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Abstract

The identification of individual and institutional drivers regarding ecological transition of individual behaviors has been widely studied in the literature. However, few studies report the specific case of private gardening practices, even though it is particularly relevant when discussing lifestyle habits and ecological transition, due to the wide range of positive and negative environmental externalities private gardens may generate. Using a European database (Eurobarometer 83.4), we estimate individual and institutional drivers of sustainable gardening practices. Our econometric approach takes the specificities of our data into account, by using a two-step approach combining a generalized Heckman model and a meta-regression, and allows us to highlight the importance of the accessibility to biodiversity-related information in the adoption of environmentally friendly behaviors. Differentiated trends between European countries are tested using indicators on economic development, social capital and environmental performances. In conclusion, we provide some recommendations in terms of public policies.

Keywords: Eurobarometer, generalized Heckman model, private gardens, meta-regression, sustainable practices

JEL classification: C3, Q57, Z

Information sur la biodiversité et comportements environnementaux: une étude européenne des déterminants individuels et institutionnels de l'adoption de pratiques de jardinage durables

Résumé

L'identification des déterminants individuels et institutionnels de la transition écologique des comportements individuels a fait l'objet de nombreux travaux dans la littérature. Cependant, peu d'études traitent du cas spécifique de pratiques de jardinage privées, bien que cela constitue un aspect important des comportements quotidiens en lien avec la transition écologique, en raison du grand nombre d'externalités environnementales positives ou négatives généré par les jardins de particuliers. A partir d'une base de données européenne (Eurobaromètre 83.4), nous évaluons les déterminants individuels et institutionnels de l'adoption de pratiques de jardinage durables. Notre approche économétrique prend en compte les spécificités de nos données, en utilisant une approche en deux étapes combinant un modèle Heckman généralisé et une méta-régression. Nous mettons en évidence l'importance de l'accessibilité à l'information sur la biodiversité dans l'adoption de comportements respectueux de l'environnement. Les tendances différenciées observées entre les pays européens sont testées à partir d'indicateurs sur le développement économique, le capital social et la performance environnementale. En conclusion, nous proposons des recommandations en termes de politiques publiques.

Mots-clés : Eurobaromètre, modèle Heckman généralisé, jardins privés, méta-régression, pratiques durables

Classification JEL : C3, Q57, Z

Information on biodiversity and environmental behaviors: a European study of individual and institutional drivers to adopt sustainable gardening practices

1. Introduction

In 2013, the French National Association of Landscape Firms (UNEP[1]) studied the European population's relationship to gardens. The results revealed a strong commitment of households towards their own garden, which German, Spanish and French households consider as one of the two most important rooms in their house, along with the living room. A vast majority of European households has at least a garden or a balcony (82% of all households[2]). However, we observe a high variability between countries: more than 90% of Dutch and British households has a garden or balcony, while the share falls down to 56% for Spanish households. Gardening activities keep European households busy almost fifteen minutes a day[3], which makes it one of the main domestic tasks, after groceries and house cleaning. However, gardening differs from other domestic tasks through the level of satisfaction it provides to individuals. Brousse (2015) notes that gardening is the most favored domestic task among French households, overtaking handiwork and cooking[4]. Yet, private gardens perceptions and associated uses may vary among individuals.

In this paper, following Allain (2013), we will define gardens as an enclosed area in which plants that are displayed have been organized by human will. Indeed, gardens exclusively exist through horticultural skills and landscape design performed by men and women. This approach seems relevant here, in the sense that it highlights the importance of gardening practices operated by garden owners. The diversity of gardens and green areas reflects a wide range of uses and visions associated to them. Beyond the traditional duality of utilitarian gardens (vegetables, fruits and medicinal herbs production) *vs* ornamental – or pleasure – gardens, many individual representations of gardens have emerged since the second half of the 20th century, based on their functional characteristics rather than their productive potential: allotment gardens, community gardens or social integration gardens (Allain, 2013). In addition to the satisfaction gained from food production or from living-environment externalities, gardens also

[1] Union Nationale des Entreprises de Paysage
[2] Data from the Eurobarometer survey 83.4 (European Commission, 2015)
[3] Data from the Eurostat Time Use survey (2000)
[4] Note that the satisfaction provided by gardening is similar to the one provided by leisure activities such as television or conversation, questioning the relevance of classifying gardening as a domestic task in Time Use surveys.

respond to social demands such as well-being, social interaction or therapeutic benefits. Households' expectations for gardens or other private green areas can be classified in three categories: economic, environmental and social values[5].

The economic value of private gardens mainly resides in its food and ornamental production potential. Home gardens are known to be a key element of local food systems, allowing to enhance food security and provide additional income to poor households in developing countries, especially in urban areas (Marsh, 1998; Galhena *et al.*, 2013). In Europe and in the US, although the production of fruits and vegetables is regularly stated by households as one of the main benefits of having a garden (Dunnett and Qasim, 2000). Few empirical studies have analyzed the economic added-value of home-grown food products. However, Langellotto (2014) shows that fruit and vegetable gardening may be significantly profitable if labor costs are not included in production costs, while Reyes-García *et al.* (2012) conclude to a positive gross financial value of home gardens in three Spanish regions. Obviously, profitability of home gardens highly depends on local geographical conditions, gardening practices and skills of each gardener. The economic valuation of private green spaces may also reflect on the real estate market. In the same way as the accessibility to open spaces and public parks, several empirical studies show that the presence of gardens (Cavailhès, 2005) or balconies (Baudry *et al.*, 2009) have a significant positive effect on housing prices and rents.

Numerous empirical studies show how gardens may also respond to several social expectations. The simple view of a green area is known to enhance human well-being (Kaplan, 2001). More specifically, gardening activity has numerous virtues, such as stress reduction (Ulrich *et al.*, 1991; Hawkins *et al.*, 2013), educational outcomes (Blair, 2009), social capital consolidation and integration (Schmelzkopf, 1995; Domene and Saurí, 2007; Gray *et al.*, 2014) or creative skills development (Dunnett and Qasim, 2000).

Finally, private gardens and balconies generate both positive and negative environmental externalities. The net balance of environmental externalities generated by private gardens obviously depends on the associated practices of their owners. In a context of ongoing urban sprawl, private green spaces are an important element of green networks and corridors in urbanized areas. Indeed, gardens are shown to strongly contribute to biodiversity conservation (Galuzzi *et al.*, 2010) in terms of fauna (Cannon, 1999; Goulson *et al.*, 2002; Gaston *et al.*, 2005; Osborne *et al.*, 2008) and flora (Loram *et al.*, 2008). However, such a positive impact

[5] For a more general overview of benefits associated with green spaces in urban areas, see Laïlle *et al.* (2013) and Roy *et al.* (2012).

remains strongly dependent on the type of plants displayed in gardens, and more generally on gardening practices, as shown by Fontaine *et al.* (2017) in the case of butterfly population. Environmental performances of private gardens also relate to air quality, soils preservation or thermal regulation (Laïlle *et al.*, 2014). In contrast, some gardening practices may generate negative environmental externalities. For example, the presence of weed in public or private green areas is still perceived as unsightly and sign of bad maintenance by a large part of the population (Menozzi, 2007). This firmly rooted perception, combined with a strong habit of conventional gardening methods, encourages garden owners to use herbicides and pesticides. We may therefore observe water pollution effects, generated by chemicals runoffs generated by green spaces public or private maintenance (Skark *et al.*, 2004; Blanchoud *et al.*, 2007). Besides, although private gardens provide a given level of diversity in terms of plant species, it may also be a source of plant invasion, possibly affecting the local ecosystem equilibrium in the long-term (Smith *et al.*, 2006; Niinemets and Peñuelas, 2008). Finally, gardening practices frequently raises natural resources use conflicts, more particularly over water rights (Domene and Saurí, 2006).

We observe that perceptions and uses associated to gardens are diverse. Households may therefore carry out heterogeneous gardening practices, with significant and differentiated environmental impacts. However, the literature on the adoption of such practices remains rare, mainly due to the lack of related behavioral data. The purpose of this study is to better understand and analyze individual and institutional drivers of the adoption of sustainable gardening practices, relying on the results of the Eurobarometer survey n° 436 on attitudes of Europeans towards biodiversity (European Commission, 2015).

Our original econometric strategy combines a simultaneous equations model (also referred to as a generalized Heckman model in the literature) and a Coarsened Exact Matching (CEM) method as a first step, and a meta-regression as a second step. This approach allows us to take the specificities of our data into account and consider four distinct behavioral effects that may lead to biased coefficients[6].

Our results highlight the causal effect of the access to biodiversity-related information on gardening practices. We also point out European heterogeneity and institutional drivers through

[6] These four effects are Causal effect (the access to biodiversity-related information is already a sign of environmental consciousness), System effect (individual practices are correlated with one another), Selection effect (gardening practices can only be observed if individuals do own a garden) and Country effect (observations within a given country are correlated with one another).

the level of economic development, trust towards environmental associations and countries' own environmental performance.

In the following section, we review the drivers of the adoption of environmentally friendly gardening behavior, as identified in the literature. We then present our Eurobarometer dataset and the economic strategy we adopted. We finally present and discuss our results.

2. The drivers of the adoption of sustainable gardening practices

The adoption of sustainable behavior usually depends on two broad categories of drivers: individual and institutional drivers.

While individual drivers of environmentally friendly behavior are well documented in the literature, specific studies on gardening and landscape or outdoor design are rare. In the case of gardening, although the observation of nature is a strong motivation for owning an outdoor space, the adoption of sustainable gardening practices is not recurrent. Clayton (2007) shows that, in the US, gardens are hardly considered as part of a larger ecosystem, and the drivers influencing gardening practices are mainly esthetical (range of colors, weeds elimination) or simply related to convenience (real estate valorization, ease of maintenance), rather than environmental (low use of resources, choice of local species). To understand the adoption of environmentally friendly gardening behaviors, Kiesling and Manning (2010) show the importance of individuals' *environmental identity*, including their aversion to pesticides, their willingness to comply with natural processes and their recognition of the ecological value of their garden. Apart from their own environmental consciousness, individuals are also known to be strongly influenced by imitation behaviors and social norms, as shown for multiple pro-environmental behaviors by Farrow *et al.* (2017), and more particularly in the case of outdoors spaces exposed to neighbors (Clayton, 2007).

Behaviors' characteristics may vary depending on given gardening practices. Robbins *et al.* (2001) studied individuals' behaviors related to the use of chemicals for lawn care in the US. Contrary to the usual results highlighted in environmental sociology, associating eco-friendly behaviors with a higher level of education, income and environmental consciousness, they show that households that are most likely to use higher levels of chemicals are also the most educated ones and the most aware of the negative environmental externalities generated by their actions. This important result reveals that esthetical motivations and social norm may overtake environmental considerations. However, several gardening practices may allow compatibility between esthetical and environmental considerations. Indeed, Lindemann-Matthies and Marty (2013) show a positive relationship between ecological practices and esthetical perception of a garden. The practices they review include the frequency of lawn mowing and weeding, and the presence of walls or nesting sites.

In terms of public policies, political actions may rely on mandatory tools (rules and regulation) or incentive approaches (taxation, market-based solutions, labeling, communication, education). The French example of the *Ecophyto* policy is relevant in the sense that it aims at drastically reducing non-agricultural pesticides and other chemicals use by banning it for all cities and local authorities and by restraining its access to individuals in garden stores. Other European countries, such as Belgium, Denmark or the Netherlands, have voted similar measures to reduce the use of chemicals in green spaces maintenance. However, the regulation of individual gardening practices remains a difficult task, mainly due to control and inspection reasons. This is why the key to change in individuals' behavior mainly resides in education, important driver of changes in individuals' pro-environmental behavior as shown by Meyer (2015), and in the accessibility to relevant information on the environment and biodiversity, but also in the level of trust that is granted to it (Rousselière and Rousselière, 2010). As shown in various studies on the role of information (Signore *et al.*, 2014; Daziano *et al.*, 2017; Pisano and Lubell, 2017), an increase in the awareness of environmental issues may lead to changes in behaviors. Combined with the promotion of local initiatives led by environmental associations, residents' organizations or local horticultural societies, information appears to be more efficient in behaviors' transitions than incentive measures, even though they may contribute (Goddard *et al.* 2010). Note however that information-based education campaigns may not always be sufficient to induce transition in individuals' behavior, as shown by the example of domestic cats' negative impacts on local biodiversity (Loss and Mara, 2017). Our study may therefore guide policy makers, by assessing the role of biodiversity-related information on actual gardening practices.

3. Presentation of the data: Eurobarometer 83.4 on Attitudes of Europeans towards biodiversity

Our data comes from the Eurobarometer survey n° 83.4, conducted on behalf of the European Commission in May and June 2015 in European countries. Around 1,000 individuals were interviewed face-to-face in each country and the sampling design followed a multi-stage random selection, geographically stratified. The survey covers the European population of 15 years old and above, residing in each Member State of the European Union. Eurobarometer surveys are frequently used in research studies (e.g. Rousselière and Rousselière 2017). However, to the best of our knowledge, our study is the first to use this specific dataset, although other studies have previously treated the environmental dimension (e.g. Meyer, 2016).

This data source is unique regarding to individual gardening practices at an international level. Indeed, the last European Time Use Survey including data on gardening habits was conducted in the early 2000's, and existing national surveys are hardly comparable due to the heterogeneity of methods and questionnaires. We also note that the limits of using such data are well known: the most problematic one being the measurement error generated by a social desirability effect[7] (Costanigro *et al.*, 2009). However, it is important to indicate here that we assess behaviors, rather than attitudes, which might lead to less bias.

Descriptive statistics of the dataset are available in European Commission (2015) and reported for our variables of interest in Appendix 1. Our dependent variables were derived from the answers to question QB15:

Do you personally do the following in your garden or on your balcony?

- Leave space for wild animals and plants (28% of respondents)
- Avoid using pesticides and chemicals (52% of respondents)
- Select plants that provide food for birds and pollinating insects (28% of respondents)
- Avoid introducing new plants that may become invasive (26% of respondents)
- You have a garden or balcony but you don't do any of these things (16% of respondents)
- You have no garden or balcony at home (18% of respondents)

[7] The social desirability effect is a response bias occurring when a survey respondent report inaccurate responses on sensitive topics in order to be viewed favorably by the others.

Overall, 82% of Europeans indicate they own a garden or a balcony, but this rate ranges from 56% in Spain to 95% in the Netherlands. On average, Europeans owning a garden or balcony declare carrying out 1.6 eco-friendly gardening practices, among the multiple answers.

4. The econometric strategy: a two-step approach

We estimate individual and institutional drivers of amateur gardening practices. A traditional approach would consist in a multilevel model with constant or random effects (e.g. Gilham, 2008; Longhofer and Schofer, 2010; Marquart-Pyatt, 2012; Pisano and Lubell, 2017). However, in our case, it would lead to an intractable model, as the estimation time exponentially increases along with the number of parameters. We have therefore two possible options: the first one consists in using a country-specific bootstrap approach in order to preserve the cluster dimension of our data and correct standard errors that might therefore be biased (Field and Welsh, 2007; Cameron *et al.*, 2008). This strategy was adopted by Harden (2011) and Musson and Rousselière (2017).

In our case, the country variability being particularly important, we adopt an alternative two-step method, initially developed by Saxonhouse (1976) and eventually refined by several authors such as Woolridge (2010), Hornstein and Greene (2012) or Bryan and Jenkins (2016), and implemented in various empirical studies (Hug and Spörri, 2011; Barattieri *et al.*, 2016). Here, it consists in a first step where we estimate a generalized Heckman model characterized by four outcome equations (y_{ij}^* where $j = 1, \dots 4$) and one selection equation (s_i^*). Indeed, gardening practices can only be observed for respondents having access to a garden or balcony.

We therefore have the following equations system:

$$\begin{cases} s_i^* = X_{si}\beta_{si} + Z_{si}\delta_{si} + \gamma_{sc} + \mu_{ic} \\ y_{i1}^* = X_{i1}\beta_{i1} + \gamma_1 + \varepsilon_{1i} \\ y_{i2}^* = X_{i2}\beta_{i2} + \gamma_2 + \varepsilon_{2i} \\ y_{i3}^* = X_{i3}\beta_{i3} + \gamma_3 + \varepsilon_{3i} \\ y_{i4}^* = X_{i4}\beta_{i4} + \gamma_4 + \varepsilon_{4i} \end{cases} \quad (1)$$

For each individual i residing in country c; where X is a vector of explanatory variables used for all equations, Z a vector of explanatory variables specific to the selection equation and γ a vector of country fixed-effects for each equation. We have $s_i^* = 1$ if y_{ji}^* is observed, and $s_i^* = 0$ otherwise.

The error terms $(\mu_{ic}, \varepsilon_{jic})$ follow a multivariate Normal distribution, with $\rho_{.}$ being the correlation between two error terms[8]. We use a Conditional Mixed Process (CMP) framework, as suggested by Roodman (2011), relying on a performant algorithm of maximum likelihood simulation.

Such a model was proposed by Jenkins *et al.* (2006) and applied in Boyer *et al.* (2016), we extend it with a treatment of observables selection (Rubin, 1974). We estimate a pure effect of biodiversity-related information by including a propensity score matching method, in order to consider potential confounders. To set the weights from propensity score, we use a method developed by Lacus *et al.* (2011). This Coarsened Exact Matching method (CEM) aims at minimizing distance L_1 between paired and unpaired elements – treated individuals being the ones having access to biodiversity-related information and untreated individuals having no access to it. In our case[9], the distance is minimized ($L_1 = 0.517$) when we use the following matching variables: age, level of education, political affiliation, political interest, socio-professional category, gender and marital status. This allows us to match 94% of all observations, revealing a performant matching process compared to the literature (Lacus *et al.*, 2012).

In our first step estimation, we use usual explanatory variables, frequently used in Eurobarometer analyses (Marquart-Pyatt, 2012; Rousselière and Rousselière, 2017), in addition to our variable of interest (information on biodiversity). They include characteristics on gender, age, education level, socio-professional category, political sensibility, residing place and household's size. Such socio-demographic variables usually influence individuals' environmental behaviors in a significant way (Pisano and Lubell, 2017). Finally, the variable Proprietary (yes/no) is specifically used for the selection equation in order to comply with exclusion conditions, allowing the identification of our model[10].

The second step consists in conducting a regression of a part of estimated parameters from step one on a set of variables observed on a national level. Two possibilities arise: we can either use the country fixed-effects derived from the first step, or use the estimated constant from a set of regression conducted for each country. Both methods lead to similar results, in terms of

[8] The implicit hypothesis when one estimates separate independent probit or logit, such as in Triguero *et al.* (2016), is that all $\rho_{.} = 0$

[9] Tests results available upon request.

[10] Note that following Roodman (2011), the identification of the model is possible even without exclusion conditions in the selection equation. However, this would lead to a much longer estimation time, for similar estimated coefficients.

parameters' range, sign and significance. In this second step, we use a meta-regression method to control for the uncertainty of parameters estimated in step one (Bryan and Jenkins, 2016). We therefore have:

$$\widehat{\gamma_{jc}} = \alpha_j + W_{jc}\lambda_j + \nu_{jc} + \xi_{jc} \qquad (2)$$

Where $\nu_{jc} \sim N(0, \tau_j^2)$ and $\xi_{jc} \sim N(0, \sigma_{jc}^2)$. This random-effect model has two terms of errors. ν_c is a usual random error term which variance τ^2 needs to be estimated. ξ_c is a random error term reflecting the uncertainty of estimations from step one, where σ_c^2 is the variance of the estimated fixed-effect for country c[11]. We estimate this equation using a restricted maximum-likelihood procedure (REML) (Thompson and Sharp, 1999), standard errors being corrected following Knapp and Hartung (2003). The combination of both methods was shown to be particularly performant, relying on the *metareg* procedure developed by Harbord and Higgins (2008) for Stata.

In the second step, we use variables at a national level, from year 2014. We choose them in order to cover all three dimensions of sustainable development. The Environmental Performance Index (EPI) was developed by the University of Yale[12]. It is an aggregated index, calculated at national level and based on two major environmental issues: protection of human health and protection of ecosystems. National wealth is measured though GDP per capita, reflecting the economic dimension of sustainable development. Finally, our last variable is the average trust of the population towards environmental associations, regarding the information they provide. This variable was extracted from the Eurobarometer survey 81.3, conducted in April and May 2014. In addition to measuring a potential information lever (Marquart-Pyatt, 2012), or exposure to environment-related information (Gilham, 2008; Longhofer and Schofer, 2010; Pisano and Lubell, 2017), this variable may also measure the level of social capital at a national level (Longhofer and Schofer, 2010; Musson and Rousselière, 2017). To assess the robustness of our model, we tested other measures of trust and social capital, such as trust towards friends and relatives, and trust towards national government, Europe or international organizations, all leading to least performant models (see Appendix 6).

[11] σ_{jc} is therefore the standard error of country c fixed-effect in outcome equation j estimated in the first step model.
[12] http://epi.yale.edu/

5. Results

The coefficient estimates are reported in Appendix 2. As a robustness check, we show in Appendices 3 and 4 the estimations for the model with separate probit and the generalized Heckman without matching, respectively. In Appendix 5, the parameter for the covariate "information" is reported for the different models. We see that there are only small changes between the various estimations which lead us to be confident in our results. As in any non-linear model, coefficient estimates are hardly interpretable. We comment two types of results: first, the correlation between error terms, then the marginal effects.

Table 1: Correlation between error terms

Variables	(1) Space for wild species	(2) Avoid using pesticides	(3) Plants providing food for birds	(4) Avoid invasive plants	(5) Access to garden
Space for wild species	-	0.2782*** (0.0184)	0.4793*** (0.0214)	0.3688*** (0.0190)	-0.1804 (0.1338)
Avoid using pesticides	-	-	0.3103*** (0.0209)	0.3806*** (0.0169)	-0.3422 (0.2898)
Plants providing food for birds	-	-	-	0.4161*** (0.0265)	-0.4024** (0.1698)
Avoid invasive plants	-	-	-	-	-0.2865* (0.1593)

*(Standard errors) ; N=26,086 ; *** p<0.01, ** p<0.05, * p<0.1*

In most cases, the error terms are significantly correlated, which justifies our use of a simultaneous equations approach. However, we note that the correlation is not significant between the selection equation and both outcome equations « Space for wild species » and « Avoid using pesticides », suggesting separated processes.

Table 2: Conditional marginal effects

Variables	(1) Space for wild species	(2) Avoid using pesticides	(3) Plants providing food for birds	(4) Avoid invasive plants	(5) Access to garden
Information	0.1060***	0.0754***	0.1066***	0.0871***	
	(0.0061)	(0.0067)	(0.0061)	(0.0062)	
Woman	0.0134**	0.0535***	0.0462***	0.0157**	0.0208***
	(0.0062)	(0.0070)	(0.0061)	(0.0063)	(0.0043)
Age	0.0013***	0.0027***	0.0028***	0.0030***	0.0019***

Variables	(1) Space for wild species	(2) Avoid using pesticides	(3) Plants providing food for birds	(4) Avoid invasive plants	(5) Access to garden
	(0.0003)	(0.0004)	(0.0003)	(0.0003)	(0.0002)
Education 16-19	0.0122	0.0059	-0.0000	0.0287***	0.0252***
	(0.0110)	(0.0114)	(0.0110)	(0.0110)	(0.0072)
Education 20+	0.0430***	0.0330***	0.0067	0.0454***	0.0243***
	(0.0112)	(0.0119)	(0.0112)	(0.0113)	(0.0075)
Strong political interest	0.0439***	0.0564***	0.0466***	0.0507***	0.0575***
	(0.0114)	(0.0129)	(0.0116)	(0.0115)	(0.0078)
Medium political interest	0.0280***	0.0410***	0.0201**	0.0424***	0.0376***
	(0.0094)	(0.0106)	(0.0095)	(0.0095)	(0.0066)
Low political interest	0.0009	0.0121	-0.0271**	0.0050	0.0285***
	(0.0109)	(0.0119)	(0.0109)	(0.0110)	(0.0078)
Self-employed	0.0448***	0.0051	0.0213	0.0231*	0.0293***
	(0.0130)	(0.0136)	(0.0131)	(0.0130)	(0.0092)
Managers	0.0196*	0.0177	-0.0024	0.0402***	0.0377***
	(0.0110)	(0.0120)	(0.0111)	(0.0113)	(0.0078)
Other white collars	-0.0162	-0.0152	-0.0203*	-0.0090	0.0129
	(0.0108)	(0.0116)	(0.0109)	(0.0110)	(0.0079)
House persons	-0.0097	-0.0027	-0.0438***	0.0009	0.0387***
	(0.0158)	(0.0171)	(0.0156)	(0.0162)	(0.0114)
Unemployed	0.0128	-0.0109	0.0033	0.0095	-0.0052
	(0.0139)	(0.0145)	(0.0139)	(0.0140)	(0.0095)
Retired	0.0097	0.0237*	0.0168	0.0010	0.0322***
	(0.0123)	(0.0134)	(0.0124)	(0.0123)	(0.0091)
Students	0.0794***	0.0394**	0.0381*	0.0613***	0.0583***
	(0.0201)	(0.0192)	(0.0201)	(0.0205)	(0.0102)
Left	0.0338***	0.0511***	0.0220***	0.0207**	-0.0086
	(0.0084)	(0.0090)	(0.0084)	(0.0086)	(0.0061)
Centre	0.0189**	0.0309***	0.0353***	0.0113	0.0029
	(0.0080)	(0.0086)	(0.0080)	(0.0082)	(0.0057)
DK/refusal	0.0180*	0.0118	0.0084	-0.0312***	-0.0234***
	(0.0099)	(0.0104)	(0.0098)	(0.0098)	(0.0067)
Small / med. size town	-0.0762***	-0.0224***	-0.0451***	-0.0317***	-0.0590***
	(0.0079)	(0.0086)	(0.0080)	(0.0081)	(0.0046)
Large town	-0.1059***	-0.0595***	-0.0799***	-0.0697***	-0.1186***
	(0.0097)	(0.0127)	(0.0101)	(0.0101)	(0.0057)
Household size: 2	0.0318***	0.0391***	0.0502***	0.0321***	0.0900***
	(0.0091)	(0.0114)	(0.0090)	(0.0093)	(0.0068)
Household size: 3	0.0379***	0.0360***	0.0568***	0.0337***	0.1099***
	(0.0115)	(0.0140)	(0.0116)	(0.0118)	(0.0076)
Household size: 4+	0.0404***	0.0504***	0.0476***	0.0399***	0.1339***

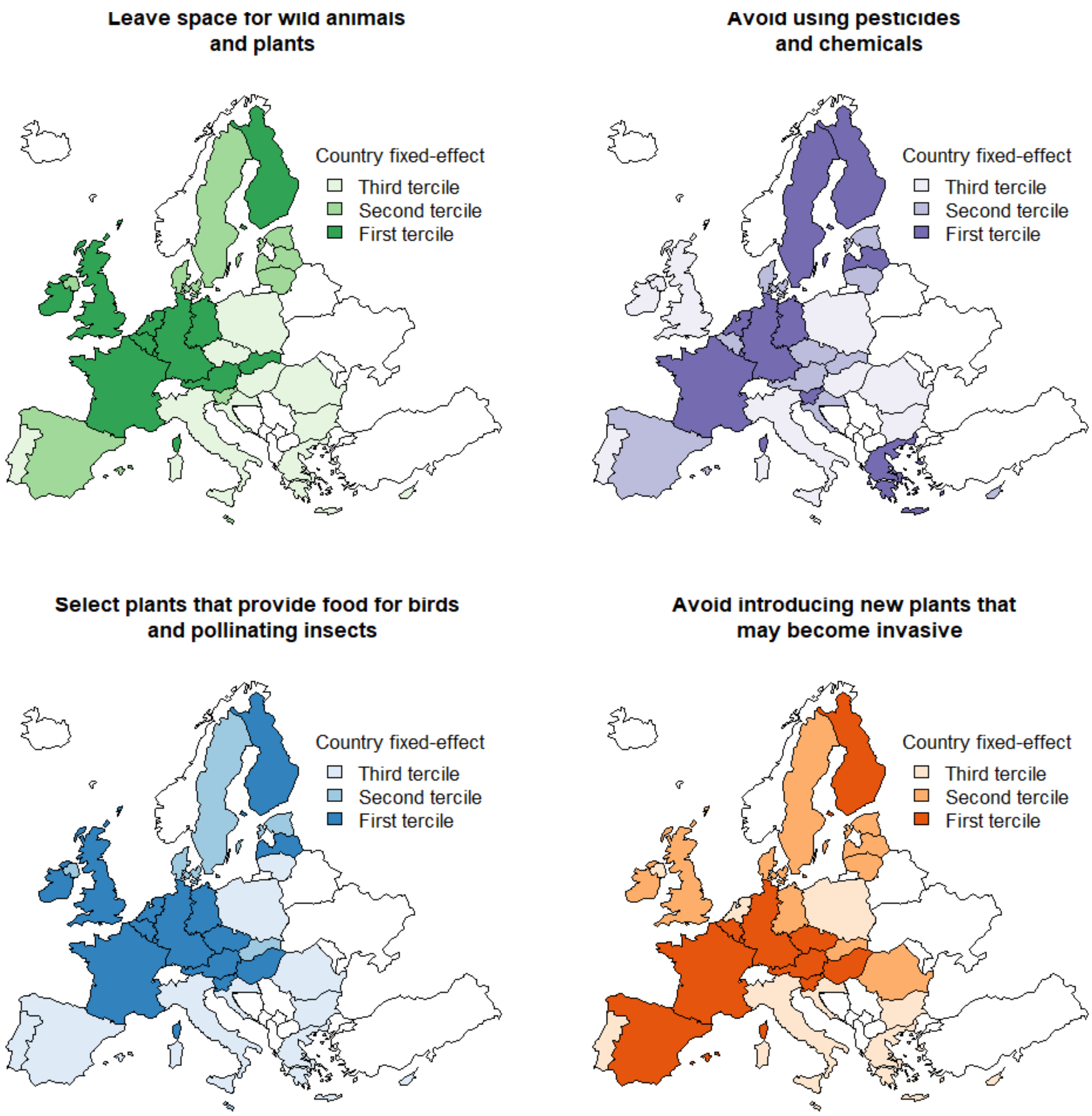
Variables	(1) Space for wild species	(2) Avoid using pesticides	(3) Plants providing food for birds	(4) Avoid invasive plants	(5) Access to garden
	(0.0119)	(0.0152)	(0.0120)	(0.0123)	(0.0072)
Proprietary	0.0071***	0.0142***	0.0160***	0.0119***	0.0796***
	(0.0006)	(0.0011)	(0.0012)	(0.0009)	(0.0058)
Observations	26,086	26,086	26,086	26,086	

*(Standard errors) ; N=26,086 ; *** p<0.01, ** p<0.05, * p<0.1*

In outcome equations, the marginal effects we report are conditional effects to having access to a garden or balcony. These marginal effects include both direct (outcome equation) and indirect effects (selection equation) of all explanatory variables.

We highlight the importance of accessibility to biodiversity-related information, while controlling for endogeneity issues. The marginal effect seems stronger for gardening practice (1) « Leave space for wild animals and plants » and for gardening practice (3) « Select plants that provide food for birds and insects », than for the two other sustainable gardening practices. As for other explanatory variables, we find the usual results consistent with previous studies on individuals' environmental behavior (e.g. Pisano and Lubell, 2017). Gender, age and political sensibility have a significant effect on all types of gardening practices. The education level, however, does not appear to influence the behavior of selecting plants that provide food for birds and insects, suggesting perhaps other incentives to carry out such behavior (esthetical outcome and life-environment for example). We can also highlight a specific relationship between the frequency of sustainable gardening practices and the place where households reside: rural population tend to develop more sustainable gardening behaviors than those living in large cities. Finally, we note a significant indirect effect of being proprietary on each sustainable gardening practice.

Figure 1: Country fixed-effects



Countries fixed-effects were classified by terciles (from highest fixed-effect to smallest) and reported in Figure 1. Some countries, such as Finland, France and Germany, have the highest fixed-effects for each type of behavior and could therefore be considered as most « virtuous » regarding gardening practices, while others systematically belong to the third tercile (Portugal, Italy, Poland…). For other countries, some specific trends appear. For example, the UK belongs to the first tercile for gardening practice (1) « Leave space for wild animals and plants » and for gardening practice (3) « Select plants that provide food for birds and insects », but is less virtuous regarding other gardening practices, such as avoiding the use of pesticides and chemicals.

Our second step consists in a multivariate approach that should contribute to explain these differentiated trends among European countries. Results are reported in Table 3. τ^2 (between-countries variance) is low, which is standard in such analysis. R^2 is the ratio of explained variance to total variance and I^2 is the share of variance coming from differences between countries and as such explained by country-level covariates. We highlight the following observations:

- We note a positive and significant impact of the level of GDP per capita on several behaviors: gardening practice (1) « Leave space for wild animals and plants », and gardening practice (3) « Select plants that provide food for birds and insects ».
- We note a positive and significant impact of the level of trust towards environmental associations on gardening practice (2), consisting in avoiding the use of pesticides and chemicals.
- The country's Environmental Performance Index (EPI) has a positive and significant impact on gardening practice (1) « Leave space for wild animals and plants ».
- R^2 is acceptable for two responses (1 and 2) but very low for response (3) and (4) suggesting the absence of important covariates.

Table 3: Results of the second-step regression

Variables	**(1) Space for wild species**	**(2) Avoid using pesticides**	**(3) Plants providing food for birds**	**(4) Avoid invasive plants**	**(5) Access to garden**
EPI	**0.031***	0.002	-0.008	0.025	-0.019
	(0.017)	(0.011)	(0.018)	(0.016)	(0.019)
Trust in associations	0.532	**1.473*****	0.267	0.226	-0.599
	(0.581)	**(0.397)**	(0.617)	(0.569)	(0.663)
GDP per capita	**0.014*****	-0.001	**0.012*****	0.005	**0.010****
	(0.004)	(0.003)	**(0.004)**	(0.004)	**(0.005)**
Constant	**-4.803*****	-1.100	-1.567	**-4.008*****	1.260
	(1.371)	(0.944)	(1.457)	**(1.342)**	(1.552)
τ^2	**0.059**	**0.014**	**0.061**	**0.053**	**0.091**
I^2	**0.699**	**0.350**	**0.629**	**0.658**	**0.840**
Adjusted R^2	**0.565**	**0.579**	**0.323**	**0.179**	**0.096**

(Standard errors) ; N=28 ; *** p<0.01, ** p<0.05, * p<0.1

6. Discussion and conclusion

We studied European sustainable gardening practices, using an unprecedented database and adopting an econometric approach taking into account the multi-dimensionality of sustainable gardening practices, the endogeneity of the access to biodiversity-related information, the selection bias of the access to a garden and the multilevel dimension of our data. This allowed us to point out interesting results and relevant contributions to the existing literature:

(1) The adoption of sustainable gardening significantly relies on socio-demographic drivers, as it is the case for other pro-environmental behaviors, as confirmed by previous studies (Marquart-Pyatt 2012; Pisano and Lubell 2017).

(2) In addition to the usual socio-demographic drivers, the significant difference between urban and rural behaviors is consistent with previous academic literature (see Clayton 2007). This result suggests that a higher attention should be focused on urban households, in order to promote sustainable behaviors. Goddard *et al.* (2013) describe some bottom-up or community-driven initiatives spread by a process of neighborhood diffusion that may inspire local and national public policies, especially in urban areas.

(3) The evidence of a causal effect of the access to biodiversity-related information on individual behavior emphasizes the need for an efficient public and private communication (though associations or horticultural societies) to promote sustainable individual behaviors, as suggested by Goddard *et al.* (2010). The accessibility of biodiversity-related information remains a specific issue. Amateur gardeners often turn to their suppliers and local garden stores as a main source of information (Hockenberry Meyer and Foord 2008). However, convenience being a major criterion in seeking information, its access should not be viewed as a constraint. Signore *et al.* (2014) suggest the use of Wikipedia to disseminate knowledge on agrobiodiversity to a large audience.

(4) We were able to show that the European diversity in terms of sustainable practices is related to three dimensions: economic development, environmental performance and social capital (or more specifically, trust). A higher economic development seems to relieve the pressure of a utilitarian vision of the garden, by favoring wild species and food for birds and insects. We also note that with higher trust in environmental associations, individuals tend to decrease their use of pesticides and chemicals in their own private garden, highlighting their relevance regarding

ecological transition. However, none of these dimensions seems to influence individuals' behavior towards invasive plants. Further research is needed, as previous studies show that increased public awareness might increase the public support for the management of invasive species (Touza *et al.* 2014; Novoa *et al.* 2017). Our result is also consistent with the results of Touza *et al.* (2014) for which there is a general agreement among stakeholder groups about the low level of environmental concern in the general public.

(5) Finally, it is interesting to note that we find a certain level of consistency between our results and a survey on garden perceptions conducted by UNEP-Ipsos (2013) in France, the UK, Germany and Spain. Indeed, the higher preference British households reveal for decorative and ornamental gardens in the survey is consistent with their preference for gardening practices (1) and (3) related to wildness and natural aspect of gardens, highlighted here. A better identification of the social representations of gardens and outdoor spaces should allow better understanding of the choice of European population to adopt one sustainable gardening practice or another. As stated by Uren *et al.* (2015), « to create change, there is a need to understand the unique cultural drivers of landscaping choices ».

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Appendix 1

Table 4: Descriptive statistics

	Mean	Standard deviation	Min	Max
Individual variables				
Space for wild species	0.322	0.467	0	1
Avoid using pesticides	0.653	0.476	0	1
Plants providing food for birds	0.328	0.469	0	1
Avoid invasive plants	0.315	0.464	0	1
Access to garden	0.844	0.363	0	1
Information	0.359	0.48	0	1
Woman	0.561	0.496	0	1
Age	49.944	18.241	15	96
Education 16-19	0.424	0.494	0	1
Education 20+	0.329	0.47	0	1
Strong political interest	0.171	0.376	0	1
Medium political interest	0.476	0.499	0	1
Low political interest	0.173	0.378	0	1
Self-employed	0.073	0.261	0	1
Managers	0.111	0.314	0	1
Other white collars	0.117	0.321	0	1
House persons	0.056	0.229	0	1
Unemployed	0.071	0.257	0	1
Retired	0.303	0.459	0	1
Students	0.071	0.257	0	1
Left	0.251	0.434	0	1
Centre	0.324	0.468	0	1
DK/refusal (political scale)	0.205	0.404	0	1
Small / med. size town	0.426	0.494	0	1
Large town	0.275	0.446	0	1
Household size: 2	0.342	0.474	0	1
Household size: 3	0.176	0.381	0	1
Household size: 4+	0.261	0.439	0	1
National variables				
EPI	85.061	3.538	78.92	90.72
GDP per capita (in K€)	36.762	15.681	17.406	99.732
Trust in associations	0.372	0.105	0.221	0.596
Trust in relatives and friends	0.112	0.029	0.063	0.173
Trust in public authorities	0.217	0.081	0.078	0.451

Appendix 2

Table 5: Estimation of the simultaneous equations model

VARIABLES	(1) Space for wild species	(2) Avoid using pesticides	(3) Plants providing food for birds	(4) Avoid invasive plants	(5) Access to garden
Information	0.3280***	0.2143***	0.3217***	0.2619***	
	(0.0213)	(0.0210)	(0.0214)	(0.0211)	
Woman	0.0355	0.1408***	0.1268***	0.0377*	0.1031***
	(0.0223)	(0.0248)	(0.0233)	(0.0227)	(0.0244)
Age	0.0254***	0.0270***	0.0295***	0.0237***	0.0190***
	(0.0045)	(0.0049)	(0.0048)	(0.0047)	(0.0048)
Square Age (²)	-0.0002***	-0.0002***	-0.0002***	-0.0002***	-0.0001**
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0001)
Education 16-19	0.0308	0.0037	-0.0157	0.0747**	0.1255***
	(0.0352)	(0.0353)	(0.0359)	(0.0359)	(0.0385)
Education 20+	0.1263***	0.0814**	0.0054	0.1255***	0.1208***
	(0.0385)	(0.0394)	(0.0391)	(0.0393)	(0.0430)
Strong political interest	0.1195***	0.1297***	0.1032**	0.1272***	0.2808***
	(0.0417)	(0.0460)	(0.0426)	(0.0427)	(0.0426)
Medium political interest	0.0769**	0.0954***	0.0377	0.1120***	0.1750***
	(0.0334)	(0.0357)	(0.0340)	(0.0343)	(0.0342)
Low political interest	-0.0050	0.0189	-0.1022***	0.0026	0.1300***
	(0.0384)	(0.0379)	(0.0384)	(0.0385)	(0.0398)
Self-employed	0.1292***	-0.0006	0.0457	0.0566	0.1397***
	(0.0448)	(0.0448)	(0.0450)	(0.0445)	(0.0521)
Managers	0.0505	0.0309	-0.0306	0.1030**	0.1833***
	(0.0399)	(0.0421)	(0.0404)	(0.0409)	(0.0464)
Other white collars	-0.0553	-0.0490	-0.0703*	-0.0337	0.0595
	(0.0383)	(0.0368)	(0.0380)	(0.0380)	(0.0421)
House persons	-0.0417	-0.0273	-0.1613***	-0.0148	0.1887***
	(0.0538)	(0.0522)	(0.0534)	(0.0535)	(0.0611)
Unemployed	0.0416	-0.0279	0.0133	0.0311	-0.0233
	(0.0473)	(0.0455)	(0.0488)	(0.0480)	(0.0492)
Retired	0.0214	0.0509	0.0307	-0.0116	0.1545***
	(0.0448)	(0.0460)	(0.0448)	(0.0444)	(0.0544)
Students	0.2227***	0.0834	0.0771	0.1543**	0.2987***
	(0.0662)	(0.0667)	(0.0698)	(0.0688)	(0.0664)
Left	0.1072***	0.1493***	0.0723**	0.0654**	-0.0430
	(0.0296)	(0.0291)	(0.0294)	(0.0294)	(0.0356)
Centre	0.0584**	0.0853***	0.1049***	0.0324	0.0148
	(0.0289)	(0.0281)	(0.0287)	(0.0284)	(0.0338)

VARIABLES	(1) Space for wild species	(2) Avoid using pesticides	(3) Plants providing food for birds	(4) Avoid invasive plants	(5) Access to garden
DK/refusal	0.0628*	0.0448	0.0403	-0.0853**	-0.1136***
	(0.0350)	(0.0340)	(0.0344)	(0.0359)	(0.0371)
Small / med. size town	-0.2107***	-0.0344	-0.0952***	-0.0656**	-0.3416***
	(0.0287)	(0.0341)	(0.0300)	(0.0300)	(0.0319)
Large town	-0.2892***	-0.1077*	-0.1662***	-0.1554***	-0.6009***
	(0.0398)	(0.0563)	(0.0453)	(0.0441)	(0.0332)
Household size: 2	0.0757**	0.0639	0.1010**	0.0584	0.3779***
	(0.0374)	(0.0468)	(0.0393)	(0.0396)	(0.0325)
Household size: 3	0.0888*	0.0448	0.1084**	0.0540	0.4809***
	(0.0462)	(0.0584)	(0.0502)	(0.0492)	(0.0392)
Household size: 4+	0.0897*	0.0737	0.0660	0.0614	0.6219***
	(0.0483)	(0.0681)	(0.0535)	(0.0535)	(0.0379)
Proprietary					0.3617***
					(0.0293)
Constant	-1.0582***	-0.2002	-1.3099***	-1.1539***	-0.2327*
	(0.1612)	(0.2254)	(0.1945)	(0.1844)	(0.1310)
		0.2782***	0.4793***	0.3688***	-0.1804
		(0.0184)	(0.0214)	(0.0190)	(0.1338)
			0.3103***	0.3806***	-0.3422
			(0.0209)	(0.0169)	(0.2898)
				0.4161***	-0.4024**
				(0.0265)	(0.1698)
					-0.2865*
					(0.1593)

Country fixed-effects not reported
N=26,086
(Standard errors)
*** p<0.01, ** p<0.05, * p<0.1

Appendix 3

Table 6: Estimations of independent separate probit models.

VARIABLES	(1) Space for wild species	(2) Avoid using pesticides	(3) Plants providing food for birds	(4) Avoid invasive plants	(5) Access to garden
Information	0.3268***	0.2344***	0.3414***	0.2862***	
	(0.0184)	(0.0173)	(0.0184)	(0.0182)	
Woman	0.0450**	0.1735***	0.1851***	0.0695***	0.1131***
	(0.0178)	(0.0164)	(0.0179)	(0.0177)	(0.0204)
Age	0.0266***	0.0326***	0.0335***	0.0291***	0.0189***
	(0.0032)	(0.0029)	(0.0033)	(0.0032)	(0.0035)
Square Age (²)	-0.0002***	-0.0002***	-0.0002***	-0.0002***	-0.0001***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Education 16-19	0.0361	0.0520**	0.0625**	0.1217***	0.1285***
	(0.0270)	(0.0242)	(0.0268)	(0.0265)	(0.0297)
Education 20+	0.1236***	0.1170***	0.0994***	0.1570***	0.1575***
	(0.0295)	(0.0271)	(0.0294)	(0.0292)	(0.0334)
Strong political interest	0.1715***	0.2691***	0.1937***	0.2034***	0.2661***
	(0.0316)	(0.0290)	(0.0315)	(0.0314)	(0.0359)
Medium political interest	0.1138***	0.1758***	0.1023***	0.1480***	0.1621***
	(0.0260)	(0.0231)	(0.0258)	(0.0259)	(0.0276)
Low political interest	0.0067	0.0951***	-0.0198	0.0445	0.1186***
	(0.0303)	(0.0268)	(0.0302)	(0.0302)	(0.0324)
Self-employed	0.1446***	0.0675*	0.0928**	0.0672*	0.1060**
	(0.0371)	(0.0345)	(0.0374)	(0.0371)	(0.0441)
Managers	0.1215***	0.1002***	0.0290	0.1426***	0.1815***
	(0.0330)	(0.0311)	(0.0331)	(0.0329)	(0.0400)
Other white collars	-0.0045	0.0065	-0.0347	-0.0033	0.0684*
	(0.0326)	(0.0292)	(0.0325)	(0.0322)	(0.0361)
House persons	-0.0019	0.0267	-0.0908**	0.0146	0.1446***
	(0.0437)	(0.0392)	(0.0440)	(0.0431)	(0.0509)
Unemployed	0.0203	-0.0355	-0.0579	0.0012	-0.0553
	(0.0389)	(0.0344)	(0.0393)	(0.0385)	(0.0400)
Retired	0.0118	0.0769**	0.0534	0.0608*	0.0756**
	(0.0330)	(0.0305)	(0.0325)	(0.0325)	(0.0384)
Students	0.2351***	0.2033***	0.1924***	0.2102***	0.3064***
	(0.0529)	(0.0468)	(0.0543)	(0.0538)	(0.0544)

VARIABLES	(1) Space for wild species	(2) Avoid using pesticides	(3) Plants providing food for birds	(4) Avoid invasive plants	(5) Access to garden
Left	0.0614**	0.0942***	0.0371	0.0411*	-0.0390
	(0.0250)	(0.0233)	(0.0249)	(0.0247)	(0.0299)
Centre	0.0387	0.0798***	0.0589**	0.0339	0.0103
	(0.0237)	(0.0218)	(0.0234)	(0.0233)	(0.0284)
DK/refusal	-0.0055	-0.0117	-0.0354	-0.1138***	-0.1270***
	(0.0284)	(0.0253)	(0.0283)	(0.0281)	(0.0313)
Small / med. size town	-0.2862***	-0.1863***	-0.1954***	-0.1287***	-0.3671***
	(0.0206)	(0.0194)	(0.0205)	(0.0205)	(0.0262)
Large town	-0.4271***	-0.3676***	-0.3505***	-0.2855***	-0.6191***
	(0.0236)	(0.0216)	(0.0235)	(0.0234)	(0.0281)
Household size: 2	0.2057***	0.2701***	0.2374***	0.2498***	0.3558***
	(0.0237)	(0.0217)	(0.0235)	(0.0235)	(0.0262)
Household size: 3	0.2427***	0.3268***	0.2753***	0.2519***	0.4482***
	(0.0299)	(0.0270)	(0.0299)	(0.0297)	(0.0326)
Household size: 4+	0.3055***	0.4179***	0.3117***	0.3163***	0.5968***
	(0.0283)	(0.0257)	(0.0285)	(0.0282)	(0.0317)
Proprietary					0.3279***
					(0.0233)
Constant	-1.4766***	-1.1684***	-1.9733***	-1.7795***	-0.2001*
	(0.0976)	(0.0888)	(0.0990)	(0.0976)	(0.1050)
Observations	23,346	23,346	23,346	23,346	27,658

Country fixed-effects not reported
N=26,086
(Standard errors)
*** p<0.01, ** p<0.05, * p<0.1

Appendix 4

Table 7: Estimation of the simultaneous equations model without matching

VARIABLES	(1) Space for wild species	(2) Avoid using pesticides	(3) Plants providing food for birds	(4) Avoid invasive plants	(5) Access to garden
Information	0.3148***	0.2120***	0.3272***	0.2731***	
	(0.0192)	(0.0189)	(0.0192)	(0.0190)	
Woman	0.0104	0.1423***	0.1592***	0.0436**	0.1103***
	(0.0191)	(0.0196)	(0.0198)	(0.0191)	(0.0204)
Age	0.0215***	0.0269***	0.0273***	0.0248***	0.0183***
	(0.0036)	(0.0036)	(0.0037)	(0.0036)	(0.0035)
Square Age (²)	-0.0002***	-0.0002***	-0.0002***	-0.0002***	-0.0001**
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Education 16-19	0.0043	-0.0086	0.0262	0.0984***	0.1333***
	(0.0286)	(0.0272)	(0.0283)	(0.0283)	(0.0296)
Education 20+	0.0880***	0.0521*	0.0538*	0.1267***	0.1605***
	(0.0316)	(0.0309)	(0.0314)	(0.0312)	(0.0333)
Strong political interest	0.1110***	0.1847***	0.1224***	0.1642***	0.2564***
	(0.0348)	(0.0353)	(0.0349)	(0.0347)	(0.0359)
Medium political interest	0.0738***	0.1215***	0.0550**	0.1263***	0.1564***
	(0.0281)	(0.0275)	(0.0280)	(0.0282)	(0.0276)
Low political interest	-0.0289	0.0397	-0.0721**	0.0200	0.1124***
	(0.0321)	(0.0304)	(0.0317)	(0.0322)	(0.0324)
Self-employed	0.1239***	0.0199	0.0629	0.0457	0.1096**
	(0.0391)	(0.0379)	(0.0391)	(0.0389)	(0.0442)
Managers	0.0833**	0.0178	-0.0242	0.1070***	0.1756***
	(0.0352)	(0.0350)	(0.0350)	(0.0350)	(0.0399)
Other white collars	-0.0292	-0.0322	-0.0643*	-0.0250	0.0593*
	(0.0340)	(0.0320)	(0.0336)	(0.0338)	(0.0360)
House persons	-0.0303	-0.0471	-0.1375***	-0.0168	0.1321***
	(0.0455)	(0.0427)	(0.0453)	(0.0450)	(0.0507)
Unemployed	0.0461	0.0030	-0.0410	0.0192	-0.0582
	(0.0413)	(0.0386)	(0.0412)	(0.0411)	(0.0399)
Retired	-0.0051	0.0555*	0.0335	0.0432	0.0689*
	(0.0346)	(0.0337)	(0.0340)	(0.0342)	(0.0383)
Students	0.1694***	0.0796	0.1097*	0.1487**	0.3061***
	(0.0577)	(0.0547)	(0.0587)	(0.0583)	(0.0548)

VARIABLES	(1) Space for wild species	(2) Avoid using pesticides	(3) Plants providing food for birds	(4) Avoid invasive plants	(5) Access to garden
Left	0.0805***	0.1455***	0.0534**	0.0563**	-0.0439
	(0.0260)	(0.0253)	(0.0257)	(0.0257)	(0.0299)
Centre	0.0450*	0.0932***	0.0636***	0.0370	0.0090
	(0.0245)	(0.0235)	(0.0241)	(0.0242)	(0.0284)
DK/refusal	0.0330	0.0707**	-0.0014	-0.0900***	-0.1271***
	(0.0301)	(0.0283)	(0.0300)	(0.0300)	(0.0312)
Small / med. size town	-0.2271***	-0.0468*	-0.1117***	-0.0639***	-0.3624***
	(0.0252)	(0.0255)	(0.0254)	(0.0244)	(0.0262)
Large town	-0.2907***	-0.1049***	-0.1742***	-0.1479***	-0.6151***
	(0.0350)	(0.0378)	(0.0363)	(0.0335)	(0.0280)
Household size: 2	0.0815***	0.0847***	0.1007***	0.1445***	0.3511***
	(0.0296)	(0.0315)	(0.0303)	(0.0294)	(0.0261)
Household size: 3	0.0803**	0.0861**	0.0979**	0.1141***	0.4434***
	(0.0373)	(0.0396)	(0.0384)	(0.0369)	(0.0326)
Household size: 4+	0.1009**	0.1107**	0.0855**	0.1389***	0.5918***
	(0.0397)	(0.0440)	(0.0416)	(0.0393)	(0.0317)
Proprietary					0.3538***
					(0.0241)
Constant	-0.8912***	-0.2862*	-1.3273***	-1.2865***	-0.1872*
	(0.1366)	(0.1498)	(0.1489)	(0.1359)	(0.1055)

Country fixed-effects not reported
N=27658
(Standard errors)
*** p<0.01, ** p<0.05, * p<0.1

Appendix 5

Table 8: Comparison of "information" parameter for the various alternative estimations

	(1) Space for wild species	(2) Avoid using pesticides	(3) Plants providing food for birds	(4) Avoid invasive plants
Separate probits	0.3268***	0.2344***	0.3414***	0.2862***
	(0.0184)	(0.0173)	(0.0184)	(0.0182)
Separate probits with matching	0.3356***	0.2312***	0.3370***	0.2766***
	(0.0183)	(0.0173)	(0.0183)	(0.0182)
Generalized Heckman	0.3148***	0.2120***	0.3272***	0.2731***
	(0.0192)	(0.0189)	(0.0192)	(0.019)
Generalized Heckman with matching	0.3280***	0.2143***	0.3217***	0.2619***
	(0.0213)	(0.021)	(0.0214)	(0.0211)

Appendix 6

Table 9: Alternative specifications for the second-step regression

	(1)		(2)		(3)		(4)		(5)	
VARIABLES	**Space for wild species**		**Avoid using pesticides**		**Plants providing food for birds**		**Avoid invasive plants**		**Access to garden**	
EPI	**0.032***	**0.032***	0.008	0.011	-0.003	-0.009	**0.029***	0.025	-0.021	-0.024
	(0.017)	**(0.017)**	(0.003)	(0.005)	(0.018)	(0.017)	**(0.016)**	(0.016)	(0.019)	(0.019)
Trust in relatives and friend	-0.749		0.002		2.185		1.488		0.350	
	(1.999)		(1.693)		(2.054)		(1.912)		(2.268)	
Trust in public authorities		0.513		**-1.228***		0.896		0.343		0.846
		(0.774)		**(0.611)**		(0.803)		(0.753)		(0.862)
GDP per capita	**0.015*****	**0.014*****	0.003	0.005	**0.013*****	**0.011****	0.006	0.005	**0.009***	0.007
	(0.004)	**(0.004)**	(0.003)	(0.003)	**(0.004)**	**(0.004)**	(0.004)	(0.004)	**(0.004)**	(0.005)
Constant	**-4.638*****	**-4.814*****	-1.215	-1.256	-2.172	-1.534	**-4.423*****	**-4.008*****	1.217	1.342
	(1.492)	**(1.382)**	(1.216)	(1.092)	(1.531)	(1.426)	**(1.427)**	**(1.340)**	(1.696)	(1.547)
τ^2	**0.062**	**0.061**	**0.036**	**0.027**	**0.058**	**0.057**	**0.051**	**0.053**	**0.095**	**0.091**
I^2	**0.705**	**0.703**	**0.588**	**0.512**	**0.618**	**0.614**	**0.653**	**0.657**	**0.846**	**0.839**
$adjusted\ R^2$	**0.547**	**0.555**	**-0.114**	**0.160**	**0.363**	**0.368**	**0.202**	**0.182**	**0.061**	**0.102**

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