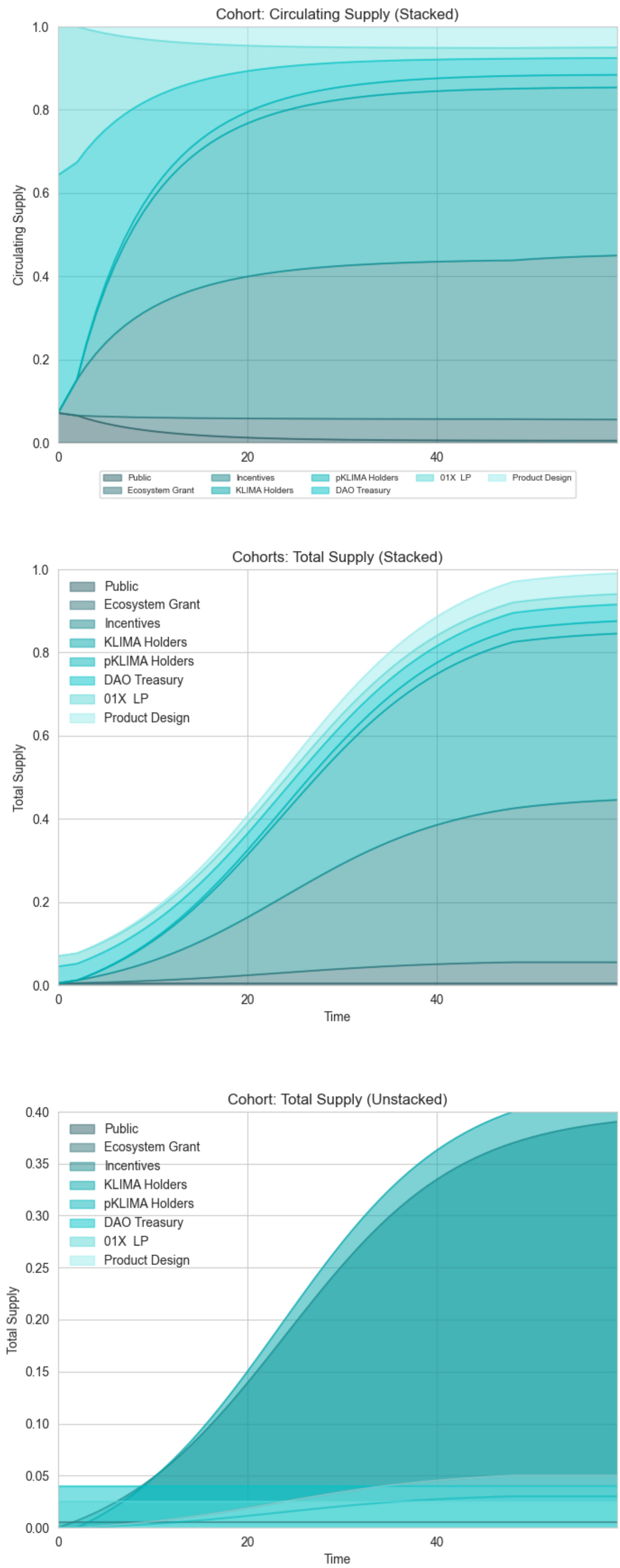
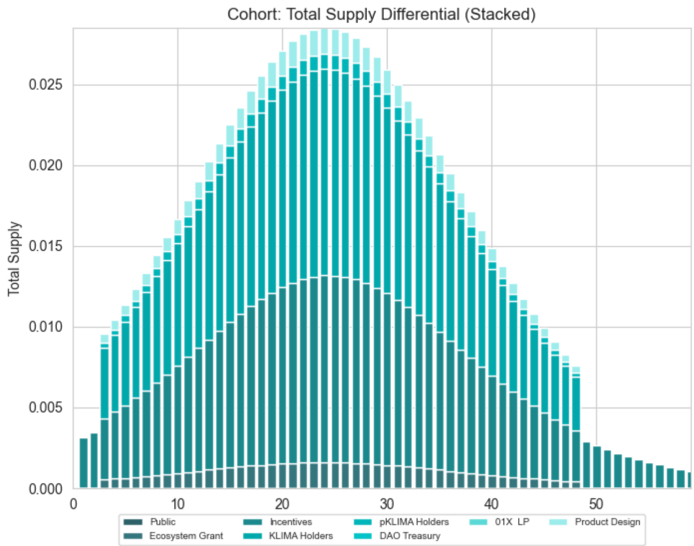
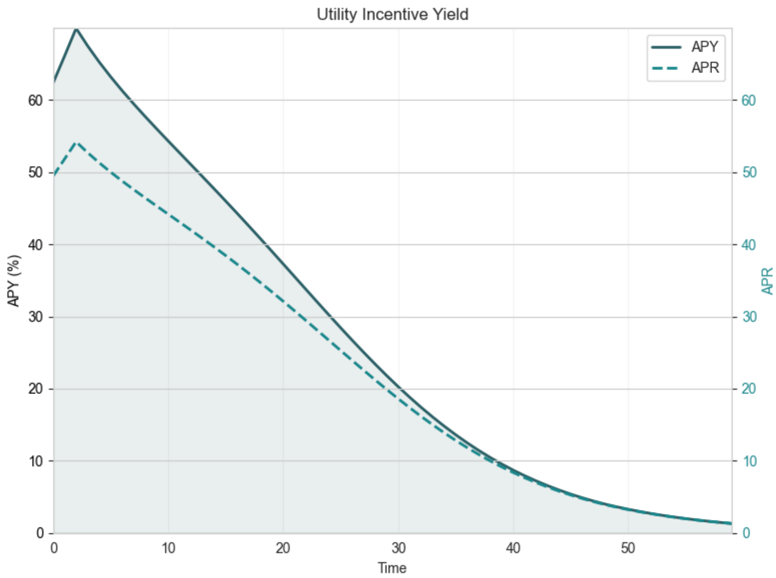


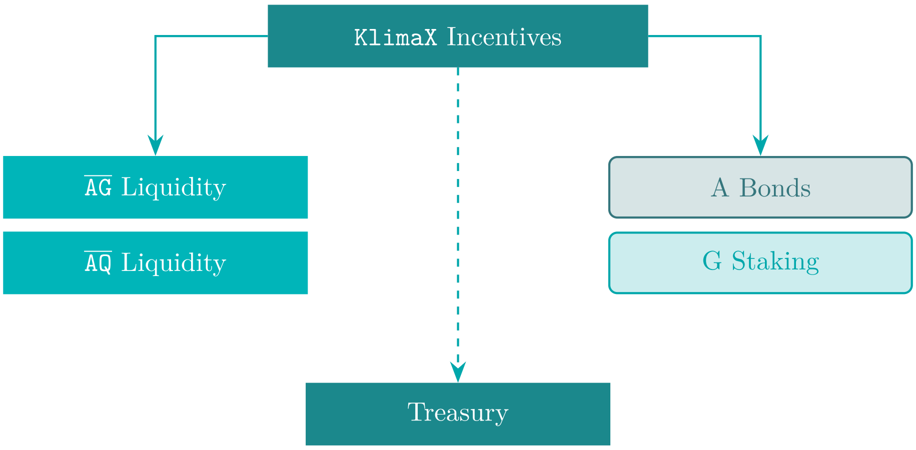
Figure 27: `KlimaX` Token Supply Risk Metrics





4.3 Incentive Allocations

Figure 28: G Token Incentive Distribution Structure



The **relative utilisation** measurement factor υ is calculated as follows:

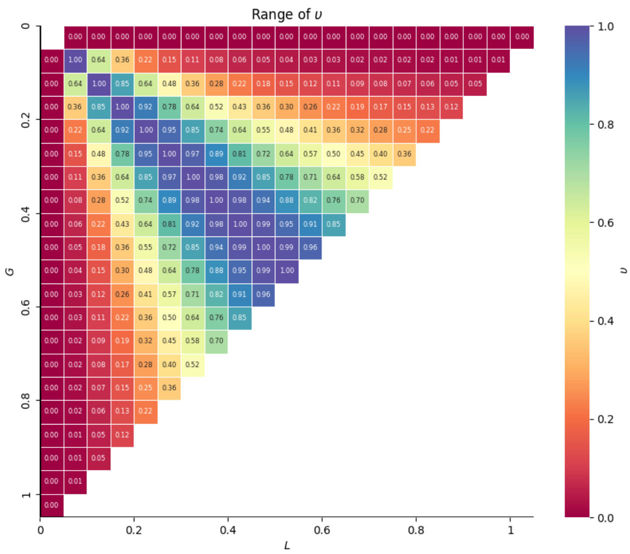
Defining initially:

G: Total G tokens staked expressed as a proportion of circulating supply, $G \in [0, 1]$.
L: Total G tokens held in the $\overline{\texttt{AG}}$ pool expressed as a proportion of circulating supply, $L \in (0, 1]$.

Where $\upsilon = 0$ if $G + L = 0$ otherwise:

$$\upsilon = \left(\frac{2GL}{G^2 + L^2}\right)^2 \tag{35}$$

Figure 29: Upsilon υ range of values



The **absolute utilisation** parameter η is defined as $\eta = 0$ if $G + L = 0$ otherwise:

$$\eta = \frac{2GL}{G(1-G) + L(1-L)} \tag{36}$$

Incentives **I** are allocated as follows:

Treasury

The allocation to the Treasury I_T is the imbalance generated from υ:

$$I_T = 1 - \upsilon\,\eta \tag{37}$$

Post Treasury

The residual post Treasury allocation is shared four ways within 2 buckets:

(1) `A` Bonds & `G` Staking

Where S is the proportion of `A` tokens that are staked for Bonds (as defined previously in Section 3.1):

i. `A` Bonds, I_S:

$$I_S = S\,\frac{L^2}{G^2 + L^2} \tag{38}$$

ii. `G` Staking, I_G:

$$I_G = (1-S)\,\frac{L^2}{G^2 + L^2} \tag{39}$$

(2) Liquidity

With λ_G, λ_Q,λ_{GG} as defined in Section 3.3.4:

iii. $\overline{\texttt{AG}}$ Pool, I_{AG}

$$I_{AG} = \frac{\lambda_G}{1-\lambda_{GG}}\,\frac{G^2}{G^2 + L^2} \tag{40}$$

iv. $\overline{\texttt{AQ}}$ Pool, I_{AQ}:

$$I_{AQ} = \frac{\lambda_Q}{1-\lambda_{GG}}\,\frac{G^2}{G^2 + L^2} \tag{41}$$

Figure 30: Share of Non-Treasury Incentives (1)(2)

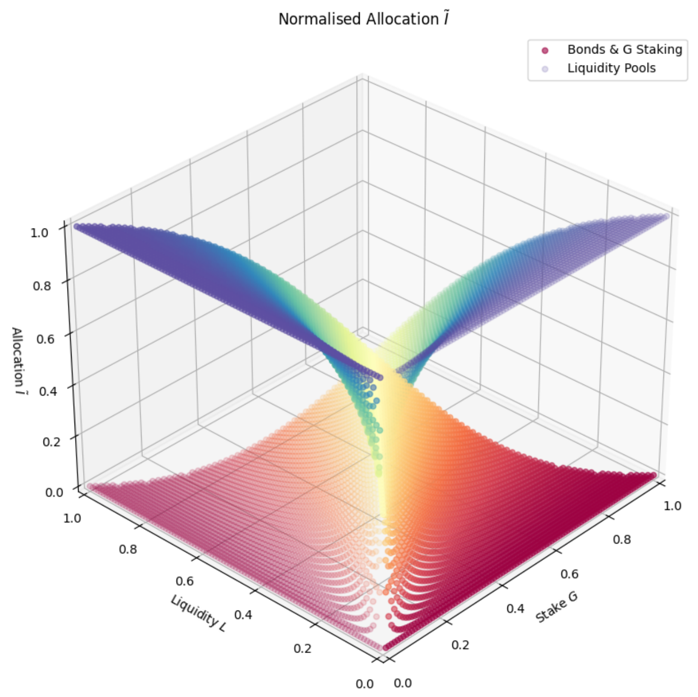
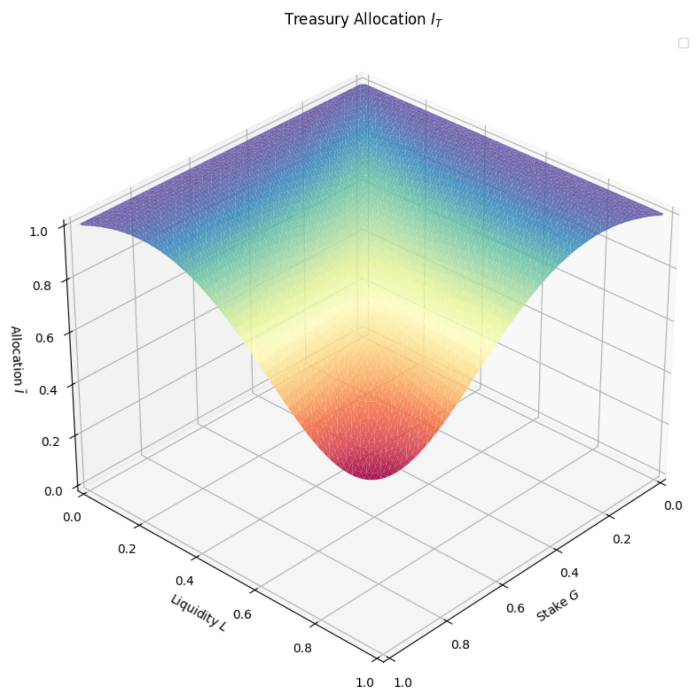
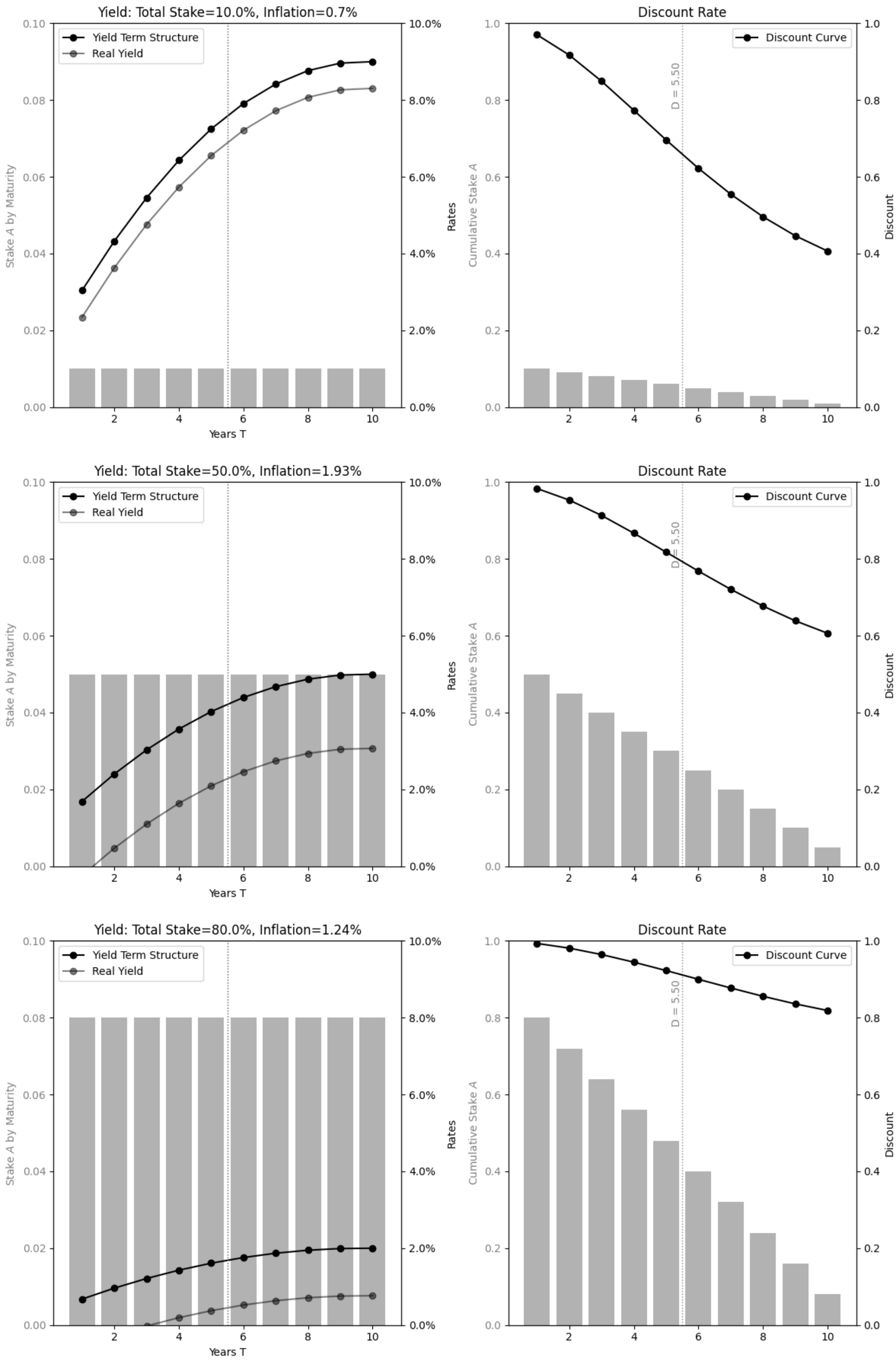


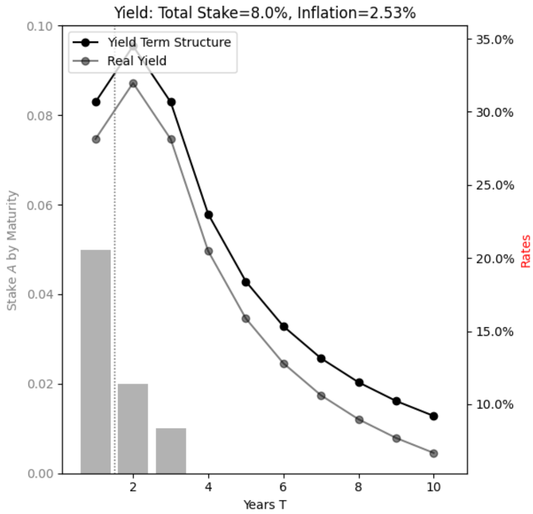
Figure 31: Treasury Incentives I_T

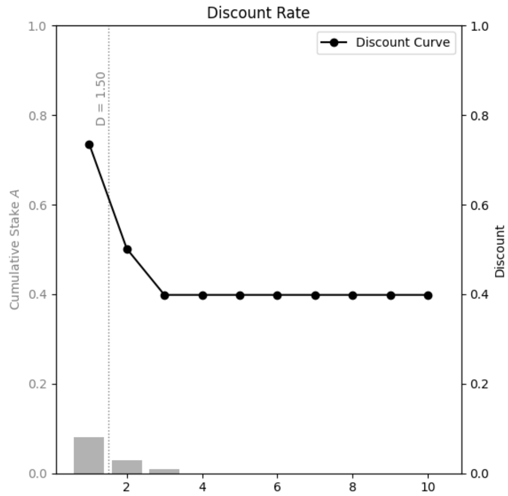


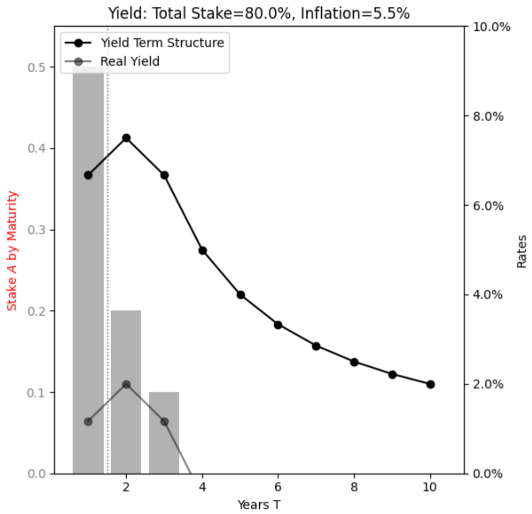
APPENDIX

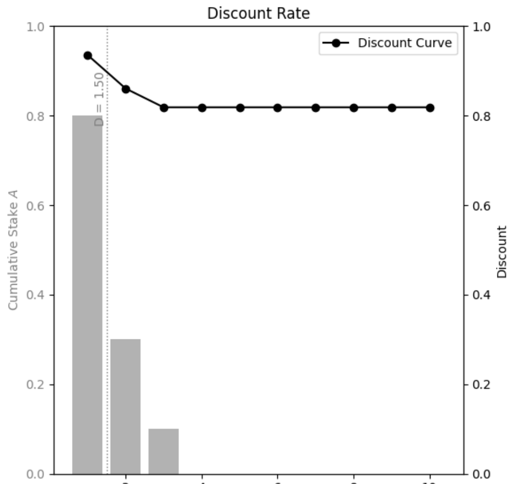
A Bond Market Outputs

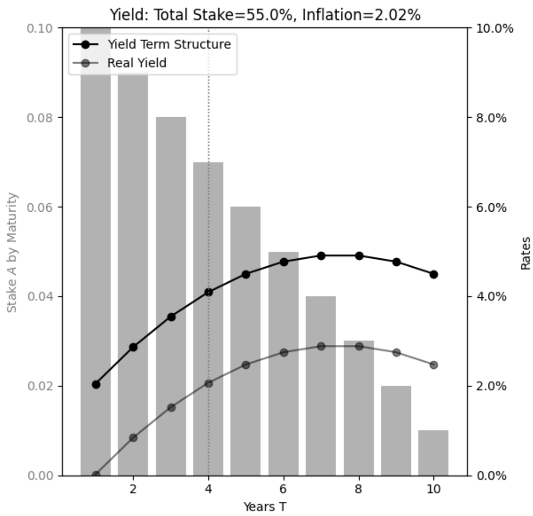


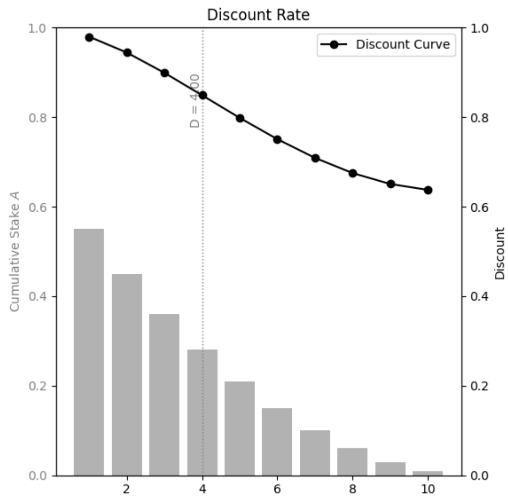

Yield: Total Stake=8.0%, Inflation=2.53%
Yield Term Structure
Real Yield
Stake A by Maturity
Rates
Years T

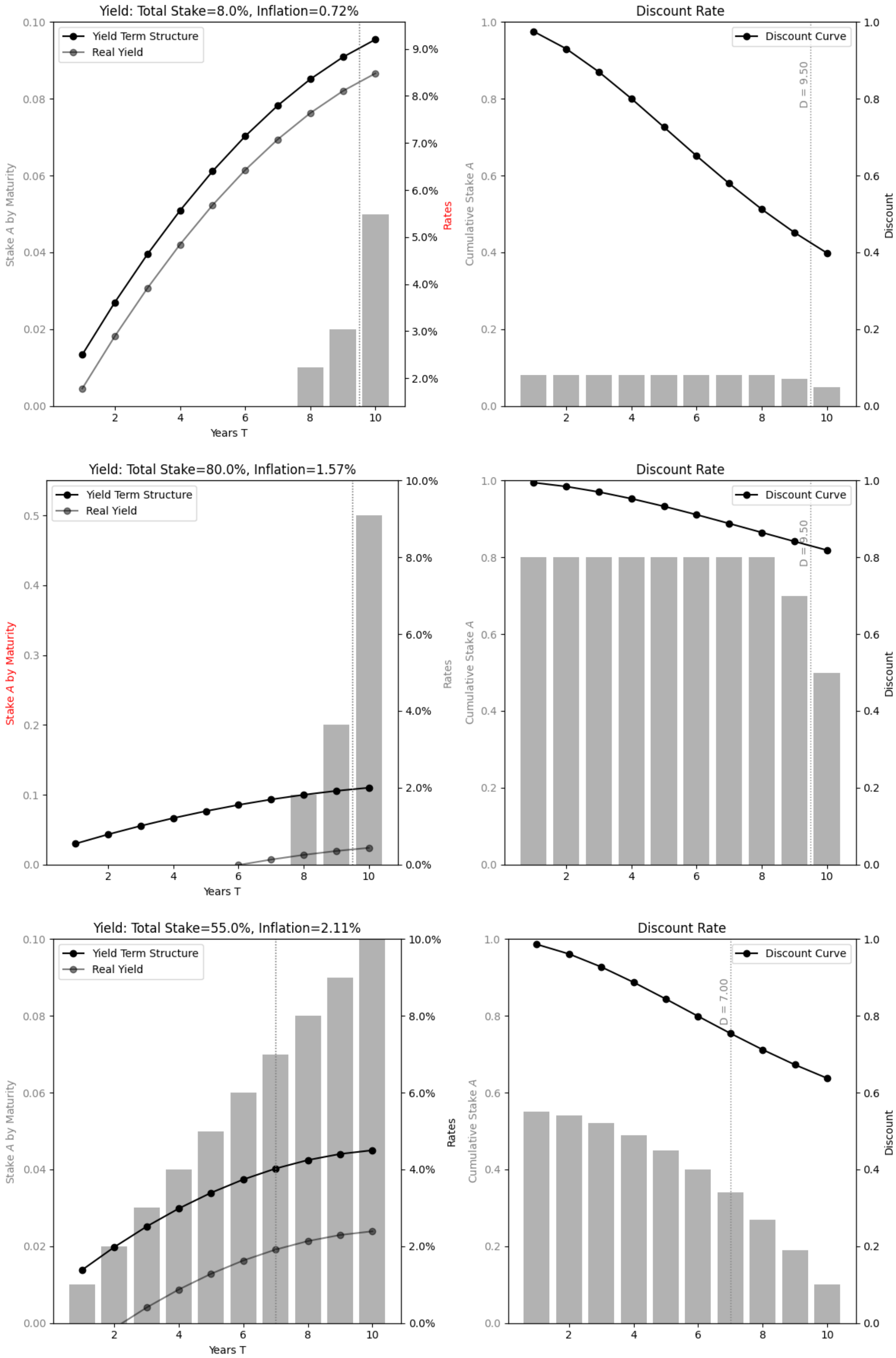

Discount Rate
Discount Curve
D = 1.50
Cumulative Stake A
Discount

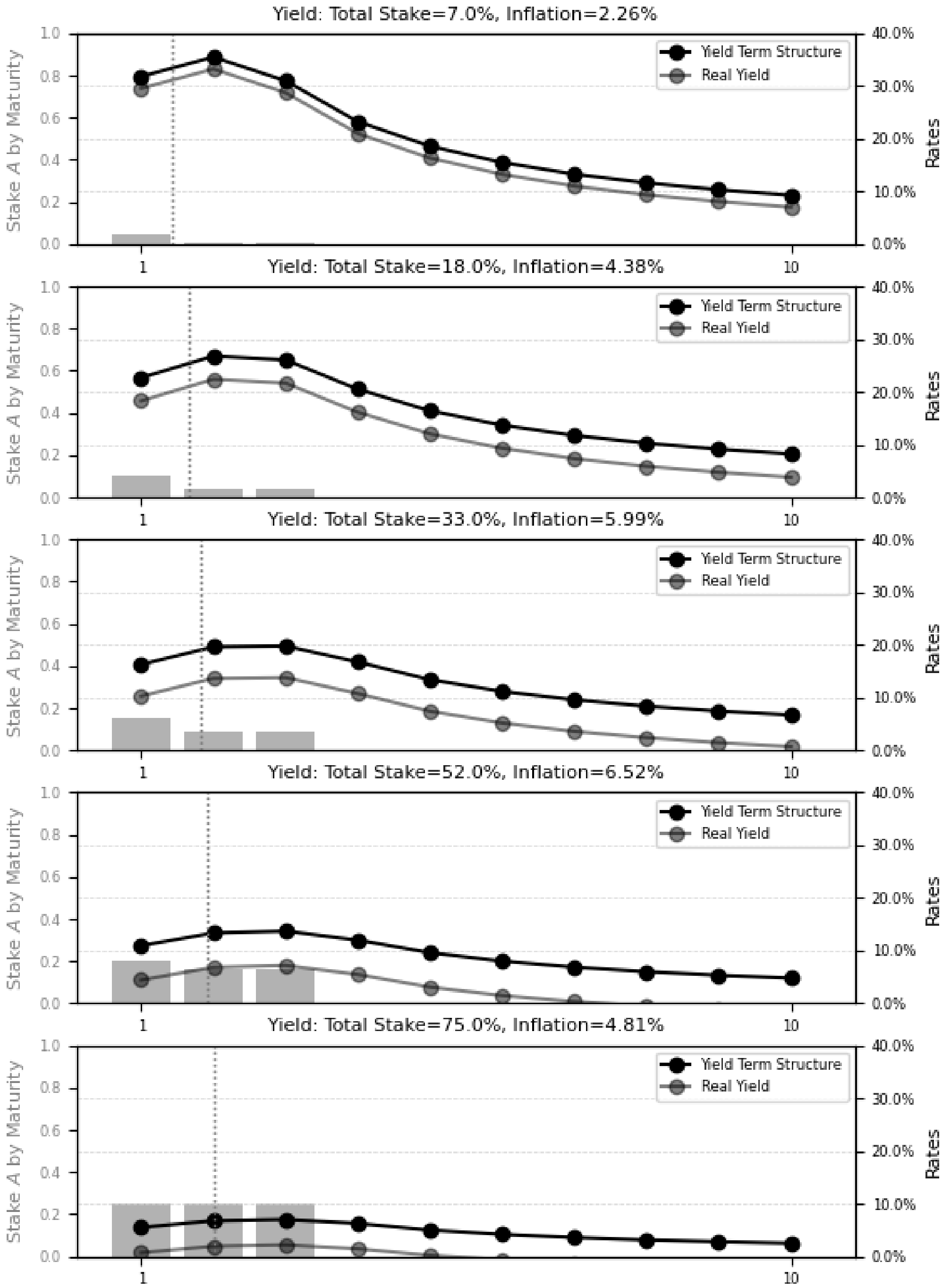

Yield: Total Stake=80.0%, Inflation=5.5%
Yield Term Structure
Real Yield
Stake A by Maturity
Rates
Years T

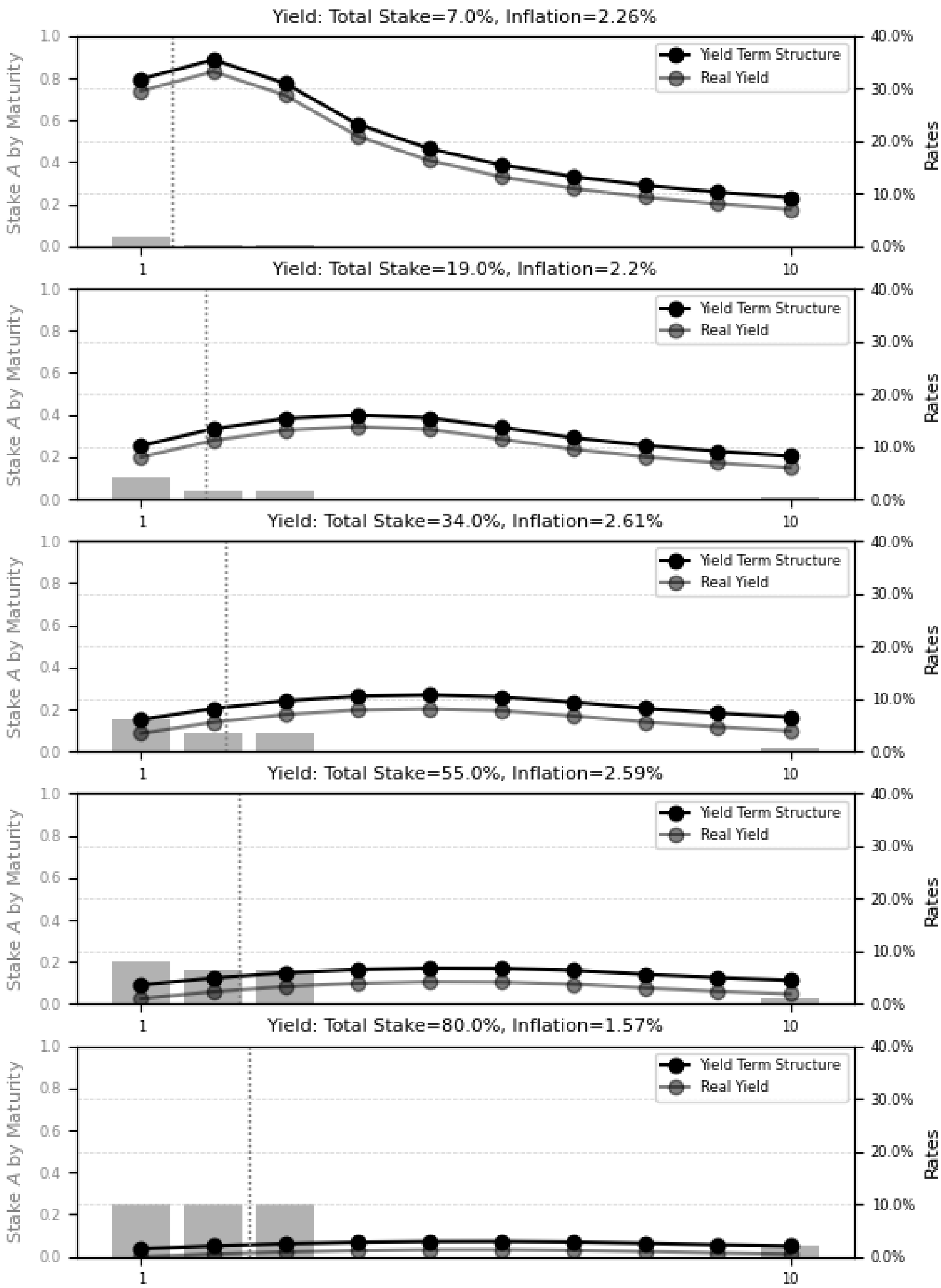

Discount Rate
Discount Curve
D = 1.50
Cumulative Stake A
Discount


Yield: Total Stake=55.0%, Inflation=2.02%
Yield Term Structure
Real Yield
Stake A by Maturity
Rates
Years T


Discount Rate
Discount Curve
D = 4.00
Cumulative Stake A
Discount


Yield: Total Stake=8.0%, Inflation=0.72%
Yield Term Structure
Real Yield
Stake A by Maturity
Rates
Years T
Discount Rate
Discount Curve
D = 9.50
Cumulative Stake A
Discount
Yield: Total Stake=80.0%, Inflation=1.57%
Yield Term Structure
Real Yield
Stake A by Maturity
Rates
Years T
Discount Rate
Discount Curve
D = 9.50
Cumulative Stake A
Discount
Yield: Total Stake=55.0%, Inflation=2.11%
Yield Term Structure
Real Yield
Stake A by Maturity
Rates
Years T
Discount Rate
Discount Curve
D = 7.00
Cumulative Stake A
Discount

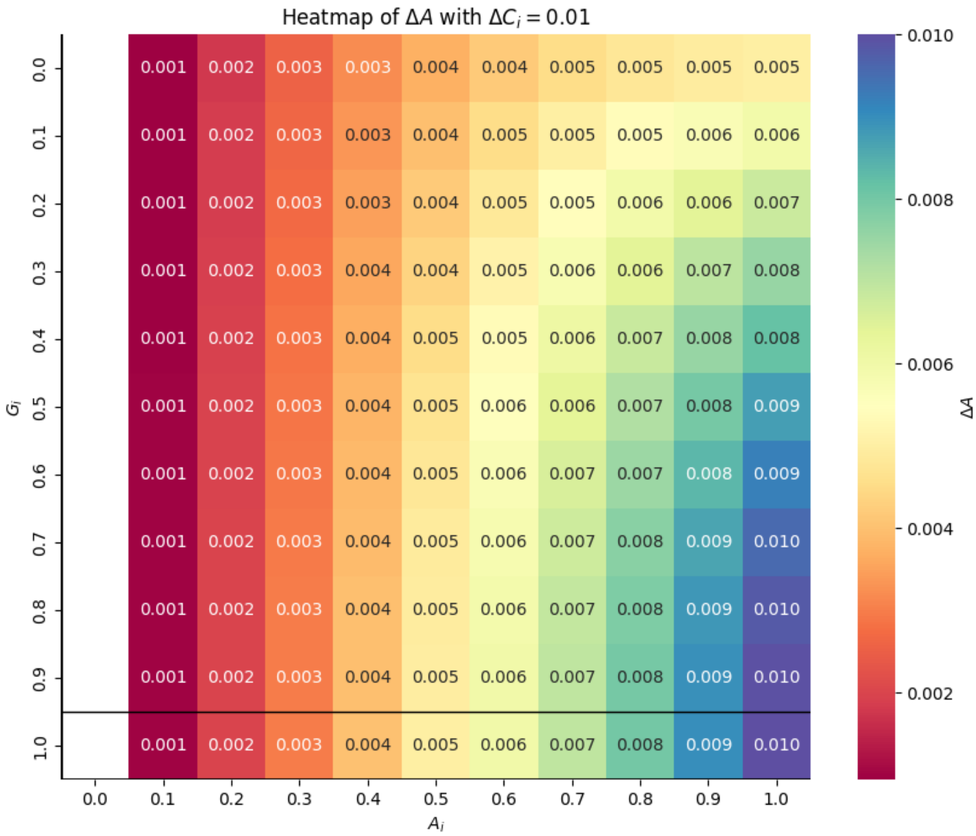

Yield: Total Stake=7.0%, Inflation=2.26%
Yield: Total Stake=18.0%, Inflation=4.38%
Yield: Total Stake=33.0%, Inflation=5.99%
Yield: Total Stake=52.0%, Inflation=6.52%
Yield: Total Stake=75.0%, Inflation=4.81%
Yield Term Structure
Real Yield
Stake A by Maturity
Rates
1.0
0.8
0.6
0.4
0.2
0.0
40.0%
30.0%
20.0%
10.0%
0.0%
1
10

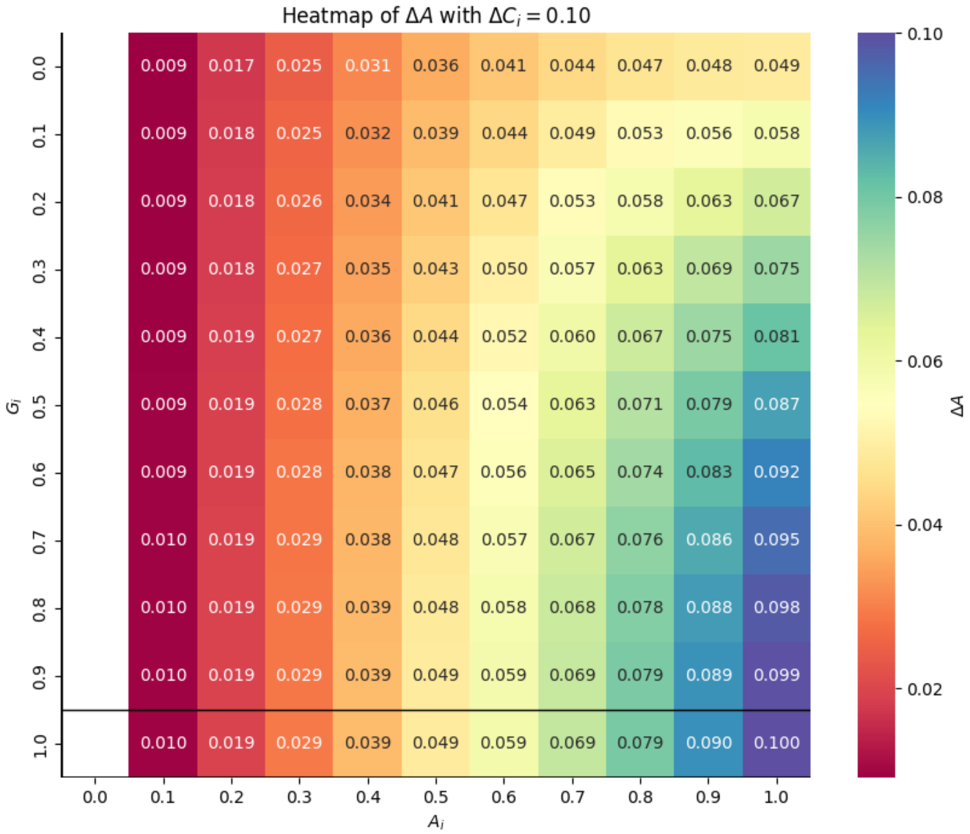

Yield: Total Stake=7.0%, Inflation=2.26%
Yield: Total Stake=19.0%, Inflation=2.2%
Yield: Total Stake=34.0%, Inflation=2.61%
Yield: Total Stake=55.0%, Inflation=2.59%
Yield: Total Stake=80.0%, Inflation=1.57%
Yield Term Structure
Real Yield
Stake A by Maturity
Rates
1.0
0.8
0.6
0.4
0.2
0.0
40.0%
30.0%
20.0%
10.0%
0.0%
1
10

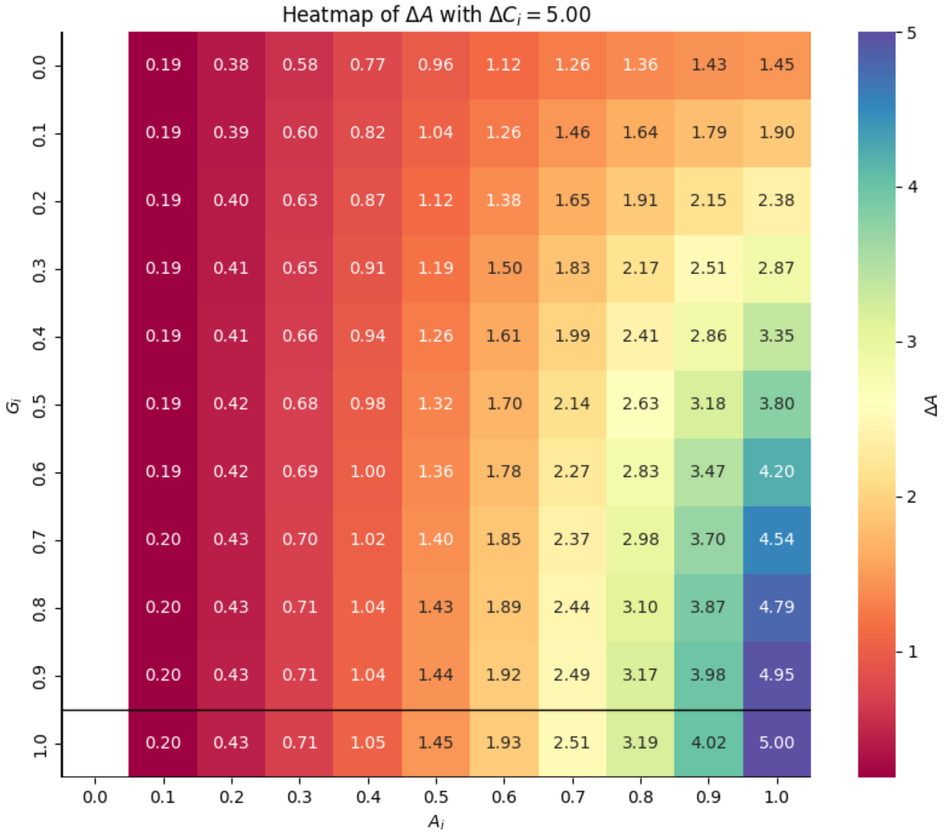
B Carbon Purchase Rates

B.1 Price Curves (ΔA)

Figure 32: A Price Curves (ΔA) when $\Delta C \in \{0.01, 0.10, 5.0\}$

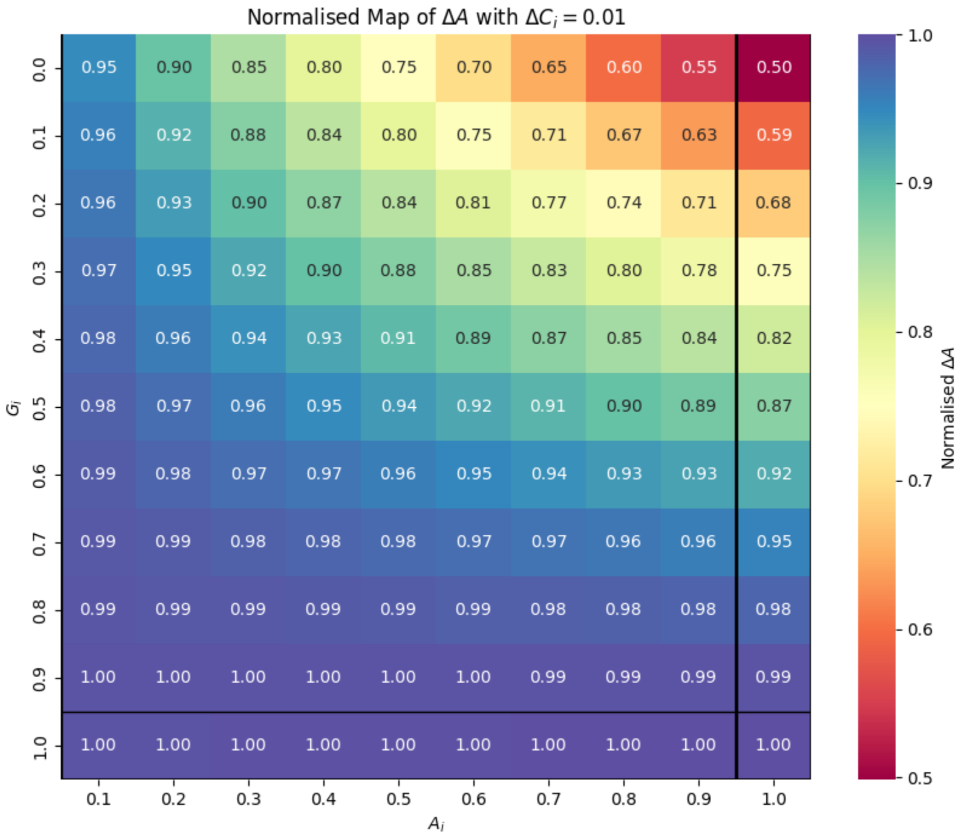


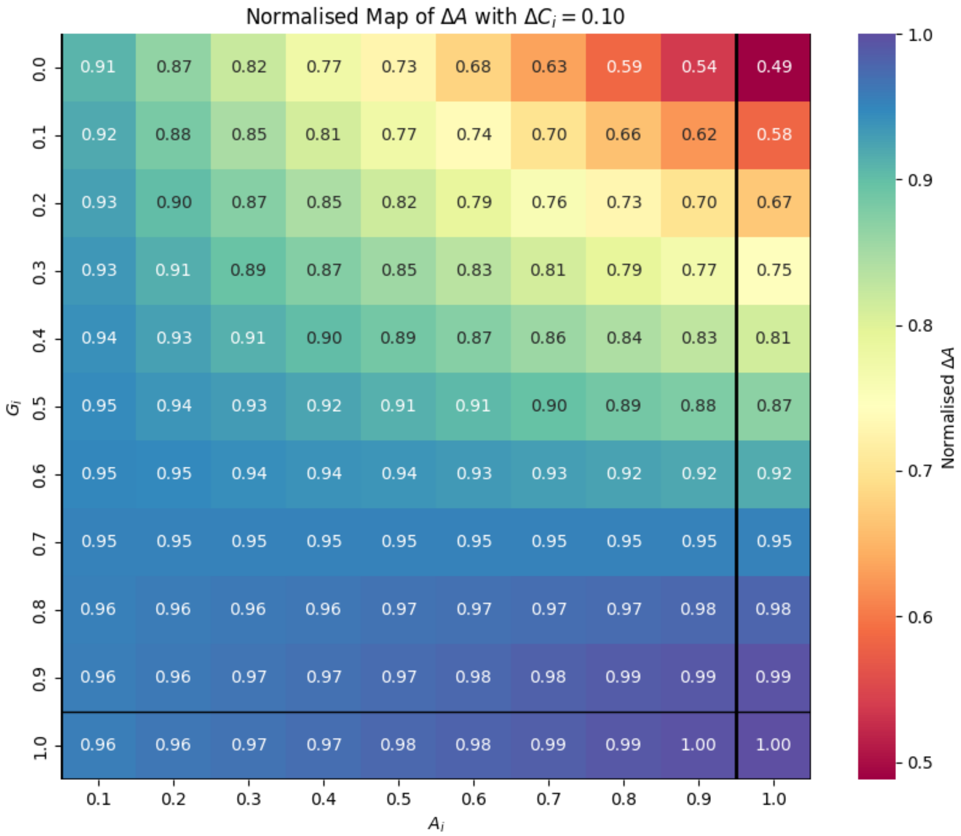

Heatmap of ΔA with $\Delta C_i = 0.10$
0.0 0.009 0.017 0.025 0.031 0.036 0.041 0.044 0.047 0.048 0.049
0.1 0.009 0.018 0.025 0.032 0.039 0.044 0.049 0.053 0.056 0.058
0.2 0.009 0.018 0.026 0.034 0.041 0.047 0.053 0.058 0.063 0.067
0.3 0.009 0.018 0.027 0.035 0.043 0.050 0.057 0.063 0.069 0.075
0.4 0.009 0.019 0.027 0.036 0.044 0.052 0.060 0.067 0.075 0.081
0.5 0.009 0.019 0.028 0.037 0.046 0.054 0.063 0.071 0.079 0.087
0.6 0.009 0.019 0.028 0.038 0.047 0.056 0.065 0.074 0.083 0.092
0.7 0.010 0.019 0.029 0.038 0.048 0.057 0.067 0.076 0.086 0.095
0.8 0.010 0.019 0.029 0.039 0.048 0.058 0.068 0.078 0.088 0.098
0.9 0.010 0.019 0.029 0.039 0.049 0.059 0.069 0.079 0.089 0.099
1.0 0.010 0.019 0.029 0.039 0.049 0.059 0.069 0.079 0.090 0.100
G_i
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
A_i
0.10 0.08 0.06 0.04 0.02
ΔA

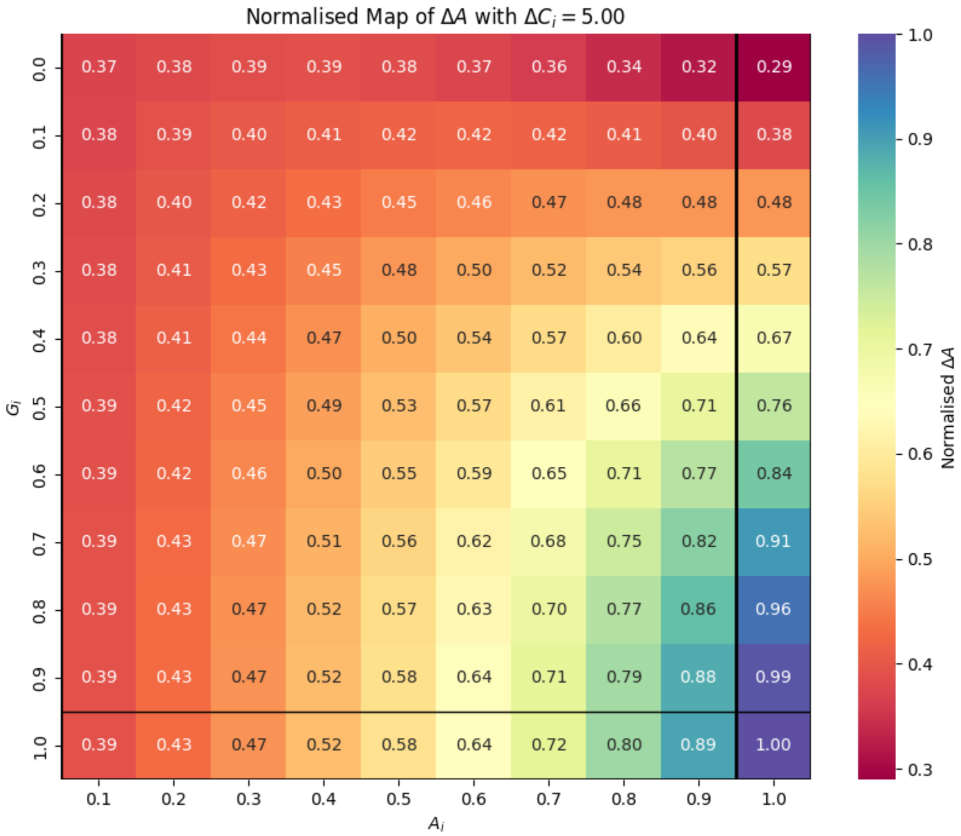

Heatmap of ΔA with $\Delta C_i = 5.00$
G_i
A_i
ΔA
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
0.0: 0.19 0.38 0.58 0.77 0.96 1.12 1.26 1.36 1.43 1.45
0.1: 0.19 0.39 0.60 0.82 1.04 1.26 1.46 1.64 1.79 1.90
0.2: 0.19 0.40 0.63 0.87 1.12 1.38 1.65 1.91 2.15 2.38
0.3: 0.19 0.41 0.65 0.91 1.19 1.50 1.83 2.17 2.51 2.87
0.4: 0.19 0.41 0.66 0.94 1.26 1.61 1.99 2.41 2.86 3.35
0.5: 0.19 0.42 0.68 0.98 1.32 1.70 2.14 2.63 3.18 3.80
0.6: 0.19 0.42 0.69 1.00 1.36 1.78 2.27 2.83 3.47 4.20
0.7: 0.20 0.43 0.70 1.02 1.40 1.85 2.37 2.98 3.70 4.54
0.8: 0.20 0.43 0.71 1.04 1.43 1.89 2.44 3.10 3.87 4.79
0.9: 0.20 0.43 0.71 1.04 1.44 1.92 2.49 3.17 3.98 4.95
1.0: 0.20 0.43 0.71 1.05 1.45 1.93 2.51 3.19 4.02 5.00
1 2 3 4 5

B.2 Normalised Price Curves (ΔA)

Figure 33: Normalised A Price Curves (ΔA) when $\Delta C = \{0.01, 0.10, 5.0\}$

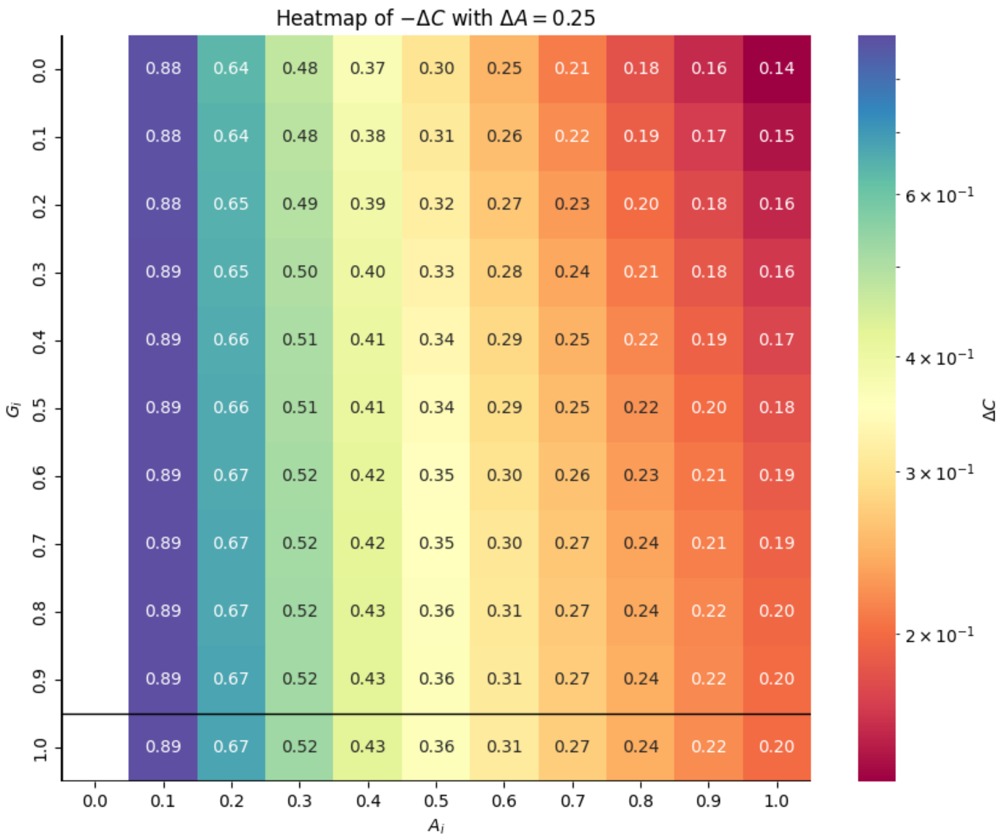


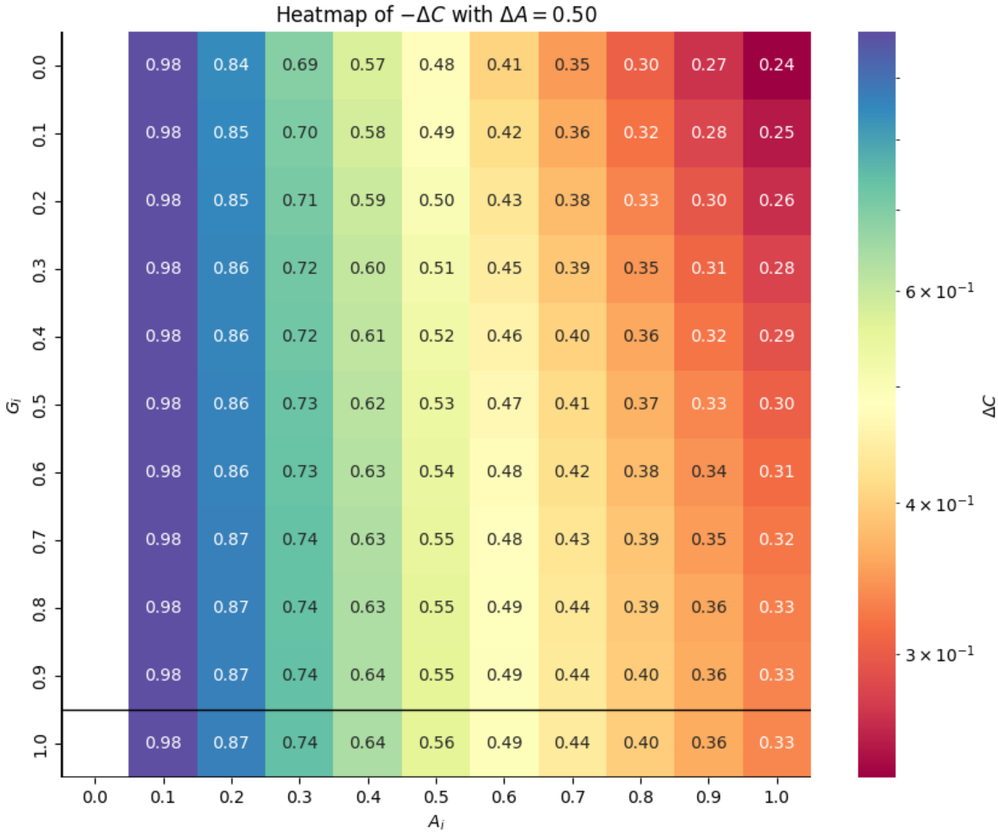

Normalised Map of ΔA with $\Delta C_i = 0.10$
G_i
A_i
Normalised ΔA
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
0.5 0.6 0.7 0.8 0.9 1.0
0.91 0.87 0.82 0.77 0.73 0.68 0.63 0.59 0.54 0.49
0.92 0.88 0.85 0.81 0.77 0.74 0.70 0.66 0.62 0.58
0.93 0.90 0.87 0.85 0.82 0.79 0.76 0.73 0.70 0.67
0.93 0.91 0.89 0.87 0.85 0.83 0.81 0.79 0.77 0.75
0.94 0.93 0.91 0.90 0.89 0.87 0.86 0.84 0.83 0.81
0.95 0.94 0.93 0.92 0.91 0.91 0.90 0.89 0.88 0.87
0.95 0.95 0.94 0.94 0.94 0.93 0.93 0.92 0.92 0.92
0.95 0.95 0.95 0.95 0.95 0.95 0.95 0.95 0.95 0.95
0.96 0.96 0.96 0.96 0.97 0.97 0.97 0.97 0.98 0.98
0.96 0.96 0.97 0.97 0.97 0.98 0.98 0.99 0.99 0.99
0.96 0.96 0.97 0.97 0.98 0.98 0.99 0.99 1.00 1.00


Normalised Map of ΔA with $\Delta C_i = 5.00$
0.0 0.37 0.38 0.39 0.39 0.38 0.37 0.36 0.34 0.32 0.29
0.1 0.38 0.39 0.40 0.41 0.42 0.42 0.42 0.41 0.40 0.38
0.2 0.38 0.40 0.42 0.43 0.45 0.46 0.47 0.48 0.48 0.48
0.3 0.38 0.41 0.43 0.45 0.48 0.50 0.52 0.54 0.56 0.57
0.4 0.38 0.41 0.44 0.47 0.50 0.54 0.57 0.60 0.64 0.67
0.5 0.39 0.42 0.45 0.49 0.53 0.57 0.61 0.66 0.71 0.76
0.6 0.39 0.42 0.46 0.50 0.55 0.59 0.65 0.71 0.77 0.84
0.7 0.39 0.43 0.47 0.51 0.56 0.62 0.68 0.75 0.82 0.91
0.8 0.39 0.43 0.47 0.52 0.57 0.63 0.70 0.77 0.86 0.96
0.9 0.39 0.43 0.47 0.52 0.58 0.64 0.71 0.79 0.88 0.99
1.0 0.39 0.43 0.47 0.52 0.58 0.64 0.72 0.80 0.89 1.00
G_i
0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0
A_i
1.0 0.9 0.8 0.7 0.6 0.5 0.4 0.3
Normalised ΔA

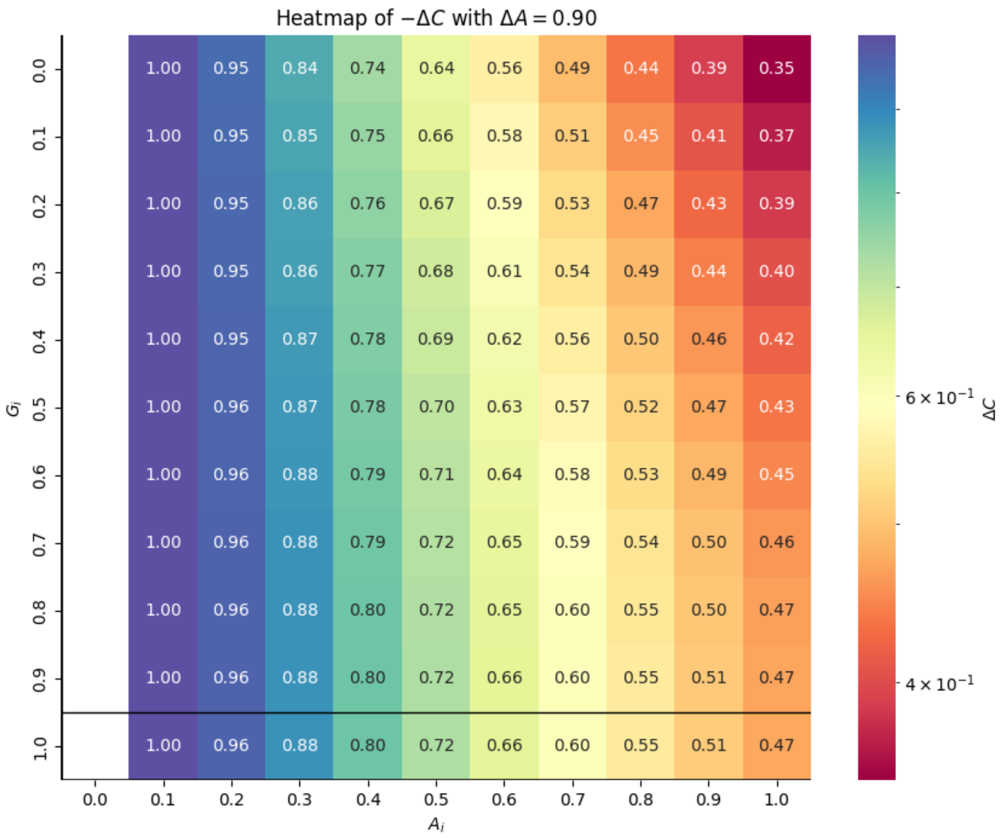
C Carbon Retirement Rates

Figure 34: C Price Curves ($-\Delta C$) when $\Delta A = \{0.25, 0.50, 0.90\}$





G_j \ A_i	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
0.0		0.98	0.84	0.69	0.57	0.48	0.41	0.35	0.30	0.27	0.24
0.1		0.98	0.85	0.70	0.58	0.49	0.42	0.36	0.32	0.28	0.25
0.2		0.98	0.85	0.71	0.59	0.50	0.43	0.38	0.33	0.30	0.26
0.3		0.98	0.86	0.72	0.60	0.51	0.45	0.39	0.35	0.31	0.28
0.4		0.98	0.86	0.72	0.61	0.52	0.46	0.40	0.36	0.32	0.29
0.5		0.98	0.86	0.73	0.62	0.53	0.47	0.41	0.37	0.33	0.30
0.6		0.98	0.86	0.73	0.63	0.54	0.48	0.42	0.38	0.34	0.31
0.7		0.98	0.87	0.74	0.63	0.55	0.48	0.43	0.39	0.35	0.32
0.8		0.98	0.87	0.74	0.63	0.55	0.49	0.44	0.39	0.36	0.33
0.9		0.98	0.87	0.74	0.64	0.55	0.49	0.44	0.40	0.36	0.33
1.0		0.98	0.87	0.74	0.64	0.56	0.49	0.44	0.40	0.36	0.33


Heatmap of $-\Delta C$ with $\Delta A = 0.90$
G_i
A_i
ΔC
6×10^{-1}
4×10^{-1}