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**AZORES BLUE ECONOMY: MEASURING THE IMPORTANCE
OF AZOREAN MARITIME-RELATED ACTIVITIES FOR
PORTUGAL'S ECONOMY USING THE PARTIAL
HYPOTHETICAL EXTRACTION METHOD**

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Azores Blue Economy: Measuring the Importance of Azorean Maritime-Related Activities for Portugal's Economy Using the Partial Hypothetical Extraction Method

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Abstract

Economic activities tied to marine and coastal resources, known as blue economy, play a crucial role in coastal regions like Portugal. Despite a small population and resource challenges, the blue economy, offers potential growth for the Azorean economy. In addition, the interest in measuring the blue economy created your own strand of research. Then, this work aims to quantify the contribution of maritime-related economic activities to the regional and national economy, evaluating not only the participation of activities directly carried out at sea but also their systemic effects, with a focus on the value chain perspective. The results reveal that 0.41% of Portugal's GDP is tied to Azorean maritime activities. Furthermore, 16.58% of the Azorean GDP relies on the blue economy, employing over 15,000 people locally and affecting employment and emissions differently across regions like Madeira and Lisbon due to varying local productive structures.

1 Introduction

Economic activities related to marine and coastal resources, referred to as the ocean economy or blue economy¹, hold significant importance in coastal regions such as Portugal. Between 2016 and 2017, according to the Portuguese National Institute of Statistics (INE), the contribution of blue economy activities to the national Gross Value Added (GVA) increased from 3.7% to 3.9%. Similarly, during the same period, the share of jobs generated by the ocean economy in total employment rose from 3.9% to 4.1%^[5]. Projections by the Portuguese government indicate that activities related to the ocean economy could grow to contribute 7% of Gross Domestic Product (GDP) by 2030, in an expansion plan that aligns maritime economic exploitation with environmental and well-being gains^[6].

¹The blue economy concerns the sustainable use of marine resources in pursuit of economic development, livelihood enhancement, and environmental sustainability. The blue economy encompasses various sectors, such as fishing, aquaculture, tourism, maritime transport, renewable and non-renewable energies, and marine biotechnology.^[1-4]

The large Exclusive Economic Zone (EEZ) of Portugal contributes to the growth of activities linked to the blue economy. Despite its vast extent, recent efforts have been made to expand the Portuguese EEZ beyond the 200 nautical miles that follow the mainland coast and surround the country's archipelagos. The Mission Structure for the Extension of the Continental Shelf's work in the Commission on the Limits of the Continental Shelf (CLCS) of the United Nations (UN) is a result of this request. A subcommission within the CLCS was established in 2017 and is evaluating the case^[7]. Nonetheless, under the current limits, the Portuguese EEZ encompasses an area of 1.7 million km², of which 955,000 km² are contiguous to the Azores archipelago — equivalent to 55.5% of Portugal's EEZ^[8].

The Azores archipelago is the youngest in Macaronesia. It is a historically significant region for maritime transport and fishing, with a subtropical regime and oligotrophic waters, located at the transition between a less productive tropical area (to the south) and a temperate area with higher productivity (to the north). The small population living in the region (just over 236,000, according to the most recent estimates^[9]), combined with resource scarcity and geographic isolation, imposes challenges to economic growth; however, the relative increase in the importance of the blue economy, through the development of activities such as ecotourism and aquaculture, has the potential to establish a new growth source for the Azorean economy. Nevertheless, the lack of quality data on the ocean economy makes the potential of this transformation uncertain^[10].

The literature related to the study of aspects of the blue economy is vast. Some works focus on measuring the economic importance of specific marine-related sectors, such as fishing^[11,12], while others aim to understand the determinants of the blue economy^[13] and the macroeconomic impacts of climate change on the blue economy^[14]. Recently, the interest in quantifying the economic participation of the blue economy has created its own strand of research. Furthermore, the creation of Satellite Accounts for the Sea, integrated into the System of National Accounts^[3,15,16], helps in standardizing measurement methods for different countries, contributing to the consistency and comparability of blue economy estimations.

Therefore, several studies have sought to measure the blue economy in different regions, such as China (4.03% of GDP in 2010)^[17], Ireland (1% of GDP in 2007)^[18], Jamaica (6.9% of GDP in 2017)^[16], United States (1.8% of GDP in 2018)^[3], Poland (0.97% of GDP in 2017)^[19], Gulf of Bothnia - Finland (4% of jobs in 2014)^[20], Spanish part of the European Atlantic Arc (1.1% of employment and 0.67% of GVA between 2011 and 2013)^[21], Philippines (3.9% of GDP in 2022)^[22], European Union (1.5% of GDP in 2018)^[23], Brazil (2.6% of GDP in 2015^[24] and 6.39% of GDP in 2019^[4]), and Portugal (3.1% of GDP, on average, between 2011 and 2013)^[25]. However, the absence of methodological standardization and the divergent definitions of the blue economy make the comparability of these statistics challenging^[26].

As seen, Portugal has a Satellite Account for the Sea, aimed at quantifying the country's blue economy. In the edition released in 2020, covering the years between 2016 and 2018, a specific Satellite Account for the Sea was also estimated for the Autonomous Region of the Azores (RAA). In this account, it was calculated that the blue economy accounted for 6.9% of GDP in 2016 and 7.9% in 2017, as well as 7.5% and 8.1% of employment in the region, respectively.

Adding to the estimates by Statistics Portugal (2020), in addition to measuring the di-

rect participation of marine-related economic activities, this article proposes an approach focused on the value chain perspective, estimating the direct and indirect effects of the blue economy in the RAA, not only within the region itself but also in other Portuguese regions, using the partial hypothetical extraction method applied to the interregional input-output system (IIOS) of Portugal for the year 2017.

This approach allows for an evaluation of the systemic effects of the ocean economy, encompassing the linkage effects. By measuring how activities related to the blue economy affect other activities, sometimes developed in other regions, policymakers gain access to detailed information about the economic complexity and interconnections. Therefore, this article contributes to the literature by presenting an alternative systemic approach to quantifying the blue economy of the Azores, given the economic and cultural importance of marine-related economic activities for Portugal, and especially for the Azores.

The results indicate that 0.41% of the country's GDP comes from maritime activities in the Azores archipelago, with 16.58% of the regional GDP depending on the blue economy. It is estimated that 15,404 workers in the Azores are directly involved in marine-related activities, while 21,214 people across the country are employed in these activities. The regions of Madeira and the Lisbon Metropolitan Area are the most impacted by the Azorean maritime economy, but different effects on employment and emissions are observed due to the distinct arrangements of local productive structures.

The text is divided into four sections, including this introduction. Section 2 discusses the sources and treatment of the data used, and provides a brief review of the methodology employed in the analysis; the third part of the paper is dedicated to discussing the results obtained; and finally, the last section presents the final conclusions of the research.

2 Methodology

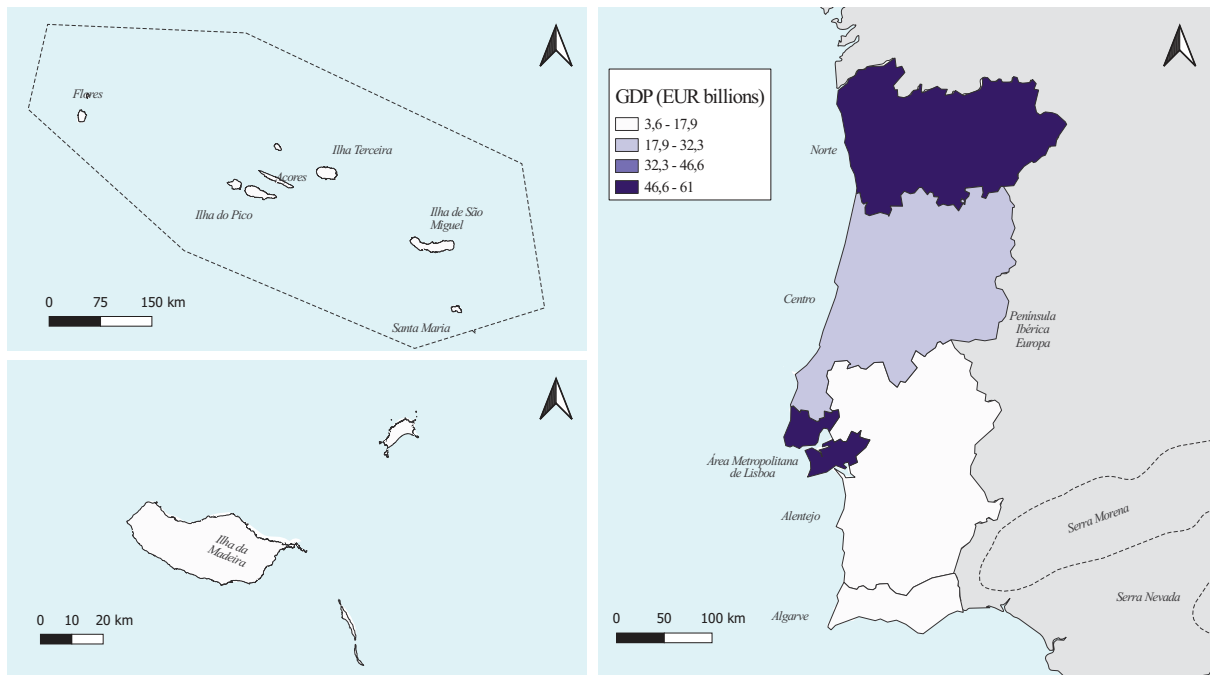
The methodology used to measure the blue economy of the Azores can be divided into two main stages: (i) defining and extracting the contribution of marine-related economic activities in the Azores region; (ii) calculating the systemic contribution of the blue economy through the partial hypothetical extraction method. Thus, this section aims to detail the methodological steps followed, as well as to present the databases used.

2.1 Data base

This work utilized two main databases: (i) the interregional input-output matrix of Portugal, estimated by Haddad *et al.* (2023)^[27]; and (ii) the microdata from the Integrated Business Accounts System 2.4 (SCIE), developed by the Statistics Portugal. The SCIE covers the population of companies engaged in the production of goods and/or services, excluding financial companies, insurers, and public administration units. The SCIE microdata were obtained through a request for accreditation and provision of statistical data (N° PED-651126895) from the Portuguese National Institute of Statistics, under the project "Measuring the Blue Economy in Portugal."

The interregional matrix of Portugal used in the study is the result of the work by Haddad *et al.* (2023)^[27]. This matrix divides intersectoral exchanges into seven regions: North (R01); Center (R02); Lisbon Metropolitan Area (R03); Alentejo (R04); Algarve

Figure 1: Map with the GDP of the regions of Portugal



Source: own elaboration based on Haddad *et al.*, 2023^[27]

(R05); Autonomous Region of the Azores (R06); and Autonomous Region of Madeira (R07). The information is presented in current values for 2017. The Figure 1 shows the GDP of each of these regions. The study area of this work, the Autonomous Region of the Azores, had the lowest contribution to the Portuguese GDP in 2017, according to the matrix data; its production corresponded to 2.1% of the total observed for the country. However, in relative terms, the region both employed more people and emitted more CO₂ than the Autonomous Region of Madeira: the Azores accounted for 2.42% of employment (compared to 2.13% for Madeira) and 1.82% of CO₂ emissions (compared to 1.69% for Madeira).

2.2 Defining and isolating the blue economy

To estimate the contribution of the blue economy of the Azores, the first step was to define and isolate the participation of economic activities directly linked to the sea. For this purpose, SCIE information on the production and demand of economic activities in the Azores and the reports from the Satellite Account of the Sea^[5] by Statistics Portugal (INE) were used to define sea-related activities.

First, information on sales, employment, wages, investment, and taxes for the RAA in 2017 was extracted from the microdata. In the RAA, 413 activities with employed labor were identified, totaling 66.5 thousand jobs, and 286 activities that had some sales, totaling 3.36 billion euros. It should be noted that the information is disaggregated at the five-digit level of the Economic Activities Classification (CAE5).

Next, after extracting the data, it is necessary to define which economic activities

are related to the sea. First, we compared the list of sea-related economic activities defined in the Satellite Account of the Sea (CSM)² by Statistics Portugal^[5], disregarding activities not included in the CSM. The **Figure 2** illustrates the information provided in the CSM. Three levels of observations are defined: i) “characteristic activities”, those in which part of the operations takes place at sea or whose products originate from, or have their final activity at, the sea or coast, such as: fishing and aquaculture, salt production, shipbuilding, port activity, maritime transport, among others; ii) “cross-sectional activities”, which support other activities considered in the CSM (e.g., maritime equipment and services); and iii) “activities favored by proximity to the sea”, which include coastal tourism.

Figure 2: Information provision scheme in CSM



Source: Statistics Portugal^[25].

The 65 sea-related products comprise nine groupings, defined following a value chain logic. The nine groups of maritime economic activities (products) are: i) fishing and aquaculture and the processing and marketing of their products; ii) non-living marine resources; iii) ports, transport, and logistics; iv) recreation, sports, culture, and tourism; v) shipbuilding, maintenance, and repair; vi) maritime equipment; vii) maritime infrastructure and works; viii) maritime services; and ix) new uses and resources of the sea.

The information provided by the CSM includes the levels of production and final demand for the nine defined groupings. For the activity level, the CSM data do not inform the values of production and final demand, hence the need to resort to the SCIE microdata. However, we have information about the level of inclusion of the economic activity in the CSM, categorized as "total", "partial", and "residual". After identifying the sea-related economic activities according to the CSM³, we consider the entire produc-

²The CSM results from a joint effort by Statistics Portugal and the Directorate-General for Maritime Policy, addressing the need for European countries to harmonize the accounting of maritime activities^[25,28].

³The economic activities in the CSM are at a more aggregated level, classified by the four-digit CAE,

tion value of activities with a "total" inclusion level as entirely sea-related. Furthermore, activities with a "residual" inclusion level are disregarded, as we understand that the production value of these activities directly related to the sea is marginal and can be measured using the hypothetical extraction methodology.

Considering the activities according to the CSM classification, the non-disregarded activities are classified into three criteria: i) activities that directly depend on the enjoyment of goods and services from marine ecosystems; ii) activities that provide goods and/or specific services to activities carried out at sea or in coastal areas; and iii) activities belonging to certain value chains of the function they provide, which can hardly be separated. Subsequently, activities classified by the third criterion are not treated as directly linked to the sea due to the difficulty in obtaining secondary data to determine the degree of partial inclusion of these activities and understanding that the intersectoral relationships of the value chain will be captured by the employed method. Thus, activities related to the manufacture and trade of textiles, furniture, machinery, and civil construction are not included, for example.

As mentioned, activities "totally" linked to the sea were considered at their total value, while "partially" linked activities used parameters gathered from secondary sources to measure the shares of the activity corresponding to the sea economy. For tourism activities, coefficients obtained from the methodological report of the Satellite Account of the Sea^[15] were used, as shown in Figure 3. Additionally, car rentals and sports equipment rentals use coefficients from travel agencies, while tourism activities (museums, zoos, aquariums, theme parks, etc.) use restaurant coefficients, believing that the shares of these sea-related activities are approximate.

Figure 3: Coefficients for tourist activities

NUTS I	Atividade Código CAE-Rev.3 / NACE Rev.2	Designação da atividade	2012	2016	2017	Fonte
Portugal Continental	55	Alojamento (excluindo turismo de negócios)	0,951	0,841	0,850	CST
	56	Restauração (excluindo turismo de negócios)	0,266	0,335	0,395	CST
	79	Agências de viagem	0,333	0,395	0,395	IDEF "Praia"
Região Autónoma da Madeira	55	Alojamento (excluindo turismo de negócios)		0,958	0,958	CSTR
	56	Restauração (excluindo turismo de negócios)		0,466	0,466	CSTR
	79	Agências de viagem (% <i>incoming + outgoing</i>)		0,829	0,829	CSTR /IDEF
Região Autónoma dos Açores	55	Alojamento (excluindo turismo de negócios)		0,932	0,932	CSTR
	56	Restauração (excluindo turismo de negócios)		0,398	0,398	CSTR
	79	Agências de viagem (% <i>incoming + outgoing</i>)		0,650	0,650	CSTR /IDEF

Source: Sea Satellite Account Methodological Report 2016-2018^[15].

and compatibility between the two bases was carried out.

The real estate activities were considered based on the proportion of secondary residences in the Azores region as linked to the promotion of coastal tourism. Thus, it was calculated from the 2021 Census data on the Portuguese housing stock that 12.5% of residences in the RAA are secondary. In the Public Administration, Defense, and Social Security sector, it was decided to extract only the portion related to the Portuguese Navy as a sea-related activity. Therefore, as data for the RAA were found, the following proxy was calculated:

$$NavyExpRAA = \frac{N^{\circ}MilitaryRAA}{N^{\circ}MilitaryPT} \times NavyExpPT$$

where $NavyExpRAA$ is the proxy for the total value of navy expenditures in the Autonomous Region of the Azores, $N^{\circ}MilitaryRAA$ is the number of military personnel in the RAA, $N^{\circ}MilitaryPT$ is the total number of military personnel in Portugal, and $NavyExpPT$ are the navy expenditures in Portugal. Thus, it was estimated that 1.75% of the public administration sector is directly part of the blue economy.

Once the parameters are defined, the production values can be distributed among the activities to reorganize them into the 65 sectors of the interregional input-output matrix. In the Portuguese IIOS used in this work, there are seven regions and 65 sectors, with $r = (1, 2, \dots, 7)$ and $j = (1, 2, \dots, 65)$, respectively. Each sector j consists of K unique activities, identified by the CAE5 code. Let x_k^r be the supply of activity k in region r , then the supply of sector j in region r will be $x_j^r = \sum_{k=1}^K x_k^r$.

Each activity k is classified according to its contribution to the blue economy in the region r , represented by θ_k^r , where:

$$0 \leq \theta_k^r \leq 1$$

with $\theta_k^r = 0$ if the activity has no participation in the blue economy and $\theta_k^r = 1$ when the activity is entirely linked to the sea. Thus, the participation of the blue economy in the production of sector j in the region r is given by:

$$\check{x}_j^r = \sum_{k=1}^K \theta_k^r x_k^r$$

Thus, the share of the gross production value for each sector j in the RAA that is not directly related to the blue economy is calculated as:

$$F_j^r = 1 - \frac{\check{x}_j^r}{x_j^r}$$

where \check{x}_j^r is the sea-related production of sector j and x_j^r is the total production of sector j , both in region r , which, in this work, is the Autonomous Region of the Azores. Thus, the resulting vector F is used in the partial hypothetical extraction, explained in more detail below⁴.

⁴In order to check the robustness of the blue economy calculation method in this work, the total value of activities directly related to the blue economy is compared with the total value calculated by Statistics Portugal in CSM. Here, 561.8 million euros were calculated, while at CSM the value is 555.8 million, which are very close.

2.3 Hypothetical Extraction Method

The hypothetical extraction method, initially proposed by Dietzenbacher *et al.* (1993)^[29], involves the hypothetical removal of a region or sector from the input-output matrix. The aim is to measure the potential reduction in the total production of an economy if that sector or region is excluded. This approach allows for analyzing the relevance of a sector/region within the economic structure by considering its removal and the subsequent decrease in the level of economic activity. It is crucial to highlight that the systemic impact is greater when there is a higher interdependence of this sector with the others.

Instead of extracting an entire sector, this work proposes an adaptation of this method, the partial hypothetical extraction, a method widely used^[4,30,31], following Haddad *et al.* (2020)^[32]. Here, a part of all sectors is extracted according to the share of production linked to the blue economy of each one, as previously estimated.

The systemic spillover effects inter-regionally through trade are fully taken into account by the clear specification of trade connections between the regions. Thus, an input-output flow table for an economy with n sectors and r regions can be represented by Figure 4:

Figure 4: Interregional Input-Output Flows

	Processing sectors							Final demand				Total output	
	11	...	rn	...	$r1$...	rn	c	i	g	e	x	
Processing sectors	11	Z_{11}^{11}	...	Z_{1n}^{11}	...	Z_{11}^{1r}	...	Z_{1n}^{1r}	c_1^1	i_1^1	g_1^1	e_1^1	x_1^1
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
	1n	Z_{n1}^{11}	...	Z_{nn}^{11}	...	Z_{n1}^{1r}	...	Z_{nn}^{1r}	c_n^1	i_n^1	g_n^1	e_n^1	x_n^1
	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
	$r1$	Z_{11}^{r1}	...	Z_{1n}^{r1}	...	Z_{11}^{rr}	...	Z_{1n}^{rr}	c_1^r	i_1^r	g_1^r	e_1^r	x_1^r
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	
rn	Z_{n1}^{r1}	...	Z_{nn}^{r1}	...	Z_{n1}^{rr}	...	Z_{nn}^{rr}	c_n^r	i_n^r	g_n^r	e_n^r	x_n^r	
Imports	m_1^1	...	m_n^1	...	m_1^r	...	m_n^r	m_c	m_i	m_g	m_e	m	
Indirect taxes	t_1^1	...	t_n^1	...	t_1^r	...	t_n^r	t_c	t_i	t_g	t_e	t	
Labor payments	l_1^1	...	l_n^1	...	l_1^r	...	l_n^r					l	
Other payments	n_1^1	...	n_n^1	...	n_1^r	...	n_n^r					n	
Outlays	x_1^1	...	x_n^1	...	x_1^r	...	x_n^r	c	i	g	e		
Employment	L_1^1	...	L_n^1	...	L_1^r	...	L_n^r					L	

Source: adapted from Haddad (2024)^[4].

with z_{ij}^{rs} , where $i, j = 1, \dots, J$ and $r, s = 1, \dots, R$ representing the inter-industry sales from sector i in region r to industry j in region s ; m_i^s and t_i^s with $i = 1, \dots, n, c, i, g, e$ representing, respectively, imports and indirect taxes in region s ; l_j^s and n_j^s , with $j = 1, \dots, J$ and $s = 1, \dots, R$ representing, respectively, payments by sectors for labor services and all other items of value added in region s ; c_i^r , i_i^r , g_i^r , and e_i^r with $i = 1, \dots, J$ and $r = 1, \dots, R$ representing the regional components of final demand, f_i^* , respectively, household consumption, investment, government expenditures, and exports from region r ; x_i^r , with $i = 1, \dots, J$ and $r = 1, \dots, R$ is the total sectoral production in region r .

Assuming that the share of the blue economy in the total sectoral production can be

identified as $\frac{\check{x}_j^r}{x_j^r}$, it is defined that the factors jxs (F_j^r), where $0 < F_j^r < 1$, represent the portion of production in each sector j of each region r that is not directly related to the blue economy. Since the objective of this article is to measure the blue economy of the Azores region, the factors F_j^r will be equal to one in all regions r , except for the Azores region ($r = 6$).

Thus, for each z_{ij}^{rs} , where $i, j = 1, \dots, J$ and $r, s = 1, \dots, R$, a corresponding restricted flow, \overline{z}_{ij}^{rs} , is calculated as follows:

$$\overline{z}_{ij}^{rs} = \begin{cases} F_i^r z_{ij}^{rs}, & \text{if } F_i^r < F_j^s \\ F_j^s z_{ij}^{rs}, & \text{if } F_i^r > F_j^s \end{cases}$$

In addition to the supply-side constraints related to the factor F_i^r , additional constraints on the demand side may be added. For each component of final demand, a demand-side factor, F_u^s , where $u = c, i, g, e$ and $s = 1, \dots, R$, can be specified.

Then, F_c^s is calculated based on the total aggregated income in the region s , excluding the income of workers employed in maritime economy activities in the Azores region. Thus, F_c^s defines the portion of income not directly related to the sea. F_i^s is calculated by subtracting from the total the share of investments associated with maritime economic activities. Similarly, F_g^s is calculated based on taxes paid by businesses. Finally, F_e^s is defined as one, assuming implicitly that external demand for exports is entirely exogenous.

Therefore, considering each component of final demand, f_{iu}^{rs} , the following rule is applied. For each f_{iu}^{rs} , with $i = 1, \dots, J$, $u = c, i, g, e$ and $r, s = 1, \dots, R$, a corresponding restricted flow, \overline{f}_{lu}^{rs} , is calculated as follows:

$$\overline{f}_{lu}^{rs} = \begin{cases} F_i^r f_{iu}^{rs}, & \text{if } F_i^r < F_u^s \\ F_u^s f_{iu}^{rs}, & \text{if } F_i^r > F_u^s \end{cases}$$

After applying the factors to the components of the original input-output matrix, two inter+industry flow matrices, Z and \overline{Z} , and two final demand vectors, f and \overline{f} , are obtained. Consequently, two distinct technical coefficient matrices, A and \overline{A} , can be derived.

In the inter-regional input-output model with the original sectoral flows, the production of this economy is given by:

$$x = (I - A)^{-1}f$$

where x is the gross production value, f is the final demand vector, and $(I - A)^{-1}$ is the Leontief inverse matrix.

Using \overline{A} and \overline{f} , which are, respectively, the matrix of technical coefficients and the final demand vector with the restriction on intersectoral flows due to the exclusion of activities related to the blue economy, the gross production value of this economy will be given by:

$$\overline{x} = (I - \overline{A})^{-1}\overline{f}$$

Thus, after applying the hypothetical extraction, one can calculate:

$$T = i'x - i'\overline{x}$$

where T is the annual aggregate loss to the economy, reflected by the reduction in total production, if the production associated with activities related to the sea were to "disappear". That is, it is a measure of the relative importance of sea-dependent activities or the total connections with which these activities are associated.

To find the results concerning GDP, CO₂ emissions, and employment, the results of gross sectoral production are converted by multiplying the gross production vector, x or \bar{x} , by a diagonal matrix, \hat{V} , whose main diagonal contains the coefficients of the variable (GDP, CO₂, or employment), i.e., the ratios of the variable values by sector-region divided by the respective sectoral-regional gross production.

2.3.1 Decomposing the results

The results obtained from the hypothetical extraction of maritime activities can be decomposed into initial effects, direct effects, and indirect effects, with the sum representing the total effect. The decomposition idea essentially follows that employed by Haddad *et al.*^[33]. The total effect refers to the impact on the total output of each sector and region resulting from the hypothetical extraction of maritime activities, obtained from the difference:

$$T = \Delta x = i'x - i'\bar{x}$$

The initial effects (or first-order effects), in this context, are equivalent to the loss in total production in the Azores region when only those activities immediately related to the sea are removed. That is, the initial effects, x^* , are equivalent to the Gross Production Value (GPV) vector containing non-zero values only for activities identified as immediately related to the sea, weighted by the contributions θ_k^r calculated as follows:

$$Initial\ Effects = x^* = \frac{\check{x}_j^r}{x_j^r}$$

Direct effects (or second-order effects) refer to the production losses caused by the reduction in output from suppliers to maritime economy activities in the Azores. In this sense, the direct effects are computed as follows:

$$Direct\ Effects = Af - \overline{Af}$$

Indirect effects refer to the impact of the extraction of maritime activities on the production of suppliers to suppliers of the maritime economy, and so on. They are obtained by residual, from the expression:

$$Indirect\ Effects = \Delta x - Initial\ Effects - Direct\ Effects$$

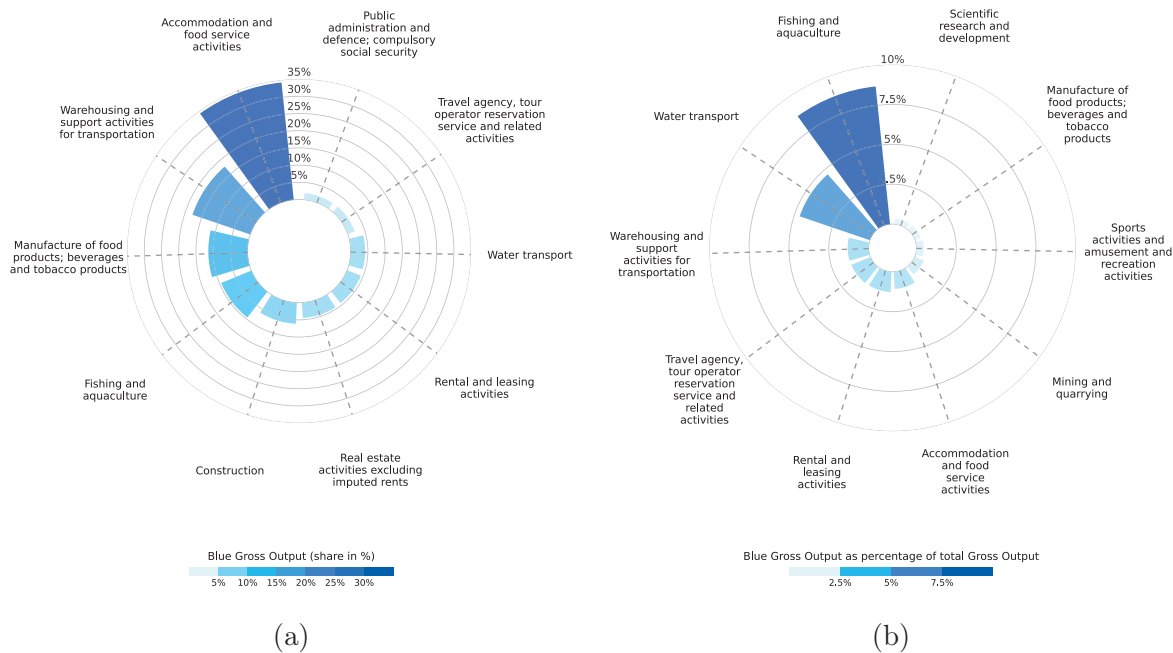
Additionally, the results obtained for GPV are converted into values of GDP, CO₂ emissions, and employment (the latter for different categories of workers). For this purpose, a diagonal matrix of coefficients, \hat{V} , is multiplied by the vector of hypothetical production losses, T_j .

3 Results

Compared to the mainland and the Autonomous Region of Madeira, the Azores has the second-largest coastal area, extending over 667 km. It is along this stretch that activities directly related to the sea are developed. For the year 2017, the Gross Value of Production (GVP) of these activities contributed approximately 0.13% to the national GVP. From a regional perspective, the value is naturally higher: for the same year, approximately 7.69% of the GVP in the Azores originates from blue economy activities.

The Figure 5a and Figure 5b respectively present the top ten sectors contributing to the GVP of the marine economy in the Azores and to the GVP of the corresponding sector in the Portuguese economy. In both cases, activities related to tourism, transportation, and food manufacturing stand out. It is noted that while the accommodation, food manufacturing, and storage sectors lead in contributing to the GVP of the marine economy in the region (and thus to the regional GVP), this is not observed when the relationship is established with the total sectoral production: the contribution of the Azorean marine economy to the accommodation, food manufacturing, and storage sectors corresponds to 1.08%, 0.37%, and 1.31% of the production of those sectors in the Portuguese economy, respectively, placing them behind other activities, such as fishing and maritime transport.

Figure 5: Relative importance of the blue economy of the Azores



Source: own elaboration.

It is estimated that 15,404 jobs in the Azores are directly related to blue economy activities. Predominantly, the blue economy in the Azores employs men (approximately 59.08%, compared to 40.83% women), adults (84.55%, in contrast to 7.91% youth and 7.46% elderly), and Portuguese nationals (only 1.75% of employees are immigrants). These activities are directly associated with the emission of 103 tons of CO₂ on an annual basis.

This work aims to measure the importance of blue economy activities in the Azores for both the local and Portuguese economies. The estimated systemic results are then categorized into three areas: economic; environmental; and social.

3.1 Economic results

From [Table 2](#) to [Table 11](#), the systemic contributions of the marine economy in the Azores region to the sectors of the Portuguese economy are presented, while [Table 1](#) demonstrates the effects in each region. Three elements directly influence the size of the estimated effect: i) the adjustment factors of the vector F , which provide the estimated direct contribution of the marine economy to each sector; ii) the intersectoral and inter-regional linkages of the economy; and iii) the assumption that the components of internal absorption are influenced by income generated in the marine economy — and its accounting could raise the level of local activity, therefore^[4].

The [Table 3](#) suggests that, considering both direct and indirect effects, the marine economy in the Azores contributes approximately 0.41% to the national GDP. Furthermore, as observed in [Table 1](#), the blue economy accounts for 16.58% of the GDP of the Autonomous Region of the Azores.

Regarding [Table 1](#), it is noted that of the total gross production of the Azorean economy related to blue economy, 40.35% is due to direct and indirect spillover effects. Additionally, the direct contribution of the maritime activities in the Azorean region to Portugal's production is 0.16%, with the total effect being 0.31%, and an implicit multiplier of approximately 1.93.

According to [Table 1](#), the effects of marine extraction are most prominent on the production of the Madeira and Lisbon Metropolitan Area regions (0.07% and 0.066%, respectively), while the Center region is the least affected (0.014%). These are also the regions where the direct impact proportional to GVP is most pronounced (0.012% for the Lisbon Metropolitan Area and 0.029% for the Madeira region), with the ratio of direct to total effects being higher in Madeira compared to Lisbon — indicating that while Madeira relies relatively more on the effect of direct trade with the blue economy of the RAA, Lisbon depends on its chain effects.

It can be observed from [Tables 2](#) and [3](#) that the sectors with the largest total economic impacts are precisely those highlighted in [Figure 5](#), namely: Accommodation and food service activities (15.89%, relative to GVP); Warehousing and support activities for transportation (9.51%); Manufacture of food products, beverages, and tobacco products (8.1%); Construction (4.9%); Wholesale trade, except of motor vehicles and motorcycles (4.6%); and Fishing and aquaculture (4.25%). Except for the Wholesale trade sector, all mentioned sectors are, in some part, directly linked to the marine economy.

Furthermore, it is important to highlight the systemic effects that "take" the sea to sectors not directly linked to these characteristic activities, in addition to the Wholesale trade. These include: Crop and animal production, hunting and related service activities; Electricity, gas, steam, and air conditioning supply; Retail trade; Financial service activities; and Legal, accounting, head offices, and management consultancy activities. Thus, these activities, although not directly related to maritime activities, are important for the execution of direct marine activities, following a value chain logic of the blue economy.

Finally, [Tables 2](#) and [3](#) reveal that, as shown in [Figure 5](#), two sectors have a significant

contribution from the blue economy of the Azores to the total production of the sector in Portugal due to the direct link of these economic activities with the sea: Fishing and aquaculture, and Water transport. Given that the Autonomous Region of the Azores represents a significant portion of Portugal's coastal area, it is expected that such activities in this region, typically developed in seas and rivers, have a significant contribution to the total sectoral productive activity of the country.

Table 1: Systemic effects of the blue economy of the Azores in each region of Portugal

	REG	Region	Initial effect	Direct effect	Indirect effect	Total effect
GVP	R01	Norte	0.000%	0.006%	0.030%	0.036%
	R02	Centro	0.000%	0.002%	0.012%	0.014%
	R03	A. M. de Lisboa	0.000%	0.012%	0.054%	0.066%
	R04	Alentejo	0.000%	0.008%	0.022%	0.029%
	R05	Algarve	0.000%	0.005%	0.026%	0.031%
	R06	R. A. dos Açores	9.320%	1.394%	4.911%	15.624%
	R07	R. A. da Madeira	0.000%	0.029%	0.041%	0.070%
		Total	0.162%	0.032%	0.119%	0.313%
GDP	REG	Region	Initial effect	Direct effect	Indirect effect	Total effect
	R01	Norte	0.000%	0.012%	0.034%	0.046%
	R02	Centro	0.000%	0.006%	0.020%	0.025%
	R03	A. M. de Lisboa	0.000%	0.024%	0.065%	0.089%
	R04	Alentejo	0.000%	0.010%	0.033%	0.043%
	R05	Algarve	0.000%	0.011%	0.030%	0.042%
	R06	R. A. dos Açores	13.923%	1.177%	1.475%	16.576%
	R07	R. A. da Madeira	0.000%	0.022%	0.063%	0.086%
	Total	0.292%	0.040%	0.073%	0.405%	
CO2 emissions	REG	Region	Initial effect	Direct effect	Indirect effect	Total effect
	R01	Norte	0.000%	0.013%	0.043%	0.056%
	R02	Centro	0.000%	0.002%	0.022%	0.024%
	R03	A. M. de Lisboa	0.000%	0.012%	0.049%	0.061%
	R04	Alentejo	0.000%	0.020%	0.060%	0.081%
	R05	Algarve	0.000%	0.007%	0.029%	0.036%
	R06	R. A. dos Açores	11.392%	1.555%	4.668%	17.615%
	R07	R. A. da Madeira	0.000%	0.037%	0.107%	0.144%
	Total	11.392%	1.647%	4.977%	18.016%	
Employment	REG	Region	Initial effect	Direct effect	Indirect effect	Total effect
	R01	Norte	0.000%	0.012%	0.034%	0.046%
	R02	Centro	0.000%	0.006%	0.020%	0.025%
	R03	A. M. de Lisboa	0.000%	0.027%	0.065%	0.092%
	R04	Alentejo	0.000%	0.008%	0.031%	0.040%
	R05	Algarve	0.000%	0.014%	0.033%	0.047%
	R06	R. A. dos Açores	13.527%	1.283%	1.520%	16.330%
	R07	R. A. da Madeira	0.000%	0.021%	0.061%	0.082%
	Total	0.321%	0.045%	0.076%	0.442%	
Employment (men)	REG	Region	Initial effect	Direct effect	Indirect effect	Total effect
	R01	Norte	0.000%	0.013%	0.038%	0.052%
	R02	Centro	0.000%	0.006%	0.023%	0.028%
	R03	A. M. de Lisboa	0.000%	0.030%	0.073%	0.103%
	R04	Alentejo	0.000%	0.009%	0.037%	0.047%
	R05	Algarve	0.000%	0.015%	0.036%	0.050%
	R06	R. A. dos Açores	14.612%	1.630%	1.857%	18.100%
	R07	R. A. da Madeira	0.000%	0.026%	0.074%	0.100%
	Total	0.364%	0.057%	0.090%	0.512%	
Employment (women)	REG	Region	Initial effect	Direct effect	Indirect effect	Total effect
	R01	Norte	0.000%	0.010%	0.030%	0.040%
	R02	Centro	0.000%	0.005%	0.017%	0.022%
	R03	A. M. de Lisboa	0.000%	0.024%	0.059%	0.083%
	R04	Alentejo	0.000%	0.008%	0.024%	0.032%
	R05	Algarve	0.000%	0.014%	0.031%	0.045%
	R06	R. A. dos Açores	12.286%	0.885%	1.134%	14.305%
	R07	R. A. da Madeira	0.000%	0.016%	0.048%	0.064%
	Total	0.277%	0.033%	0.061%	0.372%	
Employment (youth)	REG	Region	Initial effect	Direct effect	Indirect effect	Total effect
	R01	Norte	0.000%	0.013%	0.037%	0.050%
	R02	Centro	0.000%	0.006%	0.022%	0.028%
	R03	A. M. de Lisboa	0.000%	0.028%	0.067%	0.095%
	R04	Alentejo	0.000%	0.010%	0.033%	0.043%
	R05	Algarve	0.000%	0.018%	0.038%	0.057%
	R06	R. A. dos Açores	16.002%	1.364%	1.602%	18.968%
	R07	R. A. da Madeira	0.000%	0.024%	0.071%	0.094%
	Total	0.453%	0.054%	0.087%	0.594%	
Employment (adults)	REG	Region	Initial effect	Direct effect	Indirect effect	Total effect
	R01	Norte	0.000%	0.012%	0.035%	0.047%
	R02	Centro	0.000%	0.006%	0.020%	0.026%
	R03	A. M. de Lisboa	0.000%	0.027%	0.067%	0.095%
	R04	Alentejo	0.000%	0.009%	0.032%	0.040%
	R05	Algarve	0.000%	0.015%	0.034%	0.049%
	R06	R. A. dos Açores	13.619%	1.277%	1.519%	16.415%
	R07	R. A. da Madeira	0.000%	0.022%	0.063%	0.084%
	Total	0.327%	0.046%	0.077%	0.450%	
Employment (elderly)	REG	Region	Initial effect	Direct effect	Indirect effect	Total effect
	R01	Norte	0.000%	0.009%	0.027%	0.036%
	R02	Centro	0.000%	0.004%	0.017%	0.021%
	R03	A. M. de Lisboa	0.000%	0.022%	0.054%	0.076%
	R04	Alentejo	0.000%	0.007%	0.029%	0.035%
	R05	Algarve	0.000%	0.011%	0.028%	0.039%
	R06	R. A. dos Açores	10.778%	1.305%	1.496%	13.579%
	R07	R. A. da Madeira	0.000%	0.017%	0.051%	0.067%
	Total	0.209%	0.037%	0.061%	0.307%	
Employment (migrants)	REG	Region	Initial effect	Direct effect	Indirect effect	Total effect
	R01	Norte	0.000%	0.014%	0.035%	0.049%
	R02	Centro	0.000%	0.005%	0.020%	0.026%
	R03	A. M. de Lisboa	0.000%	0.028%	0.065%	0.093%
	R04	Alentejo	0.000%	0.013%	0.037%	0.050%
	R05	Algarve	0.000%	0.018%	0.034%	0.052%
	R06	R. A. dos Açores	21.079%	1.425%	1.450%	23.955%
	R07	R. A. da Madeira	0.000%	0.024%	0.065%	0.089%
	Total	0.088%	0.026%	0.053%	0.167%	

Table 2: Systemic effects of the blue economy of the Azores on GVP by sector

Sector	GVP	Blue economy (EUR million)				Blue economy (% of BE total)				Blue economy (% of sectoral total)			
		Initial effect	Direct effect	Indirect effect	Total effect	Initial effect	Direct effect	Indirect effect	Total effect	Initial effect	Direct effect	Indirect effect	Total effect
S01 Crop and animal production, hunting and related service activities	7074	0	11	35	46	0.00	10.12	5.90	3.67	0.00	0.16	0.49	0.65
S02 Forestry and logging	1265	0	0	2	2	0.00	0.04	0.33	0.16	0.00	0.00	0.15	0.15
S03 Fishing and aquaculture	612	53	0	0	53	0.02	0.01	0.01	4.25	8.69	0.00	0.01	8.70
S04 Mining and quarrying	1246	8	0	1	9	1.39	0.05	0.12	0.68	0.62	0.00	0.06	0.69
S05 Manufacture of food products, beverages and tobacco products	17303	64	15	22	101	11.40	13.95	3.79	8.10	0.37	0.09	0.13	0.59
S06 Manufacture of textiles, wearing apparel, leather and related products	11171	0	0	5	5	0.00	0.28	0.87	0.43	0.00	0.00	0.05	0.05
S07 Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	3253	0	1	4	5	0.00	0.83	0.68	0.39	0.00	0.03	0.12	0.15
S08 Manufacture of paper and paper products	4223	0	1	6	6	0.00	0.67	0.96	0.50	0.00	0.02	0.13	0.15
S09 Printing and reproduction of recorded media	1005	0	1	3	5	0.00	0.98	0.60	0.36	0.00	0.11	0.34	0.45
S10 Manufacture of coke and refined petroleum products	7138	0	2	6	8	0.00	1.54	1.12	0.65	0.00	0.02	0.09	0.11
S11 Manufacture of chemicals and chemical products	4703	0	0	4	4	0.00	0.40	0.68	0.35	0.00	0.01	0.08	0.09
S12 Manufacture of basic pharmaceutical products and pharmaceutical preparations	1265	0	0	1	1	0.00	0.06	0.18	0.09	0.00	0.01	0.08	0.09
S13 Manufacture of rubber and plastic products	4138	0	1	4	5	0.00	0.54	0.65	0.35	0.00	0.01	0.09	0.11
S14 Manufacture of other non-metallic mineral products	4054	0	2	7	9	0.00	2.19	1.19	0.74	0.00	0.06	0.17	0.23
S15 Manufacture of basic metals	2850	0	0	2	2	0.00	0.15	0.29	0.15	0.00	0.01	0.06	0.06
S16 Manufacture of fabricated metal products, except machinery and equipment	6569	0	2	8	10	0.00	1.63	1.43	0.81	0.00	0.03	0.13	0.15
S17 Manufacture of computer, electronic and optical products	2300	0	0	1	1	0.00	0.05	0.16	0.08	0.00	0.00	0.04	0.04
S18 Manufacture of electrical equipment	2712	0	0	1	2	0.00	0.15	0.25	0.13	0.00	0.01	0.05	0.06
S19 Manufacture of machinery and equipment n.e.c.	2716	0	0	2	2	0.00	0.10	0.26	0.13	0.00	0.00	0.06	0.06
S20 Manufacture of motor vehicles, trailers and semi-trailers	9242	0	0	1	1	0.00	0.02	0.23	0.11	0.00	0.00	0.01	0.02
S21 Manufacture of other transport equipment	782	0	0	0	0	0.00	0.02	0.05	0.02	0.00	0.00	0.04	0.04
S22 Manufacture of furniture, other manufacturing	3045	0	0	3	3	0.00	0.30	0.53	0.27	0.00	0.01	0.10	0.11
S23 Repair and installation of machinery and equipment	1849	3	2	4	8	0.49	1.56	0.60	0.64	0.15	0.09	0.19	0.43
S24 Electricity, gas, steam and air conditioning supply	15666	0	4	46	50	0.00	3.86	7.86	3.98	0.00	0.03	0.29	0.32
S25 Water collection, treatment and supply	1546	0	1	4	4	0.00	0.58	0.64	0.35	0.00	0.04	0.24	0.28
S26 Sewerage, waste management, remediation activities	2761	0	1	6	6	0.00	0.55	0.89	0.46	0.00	0.02	0.19	0.21
S27 Construction	18770	35	8	19	61	6.15	7.45	3.21	4.90	0.18	0.04	0.10	0.33
S28 Wholesale and retail trade and repair of motor vehicles and motorcycles	5036	0	1	10	11	0.00	0.73	1.75	0.87	0.00	0.02	0.20	0.22
S29 Wholesale trade, except of motor vehicles and motorcycles	20122	0	10	47	58	0.00	9.35	8.15	4.60	0.00	0.05	0.23	0.29
S30 Retail trade, except of motor vehicles and motorcycles	14572	0	4	31	35	0.00	3.58	5.42	2.83	0.00	0.03	0.22	0.24
S31 Land transport and transport via pipelines	7949	0	2	16	18	0.00	2.06	2.70	1.43	0.00	0.03	0.20	0.23
S32 Water transport	509	24	0	0	24	4.21	0.20	0.04	1.92	4.65	0.04	0.04	4.74
S33 Air transport	4311	0	0	3	3	0.00	0.42	0.45	0.25	0.00	0.01	0.06	0.07
S34 Warehousing and support activities for transportation	7584	100	10	119	1775	8.65	1.70	0.51	1.31	0.13	0.13	1.57	1.77
S35 Postal and courier activities	986	0	0	2	2	0.00	0.24	0.38	0.20	0.00	0.03	0.22	0.25
S36 Accommodation and food service activities	17896	193	3	4	199	34.28	2.39	0.65	15.89	1.08	0.01	0.02	1.11
S37 Publishing activities	842	0	0	2	2	0.00	0.10	0.31	0.15	0.00	0.01	0.21	0.22
S38 Motion picture, video, television programme production, programming and broadcasting activities	1668	0	0	4	4	0.00	0.07	0.67	0.33	0.00	0.00	0.23	0.24
S39 Telecommunications	5665	0	1	13	14	0.00	1.23	2.20	1.13	0.00	0.02	0.22	0.25
S40 Computer programming, consultancy, and information service activities	4521	0	1	9	10	0.00	0.89	1.54	0.79	0.00	0.02	0.20	0.22
S41 Financial service activities, except insurance and pension funding	10071	0	5	27	32	0.00	4.24	4.63	2.52	0.00	0.05	0.27	0.31
S42 Insurance, reinsurance and pension funding, except compulsory social security	3053	0	1	6	7	0.00	0.56	1.03	0.53	0.00	0.02	0.20	0.22
S43 Activities auxiliary to financial services and insurance activities	1424	0	0	3	3	0.00	0.10	0.49	0.23	0.00	0.01	0.20	0.21
S44 Imputed rents of owner-occupied dwellings	14542	0	0	26	26	0.00	0.15	4.48	2.09	0.00	0.00	0.18	0.18
S45 Real estate activities excluding imputed rents	9837	25	3	9	36	4.46	2.42	1.50	2.91	0.25	0.03	0.09	0.37
S46 Legal and accounting activities; activities of head offices; management consultancy activities	1137	0	4	20	23	0.00	3.40	3.37	1.86	0.00	0.05	0.28	0.33
S47 Architectural and engineering activities; technical testing and analysis	2630	0	1	7	8	0.00	1.06	1.18	0.64	0.00	0.04	0.26	0.30
S48 Scientific research and development	851	3	0	1	4	0.53	0.08	0.09	0.29	0.35	0.01	0.06	0.42
S49 Advertising and market research	1821	0	1	5	6	0.00	0.93	0.93	0.51	0.00	0.06	0.30	0.35
S50 Other professional, scientific and technical activities; veterinary activities	1137	0	0	2	2	0.00	0.33	0.29	0.16	0.00	0.03	0.15	0.18
S51 Rental and leasing activities	1907	24	1	2	28	4.31	1.33	0.36	2.22	1.27	0.08	0.11	1.46
S52 Employment activities	1678	0	1	4	5	0.00	0.73	0.68	0.38	0.00	0.05	0.24	0.28
S53 Travel agency, tour operator reservation service and related activities	926	12	1	1	13	2.13	0.47	0.13	1.06	1.29	0.06	0.08	1.43
S54 Security and investigation, service and landscape, office administrative and support activities	5987	0	4	17	21	0.00	3.52	2.87	1.64	0.00	0.07	0.28	0.34
S55 Public administration and defence; compulsory social security	15864	11	1	33	46	1.96	0.91	5.77	3.63	0.07	0.01	0.21	0.29
S56 Education	11286	0	0	21	22	0.00	0.18	3.67	1.72	0.00	0.00	0.19	0.19
S57 Human health activities	14034	0	0	25	25	0.00	0.33	4.23	1.99	0.00	0.00	0.17	0.18
S58 Residential care activities and social work activities without accommodation	4543	0	0	12	12	0.00	0.63	2.07	0.96	0.00	0.00	0.26	0.27
S59 Creative, arts and entertainment activities; libraries, archives, museums and other cultural activities; gambling and betting activities	1377	0	0	2	2	0.00	0.06	0.42	0.20	0.00	0.01	0.17	0.18
S60 Sports activities and amusement and recreation activities	1794	8	1	1	11	1.48	0.79	0.24	0.85	0.46	0.05	0.08	0.59
S61 Activities of membership organisations	1574	0	0	4	4	0.00	0.13	0.62	0.30	0.00	0.01	0.23	0.24
S62 Repair of computers and personal and household goods	328	0	1	1	1	0.08	0.08	0.14	0.07	0.00	0.00	0.25	0.28
S63 Other personal service activities	1935	0	0	4	4	0.00	0.16	0.67	0.32	0.00	0.01	0.20	0.21
S64 Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use	1114	0	0	4	4	0.00	0.00	0.62	0.29	0.00	0.00	0.32	0.32
S65 Activities of extraterritorial organisations and bodies	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Portugal	347793	562	111	580	1253	100	100	100	100	0.16	0.03	0.17	0.36

Source: own elaboration.

Table 3: Systemic effects of the blue economy of the Azores on GDP by sector

Sector	GDP	Blue economy (EUR million)				Blue economy (% GDP)				Blue economy (% sectoral GDP)			
		Initial effect	Direct effect	Indirect effect	Total effect	Initial effect	Direct effect	Indirect effect	Total effect	Initial effect	Direct effect	Indirect effect	Total effect
S01 Crop and animal production, hunting and related service activities	2877	15	7	5	27	3.03	9.95	4.33	3.94	0.52	0.23	0.19	0.94
S02 Forestry and logging	896	0	0	1	2	0.08	0.05	0.86	0.22	0.05	0.00	0.12	0.17
S03 Fishing and aquaculture	334	37	0	0	37	7.48	0.02	0.01	5.40	11.11	0.00	0.00	11.12
S04 Mining and quarrying	699	5	0	0	5	1.00	0.05	0.29	0.78	0.81	0.01	0.06	0.88
S05 Manufacture of food products; beverages and tobacco products	4188	12	3	2	17	2.50	3.87	1.31	2.42	0.30	0.06	0.01	0.40
S06 Manufacture of textiles, wearing apparel, leather and related products	4186	0	0	2	2	0.04	0.35	1.34	0.31	0.01	0.01	0.04	0.05
S07 Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	997	0	0	1	2	0.10	0.68	0.76	0.27	0.05	0.05	0.09	0.19
S08 Manufacture of paper and paper products	881	0	0	1	1	0.00	0.68	0.73	0.20	0.00	0.05	0.10	0.16
S09 Printing and reproduction of recorded media	444	0	1	1	2	0.07	1.19	0.80	0.31	0.08	0.18	0.22	0.49
S10 Manufacture of coke and refined petroleum products	824	0	0	1	1	0.00	0.44	0.52	0.14	0.00	0.04	0.08	0.11
S11 Manufacture of chemicals and chemical products	940	0	0	1	1	0.03	0.39	0.62	0.17	0.02	0.03	0.08	0.12
S12 Manufacture of basic pharmaceutical products and pharmaceutical preparations	591	0	0	0	1	0.00	0.11	0.38	0.08	0.00	0.01	0.08	0.09
S13 Manufacture of rubber and plastic products	1251	0	1	0	1	0.01	0.76	0.60	0.19	0.00	0.04	0.06	0.10
S14 Manufacture of other non-metallic mineral products	1448	1	1	1	3	0.21	1.39	0.98	0.47	0.07	0.06	0.08	0.22
S15 Manufacture of basic metals	474	0	0	0	0	0.00	0.11	0.18	0.04	0.00	0.02	0.05	0.07
S16 Manufacture of fabricated metal products, except machinery and equipment	2364	1	1	2	4	0.25	1.41	1.43	0.57	0.05	0.04	0.08	0.17
S17 Manufacture of computer, electronic and optical products	594	0	0	0	0	0.00	0.03	0.14	0.03	0.00	0.00	0.03	0.04
S18 Manufacture of electrical equipment	647	0	0	0	0	0.00	0.18	0.23	0.06	0.00	0.02	0.04	0.06
S19 Manufacture of machinery and equipment n.e.c.	896	0	0	0	1	0.02	0.12	0.31	0.08	0.01	0.01	0.04	0.06
S20 Manufacture of motor vehicles, trailers and semi-trailers	1507	0	0	0	0	0.00	0.01	0.17	0.03	0.00	0.00	0.01	0.01
S21 Manufacture of other transport equipment	186	0	0	0	0	0.00	0.01	0.05	0.01	0.00	0.00	0.00	0.00
S22 Manufacture of furniture; other manufacturing	1141	0	0	1	1	0.03	0.49	0.67	0.19	0.01	0.03	0.07	0.12
S23 Repair and installation of machinery and equipment	765	2	1	1	4	0.34	1.53	0.83	0.54	0.22	0.14	0.13	0.49
S24 Electricity, gas, steam and air conditioning supply	4115	4	1	9	14	0.72	1.77	7.07	1.97	0.09	0.03	0.21	0.33
S25 Water collection, treatment and supply	785	1	0	1	3	0.27	0.60	0.78	0.40	0.17	0.05	0.12	0.35
S26 Sewerage, waste management, remediation activities	992	1	0	1	3	0.17	0.42	1.14	0.37	0.09	0.03	0.16	0.28
S27 Construction	6864	17	3	4	24	3.35	5.03	3.22	3.49	0.05	0.24	0.05	0.35
S28 Wholesale and retail trade and repair of motor vehicles and motorcycles	2339	4	1	2	6	0.75	0.80	1.39	0.87	0.16	0.02	0.07	0.26
S29 Wholesale trade, except of motor vehicles and motorcycles	11989	17	9	12	38	3.49	13.83	9.55	5.60	0.14	0.08	0.10	0.32
S30 Retail trade, except of motor vehicles and motorcycles	9009	15	3	6	25	3.12	4.71	5.05	3.62	0.17	0.04	0.07	0.28
S31 Land transport and transport via pipelines	3376	2	2	5	9	0.37	2.60	4.04	1.25	0.05	0.05	0.15	0.25
S32 Water transport	138	8	0	0	9	1.70	0.10	0.04	1.24	6.09	0.05	0.03	6.17
S33 Air transport	497	1	0	0	1	0.13	0.23	0.15	0.14	0.06	0.02	0.02	0.10
S34 Warehousing and support activities for transportation	3458	58	6	3	67	11.66	8.74	2.47	9.71	1.67	0.09	1.93	1.93
S35 Postal and courier activities	486	0	0	1	1	0.09	0.24	0.68	0.21	0.09	0.03	0.17	0.30
S36 Accommodation and food service activities	10030	122	2	2	126	24.63	2.64	1.58	18.31	1.22	0.02	0.02	1.26
S37 Publishing activities	366	0	0	1	1	0.05	0.16	0.46	0.13	0.06	0.03	0.15	0.25
S38 Motion picture, video, television programme production; programming and broadcasting activities	633	0	0	1	2	0.07	0.08	1.02	0.24	0.05	0.01	0.20	0.26
S39 Telecommunications	2454	3	1	3	7	0.53	1.21	2.57	0.97	0.11	0.03	0.13	0.27
S40 Computer programming, consultancy, and information service activities	2488	1	1	4	5	0.14	1.56	0.80	0.80	0.03	0.04	0.15	0.22
S41 Financial service activities, except insurance and pension funding	6354	5	5	11	21	1.01	7.43	8.71	3.03	0.08	0.08	0.17	0.33
S42 Insurance, reinsurance and pension funding, except compulsory social security	1408	1	0	2	3	0.24	0.66	1.33	0.47	0.08	0.03	0.12	0.23
S43 Activities auxiliary to financial services and insurance activities	750	0	0	1	2	0.05	0.12	1.08	0.24	0.03	0.01	0.18	0.22
S44 Imputed rents of owner-occupied dwellings	13431	24	0	1	25	4.82	0.24	0.67	3.62	0.18	0.00	0.01	0.19
S45 Real estate activities excluding imputed rents	7764	24	2	5	31	4.80	3.53	4.01	4.53	0.31	0.03	0.06	0.40
S46 Legal and accounting activities; activities of head offices; management consultancy activities	3432	2	3	7	12	0.43	4.40	5.40	1.72	0.06	0.09	0.20	0.34
S47 Architectural and engineering activities; technical testing and analysis	1307	1	1	2	4	0.27	1.13	1.76	0.62	0.10	0.06	0.17	0.33
S48 Scientific research and development	550	2	0	0	2	0.40	0.12	0.25	0.34	0.36	0.01	0.06	0.43
S49 Advertising and market research	502	0	1	1	2	0.03	0.91	0.89	0.27	0.03	0.12	0.22	0.38
S50 Other professional, scientific and technical activities; veterinary activities	583	0	0	1	1	0.07	0.45	0.45	0.18	0.06	0.05	0.10	0.21
S51 Rental and leasing activities	1054	15	1	1	18	3.12	1.41	0.89	2.55	1.47	0.09	0.11	1.66
S52 Employment activities	1512	0	2	2	4	0.06	2.44	1.89	0.63	0.02	0.11	0.16	0.28
S53 Travel agency, tour operator reservation service and related activities	339	5	0	0	6	1.09	0.41	0.19	0.86	1.59	0.08	0.07	1.74
S54 Security and investigation, service and landscape, office administrative and support activities	3083	3	4	7	13	0.65	5.24	5.37	1.96	0.09	0.10	0.18	0.37
S55 Public administration and defence; compulsory social security	11979	29	1	3	33	5.91	1.08	2.05	4.74	0.24	0.01	0.02	0.27
S56 Education	9812	19	0	1	20	3.91	0.29	0.64	2.96	0.20	0.00	0.01	0.21
S57 Human health activities	7897	14	0	2	16	2.87	0.37	1.49	2.37	0.18	0.00	0.02	0.21
S58 Residential care activities and social work activities without accommodation	3008	7	0	0	7	1.45	0.63	0.08	1.07	0.24	0.00	0.00	0.24
S59 Creative, arts and entertainment activities; libraries, archives, museums and other cultural activities; gambling and betting activities	737	1	0	0	1	0.17	0.07	0.36	0.19	0.11	0.01	0.06	0.18
S60 Sports activities and amusement and recreation activities	803	4	0	0	5	0.77	0.65	0.38	0.69	0.48	0.05	0.06	0.59
S61 Activities of membership organisations	736	1	0	0	1	0.23	0.08	0.17	0.20	0.15	0.01	0.03	0.19
S62 Repair of computers and personal and household goods	229	0	0	1	1	0.06	0.08	0.14	0.08	0.14	0.08	0.14	0.25
S63 Other personal service activities	1341	2	0	0	2	0.44	0.16	0.12	0.36	0.16	0.01	0.01	0.18
S64 Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use	1114	4	0	0	4	0.72	0.00	0.01	0.52	0.00	0.00	0.00	0.32
S65 Activities of extraterritorial organisations and bodies	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Portugal	169642	496	67	124	688	100	100	100	100	0.20	0.04	0.07	0.41

Source: own elaboration.

Table 4: Systemic effects of the blue economy of the Azores on CO₂ emissions by sectors

Sector	Blue economy (thousand tonnes)					Blue economy (% of BE total)				Blue economy (% of sectoral total)			
	CO ₂	Initial effect	Direct effect	Indirect effect	Total effect	Initial effect	Direct effect	Indirect effect	Total effect	Initial effect	Direct effect	Indirect effect	Total effect
	S01 Crop and animal production, hunting and related service activities	1254	4	2	2	8	4.37	10.34	2.63	4.41	0.36	0.16	0.13
S02 Forestry and logging	49	0	0	0	0	0.02	0.01	0.09	0.04	0.04	0.00	0.11	0.15
S03 Fishing and aquaculture	332	29	0	0	29	28.09	0.08	0.02	15.62	8.69	0.00	0.00	8.70
S04 Mining and quarrying	266	2	0	0	2	1.62	0.07	0.24	0.99	0.62	0.00	0.06	0.69
S05 Manufacture of food products, beverages and tobacco products	1060	5	1	1	6	4.56	4.98	0.92	2.37	0.44	0.09	0.05	0.59
S06 Manufacture of textiles, wearing apparel, leather and related products	740	0	0	0	0	0.02	0.21	0.47	0.19	0.00	0.01	0.04	0.05
S07 Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	126	0	0	0	0	0.04	0.23	0.16	0.10	0.03	0.04	0.08	0.15
S08 Manufacture of paper and paper products	1230	0	1	1	2	0.00	3.15	1.94	0.99	0.00	0.05	0.10	0.15
S09 Printing and reproduction of recorded media	28	0	0	0	0	0.02	0.25	0.10	0.07	0.06	0.17	0.22	0.45
S10 Manufacture of coke and refined petroleum products	3579	0	1	3	4	0.00	6.67	4.48	2.22	0.00	0.04	0.08	0.11
S11 Manufacture of chemicals and chemical products	1321	0	0	1	1	0.06	1.50	1.42	0.67	0.00	0.02	0.07	0.09
S12 Manufacture of basic pharmaceutical products and pharmaceutical preparations	16	0	0	0	0	0.00	0.01	0.02	0.01	0.00	0.01	0.08	0.09
S13 Manufacture of rubber and plastic products	89	0	0	0	0	0.00	0.19	0.09	0.05	0.00	0.04	0.06	0.11
S14 Manufacture of other non-metallic mineral products	5961	5	4	5	14	4.41	20.73	8.22	7.42	0.08	0.07	0.09	0.23
S15 Manufacture of basic metals	203	0	0	0	0	0.00	0.17	0.15	0.07	0.00	0.02	0.05	0.06
S16 Manufacture of fabricated metal products, except machinery and equipment	223	0	0	0	0	0.09	0.45	0.26	0.19	0.04	0.04	0.07	0.15
S17 Manufacture of computer, electronic and optical products	9	0	0	0	0	0.00	0.00	0.01	0.00	0.00	0.00	0.04	0.04
S18 Manufacture of electrical equipment	11	0	0	0	0	0.00	0.01	0.01	0.00	0.00	0.02	0.04	0.06
S19 Manufacture of machinery and equipment n.e.c.	233	0	0	0	0	0.03	0.10	0.15	0.08	0.01	0.01	0.04	0.06
S20 Manufacture of motor vehicles, trailers and semi-trailers	30	0	0	0	0	0.00	0.00	0.01	0.00	0.00	0.01	0.02	0.02
S21 Manufacture of other transport equipment	3	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.04
S22 Manufacture of furniture, other manufacturing	57	0	0	0	0	0.01	0.08	0.07	0.03	0.01	0.03	0.07	0.11
S23 Repair and installation of machinery and equipment	33	0	0	0	0	0.05	0.23	0.07	0.08	0.16	0.14	0.13	0.43
S24 Electricity, gas, steam and air conditioning supply	18286	15	5	38	58	14.63	25.72	60.96	31.53	0.08	0.03	0.21	0.32
S25 Water collection, treatment and supply	41	0	0	0	0	0.06	0.09	0.07	0.06	0.14	0.04	0.28	0.10
S26 Sewerage, waste management, remediation activities	1584	1	0	2	3	1.04	1.81	3.05	1.80	0.07	0.02	0.12	0.21
S27 Construction	1098	2	1	1	4	2.61	0.98	1.95	0.98	0.23	0.05	0.06	0.33
S28 Wholesale and retail trade and repair of motor vehicles and motorcycles	103	0	0	0	0	0.13	0.11	0.11	0.12	0.13	0.02	0.07	0.22
S29 Wholesale trade, except of motor vehicles and motorcycles	954	1	1	1	3	1.14	3.49	1.42	1.48	0.12	0.09	0.09	0.29
S30 Retail trade, except of motor vehicles and motorcycles	443	1	0	0	1	0.63	0.71	0.46	0.58	0.15	0.03	0.06	0.24
S31 Land transport and transport via pipelines	3927	2	2	5	9	1.61	9.44	8.59	4.80	0.04	0.05	0.14	0.23
S32 Water transport	575	27	0	0	27	26.08	1.51	0.32	14.75	4.65	0.05	0.03	4.74
S33 Air transport	3779	2	0	1	3	1.66	2.17	0.93	1.47	0.05	0.01	0.02	0.07
S34 Warehousing and support activities for transportation	83	1	0	0	1	1.08	0.64	0.11	0.70	1.34	0.15	0.09	1.57
S35 Postal and courier activities	20	0	0	0	0	0.01	0.03	0.05	0.03	0.07	0.03	0.15	0.25
S36 Accommodation and food service activities	202	2	0	0	2	2.12	0.16	0.06	1.22	1.08	0.02	0.02	1.11
S37 Publishing activities	7	0	0	0	0	0.00	0.01	0.02	0.01	0.04	0.03	0.15	0.22
S38 Motion picture, video, television programme production; programming and broadcasting activities	10	0	0	0	0	0.00	0.00	0.03	0.01	0.04	0.01	0.19	0.24
S39 Telecommunications	17	0	0	0	0	0.02	0.03	0.03	0.02	0.09	0.03	0.12	0.25
S40 Computer programming, consultancy, and information service activities	14	0	0	0	0	0.00	0.03	0.03	0.02	0.03	0.04	0.15	0.22
S41 Financial service activities, except insurance and pension funding	41	0	0	0	0	0.03	0.16	0.11	0.07	0.07	0.08	0.17	0.31
S42 Insurance, reinsurance and pension funding, except compulsory social security	14	0	0	0	0	0.01	0.02	0.03	0.02	0.07	0.03	0.12	0.22
S43 Activities auxiliary to financial services and insurance activities	15	0	0	0	0	0.00	0.01	0.04	0.02	0.03	0.01	0.17	0.21
S44 Imputed rents of owner-occupied dwellings	8	0	0	0	0	0.01	0.00	0.00	0.01	0.17	0.00	0.01	0.18
S45 Real estate activities excluding imputed rents	5	0	0	0	0	0.01	0.01	0.01	0.01	0.28	0.03	0.06	0.37
S46 Legal and accounting activities; activities of head offices; management consultancy activities	51	0	0	0	0	0.03	0.22	0.15	0.09	0.05	0.08	0.19	0.33
S47 Architectural and engineering activities; technical testing and analysis	36	0	0	0	0	0.03	0.10	0.09	0.06	0.09	0.05	0.16	0.30
S48 Scientific research and development	7	0	0	0	0	0.02	0.01	0.01	0.02	0.35	0.01	0.06	0.42
S49 Advertising and market research	9	0	0	0	0	0.00	0.06	0.03	0.02	0.02	0.12	0.21	0.35
S50 Other professional, scientific and technical activities; veterinary activities	16	0	0	0	0	0.01	0.04	0.02	0.02	0.05	0.05	0.09	0.18
S51 Rental and leasing activities	74	1	0	0	1	0.92	0.30	0.12	0.58	1.28	0.08	0.10	1.46
S52 Employment activities	7	0	0	0	0	0.00	0.04	0.02	0.01	0.02	0.11	0.15	0.28
S53 Travel agency, tour operator reservation service and related activities	40	1	0	0	1	0.51	0.15	0.04	0.31	1.29	0.07	0.07	1.43
S54 Security and investigation; service and landscape; office administrative and support activities	122	0	0	0	0	0.59	0.58	0.34	0.23	0.08	0.09	0.17	0.34
S55 Public administration and defence; compulsory social security	355	1	0	0	1	0.89	0.12	0.12	0.55	0.26	0.01	0.02	0.29
S56 Education	68	0	0	0	0	0.12	0.01	0.01	0.07	0.18	0.00	0.01	0.19
S57 Human health activities	127	0	0	0	0	0.19	0.02	0.04	0.12	0.15	0.00	0.02	0.18
S58 Residential care activities and social work activities without accommodation	313	1	0	0	1	0.80	0.01	0.02	0.45	0.26	0.00	0.00	0.27
S59 Creative, arts and entertainment activities; libraries, archives, museums and other cultural activities; gambling and betting activities	16	0	0	0	0	0.02	0.01	0.02	0.02	0.11	0.01	0.06	0.18
S60 Sports activities and amusement and recreation activities	40	0	0	0	0	0.19	0.11	0.04	0.13	0.48	0.05	0.06	0.59
S61 Activities of membership organisations	24	0	0	0	0	0.05	0.01	0.01	0.03	0.19	0.01	0.03	0.24
S62 Repair of computers and personal and household goods	8	0	0	0	0	0.01	0.01	0.01	0.01	0.17	0.03	0.09	0.28
S63 Other personal service activities	17	0	0	0	0	0.03	0.01	0.00	0.02	0.19	0.01	0.01	0.21
S64 Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S65 Activities of extraterritorial organisations and bodies	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Portugal	49404	103	19	63	185	100	100	100	100	0.21	0.04	0.13	0.37

Source: own elaboration.

Table 5: Systemic effects of the blue economy of the Azores on employment by sector

Sector	Blue economy (workers)					Blue economy (sectoral share)				Blue economy (% employment)			
	Employment	Initial effect	Direct effect	Indirect effect	Total effect	Initial effect	Direct effect	Indirect effect	Total effect	Initial effect	Direct effect	Indirect effect	Total effect
S01 Crop and animal production, hunting and related service activities	339371	783	354	302	1439	5.09	16.36	8.27	6.78	0.23	0.10	0.09	0.42
S02 Forestry and logging	62192	24	2	68	94	0.15	0.09	1.87	0.44	0.04	0.00	0.11	0.15
S03 Fishing and aquaculture	30107	2491	1	1	2494	16.17	0.07	0.03	11.76	8.28	0.00	0.00	8.28
S04 Mining and quarrying	11702	120	1	8	128	0.78	0.04	0.21	0.60	1.02	0.01	0.07	1.10
S05 Manufacture of food products, beverages and tobacco products	112936	602	123	72	797	3.91	5.70	1.98	3.76	0.53	0.11	0.06	0.71
S06 Manufacture of textiles, wearing apparel, leather and related products	214730	13	12	86	112	0.09	0.58	2.37	0.53	0.01	0.01	0.04	0.05
S07 Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	30066	26	22	41	88	0.17	1.01	1.12	0.42	0.08	0.07	0.13	0.29
S08 Manufacture of paper and paper products	12990	0	6	12	18	0.00	0.28	0.33	0.09	0.00	0.05	0.10	0.15
S09 Printing and reproduction of recorded media	16117	28	34	41	103	0.18	1.55	1.13	0.49	0.18	0.21	0.26	0.64
S10 Manufacture of coke and refined petroleum products	1607	0	1	1	2	0.00	0.02	0.03	0.01	0.00	0.03	0.07	0.10
S11 Manufacture of chemicals and chemical products	12977	0	3	8	11	0.00	0.14	0.22	0.05	0.00	0.02	0.06	0.09
S12 Manufacture of basic pharmaceutical products and pharmaceutical preparations	7365	0	1	6	6	0.00	0.04	0.15	0.03	0.00	0.01	0.08	0.09
S13 Manufacture of rubber and plastic products	27162	1	11	16	27	0.01	0.49	0.43	0.13	0.00	0.04	0.06	0.10
S14 Manufacture of other non-metallic mineral products	39421	27	24	31	82	0.17	1.10	0.86	0.39	0.07	0.06	0.08	0.21
S15 Manufacture of basic metals	8321	0	1	4	6	0.00	0.06	0.11	0.03	0.00	0.02	0.05	0.07
S16 Manufacture of fabricated metal products, except machinery and equipment	84209	58	39	71	168	0.37	1.82	1.94	0.79	0.07	0.05	0.08	0.20
S17 Manufacture of computer, electronic and optical products	11504	0	0	4	4	0.00	0.02	0.11	0.02	0.00	0.00	0.03	0.04
S18 Manufacture of electrical equipment	18588	0	4	8	12	0.00	0.17	0.23	0.06	0.00	0.02	0.05	0.07
S19 Manufacture of machinery and equipment n.e.c.	24992	1	2	10	12	0.00	0.09	0.27	0.06	0.00	0.01	0.04	0.05
S20 Manufacture of motor vehicles, trailers and semi-trailers	40636	0	0	6	6	0.00	0.01	0.16	0.03	0.00	0.00	0.01	0.02
S21 Manufacture of other transport equipment	5911	0	0	2	2	0.00	0.01	0.05	0.01	0.00	0.00	0.01	0.03
S22 Manufacture of furniture, other manufacturing	55381	13	16	40	70	0.08	0.76	1.11	0.33	0.02	0.03	0.07	0.13
S23 Repair and installation of machinery and equipment	25425	97	35	35	167	0.63	1.62	0.96	0.79	0.38	0.14	0.14	0.66
S24 Electricity, gas, steam and air conditioning supply	8717	36	12	80	128	0.24	0.56	2.19	0.61	0.42	0.14	0.92	1.47
S25 Water collection, treatment and supply	16500	47	14	31	92	0.30	0.64	0.86	0.28	0.08	0.08	0.19	0.56
S26 Sewerage, waste management, remediation activities	25917	37	12	106	166	0.24	0.56	1.57	0.59	0.14	0.05	0.22	0.41
S27 Construction	289139	845	169	189	1203	5.48	7.84	5.18	5.67	0.29	0.06	0.07	0.42
S28 Wholesale and retail trade and repair of motor vehicles and motorcycles	92121	149	21	67	237	0.97	0.98	1.84	1.12	0.16	0.02	0.07	0.26
S29 Wholesale trade, except of motor vehicles and motorcycles	213047	337	171	214	722	2.19	7.93	3.86	3.40	0.16	0.08	0.10	0.34
S30 Retail trade, except of motor vehicles and motorcycles	410658	785	158	288	1241	3.10	7.29	8.16	5.85	0.19	0.04	0.07	0.30
S31 Land transport and transport via pipelines	110223	79	63	177	319	0.51	2.92	4.85	1.50	0.07	0.06	0.16	0.29
S32 Water transport	2098	151	1	1	153	0.98	0.05	0.02	0.72	7.21	0.05	0.03	7.28
S33 Air transport	11957	9	2	2	14	0.06	0.10	0.07	0.06	0.08	0.02	0.02	0.11
S34 Warehousing and support activities for transportation	34993	767	70	33	870	4.98	3.26	0.91	2.29	0.20	0.10	0.20	2.49
S35 Postal and courier activities	15767	19	7	34	59	0.12	0.33	0.02	0.28	0.12	0.04	0.21	0.38
S36 Accommodation and food service activities	332686	3557	52	60	3668	23.09	2.39	1.63	17.29	1.07	0.02	0.02	1.10
S37 Publishing activities	10100	12	3	15	30	0.08	0.15	0.42	0.14	0.12	0.03	0.15	0.30
S38 Motion picture, video, television programme production; programming and broadcasting activities	9370	10	1	20	31	0.06	0.05	0.56	0.15	0.10	0.01	0.22	0.33
S39 Telecommunications	15498	25	7	24	56	0.16	0.31	0.66	0.26	0.16	0.04	0.16	0.36
S40 Computer programming, consultancy, and information service activities	58953	18	25	88	131	0.12	1.16	2.41	0.62	0.03	0.04	0.15	0.22
S41 Financial service activities, except insurance and pension funding	56747	60	48	101	209	0.39	2.23	2.78	0.99	0.11	0.08	0.18	0.37
S42 Insurance, reinsurance and pension funding, except compulsory social security	17058	18	6	20	43	0.12	0.26	0.55	0.29	0.10	0.03	0.12	0.25
S43 Activities auxiliary to financial services and insurance activities	7981	3	1	15	19	0.02	0.05	0.42	0.09	0.04	0.01	0.19	0.24
S44 Imputed rents of owner-occupied dwellings	21688	17	0	1	18	0.11	0.01	0.04	0.08	0.08	0.00	0.01	0.08
S45 Real estate activities excluding imputed rents	14783	18	2	7	27	0.12	0.09	0.18	0.13	0.12	0.01	0.05	0.18
S46 Legal and accounting activities; activities of head offices; management consultancy activities	110841	88	100	224	412	0.57	4.63	0.14	1.94	0.08	0.09	0.20	0.37
S47 Architectural and engineering activities; technical testing and analysis	40876	51	27	74	153	0.33	1.26	2.03	0.72	0.13	0.07	0.18	0.37
S48 Scientific research and development	10206	52	2	6	60	0.34	0.08	0.16	0.28	0.51	0.02	0.06	0.58
S49 Advertising and market research	11483	4	14	26	44	0.03	0.66	0.70	0.21	0.04	0.12	0.22	0.39
S50 Other professional, scientific and technical activities; veterinary activities	26033	21	15	28	64	0.14	0.71	0.77	0.20	0.08	0.06	0.11	0.25
S51 Rental and leasing activities	8700	148	9	10	166	0.96	0.42	0.27	0.78	1.70	0.10	1.01	1.91
S52 Employment activities	89515	25	100	143	268	0.16	4.63	3.91	1.26	0.03	0.11	0.16	0.30
S53 Travel agency, tour operator reservation service and related activities	9891	173	8	7	188	1.12	0.38	0.19	0.89	1.74	0.08	0.07	1.90
S54 Security and investigation, service and landscape, office administrative and support activities	256338	269	271	500	1040	1.75	12.53	15.70	4.90	0.11	0.11	0.20	0.41
S55 Public administration and defence; compulsory social security	288401	941	23	70	1034	6.11	1.07	1.01	4.87	0.33	0.01	0.02	0.36
S56 Education	309668	647	7	26	679	4.20	0.31	0.70	3.20	0.01	0.00	0.01	0.22
S57 Human health activities	233785	428	8	55	491	2.78	0.35	1.52	2.31	0.18	0.00	0.02	0.21
S58 Residential care activities and social work activities without accommodation	157222	401	1	5	408	2.61	0.05	0.15	1.92	0.26	0.00	0.00	0.26
S59 Creative, arts and entertainment activities; libraries, archives, museums and other cultural activities; gambling and betting activities	229053	39	2	17	58	0.25	0.09	0.46	0.27	0.17	0.01	0.07	0.88
S60 Sports activities and amusement and recreation activities	29452	216	23	20	259	1.40	1.08	0.54	1.22	0.73	0.08	0.07	0.88
S61 Activities of membership organisations	45133	89	4	14	107	0.58	0.20	0.40	0.51	0.20	0.01	0.03	0.24
S62 Repair of computers and personal and household goods	9052	16	3	8	27	0.10	0.13	0.22	0.12	0.03	0.17	0.23	0.38
S63 Other personal service activities	55452	105	5	7	117	0.68	0.24	0.18	0.55	0.19	0.01	0.01	0.21
S64 Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use	113291	411	0	1	412	2.67	0.00	0.02	1.94	0.00	0.00	0.00	0.36
S65 Activities of extraterritorial organisations and bodies	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Portugal	4802604	15404	2161	3650	21214	100	100	100	100	0.32	0.04	0.08	0.44

Source: own elaboration.

Table 6: Systemic effects of the blue economy of the Azores on male employment by sector

Sector	Employment	Blue economy (workers)				Blue economy (sectoral share)				Blue economy (% employment)			
		Initial effect	Direct effect	Indirect effect	Total effect	Initial effect	Direct effect	Indirect effect	Total effect	Initial effect	Direct effect	Indirect effect	Total effect
S01 Crop and animal production, hunting and related service activities	230396	658	296	248	1201	7.37	21.31	11.17	9.58	0.29	0.13	0.11	0.52
S02 Forestry and logging	52851	20	2	58	80	0.23	0.12	2.62	0.64	0.04	0.00	0.11	0.15
S03 Fishing and aquaculture	26259	2212	1	1	2214	24.77	0.09	0.05	17.67	8.42	0.00	0.00	8.43
S04 Mining and quarrying	10351	117	1	7	125	1.31	0.05	0.32	1.00	1.13	0.01	0.07	1.21
S05 Manufacture of food products, beverages and tobacco products	55490	351	72	41	464	3.93	5.16	1.87	3.70	0.61	0.12	0.07	0.81
S06 Manufacture of textiles, wearing apparel, leather and related products	67686	3	4	27	34	0.03	0.28	1.23	0.27	0.00	0.01	0.04	0.05
S07 Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	23481	24	20	36	80	0.27	1.43	1.65	0.64	0.10	0.08	0.16	0.34
S08 Manufacture of paper and paper products	8782	0	4	9	13	0.00	0.32	0.39	0.11	0.00	0.05	0.10	0.15
S09 Printing and reproduction of recorded media	10670	20	23	28	71	0.23	1.65	1.27	0.57	0.19	0.21	0.28	0.67
S10 Manufacture of coke and refined petroleum products	1225	0	0	1	1	0.00	0.03	0.04	0.01	0.00	0.04	0.08	0.11
S11 Manufacture of chemicals and chemical products	8501	0	2	5	7	0.00	0.14	0.24	0.06	0.00	0.02	0.06	0.09
S12 Manufacture of basic pharmaceutical products and pharmaceutical preparations	3922	0	0	2	3	0.00	0.03	0.10	0.02	0.00	0.01	0.08	0.09
S13 Manufacture of rubber and plastic products	18547	8	1	8	11	0.01	0.57	0.51	0.16	0.00	0.04	0.06	0.11
S14 Manufacture of other non-metallic mineral products	27066	22	19	25	66	0.25	1.40	1.11	0.53	0.08	0.07	0.09	0.24
S15 Manufacture of basic metals	6664	0	1	3	5	0.00	0.08	0.14	0.04	0.00	0.02	0.05	0.07
S16 Manufacture of fabricated metal products, except machinery and equipment	69267	52	35	61	148	0.58	2.50	2.78	1.18	0.08	0.05	0.09	0.21
S17 Manufacture of computer, electronic and optical products	6220	0	0	2	2	0.00	0.02	0.10	0.02	0.00	0.00	0.03	0.04
S18 Manufacture of electrical equipment	12905	0	3	6	8	0.00	0.18	0.26	0.07	0.00	0.02	0.05	0.07
S19 Manufacture of machinery and equipment n.e.c.	19195	0	2	8	10	0.01	0.11	0.36	0.08	0.00	0.01	0.04	0.05
S20 Manufacture of motor vehicles, trailers and semi-trailers	23816	0	0	3	4	0.00	0.01	0.15	0.03	0.00	0.00	0.01	0.01
S21 Manufacture of other transport equipment	3906	0	0	1	2	0.00	0.02	0.06	0.01	0.00	0.01	0.01	0.01
S22 Manufacture of furniture, other manufacturing	37724	10	12	29	51	0.12	0.85	1.29	0.41	0.03	0.03	0.08	0.13
S23 Repair and installation of machinery and equipment	22242	87	30	30	148	0.97	2.19	1.37	1.18	0.39	0.14	0.14	0.66
S24 Electricity, gas, steam and air conditioning supply	6774	31	10	67	108	0.34	0.74	3.04	0.86	0.45	0.15	1.00	1.60
S25 Water collection, treatment and supply	11841	36	11	24	70	0.77	1.08	0.36	0.36	0.30	0.09	0.60	0.60
S26 Sewerage, waste management, remediation activities	20047	28	9	44	81	0.66	0.66	1.97	0.64	0.14	0.05	0.22	0.40
S27 Construction	263217	799	160	177	1135	8.94	11.52	7.97	9.06	0.30	0.06	0.07	0.43
S28 Wholesale and retail trade and repair of motor vehicles and motorcycles	75862	128	18	56	202	1.43	1.29	2.54	1.61	0.17	0.02	0.07	0.27
S29 Wholesale trade, except of motor vehicles and motorcycles	131868	231	113	138	482	2.58	8.12	6.23	3.84	0.17	0.09	0.10	0.37
S30 Retail trade, except of motor vehicles and motorcycles	173244	359	71	131	561	4.02	5.11	5.90	4.47	0.21	0.04	0.08	0.32
S31 Land transport and transport via pipelines	94794	71	56	155	281	0.79	4.00	6.99	2.24	0.07	0.06	0.16	0.30
S32 Water transport	1489	1	0	0	115	1.28	0.05	0.02	0.92	7.66	0.05	0.03	7.74
S33 Air transport	7271	5	1	1	8	0.06	0.09	0.07	0.06	0.07	0.02	0.02	0.11
S34 Warehousing and support activities for transportation	24906	500	53	24	647	6.61	3.80	1.09	5.32	2.37	0.21	0.10	2.68
S35 Postal and courier activities	11029	14	5	24	43	0.15	0.37	1.07	0.34	0.12	0.05	0.22	0.39
S36 Accommodation and food service activities	145851	1339	20	25	1385	15.00	1.43	1.15	11.05	0.92	0.01	0.02	0.95
S37 Publishing activities	5298	7	2	8	17	0.08	0.13	0.36	0.13	0.13	0.03	0.15	0.31
S38 Motion picture, video, television programme production; programming and broadcasting activities	5759	6	1	12	19	0.06	0.05	0.56	0.15	0.10	0.01	0.21	0.33
S39 Telecommunications	9454	17	4	16	37	0.19	0.32	0.71	0.29	0.18	0.05	0.17	0.39
S40 Computer programming, consultancy, and information service activities	42400	14	18	63	96	0.16	1.31	2.86	0.77	0.03	0.04	0.15	0.23
S41 Financial service activities, except insurance and pension funding	28526	31	24	51	107	0.35	1.76	2.31	0.85	0.11	0.09	0.18	0.37
S42 Insurance, reinsurance and pension funding, except compulsory social security	7901	11	3	9	23	0.12	0.20	0.42	0.18	0.13	0.03	0.12	0.29
S43 Activities auxiliary to financial services and insurance activities	4075	2	1	8	10	0.02	0.04	0.37	0.08	0.04	0.01	0.20	0.26
S44 Imputed rents of owner-occupied dwellings	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S45 Real estate activities excluding imputed rents	6814	10	1	3	14	0.11	0.07	0.15	0.11	0.14	0.01	0.05	0.20
S46 Legal and accounting activities; activities of head offices; management consultancy activities	43231	34	39	87	160	0.38	2.81	3.95	1.28	0.08	0.09	0.20	0.37
S47 Architectural and engineering activities; technical testing and analysis	26591	33	17	47	98	0.37	1.26	2.14	0.78	0.12	0.07	0.18	0.37
S48 Scientific research and development	4431	24	1	3	28	0.27	0.06	0.12	0.22	0.55	0.02	0.06	0.63
S49 Advertising and market research	6032	3	8	14	24	0.03	0.55	0.62	0.19	0.05	0.13	0.23	0.40
S50 Other professional, scientific and technical activities; veterinary activities	11329	10	7	13	29	0.11	0.50	0.57	0.23	0.09	0.06	0.11	0.26
S51 Rental and leasing activities	5753	87	5	6	98	0.97	0.38	0.27	0.78	1.51	0.09	0.10	1.71
S52 Employment activities	39520	12	45	64	121	0.14	3.21	2.87	0.96	0.03	0.11	0.16	0.31
S53 Travel agency, tour operator reservation service and related activities	4030	70	3	76	133	0.78	0.25	0.13	0.61	1.73	0.09	0.07	1.89
S54 Security and investigation, service and landscape, office administrative and support activities	109051	102	110	203	415	1.14	7.89	9.17	3.21	0.09	0.10	0.19	0.38
S55 Public administration and defence; compulsory social security	152558	547	13	39	599	6.13	0.97	1.75	4.78	0.36	0.01	0.03	0.39
S56 Education	71717	154	2	6	162	1.72	0.11	0.27	1.29	0.21	0.00	0.01	0.23
S57 Human health activities	54668	102	2	13	117	1.15	0.13	0.39	0.94	0.19	0.00	0.02	0.21
S58 Residential care activities and social work activities without accommodation	15425	59	0	1	60	0.66	0.01	0.03	0.48	0.38	0.00	0.00	0.39
S59 Creative, arts and entertainment activities; libraries, archives, museums and other cultural activities; gambling and betting activities	12440	19	1	8	28	0.21	0.07	0.38	0.22	0.15	0.01	0.07	0.20
S60 Sports activities and amusement and recreation activities	18580	139	15	13	166	1.56	1.08	0.57	1.33	0.75	0.08	0.07	1.90
S61 Activities of membership organisations	18744	37	2	6	44	0.41	0.13	0.27	0.35	0.20	0.01	0.03	0.24
S62 Repair of computers and personal and household goods	6078	12	2	0	21	0.15	0.15	0.28	0.16	0.15	0.03	0.15	0.31
S63 Other personal service activities	10621	22	1	1	25	0.25	0.08	0.06	0.20	0.21	0.01	0.01	0.23
S64 Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use	12933	45	0	0	46	0.51	0.00	0.00	0.36	0.35	0.00	0.00	0.35
S65 Activities of extraterritorial organisations and bodies	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Portugal	2450178	8930	1388	2216	12534	100	100	100	100	0.36	0.06	0.09	0.51

Source: own elaboration.

Table 7: Systemic effects of the blue economy of the Azores on female employment by sector

Sector	Employment	Blue economy (workers)				Blue economy (sectoral share)				Blue economy (% employment)			
		Initial effect	Direct effect	Indirect effect	Total effect	Initial effect	Direct effect	Indirect effect	Total effect	Initial effect	Direct effect	Indirect effect	Total effect
S01 Crop and animal production, hunting and related service activities	108975	125	58	54	238	1.94	7.49	3.80	2.74	0.11	0.05	0.05	0.22
S02 Forestry and logging	9341	3	0	10	14	0.05	0.04	0.71	0.16	0.04	0.00	0.11	0.15
S03 Fishing and aquaculture	3849	280	0	0	280	4.33	0.02	0.01	3.23	0.00	0.00	0.00	7.27
S04 Mining and quarrying	1351	2	0	1	3	0.04	0.01	0.05	0.04	0.18	0.00	0.05	0.23
S05 Manufacture of food products; beverages and tobacco products	55446	251	52	31	333	3.89	6.67	2.14	3.85	0.45	0.09	0.06	0.60
S06 Manufacture of textiles, wearing apparel, leather and related products	147044	10	9	59	78	0.16	1.11	4.12	0.90	0.01	0.01	0.04	0.05
S07 Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	7125	2	2	4	8	0.03	0.25	0.30	0.09	0.02	0.03	0.06	0.11
S08 Manufacture of paper and paper products	3309	0	2	3	5	0.00	0.21	0.23	0.06	0.00	0.05	0.10	0.15
S09 Printing and reproduction of recorded media	5446	8	11	13	32	0.13	1.39	0.33	0.37	0.15	0.20	0.24	0.59
S10 Manufacture of coke and refined petroleum products	382	0	0	0	0	0.00	0.01	0.01	0.00	0.00	0.02	0.05	0.07
S11 Manufacture of chemicals and chemical products	4476	0	1	3	4	0.00	0.13	0.20	0.04	0.00	0.02	0.06	0.09
S12 Manufacture of basic pharmaceutical products and pharmaceutical preparations	4343	0	1	3	4	0.00	0.07	0.23	0.04	0.00	0.01	0.08	0.09
S13 Manufacture of rubber and plastic products	8614	0	3	4	7	0.00	0.35	0.30	0.08	0.00	0.03	0.05	0.08
S14 Manufacture of other non-metallic mineral products	12356	5	4	7	16	0.07	0.55	0.48	0.18	0.04	0.03	0.06	0.13
S15 Manufacture of basic metals	1657	0	0	1	1	0.00	0.03	0.05	0.01	0.00	0.02	0.05	0.06
S16 Manufacture of fabricated metal products, except machinery and equipment	14942	5	5	9	19	0.08	0.59	0.65	0.22	0.04	0.03	0.06	0.13
S17 Manufacture of computer, electronic and optical products	5274	0	3	4	7	0.00	0.03	0.13	0.02	0.00	0.00	0.04	0.04
S18 Manufacture of electrical equipment	6583	0	1	3	4	0.00	0.14	0.19	0.05	0.00	0.02	0.04	0.06
S19 Manufacture of machinery and equipment n.e.c.	4897	0	0	2	2	0.00	0.05	0.13	0.03	0.00	0.01	0.04	0.05
S20 Manufacture of motor vehicles, trailers and semi-trailers	16820	0	0	3	3	0.00	0.01	0.18	0.03	0.00	0.00	0.02	0.02
S21 Manufacture of other transport equipment	1945	0	1	1	0	0.01	0.04	0.01	0.00	0.01	0.00	0.03	0.03
S22 Manufacture of furniture, other manufacturing	17957	2	5	12	19	0.04	0.60	0.82	0.22	0.01	0.03	0.07	0.11
S23 Repair and installation of machinery and equipment	3183	11	5	4	20	0.16	0.59	0.31	0.23	0.33	0.14	0.14	0.62
S24 Electricity, gas, steam and air conditioning supply	1943	6	2	13	20	0.09	0.24	0.88	0.23	0.29	0.10	0.65	1.03
S25 Water collection, treatment and supply	4659	11	3	7	21	0.17	0.51	0.24	0.23	0.07	0.16	0.16	0.46
S26 Sewerage, waste management, remediation activities	5870	9	3	14	25	0.14	0.38	0.96	0.29	0.15	0.05	0.23	0.43
S27 Construction	25922	46	10	12	68	0.71	1.24	0.86	0.78	0.18	0.04	0.05	0.26
S28 Wholesale and retail trade and repair of motor vehicles and motorcycles	16258	21	3	11	35	0.33	0.42	0.77	0.41	0.13	0.02	0.07	0.22
S29 Wholesale trade, except of motor vehicles and motorcycles	81179	106	39	76	241	1.65	7.59	5.28	2.78	0.13	0.07	0.09	0.30
S30 Retail trade, except of motor vehicles and motorcycles	243435	426	87	680	680	6.60	11.21	11.66	7.85	0.18	0.04	0.07	0.28
S31 Land transport and transport via pipelines	15429	8	8	22	38	0.13	0.98	1.55	0.44	0.05	0.05	0.14	0.25
S32 Water transport	608	37	0	0	37	0.57	0.04	0.01	0.43	6.09	0.05	0.03	6.16
S33 Air transport	4687	4	1	1	6	0.06	0.11	0.07	0.06	0.08	0.02	0.02	0.12
S34 Warehousing and support activities for transportation	9097	177	18	9	204	2.74	2.29	0.64	2.35	1.77	0.18	0.09	2.04
S35 Postal and courier activities	4738	5	2	9	16	0.08	0.25	0.66	0.19	0.11	0.04	0.20	0.35
S36 Accommodation and food service activities	186835	2218	32	34	2284	34.35	4.12	2.38	26.36	1.19	0.02	0.02	1.22
S37 Publishing activities	4892	5	2	7	14	0.08	0.20	0.51	0.16	0.11	0.03	0.15	0.29
S38 Motion picture, video, television programme production; programming and broadcasting activities	3611	4	0	8	12	0.06	0.05	0.55	0.14	0.11	0.01	0.22	0.34
S39 Telecommunications	6044	8	2	9	19	0.13	0.30	0.60	0.22	0.13	0.04	0.14	0.31
S40 Computer programming, consultancy, and information service activities	16553	4	7	25	35	0.06	0.89	1.71	0.40	0.02	0.04	0.15	0.21
S41 Financial service activities, except insurance and pension funding	28222	29	24	50	103	0.45	3.08	3.30	1.19	0.10	0.08	0.18	0.36
S42 Insurance, reinsurance and pension funding, except compulsory social security	9158	3	7	11	21	0.11	0.37	0.74	0.64	0.08	0.03	0.12	0.23
S43 Activities auxiliary to financial services and insurance activities	3907	1	0	7	9	0.02	0.06	0.50	0.10	0.03	0.01	0.18	0.23
S44 Imputed rents of owner-occupied dwellings	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S45 Real estate activities excluding imputed rents	7970	9	1	4	13	0.13	0.12	0.25	0.15	0.11	0.01	0.04	0.16
S46 Legal and accounting activities; activities of head offices; management consultancy activities	67910	54	61	137	252	0.84	7.91	9.54	2.91	0.08	0.09	0.20	0.37
S47 Architectural and engineering activities; technical testing and analysis	14285	19	10	27	55	0.29	1.27	1.86	0.64	0.13	0.07	0.19	0.39
S48 Scientific research and development	5775	28	1	3	32	0.43	0.13	0.23	0.37	0.48	0.02	0.06	0.55
S49 Advertising and market research	5451	2	7	12	20	0.03	0.86	0.83	0.23	0.03	0.12	0.22	0.37
S50 Other professional, scientific and technical activities; veterinary activities	14713	11	8	15	35	0.17	1.10	1.08	0.40	0.08	0.06	0.10	0.24
S51 Rental and leasing activities	2947	61	4	4	68	0.94	0.48	0.26	0.79	2.06	0.13	2.06	2.31
S52 Employment activities	49995	12	56	79	147	0.19	7.18	5.53	1.70	0.02	0.11	0.16	0.29
S53 Travel agency, tour operator reservation service and related activities	5860	103	5	4	111	1.59	0.63	0.28	1.29	1.75	0.08	0.07	1.90
S54 Security and investigation, service and landscape, office administrative and support activities	147287	167	161	297	625	2.59	20.85	29.74	7.22	0.11	0.11	0.20	0.42
S55 Public administration and defence; compulsory social security	135843	394	10	31	434	6.10	1.26	2.16	5.01	0.29	0.01	0.02	0.32
S56 Education	237951	493	5	20	517	7.63	0.65	1.37	5.97	0.21	0.00	0.01	0.22
S57 Human health activities	179117	326	6	42	374	5.04	0.75	2.95	4.31	0.18	0.00	0.02	0.21
S58 Residential care activities and social work activities without accommodation	141797	342	1	5	348	5.30	0.11	0.33	4.02	0.24	0.00	0.00	0.25
S59 Creative, arts and entertainment activities; libraries, archives, museums and other cultural activities; gambling and betting activities	10162	21	1	8	30	0.32	0.13	0.58	0.34	0.20	0.01	0.08	0.29
S60 Sports activities and amusement and recreation activities	10873	77	8	7	93	1.20	1.08	0.51	1.07	0.71	0.08	0.07	0.86
S61 Activities of membership organisations	26389	52	3	9	63	0.81	0.33	0.59	0.73	0.20	0.01	0.03	0.24
S62 Repair of computers and personal and household goods	2674	3	1	2	6	0.05	0.07	0.14	0.07	0.12	0.02	0.12	0.22
S63 Other personal service activities	44831	83	4	5	93	1.29	0.54	0.37	1.07	0.19	0.01	0.01	0.21
S64 Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use	100358	366	0	1	366	0.00	0.00	0.05	4.23	0.36	0.00	0.00	0.37
S65 Activities of extraterritorial organisations and bodies	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Portugal	2330739	6457	773	1433	8662	100	100	100	100	0.28	0.03	0.06	0.37

Source: own elaboration.

Table 8: Systemic effects of the blue economy of the Azores on youth employment by sector

Sector	Employment	Blue economy (workers)				Blue economy (sectoral share)				Blue economy (% employment)			
		Initial effect	Direct effect	Indirect effect	Total effect	Initial effect	Direct effect	Indirect effect	Total effect	Initial effect	Direct effect	Indirect effect	Total effect
S01 Crop and animal production, hunting and related service activities	14664	51	23	19	92	3.96	14.82	7.58	5.48	0.35	0.15	0.13	0.63
S02 Forestry and logging	3232	1	0	3	5	0.09	0.06	1.37	0.27	0.03	0.00	0.10	0.14
S03 Fishing and aquaculture	1312	199	0	0	199	15.59	0.04	0.02	11.88	15.19	0.00	0.00	15.19
S04 Mining and quarrying	572	10	0	0	11	0.79	0.04	0.18	0.63	1.77	0.01	0.08	1.86
S05 Manufacture of food products; beverages and tobacco products	7457	43	9	5	56	3.34	5.70	2.96	3.36	0.57	0.12	0.07	0.76
S06 Manufacture of textiles, wearing apparel, leather and related products	13811	1	1	6	7	0.05	0.53	2.31	0.43	0.00	0.01	0.04	0.05
S07 Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	1813	2	1	3	6	0.13	0.90	1.04	0.33	0.09	0.08	0.14	0.31
S08 Manufacture of paper and paper products	915	0	0	1	1	0.00	0.30	0.37	0.08	0.00	0.05	0.10	0.15
S09 Printing and reproduction of recorded media	809	1	2	2	5	0.10	0.59	0.77	0.28	0.16	0.19	0.23	0.58
S10 Manufacture of coke and refined petroleum products	42	0	0	0	0	0.00	0.01	0.02	0.00	0.00	0.04	0.09	0.13
S11 Manufacture of chemicals and chemical products	756	0	0	1	1	0.00	0.13	0.21	0.04	0.00	0.03	0.07	0.10
S12 Manufacture of basic pharmaceutical products and pharmaceutical preparations	414	0	0	0	0	0.00	0.03	0.10	0.02	0.00	0.01	0.06	0.07
S13 Manufacture of rubber and plastic products	2592	0	1	0	1	0.00	0.60	0.55	0.14	0.00	0.04	0.05	0.09
S14 Manufacture of other non-metallic mineral products	2444	2	1	2	5	0.12	0.89	0.74	0.28	0.06	0.06	0.07	0.19
S15 Manufacture of basic metals	603	0	0	0	0	0.00	0.06	0.12	0.02	0.00	0.02	0.05	0.07
S16 Manufacture of fabricated metal products, except machinery and equipment	6706	4	3	5	12	0.33	1.88	2.13	0.74	0.06	0.04	0.08	0.18
S17 Manufacture of computer, electronic and optical products	1048	0	0	0	0	0.00	0.03	0.15	0.03	0.00	0.00	0.04	0.04
S18 Manufacture of electrical equipment	1564	0	0	1	1	0.00	0.18	0.28	0.06	0.00	0.02	0.04	0.06
S19 Manufacture of machinery and equipment n.e.c.	2128	0	0	1	1	0.01	0.13	0.39	0.07	0.00	0.01	0.05	0.06
S20 Manufacture of motor vehicles, trailers and semi-trailers	4077	0	0	1	1	0.00	0.02	0.26	0.04	0.00	0.00	0.02	0.02
S21 Manufacture of other transport equipment	595	0	0	0	0	0.00	0.01	0.07	0.01	0.00	0.00	0.03	0.03
S22 Manufacture of furniture, other manufacturing	4137	1	1	3	4	0.04	0.71	1.13	0.26	0.01	0.03	0.07	0.11
S23 Repair and installation of machinery and equipment	1762	9	2	2	13	0.67	1.47	0.92	0.78	0.49	0.13	0.13	0.74
S24 Electricity, gas, steam and air conditioning supply	551	3	1	6	9	0.21	0.59	2.39	0.57	0.49	0.16	1.07	1.72
S25 Water collection, treatment and supply	1	1	0	3	4	0.10	0.26	0.36	0.31	0.09	0.09	0.21	0.62
S26 Sewerage, waste management, remediation activities	1694	3	1	5	9	0.25	0.68	1.87	0.52	0.29	0.09	0.42	0.80
S27 Construction	14956	58	11	12	82	4.55	7.51	4.89	4.87	0.39	0.08	0.21	0.55
S28 Wholesale and retail trade and repair of motor vehicles and motorcycles	6247	13	2	5	19	1.01	1.10	2.00	1.16	0.21	0.03	0.08	0.31
S29 Wholesale trade, except of motor vehicles and motorcycles	13058	27	13	15	55	2.15	8.25	6.10	3.28	0.21	0.10	0.11	0.42
S30 Retail trade, except of motor vehicles and motorcycles	41043	87	17	31	135	6.82	11.14	12.68	8.08	0.21	0.04	0.08	0.33
S31 Land transport and transport via pipelines	3485	3	2	6	10	0.21	1.32	2.31	0.62	0.08	0.06	0.16	0.30
S32 Water transport	79	4	0	0	4	0.28	0.02	0.01	0.22	4.54	0.04	0.03	4.60
S33 Air transport	259	0	0	0	0	0.02	0.04	0.03	0.02	0.10	0.02	0.03	0.15
S34 Warehousing and support activities for transportation	1153	21	2	1	24	1.66	1.34	1.42	1.45	1.84	0.18	0.09	2.10
S35 Postal and courier activities	999	1	0	2	3	0.08	0.24	0.07	0.19	0.10	0.04	0.19	0.32
S36 Accommodation and food service activities	32329	452	6	6	464	35.36	4.14	2.48	27.68	1.40	0.02	0.02	1.44
S37 Publishing activities	491	1	0	1	2	0.11	0.14	0.31	0.14	0.28	0.04	0.16	0.48
S38 Motion picture, video, television programme production; programming and broadcasting activities	593	0	0	1	2	0.03	0.04	0.46	0.10	0.07	0.01	0.19	0.28
S39 Telecommunications	1371	2	1	2	5	0.17	0.38	0.86	0.29	0.16	0.04	0.15	0.36
S40 Computer programming, consultancy, and information service activities	4637	3	2	7	13	0.26	1.45	0.76	0.76	0.07	0.05	0.16	0.27
S41 Financial service activities, except insurance and pension funding	2167	2	2	4	8	0.20	1.22	1.57	0.49	0.12	0.09	0.18	0.38
S42 Insurance, reinsurance and pension funding, except compulsory social security	546	1	0	1	2	0.08	0.13	0.27	0.11	0.18	0.04	0.12	0.34
S43 Activities auxiliary to financial services and insurance activities	301	0	0	1	1	0.02	0.05	0.35	0.07	0.09	0.02	0.29	0.40
S44 Imputed rents of owner-occupied dwellings	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S45 Real estate activities excluding imputed rents	529	1	0	0	2	0.10	0.09	0.13	0.11	0.25	0.03	0.06	0.34
S46 Legal and accounting activities; activities of head offices; management consultancy activities	6440	11	8	18	37	0.84	5.34	7.23	2.19	0.17	0.13	0.28	0.57
S47 Architectural and engineering activities; technical testing and analysis	1347	2	1	3	6	0.16	0.68	1.09	0.35	0.15	0.08	0.20	0.43
S48 Scientific research and development	507	3	0	0	4	0.25	0.07	0.11	0.21	0.63	0.02	0.06	0.71
S49 Advertising and market research	981	1	1	2	4	0.04	0.82	0.91	0.24	0.05	0.13	0.23	0.41
S50 Other professional, scientific and technical activities; veterinary activities	1727	2	1	2	5	0.14	0.78	0.87	0.31	0.11	0.07	0.12	0.30
S51 Rental and leasing activities	451	19	1	1	21	1.48	0.75	0.34	1.25	4.20	0.25	0.19	4.64
S52 Employment activities	9187	3	10	15	28	0.23	6.78	6.01	1.67	0.03	0.11	0.16	0.31
S53 Travel agency, tour operator reservation service and related activities	362	19	1	0	20	1.51	0.40	0.13	1.20	5.32	0.17	0.09	5.58
S54 Security and investigation, service and landscape, office administrative and support activities	15772	18	16	29	63	1.37	10.49	11.96	3.76	0.13	0.12	0.21	0.46
S55 Public administration and defence; compulsory social security	10188	59	1	4	64	4.65	0.95	1.44	3.84	0.58	0.01	0.03	0.63
S56 Education	6934	24	0	1	24	1.84	0.15	0.31	1.46	0.34	0.00	0.01	0.35
S57 Human health activities	12016	27	0	3	30	2.09	0.30	1.29	1.81	0.22	0.00	0.03	0.25
S58 Residential care activities and social work activities without accommodation	6798	24	0	24	48	1.88	0.04	0.11	1.45	0.35	0.00	0.00	0.36
S59 Creative, arts and entertainment activities; libraries, archives, museums and other cultural activities; gambling and betting activities	1309	4	0	1	5	0.28	0.11	0.51	0.30	0.27	0.01	0.10	0.38
S60 Sports activities and amusement and recreation activities	3616	32	3	3	38	2.53	2.22	1.07	2.28	0.89	0.09	0.07	1.06
S61 Activities of membership organisations	1416	6	0	1	7	0.47	0.19	0.32	0.42	0.02	0.06	0.06	0.50
S62 Repair of computers and personal and household goods	545	1	0	1	2	0.05	0.07	0.16	0.07	0.11	0.02	0.07	0.20
S63 Other personal service activities	2874	6	0	0	7	0.50	0.21	0.15	0.42	0.22	0.01	0.01	0.25
S64 Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use	2152	10	0	0	11	0.82	0.00	0.01	0.63	0.49	0.00	0.00	0.49
S65 Activities of extraterritorial organisations and bodies	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Portugal	282302	1278	153	246	1677	100	100	100	100	0.45	0.05	0.09	0.59

Source: own elaboration.

Table 9: Systemic effects of the blue economy of the Azores on adult employment by sector

Sector	Employment	Blue economy (workers)				Blue economy (sectoral share)				Blue economy (% employment)			
		Initial effect	Direct effect	Indirect effect	Total effect	Initial effect	Direct effect	Indirect effect	Total effect	Initial effect	Direct effect	Indirect effect	Total effect
S01 Crop and animal production, hunting and related service activities	253168	603	272	232	1107	4.63	14.97	7.51	6.17	0.24	0.11	0.09	0.44
S02 Forestry and logging	50880	19	2	56	77	0.15	0.09	1.81	0.43	0.04	0.00	0.11	0.15
S03 Fishing and aquaculture	24854	2152	1	1	2155	16.52	0.06	0.03	12.01	8.66	0.00	0.00	8.67
S04 Mining and quarrying	10148	103	1	7	111	0.79	0.04	0.22	0.62	1.02	0.01	0.07	1.09
S05 Manufacture of food products; beverages and tobacco products	9322	321	107	62	490	4.00	5.86	2.02	3.85	0.55	0.11	0.07	0.73
S06 Manufacture of textiles; wearing apparel; leather and related products	188235	11	11	76	98	0.08	0.60	2.46	0.54	0.01	0.01	0.04	0.05
S07 Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	25621	22	19	35	76	0.17	1.04	1.14	0.43	0.09	0.07	0.14	0.30
S08 Manufacture of paper and paper products	10342	0	5	10	16	0.00	0.28	0.33	0.09	0.00	0.05	0.10	0.15
S09 Printing and reproduction of recorded media	13991	25	29	36	91	0.19	1.62	1.17	0.51	0.18	0.21	0.28	0.65
S10 Manufacture of coke and refined petroleum products	1357	0	0	1	1	0.00	0.02	0.03	0.01	0.00	0.03	0.07	0.10
S11 Manufacture of chemicals and chemical products	11030	0	3	7	10	0.00	0.14	0.22	0.05	0.00	0.02	0.06	0.09
S12 Manufacture of basic pharmaceutical products and pharmaceutical preparations	6649	0	1	5	6	0.00	0.04	0.16	0.03	0.00	0.01	0.08	0.09
S13 Manufacture of rubber and plastic products	23959	1	9	13	23	0.01	0.50	0.43	0.13	0.00	0.04	0.06	0.10
S14 Manufacture of other non-metallic mineral products	33503	23	20	27	70	0.18	1.12	0.87	0.39	0.07	0.06	0.08	0.21
S15 Manufacture of basic metals	7052	0	1	3	5	0.00	0.06	0.11	0.03	0.00	0.02	0.05	0.07
S16 Manufacture of fabricated metal products, except machinery and equipment	70797	51	34	61	145	0.39	1.86	1.97	0.81	0.07	0.05	0.09	0.20
S17 Manufacture of computer, electronic and optical products	9885	0	0	3	3	0.00	0.02	0.11	0.02	0.00	0.00	0.03	0.04
S18 Manufacture of electrical equipment	16141	0	3	7	11	0.00	0.17	0.24	0.06	0.00	0.02	0.05	0.07
S19 Manufacture of machinery and equipment n.e.c.	20383	0	2	8	10	0.00	0.09	0.27	0.06	0.00	0.01	0.04	0.05
S20 Manufacture of motor vehicles, trailers and semi-trailers	35359	0	0	5	5	0.00	0.01	0.17	0.03	0.00	0.00	0.01	0.02
S21 Manufacture of other transport equipment	4932	0	1	0	1	0.00	0.01	0.05	0.01	0.00	0.00	0.01	0.00
S22 Manufacture of furniture; other manufacturing	46297	11	14	34	59	0.09	0.76	1.10	0.33	0.02	0.03	0.07	0.13
S23 Repair and installation of machinery and equipment	21406	85	30	30	144	0.65	1.63	0.96	0.80	0.40	0.14	0.67	1.44
S24 Electricity, gas, steam and air conditioning supply	7166	29	10	64	103	0.22	0.53	2.09	0.58	0.41	0.14	0.90	1.44
S25 Water collection, treatment and supply	14658	38	11	26	75	0.29	0.83	0.62	0.42	0.08	0.03	0.18	0.53
S26 Sewerage, waste management, remediation activities	22540	32	11	51	94	0.25	0.59	1.64	0.52	0.14	0.05	0.22	0.42
S27 Construction	243171	739	148	163	1050	5.67	8.13	5.30	5.85	0.30	0.06	0.07	0.43
S28 Wholesale and retail trade and repair of motor vehicles and motorcycles	77646	127	18	57	202	0.97	0.99	1.85	1.13	0.16	0.02	0.07	0.26
S29 Wholesale trade, except of motor vehicles and motorcycles	189656	290	147	183	619	2.22	8.06	3.92	3.45	0.16	0.08	0.10	0.34
S30 Retail trade, except of motor vehicles and motorcycles	341291	661	132	248	1041	3.08	7.27	8.03	5.81	0.19	0.04	0.07	0.31
S31 Land transport and transport via pipelines	95022	66	53	151	270	0.50	2.94	4.88	1.50	0.07	0.06	0.16	0.28
S32 Water transport	1806	137	1	1	138	1.05	0.05	0.02	0.77	7.57	0.05	0.03	7.65
S33 Air transport	11307	8	2	2	13	0.07	0.11	0.07	0.07	0.08	0.02	0.02	0.11
S34 Warehousing and support activities for transportation	30336	665	61	29	755	3.10	3.36	4.93	4.21	2.19	0.20	0.10	2.49
S35 Postal and courier activities	13993	16	6	28	50	0.12	0.33	0.02	0.28	0.12	0.05	0.22	0.38
S36 Accommodation and food service activities	266407	2955	43	49	3046	22.67	2.36	1.58	16.98	1.11	0.02	0.02	1.14
S37 Publishing activities	8854	10	3	13	26	0.07	0.16	0.43	0.14	0.11	0.03	0.15	0.29
S38 Motion picture, video, television programme production; programming and broadcasting activities	8261	8	1	18	27	0.06	0.05	0.58	0.15	0.10	0.01	0.22	0.33
S39 Telecommunications	13555	22	6	21	49	0.17	0.32	0.69	0.27	0.16	0.04	0.16	0.36
S40 Computer programming, consultancy, and information service activities	53316	15	22	79	116	0.11	1.23	2.56	0.65	0.03	0.04	0.15	0.22
S41 Financial service activities, except insurance and pension funding	52033	53	44	92	190	0.41	2.41	2.99	1.06	0.10	0.08	0.18	0.36
S42 Insurance, reinsurance and pension funding, except compulsory social security	15168	16	5	18	39	0.12	0.28	0.58	0.22	0.10	0.03	0.12	0.26
S43 Activities auxiliary to financial services and insurance activities	6998	3	1	13	17	0.02	0.05	0.43	0.09	0.04	0.01	0.24	0.31
S44 Imputed rents of owner-occupied dwellings	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S45 Real estate activities excluding imputed rents	12462	16	2	6	23	0.12	0.09	0.19	0.13	0.13	0.01	0.05	0.19
S46 Legal and accounting activities; activities of head offices; management consultancy activities	95339	71	83	186	339	0.54	4.56	6.02	1.89	0.08	0.09	0.09	0.36
S47 Architectural and engineering activities; technical testing and analysis	36433	45	24	66	135	0.35	1.33	2.13	0.75	0.12	0.07	0.18	0.37
S48 Scientific research and development	9090	47	2	5	54	0.36	0.09	0.17	0.30	0.52	0.02	0.06	0.59
S49 Advertising and market research	10108	4	13	23	39	0.03	0.70	0.73	0.22	0.04	0.13	0.22	0.39
S50 Other professional, scientific and technical activities; veterinary activities	23919	18	13	25	56	0.14	0.74	0.79	0.31	0.08	0.06	0.11	0.24
S51 Rental and leasing activities	7762	124	8	8	140	0.95	0.42	0.27	0.78	1.60	0.10	1.60	1.80
S52 Employment activities	76861	20	85	122	228	0.16	4.70	3.96	1.27	0.03	0.11	0.16	0.30
S53 Travel agency, tour operator reservation service and related activities	8823	144	7	6	157	1.11	0.39	0.20	0.88	1.63	0.08	0.07	1.78
S54 Security and investigation, service and landscape, office administrative and support activities	21043	224	231	426	881	1.80	12.69	13.80	4.97	0.11	0.11	0.20	0.41
S55 Public administration and defence; compulsory social security	236530	778	19	58	855	5.97	1.05	1.87	4.77	0.33	0.01	0.02	0.36
S56 Education	25685	548	6	21	575	4.20	0.31	0.69	3.20	0.21	0.00	0.01	0.22
S57 Human health activities	197897	363	6	47	417	2.79	0.35	1.52	2.32	0.18	0.00	0.02	0.21
S58 Residential care activities and social work activities without accommodation	13064	354	1	5	360	2.72	0.05	0.15	2.01	0.27	0.00	0.00	0.27
S59 Creative, arts and entertainment activities; libraries, archives, museums and other cultural activities; gambling and betting activities	19164	33	2	14	49	0.25	0.09	0.46	0.27	0.17	0.01	0.07	0.25
S60 Sports activities and amusement and recreation activities	24304	176	19	16	211	1.35	1.05	0.53	1.18	0.72	0.08	0.07	0.87
S61 Activities of membership organisations	37350	73	4	12	88	0.56	0.19	0.39	0.49	0.20	0.01	0.03	0.24
S62 Repair of computers and personal and household goods	7205	13	0	2	15	0.10	0.12	0.21	0.12	0.18	0.02	0.09	0.30
S63 Other personal service activities	48391	93	5	6	103	0.71	0.25	0.19	0.57	0.19	0.01	0.01	0.21
S64 Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use	87331	360	0	1	360	0.00	0.00	0.02	2.01	0.00	0.00	0.00	0.41
S65 Activities of extraterritorial organisations and bodies	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Portugal	3982866	13032	1818	3086	17936	100	100	100	100	0.33	0.05	0.08	0.45

Source: own elaboration.

Table 10: Systemic effects of the blue economy of the Azores on elderly employment by sector

Sector	Employment	Blue economy (workers)				Blue economy (sectoral share)				Blue economy (% employment)			
		Initial effect	Direct effect	Indirect effect	Total effect	Initial effect	Direct effect	Indirect effect	Total effect	Initial effect	Direct effect	Indirect effect	Total effect
S01 Crop and animal production, hunting and related service activities	71539	129	59	52	240	12.00	31.04	16.29	15.14	0.18	0.08	0.07	0.33
S02 Forestry and logging	8072	3	0	9	13	0.29	0.14	2.86	0.79	0.04	0.00	0.11	0.15
S03 Fishing and aquaculture	3942	140	0	0	140	12.98	0.11	0.06	8.85	3.55	0.01	0.00	3.56
S04 Mining and quarrying	982	6	0	1	7	0.58	0.03	0.19	0.44	0.64	0.01	0.06	0.70
S05 Manufacture of food products, beverages and tobacco products	10356	38	8	5	51	3.54	4.17	1.52	3.21	0.57	0.08	0.05	0.49
S06 Manufacture of textiles, wearing apparel, leather and related products	12683	2	1	5	7	0.16	0.38	1.48	0.45	0.01	0.01	0.04	0.06
S07 Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	3172	2	1	3	6	0.15	0.79	0.96	0.39	0.05	0.05	0.10	0.19
S08 Manufacture of paper and paper products	833	0	0	1	1	0.00	0.22	0.26	0.08	0.00	0.05	0.10	0.15
S09 Printing and reproduction of recorded media	1316	2	3	3	8	0.17	1.39	1.03	0.49	0.14	0.20	0.25	0.58
S10 Manufacture of coke and refined petroleum products	297	0	0	0	0	0.00	0.03	0.04	0.01	0.00	0.03	0.07	0.10
S11 Manufacture of chemicals and chemical products	1191	0	0	1	1	0.00	0.13	0.22	0.06	0.00	0.02	0.06	0.08
S12 Manufacture of basic pharmaceutical products and pharmaceutical preparations	392	0	0	0	0	0.00	0.02	0.08	0.02	0.00	0.01	0.09	0.10
S13 Manufacture of rubber and plastic products	1691	0	1	1	2	0.01	0.36	0.31	0.11	0.01	0.04	0.06	0.11
S14 Manufacture of other non-metallic mineral products	3474	2	2	3	7	0.21	1.11	0.87	0.45	0.07	0.06	0.08	0.21
S15 Manufacture of basic metals	666	0	0	0	0	0.00	0.05	0.09	0.03	0.00	0.02	0.04	0.06
S16 Manufacture of fabricated metal products, except machinery and equipment	6706	3	3	5	10	0.25	1.35	1.54	0.64	0.04	0.04	0.07	0.15
S17 Manufacture of computer, electronic and optical products	570	0	1	0	1	0.00	0.01	0.06	0.01	0.00	0.00	0.03	0.04
S18 Manufacture of electrical equipment	883	0	0	0	1	0.00	0.10	0.13	0.04	0.00	0.02	0.05	0.07
S19 Manufacture of machinery and equipment n.e.c.	1580	0	0	1	1	0.00	0.06	0.19	0.05	0.00	0.01	0.04	0.05
S20 Manufacture of motor vehicles, trailers and semi-trailers	1201	0	0	0	0	0.00	0.00	0.05	0.01	0.00	0.00	0.01	0.01
S21 Manufacture of other transport equipment	384	0	0	0	0	0.00	0.01	0.04	0.01	0.00	0.01	0.03	0.04
S22 Manufacture of furniture, other manufacturing	4946	1	2	4	6	0.09	0.81	1.20	0.40	0.02	0.03	0.08	0.13
S23 Repair and installation of machinery and equipment	2258	4	3	3	10	0.38	1.62	0.96	0.64	0.18	0.14	0.13	0.45
S24 Electricity, gas, steam and air conditioning supply	1000	4	1	10	16	0.41	0.78	3.08	0.99	0.44	0.15	0.98	1.57
S25 Water collection, treatment and supply	2017	7	2	5	14	0.77	1.13	0.80	1.19	0.36	0.11	0.23	0.70
S26 Sewerage, waste management, remediation activities	2283	1	0	2	4	0.11	0.21	0.73	0.25	0.05	0.02	0.10	0.17
S27 Construction	31011	48	10	13	71	4.44	5.32	4.23	4.50	0.15	0.03	0.04	0.23
S28 Wholesale and retail trade and repair of motor vehicles and motorcycles	8228	9	1	5	16	0.83	0.79	1.67	0.99	0.11	0.02	0.06	0.19
S29 Wholesale trade, except of motor vehicles and motorcycles	19333	20	12	16	48	1.86	6.41	5.11	3.05	0.10	0.06	0.08	0.25
S30 Retail trade, except of motor vehicles and motorcycles	34325	37	8	19	64	3.41	4.43	5.91	4.03	0.11	0.02	0.05	0.19
S31 Land transport and transport via pipelines	11715	10	8	21	39	0.97	4.01	6.57	2.45	0.09	0.06	0.18	0.33
S32 Water transport	213	0	0	0	11	1.00	0.06	0.02	0.69	5.06	0.05	0.03	5.14
S33 Air transport	391	0	0	0	0	0.03	0.04	0.02	0.03	0.07	0.02	0.02	0.11
S34 Warehousing and support activities for transportation	3414	81	7	3	91	7.48	3.85	1.06	2.76	2.26	0.21	0.10	2.67
S35 Postal and courier activities	1675	2	1	4	6	0.18	0.39	1.12	0.39	0.12	0.04	0.21	0.37
S36 Accommodation and food service activities	33950	151	2	5	158	13.99	1.32	1.51	9.98	0.44	0.01	0.01	0.47
S37 Publishing activities	755	1	0	1	3	0.10	0.14	0.37	0.16	0.14	0.04	0.16	0.34
S38 Motion picture, video, television programme production; programming and broadcasting activities	516	1	0	1	2	0.08	0.04	0.41	0.14	0.18	0.02	0.25	0.44
S39 Telecommunications	571	1	0	1	2	0.08	0.13	0.28	0.13	0.16	0.04	0.15	0.36
S40 Computer programming, consultancy, and information service activities	1000	0	0	2	2	0.02	0.23	0.48	0.14	0.02	0.04	0.15	0.22
S41 Financial service activities, except insurance and pension funding	2548	4	3	5	12	0.37	1.34	1.60	0.74	0.16	0.10	0.20	0.46
S42 Insurance, reinsurance and pension funding, except compulsory social security	1345	1	0	1	3	0.09	0.20	0.45	0.17	0.07	0.03	0.11	0.21
S43 Activities auxiliary to financial services and insurance activities	682	0	0	1	1	0.02	0.03	0.34	0.08	0.02	0.01	0.16	0.19
S44 Imputed rents of owner-occupied dwellings	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S45 Real estate activities excluding imputed rents	1692	1	0	1	2	0.08	0.06	0.20	0.10	0.05	0.01	0.04	0.09
S46 Legal and accounting activities; activities of head offices; management consultancy activities	11082	7	9	20	36	0.61	4.78	6.44	2.28	0.06	0.08	0.18	0.33
S47 Architectural and engineering activities; technical testing and analysis	3096	4	2	6	12	0.36	1.11	1.83	0.75	0.13	0.07	0.19	0.38
S48 Scientific research and development	609	2	0	0	2	0.16	0.04	0.12	0.14	0.28	0.01	0.06	0.36
S49 Advertising and market research	394	0	0	1	1	0.00	0.23	0.25	0.08	0.01	0.11	0.20	0.32
S50 Other professional, scientific and technical activities; veterinary activities	1288	1	1	1	3	0.08	0.38	0.42	0.19	0.07	0.06	0.10	0.23
S51 Rental and leasing activities	486	5	0	0	5	0.42	0.15	0.13	0.33	0.94	0.06	0.09	1.08
S52 Employment activities	3467	1	4	6	12	0.13	2.21	1.87	0.73	0.04	0.12	0.17	0.33
S53 Travel agency, tour operator reservation service and related activities	705	9	1	1	10	0.85	0.29	0.16	0.64	1.30	0.08	0.07	1.45
S54 Security and investigation, service and landscape, office administrative and support activities	27323	18	24	45	86	1.64	12.65	11.15	5.46	0.06	0.09	0.16	0.31
S55 Public administration and defence; compulsory social security	41683	103	3	9	114	9.55	1.35	2.74	7.21	0.25	0.01	0.02	0.27
S56 Education	47049	75	1	4	79	6.98	0.41	1.11	5.02	0.16	0.00	0.01	0.17
S57 Human health activities	23871	38	1	5	44	3.32	0.36	1.67	2.77	0.16	0.00	0.02	0.18
S58 Residential care activities and social work activities without accommodation	17369	23	0	23	46	2.12	0.63	0.15	1.47	0.13	0.00	0.00	0.13
S59 Creative, arts and entertainment activities; libraries, archives, museums and other cultural activities; gambling and betting activities	2130	3	0	1	4	0.25	0.08	0.43	0.26	0.12	0.01	0.06	0.20
S60 Sports activities and amusement and recreation activities	1533	8	1	1	10	0.75	0.49	0.29	0.63	0.53	0.06	0.06	0.65
S61 Activities of membership organisations	6307	10	0	2	12	0.91	0.25	0.55	0.76	0.15	0.01	0.03	0.19
S62 Repair of computers and personal and household goods	1693	2	1	4	7	0.19	0.19	0.38	0.13	0.23	0.02	0.08	0.23
S63 Other personal service activities	4187	6	0	0	7	0.59	0.17	0.14	0.45	0.15	0.01	0.01	0.17
S64 Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use	23808	41	0	0	41	3.82	0.00	0.05	2.61	0.17	0.00	0.00	0.17
S65 Activities of extraterritorial organisations and bodies	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Portugal	515740	1077	189	317	1583	100	100	100	100	0.21	0.04	0.06	0.31

Source: own elaboration.

Table 11: Systemic effects of the blue economy of the Azores on immigrant employment by sector

Sector	Employment	Blue economy (workers)				Blue economy (sectoral share)				Blue economy (% employment)			
		Initial effect	Direct effect	Indirect effect	Total effect	Initial effect	Direct effect	Indirect effect	Total effect	Initial effect	Direct effect	Indirect effect	Total effect
S01 Crop and animal production, hunting and related service activities	36994	5	3	6	14	2.52	5.08	4.80	3.64	0.01	0.01	0.02	0.04
S02 Forestry and logging	3835	0	0	3	3	0.00	0.01	2.51	0.79	0.00	0.00	0.08	0.08
S03 Fishing and aquaculture	1255	42	0	0	42	21.40	0.11	0.05	11.38	3.37	0.00	0.01	3.38
S04 Mining and quarrying	329	0	0	0	0	0.00	0.01	0.11	0.04	0.00	0.00	0.04	0.04
S05 Manufacture of food products, beverages and tobacco products	4931	6	1	1	9	3.25	2.50	0.91	2.29	0.13	0.03	0.02	0.18
S06 Manufacture of textiles, wearing apparel, leather and related products	1682	0	0	1	1	0.21	0.16	0.46	0.28	0.02	0.01	0.03	0.06
S07 Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	502	0	0	1	1	0.13	0.46	0.47	0.29	0.05	0.05	0.11	0.21
S08 Manufacture of paper and paper products	231	0	0	0	0	0.00	0.26	0.25	0.12	0.00	0.06	0.13	0.19
S09 Printing and reproduction of recorded media	256	0	0	1	1	0.00	0.79	0.47	0.27	0.00	0.18	0.21	0.39
S10 Manufacture of coke and refined petroleum products	13	0	0	0	0	0.00	0.01	0.01	0.00	0.00	0.04	0.08	0.11
S11 Manufacture of chemicals and chemical products	273	0	0	0	0	0.00	0.11	0.15	0.06	0.00	0.02	0.06	0.09
S12 Manufacture of basic pharmaceutical products and pharmaceutical preparations	133	0	0	0	0	0.00	0.03	0.11	0.04	0.00	0.01	0.09	0.11
S13 Manufacture of rubber and plastic products	674	0	0	0	0	0.00	0.48	0.33	0.18	0.00	0.04	0.06	0.10
S14 Manufacture of other non-metallic mineral products	1125	0	0	1	1	0.14	0.59	0.46	0.31	0.02	0.03	0.05	0.10
S15 Manufacture of basic metals	238	0	0	0	0	0.00	0.05	0.08	0.03	0.00	0.01	0.04	0.05
S16 Manufacture of fabricated metal products, except machinery and equipment	2142	0	1	1	2	0.05	1.01	1.06	0.52	0.00	0.03	0.06	0.09
S17 Manufacture of computer, electronic and optical products	196	0	0	0	0	0.00	0.01	0.05	0.02	0.00	0.00	0.03	0.04
S18 Manufacture of electrical equipment	319	0	0	0	0	0.00	0.08	0.08	0.04	0.00	0.01	0.03	0.04
S19 Manufacture of machinery and equipment n.e.c.	490	0	0	0	0	0.00	0.05	0.13	0.05	0.00	0.01	0.03	0.04
S20 Manufacture of motor vehicles, trailers and semi-trailers	1027	0	0	0	0	0.00	0.01	0.13	0.04	0.00	0.00	0.01	0.02
S21 Manufacture of other transport equipment	369	0	0	0	0	0.00	0.03	0.08	0.03	0.00	0.01	0.04	0.04
S22 Manufacture of furniture, other manufacturing	1055	0	0	1	1	0.00	0.63	0.81	0.35	0.00	0.03	0.09	0.12
S23 Repair and installation of machinery and equipment	711	2	1	1	4	0.80	1.91	0.90	1.00	0.22	0.15	0.15	0.53
S24 Electricity, gas, steam and air conditioning supply	75	0	0	0	0	0.07	0.08	0.27	0.13	0.18	0.06	0.42	0.66
S25 Water collection, treatment and supply	0	0	0	0	0	0.00	0.00	0.02	0.01	0.00	0.00	0.02	0.02
S26 Sewerage, waste management, remediation activities	1351	0	0	0	0	0.07	0.08	0.49	0.29	0.01	0.00	0.04	0.06
S27 Construction	16820	11	3	5	18	5.35	4.51	4.52	4.96	0.06	0.02	0.03	0.11
S28 Wholesale and retail trade and repair of motor vehicles and motorcycles	1797	1	0	1	2	0.33	0.38	0.88	0.51	0.04	0.01	0.06	0.11
S29 Wholesale trade, except of motor vehicles and motorcycles	7634	2	3	5	10	0.84	5.49	4.34	2.66	0.02	0.04	0.07	0.13
S30 Retail trade, except of motor vehicles and motorcycles	14406	8	2	7	18	4.28	4.29	4.21	4.89	0.06	0.02	0.05	0.13
S31 Land transport and transport via pipelines	4950	0	2	5	7	0.19	2.68	4.37	1.89	0.01	0.03	0.10	0.14
S32 Water transport	95	6	0	0	6	2.88	0.04	0.01	1.54	6.00	0.03	0.02	6.04
S33 Air transport	319	0	0	0	0	0.00	0.01	0.03	0.01	0.00	0.00	0.01	0.01
S34 Warehousing and support activities for transportation	852	3	1	1	4	1.50	1.38	0.54	1.18	0.35	0.09	0.07	0.52
S35 Postal and courier activities	105	0	0	0	0	0.03	0.05	0.14	0.07	0.07	0.03	0.15	0.25
S36 Accommodation and food service activities	39450	66	1	5	73	33.60	2.57	4.63	19.68	0.17	0.00	0.01	0.19
S37 Publishing activities	171	0	0	0	0	0.00	0.07	0.20	0.07	0.00	0.02	0.14	0.16
S38 Motion picture, video, television programme production; programming and broadcasting activities	332	0	0	1	1	0.00	0.03	0.49	0.16	0.00	0.01	0.17	0.18
S39 Telecommunications	236	0	0	0	0	0.10	0.12	0.24	0.15	0.08	0.03	0.12	0.23
S40 Computer programming, consultancy, and information service activities	2217	0	1	3	4	0.00	1.52	2.76	1.11	0.00	0.04	0.15	0.19
S41 Financial service activities, except insurance and pension funding	800	0	1	1	2	0.09	0.92	1.05	0.52	0.02	0.07	0.15	0.24
S42 Insurance, reinsurance and pension funding, except compulsory social security	151	0	0	0	0	0.00	0.07	0.14	0.06	0.00	0.03	0.11	0.14
S43 Activities auxiliary to financial services and insurance activities	229	0	0	0	0	0.02	0.03	0.32	0.11	0.01	0.01	0.16	0.18
S44 Imputed rents of owner-occupied dwellings	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S45 Real estate activities excluding imputed rents	1044	0	0	0	0	0.00	0.04	0.32	0.11	0.00	0.00	0.04	0.04
S46 Legal and accounting activities; activities of head offices; management consultancy activities	2054	0	2	5	7	0.23	3.62	4.11	1.98	0.02	0.07	0.16	0.25
S47 Architectural and engineering activities; technical testing and analysis	1038	0	0	1	2	0.23	0.65	1.10	0.57	0.04	0.04	0.12	0.20
S48 Scientific research and development	382	1	0	0	2	0.66	0.09	0.17	0.42	0.34	0.01	0.05	0.41
S49 Advertising and market research	376	0	0	1	2	0.07	0.86	0.75	0.41	0.04	0.13	0.23	0.40
S50 Other professional, scientific and technical activities; veterinary activities	816	1	0	1	2	0.26	0.80	0.71	0.48	0.06	0.06	0.10	0.22
S51 Rental and leasing activities	259	2	0	0	2	0.79	0.18	0.18	0.50	0.01	0.04	0.08	0.72
S52 Employment activities	8756	0	10	13	23	0.00	17.32	11.16	6.19	0.00	0.11	0.15	0.26
S53 Travel agency, tour operator reservation service and related activities	530	6	0	0	7	2.94	0.74	0.36	1.79	1.09	0.08	0.08	1.26
S54 Security and investigation, service and landscape, office administrative and support activities	28748	3	19	37	58	1.31	33.40	31.22	15.70	0.01	0.07	0.13	0.20
S55 Public administration and defence; compulsory social security	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S56 Education	8402	7	0	1	7	3.37	0.13	0.49	1.96	0.08	0.00	0.01	0.09
S57 Human health activities	5769	3	0	1	4	1.60	0.12	0.77	1.11	0.05	0.00	0.02	0.07
S58 Residential care activities and social work activities without accommodation	4290	2	0	2	4	1.09	0.01	0.09	0.61	0.05	0.00	0.00	0.05
S59 Creative, arts and entertainment activities; libraries, archives, museums and other cultural activities; gambling and betting activities	944	1	0	1	2	0.60	0.12	0.55	0.51	0.13	0.01	0.07	0.85
S60 Sports activities and amusement and recreation activities	2236	16	2	2	19	8.01	3.04	1.31	5.13	0.71	0.08	0.07	0.85
S61 Activities of membership organisations	1417	1	0	0	1	0.52	0.09	0.25	0.37	0.07	0.00	0.02	0.10
S62 Repair of computers and personal and household goods	422	0	0	0	0	0.00	0.00	0.18	0.06	0.00	0.00	0.05	0.05
S63 Other personal service activities	4213	1	0	0	1	0.45	0.10	0.22	0.33	0.02	0.00	0.01	0.03
S64 Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S65 Activities of extraterritorial organisations and bodies	0	0	0	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Portugal	223378	197	57	118	372	100	100	100	100	0.09	0.03	0.05	0.17

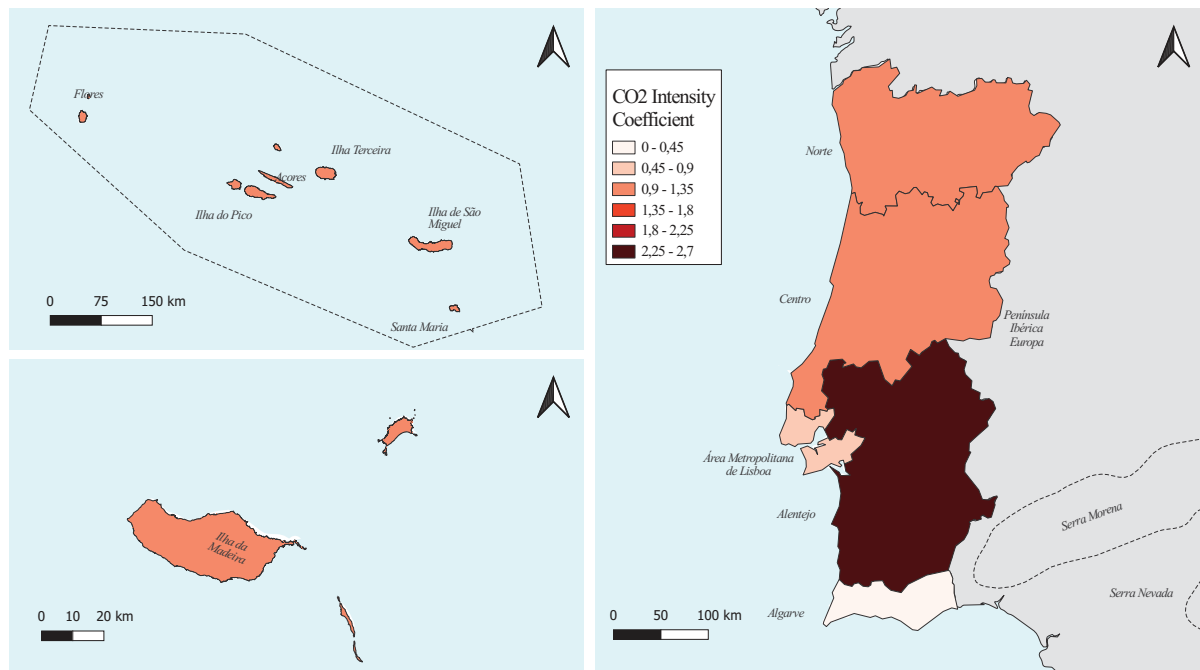
Source: own elaboration.

3.2 Environmental results

The environmental results analyzed here are restricted to the variation in CO₂ emissions resulting from the exclusion of marine-related activities in the Azores. The [Table 4](#) provides these values broken down by sector. For regional data, [Table 1](#) is again referenced. The results suggest that the blue economy of the Azores is directly or indirectly responsible for 0.37% of Portuguese emissions. The majority of this percentage pertains to activities immediately related to the sea, which contribute approximately 0.21% of CO₂ emissions in Portugal. Again, the relative importance of each sector in total emissions closely follows that indicated in [Figure 5](#), with sectors showing the highest immediate participation in marine economy activities standing out, among which electricity and gas (14.63% of those directly employed) and maritime transport (26.08% of directly employed) are prominent.

Regarding regional impacts on emissions, the regions of Madeira (0.144% of the total impact on emissions), Lisbon Metropolitan Area (0.061%), and Alentejo (0.081%) stand out. In the latter case, it is worth noting that the result can be explained by the region's production structure, which is more emission-intensive. The [Figure 6](#) sheds light on this point. It presents emission intensity coefficients by administrative region. With the subscript *r* referring to the region and the subscript *all* referring to the value observed when all regions are considered, the CO₂ emission intensity coefficient for the region *r* is calculated as follows:

Figure 6: CO₂ intensity index by administrative region



Source: own elaboration.

$$ICO2_r = \frac{VA_r}{CO2_r} \times \frac{CO2_{all}}{VA_{all}}$$

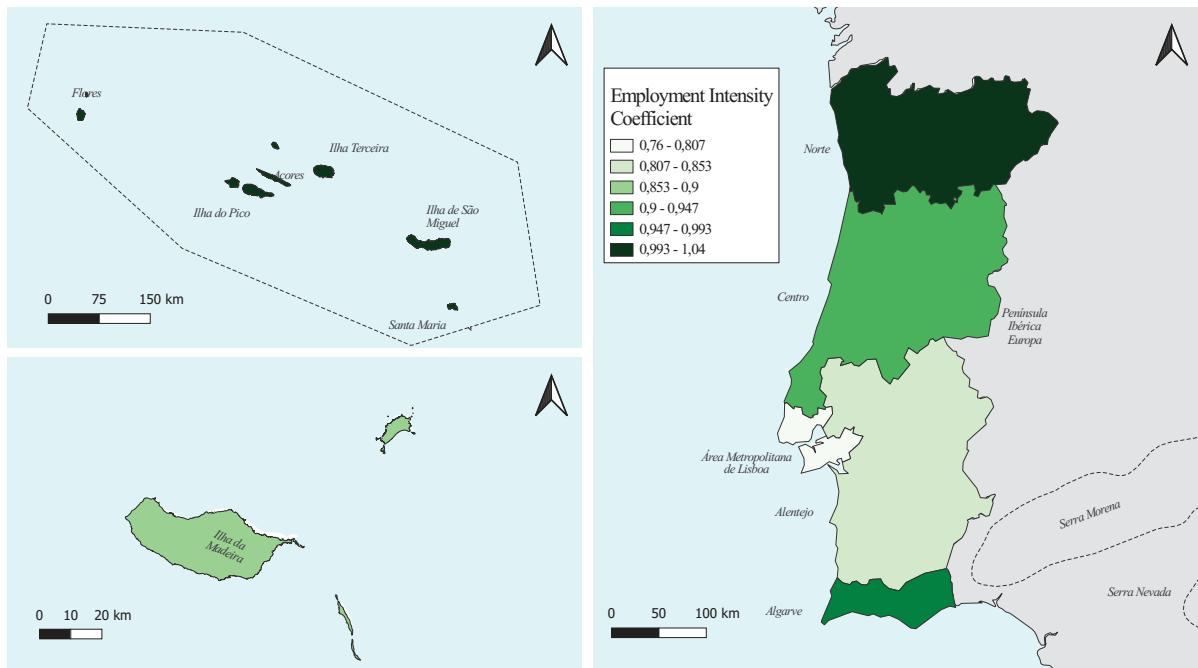
where $CO2$ represents the amount (in tons) of CO_2 emitted, and VA is the value added (in millions of euros). It is noted that Alentejo has the highest emission intensity coefficient (2.631). Furthermore, except for Algarve (0.436) and Lisbon Metropolitan Area (0.601), the emission intensity coefficient is above one in the North, Center, Madeira, and Azores regions, and is relatively homogeneous in these areas.

3.3 Social results

The Table 5 presents the sectoral impacts on employment resulting from marine extraction. Tables 6 through 11 decompose this result by various categories of workers (men and women; youth, adults, and elderly; immigrants and nationals). The results suggest that, considering both direct and indirect employment, 0.44% of Portuguese workers are engaged in activities related to the blue economy in the Azores, which rises to 16.58% when focusing solely on the Autonomous Region of the Azores.

The blue economy primarily employs men (0.51% of Portuguese men are, directly or indirectly, engaged in marine activities in the Azores, compared to 0.37% for women), with most employed in fishing, maritime transport, and related activities. At this point, it is notable that there is a distinction in the roles performed by men and women in activities initially related to the sea: while the male workforce finds more employment in activities such as fishing (24.77% of immediate jobs) and construction (8.94% of immediate jobs),

Figure 7: Employment intensity index by administrative region



Source: own elaboration.

women are more employed in activities such as accommodation and services (34.35%), education (7.63%), and domestic services (5.66%). These differences become narrower when analyzing the age of the workers: the blue economy employs youth, adults, and elderly in accommodation and food service activities, as well as those related to fishing and aquaculture. Public administration also plays an important role in adult employment, but its role is replaced by activities related to harvesting and hunting for the elderly.

Table 1 presents the results of the regional distribution of employment, with decomposition for different categories of workers. It is noted that the effects of maritime extraction on the number of employees are greater in the Lisbon Metropolitan Area (a reduction of 0.092% in employment) and in Madeira (a decrease of 0.082%), consistent with the results from the GDP decomposition. Figure 7 shows the geographic results for the employment intensity coefficient. Similarly to emissions, this coefficient is calculated as follows:

$$IEMP_r = \frac{VA_r}{EMP_r} \times \frac{EMP_{all}}{VA_{all}}$$

where the variable EMP refers to the observed employment. In the figure, the North and Azores regions stand out for having the highest coefficients (1.039 and 1.018, respectively). For other regions, the employment intensity coefficient is always below one. Notably, the coefficient value for the Algarve (0.977) helps to explain, in relative terms, the greater variation in employment in the region in response to maritime extraction in the Azores.

4 Conclusion

In parallel with the Portuguese government's efforts to develop the maritime economy in the country, this work aims to contribute to the study of the blue economy of the Azores archipelago. Thus, the objective of this study is to measure the contribution of maritime-related economic activities to the regional and national economy, evaluating not only the participation of activities directly carried out at sea but also their systemic, direct, and indirect effects, with a focus on the value chain perspective.

The results, classified according to different economic sectors and geographic regions, suggest that 0.41% of the country's GDP originates, either directly or indirectly, from activities developed from the sea in the Azores archipelago, with 16.58% of the region's own GDP dependent on its blue economy. It is estimated that 15,404 workers in the Azores are employed in roles directly related to the sea, and that 21,214 people across the country are employed in these activities. The Madeira and Lisbon Metropolitan Area regions are the most affected by the Azorean maritime economy, but different impacts on employment and emissions are observed in response to varying local production structure arrangements.

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