

**Bigger is better**  
**Avoided Deforestation Offsets**  
**in the Face of Adverse Selection**

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# Motivation



Avoiding deforestation is apparently low cost.

Models assume efficient policy

But most policy is extremely inefficient

When we cannot put liabilities on those who deforest, how can we improve policy?

# Policy constraints and policy criteria

Contracts to pay for avoiding deforestation

Voluntary participation by developing countries

## Key Policy Criteria

1. Efficiency – is land in efficient use
2. Offset quality - fraction of offsets that are spurious
3. Value – average cost



# The Model

Continuum of plots of forested land  $i$ .

$r_i$  = agricultural plus timber revenues minus  
clearing costs:  $r_i \sim f_r(r)$

$p_c$  = payment to maintain forest

Clear if  $r_i > p_c$

$\delta$  = environmental externality from  
deforestation



Simplest policy:  $p_c = \delta$

$$\textit{Avoided deforestation} = AD = \int_0^{p_c} f_r(r) dr$$

Perfectly 'efficient'

but

Very expensive because pay for all forest



Voluntary policy: reward relative to baseline

$$BL_i = \begin{cases} 1 & \text{if } r_i \leq 0 \\ 0 & \text{if } r_i > 0 \end{cases}$$

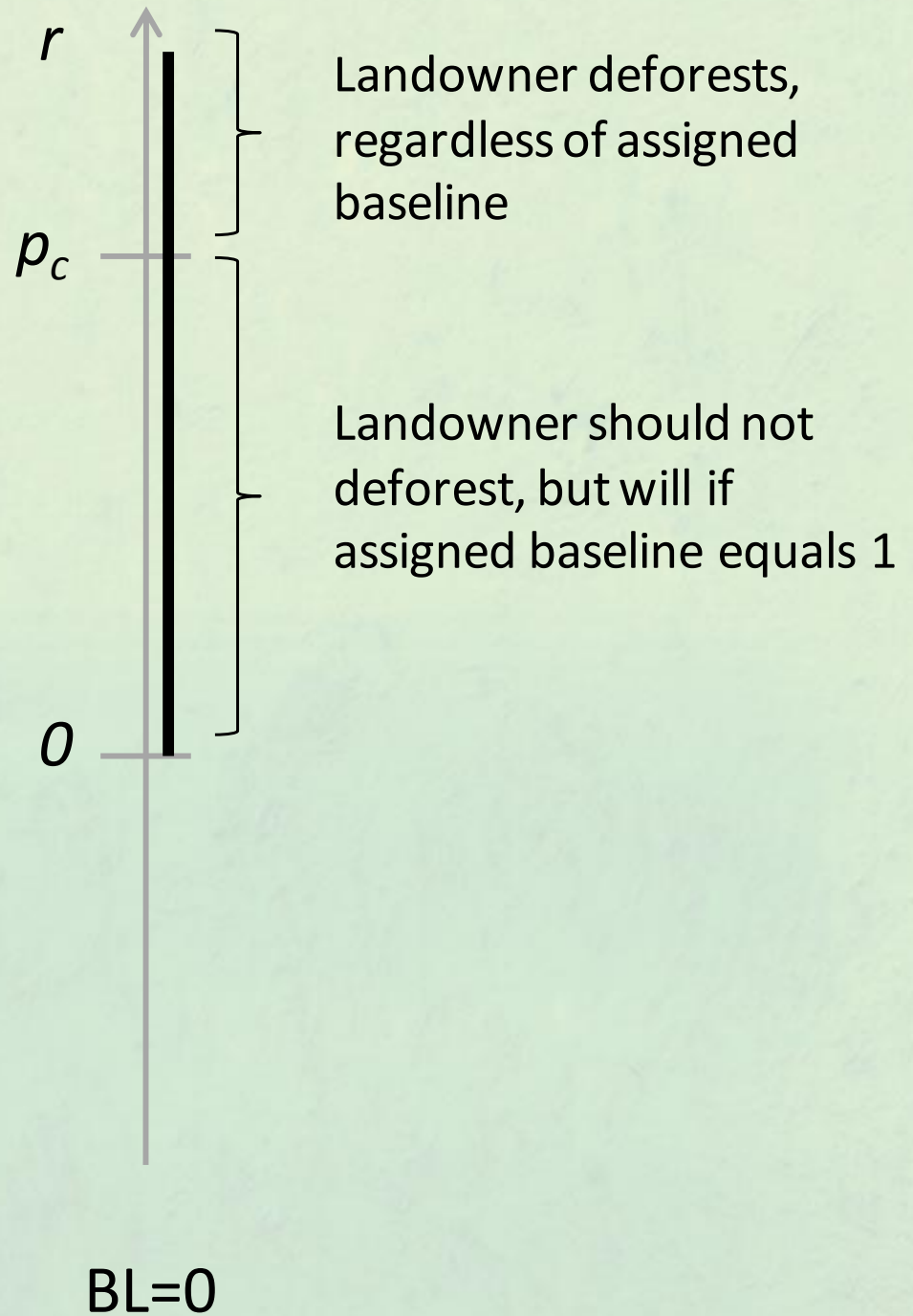
1 = forest; 0 = no forest

But  $\hat{r}_i = r_i + \varepsilon_i$

Efficiency loss from adverse selection is:

$$\int_0^{p_c} (p_c - r) \left( \int_{-\infty}^r f_\varepsilon(\varepsilon) d\varepsilon \right) f_r(r) dr$$





# Voluntary program with baseline:

Average cost to industrialized country

$$p_c \left( 1 + \frac{OS}{AD} \right)$$

Relative to subsidy offsets that are spurious(OS)  
fall but avoided deforestation (AD) also falls

Average cost probably falls relative to pure  
subsidy





Landowner will not deforest, regardless of assigned baseline

Landowner may receive payment with no behavioral change

BL=1



Landowner deforests, regardless of assigned baseline

Landowner should not deforest, but will if assigned baseline equals 1

BL=0

# Solutions: 1. Scale

$$BL_N = \sum_{j=1}^N BL_j \quad \text{where} \quad BL_j = \begin{cases} 1 & \text{if } r_j \leq 0 \\ 0 & \text{if } r_j > 0 \end{cases}$$

$$p_c * (N_{p_c} - \bar{BL}_N) > \sum_{j | r_j \in [0, p_c]} r_j$$

Some plots with unfavourable baselines will now be included.

Some risk that plots will inefficiently opt out as part of a larger group.



As  $N \rightarrow \infty$ ,

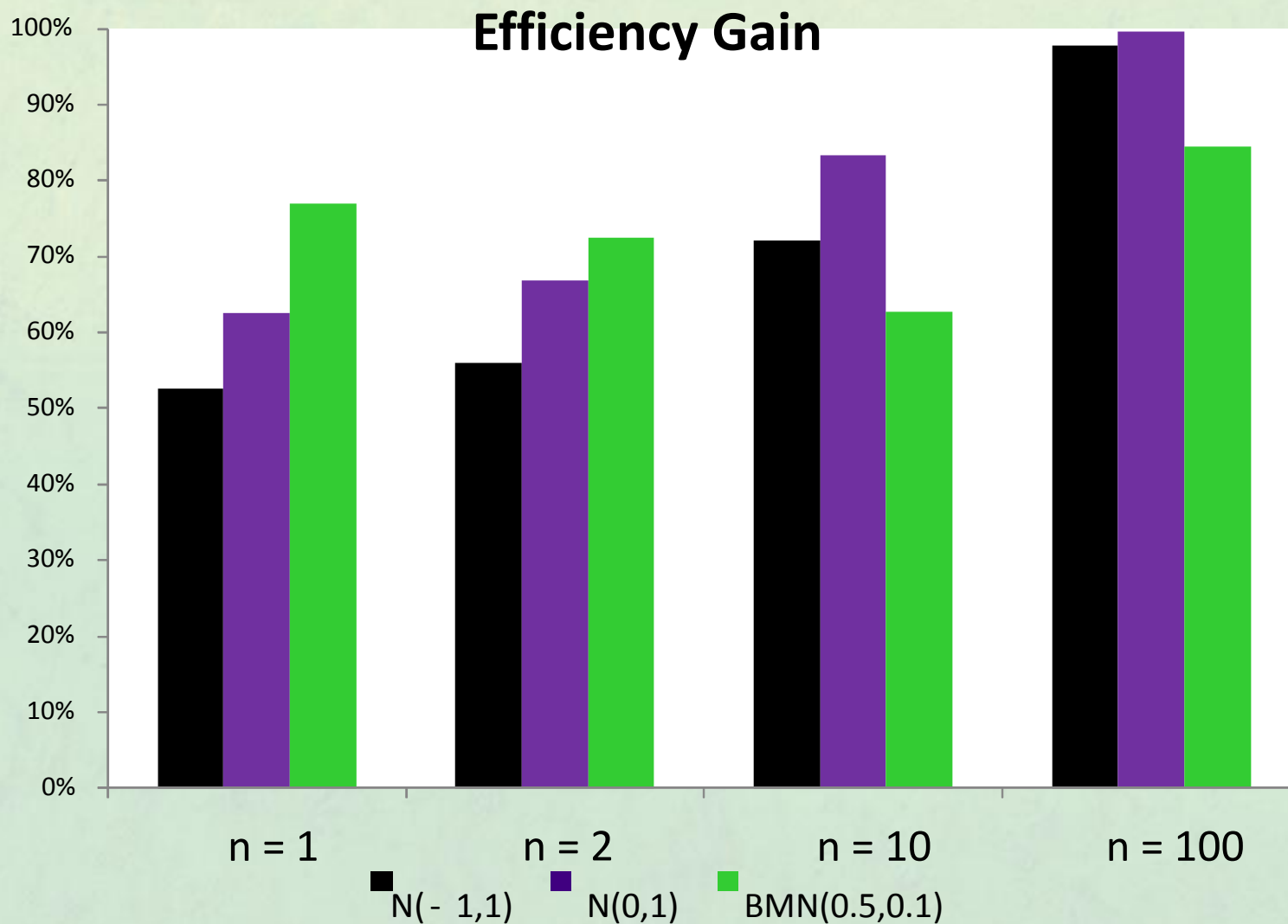
$$\frac{\widehat{BL}_N}{N} \rightarrow \frac{BL_N}{N}$$

In the limit the program is:

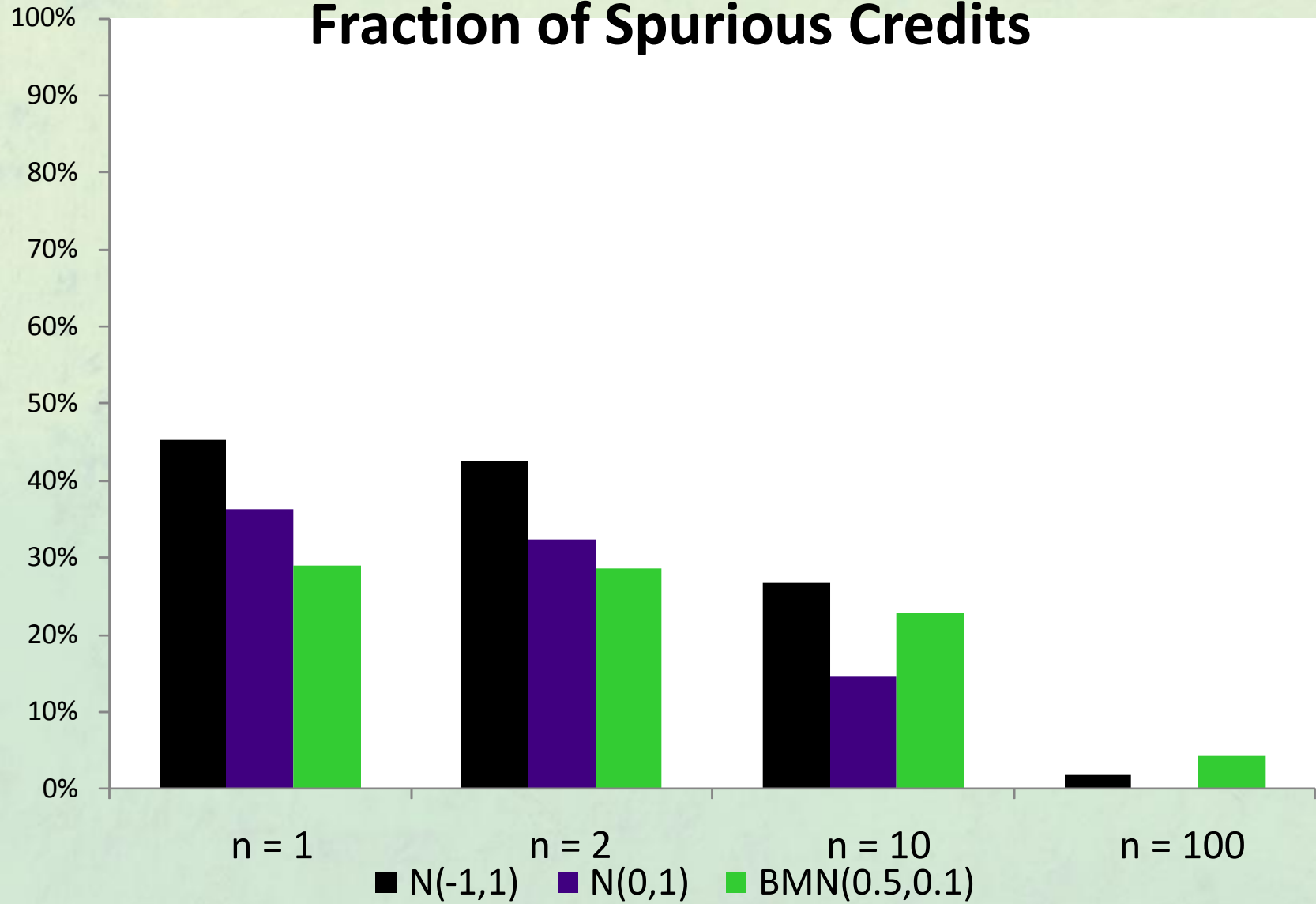
- Efficient
- Tradeoff between efficiency and transfers goes away.



# Scale and efficiency



# Fraction of Spurious Credits



## Solutions: 2. Stringent baselines

- Reduces efficiency as some landowners (those with lowest gains) opt out.
- Improves quality of offsets
- Lowers average cost to industrialised country (generally)



## Solutions: 3. Discounting

- Reduces efficiency (and avoided deforestation)
- Lowers the quality of offsets

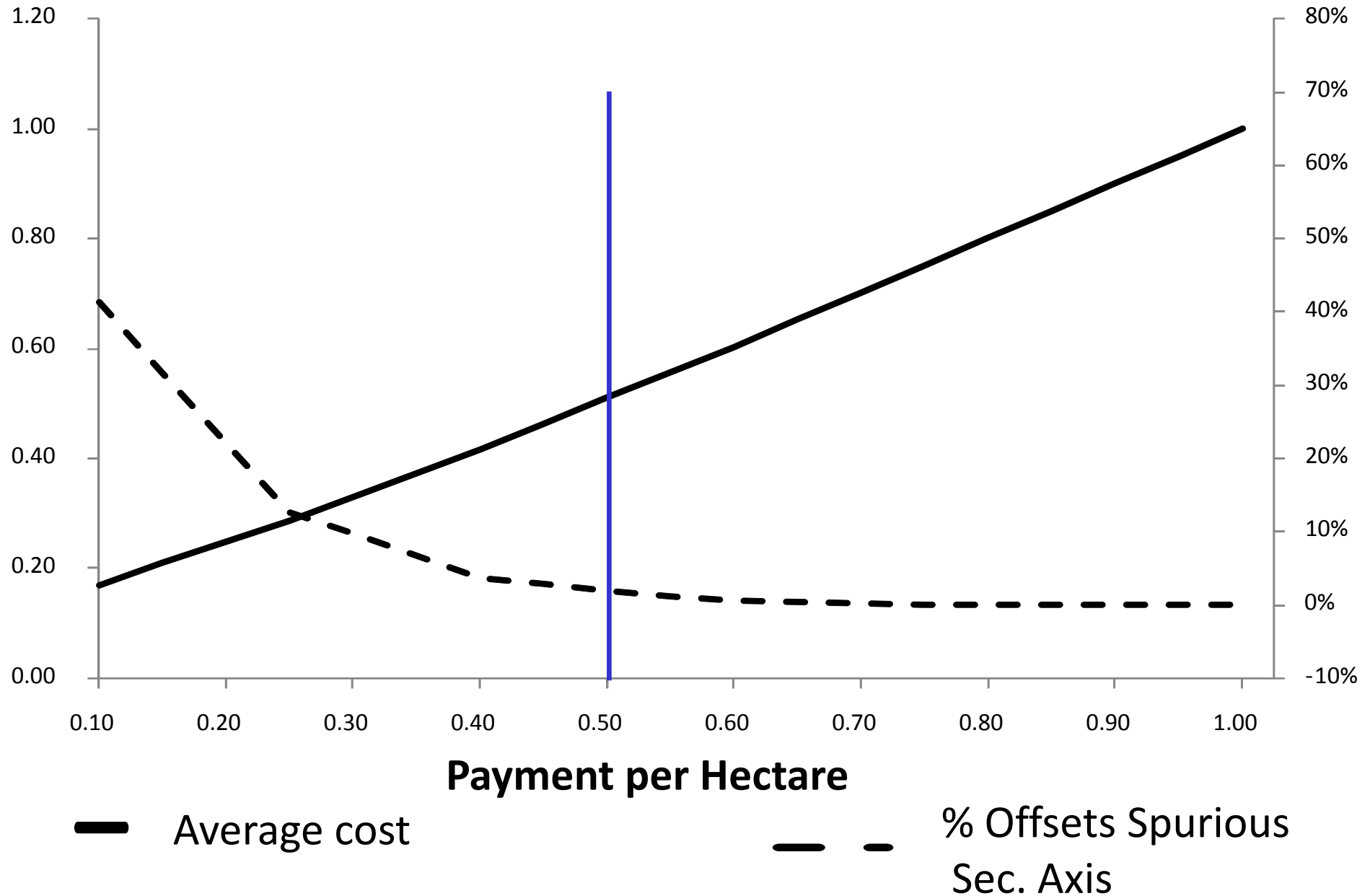
Why? The number of spurious offsets is not a function of  $p_c$

$$\int_{-\infty}^0 \left( \int_{-r}^{\infty} f_{\varepsilon}(\varepsilon) d\varepsilon \right) f_r(r) dr$$

- Generally lowers average cost
- 'trading ratios' will affect efficiency and quality but may not affect environment



# Price, average cost and spurious offsets



# Key conclusions

- Larger scale is better
- Stringent baselines lower average cost by raising the quality of offsets but could lead to opt out and efficiency loss.
- Discounting lowers average cost to industrialised countries but reduces the quality of offsets
  - Limits on use of offsets control damage but make quality and efficiency worse.
  - Trading ratios may protect the environment but at high efficiency cost



A photograph of a small stream flowing through a dense, lush green forest. The water is clear and flows over large, moss-covered rocks. The surrounding vegetation is thick and vibrant green, with sunlight filtering through the canopy. The overall scene is peaceful and natural.

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