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Reallocation of Price Risk among Cooperative Members

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Objective

- Title:
  - Reallocation of Price Risk among Cooperative Members
- Objective:
  - Explore the theoretical potential for reallocation of risk among members in marketing cooperatives as an alternative to futures based risk transfer
- Background
  - (Almost) No active use of price risk management tools on the output side of livestock farms in Denmark (dairy and pigs)
  - Basis risk high due to cooperative marketing ?
  - The need for price risk management increased due to increased price volatility and due to decreased credit reserves ?

Tican: Fast pris på slagtesvin sikrer arbejdspladser

BUSINESS | Skrevet af Redaktionen den 14. januar 2013 - 14:09

Grise i stald / arkivfoto

Tican i Thisted går utraditionelle veje for at have slagtesvin nok, og det betyder tryghed for de ansatte.

Tican – the second largest coop slaughterhouse in Denmark has recently introduces fixed price contracts. This is – in reality – a reallocation of risk among coop members.

The use of these contracts is modest – so fare – but they might illustrate the beginning of something new…

The model presented today represents a more refined way of reallocating this risk.

Reallocation of price risk among cooperative members

- A model by Collins (1997) is extended to illustrate the potential of reallocation of price risk among cooperative members
- This model builds on the tradition where the risk of financial failure is the core interest of risk management – and not income stabilisation –

The Collins (1997) model

$$\tilde{E}_1 = E_0 + [p_h H + \tilde{p}_c(1 - H)]Y - kY - iD - F$$

Where:
$\tilde{E}_1$ is the terminal equity,
E_0 is the initial equity,
p_h is the forward price of hedged output,
H is the hedge ratio,
$\tilde{p}_c$ is the stochastic cash price of the unhedged output,
Y is output,
k is variable costs,
i is the interest rate paid on debt,
D is debt,
F is fixed costs

Extension of the Collins (1997) model to the cooperative reallocation model…

Suppose you have a cooperative with member heterogeneity in the cost of risk, imaging three member segments with low, medium and high cost of risk. The residual claims in the cooperative are:

$$[\tilde{p}_c]Y_{coop}$$

where $Y_{coop} = Y_{low} + Y_{medium} + Y_{high}$ for low, medium and high cost of risk members

This extends to:

$$[p_h H + \tilde{p}_c(1-H)]Y_{coop} \quad \text{where } H = 0 \quad \text{(by tradition)}$$

$$\tilde{E}_1 = E_0 + [p_h H + \tilde{p}_c(1-H)]Y - kY - iD - F \quad \text{Collins (1997)}$$

Extension of the Collins (1997) model to the cooperative reallocation model…

Now suppose that all cooperative members are endowed with $\bar{H}\frac{Y_i}{Y_{coop}}$

$$[p_h H + \tilde{p}_c(1-H)]Y_{coop} \quad \text{where } H > 0$$

Extends to:

$$\left[p_h \bar{H}\frac{Y_{low}}{Y_{coop}} + \tilde{p}_c(1-\bar{H})\frac{Y_{low}}{Y_{coop}}\right]$$

$$+ \quad \left[p_h \bar{H}\frac{Y_{medium}}{Y_{coop}} + \tilde{p}_c(1-\bar{H})\frac{Y_{medium}}{Y_{coop}}\right]$$

$$+ \quad \left[p_h \bar{H}\frac{Y_{high}}{Y_{coop}} + \tilde{p}_c(1-\bar{H})\frac{Y_{high}}{Y_{coop}}\right]$$

$$= \quad [p_h \bar{H} + \tilde{p}_c(1-\bar{H})]Y_{coop}$$

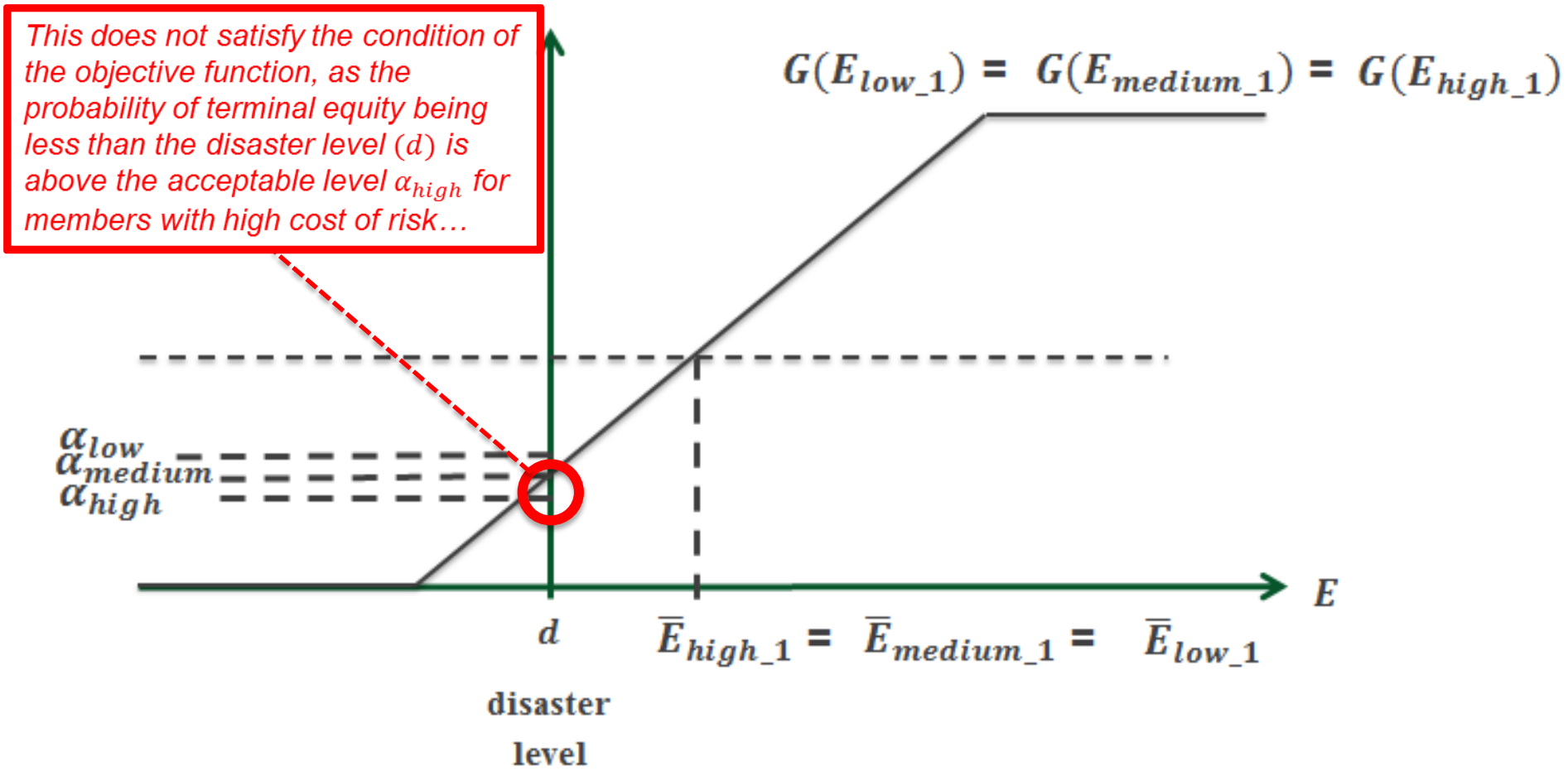
Collins (1997) objective function:

$$\max \bar{E}_1 = \int_{-\infty}^{\infty} E_1 g(E_1) dE_1$$

$$\text{s.t.} \int_{-\infty}^{d} g(E_1) dE_1 \leq \alpha$$

Where $g(E_1)$ is the probability density function for terminal equity

The "*realistic objective of a single-period model is to maximize the expected effect of this period's operations on the firm's terminal equity… …subject to the constraint that the chance that terminal equity is less than some disaster level* (d) *is less than* α" Collins (1997)


This does not satisfy the condition of the objective function, as the probability of terminal equity being less than the disaster level (d) is above the acceptable level α_{high} for members with high cost of risk…
$G(E_{low\_1}) = G(E_{medium\_1}) = G(E_{high\_1})$
α_{low}
α_{medium}
α_{high}
E
d
$\overline{E}_{high\_1} = \overline{E}_{medium\_1} = \overline{E}_{low\_1}$
disaster level

Trade with forward price contracts among cooperative members

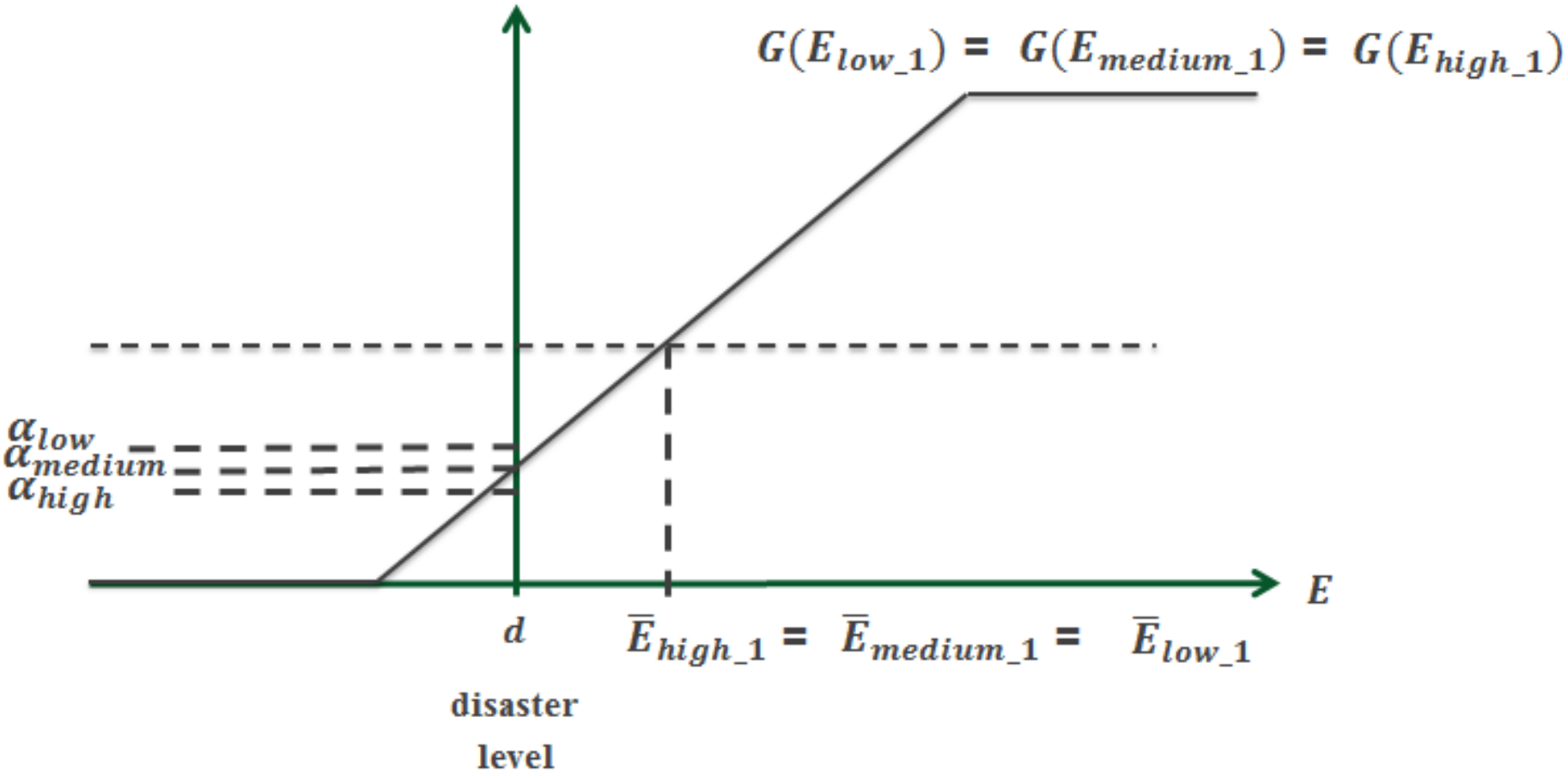
Suppose you redistribute $\bar{H}$ at a price z the revenue function extends to:

$$\left[p_h\bar{H}\frac{Y_{low}}{Y_{coop}} - p_h h\bar{H}\frac{Y_{low}}{Y_{coop}} + \tilde{p}_c(1-\bar{H})\frac{Y_{low}}{Y_{coop}} + \tilde{p}_c h\bar{H}\frac{Y_{low}}{Y_{coop}} + zh\bar{H}\frac{Y_{low}}{Y_{coop}}\right]$$

$$+\left[p_h\bar{H}\frac{Y_{medium}}{Y_{coop}} + \tilde{p}_c(1-\bar{H})\frac{Y_{medium}}{Y_{coop}}\right]$$

$$+\left[p_h\bar{H}\frac{Y_{high}}{Y_{coop}} + p_h h\bar{H}\frac{Y_{low}}{Y_{coop}} + \tilde{p}_c(1-\bar{H})\frac{Y_{high}}{Y_{coop}} - \tilde{p}_c h\bar{H}\frac{Y_{low}}{Y_{coop}} - zh\bar{H}\frac{Y_{low}}{Y_{coop}}\right]$$

$$= [p_h\bar{H} + \tilde{p}_c(1-\bar{H})]Y_{coop}$$


$G(E_{low\_1}) = G(E_{medium\_1}) = G(E_{high\_1})$
α_{low}
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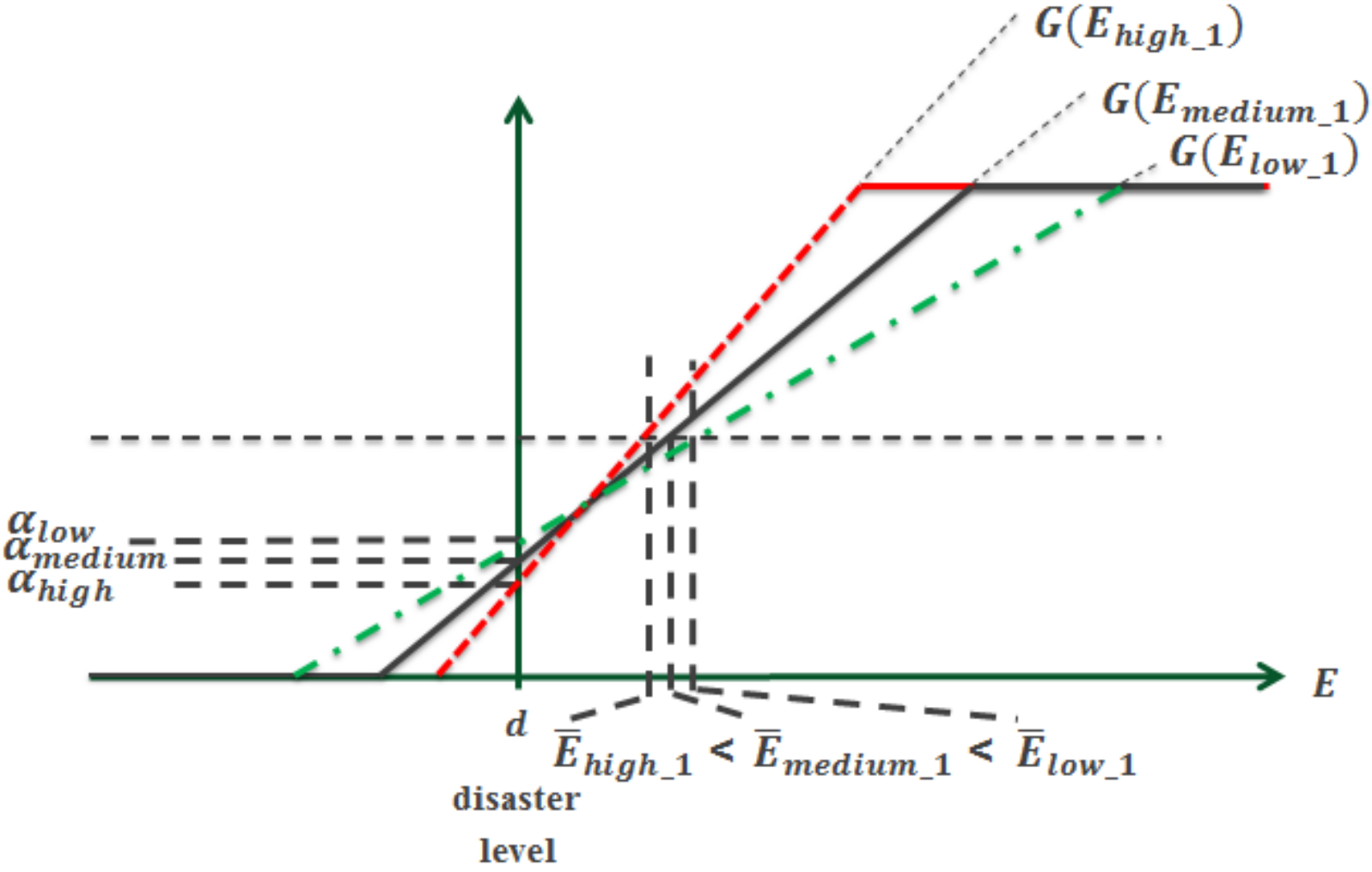
disaster level

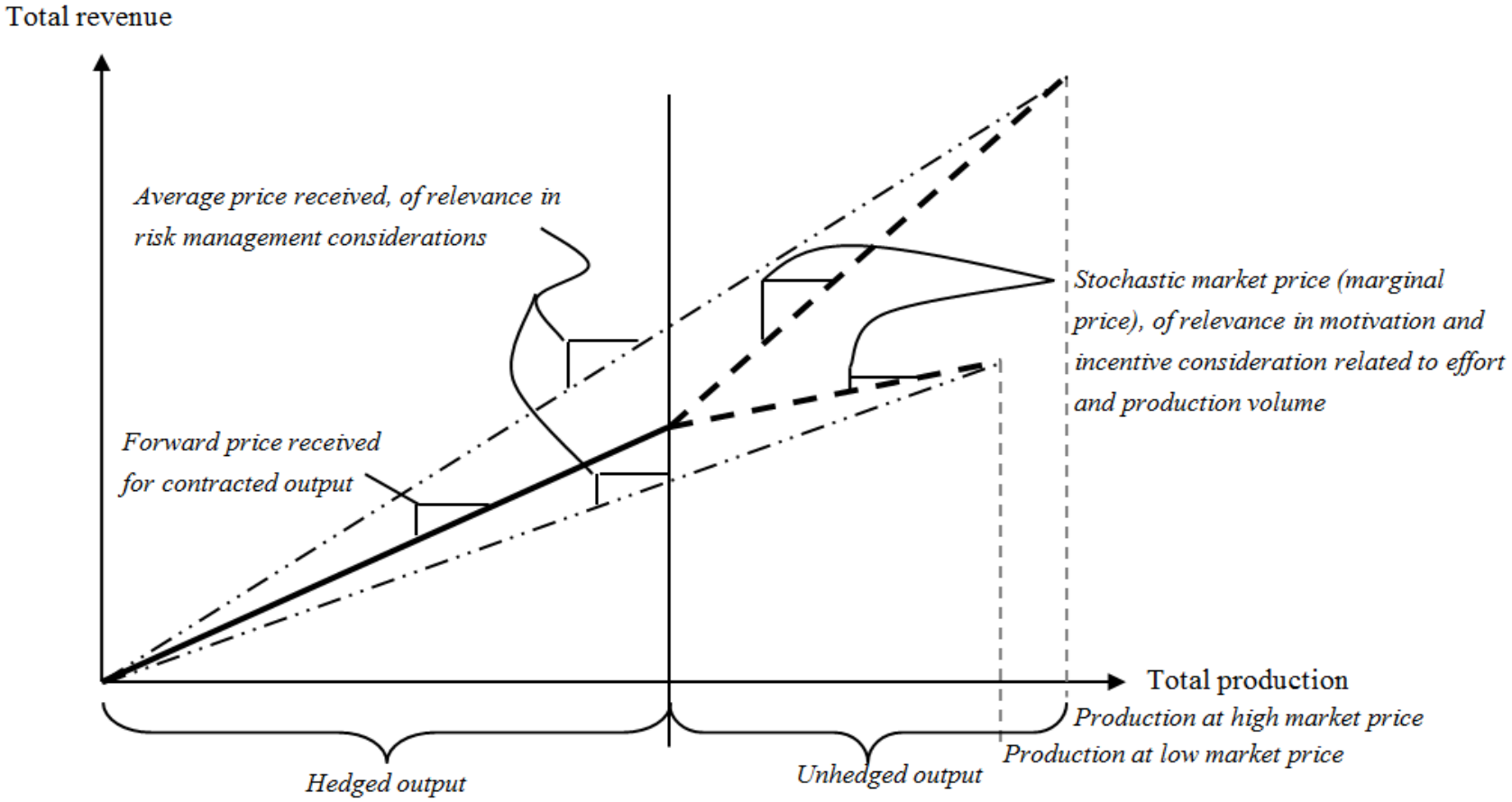
Ex post distribution of risk exposure for cooperative members



Extension of the Collins (1997) model to the cooperative reallocation model…

- The endowment forward contracts and reallocation of risk among member is an Pareto improvement assuming:
  - zero transaction cost, and
  - $\frac{\partial Y}{\partial \sigma_c} = 0$, where $\partial \sigma_c$ is the change in volatility of $\tilde{p}_c$
- These assumptions are of course very strong
  - Transaction costs are certainly positive, but if they are small enough gains from trade may be reaped…
  - There may be an quantity effect of increased volatility of marginal price

The difference of contract price, stochastic market price and average price



Quantity effect of increased volatility of marginal price

- If $\frac{\partial Y}{\partial \sigma_c} \neq 0$ and $\tilde{p}_c < k$
- Y_{coop} may be significantly affected,
- … and thus have an impact on $[p_h H + \tilde{p}_c(1-H)]Y_{coop}$
- Medium cost of risk members will not be unaffected…
- Conditions for Pareto improvement may not hold, but
- Aggregate cost of risk is reduced
- Member may better be able to signal risk appetite
- Quantity control problem may be alleviated if $\frac{\partial Y}{\partial \sigma_c} \neq 0$
- Kaldor-Hicks improvement may be realised

Reallocation of price risk among members in marketing cooperatives

- Reallocation of risk among coop members is an example of horizontal transfer of risk in the value chain – as oppose to usual thinking on vertical transfer of risk in the value chain
- Endowment of property rights to fixed price contracts enables the reallocation of risk and gains from trade
- This model has similarities to the contract production in New Generation Cooperatives, the difference is the relative short term of the forward price contracts

Thank you for listening

Questions / comments ?