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► Environmental and health labelling : and opportunity for the provision of agri-environmental-climate public goods?

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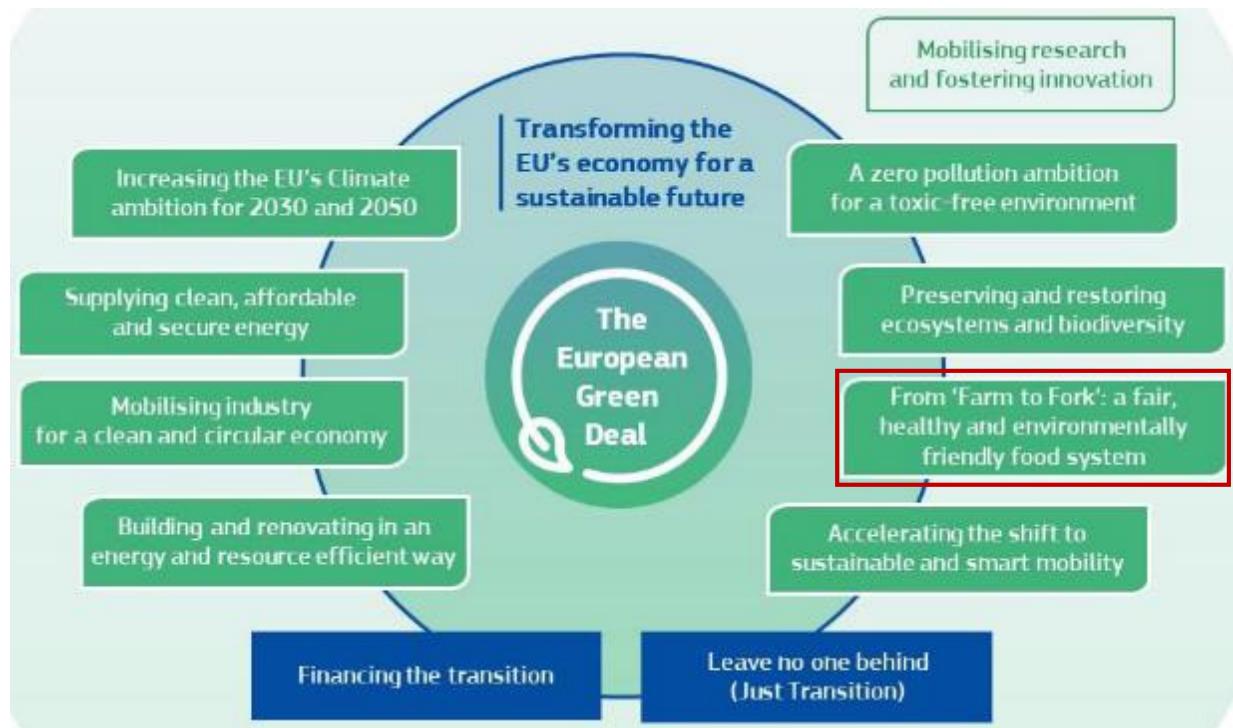
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➤ Introduction: context

The European Green Deal

New EU growth strategy “decoupled from resource use” aiming for zero net GHG emissions in 2050 (EC, 2019).



"Farm to Fork" strategy (EC, 2020).

« Create a sustainable labelling framework that covers [...] the nutritional, climate, environmental and social aspects of food products ».
→ Empower consumers to make sustainable food choices.

Labels = market-based instruments to finance environmentally-friendly food systems.

Does the information given to consumers on the different attributes of a food product impact the level of agri-environmental-climate public goods (AECPG) provision through the market?

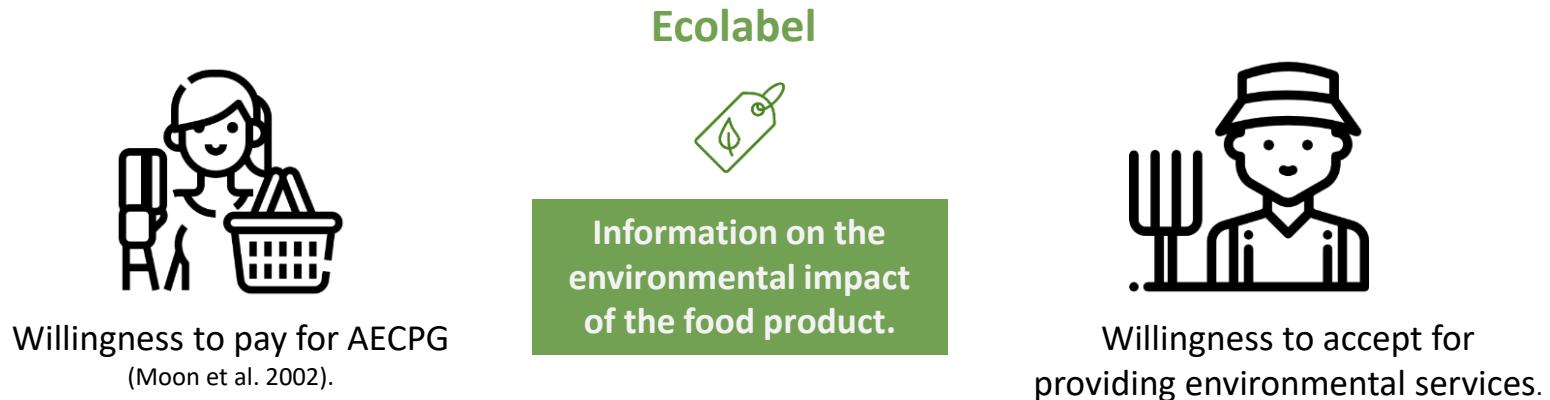


➤ Introduction: motivations

Labels as instruments for financing AECPG provision

«Instrument [...] that [...] regulates the presentation of product-specific information to consumers. This information might describe use characteristics of the product, such as price, taste, and nutrition, or non-use characteristics, such as the environmental impact or moral/ethical elements surrounding the product's manufacturing process» (Teisl and Roe., 1998).

- ➔ A label reduces asymmetric information, a source of market failure.



- Consumers express their preferences for environmental quality through their food choices (demand for AECPG).
- Farmers are encouraged to adopt environmentally-friendly agricultural practices (supply of AECPG).



➤ Literature review

Labels as instruments for financing AECPG provision

- ❖ Assumption on consumers behaviour:
 - Each consumer buys the product until the benefit he/she gets from 1 extra-unit equals its marginal cost.
- ❖ Allocation of goods through the market:
 - Private good: benefits from consumption are individual. Rationality leads to the optimal allocation.
 - Public good: the benefits from each unit provided are for everyone. By only considering his/her individual benefit from purchasing one more unit, a rational consumer does not take into account the benefits to others (Cernes and Sandler, 1984). The allocation is not optimal.
- ❖ A voluntary contribution through the market does not meet the Bowen-Lindahl-Samuelson (BLS) condition for the optimal provision of a PG (Sandmo, 2008):
 - The sum of the marginal willingness to pay for the PG of all the beneficiaries should be equal to the marginal cost of production.
- ❖ Public economics theory on the voluntary contribution to public goods (PG) provision :
 - Environmental quality is underfunded. Ecolabels are inefficient tools.



➤ Literature review

Labels as instruments for financing AECPG provision

- ❖ Empirical studies on other labels in the « green market » :
 - Emerging labels emphasising the nutritional/sanitary quality of food produced with environmentally-friendly practices (0 pesticides, 0 GMO, 0 hormones, 0 antibiotics).
 - Organic label (strict limitation of synthetic chemical inputs use): health concerns are the primary cause of purchase (Hughner et al., 2007; Kushwah et al., 2019; Loureiro et al., 2001).
- ❖ Internalities from food consumption :
 - Asymmetric information on the costs and benefits “borne by individuals themselves in the future but are ignored at the point of consumption” : balanced diet, addictions, risk of developing cancer or cardio-vascular diseases...(Griffith et al., 2018).

Hypothesis: «environment and health» labels would capture **both** the willingness to pay of consumers with environmental concerns and the willingness to pay of consumers with health concerns, what should **increase the level of AECPG provision** in comparison with ecolabels.

➤ Literature review

Modelling consumption choices

- ❖ Numerous empirical studies on stated or observed choices between conventional products and products with a lower environmental impact (Bougerara et Combris, 2009), particularly using discrete choice modelling (Bjorner et al, 2004; Lusk et al., 2007; Brécard et al. 2009, 2012).
- ❖ Theoretical modelling: impure public good model (Cornes and Sandler, 1994).
 - Consumers' utility is derived from the characteristics of the goods they consume (Lancaster, 1966).
 - Impure public good:
 - Private good for which the production is joint to the delivery of a PG.
 - Display a private characteristic *and* a public characteristic.
 - Kötchen (2005, 2006) : theory of green consumption. A consumer allocates her/his income among:
 - An impure public good g (eco-labeled product) with the private characteristic X and the public characteristic Y .
 - Its conventional substitute c , a private good with the private characteristic X .

➤ Contribution to the literature

Expansion of the impure public good model

- ❖ Compare the environmental performance of 3 types of label :

Market	Good	Characteristics	
 Eco-label	c	Private characteristic X	Kötchen (2005, 2006)
	g	Private characteristic X and public characteristic Y	
 Health label	c	Private characteristic X	+ Complementary private characteristic H (health)
	g	Private characteristics X and H	
 Environment and health label	c	Private characteristic X	
	g	Private characteristics X and H , and public characteristic Y	

- Show the effect on the level of Y of the information available to consumers on the complementary provision of H and Y .

➤ Illustrative example

❖ BBC Label (France):

Enriching dairy cows' diet with grass fodders and extruded linseed (Weill et al., 2009):

- Increases the omega-3 content of milk.
- Decreases enteric methane emissions per litre of milk.



BBC label (since 2000):

Approximately 400 dairy farmers.

X: milk

Y: climate change mitigation

H: omega-3 intake



➤ Main theoretical findings

When environmentally-friendly practices produce a good with benefits for health:

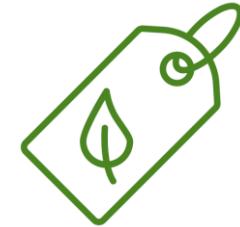
- The environmental and health labelling of the product increases the provision of AECPG compared with a health label or an eco-label.
- The level of the increase depends on consumers preferences for the food product, health and environmental issues, and on the market size.
- Health concerns indirectly contribute to financing AECPG provision and, under certain conditions, up to the optimal level of an environmental agency.

> Theoretical model

- ❖ Impure public good (labeled product): g (price p_g)
- ❖ Its conventional substitute: c (price p_c)
- ❖ Private characteristic (food): $X^i = c^i + g^i$
- ❖ Public characteristic (global AECPG) : $Y^- = Y^i + Y^{-i}, Y^i = \beta g^i$
- ❖ **Private characteristic (health): $H^i = \alpha g^i$**
- ❖ Joint production technology: 1 unit of g provides α units of H et β units of Y .
- ❖ Assumption for the viability of c on the market : $p_g > p_c$
- ❖ **Preferences:** $\max_{c^i, g^i} U^i(X^i, H^i, Y)$
- ❖ I homogeneous consumers with income r .

➤ Theoretical model

Eco-label (Kötchen, 2005, 2006)



Consumers have **no information on the health characteristic** of good g .

- No demand for characteristic H .

$$\max_{c^i, g^i} U^i(X^i, Y, H^i) \mid$$

$$X^i = c^i + g^i, \mathbf{Y}^i = \beta \mathbf{g}^i, Y = Y^i + Y^{-i}, p_c c^i + p_g g^i \leq r$$

➤ Theoretical model

Health label



Consumers have **no information on the environmental characteristic** of good g .

- No demand for characteristic Y .

$$\max_{X^i, H^i} U^i(X^i, Y, H^i) |$$

$$X^i = c^i + g^i, \mathbf{H}^i = \alpha \mathbf{g}^i, p_c c^i + p_g g^i \leq r$$

- Consumers are not informed of the provision of Y but the AECPG is still provided through the joint agricultural production technology $\mathbf{Y} = \beta \mathbf{g}^i + \mathbf{Y}^{-i}$

> Theoretical model

Environment and health label



Consumers have a **complete information on the characteristics** of good g .

$$\max_{X^i, H^i, Y} U^i(X^i, H^i, Y) \mid \\ X^i = c^i + g^i, H^i = \alpha g^i, Y^i = \beta g^i, Y = Y^i + Y^{-i}, p_c c^i + p_g g^i \leq r$$

➤ Results

Comparison of the provision levels of AECPG

Assumption : $U^i(X^i, Y, H^i) = a \ln X^i + b \ln Y + c \ln H^i$

$$\frac{1}{Y_e} = \frac{1}{\beta} \frac{p_g - p_c}{r} \left(\frac{1}{I} + \frac{a}{b} \right)$$

$$\frac{1}{Y_h} = \frac{1}{\beta} \frac{p_g - p_c}{r} \left(\frac{1}{I} + \frac{a}{Ic} \right)$$

$$\frac{1}{Y_{eh}} = \frac{1}{\beta} \frac{p_g - p_c}{r} \left(\frac{1}{I} + \frac{a}{b + Ic} \right)$$

a: preferences for the type of food

b: preferences for the environment

c: preferences for health

Results

				Market size
		$1 < I < \frac{b}{c}$	$I = \frac{b}{c}$	$I > \frac{b}{c}$
$a = 0$		$Y_{eh} = Y_h = Y_e$		
$a > 0$	$0 = b = c$	$Y_{eh} = Y_h = Y_e = 0$		
	$0 = b < c$	$Y_{eh} = Y_h > Y_e = 0$		
	$0 < b < c$	$Y_{eh} > Y_h > Y_e$		
	$0 < b = c$	$Y_{eh} > Y_h > Y_e$		
	$b > c > 0$	$Y_{eh} > Y_e > Y_h$	$Y_{eh} > Y_h = Y_e$	$Y_{eh} > Y_h > Y_e$
	$b > c = 0$	$Y_{eh} = Y_e > Y_h = 0$		



> Theoretical model

Regulation of the economy

Social planner:

$$\max_{X^i, H^i, Y, z_c} W = \sum_i U^i(X^i, Y, H^i) \mid$$

$$\sum_i X^i = c(z_c) + g(1 - z_c), Y = \beta g(1 - z_c), \sum_i H^i = \alpha g(1 - z_c)$$

Environmental agency:

$$\max_{X^i, Y, z_c} W = \sum_i U^i(X^i, Y, H^i) \mid$$

$$\sum_i X^i = c(z_c) + g(1 - z_c), Y = \beta g(1 - z_c)$$

Results

Optimality of AECPG provision

Assumption: $U^i(X^i, Y, H^i) = a \ln X^i + b \ln Y + c \ln H^i$

Eco-label

$$\beta \frac{\mathbf{b} X_e^i}{a Y_e} = \frac{\partial c(z_c)/\partial z_c}{\partial g(1-z_c)/\partial z_c} - 1$$

Health label

$$\beta \frac{\mathbf{Ic} X_h^i}{a Y_h} = \frac{\partial c(z_c)/\partial z_c}{\partial g(1-z_c)/\partial z_c} - 1$$

Environment and health label

$$\beta \frac{\mathbf{b} + \mathbf{Ic} X_{eh}^i}{a Y_{eh}} = \frac{\partial c(z_c)/\partial z_c}{\partial g(1-z_c)/\partial z_c} - 1$$

Social planner:

$$\beta \frac{\mathbf{Ib} + \mathbf{Ic} X_p^i}{a Y_p} = \frac{\partial c(z_c)/\partial z_c}{\partial g(1-z_c)/\partial z_c} - 1$$

Environmental agency:

$$\beta \frac{\mathbf{Ib} X_{ea}^i}{a Y_{ea}} = \frac{\partial c(z_c)/\partial z_c}{\partial g(1-z_c)/\partial z_c} - 1$$

- A health label reaches the objective of the environmental agency if $\frac{c}{b} \geq 1$.
- An environment and health label reaches the objective of the environmental agency if $\frac{c}{b} \geq 1 - \frac{1}{I}$.



➤ Discussion

Main findings

When environmentally-friendly practices produce a good with benefits for health (complementary provision of AECPG and a positive consumption internality):

- The environmental and health labelling of the product increases the provision of AECPG compared with a health label or an eco-label.
- The level of the increase depends on the relative preferences for the food product, health and environmental issues, and on the market size.
- Health concerns indirectly contribute to financing AECPG provision and, under certain conditions, up to the optimal level of an environmental agency.

➤ Discussion

Limits of the theoretical model

- ❖ **Assumption that p_g is identical under the 3 types of labelling.**
- Transaction costs (information, certification) would affect their relative performances.
- ❖ **Assumption that consumers are homogeneous with homothetic preferences (no income effect).**
- There exist different groups of consumers depending on preferences and income levels:
 - Young altruistic individuals with high levels of revenue, education and environmental awareness exhibit high preferences for environmental quality (Aldanondo-Ochoa and Almansa-Sáez, 2009; Brécard et al., 2009; Lusk et al., 2007; Moon et al., 2002).
 - Older individuals with a lower level of education exhibit high preferences for health (Brécard et al., 2012; Govindasamy and Italia, 1999; Schifferstein and Ophuist, 1998).

> Conclusion

- ❖ This theoretical analysis contributes to:
 - Better understand the market parameters influencing the impact of food labelling on AECPG provision.
 - Discussing the development of « environment and health » labels as a lever to reach EU's environmental and climate targets as part of the « Farm to Fork » strategy.
- ❖ Recommendations for public policies:
 - Health labelling is relevant to increase AECPG provision through the market.
 - Bring to light complementarities between positive consumption internalities and PG provision in the agricultural sector requires investing in research and education.

Thank you for your attention!

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