E C O N O M I C S B U L L E T I N

Why some countries adopt ecolabeling schemes in their regulatory arsenal and others do not?

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Abstract

We use data to investigate econometrically the determinants of the adoption of ecolabeling schemes among countries. Our findings show that economic and political freedoms, innovation capacities and experience with other environmental voluntary approaches play a major, sometimes counter-intuitive, role to explain the diffusion of governmental ecolabeling programs.

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1. Introduction

During the last two decades, policymakers turned their attention to information-based policies in response to dysfunctional markets. According to the Coase Theorem, socially optimal risk sharing can be obtained if all stakeholders can negotiate at a very low cost. Information asymmetries constitute an impediment to such private bargaining. Removing or at least attenuating such information asymmetries may enable to reach a Pareto-optimal outcome (Tietenberg, 1998; Case, 2001). In line with economists' arguments "preaching" the good impact of information provision, several governments have implemented ecolabeling schemes in their regulatory arsenal. By making information publicly available, consumers can make informed decisions and choose products in accordance with their preferences. The potential for such an increasing role for disclosure strategies is reinforced by the continual decrease of the cost of information collection, aggregation and dissemination[1].

In 1977, Germany introduced the first national and multiproduct ecolabel, *i.e.,* the *Blue Angel* label. A decade later, several countries (*e.g.,* Nordic countries, Canada, Japan) developed their own ecolabeling programs. Ecolabeling schemes are now present in almost all OECD countries, and in some transitional economies (Kern et al., 2001). There are more than 40 ecolabeling schemes worldwide with a very unequal diffusion among countries. Nevertheless, the determinants of the unequal diffusion of ecolabeling schemes remain unexplored. The aim of this contribution is to fill this gap by investigating why some countries adopt ecolabeling schemes in their regulatory arsenal while others do not. We use survey data to test econometrically whether a set of *ad hoc* factors may explain these trends about ecolabeling schemes. Because of data limitations, the ecolabeling schemes studied here combine two features: they are governmental or quasi-governmental schemes at a national or supranational level and are also multiproduct schemes. Concretely, this delineation excludes schemes devoted to one product category (*e.g.,* dolphin friendly ecolabel) or private schemes (*e.g.,* the FSC ecolabel on wood products).

The remainder of the paper is organized as follows. The next section uses economic literature to formulate some hypotheses on the determinants of the diffusion and development of ecolabeling schemes. The third section presents the data, the econometric methods used, and discusses the results. The fourth section concludes and suggests possible extensions.

2. Related literature and hypotheses

The existing literature on the diffusion of innovations is mainly devoted to private entities motivated by profit objectives (Rogers, 1995). A first branch of this literature considers that the diffusion of an innovation is primarily driven by its profitability. Rational agents select within the choice set, the most profitable alternative (Davies, 1979). Without neglecting the significant role of profitability, another branch considers that diffusion results from social pressures pushing agents toward an organisational convergence or isomorphism (DiMaggio and Powell, 1983). Some contributions suggest that these two perspectives are not mutually exclusive and can contribute to a better understanding of the diffusion of organisational innovations (Mansfield, 1995; Hislop et al., 1997). Moreover, other studies show the significant impact of certain macro-economic variables such as GDP per capita (Lucke, 1993; Neumayer and Perkins, 2005). We formulated several hypotheses, inspired by the related literature on the diffusion of (eco)organizational innovations at the firm and country levels.

[1] The interested reader can take a look at the following website http://www.greenerchoices.org/eco-labels/eco-home.cfm (visited 23 October 2007), where a wide range of private and public ecolabeling schemes are detailed and analysed by a consumer union.

First, according to the so-called environmental Kuznet curves, beyond a certain point, the richer a country is, the more likely it is to be environmentally concerned. Indeed, once basic needs are satisfied, people are more likely to devote attention to environmental issues. Consequently, by considering that ecolabeling schemes reflect a higher degree of concern for environmental issues, we hypothesize that *richer countries are more likely to adopt an ecolabeling scheme, ceteris paribus (H1).*

Second, standard economic theories predict that country size can affect policy choice and design. Small domestic markets can be disadvantaged because of (dis)economies of scale and because learning curves in production of public and private goods, which play an important role in differentiated product markets, cannot be exploited. Moreover, larger domestic markets raise the intensity of product market competition which results in beneficial pro-competitive effects (Alesina et *al.*, 2005). Subsequently, we hypothesise that *large sized economies are more likely to adopt an ecolabeling scheme, ceteris paribus (H2)*.

Third, since Adam Smith (1776 [1976]), economic theory emphasizes the necessity of protecting the freedom of individuals that results in greater prosperity for the whole society. In the same vein, some authors argue that countries with high levels of economic freedom will prefer instruments that allow individuals to make informed choices rather than political control of environmental decision making (Stroup, 2004). As indicated earlier, the conceptual economic foundation for ecolabeling strategies is the Coase Theorem which asserts that bargaining will lead to an efficient outcome if symmetric information is available at a low cost. Thus, more efficient governments are more likely to support and promote market-based instruments rather than more intrusive instruments, such as command-and-control standards (Buchanan and Tullock, 1975). Moreover, inefficient and corrupted governments discourage private sector from any voluntary environmental initiatives, making ecolabeling schemes less interesting for these countries. Therefore, we hypothesize that *the probability of adopting an ecolabeling scheme increases with the degree of economic freedom in an economy, ceteris paribus (H3).*

Fourth, open economies are more likely to face environmental demands from export markets. Ecolabeling can be used either as a signalling device or as a screening mechanism about unobservable environmental attributes (Spence, 1973). Given that environmental attributes can be used as barriers to trade, exporting countries are more likely to develop ecolabeling schemes (Kern et al., 2001). So, we hypothesize that *the probability of adopting an ecolabeling scheme increases with the degree of openness of an economy, ceteris paribus (H4).*

Fifth, because ecolabeling schemes are based on the periodical raise of environmental standards, countries that possess technological innovation capacities are more likely to be interested in ecolabeling schemes. Moreover, innovation capacities are likely to allow increased profits and environmental improvements (Porter and Van der Linde, 1995). In turn, high technological innovation capacities can also promote innovation in the choice of policy instruments. Therefore, we formulate the following hypothesis*: The probability of adopting an ecolabeling scheme increases for countries having higher technological innovation capacities, ceteris paribus (H5).*

Sixth, previous experience with environmental and/or organizational innovations may facilitate the adoption of more recent innovations, notably because of learning by doing and

economies of scale (Delmas, 2003; King and Lenox, 2001). Accordingly, the acquisition of specific competences and skills (e.g., standard setting, certification and accreditation procedures) are likely to reduce the cost of designing and implementing an ecolabeling scheme. Therefore we formulate the following hypothesis: The probability of adopting an ecolabeling programme increases with a society past experience with (eco)organisational innovations, ceteris paribus (H6).

Seventh, it is intuitively convincing that countries that exhibit high concern levels regarding environmental issues are more likely to adopt ecolabeling schemes. Indeed, such programs can help people to express their environmentally friendly preferences through their consumption choices and provide incentives to manufacturers to produce environmentally friendly products. For the Blue Angel, "this early innovation can be explained, on the one hand, by a high awareness among German consumers regarding the environmental characteristics of a product. On the other hand, this environmental policy innovation was the result of campaigns by consumer organizations for more regulative instruments to prevent the negative impacts of specific products on health and environment" (Kern et al., 2001, p. 2). As a consequence, we hypothesize that *the probability of adopting an ecolabeling programme increases with the society involvement in environmental issues, ceteris paribus (H7).*

Eighth, by giving all citizens an influence over government, including the design of environmental policy (Grolleau et al. 2004), increased political freedom and reduced corruption are expected to improve the environmental outcome because of political leaders being held politically accountable for their actions. Indeed, a well functioning democratic system can provide adequate incentives in favour of environmental quality. The positive influence of more democratic systems on environmental quality is documented in several contributions (Congleton, 1992; Magnani, 2000). *Therefore, we hypothesize that the probability of adopting an ecolabeling scheme increases with the degree of political freedom in an economy, ceteris paribus (H8).*

3. Data, methods and results

To constitute our database (N=116 countries[2]), we compiled variables from secondary data sources, namely the 2007 Index of Economic Freedom (IEF) (http://www.heritage.org/index/), the 2005 Environmental Sustainability Index (ESI) (http://sedac.ciesin.columbia.edu/es/esi/), the Global Ecolabeling Network (GEN) (http://www.gen.gr.jp/) and the 2005 CIA World Factbook (https://www.cia.gov/library/publications/the-world-factbook/)[3].

3.1 Dependent variable

The dependent variable (ECOLABEL) is a dummy variable equal to 1 if the country has adopted a governmental or quasi-governmental multiproduct ecolabeling scheme and 0 elsewhere. The presence of an ecolabeling scheme is measured for the year 2006.

3.2 Independent variables

To test hypotheses H1 to H8 we use several independent variables with a two-year lag as described in Table I. The variable type, that is, whether the variables are dummy, continuous or score variables, their sources and some descriptive statistics are also indicated in Table I. Table II provides the Pearson correlation coefficients.

[2] The list of countries is available upon request.
[3] These websites have been visited on June, 2007.

Table I: Definition of variables and descriptive statistics (N = 116)

Hypothesis	Corresponding variable and acronym	Source	Variable type	Descriptive statistics			
				Min	Max	Mean	SD
H1: Richer countries are more likely to adopt an ecolabeling scheme, *ceteris paribus.*	Gross domestic product per capita GDP-C	ESI database (2005)	Continuous	0.15	64.23	10.442	14.749
H2: Large sized economies are more likely to adopt an ecolabeling scheme, *ceteris paribus.*	Gross domestic product GDP	CIA world factbook (2005)	Continuous	11	11750000	335218.5	1393886
H3: The probability of adopting an ecolabeling scheme increases with the degree of economic freedom in an economy, *ceteris paribus.*	Economic freedom score ECO-FREEDOM	IEF database (2007)	Score	28.4	83	58.9078	10.074
H4: The probability of adopting an ecolabeling scheme increases with the degree of openness of an economy, *ceteris paribus.*	Export of good and services (% of GDP) EXPORT	World bank database (2007)	Continuous	11	123	42.2907	21.1366
H5: The probability of adopting an ecolabeling scheme increases for countries having higher technological innovation capacities, *ceteris paribus.*	Innovation index INNOV	ESI database (2005)	Score	0.85	6.44	2.5494	1.08356
H6: The probability of adopting an ecolabeling programme increases with a society past experience with organisational innovations, *ceteris paribus.*	Number of ISO14001 *certificates* ISO14	ESI database (2005)	Continuous	0	23466	921.534	2795.120
H7: The probability of adopting an ecolabeling programme increases with a society involvement in environmental issues, *ceteris paribus.*	Number of memberships in environmental inter-governmental organizations MEMB	ESI database (2005)	Continuous	0	29	10.974	5.705
H8: The probability of adopting an ecolabeling scheme increases with the degree of political freedom in an economy, *ceteris paribus.*	Civil and Political Liberties POL-FREEDOM	ESI database (2005)	Score	1 (freest)	7 (less free)	3.224	1.819

Table II: Pearson correlation matrix

	GDP-C	GDP	ECO-FREEDOM	EXPORT	MEMB	INNOV	ISO14	POL-FREEDOM
GDP-C	1							
GDP	0.232	1						
ECO-FREEDOM	0.643	0.158	1					
EXPORT	0.132	-0.217	0.162	1				
MEMB	0.485	0.343	0.275	-0.163	1			
INNOV	0.838	0.368	0.636	0.137	0.498	1		
ISO14	0.342	0.565	0.146	-0.181	0.391	0.446	1	
POL-FREEDOM	-0.565	-0.103	-0.709	0.014	-0.34	-0.569	-0.209	1

3.3 Econometric model

We use a linear model for the underlying latent variable driving adoption of an ecolabeling scheme:

$$Y_i^* = \alpha + \sum_{j=1}^{7} \beta_j X_{ji} + u_i, \quad i = 1,2,...,N \qquad (1)$$

where X_j represents the vector of variables for adopting of an ecolabeling scheme; β_1 to β_8 are slope coefficients to be estimated, and α and μ are the intercept and the disturbance term, respectively. The interpretation of the latent variable in this kind of model is typically that of an overall net gain originating from adoption. Of course, the net gain here has to be taken in a very broad sense. When this latent variable is positive, adoption gains outweigh losses due to the adoption. The model of country adoption of an ecolabeling scheme is stated as a discrete-choice model, with the dummy variable indicating adoption of an ecolabeling scheme, as the dependent variables Y_i:

$$\begin{aligned} Y_i &= 1 \quad if \quad Y_i^* > 0, \\ Y_i &= 0 \quad otherwise. \end{aligned} \qquad (2)$$

We specified logistic distributions for μ and maximized the log-likelihood of the logit models (Greene, 2003) to estimate models parameters up to a positive constant.

3.4 Results and discussion

Logit estimation results are presented in Table III, together with goodness-of-fit measures (Maximum-Likelihood estimation). Thanks to the model chi-square statistic, we can reject the null hypothesis stating that coefficients for all variables in the model are zero. To better interpret the sensitivity of the probability of certification with respect to explanatory variables, we also report marginal effects[4]. The sensitivity (proportion of observations correctly predicted as 1) and specificity (proportion of observations correctly predicted as 0) statistics are acceptable. The Nagelkerke R^2 of 0.83 indicates that the model explains about 83% of the variation in the dependent variable. We are now in a position to test for the validity of each hypothesis, based on the statistical significance of associated parameters[5].

The hypothesis that richer countries are more likely to adopt an ecolabeling scheme, ceteris paribus (H1) is not supported. A plausible explanation is that richer countries prefer political control of environmental decision making that demonstrates a higher commitment to environmental performances rather than a more risky instrument in terms of environmental outcomes. The hypothesis that large sized economies are more likely to adopt an ecolabeling scheme, ceteris paribus (H2) is also not supported.

The hypothesis that the probability of adopting an ecolabeling scheme depends on the degree of economic freedom in an economy, ceteris paribus (H3) is supported by our findings, but

[4] For continuous explanatory variables, marginal effects measure the change in the estimated probability following an increase of the explanatory variable by 1 unit; for discrete variables however, the marginal effect is calculated as the difference between the probabilities estimated at the sample means when the dummy variable takes the values 1 and zero respectively.

[5] In order to remedy to potential multicollinearity problems, we can either increase the sample size or use a seemingly unrelated regression to eliminate one or several correlated variables. Nevertheless, these strategies are not adequate here. Despite some controversial issues regarding the backward stepwise logistic procedure, we implemented it. The selected predictors are ECO-FREEDOM, INNOV, POL-FREEDOM. We also estimated several versions of the model (not reported here) showing that our results are robust to the inclusion/exclusion of some variables while the model fitness remains good.

Table III : Logit estimates regarding the adoption of an ecolabeling scheme

Parameter	Estimate	*t*-ratio	Marginal effect
Intercept	3.6240	0.7834	
GDP-C	0.0237	0.459	0.0008451
GDP	-0.000056	-1.186	-5.57e-08
ECO-FREEDOM	-0.147(**)	-2.033	-0.0052449
EXPORT	-0.0105	0.515	-0.0003733
INNOV	2.9556(**)	2.242	0.1054343
ISO 14	0.00681(***)	2.885	0.0002428
MEMB	-0.1621	-1.281	-0.0057827
POL-FREEDOM	-0.9344(***)	-2.53	-0.0333324
R^2 Nagelkerke		0.846	
Log likelihood		-20.384	
Likelihood Ratio Test $\chi^2(8)$		112.1943	
Correct predictions (per cent)		94%	
Correct predictions with intercept only		62.9%	
Sensitivity (proportion of observations correctly predicted as 1)		88.4%	
Specificity (proportion of observations correctly predicted as 0)		97.3%	
Number of observations		116	
Number of observations having an ecolabeling scheme (ECOLABEL)		43	

*, (**), (***) indicate parameter significance at the 10, (5), (1) per cent level respectively. Marginal effects are computed at the sample mean.

the sign is negative. A higher degree of economic freedom is likely to decrease the probability of adopting a governmental ecolabeling scheme, maybe because private ecolabeling schemes are preferred in such contexts. Another explanation may be found in the multidimensional nature of the index of economic freedom. Indeed, the index of economic freedom aggregates 10 specific factors, and average them equally into a total score that may mask the respective effects of each dimension[6]. The hypothesis that the probability of adopting an ecolabeling scheme increases with the degree of openness of an economy, ceteris paribus (H4) is not supported. A plausible explanation is that our proxy (EXPORT) does not distinguish between export destinations or isolate the kind of exports for which ecolabeling schemes would act as a useful signalling or/and screening device. Export markets in eco-sensitive countries like Germany may have a strong impact (relative to eco-insensitive countries) on the decision to adopt an ecolabeling scheme. However, if the exporting country is considered as sufficiently environmentally friendly, ecolabeling schemes would play a weaker role as a market signal.

The hypothesis that the probability of adopting an ecolabeling scheme increases for countries having higher technological innovation capacities, ceteris paribus (H5) is supported. Consequently, countries with higher technological innovation capacities can consider ecolabeling schemes as a way to increase the value of their innovations. The hypothesis that the probability of adopting an ecolabeling program increases with previous experience with other environmental organizational innovations, ceteris paribus (H6) is supported. Thus, the diffusion of different (eco)organizational innovations is somewhat shaped by a kind of 'path dependency'.

The hypothesis related to society involvement in environmental issues (H7) is not supported. Countries participation in global environmental governance may be an inadequate proxy of society involvement in environmental issues. Moreover, the possible weak overlap between issues affected by ecolabeling schemes and global environmental governance can explain this finding. Last, but not least the hypothesis that the probability of adopting an ecolabeling scheme increases with the degree of political freedom in an economy, ceteris paribus (H8) is supported. This result is consistent with several studies (*e.g.,* Barrett and Graddy, 2000) indicating that civil and political liberties can improve various non-monetary measures of human welfare.

4. Conclusion

We have presented empirical estimates of the impacts of various determinants on the adoption of official ecolabeling schemes among countries. Our findings indicate that economic and political freedoms, innovation capacities and experience with other environmental voluntary approaches play a major and sometimes counter-intuitive role to explain the diffusion of governmental ecolabeling programs. The adoption of some policy instruments seems related to a set of institutional factors such as political freedom which may serve the implementation of innovative environmental policies. Although studying the determinants of the political decision of ecolabeling programmes adoption is important, it does not inform us on the 'real use' of these schemes by market actors and ultimately on their overall success. Therefore, measuring the 'real implementation' of such programmes in terms of number of product categories covered or number of ecolabeled products number can allow to refine our empirical analysis. Moreover, considering the adoption of a larger set of ecolabeling schemes (private

[6] Given the number of observations (*N=116*), we are limited regarding the introduction of each dimension of economic freedom that may allow to disentangle their respective effects on the adoption of an ecolabeling scheme.

and/or sector specific ecolabeling schemes ecolabels) can improve our understanding of the interplay between public and private spheres in the adoption of innovative environmental policies.

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