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# Modeling New-Age Farm Programs

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A. What is “New Age”?
B. How are they handled in simulation models?
C. Some lessons on risk
D. Conclusions

# A. What is “New Age”?

- New Age Music (Suzanne Ciari):
  - Peaceful
  - Smooth
- New Generation of Farm programs since de 90s:
  - More decoupled
  - Smoothing variability
- Different modelling challenges

# “New Age” features

1. From support to production to land payments with no obligation to produce

2. From individual commodity programs to broad commodity coverage and freedom

3. Counter-cyclical payments

# Why is "more decoupled"?

1. **LAND: Incentive to use land as compared to other inputs.**
   - **From price support to area payments:**
     **↑Area << ↓Yields ⇨ ↓Prod.**
   - **Input substitution is crucial (empirical)**
2. **BROAD set of commodities**
   - **Less possibilities for alternative uses of resource, particularly land**
   - **Land response is crucial (capitalization)**
3. **COUNTER-CYCLICAL programs: "more coupled"**
   - **Farmers are risk averse**
   - **The existence of risk reducing market instruments may reduce risk effects**

# B. How these programs are handled in simulation models?

# The challenges

- **Potential effects**
  - **Non-lump sum effects**
    - Relative price effects
    - Risk related effects (insurance/wealth) (Hennessy)
    - Expectations about policy changes (Sumner, OECD)
  - **Lump sum effects:**
    - Investment (Coyle, Sckokai)
    - Labour / leisure decisions (ERS)
    - Fixed costs and entry/exit (Chau & de Gorter)
- **Modeling Alternatives**
  - Structural models
  - Reduced form models
  - Hybrid models

# The empirical evidence

**OECD Papers 2005(5): Special issue on "decoupling"**

- **EU**
  - **Scarce for 1992 Area Payments.**
    - **Very few published econometric estimations**
      - **Moro& Sckokai (1999), OECD (2003 & 2005), Sckokai & Antón (2005)**
    - **AP "estimated" as partially decoupled**
  - **Inexistent for new Single Farm Payment**

- **US: Scarce for PFC and MLA/CCP**
    - **Until recently, only one published (Adams et al 2002)**
    - **New studies: Goodwin & Mishra (2005 & 2006), Key, Lubowski and Roberts (2005)**
    - **PFC and MLA are found to have "some impact" on production.**

- **Canada**
    - **Coyle (2005)**

# Model Structures: Land allocation,Commodities and Risk

| | FAPSIM Linker (ERS) | FAPRI | AGLINK (OECD) | PEM (OECD) | ESIM (EC) | WEMAC (INRA) |
|---|---|---|---|---|---|---|
| Inputs represented in the model | Land and yields | Land and yields | Land and yields | Land+ set of other inputs | Land+ set of other inputs | Land and yields |
| Input substitution in production | No | No | No | CES | Yes | No |
| Market of land: demand & supply | Yes | 1 land equation[1] | 1 land equation[1] | Yes | 1 land equation[1] | 1 land equation[1] |
| Land heterogeneity | Yes | Yes | Yes | Yes | Yes | Yes |
| Idling | Yes | Compuls. Exogenous | Endogenous voluntary set aside eq. | Compulsory exogenously | Compulsory exogenously | Exogenous |
| Commodity coverage | C,O,P | " | " | " | " | " |
| Risk effects | No | No[2] | Yes[3] | Yes[4] | No | No |

# Degree of coupling / decoupling: Production ratios

| [1] | FAPSIM Linker (ERS) | FAPRI | AGLINK (OECD) | PEM (OECD) | ESIM (EC) | WEMAC (INRA) |
|---|---|---|---|---|---|---|
| EU 1992 Area Payments | 1 | ≈ 1.00 | < 0.27 | 0.27 | (0 , 1) | (0 , 1) |
| EU 2003 Single Farm Payment | | ≈ 0.60 | < 0.11 | 0.11 | 0 | 0 |
| US 1996 AMTA / 2002 Direct Payment | | ≈ 0.34 | < 0.09 | 0.09 | | (0 , 1) |
| US 2002 Counter-cyclical Payments | | ≈ 0.59 | < (0.09+Risk) | ? | | (0 , 1) |

1. These numbers are calculated as production ratios: increase in production per dollar of additional payments as compared to the increase in production per dollar of additional price support (OECD, 2001). Calculations in this table are sensitive to the details of the experiment design and are approximate with the purpose of illustrating the range of potential available assumptions only. When no calculation was available but the magnitude could be inferred as the interval (0 , 1), this interval is shown in the table and represents partial decoupling. When the modeler makes no claim of representing a given program, the cell is left empty.

# An example (1): CCPs in FAPRI

- **First Component:**
  - “wealth” or “decoupled” effect
  - $\Delta$ Crops Area = 0.25*NetCoef*CCP
  - $\varepsilon$ = 0.01
- **Second component**
  - “Coupled” effect
  - Commodity area =
    f(returns+0.25*CCP (E[P]))
  - This effects almost doubles the impact of DP

# An example (2): CCPs in PEM and AGLINK

- **First Component:**
  - **PEM captures relative land price effects**
    - **Commodity land supply = f (Pa+E[CCP])**
  - **AGLINK: captures reduced form from PEM**
    - **Commodity area = f(returns+0.09*E[CCP])**
- **Second component:**
    - **Estimate of Price variance (time series)**
    - **Truncation of Price distribution at Target Price (N)**
    - **Commodity supply = f (P*[1-RiskPremium])**
    - **Risk Premium from Mean-Variance approach to EU**
    - **R=2; $\mu$=Receipts/income; PL=Truncation price**

$$\theta = \frac{1}{\dfrac{1}{\mu * R * CV^2[Max(P_L, \widetilde{P})]} + \dfrac{\mu}{2}}$$

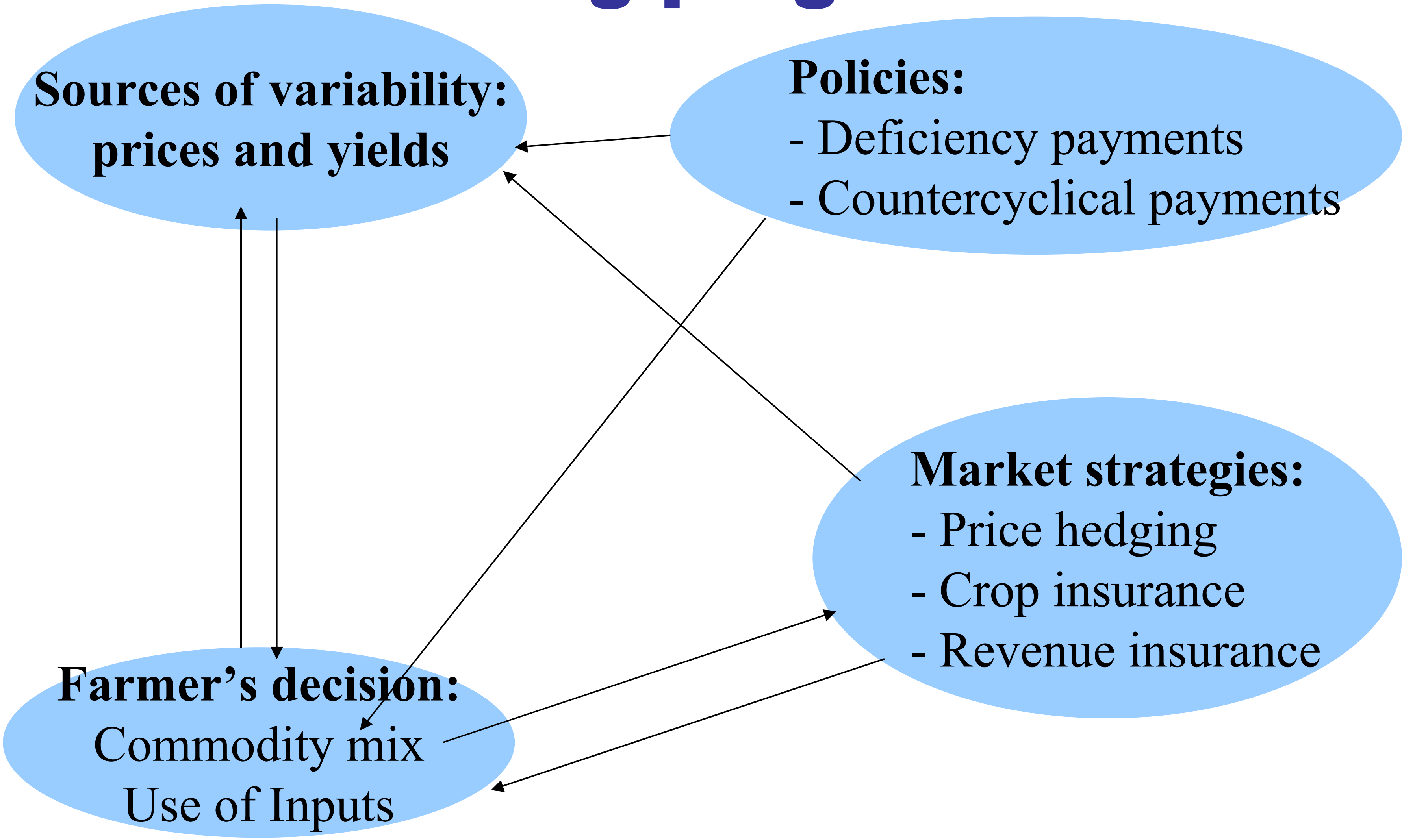
# An example (3): More general formula

– **Including Deficiency Payments and CCP (see Antón & LeMouel (2004))**

$$\theta=\frac{1+\alpha*\frac{\bar{Q}}{Q}*\frac{Cov\left[Max(P_T,\tilde{P}),Max(P_L,\tilde{P})\right]-V\left[Max(P_L,\tilde{P})\right]}{V\left[Max(P_L,\tilde{P})\right]}}{\frac{1}{\mu*R*CV^2[Max(P_L,\tilde{P})]}+(1-\alpha*\frac{\bar{Q}}{Q})^2*\frac{\mu}{2}+\alpha*\mu*\left[\frac{\alpha}{2}*\left(\frac{\bar{Q}}{Q}\right)^2*\frac{V\left[Max(P_T,\tilde{P})\right]}{V\left[Max(P_L,\tilde{P})\right]}+\frac{\bar{Q}}{Q}(1-\alpha*\frac{\bar{Q}}{Q})*\frac{Cov\left[Max(P_T,\tilde{P}),Max(P_L,\tilde{P})\right]}{V\left[Max(P_L,\tilde{P})\right]}\right]}$$

# C. Some lessons on risk

# Micro response to risk reducing programmes



# The sources of risk: An example

## Italian wheat producers example

| | | Yield | Price |
|---|---|---|---|
| Aggregate level | Coefficient of variation | 7% | 3% |
| Individual level | Av. coefficient of variation | 18% | 5% |
| | % of farms with CV > CV (Price) | 96% | 0% |

| | Correlation Price / yield |
|---|---|
| Aggregate level | -0.3 |
| Individual level | 0.0 |

*Coefficients of variation and correlations are calculated for time series.*

# Farmer's decision (1)

## Profits:

$$\tilde{\pi} = \tilde{p} * \tilde{q} * f(L, I) - r * L - w * I + g(\tilde{p}, \tilde{q}, \lambda...)$$

with

| | |
|---|---|
| $\tilde{p}$ | uncertain price |
| $\tilde{q}$ | random yield shock with $E[\tilde{q}] = 1$ |
| $f(L, I)$ | production function depending on land L and other inputs I |
| $r, w$ | rental price of land and the price of the other inputs |
| $g(\tilde{p}, \tilde{q}, \lambda...)$ | Net indemnity from a given risk strategy |

## Maximisation of expected utility

Power utility function

Decreasing ARA and constant RRA

# Farmer's decision (2)

**Net indemnities for certain risk reducing program or strategy**

**Total indemnity**

$$\tilde{g} = \sum_i \tilde{g}_i$$

**Crop Insurance**

$$\tilde{g}_1 = \qquad \text{Indemnity} \qquad - \qquad \text{Premium}$$

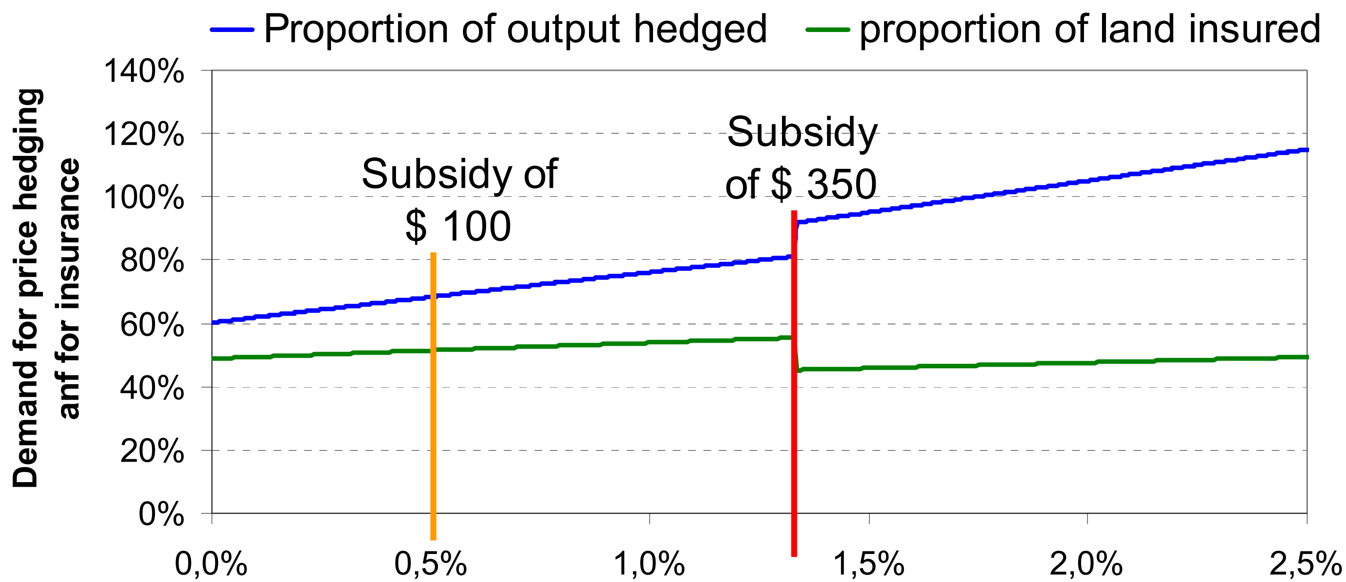
$$\left(P_f \times Max(0, \beta - \tilde{q}) \times Y_H \times L_I\right) - \left((1+\gamma) \times P_f \times E\left[Max(0, \beta - \tilde{q})\right] \times Y_H \times L_I\right)$$

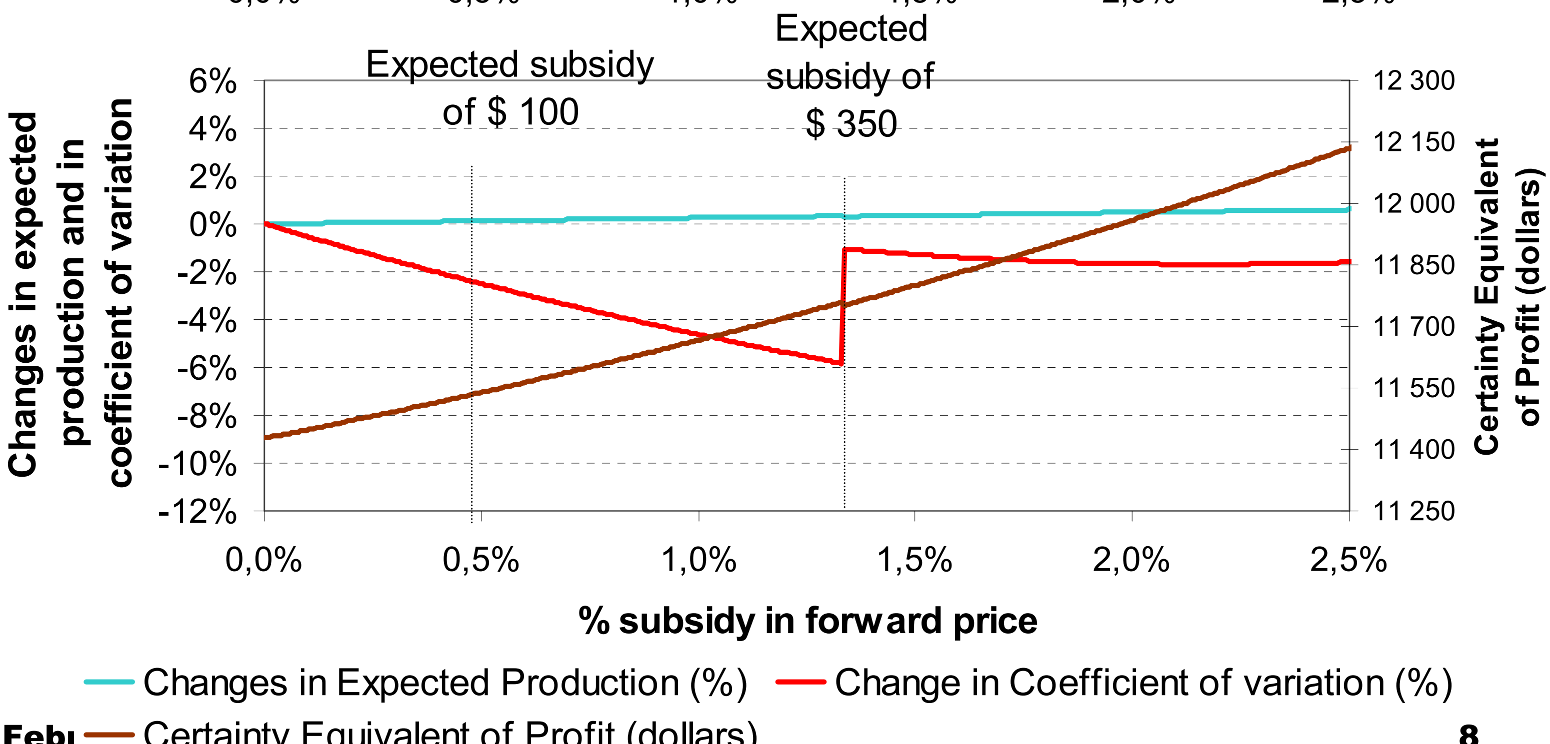
**Historical Area Payments countercyclical with prices**

$$\tilde{g}_6 = \qquad \text{Indemnity}$$

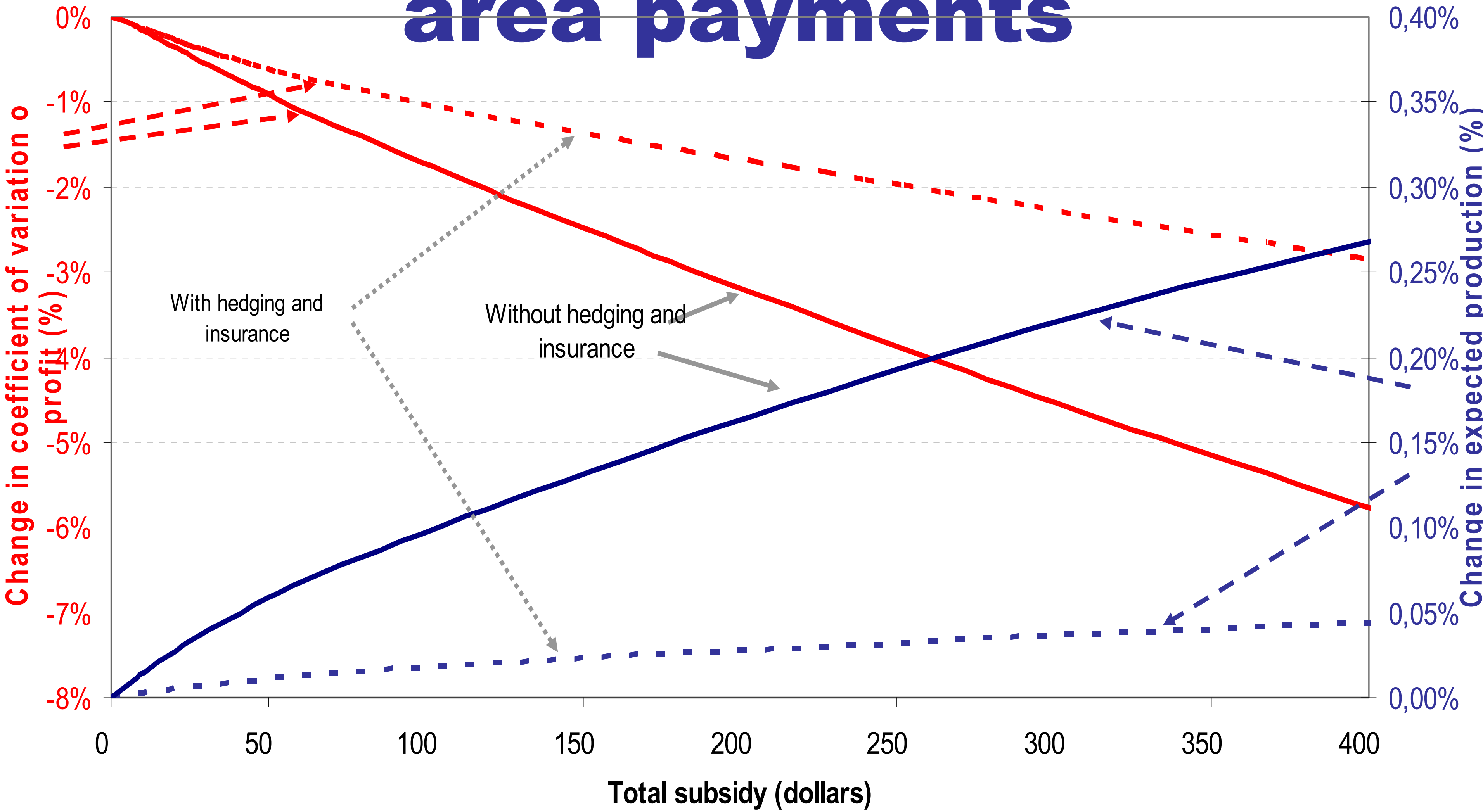
$$Max\left(0, P_f - \tilde{p}\right) \times Y_H \times L_H$$

# Interactions (1): Price hedging / Crop insurance

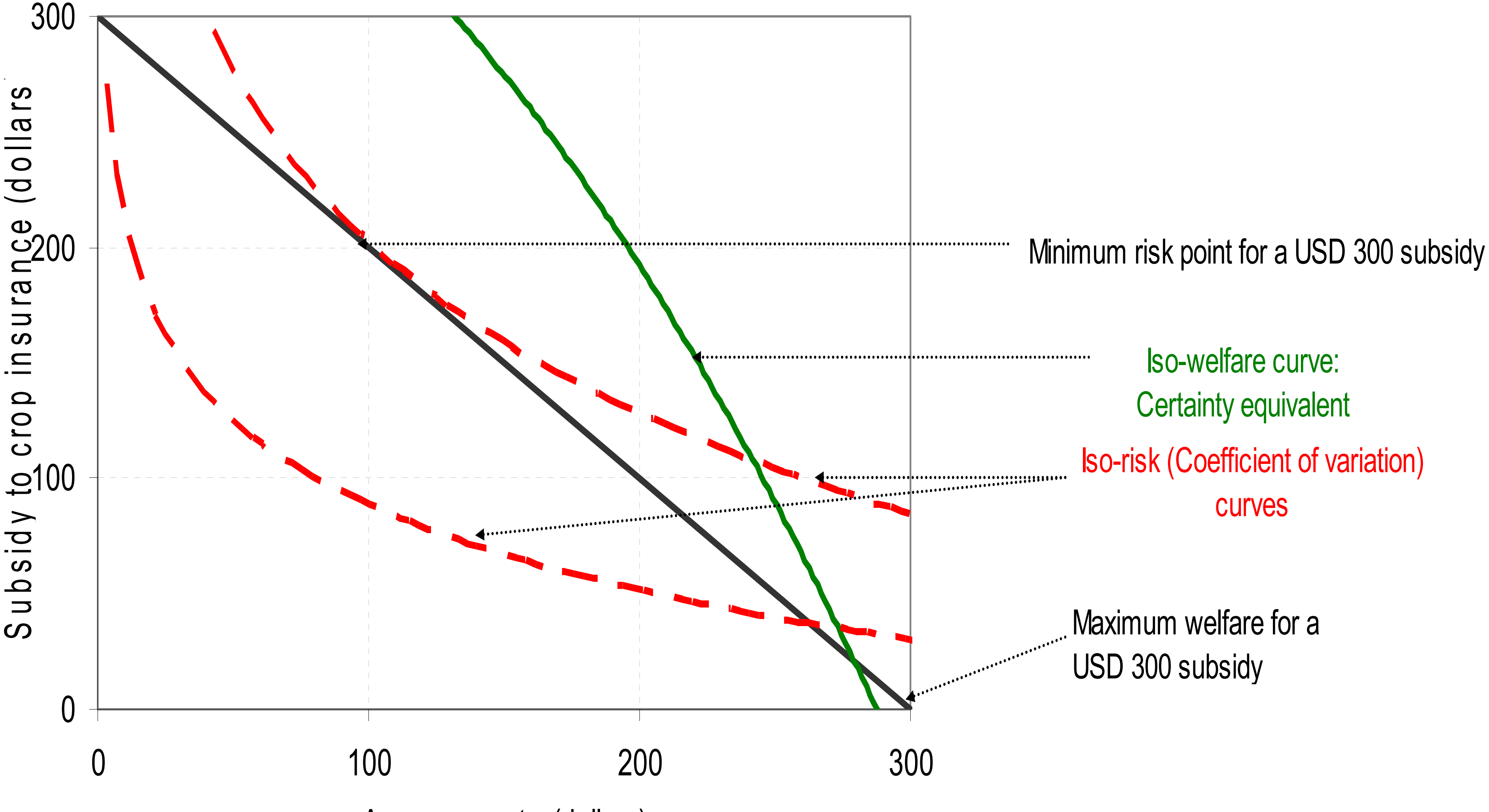


# Interactions (2): Impact of historical countercyclical area payments



# Interactions (3): Optimal policy mix



# Some lessons on Risk

- **Impact on farmer's risk and welfare differs between payments and market strategies (perverse effects)**
- **The better the policy is targeted to the most relevant source of risk, the larger the potential reductions of risk**
- **Broader set of commodities implies better targeting to relevant risk**
- **There may be a trade-off between welfare and risk reduction : Why should farm risks be reduced if the farmer's utility is not most increased?**

# D. Evaluation and Conclusions

- **Area / yield models are not well equipped for structural representation of area / income based payments**
- **Simulation models are technically capable of dealing with these payments**
  - **Main weakness: LACK OF EMPIRICAL EVIDENCE**
- **Effective degree of decoupling differs significantly across models**

# Thank You!