Understanding the drivers for Natura 2000 payments in forests: A Heckman selection analysis

Zuzana Sarvašová, Sonia Quiroga, Cristina Suárez, Tamás Ali, Diana Lukmine, Ilija Đorđević, Michal Hrib

The ecological network Natura 2000 is one element of the common European Union policy regarding biodiversity protection. National implementation of Natura 2000 differs across the European Union. Ecologically valuable forest ecosystems are often within private lands. The aim of this paper is to assess the implementation of the compensation mechanism developed through adapted management of private forests by using the Natura 2000 payments’ measure of the European rural development programmes for the financing period 2007–2014. The econometric Heckman selection model was used to assess the drivers influencing the implementation of the payments measure. Data sources include European and national statistics and expert knowledge. The results show that the countries with the highest proportion of forest cover in Natura 2000 protected areas are the least paid for compensation, and the implementation apparently does not follow the needs of private forests (assuming from the share of private forests in the country). The state of progress in designating Natura 2000 sites can be an important driver for increasing the probability of Natura 2000 payments for those countries accessing the European Union after 1995. Other evidence includes that national economic development is not observed to be significant in explaining the implementation of Natura 2000 payments. The drivers affecting the implementation of Natura 2000 payments are more focused on increasing the competitiveness of the forest sector than supporting environmental sustainability.

1. Introduction

Natura 2000 is an ecological network developed by the European Union (EU). The legal basis for this ecological network has two directives: one from 1979 (Birds Directive, 79/409/EEC) and the other from 1992 (Habitats Directive, 92/43/EEC). Natura 2000 forms the cornerstone of the EU’s nature conservation policy and represents one of the biggest areas of nature protection in the world (Blicharska, Orlikowska, Roberge, & Grodzinska-Jurczak, 2016; Posavec, Beljan, & Lovrić, 2011; Sotirov, 2017; Winkel et al., 2015; Winkel & Sotirov, 2011). Natura 2000 is a system of protected areas for endangered species and habitats at the EU level. The aim of the network is to assure the long-term survival of Europe’s most valuable and threatened species and habitats. A competent application of Natura 2000 mechanisms would ensure a more coherent and resource-efficient use of the EU’s valuable natural capital and foster economic growth that is more sustainable and inclusive (EC, 2013).

Private forest ownership in the EU in 2015 is on average 31.4% (Schmithüsen & Hirsch, 2010), and the Natura 2000 network average is approximately 17.5% of the EU’s land area (EC, 2011). The Natura 2000 network is not a system of strict protections from which all human activities are excluded; instead, it includes restrictions for management

Abbreviations: EU, European Union; DGAgri, Directorate General for Agriculture and Rural Development; DGEnviro, Directorate General for the Environment; FWG, Forum for a World Governance; GDP, gross domestic product; N.I, No Incentives; RDP, Rural Development Programme; RQ, research question; WB, World Bank

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in specific areas which, in practice, may limit private economic returns. According to the EC (2013) and Gantioler, Payment, ten, Brink, McConville, and Kettunen (2014), a well-managed Natura 2000 network will more than repay the costs related to its maintenance. However, according to Gantioler et al. (2014) the benefits are mostly for the public and less for the forest owners because private landowners enjoy no direct benefits from their land being included in protected areas (Grodzińska-jurczak & Cent, 2011; Grodzińska-jurczak et al., 2012; Pietrzek-Kaszyńska, Cent, Grodzińska-jurczak, & Szymańska, 2012), and few to no direct monetary benefits exist in Natura 2000 for private forest owners. For example, a voluntary contract between the forest owner or manager and the responsible public authority used in France, Germany, Denmark, and the United Kingdom (Ecochard, Hily, & Garcia, 2017; Geitzenauer et al., 2017; Sotirov, 2017) stress that many private forest owners are already conducting measures related to the conservation of Natura 2000 forests for nonadditional payments. Indeed, improved ecological forest management benefits the community (tourism, marketing, branding, quality label for regional products) more than the forest owners who make the investment. Understanding the benefits of sites and the services they provide to communities is invaluable in clarifying issues of who should be rewarded for helping maintain or enhance these services and how much they should be paid.

Biodiversity conservation targets in private forests have led to the use of several mechanisms for compensating for the costs of the limited use of private forests. Those mechanisms can range from public to private (Weiss, Suominen-Ramlciovic, & Mavasar, 2011). The literature explains these mechanisms as ‘compensation’, ‘financing’, or ‘payments’, and all are understood as general terms for paying forest landowners for different environmental services. Public financing mechanisms include pure public instruments, including negative (taxes, fees, and charges) and positive (subsidies) incentives. A mixed mechanism refers to state interventions that are voluntary, or initiatives aimed at creating new markets for the externalities of forest ecosystems. Private mechanisms include all market solutions developed without any specific public intervention (Mavasar et al., 2008).

The mechanism of compensation, developed within the EU for private forest ownership within the Natura 2000 sites, has some restrictions and belongs to a group of public financing mechanisms with positive incentives. The situation regarding benefits from Natura 2000 payments for agriculture and forest landowners differs. High biodiversity generally corresponds to a low agricultural output (Snethlage et al., 2012). Such areas are, therefore, well represented in the Natura 2000 network. Payments for Natura 2000 are, therefore, likely to offer a welcome alternative income option for farmers in these areas (Snethlage et al., 2012). For private forest owners, Natura 2000 areas result in many restrictions that cause a loss in income (Blicharska et al., 2016; Geitzenauer, Hogl, & Weiss, 2016, 2017; Sotirov, 2017; Winkel et al., 2015). The private forest owners generally support the conservation of nature and biodiversity but do not favour Natura 2000 because of its red tape, regulations, and restrictions. The contracts and payments are available only for conservation measures and not for sustainable forestry management, as in agro-environmental schemes (Snethlage et al., 2012).

Policy studies (e.g. Geitzenauer et al., 2016; 2017) have shown that the implementation of policy instruments does not only follow the formal goals of effective and efficient implementation but may be motivated by informal interests of public administration, stakeholders’ engagement, or scientific input. Drivers for the implementation of Natura 2000 payments (Blicharska et al., 2016; Sotirov, 2017; Winkel et al., 2015) are connected with the legal and policy frameworks, social and economic backgrounds, economic wealth, and political cultures of the country regarding compliance with EU regulations (Geitzenauer et al., 2016) and private forest owners preferences (Geitzenauer et al., 2017; Polomé & Michel, 2017). Thus, for this study, the formal goals (area of Natura 2000 sites, share of forests, share of private forests in a country, sufficiency index) and informal goals (governance index, GDP, RDP-CAP axes) were tested as drivers.

This paper analyses Natura 2000 compensation payments during the EU programming period 2007–2014 from Council Regulation (EC) No 1698/2005. These Natura 2000 payments are financed through the Common Agriculture Policy and defined within its second objective, namely, ‘improving the environment and the countryside’, and target the sustainable use of forestland. Specifically, Measure 224—Natura 2000 payments—has been implemented through the European Agriculture Fund for Rural Development for private forest owners through the rural development programmes (RDP) in Axis 2. All RDPs on the national or regional levels must be adopted by the EU. Article 46 of the mentioned regulation defines Natura 2000 payments as the support provided annually and per hectare of forest to private forest owners or associations thereof to compensate for costs incurred and income foregone resulting from the restrictions on the use of forests and other wooded land due to the implementation of Birds and Habitats Directives in the area concerned. Support shall be fixed between the minimum and maximum amounts, in this case, between 40 and 200 EUR per hectare per year.

Research conducted by the Confederation of European Forest Owners argued that the situation for financing instruments to compensate extra costs or income foregone as a result of the implementation of Natura 2000 in private forests is insufficient. In 2016, only 16% of the RDP compensations for Natura 2000 forest land were used (CEPF, 2016).

This study is based on the assumption that common drivers influence the execution of RDP Measure 224 in those EU Member States which have implemented Natura 2000 payments. The assumptions in the paper are based on the following key statements: (i) private forest owners in the EU are compensated (or partly compensated) for constraints and obligations related to forest management in Natura 2000 forest areas; and (ii) RDP 2007–2014 Measure 224—Natura 2000 payments—was used for private forest owners in Member States to compensate for the implementation of Natura 2000 according to RDP environment and greening targets.

The three research questions (RQ) of this paper are as follows: (i) Which drivers influenced compensations from RDP in the period 2007–2014 for private forests and how was Measure 224 used in the RDP period 2007–2014?; (ii) Is the EU order of accession a conditioning factor for Natura 2000 implementation in the territories of the Member States?; and, (iii) How has Measure 224 been used in the RDP regarding the link between payments and proportion of protected area on a country level?

An econometric analysis (Wooldridge, 2010) was used to assess the drivers for Natura 2000 payments in the EU forests. Our analysis integrates two essential steps of the compensation policy: the implementation of Natura 2000 protection (with the goal to compensate private forest owners for the disadvantages related to forest areas in the Natura 2000 network), and the claim for payments from private forest owners as a compensation for protection costs from RDP. To analyse the drivers for these two steps, we used the Heckman sample selection model. The Heckman model allows for consideration of different determinants affecting the country decision for implementing Natura 2000 compensation payments and those drivers that determine the amount of payments claimed by the forest owners. The general framework of the study is presented in Fig. 1. Each RQ is connected with a defined hypothesis and methodology used for the collection and analysis of the data and main findings.

2. Data and methods

2.1. Data and statistics

This study focuses on forest areas designated as Natura 2000 sites, which are privately owned and where some restrictions on their use apply. For the data analysis, information on the implementation of
Measure 224 of the RDP in the period 2007–2014 from 27 EU Member States is used. Region or nationwide RDP were studied as basic documents for particular EU Member States.

Non-reactive methods were used to answer the three RQs and assess the assumptions; also involved is an analysis of the secondary data, including an analysis of quantitative and/or qualitative data not collected by the researchers (Bryman, 2008; Neuman, 2012), official documents (RDP, monitoring reports), and statistics. The assessment year for the RDP data is 2014. This method was used to collect data for RQs 1, 2, and 3.

To understand the implementation of the same measure in different countries, characterising the potentially affected area and its significance within the forestry of the specific country is necessary. Table 1 presents a full description and motivation of the variables selected for the model to analyse the proposed RQ. Total expenditure for Measure 224 was used as a dependent variable. The percentage of Natura 2000 forests and three axes were considered drivers to measure the economic, environmental, and social targets of RDP to manage the RQ 3. The percentage of private forests, sufficiency index (sufficiency of the sites of Community Importance under the Habitats Directive), GDP, and governance index were used to provide answers to RQ 1. Data on EU accession were used to manage RQ 2.

For this purpose, a range of secondary data sources [Eurostat, DG Environment, WB databases, and FWG (2011)] and primary data Table 1
Description of the variables in the model.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition</th>
<th>Reason of use (RQ)</th>
<th>Source\textsuperscript{*}</th>
</tr>
</thead>
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<td>Payments</td>
<td>Total expenditure in 224 Measure 2007–2014</td>
<td>Dependent variable for analysing Natura 2000 compensation payments</td>
<td>DG Agri</td>
</tr>
<tr>
<td>Natura 2000 forests</td>
<td>Natura 2000 forests as a percentage of total Natura 2000 protected area</td>
<td>Proxy for the forest cover in protected areas (RQ3)</td>
<td>DG Enviro</td>
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<tr>
<td>Private forest</td>
<td>Private forests as a percentage of total forest area</td>
<td>Forest owners composition as a driver for payments claim (RQ1)</td>
<td>DG Agri</td>
</tr>
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<td>Ax1</td>
<td>Axis 1 measures aimed at promoting the competitiveness of the agricultural and forestry sector</td>
<td>Number of measures as a factor that influence the promoting of RDP economic targets (RQ3)</td>
<td>DG Agri</td>
</tr>
<tr>
<td>Ax2</td>
<td>Axis 2 measures aimed at improving the environment and the countryside</td>
<td>Number of measures as a factor that influence the promoting of RDP environment targets (RQ3)</td>
<td>DG Agri</td>
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<td>Ax3</td>
<td>Axis 3 measures aimed at quality of life in rural areas and diversification of the rural economy</td>
<td>Number of measures as a factor that influence the promoting of RDP social targets (RQ3)</td>
<td>DG Agri</td>
</tr>
<tr>
<td>Natura 2000 compensation</td>
<td>Dummy variable (1=Natura 2000 compensation payments being implemented; 0=No compensation)</td>
<td>Dependent variable for analysing the factors conditioning the decision of implementing the payments can be different from those with the amount of payments claimed</td>
<td>DG Agri</td>
</tr>
<tr>
<td>EU accession</td>
<td>A set of dummy variables from the data on the EU order of accession (EU58 = 1 if access was in 1958, EU58-95 = 1 if access was between 1958 and 1995, EU &gt; 95 = 1 if access was after 1995)</td>
<td>The EU order of accession as a potential conditioning factor for Natura 2000 compensation (RQ2)</td>
<td>EUROSTAT</td>
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<td>Sufficiency index</td>
<td>Sufficiency of the sites of Community Importance index proposed by the Member States under the Habitats Directive</td>
<td>Measuring the degree of implementation in terms of different habitats/sites covered and the number of species occurring there (RQ1)</td>
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<tr>
<td>GDP</td>
<td>GDP (in millions of US$), aggregated goods and services production valued at market prices (2013)</td>
<td>Economic development as a driver for Natura 2000 compensation (RQ1)</td>
<td>WB database</td>
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<td>Governance index</td>
<td>Ranking of the aggregated World Governance Index based on several dimensions including: government effectiveness, regulatory quality, control of corruption, and rules of law</td>
<td>Empowered institutions as a driver for Natura 2000 compensation (RQ1)</td>
<td>FWG</td>
</tr>
</tbody>
</table>

Note: N.I. (No Incentives) is used for countries that have not implemented the measure. For the variables' definitions see Table 1.

\textsuperscript{*} DG Agri (Directorate General for Agriculture and Rural Development, European Commission), DG Enviro (Directorate General for Environment, European Commission), EUROSTAT (Eurostat, European Commission), WB (World Bank), FWG (Forum for a World Governance).
information on RDP (DG Agri) were used to analyse the implementation of Measure 224. There is limited reliability regarding the official monitoring and evaluation data due to many RDP modifications, an ongoing validation process, and that payments are reported in national currencies respecting the rule n+2, that is, by 31 December of the second year following the year (n) when the money were claimed. Therefore, information about Measure 224 provided by DG Agri up to the 3rd quartile of 2014 was used for the analysis. Table 2 shows the data for the variables selected in this study for the Member States.

### Table 2
Country-specific data.

<table>
<thead>
<tr>
<th>Member States</th>
<th>Payments (Euro)</th>
<th>Natura 2000 forests (%)</th>
<th>Private forests (%)</th>
<th>Ax1</th>
<th>Ax2</th>
<th>Ax3</th>
<th>Natura 2000 compensation</th>
<th>EU accession (year)</th>
<th>Sufficiency index</th>
<th>GDP (million USD)</th>
<th>Governance Index (rank)</th>
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2.2. Modelling determinants of Natura 2000 payments

Our prime interest is to identify the determinants of Natura 2000 payments. A number of Member States, despite creating Natura 2000 sites, have not implemented Measure 224. In this study, we used the Heckman sample selection approach to deal with the selectivity of bias resulting from the non-random subsets of countries that have not implemented Natura 2000 compensation payments.

In our framework we consider that—as a country’s decision—drivers affecting the implementation of Natura 2000 compensation payments may be driven by policy and governance (e.g. accession to the EU, GDP, sufficiency index, etc.), whereas the drivers affecting the application for compensation payments are the forest owners’ decision and, thus, more related to biophysical drivers, for example, the amount of area protected by Natura 2000 or number of private forest owners in the country. Therefore, we estimate a Heckman model that allows for testing the drivers affecting each decision.

The topic of sample selection has been a popular subject of recent literature. The sample selection often arises from practice because of the partial observability of the outcome variable. When sample selection is present (as herein, where we only observe payments in those countries that have implemented Measure 224), the observed data do not represent a random sample of the population, even after checking explanatory variables, that is, the data missing in the sample does not respond to a random selection process. Thus, a standard analysis using only complete cases will lead to biased results. The Heckman sample selection model properly analyses such types of data. Applications of this model have been prominent in several fields, including economics (Christofides, Polycarpou, & Vrachimi, 2013; Lennox, Francis, & Wang, 2012), health (Hoornbeek, Morris, & Stefanak, 2015; Liu & Waite, 2012), education (Andrabi, Das, & Khwaja, 2013; Winters, Dixon, & Polycarpou, 2013; Lennox, Francis, & Wang, 2012), and political science (Vance & Ritter, 2014). When an explanatory variable is common in several stages of a decision process, the estimation should consider the direct and indirect effects (Lazaridis, 2004; Saha, Capps, & Byrne, 1997). The same principle applies to the calculation of the marginal effects: the change experienced by the dependent variable when an explanatory variable increases by one unit.

The specification for the Heckman selection model assumes an existing underlying regression relationship

\[ y_i = x_i \beta + \varepsilon_{2i} \]  

(A)

However, the dependent variable \( y_i \) is only observed if

\[ x_i \gamma + \varepsilon_{1i} > 0 \]  

(B)

where \( i = 1, \ldots, n \) are different Member States, \( x_i \) and \( z_i \) are the full set of variables that describe individual characteristics that may or may not be common in the specifications of both equations, and \( (A) \) and \( (B) \) and \( \beta \) and \( \gamma \) are vectors of unknown parameters. \( \varepsilon_{2i} \) and \( \varepsilon_{1i} \) are, respectively, the error terms for the Eqs. \( (A) \) and \( (B) \), which follow a normal distribution: \( \varepsilon_{2i} \sim N(0, \sigma^2) \) and \( \varepsilon_{1i} \sim N(0, \sigma^2) \). The model allows for correlation between unobservable information of Eqs. \( (A) \) and \( (B) \). If \( \rho \neq 0 \), a standard regression model applied to the Eq. \( (A) \) would provide biased results. Additionally, the Heckman model with the sample selection provides consistent and asymptotically efficient estimators for all model parameters. If \( \rho = 0 \), the standard regression model applied to the Eq. \( (A) \) would provide biased results.
2.3. Marginal effects and simulations for policy scenarios

The interpretation of the coefficient estimates in the Heckman model can be complex, and the marginal effects must be calculated using a nonlinear function of the underlying model parameters to avoid selectivity bias (see Vance, 2009 for implementation guidance). We calculated the marginal effects of nature conservation considering Eqs. (A) and (B):

\[
\frac{\partial}{\partial x_k} \left[ \frac{\gamma}{\gamma_i} > 0, x_i \right] = E(y_i | z_i = 1, x_i),
\]

where the subscript \( k \) denotes one of the variables of the full set of \( x_i, \beta_k \) and \( \gamma_k \) are the estimated coefficients for \( x_k \) in Eqs. (A) and (B), and the inverse of the Mills ratio is denoted as \( \delta(\gamma_i) \).

Additionally, to simulate policy responses, we calculated the probability of implementing compensation payments as a response to the share of private forest land as follows:

\[
Pr[\text{Natura 2000 Compensation}] = \text{Prob}\left[\gamma | z_i + \epsilon \right] = F(\gamma | z_i)
\]

3. Results

The results are introduced in three subsections. First, we present the results of the evaluation of the drivers for the implementation process and payments (Section 3.1) to answer RQs 1 and 3. The second section presents the results regarding the marginal effects of nature conservation (Section 3.2) as an answer to the second RQ. Third, we present the results regarding policy simulations of compensation payments as a function of the private forest land proportion (Section 3.3).

3.1. Drivers for the implementation process and payments

The main Eq. (A) on the determinants of Natura 2000 payments is formulated as follows:

\[
\text{Payments}_i = \beta_0 + \beta_1 \text{ Natura 2000 forests}_i + \beta_2 \text{ Private forest}_i + \beta_3 \text{ Ax1}_i + \beta_4 \text{ Ax2}_i + \beta_5 \text{ Ax3}_i + \epsilon_{2i}
\]

The Eq. (B) on the determinants of Natura 2000 compensation is written as follows:

\[
\text{Prob}(\text{Natura 2000 compensation}) = F(\gamma_0 + \gamma_1 \text{ EUS8} + \gamma_2 \text{ EUS8-95} + \gamma_3 \text{ Sufficiency index} + \gamma_4 \log \text{ GDP} + \gamma_5 \text{ Governance index})
\]

Table 3 shows the results for the estimated model (simultaneous estimation of Eqs. (E) and (F)) for the compensation and payments in the context of Measure 224.

<table>
<thead>
<tr>
<th>Payments</th>
<th>Coef</th>
<th>Std. Err.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natura 2000 forests</td>
<td>-0.6287</td>
<td>(0.145)**</td>
</tr>
<tr>
<td>Private forests</td>
<td>-0.1795</td>
<td>(0.081)**</td>
</tr>
<tr>
<td>Ax1</td>
<td>5.2870</td>
<td>(0.144)**</td>
</tr>
<tr>
<td>Ax2</td>
<td>-3.2801</td>
<td>(0.345)**</td>
</tr>
<tr>
<td>Ax3</td>
<td>-2.5106</td>
<td>(0.312)**</td>
</tr>
<tr>
<td>Constant</td>
<td>45.5569</td>
<td>(7.442)**</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Natura 2000 compensation</th>
<th>Coef</th>
<th>Std. Err.</th>
</tr>
</thead>
<tbody>
<tr>
<td>EUS8</td>
<td>-2.4226</td>
<td>(0.944)**</td>
</tr>
<tr>
<td>EUS8-95</td>
<td>-2.8092</td>
<td>(0.719)**</td>
</tr>
<tr>
<td>Sufficiency index</td>
<td>0.0246</td>
<td>(0.011)**</td>
</tr>
<tr>
<td>GDP</td>
<td>0.1550</td>
<td>(0.239)</td>
</tr>
<tr>
<td>Governance index</td>
<td>-0.0161</td>
<td>(0.005)**</td>
</tr>
<tr>
<td>Constant</td>
<td>-2.6737</td>
<td>(3.067)</td>
</tr>
</tbody>
</table>

Table 3 shows different drivers for Natura 2000 compensation and payments received by the countries. Those countries with a lower probability of implementation are those Member States with EU accession between 1958 and 1995, whereas those presenting a higher probability of Natura 2000 compensation are the Member States with EU accession after 1995. Regarding, habitat conservation, the higher the sufficiency index, the greater the probability of compensation. That is, the Member States, where greater efforts have been made to implement Natura 2000, show a higher probability of Natura 2000 compensation, and the policy serves its purpose, at least in terms of biodiversity conservation expectations. Economic development measured as GDP elasticity is not observed to be significant in explaining the probability of compensation.

The governance index has a negative effect on the compensation. Therefore, a positive relationship is observed between institutional development and implementation of Natura 2000 because the governance index is a rank. A lower the index indicates the country is in the upper ranks. Greater institutional development corresponds with additional implementation of protection measures.

Regarding the payments made by the countries to implement Measure 224, they mainly depend on the type of measure implemented. Countries with a higher amount of Axis 1 measures implemented receive a higher percentage of total payments. By contrast, countries that have increasingly implemented Axis 2 and Axis 3 measures receive a lower percentage of payments (especially those based on Axis 2 measures). This result is critical because two measures are address environmental sustainability of forests. Therefore, the payments do not support environmental sustainability as a main objective but are more focused on increasing the competitiveness of the agricultural and forestry sector (because Axis 1 is the more important driver in the estimated model).

Countries with a higher percentage of Natura 2000 forest area receive a lower percentage of total payments for Measure 224 than those with a lower percentage of protected areas. Additionally, those countries with a higher percentage of private forests receive a smaller proportion of Natura 2000 payments. It is a paradox that the more the private protected areas there are in a country, the less is claimed for payments. The motivation for (nonstate) landowners’ opposition to Natura 2000 in intensively managed European forests remains an open question. In addition to the compensated costs, a Natura 2000 protection regime may also restrict the decision-making freedom of private owners, which has been highlighted as a motive for non-adoption (Polomé & Michel, 2017; Sotirov, 2017).

3.2. Effects of nature conservation on Natura 2000 implementation

Fig. 2 shows the simulated probability of implementing Measure 224 as a function of the sufficiency index (sufficiency of the sites of Community Importance under the Habitats Directive). These simulated probabilities were calculated from the estimated model in Table 3 and tacked into account Eq. (F). In general, countries with a higher sufficiency index are observed to have a higher probability of implementing Measure 224.

In this study, the simulated probability, based on the results of the model shown in Table 3, presents the response to changes in the specific sufficiency index by groups of countries depending on their accession to the EU. Such an analysis is possible due to a joint test for the significance of country group effects (null hypothesis: \( \gamma_1 = \gamma_2 = 0 \)) being rejected \((\chi^2(2) = 16.46^{***})\). This result supports the idea that ecologically oriented landowners will be more likely to implement Natura 2000 (Sotirov, 2017). We can also observe a very different picture in different groups of countries. While the sufficiency index is an important driver for increasing the probability of compensation for those countries accessing the EU after 1995, it is not observed to be so
relevant for countries entering the EU in previous stages.\(^1\) This result may be because the countries accessing the EU before 1995 have a low variability in the sufficiency index.

Fig. 3 shows the simulated change in the EU payments for 224 compensation measures as a response to the percentage of Natura 2000 forest area with respect to the protected area in the analysed countries. It can be observed that those countries with greater areas of protected forest do not receive a higher amount of compensation payments. This is a paradox because evidence suggests that the policy is not serving its main purpose of compensating forest owners for the economic disadvantages that the protection may imply. The demand for compensation payments is logically higher in Member States with a high proportion of the protected areas. The amount of available funds for compensation is important for convincing forest owners to change their management practices in Natura 2000 forests. The insufficient financing of Natura 2000 is also, according to the Fitness Check of the Birds and Habitats Directives (EC, 2016), one of the greatest barriers to the effective implementation of Natura 2000 Directives.

Fig. 4 shows the increase in the percentage of payments as a function of the measures implemented. The vertical line in the graph represents the mean of the implemented measures in the EU-27 in the studied period. As aforementioned, we can observe that the more the measures are implemented from Axis 1, the more the percentage of payments we expect a country will grant; the opposite applies to Axis 2 and 3. Thus, it is observed that the payments are especially responsive to competitiveness incentives and not so much to environmental criteria.

3.3. Policy simulations of compensation payments as a response to share of private forests

Fig. 5 shows the simulated values for the percentage of payments received for a Member State as a function of its percentage of private forests. The share of total payments for compensation is observed to decrease with the increasing share of private forests. As aforementioned, several studies have shown economic, social, or ethical motives for adoption or non-adoption of compensation payments (Geitzenauer et al., 2016, 2017; Sneathlage et al., 2012; Sotirov, 2017), the control over one’s property as one of the motives for non-adoption among private forest owners was stressed by Polomé and Michel (2017).

Fig. 6 shows the simulated probability based on the estimated Heckman model for the implementation of Natura 2000 compensation payments (based on Measure 224) in the EU Member States. Following the simulated probabilities, the categories observed in Fig. 6 are countries which have already implemented the measure and those with a high, medium, and low probability of implementing Natura 2000. Notably, the countries presenting a lower probability are Ireland and Finland, whereas France and Slovenia have a higher probability of compensation. As shown in Table 3, the determinants for the simulated probability are the accession processes, level of nature protection, institutional development, and type of the orientation of the protection measures (e.g. market competitiveness, environment, rural development).

4. Summary and discussion

Before a discussion of our findings, we highlight the main insights that answer the three RQs considered in Fig. 1:

(i) RQ1: Country factors, such as forest ownership composition, existing biodiversity, and institutional development, are the main drivers influencing compensation. Economic development is not among the significant factors that explain the probability of Natura 2000 compensation. Among the specific effects, the higher the private forest proportion in a country, the lower the share of that country’s total Natura 2000 payments; the higher the sufficiency index, the greater the probability of compensation; and the greater the institutional development, the greater the implementation of protection measures.

(ii) RQ2: More recent accession to EU affects the probability of implementation but is not significant to determine the amount of payments.

(iii) RQ3: The higher the percentage of Natura 2000 forest land, the lower the payments. The payments support more the Axis 1 measures: therefore, increasing competitiveness in the forest sector is a critical driver. Because the main purpose is to compensate private forest owners within Natura 2000 sites, the results may indicate that the amount for compensation would not be sufficient for the payments, especially in cases where the private forest ownership dominates.

Natura 2000 sites are one element of the common EU policy...
regarding biodiversity protection (Winkel et al., 2015). At Natura 2000 sites, the EU Member States must establish the conservation measures necessary to maintain the habitat types and species at a favourable conservation status (Lazaridis, 2004). All these measures address biodiversity and, as a positive externality, an enhanced supply of ecosystem services; however, such measures can also result in significant expense (Bastian, 2013). Natura 2000 sites can be particularly important for local and regional economic development, because they attract financing and offer a vital source of direct and indirect employment (Gantioier et al., 2010; Geitzenauer et al., 2016; Jarský & Pulkrab, 2013; Štěrová & Šáka, 2016). Natura 2000 includes public and privately owned lands as well as strictly protected nature reserves and protected areas where human activities are permitted (Blondet et al., 2017). A driver is any natural or human-induced factor that directly or indirectly causes a change in an ecosystem (Nelson, 2005). Winter et al. (2014) noted that management practices vary significantly depending on the region and especially on the social and political contexts within these regions.

This article attempted to quantify the effects of drivers influencing Natura 2000 policy and payments. One main driver is the percentage of private forests in the countries. The importance of maintaining biodiversity conservation targets in private forests results from the participation of private forest owners in the Natura 2000 network. This result indicates that the measure is not well designed, at least in such cases where private forest ownership is significant. This study’s results show that Axis 1 measures are critical drivers for increasing competitiveness in the forest sector. The results also show variant drivers for Natura 2000 compensation and payments received by the countries.

Economic development measured as GDP elasticity is not observed to be significant in explaining the probability of compensation. Although the environmental Kuznets curve hypothesis indicates a relationship between the economic growth and environmental protection (first decreasing and then increasing with GDP), evidence of this effect’s existence was questioned in the literature (Dinda, 2004), and here we have a heterogeneous range of countries where the negative effects on the low-income countries can be compensated with the positive effect of those high-income countries.

The development of the governance system has a negative effect on the implementation. Countries with good governance and developed administrations have not promoted compensations as much. Restrictions by Natura 2000 in private forests are obvious in several EU Member States (Bonsu, Dhubháin, & O’Connor, 2015; Borrass, 2014; Brescancin, Dobšinská, De Meo, Šáka, & Paletto, 2017; De Koning et al., 2014; Grodzińska-jurczak & Cent, 2011; Sarvašová, Šáka, & Dobšinská, 2013; Sotirov, Lovric, & Winkel, 2015; Winkel et al., 2015; Winter et al., 2014). The loss caused by Natura 2000 restrictions depends on the level of the usual management. Valuable forests for Natura 2000 on private land are widely protected, but the compensations are delivered from national policy framework. The study results showed that those countries with a greater area of protected forest do not receive a higher amount of compensation payments. Successful implementation of funding instruments requires focusing on the reasons for the funding and acceptance by the target groups (Sotirov, 2017). Forest owners fear further restriction of their property rights, and their opposition to Natura 2000 policy may lead to a resistance against involvement in subsidy schemes (Geitzenauer et al., 2017; Sotirov, 2017).

Access to compensation data is limited; no detailed information regarding the amounts, entities, or hectares is available—not even from...
DG Agri. The unreliability of a monitoring system inhibits the interpretation of the available data. Compensation mechanisms are focused on private forest estates, but gaps in information regarding the scale of private forests in Natura 2000 limit proper target formulation. Due to delays in Natura 2000 management planning (Trentanovi, Campagnaro, Rizzi, & Sitzia, 2017, this issue) or other issues regarding the level of constraints, several Member States or regions introduced this measure at a later phase as a modification, which is one cause of the unreliable data. The fulfilment of environmental goals should be promoted by compensation, but only a few Member States used the RDP Measure 224 in the period 2007–2014 for this purpose. The monitoring data system is unsuitable for a detailed analysis of the compensation because the monitoring system has a different financial approach. Our paper shows that the possibility of the implementation of this compensation was mainly driven by economic factors (competitiveness incentives), rather than environmental criteria. Previous analyses have suggested that the implementation process largely depends on socioeconomic aspects; notably, those are not considered here (e.g. historical circumstances, trust in state administration, corruption). For example, in the case of Greece, the national strategy was compromised by the absence of conservation policy history, lack of state capacity, uncommunicated biological knowledge, and lack of public participation (Apostolopoulou & Pantis, 2009). This absence of clear goals and divergences between stated and actual goals led to bureaucratic interpretations of conservation objectives and a distortion of decision processes in favour of satisfying economic and development interests. The European Commission announced that post-communist countries may struggle more with Natura 2000 compensation (Křenová & Kindlmann, 2015) than other Member States. Authors from Eastern Europe defined the problems with the implementation of Natura 2000 and blamed them on the poor environmental education of local communities and lack of quality control regarding the Appropriate Assessments delineated in the Habitats Directive (art. 6(4)) (Křenová & Kindlmann, 2015; Sitzia, Campagnaro, & Grigolato, 2016). Other studies have shown that conservationists and others involved in nature conservation should focus more on the manner in which conservation needs and practices are represented and institutionalised, how these representations become embedded in more general narratives, and how the new institutions are bound to be gamed and re-narrated themselves (Beunen, Van Assche, & Duineveld, 2013). Situation regarding Natura 2000 payments is dramatic, since costs of damage caused by some protected species are highlighted by some stakeholders as a significant concern (EC, 2016). Forest protection may be understood differently by the forest owner and decision-making authority undertaking protection processes because attitudes are related to the cultural context. Different attitudes may, therefore, prevent or obstruct communication in the process (Bergseng & Vatn, 2009). Furthermore, the ownership of a forest property entails more than monetary benefits for the private forest owner because many own the property as a family project (Berlin, Lidestaw, & Holm, 2006; Törnqvist, 2015). Decision-making authorities must, therefore, consider the compensation level and how the owner identifies themselves as an owner (Gren & Carlsson, 2012). The relationship between economic growth and various indicators of environmental quality has come under increasing scrutiny because of the widely observed manifestations of the consequences of unsustainable resources used on the local and global scales (Dietz & Adger, 2003). The environmental Kuznets curve is often used to describe the relationship between economic growth and environmental quality. Changes in the GDP per capita lead to environmental damage (first increasing and then decreasing with GDP) (Ekins, 1997; Stern, Common, & Barbier, 1996; Stern, 1998). The evidence for this effect has been questioned in literature (Dinda, 2004). Here, we have a heterogeneous range of countries where the negative effects on the low-income countries can be compensated for by the positive effect of the high-income countries. Therefore, the aggregated effect is not significant. In this paper, Natura 2000 payments in forests on the country level were analysed, but we did not analyse the efficiency of this financial instrument; this topic could be analysed in future with more detailed data about the implementation of financial instruments for Natura 2000 payments.

5. Conclusions

The main aim of this study was to evaluate the drivers influencing the Natura 2000 payments (RDP Measure 224 in the period 2007–2014). The research revealed that the implementation of Natura 2000 compensations was mainly driven by competitiveness incentives rather than environmental criteria of RDP policy. To fulfil the environmental criteria, the environmental objectives should be promoted by the compensation. However, only a few Member States used the RDP Measure 224 in the period 2007–2014 for this purpose. It was further revealed that the monitoring data system was unsuitable for a detailed analysis of the compensation. Moreover, there were limitations of a Member State scale of analysis caused by national internal variability of the determinant drivers used, GDP in particular, and internal possible differences in the implementation of Measure 224 among regional
administrations. Because privately owned forest areas are observed to be one of the main barriers to claiming compensation payments in RDPs, this may indicate that the measure is not well designed, especially regarding those cases where the forest private ownership is significantly dominant.

Regarding the original and main purpose of the Natura 2000 payments, namely to compensate forest owners for related possible burdens, it could be assumed that countries with more protected areas in private forests would receive more payments. This was also the reason why the share of private forests and protected areas within the private forests were analysed. However, the results of the analysis proved otherwise: the emphasis is on increasing competitiveness rather than support of ecological and environmental stability.

Furthermore, it could be assumed that in the countries with higher needs in terms of GDP, the compensations would have a tendency to increase; however, this was not confirmed either. Instead, the use of the payments, on the one hand, follows the countries’ use of Axis 1 measures aimed at increasing competitiveness, and on the other, follows the countries’ governance index, that is, well-governed countries or well-functioning public administrations.

Due to delays in Natura 2000 management planning or other issues regarding the level of constraints, several Member States or regions introduced this measure at a later phase as a modification, which resulted in the unreliability of the acquired data. Therefore, further research would provide insights regarding payment implementation, which might result in drivers engagement of other than competitive drivers influencing the compensation policy.

Conflict of interest

The authors declare no conflict of interest.

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