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

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Elodie Letort, Fanny Le Gloux and Pierre Dupraz*

**UMR SMART-LERECO, INRAE, Rennes, France*

➤ 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.

Ecolabel



Willingness to pay for AECPG
(Moon et al. 2002).



Information on the
environmental impact
of the food product.



Willingness to accept for
providing environmental services.

- 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 (Cornes 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 (Bougherara 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 .

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

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

➤ Theoretical model

Health label



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

- No demand for characteristic Y .

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

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

➤ 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

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

$Y_{eh} - Y_e$ 

$Y_{eh} - Y_h$ 

➤ 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

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

Health label

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

Environment and health label

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

Social planner:

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

Environmental agency:

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

- 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 externalities and PG provision in the agricultural sector requires investing in research and education.

Thank you for you attention!

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