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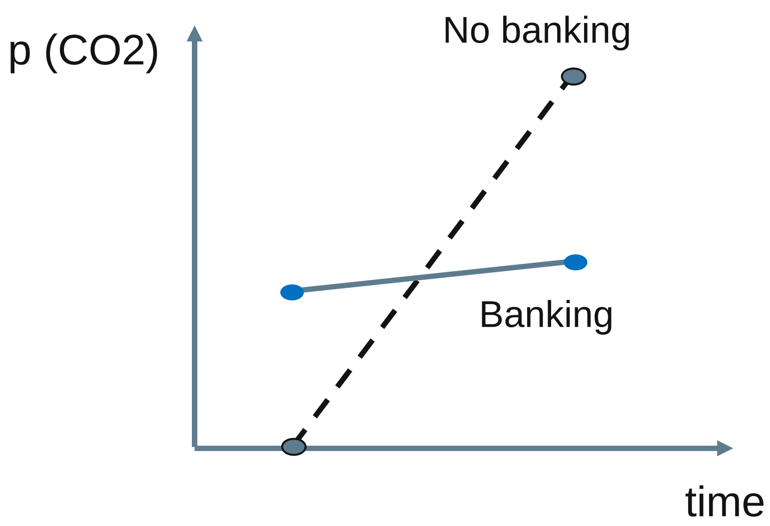
Market Stability Reserve

Why can it work?

Karsten Neuhoff

DIW Berlin, 9.6.2017



Mitigation Cost $$C = \frac{\alpha}{2} p_0^2 + \frac{1}{1+r} \frac{\alpha}{2} p_1^2$$

No banking:

Emission Cap $$E_0 - \alpha p_0 \leq 0$$ $$E_1 - \alpha p_1 \leq 0$$

Cost: $$C_{nb} = \frac{{E_0}^2}{2\alpha} + \frac{1}{1+r} \frac{{E_1}^2}{2\alpha}$$

Banking:

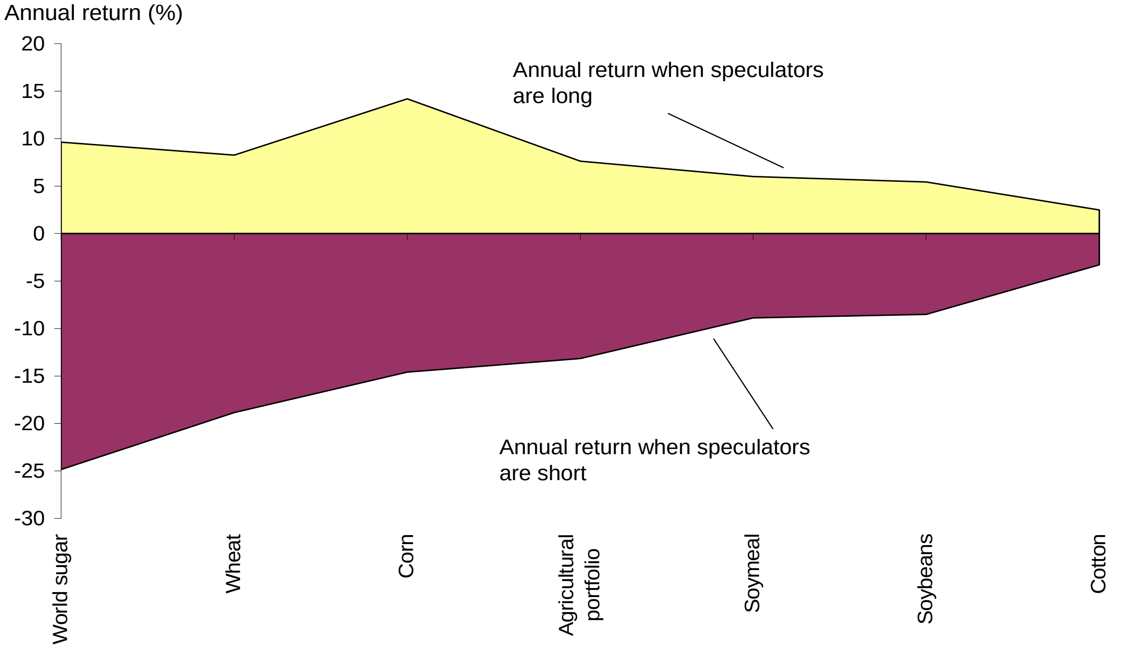
Emission Cap $$E_0 - \alpha p_0 + E_1 - \alpha p_1 \leq 0$$

Optimal choice: $$p_0 = \frac{1}{2+r} \frac{E_0+E_1}{\alpha} \qquad p_1 = \frac{1+r}{2+r} \frac{E_0+E_1}{\alpha}$$

Minimum cost: $$C_b = \frac{1}{2+r} \frac{(E_0+E_1)^2}{2\alpha} \overset{if\ E_0=0}{=} \frac{1+r}{2+r} C_{nb}$$

2 What discount rate to assume for speculative banking?

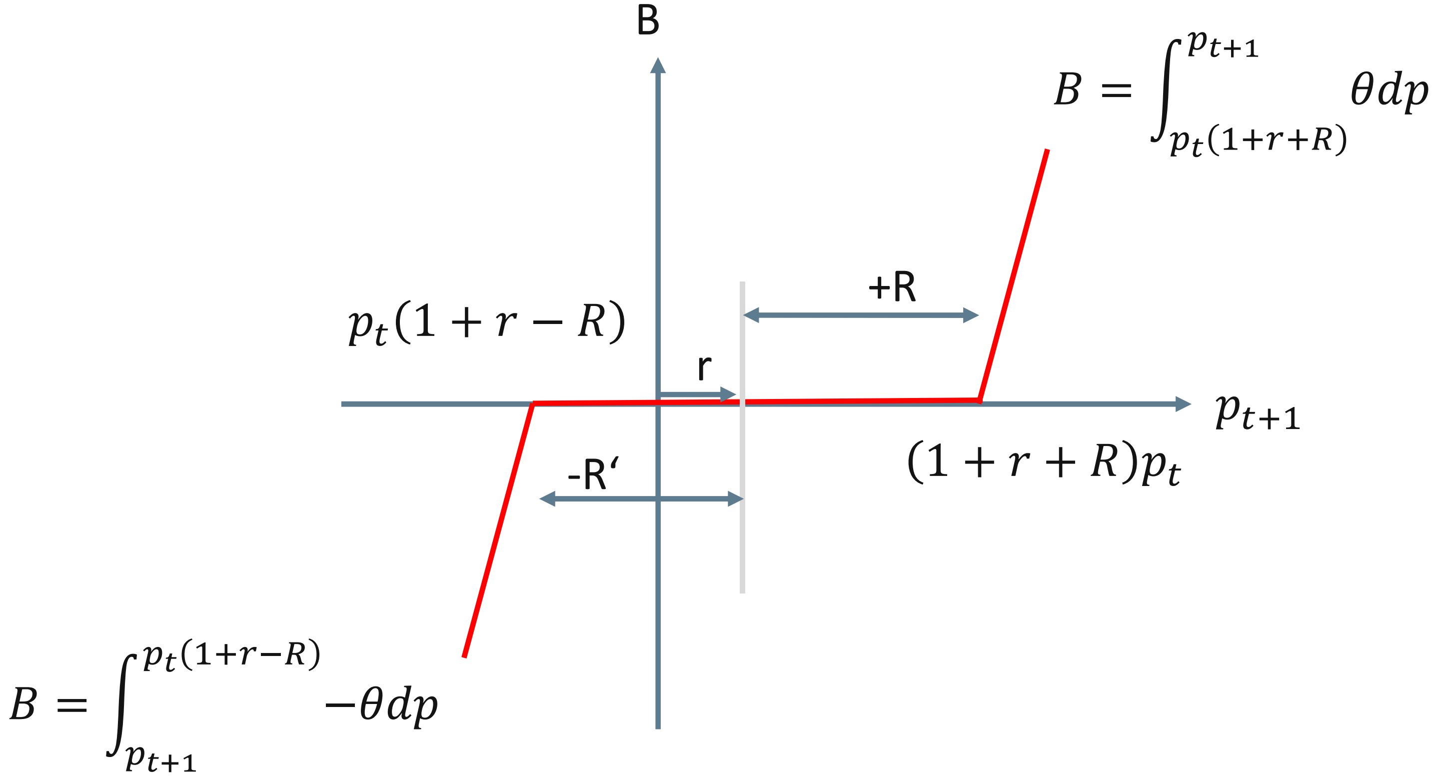
Returns in future markets, 1993-2003



- Commodity markets R > 15% (See above)
- Industry level – pay-back on efficiency improvements ≤3a corresponds to R> 30% (if depreciation for $10-15a$)
- Value at Risk -> expected prices discounted with volatility

Source: based on Bessembinder 1992, annual returns derived from daily returns (*250)
1993-2003 (Wang 2001) conditional on large speculators' sentiment above or below median

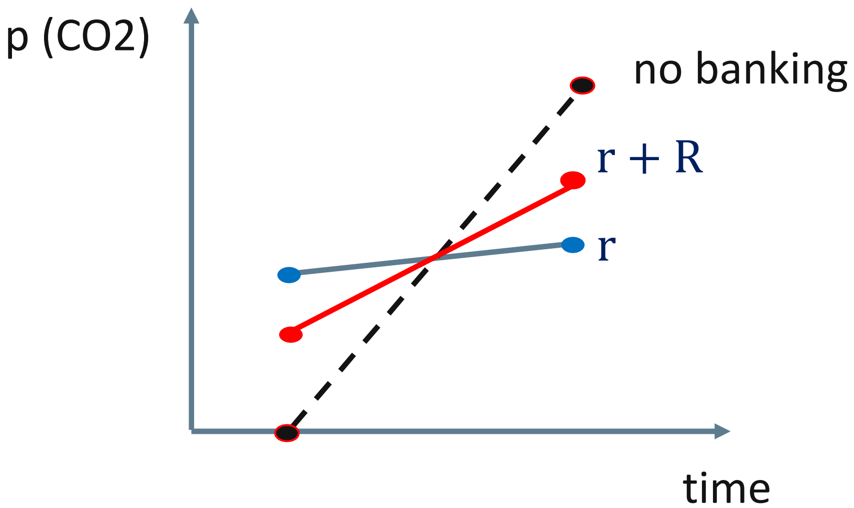
Banking perspective – distribution of speculative appetite for banking



Integrating: $$\frac{B_t}{\theta} = p_{t+1} - (1 + r \pm R)p_t$$

Using $p_{t+1} - p_t = \dot{p}_t$: $$\dot{p}_t = \frac{B_t}{\theta} - (r \pm R)p_t$$

Implications if social discount rate differ from market participants ROR



Market arbitrage, assuming $\theta \to \infty$

$$(1+r-R)p_t \leq p_{t+1} \leq (1+r+R)p_t$$

Toegther with emission constraint:

$$E_0 + E_1 - \alpha(p_0 + (1+r+R)p_0) \leq 0$$

Gives equilibrium outcome:

$$p_0 = \frac{1}{2+r+R}\frac{E_0+E_1}{\alpha} \text{ and } p_1 = \frac{1+r+R}{2+r+R}\frac{E_0+E_1}{\alpha}$$

Mitigation cost: $C = \left(\frac{1+r+(1+r+R)^2}{1+r}\right)\left(\frac{1}{2+r+R}\right)^2 \frac{(E_0+E_1)^2}{2\alpha}$

Min C für $R = 0$ if $R \neq 0$ $\to$ Extra mitigation cost

Risk premium on speculative banking results in

- Inefficiency of mitigation choices
- Inefficient investment signal from forward price

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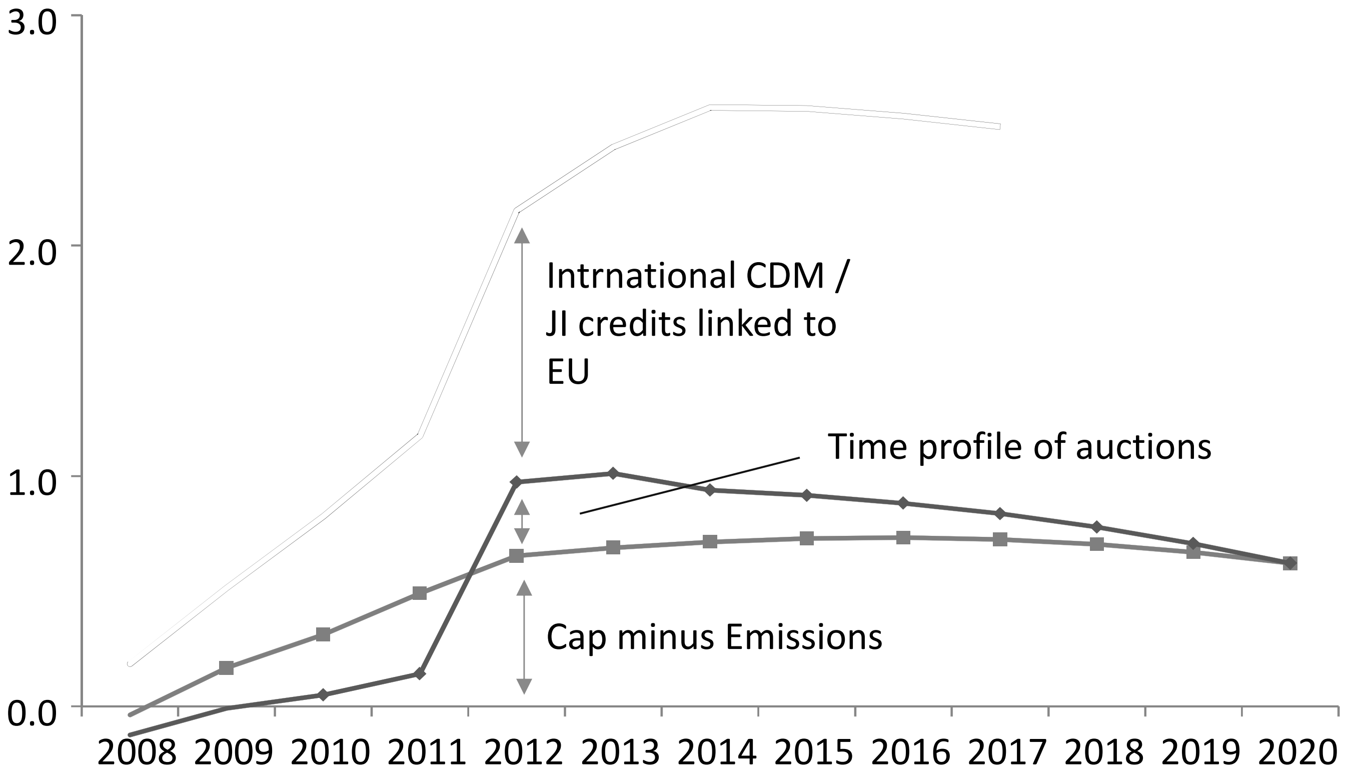
What can we observe in EU ETS?
I. Emergence of CO_2 allowance surplus



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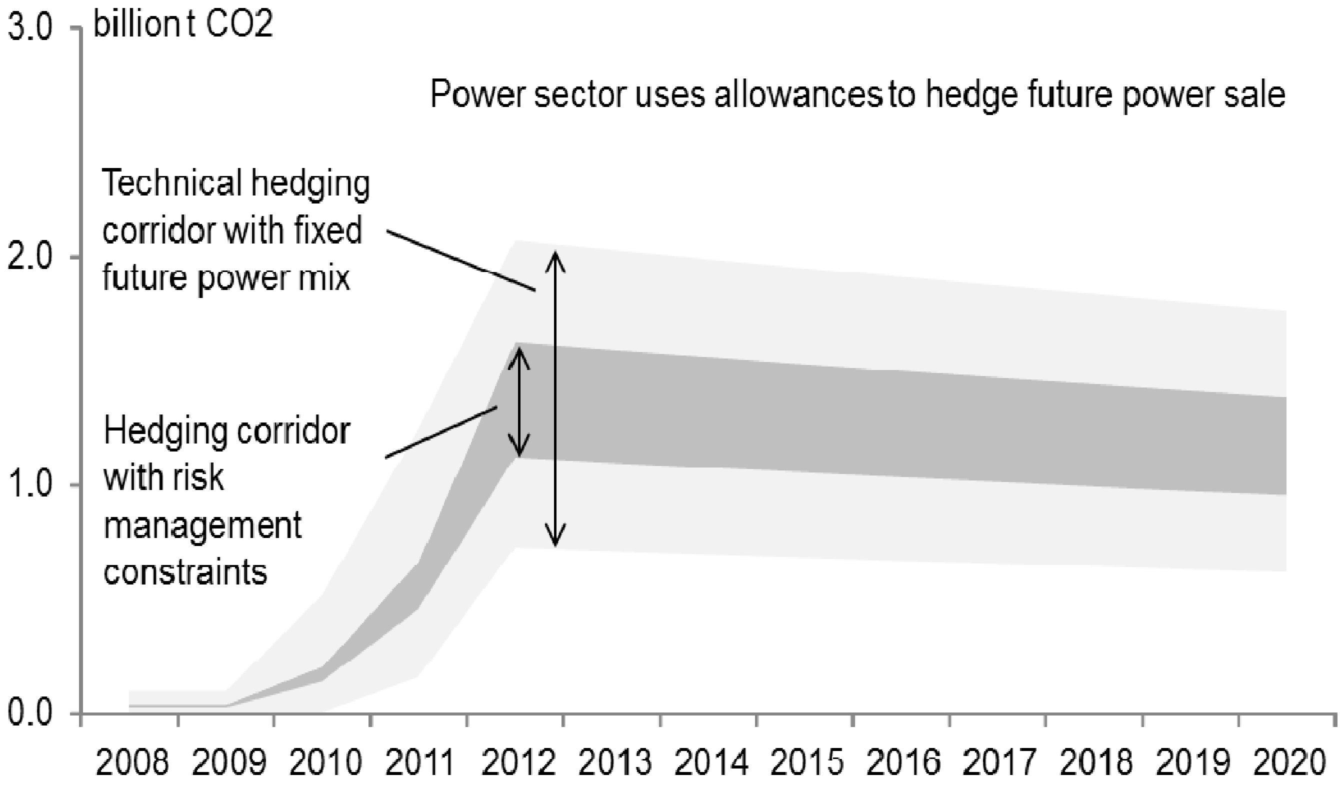
6 What can we observe in EU ETS?
I. Emerging demand for hedging by power sector with move to auctioning



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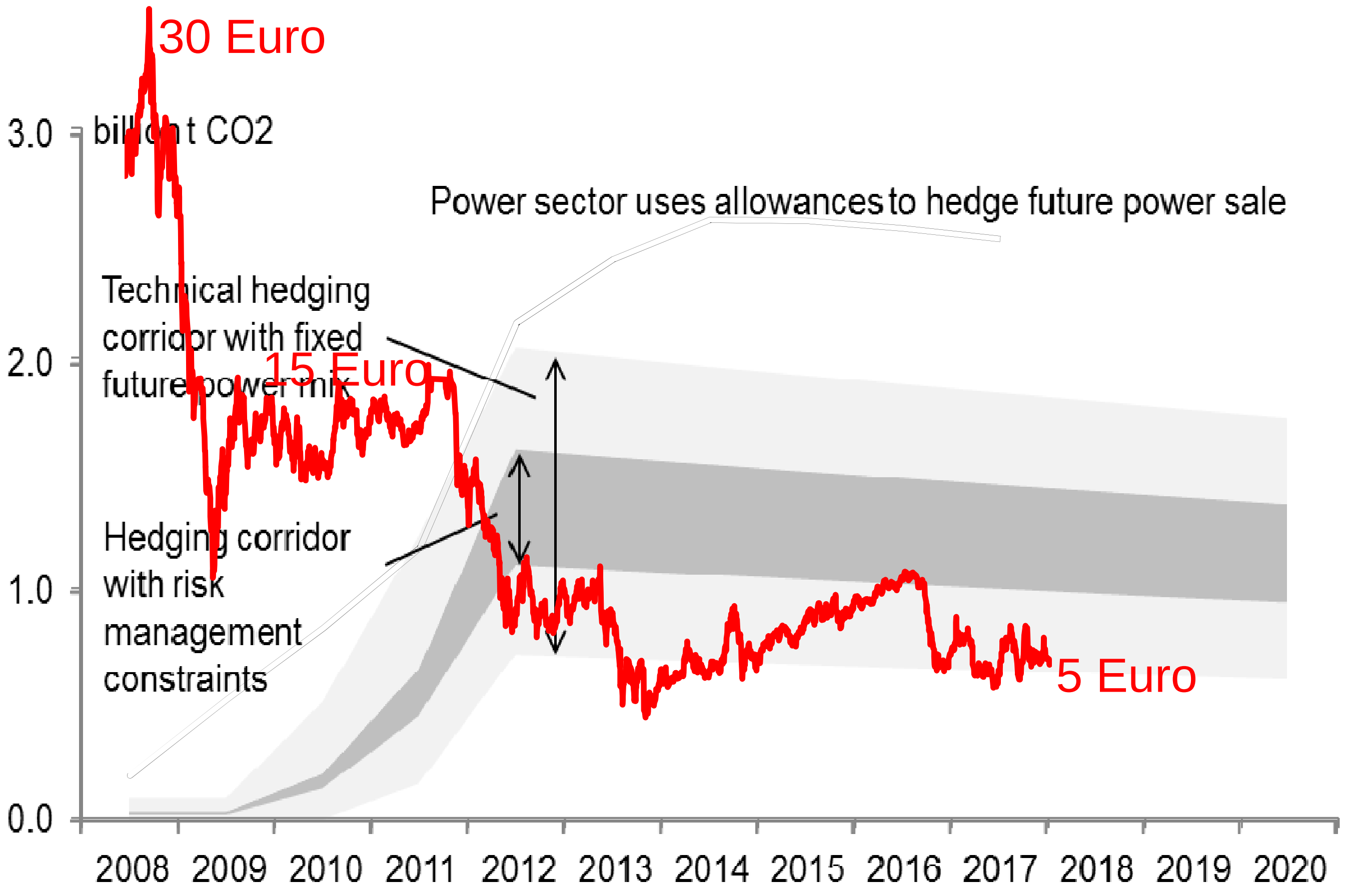
What can we observe in EU ETS?
I. Emerging surplus exceeding hedging demand coincides with price drop 15->5 Euro



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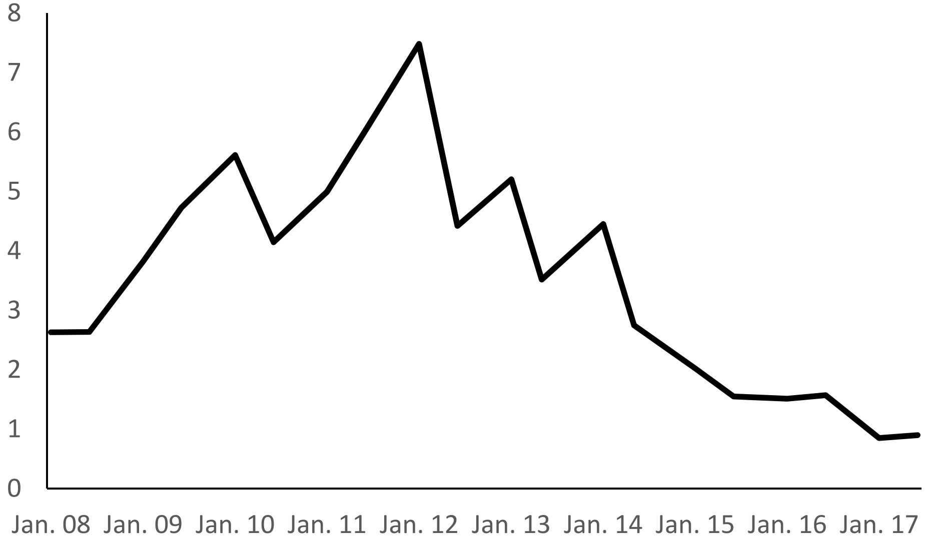
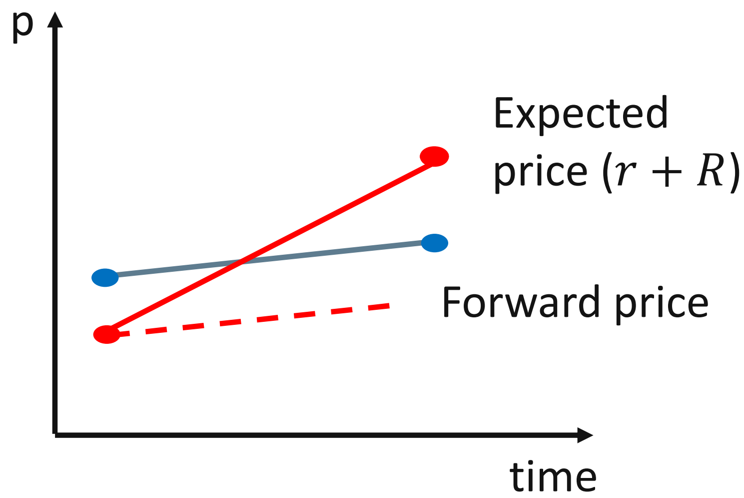
8 What can we observe in EU ETS?
II. Implied discount rate of forward curve

Slope of forward curve (%)





Why is the slope so low ?

- Buy one allowance and sell forward contract on allowance
- Limited risk premium because of no exposure to carbon price

What can explain increase towards 2012?

- Perceived risk of moving phase II to phase III
- Limited competition (with market exit of players etc.)

Increase of price of forward contract (average of 2nd to 3rd and 3rd to 4th year)

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Implications in multi-period model

Intertemporal arbitrage: $\dot{p}_t = \frac{B_t}{\theta} - p_t(r \pm R)$

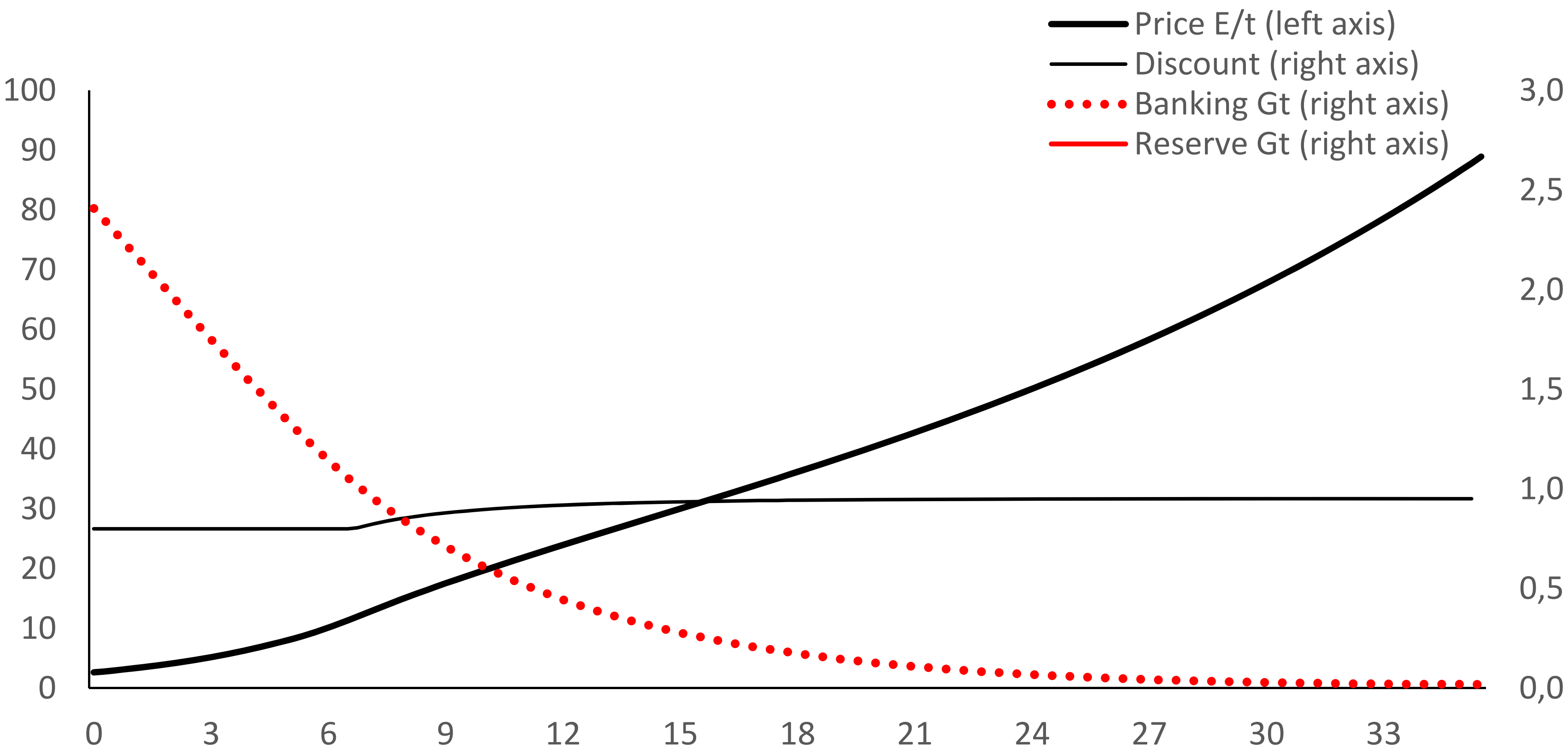
Markt clearing: $b_t = -(E_t - \alpha p_t)$

Gives equation for price path: $\ddot{p}_t + \dot{p}_t(r \pm R) = p_t \frac{\alpha}{\theta} - \frac{E_t}{\theta}$

Assume r=R=0, E const.: $p_t = x_1 exp\left(x_2 - t\sqrt{\frac{\alpha}{\theta}}\right) + \frac{E}{\alpha}$

Assume $\theta \to \infty$ $p_t = x_1 + x_2 exp(-(r \pm R)t)$

Longer-term scenario



Cost development: $r = 0{,}05, \dot{E}/E = 0{,}05$

Risk mark-up: $\theta = 0{,}5$, R_{max}=0,15

Initial surplus: $B_0 + H = 3{,}3\ Gt$, H=0,8 Gt

Mitigation cost: $E_0 = 0{,}265, \alpha = 0{,}017$

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Resulting challanges for intertemporal optimization of ETS

- Risk Mark-up (R, θ) restrains intertemporal arbitrage
- How to get to socially desired outcome
- Market stabilty reserve
  - buy if $p_{t+1} > (1 + r)p_t$
  - release if $p_{t+1} < (1 + r)p_t$

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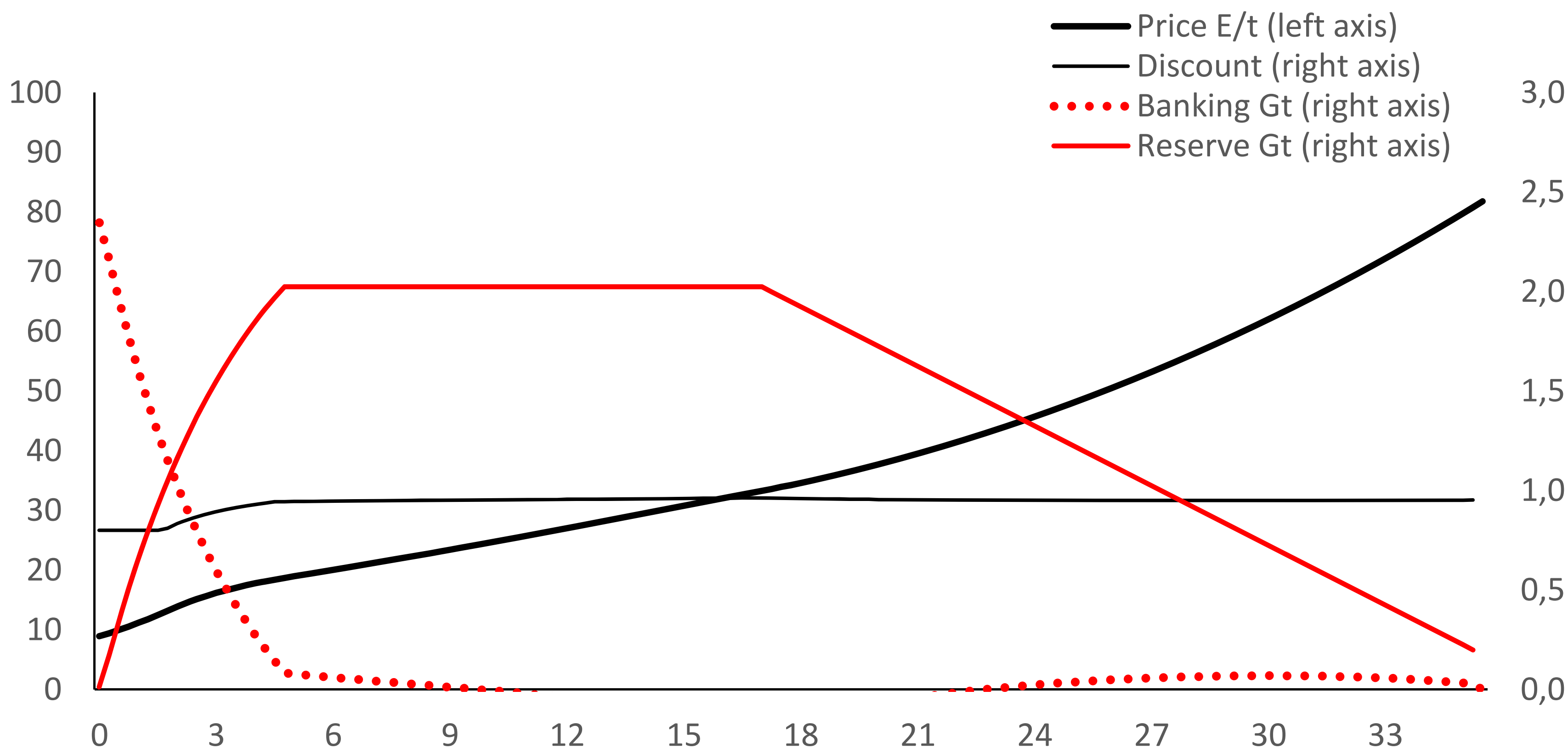
Longer-term scenario with Market Stability Reserve



Assumptions as before, but now additional MSR

Trigger to fill up: IF B+H>0,88: 25% of surplus/year

Release from year 18 to empty by end of period (boundary condition)

Discounted savings of mitigation costs: 50 billion Euro

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Summary

Intertemporal arbitrage essential for functioning ETS

- Speculative banking linked to risk premium
- Hedging demand constrained

Implies inefficient price and mitigation path

- 2 Period model
- EU ETS surplus and price development
- Forward curve may not represent expected price
- Reduction of regulatory risk can reduce but not mitigate effect

The role of a market stability reserve

- Can substitute for inframarginal speculative banking
- Thus get price path closer to socially optimal path
- Delivering savings on mitigation cost (and signals for investors)

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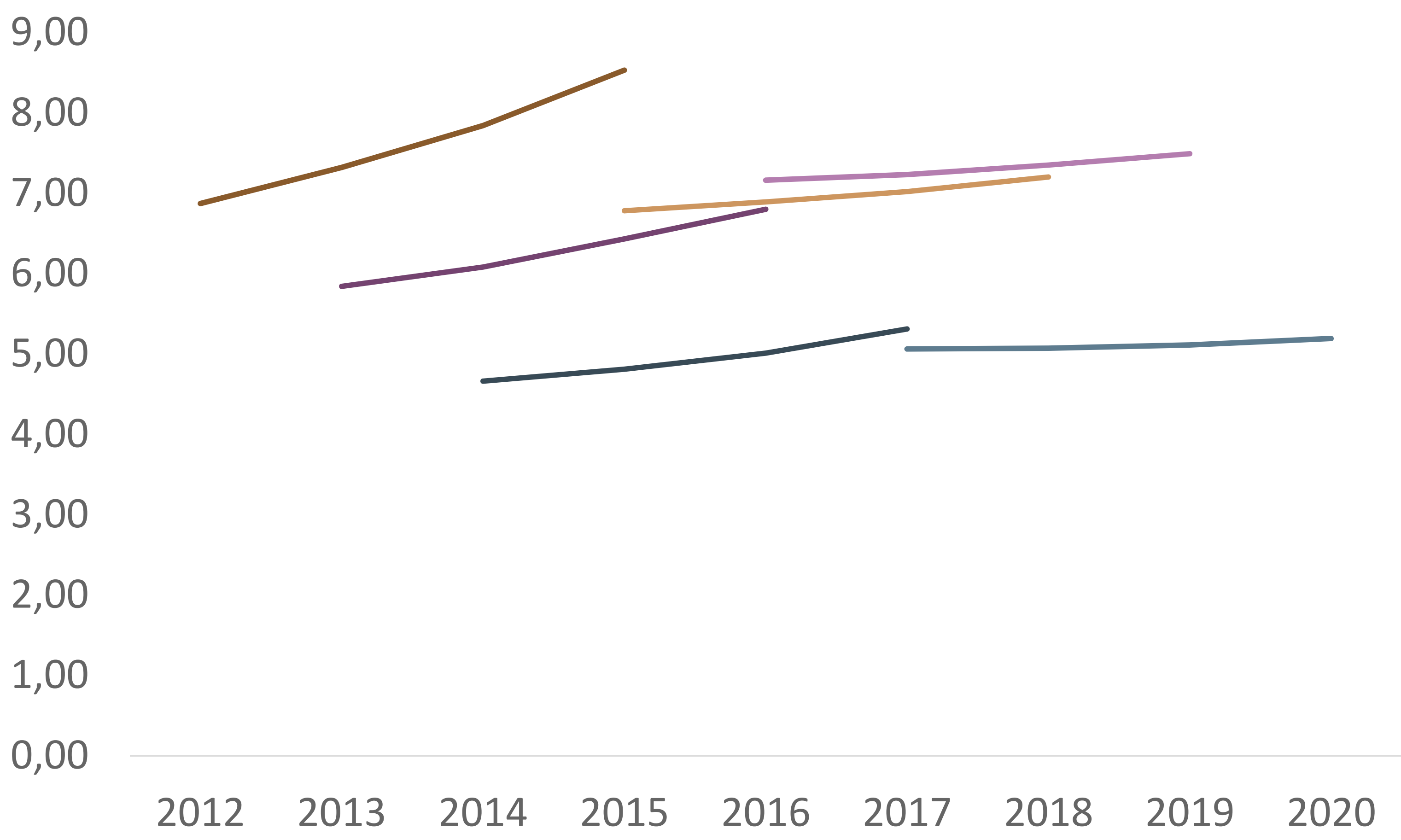
4 What can we observe in EU ETS?
II. Slope of forward curve



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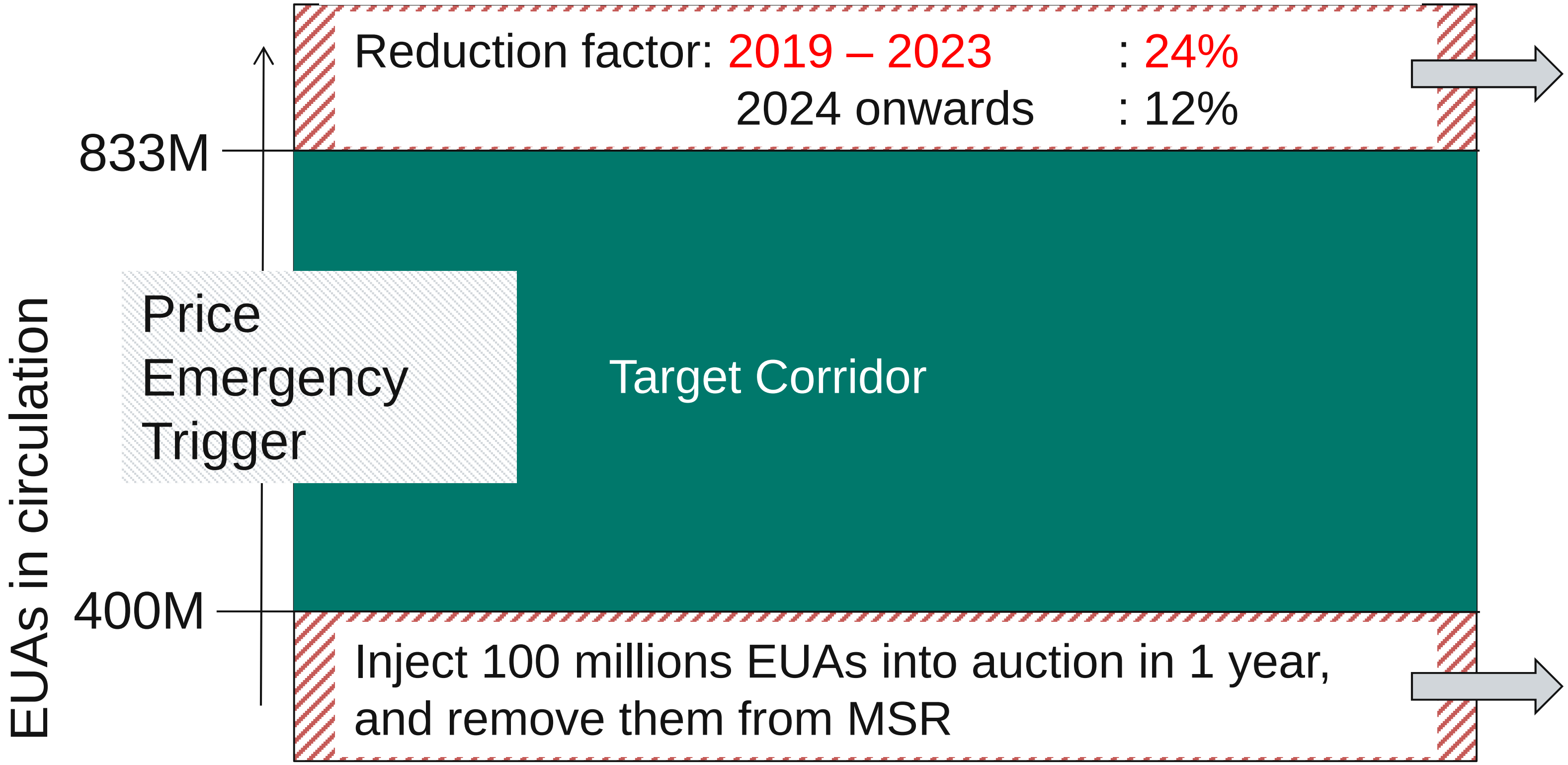
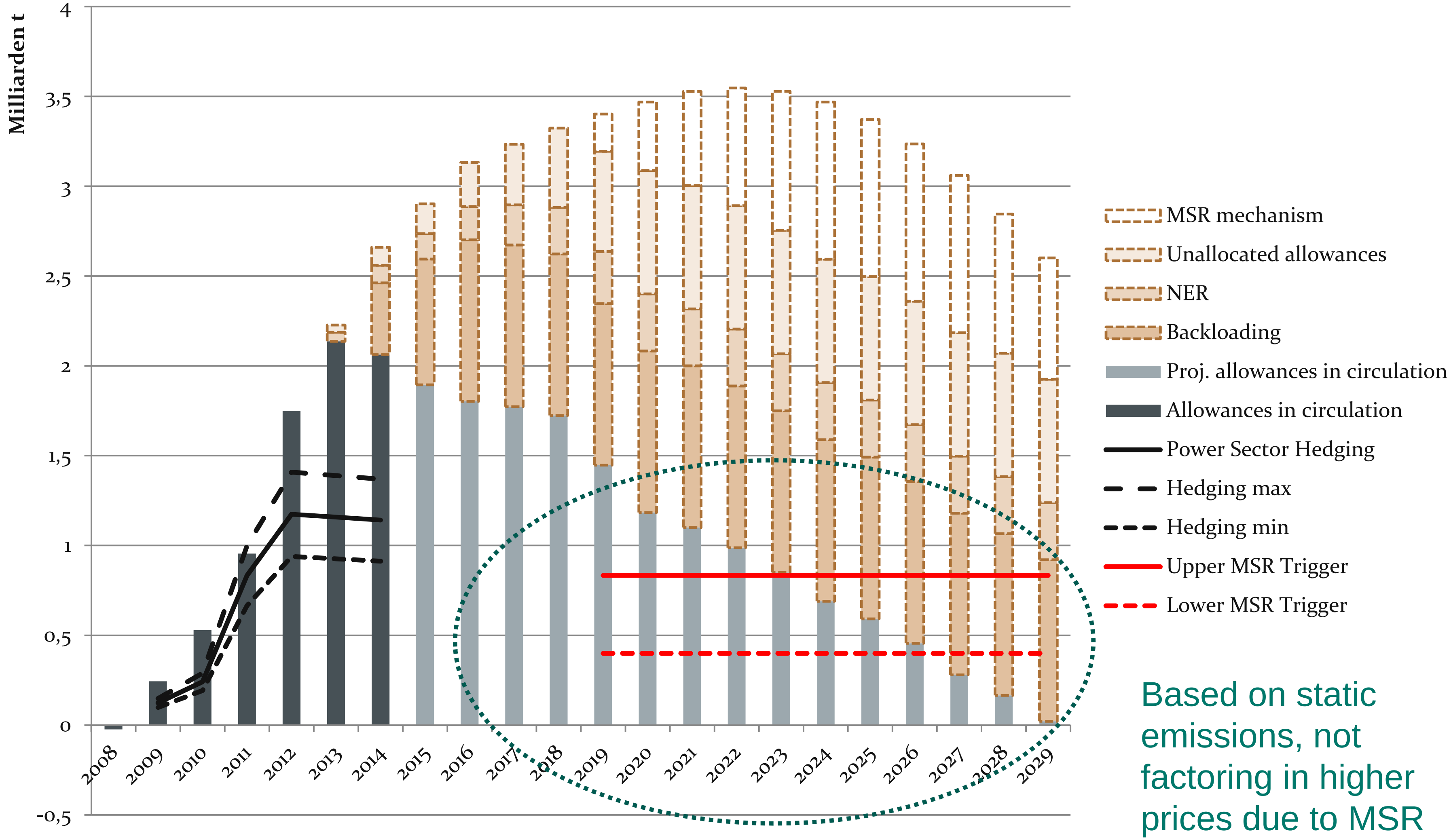
Changes to the MSR: Prospective design

Reduce auction in 1 year by X% of currently banked EUAs, and put them in the MSR



- Starts in 2019
- Do not return backloaded credits to the market but place them in the MSR!

8 Effect on surplus allowances: current design



Based on static emissions, not factoring in higher prices due to MSR

Why MSR does work

Illustrate alternative / complementing role of regulatory uncertainty

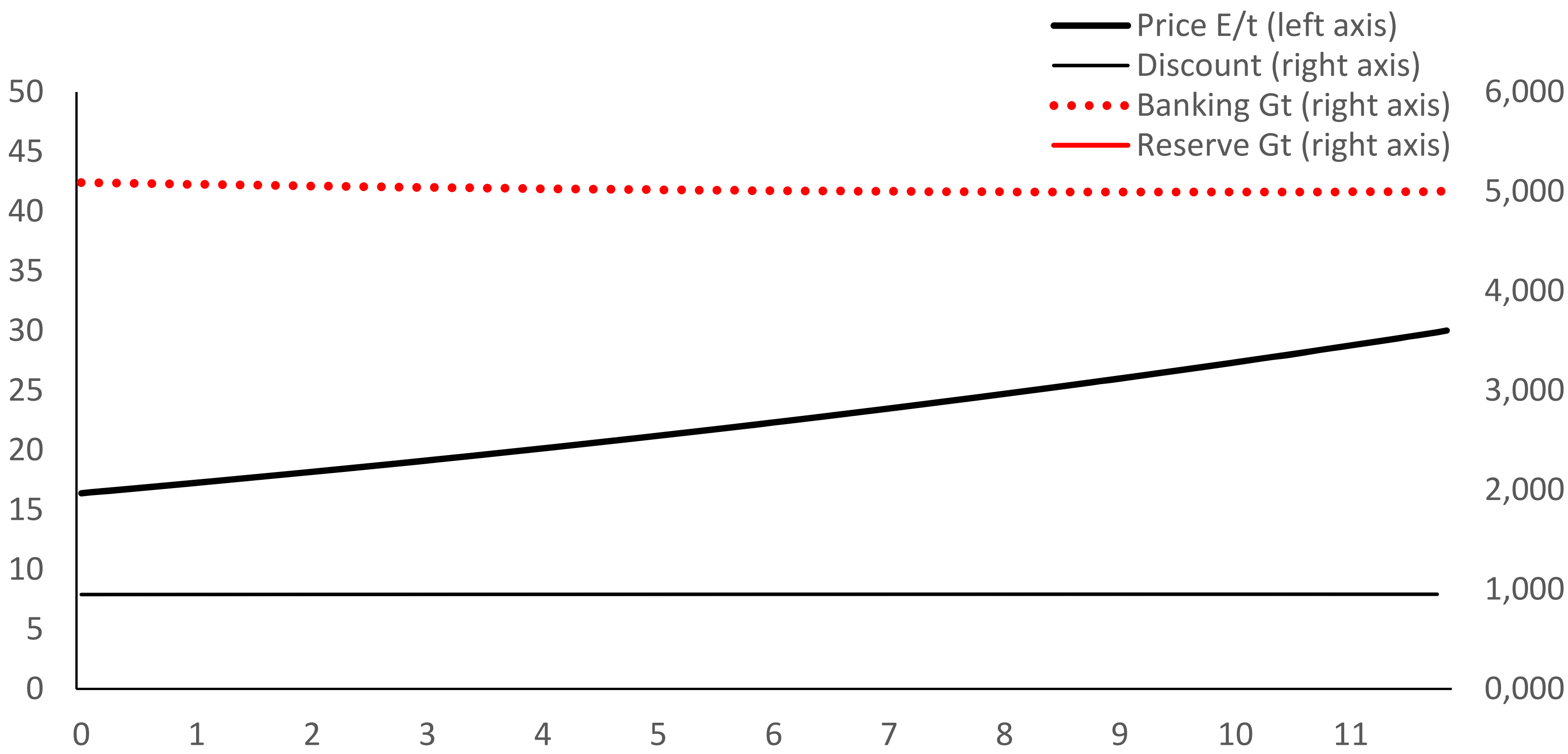
- Enhancing regulatory certainty can reduce impat

Compare to alternative interpretations how it could work

- myopia

- Compare to gold etc.

Reference case

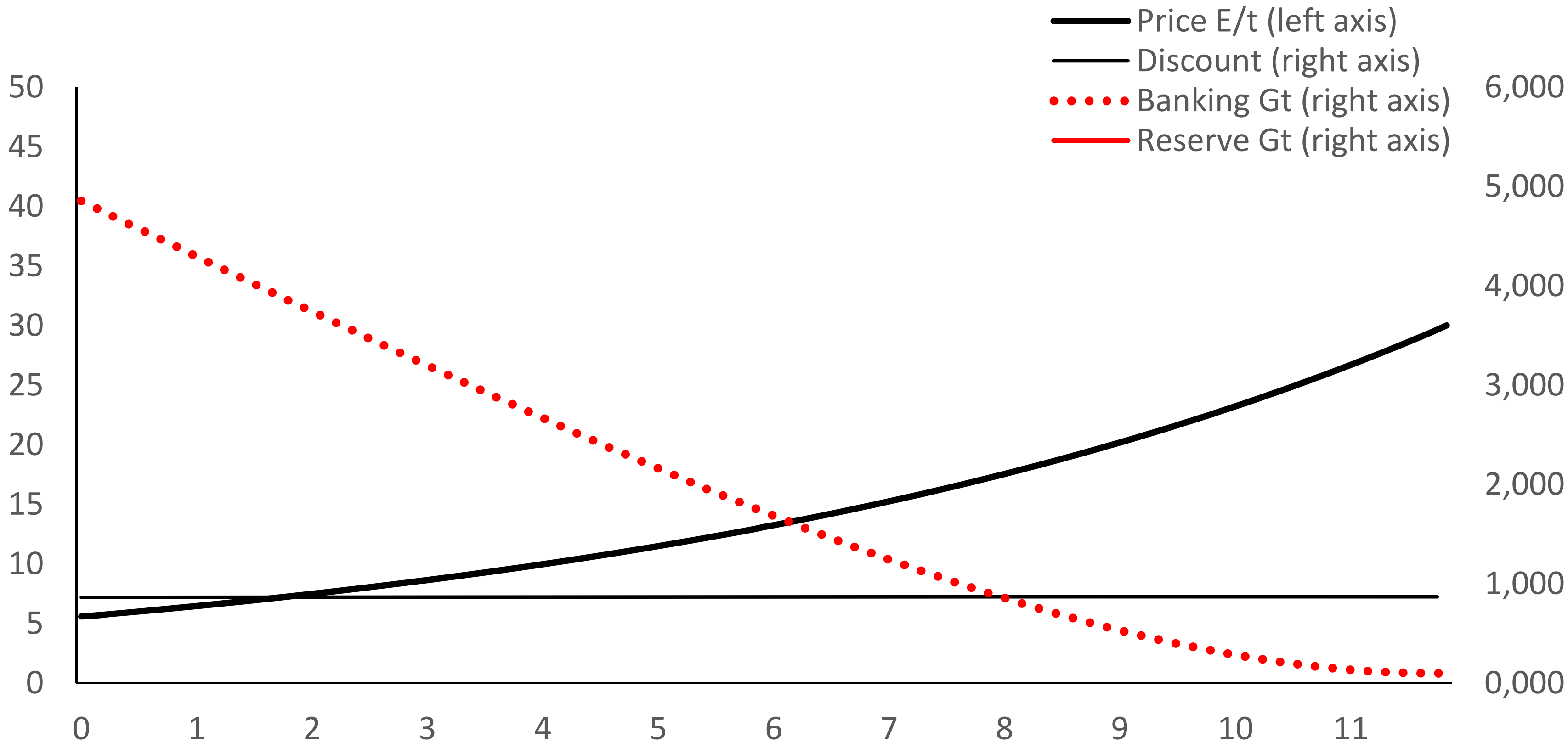


Simpe assumptions: $r = \dot{E}/E = 0{,}05,$

No risk mark up: $\theta \to \infty$, R=0

Initial surplus $B_0 = 5\ Gt$

Risk mark-up (I) - implications from surplus

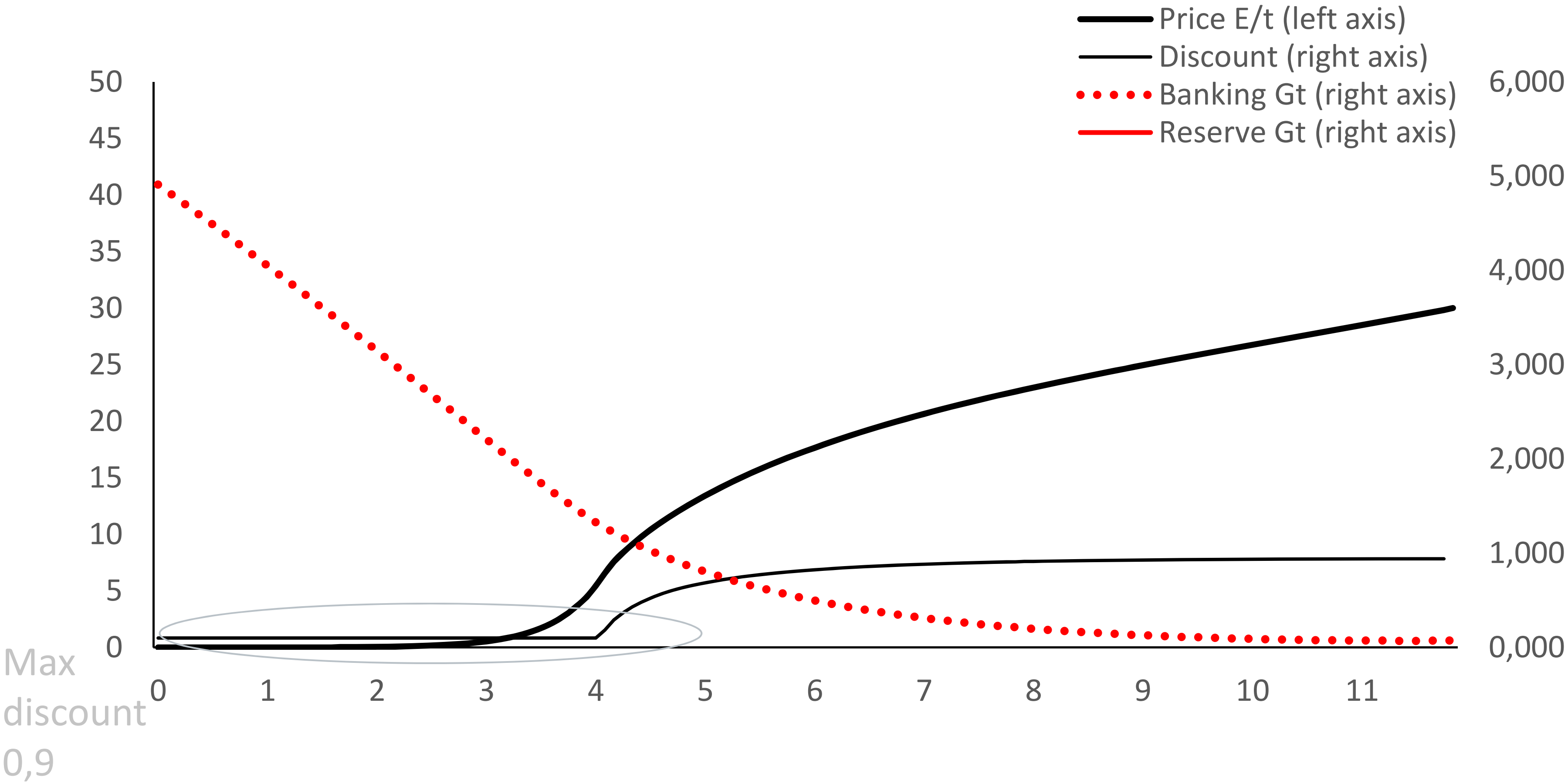


Simpe assumptions: $r = \dot{E}/E = 0{,}05,$

Risk mark up: $\theta \rightarrow \infty$, **R=0,1**

Initial surplus $B_0 = 5\ Gt$

11 Risk mark-up (II) – implications from surplus



Simpe assumptions: $r = \dot{E}/E = 0{,}05$,

Risk mark up: $\boldsymbol{\theta \rightarrow 0,1}$, R=0

Initial surplus $B_0 = 5 \text{ Gt}$

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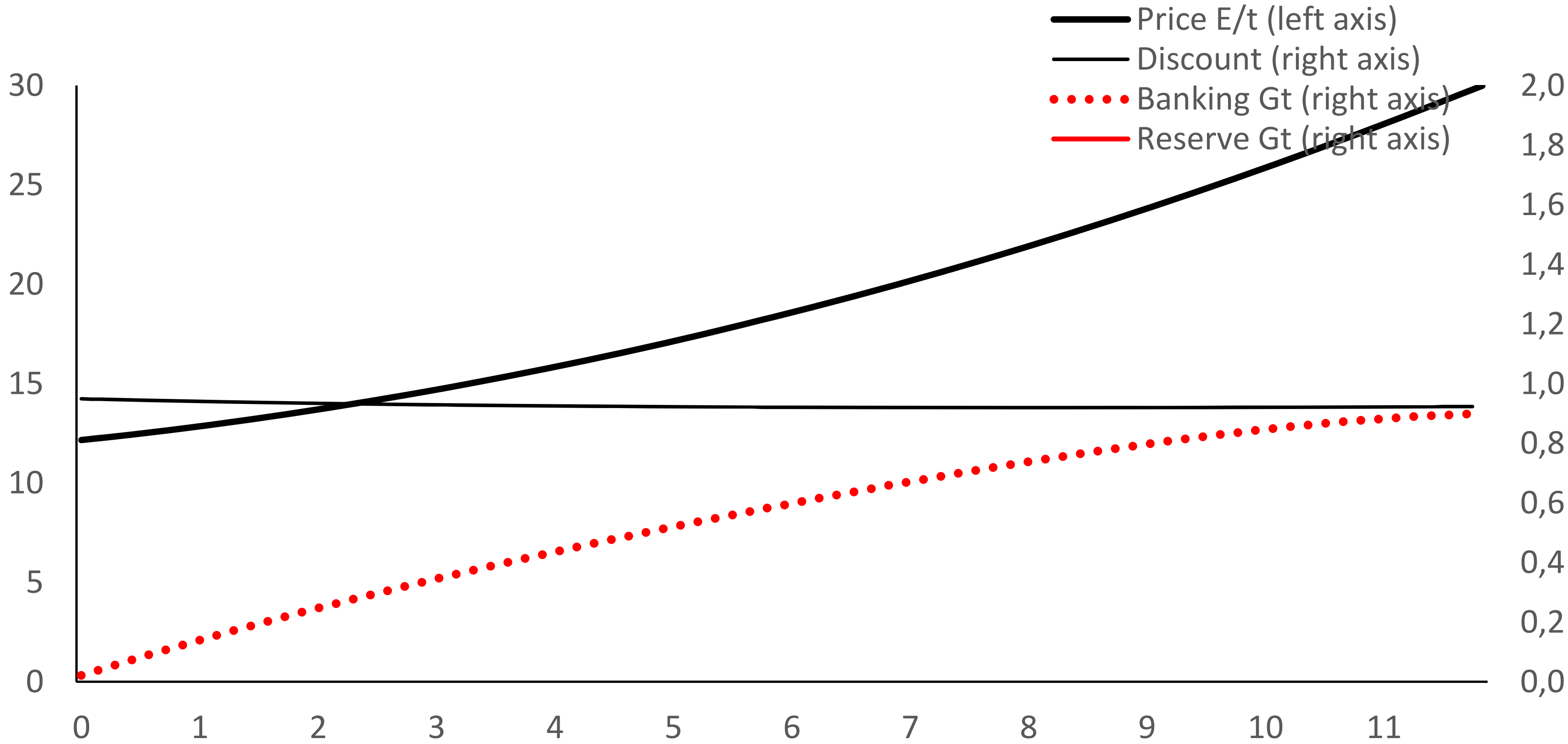
Risk mark up (III) response to difference between optimal cost path and discount rate



Simpe assumptions: $r = 0{,}05, \dot{E}/E = 0{,}1$

No risk mark up: $\theta \rightarrow \infty$, R=1

Initial surplus $B_0 = 0\ Gt$

Resulting average discount 0,078 (this example)