Improving the quality of multi-level governance and strengthening the resilience of island economies of Croatia, Greece, and Sweden

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# Estimating the cost of insularity for islands in Croatia, Greece and Sweden

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## Executive Summary

Island communities – consisting of households, businesses and governments – often face additional costs compared to those located on the mainland. With a specific focus on Croatia, Greece and Sweden, countries with substantial island territories, this paper sought to measure the severity of island costs in order to help support future policy and investment decisions. This included an assessment of several specific cost types, such as land prices, rent, and transport, as well as broader analysis of GDP and local government expenditure, both of which could potentially be adversely affected by higher costs on average. Further, the paper has explored how higher costs may affect particular activities and industries, as well as analysing the specific implications for broad island stakeholder groups such as households, businesses and governments.

Due to differences in data availability, a different econometric approach was used for each of the three case study countries. As a result of these methodological differences, it was not possible to aggregate evidence from island communities and therefore no cross-country analysis or insights have been included in the report. Rather, the findings from each country offer three new and independent perspectives on the cost of insularity. In Sweden, analysis was focused on transport and land values, aiming to measure the additional cost of travel to major cities, rent and home ownership for island residents. In Croatia, for which fewer municipal indicators were available, regression analysis focused on comparing the expenditures of local governments with island territories versus mainland municipalities. In Greece, where data availability was very limited, the analysis aimed to measure the overall loss in efficiency, and therefore GDP, for island regions at the TL3 level[1] that may be affected by higher costs.

The table below summarises the methodological differences and the key data constraints that influenced the econometric approach used for each country. Due to the large differences in methodology and the types of economic costs that they sought to measure, the results should not be directly compared numerically across countries. Instead, they offer country-specific evidence on how insularity generates additional costs, highlighting common mechanisms through which they are felt – such as transport access, service-delivery challenges, and land and housing pressures.

### Table 1. Methodological differences reflecting variations in data availability

| Country | Dependent variable | Analytical focus | Key limitation |
|---|---|---|---|
| **Croatia** | Municipal expenditure per capita | Fiscal cost of public service provision | Overlap between insularity and coastal effects |
| **Greece** | GDP per capita | Macroeconomic efficiency loss | Limited regional data (TL3 only) |
| **Sweden** | Transport and land/housing costs | Household and business cost burden | Only two island municipalities |

Note: Indicators and units differ across countries.

[1] To assist subnational analysis, most OECD member countries are divided into several TL3 regions. TL3 boundaries typically correspond to existing administrative regions such as counties and in European countries are mostly consistent with Eurostat's NUTS 3 classifications.

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## Main findings of the econometric analysis

1. **In Croatia**, municipal expenditure is significantly higher among island municipalities than mainland municipalities. The econometric evidence suggests that the higher costs faced by island municipalities remain significant when compared to those faced by municipalities with similar geographical features, such as the distance to Zagreb or the share of cropland. The analysis also shows that Croatian islands face comparable cost challenges to coastal mainland municipalities, possibly due to similarities in geography, climate, and tourist activity.
2. **In Greece,** economic differences between islands and the mainland are small, and many social indicators including housing, demography and education are around the national average. However, the direct cost of transport and the indirect cost of tourism activity appear to be much higher on islands. Further, the available evidence suggests that transport costs are substantially higher for islands located farthest from the Greek mainland.
3. **In Sweden**, transport costs for island businesses and residents are significantly higher than for comparable mainland territories due to ferry-related costs and additional travel time. Housing and land costs on Swedish islands are also generally higher, on average, than on the mainland. However, after controlling for other explanatory variables there was no significant difference in land costs compared to mainland municipalities.
4. **In addition to econometric evidence, additional quantitative and qualitative evidence from Croatia, Greece and Sweden** also suggests that islands face unique challenges which are associated with higher costs for households, businesses and government. These challenges are, in some cases, similar to those faced by other non-metropolitan regions (e.g. distance from major infrastructure and services), and in other cases are uniquely applicable to islands (e.g. the need for maritime transport).

In addition to direct findings to help estimate the cost of insularity in Croatia, Greece and Sweden, this paper has sought to develop a methodological framework that can be replicated in future research. For example, as new data become available more precise analysis may be possible that can build upon and refine the paper's estimates of the cost of insularity. For other countries and regions with island territories, the paper provides a menu of econometric options that could be potentially used in future research based upon the policy priorities, data availability and territorial structure of the specific country. Further, with additional data, this framework could be expanded to support a cross-country study that applies the same econometric approach to multiple countries simultaneously, allowing broader conclusions to be drawn about the cost of insularity.

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## Introduction

Compared to mainland territories, island economies are exposed to several additional government, business and household costs as a direct result of their geographic isolation. In many cases, these costs are influenced by limited market depth (few producers, consumers and employers, reducing competition and dynamism), additional infrastructure needs, complex logistics, inadequate transport, and the wide distribution of population across multiple coastal settlements – all of which are the result of island geography. However, institutional arrangements, developed and shaped by island conditions, can also contribute to additional indirect costs. These include reduced efficiency, lower rates of innovation, and weaker governance which must be added to the costs directly caused by geography.

For countries with substantial island populations, the additional costs they face have significant policy implications. First, island communities are potentially at risk, all things being equal, to a lower standard of living compared to their mainland peers. This is due to reduced purchasing power for island residents resulting from more expensive consumption goods. Second, higher costs can affect government effectiveness in numerous ways and reduce access to essential services, such as healthcare, education and utilities. For example, barriers to service access, lower service quality, and the need for self-sufficiency by individual households in locations where government services do not exist, are all possible outcomes that can reduce equity for island residents due to higher costs. Finally, high costs are a burden on competitiveness and cannot be easily reduced, ameliorated or overcome by individual households or businesses resulting in a direct, and negative, impact on GDP. Government policies and investment may therefore be required to reduce the costs of insularity and enable island economies to reach their full economic potential.

Because of these significant policy considerations, this paper aims to establish a framework that can guide the estimation of island costs as well as provide new evidence to better understand their underlying causes. This framework will be based, where possible, on published research as well as incorporating new econometric evidence. The paper will also explore different methodologies and approaches for cost measurement to provide flexibility for future applications. This flexibility will assist future studies to adjust their methodology and help avoid complications caused by country-specific territorial boundaries and data gaps.

### *What is insularity and how it affects Croatia, Greece and Sweden*

Insularity, for the purpose of this study, is the characteristic of being an island territory (Box 1). Islands exhibit considerable diversity in territorial and population size, administrative structure, and geographic location (including proximity or distance from the mainland). However, all islands are physically disconnected to some degree from neighbouring territories. From a socio-economic perspective, insularity can also refer to social, political and economic arrangements that are disconnected from other territories. For example, island businesses may have limited contact with mainland competitors and suppliers, limiting their exposure to new ideas, technologies and broader market trends. In this paper, the cost of insularity refers to the additional costs faced by island communities compared to mainland equivalents, all else being equal. Insularity costs could potentially be caused by geographic factors, such as unique infrastructure needs, insular institutional arrangements, such as high levels of informality in local government, or a combination of both.

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### Box 1. Definitions of key terms

**Throughout this paper, the following terms are frequently used according to the below definitions.**

**Cost of insularity** – the additional costs of undertaking an activity on an island compared to the same activity on the mainland.

**Insularity** – the geographic characteristic of being an island (if a territory) or based on an island (if a locality, business, government, or household).

**Island municipality** – a local government entity that encompasses one or more islands and has no mainland territory.

**Remoteness** – a geographic measure of the distance from the main centres of political, economic, and cultural activity.

Source: Author's elaboration.

Croatia, Greece and Sweden, the three case study countries used in this paper, contain thousands of islands and hundreds of island communities that may be affected by higher costs. For example, Sweden has 267 570 islands, the largest number of any country in the world, 984 which are inhabited by approximately 0.9% of the population (European Commission, 2021[1]). In Croatia, islands are home to around 3.3% of the population and make up 6% of territory, yet only 53 out of its 1 244 islands (4%) are inhabited (Ministry of Regional Development and EU Funds, 2024[2]). And although Greek islands make up a relatively large share of the national population and territory, home to over 15% of the national population and representing nearly 18% of the country's land mass, only 227 of the total of 3 054 (7%) are inhabited (Island Studies, 2016[3]).

In this paper, the objective is to identify and measure the specific costs, both geographic and institutional, affecting islands in Croatia, Greece and Sweden. The paper will focus on the available quantitative evidence and use econometric analysis to determine, as precisely as possible, the degree to which island communities face higher cost burdens than their mainland peers. It will attempt to quantify the total cost burden of insularity by focusing on the major cost types identified through study visits, including costs imposed from both geographic and institutional factors. Using this evidence, the paper will then consider the relevant policy implications and propose recommendations for consideration by subnational and national governments in Croatia, Greece and Sweden.

The paper is structured as follows: the first section examines the existing academic literature and utilises qualitative evidence from study visits to construct an analytical framework to assist the measurement of insularity costs. The second section will review the data available in the three case study countries and propose a suitable methodological approach. The third section presents the empirical findings, with results reported separately for each country. The final section analyses the policy implications and concludes with preliminary recommendations for consideration.

## Conceptual and analytical framework

To guide the measurement of the cost of insularity in Croatia, Greece and Sweden, this section reviews and builds upon the existing academic literature and empirical evidence on the cost of insularity. Recent contributions from island stakeholders have also been incorporated to complement the academic findings, providing insights on the potential impact of island size, population, remoteness, and connectivity. Drawing on this combined knowledge base, a new analytical framework is proposed to systematically link insularity

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costs with their underlying structural and geographic causes, enabling more targeted and effective policy responses.

Each cost mechanism identified in the conceptual framework is represented in the empirical analysis through measurable proxies. These proxies enable the econometric models to quantify how insularity affects costs through distinct channels such as geographic isolation, population size, and connectivity.

### *The academic evidence suggests that island economies face higher costs on average*

Over the past two decades, a small number of studies have sought to measure the costs of insularity in a variety of countries. These publications, though low in number, provide a useful starting point for understanding the costs of insularity and provide some insights into the quantitative techniques available for their measurement.

A particularly valuable study, commissioned by the Corsican Chamber of Commerce, examined a range of quantitative and qualitative evidence to help identify and then estimate the additional costs for Corsican businesses (Goodwill Management, 2018[4])). These included calculations of the costs associated with dozens of individual actions that island businesses regularly take, such as purchasing plane tickets and maintaining larger inventories due to uncertainty in supply. The methodology used for gathering evidence was the completion of surveys estimating the addition cost burden by island businesses. Notwithstanding the limitations of self-assessment, the study found that total business costs were approximately 10.2% higher for companies located on Corsica compared to those operating on the French mainland.

A related research report focused on the island of Sicily, Italy, explored several alternative approaches, including econometric analysis. This study sought to estimate the lost GDP per capita resulting from dozens of individual cost types that affect island economies (Regione Siciliana, 2020[5]). The initial estimates, controlling for only a small number of variables such as the quantity of transport infrastructure, was that GDP per capita was 7.4% lower as a result of insularity. A similar study led by the Bruno Leoni Institute with a focus on Sardinia, Italy, attempted to measure the “tax of insularity” (Amenta, Stagnaro and Vitale, 2020[6]). The econometric approach, with controls for infrastructure stock, international trade, human capital, and the savings of local inhabitants, found that GDP per capita was between EUR 3 800 and EUR 7 600 lower (approximately equal to 18-36% of total GDP per capita based on 2018 data) than would otherwise be the case if Sardinia was connected to the Italian mainland.

The dependent variable used in both of these econometric analyses – GDP per capita – has two significant limitations. First is the high likelihood of omitted variables. Due to the large number of factors that contribute to GDP, and the impracticality of including them all in regression analysis, a misleading understanding of the relationship between GDP and insularity may be estimated. Second is the limited capacity of variation in GDP per capita to help inform policy decisions for island economies. Lower GDP per capita, as the studies in Sicily and Sardinia estimated, provides few insights into which population groups are most affected by the cost burden of insularity or how mitigating measures might be best targeted.

At a more conceptual level, it has been found that, in most cases, insularity is comparable to remoteness, with both acting as an impediment to economic performance (Cerina, 2015[7])). Island-based firms like those in remote regions, are encouraged to relocate to the mainland for closer proximity to their customers and lower costs, which can reduce employment opportunities for island residents. Further this dynamic is more pronounced for small islands, i.e. those with few inhabitants and low GDP (Cerina, 2015[7])).

The norms, approaches and behaviours that are propagated and reinforced by island institutions may also contribute to the cost of insularity. Although the formal political, social, and economic institutions present on island territories – i.e. municipalities, chambers of commerce, political parties, unions, etc. – broadly mirror those present on the mainland within the same country, the behaviour and effectiveness of the institutions located on islands can sometimes differ as a result of their social and political isolation (Wettenhall, 2018[8]). For example, in small, close-knit, isolated island societies where most people know

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each other, societal problems cannot be easily depersonalised, and governance institutions may display a higher degree of informality in their methods of operation (Boswell et al., 2024[9]). This could potentially lead to less strict enforcement of regulations, less competitive tender processes, or less meritocratic recruitment of civil servants – all of which may benefit some individuals and businesses but impose a broader cost on society.

The high proportion of the population employed in public-sector roles and longstanding familial connections are additional characteristics of island governance that can contribute to the blurring of roles and responsibilities within and among island institutions (Baldacchino, 2015[10]). These features can, in some situations, be beneficial, such as in times of natural disaster when collective action is immediately required. However, in other cases, the informality and interconnectedness of island institutions can lead to norms and behaviours that dilute authority and limit the capacity of government to enforce existing regulations, pursue new policies, or implement reforms (Boswell et al., 2024[9]). These poor governance practices, in turn, can result in less efficient markets, missing infrastructure, and reduced competition – all of which could lead to higher costs for island residents and businesses. These documented island features are, at least partially, a function of scale. A multi-country study concluded that on islands with more than 500 000 residents, governance outcomes were unlikely to be negatively affected by familial or interpersonal relationships (Global Centre for Public Service Excellence, 2014[11]).

Island institutions may also be affected by lower rates of social and political competition, compounding the high rates of social interconnectedness among island inhabitants (Veenendaal and Corbett, 2022[12]). The small pool of business leaders, political candidates, and civil society representatives, for example, can lead to the creation of clientelist relationships and patronage networks. These relationships are more likely to occur on small islands due to a higher occurrence of face-to-face interaction, overlapping roles between citizens and politicians, and electoral dependence on a very small number of voters.

The self-selection of residents in pursuit of specific lifestyle and occupational preferences is a further factor that may contribute to unique island norms and institutional behaviours, especially in countries with both island and non-island territories (Matheson, Pawson and Clegg, 2024[13]). New residents in island locations throughout the UK, for example, were found to be seeking a specific island culture and "traditional" way of life that far exceeded those migrating to other, non-island, rural areas. The degree to which these personal preferences might influence island institutions is likely to vary significantly by region, country, or governance system. Nonetheless, they have the potential to exert considerable influence on local institutions, norms and approaches.

Although the exact causality is difficult to determine precisely and may vary significantly, the unique social structures of islands also have the potential to create significant challenges that occasionally result in higher costs. These could include delays to new infrastructure projects, slower uptake of technologies, and higher susceptibility to corruption (Anti-Corruption Resource Centre, 2010[14]).

### *New evidence from island stakeholders has broadened the understanding of the cost of insularity*

In addition to published research, interviews conducted with island stakeholders in Croatia, Greece and Sweden have helped to not only inform how insularity costs accrue but also which stakeholders are most affected. These interviews – including with national government officials, local business owners, municipal representatives and other island-based organisations – emphasised that although many policy settings were the same on island and non-island locations, particular activities were exceptionally affected by higher costs. These included:

- The cost of land-use, especially house prices and rent
- The cost of maritime transport, for both people and cargo
- The cost of environmental management and natural disasters

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- The cost of infrastructure
- The cost of providing basic or essential government services

An important finding from the interviews that has not featured prominently in the academic literature is the additional cost of non-market activities. Examples include the delivery of education services, the operation of hospitals and the time spent by government agencies undertaking environmental management, which can be more resource intensive in an island environment. This paper has therefore attempted to include non-financial costs for three main reasons. First, all resources, used by either government or individuals, carry an opportunity cost and could otherwise support alternative productive uses. For example, a municipal government allocating additional staff to the management of island transport utilises resources that could have alternatively been used to strengthen education or business support services. Second, providing high-cost goods and services imposes a burden on government, which is ultimately funded by taxes. Delivering the same level of services in a high-cost location will lead to a higher tax burden. Third, high costs can limit the accessibility and compromise the quality of goods and services, which reduces welfare in the short term and can have long-term implications for productivity and well-being. Under-resourced education facilities in island communities, for example, can undermine human capital formation and stifle economic growth.

### *Island typology is expected to greatly influence the severity of insularity costs*

The estimate of island-specific costs in relation to comparable mainland territories is a significant advance on the existing literature but provides only limited guidance to policy makers. It primarily provides insights into the overall impact of insularity for the average island included in the sample. It can also guide the broader funding needs of all islands as a collective, which may be much greater than on the mainland for certain services. However, due to the diverse characteristics of individual islands, with their varying degrees of remoteness and accessibility, it is expected that certain types of islands will be more or less affected by insularity costs.

The concept "double insularity" is one example of an island characteristic that could lead to exceptionally high insularity costs (Boumpa and Paralikas, 2020[15]). "Double insularity" occurs when an individual living on one island is unable to access the mainland without transiting through another island to do so. In contrast, for islands with a bridge connection or those located in very close proximity to the mainland, the cost of insularity would be expected to be less severe. This variance in the severity of insularity costs throughout island communities should not obscure the broader point that, all else being equal, it is anticipated that costs will generally be higher if insularity is present.

For an even more precise cost comparison, geographic size, topography, length of coastline, and distances from a major city, as well as other influential factors should be held constant. In addition, the variance of costs among island locations, and grouping together island locations with shared characteristics, could provide insights into the different degrees of insularity costs likely to affect certain types of island territories.

Throughout this paper, all references to additional costs for islands – generally or with specific traits – should be seen as additional to what would otherwise be expected on the mainland. For example, many islands are a great distance from a major city, which imposes high transport costs on residents seeking to access essential services. However, remote settlements on the mainland would be expected to face similarly high costs, and a distinction between long distances and insularity is required to tease out the exact costs attributable to island geography and institutions.

### *A new analytical framework can help link insularity costs with their underlying causes*

In addition to establishing a relevant conceptual benchmark for comparing island territories with non-island territories, i.e. a hypothetical mainland locality with identical characteristics, a clear measurement framework is also required to assist the attribution of costs. The aim of such a framework is to provide a

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flexible, but rigorous, set of analytical approaches that can be used selectively in future research depending on the research question, data availability and specificities of the territories.

This framework, developed below, highlights the specific underlying causes of insularity costs, and also helps avoid double-counting island costs that affect multiple stakeholders sequentially. For example, high rental costs are not only a charge on household budgets, but can lead to additional challenges for businesses, municipalities and social service providers wishing to attract workers. For example, in addition to tenants paying higher rental prices, employers may be pressured to incorporate expensive housing into their salary structure. However, this secondary impact on employers is not additive, instead it is a direct response to the initial cost. Therefore, if in a hypothetical situation monthly rent was EUR 200 higher on a specific island, and the island's businesses compensated their employees with a rental supplement of EUR 200, the net impact would remain as only EUR 200.

Although the cost of insularity in the example above is borne by island businesses, the potential for cascading costs that are additional to the initial impost remain high and should also be included in the final calculations when relevant. An example of a cascading cost impact that builds upon high rental costs are the additional challenges, time spent, and resources expended by island businesses in attracting and retaining skilled labour. These costs could take the form of additional advertising, the provision of sign-on bonuses, the use of private agencies, or the additional time spent by company staff. In this example, these costs are related to, but incurred in addition to, the initial EUR 200 cost of higher rent.

The final benefit of a cost measurement framework, in addition to greater precision in the measurement of the exact causes, effects, and affected groups, is to help avoid the misunderstanding that high costs themselves are the problem. High costs on islands may be present due to a range of factors, some unrelated to insularity, and policy responses will be more effective if they are targeted to address the root cause rather than simply alleviate the financial burdens imposed on island businesses and residents. Therefore, in addition to precise measurement of the additional cost of island housing, for example, attribution of that cost increment to a particular feature, or multiple features, of island housing markets, geography or institutions should also be provided to frame and shape appropriate policy responses.

The underlying causes of the costs of insularity, and an example of their impact on the three major affected groups – households, businesses and governments – are included in the table below (Table 2). It shows that islands are different from mainland regions due to two main factors – their geography and institutions. These two differences, with geography having an immediate impact on island terrain and island institutions shaping social organisation, can lead to a wide range of secondary impacts, and therefore costs, on specific island stakeholders. For some secondary impacts, such as limited infrastructure availability, island geography and institutions may be equally responsible. A shortfall in water infrastructure, for example, could be partly due to island institutions being unable to maintain existing assets adequately, as well as geographic challenges, such as a limited number of natural reservoirs.

## Table 2. Underlying causes of the cost of insularity

| | Island geography alone | | Geography and institutions | | Island institutions alone | |
|---|---|---|---|---|---|---|
| **Primary impact** | Distance, terrain, disconnection | | Shortages and inequities in the factors of production | | Norms, approach, behaviours | |
| **Secondary impact** | Transport | Limits to development | Limited infrastructure | Shallow markets | Weak governance | Low productivity |
| **Examples of cost impact** | | | | | | |
| **Households** | Travel | Housing | Commuting | Petty services | Water | Renovations |
| **Businesses** | Freight | Manufacturing | Exports | Skilled labour | Permits | Construction |
| **Governments** | Subsidies | Roads | Service delivery | Procurement | Staff costs | Health services |

Note: Costs accruing to volunteer and non-government organisations are included in households.
Source: Author's elaboration.

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Numerous goods and services can be affected by secondary impacts, such as the influence of distance and disconnection on transport services. An island's geography, for example, and its lack of land connections, will often necessitate maritime transport that would not be needed or economical in most mainland locations, such as the use of ferries or private boats, leading to more expensive journeys for passengers and freight. More frequent use of maritime transport, in turn, affects all three major groups. Businesses may need to pay more for the delivery of essential parts and machinery; households are affected by the time, inconvenience and ticket price of a trip to the mainland; and governments, which typically subsidise transport services, are required to fund and manage ferry services. Therefore, hundreds of individual activities, and the cost of thousands of products, could potentially be affected by the need for maritime transport. Most goods sold at an island supermarket, for example, would be shipped from the mainland, leading to an increase in their retail price.

## Methodology and data

The methodology employed in this paper has been fundamentally shaped by the data available in Croatia, Greece and Sweden. Due to differences in territorial boundaries, the limited availability of some indicators and different methods of measurement across countries, no single econometric approach could be applied. To compensate for these limitations, different functional forms were developed to explore different dependent variables in each country. The upside of this three-tiered approach is that it demonstrates the variety of different analytical options available. As a result, this approach provides a menu of methodological options for countries seeking to measure insularity costs and highlights the types of data required.

To maintain analytical clarity and prevent double counting, each cost dimension in the econometric framework is analysed according to its primary underlying mechanism. For instance, higher transport costs are treated as a mobility penalty, while higher housing prices are classified as a land constraint effect, even when both may originate from geographic isolation. Likewise, fiscal costs are analysed separately from household or market costs to ensure that the estimated effects remain additive rather than overlapping.

### *Several analytical approaches are available to measure the cost of insularity*

As part of this study, a wide range of analytical approaches were tested for suitability with the case study countries and could potentially be used in future research. They consisted of:

- **Descriptive statistics**: comparison of mean outcomes for island territories with mainland equivalents.
- **Transport cost estimator**: calculation of the average additional costs imposed on island residents and businesses (Box 2).
- **Econometric analysis of specific cost types**: measurement of the cost of land, rent, service delivery, infrastructure and capital costs.
- **Econometric analysis of total government expenditure:** estimation of the annual spending with a focus on expenditure at the municipal level.
- **Econometric analysis of GDP per capita**: assessment of the efficiency of island economies that may be negatively affected by insularity costs.

These different approaches were explored for several reasons, and, primarily, due to the absence of a standard methodology in the existing academic literature. Descriptive statistics are the most commonly available, cover the broadest range of policy areas, and require less technical expertise to compute. The transport cost estimator provides a very precise insight into a major cost type that effects all islands but is laborious to model and may be impractical for countries with many islands, ferry routes, or ferry service

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providers. Econometric analysis of specific cost types is the preferred analytical approach but is reliant upon the existence of suitable measures of costs on both island and non-island territories. Econometric analysis of government expenditure provides a valuable insight into government costs but is broad in its scope, creating difficulties for the costs of insularity to be disentangled from other factors. Econometric analysis of GDP per capita is an imperfect measure of the cost of insularity but is easily undertaken, can provide valuable indications of the cost of insularity and is comparable to past academic studies. Depending on the research question and data available, future studies may choose from this menu of options the approach that is most suitable for their needs. The approach chosen for each country in this study is detailed in the subsequent sections.

### *The available analytical approaches could potentially support a future cross-country study*

Despite their different areas of focus and methodologies, each of the analytical approaches described above has the potential to produce credible evidence of the cost of insularity. This is because, within each method, islands are compared with territories that are in other respects identical, allowing the island effect to be isolated. However, it should be noted that these approaches, and the costs that they are estimating, are not independent of one another. The detection of higher transport costs and higher municipal government expenditure per capita on island territories, for example, would not necessarily signify two separate costs. In many cases, these costs may have the same underlying cause (i.e. insularity), and the findings of each approach should instead be interpreted as complementary evidence of the same phenomena.

Due to the broad methodological validity of these distinct approaches a cross-country study might potentially be undertaken in the future. However, a major barrier to a multi-country study is the potential differences across countries in territorial scale and administrative organisation. For example, the comparison of small island with 100 residents with an island regions such as Sicily, would introduce new sources of variation in costs that might obscure the similarities between islands.

The other major potential challenge to a cross-country study is data availability. Most critically, island data is often unavailable or out of date and this scarcity of suitable data may inhibit the inclusion of some countries. Further, because each country uses slightly different methodologies to develop island-level indicators, it may not be possible to fairly compare less standardised variables, such as annual infrastructure spending or average transport costs. Overall, however, these barriers also exist in non-island territories and a cross-country study using one of the approaches explored in this paper is achievable if the chosen methodology, data availability and administrative structures of the countries under consideration are aligned.

### *How econometrics can help to estimate insularity costs*

Insularity, defined as the physical disconnection from the mainland, is just one geographical condition that can affect the cost of economic activities for citizens and businesses in a given region. Other geographical conditions that can affect the cost of economic activity include distance to the main centre of economic activity (remoteness), land area size, and topography, i.e. the quality and suitability of the land for economic activity. Aside from physical disconnection from the mainland, all other geographic conditions, in theory, could affect both island and mainland regions. Consequently, island regions potentially share some challenges with mainland regions, such as those having a high proportion of mountainous terrain or being remote from the country's capital. This analysis focuses on the economic burdens and costs that can be solely attributed to insularity.

To understand the effects of insularity, it is important to disentangle the impact of different geographical conditions on economic costs. The following example illustrates why this is important. Suppose that, on average, transport costs for businesses on a given Island are higher than on the mainland. These higher costs could be driven by ferry ticket prices, or they could be the result of other geographical factors, such

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as the long distance from the island to the nearest large city, or the mountainous terrain affecting road quality and driving speed. An econometric analysis can help to distinguish the effects of insularity from other potential factors influencing economic costs. To conduct such an analysis, a sample of diverse island and mainland regions, reliable estimates of transport costs, as well as indicators that measure the geographic conditions in each region are needed.

The econometric approach employed in this paper essentially compares island regions with similar regions on the mainland, controlling for geographic conditions to isolate the association between insularity and economic costs to assess how insularity is associated with economic costs, all other geographic conditions being equal.

As discussed in the literature review, so far, there is little econometric evidence of insularity costs. The study that most closely resembles the methodological approach employed in this report is Del Gatto and Mastinu (Del Gatto and Mastinu, 2015[16]). The study aims to disentangle the economic costs of insularity, measured in GDP per capita, from costs associated with geographic remoteness and smallness and is based on 474 regions in 22 countries, including 76 island regions. Even after controlling for region size and geographical remoteness (measured by the distance to the historical economic frontier in each country) their regression analysis reveals a significant negative association between being an island and GDP per capita. These findings provide evidence of the additional challenges islands face on top of remoteness and smallness (challenges that also affect mainland regions). However, the study is of limited value when it comes to assessing the costs of insularity because the dependent variable (GDP per capita) is only an indirect measure of economic costs. Additionally, the study does not control for other geographical determinants of economic activity, potentially resulting in an overestimation of the cost of insularity.

Generally, it is also possible that differences in economic cost across regions can be explained by non-geographic characteristics, including institutions, culture, technology and demographics. However, geography itself does affect all these factors. For example, island populations are the present-day outcome of geographic factors such as remoteness and topography shaping demography over many years, with territories deemed the most suitable for economic development generally attracting more migrants. Additionally, institutions and culture can moderate – either increasing or dampening – the effects of geography on economic costs. Nevertheless, due to data availability and to assess the ultimate geographic sources of economic costs, the empirical part of this paper focusses on the geographical factors that influence economic costs. Future research could potentially incorporate cultural and institutional factors into the analysis.

Following the literature discussed above, the basic premise of this paper is that insularity poses a cost burden to citizens, businesses, and local governments on islands due to their geographical disadvantage. It is important to note that the indicators used in this paper are based on administrative and other publicly available sources and therefore only partly reflect the structural disadvantages that island economies face as the indicators themselves are influenced by policies. For instance, ferry ticket prices can impose significant costs on island citizens and businesses, but these prices themselves are a function of political decisions to subsidise ferry travel. Consequently, using ticket prices as a proxy for insularity costs potentially underestimates the structural cost of insularity.

### *Croatia, Greece and Sweden all face unique data challenges*

The data available for the analysis of islands in Croatia, Greece and Sweden was limited, with each country affected by different data challenges. In Croatia, data availability was patchy for islands and municipalities, but better for its TL3 regions (none of which are exclusively island territory. In Greece, although the administrative structure was advantageous, with numerous TL3 regions and municipalities exclusively made up of islands, numerous indicators are unavailable. In Sweden, where municipal data was excellent, only two municipalities were exclusively island territory. These limitations necessitated a different approach

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for each country. The following sections provide an overview of the data availability in each of the three countries and a discussion on which indicators are most suitable for econometric analysis.

*Municipal expenditure was the most suitable dependent variable for Croatia*

Croatia has 53 inhabited islands and has proactively developed a database of over 130 island-level indicators. The island-level indicators include valuable demographic, geographic, economic and administrative data, enabling comparisons across islands and the development of island clusters based upon shared characteristics. The indicators are collected and updated by the Ministry of Regional Development and EU Funds (Ministry of Regional Development and EU Funds, 2024[17]).

In the case of Croatia, analysis at the island level differs from analysis at the municipal level because the territorial boundaries of islands usually do not match municipal boundaries. An island may house several municipalities or form part of a municipality that also includes mainland territory. For instance, the island of Krk contains seven municipalities, whereas the island of Iž belongs to the Zadar municipality, which also covers mainland territory and the islands of Ist, Molat, Olib, Premuda, Rava, Silba, Škarda.

A comparison of island-level indicators with municipal averages (of all 556 Croatian municipalities) provides an initial overview of how islands and municipalities differ from each other (Table 3). The island-level indicators reveal that the average Croatian island is smaller and less densely populated than the average Croatian municipality. On average, municipalities are about 34 km² bigger than islands and have 36 more inhabitants per km².

## Table 3. Geographic characteristics of Croatian islands and municipalities

| Indicator | Island average | Municipal average |
|---|---|---|
| Land area (km$^2$) | 67.2 | 101.7 |
| Population | 2 498.1 | 6 963.7 |
| Population density (inhabitants per km$^2$) | 51.4 | 87.9 |

Note: All data from 2024 except island population (2022), municipal population (2021) and municipal population density (2021). Municipal (n=556) and inhabited island averages (n=51) are unweighted.
Source: Author’s elaboration with data from (Ministry of Regional Development and EU Funds, 2024[2]).

The availability of island-level indicators also makes it possible to compare islands with each other based on their geography and socio-economic characteristics. The following comparison of island-level indicators reveals that the Croatian islands are quite distinct from each other. For example, the island of Krk has 19 970 inhabitants and covers an area of 405 km². In contrast, the island of Male Srakane has only one inhabitant and covers 0.6 km². Tourism intensity also differs greatly across the islands. The three islands that had the most overnight stays in 2022 were Krk (6.4 million), Pag (3.8 million), and Vir (2.5 million) (Ministry of Regional Development and EU Funds, 2024[2]). In contrast, eight Croatian islands reported fewer than 1 000 overnight stays. Croatian islands also differ in terms of business activity. Krk (1 380 active businesses), Hvar (871 active businesses) and Brač (735 active businesses) have the highest level of business activity, while eleven Croatian islands have fewer than five active companies.

Croatian islands also differ in terms of their administrative structure and affiliation. The local government headquarters of 19 islands are located on the island itself, whereas for 12 islands the local government is located on a neighbouring island. Further, the local governments of 22 islands are based on the mainland. The different locations of the local government offices could result in variations in the accessibility of public services such as the expert advice on spatial planning rules and therefore costs, as well as impacting local labour markets, e.g. the availability of public-sector jobs.

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Furthermore, Croatian islands differ in how they are connected to the mainland. Five islands (Čiovo, Krk, Murter, Pag and Vir) are permanently connected to the mainland via bridges, reducing dependence on maritime travel. Pelješac is a special case as it is technically a peninsula that is administratively treated as an island (Parliament of Croatia, 2018[18]). The differences with regard to the connection and distance to the mainland could have consequences for transport costs and the delivery of public services. Taken together, these island-level insights suggest that, due to their economic, demographic and geographic dissimilarity, Croatian islands face different challenges and opportunities. This is important to note as the descriptive and econometric analysis will focus on *average* cost differences between island and non-island territories.

Some island-level indicators available in Croatia, such as the number of businesses, income per capita and the annual tax revenue of local government units, are suitable as dependent variables for the econometric analysis. However, island-level indicators need to be compared to a control group. Unfortunately, most of the indicators available at island level are not easily comparable to indicators at the municipal level. Therefore, the descriptive and econometric analysis to measure insularity costs focusses on the municipality level rather than the island level.

The use of municipal-level data has several advantages over using island-level indicators. First, using data at the municipal level offers a greater variety of standardised indicators and enables a much broader comparison of economic costs for island and non-island territories. For example, municipal government expenditure on public services is generally not available at the island level, as many islands form part of larger municipalities with costs that are not easily divisible. Second, the municipal level also offers a wider range of potential control variables, e.g. forest cover and land use, that ensure that island municipalities are compared to geographically similar municipalities on the mainland. Third, using the same administrative level is advantageous because the geographical units of interest (island municipalities) are more similar to the control group (i.e. mainland municipalities) in terms of observable and unobservable characteristics (e.g. size, population, economic sophistication). This is particularly important as, due to data availability, many of these observable similarities cannot be controlled for.

In this paper, the descriptive and econometric analysis of Croatia is based on municipal-level data. This approach allows for a more robust econometric analysis and enables comparisons between similar geographical units at the same administrative level. Nevertheless, the island-level indicators are a highly valuable resource that can complement and help explain the findings generated at the municipal level.

Overall, the sample that is used for the descriptive and econometric analysis includes 553 of the 556 Croatian local self-governing units[2] (426 municipalities and 127 cities and excluding Zagreb and the municipalities Bedekovčina and Civljane[3]), 59 of which include island territories. Of those 59 cities and municipalities that include island territory, 13 cities and municipalities include both island and mainland territory. As this paper defines insularity as the physical disconnection from the mainland, the main subsample of interest for the analysis comprises the 46 local government units that encompass island territory only (Figure 1).

[2] To improve readability, the report uses the term ‘municipal level’ when referring to the unit of analysis of the Croatia sample.

[3] The exclusion of Zagreb and Bedekovčin is due to the unavailability of data for the primary variables of interest. Civljane is excluded from the sample because it is an extreme outlier in terms of government expenditure (see empirical results section for a more detailed explanation).

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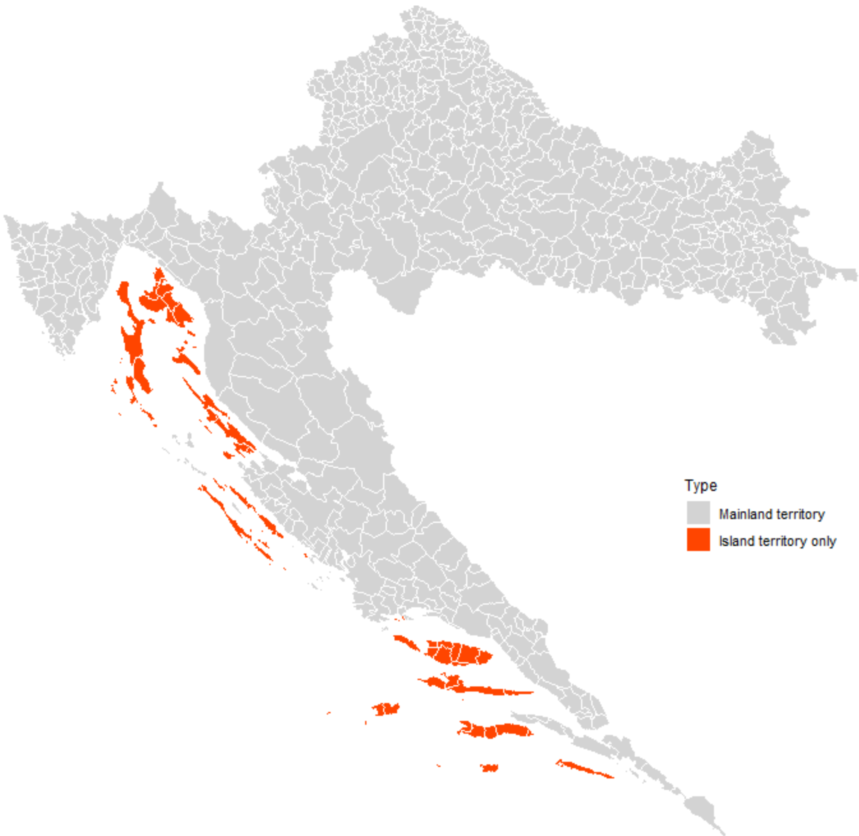
## Figure 1. Croatian municipalities with island territory only




Note: Municipalities coloured orange are exclusively island territory. Mainland municipalities coloured grey may include some islands.
Source: Author's elaboration.

Publicly available municipal-level indicators in Croatia that could potentially be used to approximate insularity costs include tourism intensity, employment rates, and the share of protected areas, but many others available at the county level are not available for municipalities. For this reason, municipal government expenditure per capita has been chosen as the main dependent variable with the aim of measuring the costs of insularity related to government services. In general, as described in the conceptual framework, municipalities with island territory are expected to spend more on government services, all other things being equal. Data on municipal government finance is drawn from the OECD municipal finance database (OECD, 2024[19]) which includes total local government expenditure from 2014 to 2020. In this analysis, data from 2019 was used instead of 2020 to avoid the potential impacts of the Covid-19 pandemic.

Control variables at the municipal level covering geography (e.g. forest coverage and coastline length), remoteness (geodesic straight-line distance to Zagreb), size (land area) and demography (e.g. population density) were collected from the Croatian Statistical Office database and the OECD Local Data Portal. 0 provides an overview of the main variables of interest, including summary statistics.

### *Due to data limitations, Greek analysis was limited to GDP*

This section provides an overview of the various approaches that were considered for the econometric analysis of insularity costs in Greece. Island-level, municipal-level and TL3-level analysis were all

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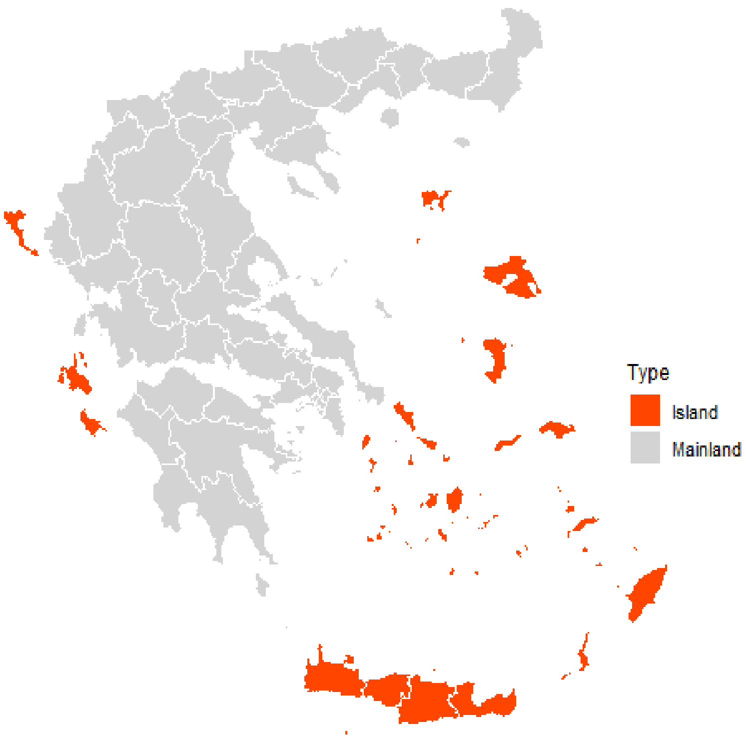
investigated for suitability. Measurement of the cost of land, the cost of transport, the cost of water and water infrastructure, the cost of tourism and seasonality, and the cost of land-use restrictions were all attempted as part of this research due to their identification as major insularity costs during the study visits.

Due to the limited availability of data at the municipal levels, the econometric analysis for Greece focuses on the TL3 (NUTS3) level. Although many other cost types were considered, GDP per capita was the only indicator with suitable data to support a dependent variable. However, GDP per capita is not a direct measure of economic costs. Nevertheless, it provides initial evidence of differences in economic development and productivity between Greek islands and mainland regions.

Following Eurostat's methodology on territorial typologies, 12 of Greece's TL3 regions are classified as consisting entirely of one or more islands (Figure 2). To be classified as an island region, the territory must have no fixed link to the mainland, such as a bridge, and must be at least 1 km from the mainland. Therefore, the Lefkada and Euboea TL3 regions are not classified as islands according to this definition and were excluded from the analysis.

## Figure 2. Island and mainland regions, TL3




Note: Municipalities coloured orange are exclusively island territory. Mainland municipalities coloured grey may include some islands.
Source: Author's elaboration

In total, Greece has 52 TL3 regions, allowing a good sample of island and non-island territories to be included in econometric analysis. However, the data available for use as control variables are very limited (see 0). Due to these shortcomings, the econometric analysis is supplemented by a descriptive analysis of municipal-level data gathered from the OECD Local Data Portal and island-level transport data to produce initial insights in how economic costs might vary across islands.

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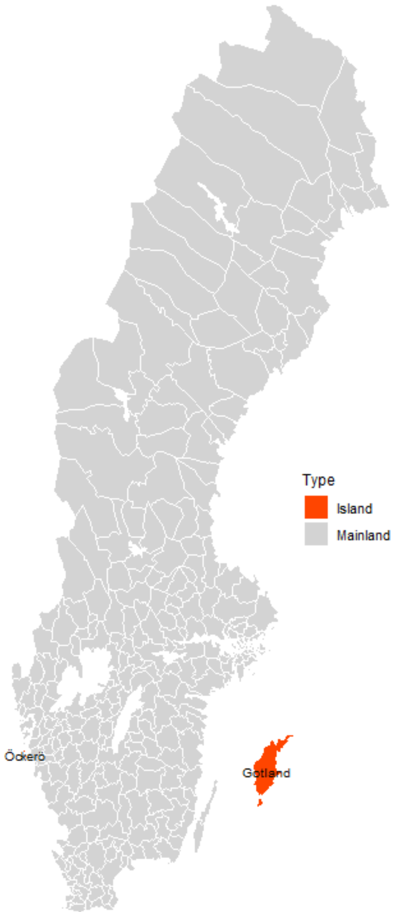
*Econometric analysis in Sweden focused on transport and land-use costs*

To measure insularity costs in Sweden, the municipal level is the most suitable unit of analysis due to the presence of only one island TL3 region (Gotland). Nonetheless, among the municipalities, only two, Gotland and Öckerö, are solely island municipalities without fixed mainland connections (Figure 3). Gotland is distinctive in that it functions both as a municipality and as a county. Öckerö, by contrast, belongs to Västra Götaland County and consists of ten inhabited islands. In Sweden, data at the municipal level is comprehensive and publicly available, allowing for consistent comparison across all 290 municipalities in Sweden. The best available analytical approach therefore consists of comparing the two island municipalities with comparable mainland municipalities.

### Figure 3. Mainland and island municipalities in Sweden




Note: Bridged islands and islands that form part of a mainland municipality excluded.
Source: Author's elaboration.

The two main categories of dependent variables selected to assess the cost of insularity in Sweden are housing and transport costs. These were chosen for two reasons. First, unlike the other countries included in the study, the Swedish statistical agency provides detailed housing and land indicators at the municipal level. Second, despite the absence of official data on actual transport expenditure for businesses and inhabitants, the small number of Swedish island municipalities allowed a new transport indicator to be

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modelled based on estimated fuel and ferry costs for a standard trip to Stockholm from each municipality, including the two islands (Box 2).

To approximate the real travel costs for businesses and inhabitants in every Swedish municipality, a transport cost indicator combining distance-based costs with specific adjustments for ferry-related costs was constructed. For land and housing, the main variables of interest are the average property price for individually owned apartments and houses (i.e. the average purchase price), the average rent, and the average value (estimated by the government) of residential buildings.

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### Box 2. Constructing a transport cost indicator

Using publicly available data on travel times, ticket prices and ferry schedules, an indicator reflecting the costs for inhabitants and businesses of each municipality for a standard trip to Stockholm by car was developed. Stockholm was chosen as a central reference point for illustrative purposes and because a consistent destination is needed for a fair comparison of travel costs across all Swedish municipalities. The transport indicator consists of a mainland and ferry-related cost component. In other words, total travel costs for a trip to Stockholm are the sum of mainland car travel costs (e.g. fuel and depreciation, time) and ferry-related costs (e.g. tickets, time, and inconvenience). For example, travelling from the city of Gothenburg to Stockholm on the mainland takes around 315 minutes (based on actual travel time data), incurring fuel and vehicle depreciation costs, as well as non-financial costs (opportunity costs) due to lost productive time during the journey. By contrast, a trip from Gotland to Stockholm first involves taking a ferry to the mainland, which incurs ticket costs, as well as time and inconvenience costs. The rest of the journey on the mainland incurs the same kinds of costs, e.g. for fuel and depreciation, as any other journey starting in a mainland municipality.

The mainland component of the transport cost indicator, which provides an average cost estimate for a journey to Stockholm from a mainland location, is based on fuel and electricity costs, maintenance costs, and travel time costs. Fuel and electricity costs are calculated based on distance travelled, the assumed average price for fuel and electricity per kilometre, and the assumed average consumption per kilometre. Maintenance costs are calculated based on the distance travelled and estimated depreciation costs per kilometre. Time costs are calculated based on the observed average travel time between the relevant municipality and Stockholm and the average wage in Sweden. **Error! Reference source not found.** provides additional details on the assumptions and calculations relating to travel costs on the mainland.

In addition to the transport costs for travelling on the mainland, each trip from an island incurs extra ferry-related costs. The ferry component of the transport indicator is calculated based on ticket prices, travel time, and inconvenience costs. As the ferry from Ockerö is free of charge, ticket costs only affect journeys to or from Gotland. The ticket costs for Gotland were calculated using the actual prices of commuter tickets for passengers and cars. For businesses, the cost indicator includes additional freight charges. Time costs were calculated based on the duration of each ferry journey and the average wage in Sweden. To account for the inconvenience of waiting for the ferry, inconvenience costs are based on ferry service frequency and include assumptions about delays, cancellations, and the utilisation of waiting time.

It is important to note that this indicator captures transport costs for businesses and citizens, which can affect travel patterns and economic activity on islands. However, even when ferry tickets are free of charge, the national, regional or municipal government, and ultimately the taxpayer, typically bears some of the costs of insularity through subsidies. This applies not only to Ockerö but also to Gotland. For instance, in 2023, the European Commission approved SEK 33 million in state subsidies to shipping companies that operate the ferries connecting Gotland and the mainland in response to rising fuel prices (EUR-Lex, 2023[20]).

Source: Author's elaboration.

To support the econometric analysis, municipality-level covariates were obtained from official sources including Statistics Sweden and the Kolada municipal database (Kolada, 2025[21]). These independent variables included data related economic activity (e.g. GDP per capita), geography (e.g. forest and arable

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land coverage), remoteness (e.g. straight-line distance to Stockholm), size (e.g. land area) and demography (e.g. population density) are available at the municipal level.

The main challenge for the measurement of insularity costs in Sweden is not related to data availability, but to the fact that Sweden only has two island municipalities. This makes it difficult to compare the two islands with the other 288 municipalities that are predominantly mainland and obtain a robust econometric estimation, since the small number of island units increases the sensitivity of the estimates and standard errors. To overcome this limitation, future research could potentially collect or construct island-level data below the municipal level such as settlement or grid-level data.

## Empirical results by country

The results available from the analysis of Croatia, Greece and Sweden all offer valuable insights for policy makers. Although utilising different functional forms and with a focus on different dependent variables, the resulting econometric evidence from each country is complementary. Taken together, they suggest that island communities do indeed face higher costs than mainland localities. Further, they show that these costs can accrue in multiple cost-areas – in land costs, transport costs, government costs or the overall costs to the economy. However, due to data limitations such as the lack of a standardised cost indicator across all three countries at the same administrative level, cross-country comparisons are not possible at this stage.

### *Island municipalities in Croatia generally spend more than their mainland equivalents*

An initial comparison of island and non-island municipalities in Croatia is suggestive of higher costs for islands (Table 4). On average, island municipalities have higher expenditure per capita, have lower population densities, receive more tourists, and have larger protected areas to manage. Overall local government spending in island municipalities was 54.2% higher than in mainland municipalities[4]. These differences are particularly stark in the health (161%), public order (74%), housing (73%) and subsidies (66%) subcategories (0).

**Table 4. Differences of means between island and mainland municipalities, 2024**

| Variable | Absolute difference | Difference in % |
|---|---|---|
| Government expenditure per capita (USD PPP) | 914 | 54.2 |
| Protected areas (%) | 26 | 86.7 |
| Population density (inhabitants per km²) | -35 | -39.3 |
| Tourism arrivals | 24 709 | 50.7 |
| Tourism nights | 217 840 | 97.3 |
| Tourism intensity (tourist nights per 100 inhabitants) | 12 386 | 234.5 |

[4] This does not imply that municipalities with island territories have higher budget deficits. Personal income tax is the main source of revenue for subnational governments in Croatia and municipalities with island territories generate 57% more municipal revenue than their mainland counterparts (USD 2019 PPP 873 per capita). Although municipalities can levy an additional surcharge on top of the personal income tax paid by residents to the national government, this is capped at 10% for most municipalities, 12% for towns, and 15% for cities (SNG-WOFI, 2022[47]). This suggests that the higher level of government revenue of island municipalities is not the result of higher tax rates or deficit spending but rather the outcome of high economic activity.

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Note: Government expenditure data from 2019, population density from 2021. The mainland sample incudes all municipalities that do not exclusively contain island territory. Protected areas refer to land with a specific legal status aimed at conservation of its natural or cultural characteristics.
Source: Author's elaboration with data from (Državni zavod za statistiku, 2025[22]), (OECD, 2024[19]), (OECD, 2025[23]).

The average level of government expenditure can also be broken down into groupings of municipalities that consist of islands only and those that have at least some coastline (Table 5). The second column displays the means for the main subsample of interest which includes the 46 municipalities that only contain island territory. The sample of the third column also includes municipalities which include both island and mainland territory including municipalities on the peninsula Pelješac (59 in total). The 12 municipalities that include island and mainland territory are: Janjina, Orebić, Ston, Trpanj (all on the peninsula), Dubrovnik, Jakov, Pakoštane, Split, Sveti Filip i Šibenik, Tisno, Trogir, Vodice, and Zadar. The subsample of the fourth column is the main control group of the analysis and includes all municipalities that include mainland territory (507). The fifth column presents mean values for all coastal mainland municipalities to highlight the differences and similarities with regard to economic challenges of island and coastal municipalities. The overall sample (column six) of the descriptive and econometric analysis consist of 553 municipalities (excluding Zagreb due to data limitations). Two municipalities were excluded from the analysis: Bedekovčina due to a lack of municipal government expenditure data, and Civljane, because it is an extreme outlier in terms of municipal government expenditure.

## Table 5. Municipal average of main variables

| Variable | Island only (n= 46) | Island incl. mainland (n= 59) | Mainland (n= 507) | Coastal (n= 75) | National average (n= 553) |
|---|---|---|---|---|---|
| Government expenditure per capita (USD PPP) | 2 599 | 2 508 | 1 685 | 2 343 | 1 761 |
| Protected areas (%) | 56 | 57 | 30 | 46 | 32 |
| Population density | 54 | 101 | 89 | 198 | 86 |
| Tourism arrivals | 73 445 | 128 995 | 48 736 | 176 877 | 51 816 |
| Tourism nights | 441 651 | 612 369 | 223 811 | 865 203 | 250 965 |
| Tourism intensity (tourist nights per 100 inhabitants) | 17 667 | 16 176 | 5 281 | 19 714 | 6 825 |

Note: The fourth column (Mainland) refers to all municipalities that do not exclusively contain island territory.
Source: Author's elaboration with data from (Državni zavod za statistiku, 2025[22]), (OECD, 2024[19]), (OECD, 2025[23])

These comparisons further demonstrate that island municipalities have a higher tourism density and a higher proportion of protected areas than the national and mainland averages. However, compared to other coastal municipalities, the magnitude of these challenges is comparable. Municipalities in the island-only sample are less densely populated than the national and mainland averages. However, the second island subsample, which also includes municipalities with both island and mainland territory, has an above-national-average population density, as it includes the cities of Split and Zadar.

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*Econometric analysis is required to test the significance of these differences*

After assessing the differences in means, regression analysis is employed to examine whether municipalities with island territory face higher costs than mainland municipalities that are similar in terms of geographic characteristics and remoteness. The following simple OLS model forms the basis of the analysis:

$$\begin{aligned} Log\ (\text{Gov expenditure}_i) &= \beta_0 + \beta_1 \cdot \text{Island}_i + \beta_2 \cdot \text{Distance Zagreb}_i + \beta_3 \cdot \text{Distance County Seat}_i + \beta_4 \\ &\cdot \text{Cropland share}_i + \beta_5 \cdot \text{Land area}_i + \beta_6 \cdot \text{Population Density}_i + \varepsilon_i \end{aligned}$$

The dependent variable denotes government expenditure per capita for each Croatian municipality. The distribution of the dependent variable is rightly skewed. Therefore, the variable is logarithmically transformed to improve the distribution of the residuals, reduce the influence of outliers and to enable a clearer interpretation of the associations of being an island with government expenditure in percentages. The main variable of interest is the island dummy variable, which indicates whether a municipality is considered as an island (value = 1) or not (value = 0). The coefficient $\beta_1$ reflects the difference in government expenditure between island and non-island municipalities, conditional on control variable. The main specification includes five controls. $\beta_2$ and $\beta_3$ captures the association between remoteness (straight-line distance to Zagreb and the closest county seat) and government expenditure. Additionally, the model also includes variables that control for topographic features that could also influence government expenditure. $\beta_4$ reflects the association of the share of cropland (i.e. the percentage of land on which agricultural crops are grown) with government expenditure. The variables land area (in $km^2$) and population density control for the size and population of municipalities. ε represents the error term. The model uses heteroscedasticity-robust standard errors (HC1).

The estimation strategy involves two additional model specifications. Based on the findings from the descriptive statistics, model 4 includes a dummy variable indicating whether a municipality has a maritime coast. It is important to note that all exclusively island municipalities (n = 46) in the dataset are considered included in this dummy. The two dummies should be interpreted as follows:

- The coastal dummy captures the association of being a coastal municipality relative to mainland municipalities, holding island status constant.
- The island dummy captures the additional association of being on an island compared to a coastal mainland municipality (since both have coastal dummy = 1).

Model 3 includes county-level fixed effects to compare municipalities within the same county. All municipalities are part of one of Croatia's 21 counties. The municipalities with island municipalities are part of the following six coastal counties: Dubrovnik-Neretva, Lika-Senj, Primorje-Gorski Kotar, Šibenik-Knin, Split-Dalmatia, and Zadar. In this model, the island dummy variable captures the additional per capita government expenditure of island municipalities compared to non-island municipalities within the same county, after accounting for factors such as distance, land characteristics, and population density. For the fixed effects model, the standard errors are clustered at the county level.

The results of the main regression models provide mixed evidence to support the cost of insularity (Table 6). The table includes the coefficients of each variable of the different models and their standard errors, which are shown in brackets. Each column of the table includes an additional variable so one can analyse how the island coefficient changes when adding control variables to the model. Since the coefficients are log transformed one needs to exponentiate (for every 1 unit increase in X, the dependent variable changes by $(e^{\beta} - 1) \cdot 100\%$.) them to interpret them as percentage changes. The island coefficient

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in the second column (model 1) suggests that islands municipalities have 57.6% higher government expenditure than their mainland equivalents. After adding geographical and demographic controls, the island coefficient gets smaller. The island coefficient in column four (model 3) indicates that island municipalities have 29% higher government expenditure than geographically and demographically similar mainland municipalities.

## Table 6. Baseline regression models for Croatia

Dependent variable: Log (Gov_expenditure)

| | Model 1 (Baseline) | Model 2 (Including demography) | Model 3 (Including geography) | Model 4 (Including coastal dummy) |
|---|---|---|---|---|
| | | | | |
| Island | 0.455*** | 0.264*** | 0.258*** | 0.085 |
| | (0.058) | (0.071) | (0.072) | (0.079) |
| Distance Zagreb | | 0.001*** | 0.001*** | 0.001*** |
| | | (0.0002) | (0.0002) | (0.0002) |
| Distance county seat | | 0.001 | 0.0004 | 0.0004 |
| | | (0.001) | (0.001) | (0.001) |
| Cropland share | | -0.003*** | -0.003*** | -0.002** |
| | | (0.001) | (0.001) | (0.001) |
| Land area | | 0.0005*** | 0.0005*** | 0.001*** |
| | | (0.0001) | (0.0001) | (0.0001) |
| Population density | | | -0.0001 | -0.0002** |
| | | | (0.0001) | (0.0001) |
| Coastal dummy | | | | 0.306*** |
| | | | | (0.064) |
| Constant | 7.342*** | 7.159*** | 7.184*** | 7.173*** |
| | (0.018) | (0.045) | (0.049) | (0.048) |
| Observations | 533 | 533 | 533 | 533 |
| R2 | 0.088 | 0.217 | 0.220 | 0.259 |
| Adjusted R2 | 0.087 | 0.210 | 0.211 | 0.249 |
| Residual Std. Error | 0.404 (df = 551) | 0.376 (df = 547) | 0.376 (df = 546) | 0.366 (df = 545) |
| F Statistic | 53.393*** (df = 1; 551) | 30.301*** (df = 5; 547) | 25.606*** (df = 6; 546) | 27.210*** (df = 7; 545) |
| | | | | |

Note: *p<0.1; **p<0.05; ***p<0.01
Source: Author's elaboration.

The coefficients and standard errors of the control variables in model 3 suggest that the distance to Zagreb, land area and the share of cropland are significantly associated with government expenditure. A 1 km increase of the distance from the municipal centroid to Zagreb is associated with a 0.1% increase in government spending indicating that municipalities that are more distant from the capital have higher expenditure. An increase of the land area by one $km^2$ is associated with 0.04% higher governing spending. A one percentage point increase of the share of cropland is associated with an 0.1% increase in government spending.

Model 4 includes a dummy which indicates whether a municipality is located on the maritime coast of Croatia. The coefficient of the coastal dummy suggests that coastal regions have significantly higher government expenditure than inland municipalities. Having access to the maritime coast is associated with 36% higher costs, holding all control variables constant. In this specification, the island dummy is non-

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significant suggesting that there is no significant difference in government expenditure between island and similar mainland coastal municipalities.

An alternative model uses fixed effects and examines intra-county variation of municipal expenditure by controlling cross-municipal variation of potential confounding variables (Table 7). The island coefficient of the model suggests that, on average, island municipalities have 27% higher government expenditure than similar municipalities within each county. After adding the coastal dummy, the island coefficient is still significant and suggests that island municipalities have 12% higher municipal government spending per capita compared to coastal mainland municipalities within each county. The findings suggest that within each county, island municipalities are significantly different from other coastal municipalities with regard to government expenditure. Further, even within each county, there seem to be significant differences between coastal and non-coastal municipalities, potentially reflecting the additional costs faced by coastal municipalities for providing public services.

## Table 7. Fixed effect model of municipal government expenditure

| | FE (Model 1) | FE with Coastal dummy (Model 2) |
|---:|:---:|:---:|
| Island | 0.2357*** | 0.1147** |
| | (0.0530) | (0.0526) |
| Distance Zagreb | 0.0020 | 0.0012 |
| | (0.0014) | (0.0013) |
| Distance county seat | 0.0015 | 0.0014 |
| | (0.0024) | (0.0023) |
| Cropland share | -0.0025* | -0.0021 |
| | (0.0013) | (0.0013) |
| Land area | -0.0000 | 0.0001 |
| | (0.0002) | (0.0002) |
| Population density | -0.0001 | -0.0002** |
| | (0.0001) | (0.0001) |
| Coastal dummy | | 0.2408*** |
| | | (0.0678) |
| Observations. | 553 | 553 |
| R2 | 0.354 | 0.374 |
| R2 Within | 0.061 | 0.091 |
| Fixed Effects | County | County |
| Clustered SEs | County | County |

Note: Log government expenditure. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
Source: Author's elaboration.

Overall, the findings suggest that, on average, Croatian island municipalities have higher government spending than mainland municipalities. This is particularly evident in spending on health, housing, public order and public services. The findings may reflect the additional costs of providing government services on islands, as well as distinct characteristics and compositions of island populations. For example, municipalities with island territory have a lower share of working-age citizens, and a higher share of elderly residents, which could increase demand for health services.

The findings of the econometric analysis show that municipalities with island territory have higher municipal expenditure even when controlling for the potential effects of remoteness and geography, which islands share with other remote regions. However, the evidence is more mixed when comparing island municipalities with similar coastal mainland municipalities. The insignificant findings in the first set of models, and significant but smaller difference in the fixed effects model for island municipalities compared

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to coastal municipalities suggest that at least some of the additional costs are not island-specific but also shared by coastal municipalities with similar characteristics and challenges, e.g. those related to tourism.

In addition to the findings regarding municipal government expenditure, descriptive statistics show that coastal mainland municipalities and those with island territories have similar characteristics. One such characteristic is the high proportion of protected areas (OECD, 2025[24]). Additionally, both types of municipalities differ from inland municipalities in that they have significantly higher tourism intensity. While this can be a driver of economic activity, it can also increase costs for households (e.g. for consumption goods), and municipalities, by placing pressure on local infrastructure, public order and waste management systems.

### *Island typology may also influence costs*

In this paper, the analysis has primarily focused on the difference in *average* costs between island and mainland municipalities. However, due to their varying characteristics, such as distance from the mainland, it is anticipated that the cost burden on citizens and businesses will differ from island to island. Croatia's Ministry of Regional Development and EU Funds' database of island-level data includes a categorical indicator of the location of the islands and their distance from the mainland, on the basis of which the islands can be classified as close, intermediate or remote. This potentially enables some form of regression analysis using a categorical typology variable to assess whether there are cost differences between different types of islands. This approach was attempted, but it did not yield promising results, mainly because there was no appropriate dependent variable. Municipal-level analysis of this kind was also challenging because some municipalities, such as Murter-Kornati, contain a mix of islands that are either close to or far from the mainland, and others contain mainland territory.

In contrast, transport costs can be more directly analysed at the island level and can be estimated selectively to measure costs on different types of islands. Remote islands are expected to face greater challenges in terms of cost with regard to transport because of long travel times and high ticket prices. An analysis of five islands with diverse characteristics provides initial evidence of transport costs for passengers and businesses on Croatian islands (Figure 4). Similar to the analysis of transport costs in Sweden, a transport indicator was generated to estimate the cost per ferry trip for businesses and passengers on the following five islands: Brač, Dugi Otok, Lošinj, Šipan and Ugljan. These islands were chosen as they represent a balanced mix of different land sizes, populations, distances from the mainland and regions. 0 describes the calculation of the three components of the overall transport costs.

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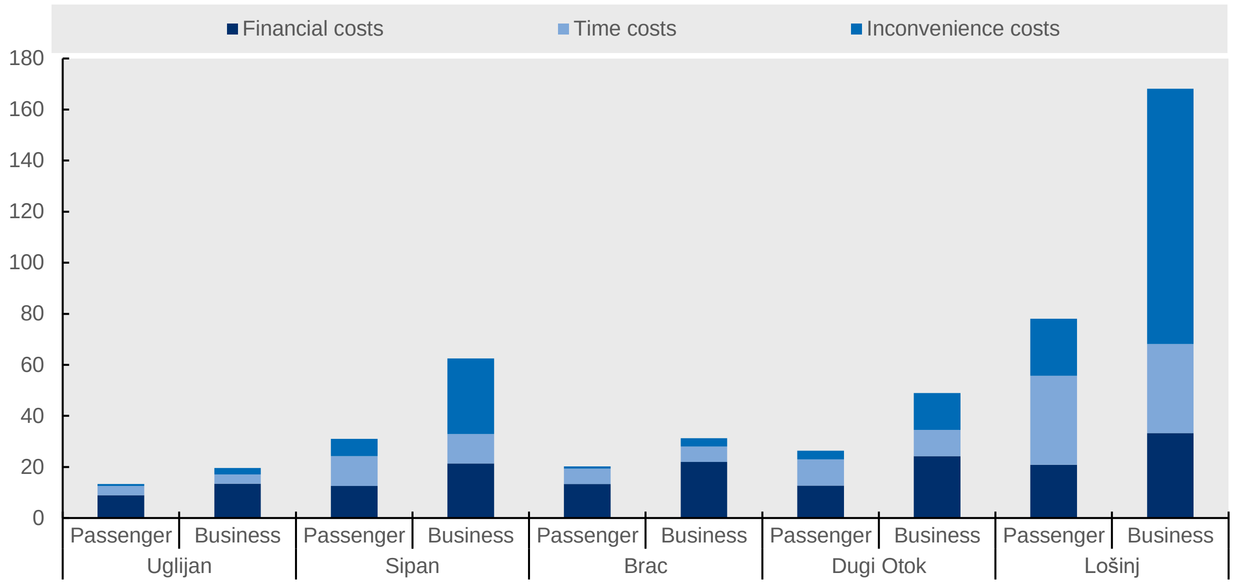
### Figure 4. Transport cost estimate for five Croatian islands, EUR per passenger




Note: One-way trip.
Source: (Agency for Coastal Liner Maritime Transport, 2025[25]).

Throughout the five sample islands the cost of transport varies widely. This variation is primarily driven by large differences in time and inconvenience costs, although ticket prices do differ across islands and between passengers and businesses. Most strikingly, the costs for the island of Lošinj, which requires a six-hour ferry journey to reach Zadar, greatly exceeds the others included in the sample. This suggests that the costs of insularity for some islands, particularly those that are geographically remote, are likely to greatly exceed the average. Conversely, those with faster, more frequent and less expensive transport services are likely to be less affected by the cost of insularity.

The available evidence for Croatia clearly suggests that island municipalities face substantially higher costs, especially for health public order and housing. These elevated costs are consistent with the small, dispersed populations of Croatian islands, their well-protected environments that require careful management, and the impacts of seasonal tourism demand. Even after controlling for geography and remoteness, the expenditure gap between island and mainland municipalities remains significant. For policymakers in Croatia, consideration should therefore be given to the current fiscal equalisation system to ensure that the requisite funding for government services is available. Improved monitoring of service delivery outcomes and efficiency could further assist governments to determine whether higher costs are the result of insularity, a coastal location, or other factors, as well as what specific service costs are the most affected.

### *The cost of insularity on Greek islands is difficult to estimate*

To provide an initial assessment of how island regions in Greece differ from their mainland counterparts, it is instructive to compare the mean GDP, tourism intensity and population of the island and mainland regions with the national average (Table 8). Although Greek islands are approximately equal to mainland regions in economic size, as measured by GDP per capita, the density of tourism is significantly higher. Further, population density is below the national average.

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### Table 8. Mean of Greek island and mainland regions, TL3, 2023

| Variable | Island regions (Eurostat classification) | Island regions (incl. Lefkada and Euboea) | Mainland regions (incl. Lefkada and Euboea) | Greece |
|---|---|---|---|---|
| GDP per capita (EUR) | 20 267 | 20 129 | 20 563 | 19 650 |
| Nights spent at tourist accommodation establishments | 7 812 516 | 6 932 499 | 1 336 491 | 2 830 958 |
| Tourist nights per inhabitant | 69 | 64 | 10 | 14.1 |
| Population density (inhabitants per km²) | 72 | 70 | 823 | 80.0 |

Note: Regional averages are unweighted. GDP at current market prices in 2022. Tourism nights in Greece the regional (unweighted) average.
Source: Author's elaboration based on (Eurostat, 2021[26]) (Eurostat, 2024[27]) (Eurostat, 2023[28]).

Population shrinkage has also been more subdued in island regions, suggesting above-average demand for island housing and government services. Between 2015-2024, the total population of all island regions declined slightly, averaging -0.2% each year. For mainland territories, population shrinking was generally faster, averaging -0.5% (Eurostat, 2024[29]). Taken together, these socio-economic indicators provide few clues about the cost of insularity.

*Regression analysis can determine whether island regions have a lower GDP per capita*

By controlling for other geographic and demographic factors that might influence GDP, a more precise measure of insularity's influence on island economies can be estimated. Higher or lower GDP, with other factors held constant, can provide clues about costs and their potential impact on regional productivity. The main specification is given by the following equation:

$$\log(\text{GDP per capita}_i) = \beta_0 + \beta_1 \cdot \text{Island Dummy}_i + \beta_2 \cdot \text{Distance to Athens}_i + \beta_3 \cdot \text{Land area}_i + \beta_4 \cdot \text{Mountain Dummy}_i + \beta_5 \cdot \text{Coastal Dummy}_i + \beta_6 \cdot \text{Population density}_i + \varepsilon_i$$

The sample for the regression analysis consists of the 53 Greek TL3 regions. The dependent variable denotes the logarithmically transformed GDP per capita for each TL3 regions. The main coefficient of interest is $\beta_1$ which reflects the association of being an island region and GDP per capita. The main specification presented here uses the Eurostat definition and therefore treats Lefkada and Euboea as mainland regions. As a robustness check, 0 presents the econometric findings when treating Lefkada and Euboea as island regions. To interpret the island coefficient as a difference in percentage terms one has to exponentiate the coefficient[5]. The specification includes five control variables. $\beta_2$ and $\beta_3$ capture the association between remoteness (distance to the capital) and size (land area). The variable Mountain Dummy indicates whether a region includes a high share of mountainous land. The mountain dummy equals 1, when over 50% of the population or 50% of the land area are in mountainous areas (following the Eurostat definition (Eurostat, 2024[30])). The Coastal Dummy indicates if a region is located on the coast (=1). The coefficient $\beta_6$ reflects the association between population density and GDP per capita. $\varepsilon$ represents the error term. The model uses heteroscedasticity-robust standard errors (HC1).

The results of the econometric analysis are inconclusive, but do not suggest that island geography is dampening GDP (Table 9). Rather, islands in all model specifications are positively associated with higher GDP, providing few immediate insights into the cost of insularity.

[5] For every 1 unit increase in X, GDP per capita changes by $(e^{\beta} - 1) \cdot 100\%$.

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### Table 9. Regression analysis of GDP per capita in Greek TL3 regions

| | Baseline | Including geography | Including demography |
|---|---|---|---|
| Island dummy | 0.01248 | 0.13964* | 0.13744 |
| | (0.07649) | (0.08267) | (0.08218) |
| Distance to Athens | | -0.00146*** | -0.00120*** |
| | | (0.00028) | (0.00034) |
| Land area | | -0.00001 | -0.00000 |
| | | (0.00002) | (0.00002) |
| Mountain dummy | | -0.04302 | 0.03279 |
| | | (0.09064) | (0.07781) |
| Coastal dummy | | -0.12542 | -0.08752 |
| | | (0.09399) | (0.09458) |
| Population density | | | 0.00003 |
| | | | (0.00003) |
| Constant | 9.88339*** | 10.36175*** | 10.16438*** |
| | (0.04690) | (0.15974) | (0.18729) |
| Num.Obs. | 52 | 52 | 52 |
| R2 | 0.000 | 0.420 | 0.445 |
| R2 Adj. | -0.020 | 0.357 | 0.371 |
| F | 0.027 | 5.401 | 4.946 |
| Std.Errors | HC1 | HC1 | HC1 |

Note: * p < 0.1, ** p < 0.05, *** p < 0.01
Source: Author's elaboration.

Across all model specifications, the coefficient of the island dummy variable is positive but not significant at the 5% level. After adding geographical and demographic controls, however, the magnitude of the (positive) coefficient increases. This suggests that island regions may have a higher GDP per capita than geographically similar mainland regions. In the fully specified model (column 3), the island dummy coefficient indicates that island regions have approximately 15% higher GDP than mainland regions when all other variables are held constant. However, this difference is not statistically significant (p-value = 0.10). One potential driver of this association could be tourism. As discussed above, island regions have a higher tourism intensity than mainland regions, which could have a positive effect on economic activity and lead to a higher GDP per capita in island regions compared to remote mainland regions.

The distance to Athens is the only control variable that is statistically significant in all model specifications. It suggests that regions, whether mainland or island, have a lower GDP when located further away from the capital. The size of this GDP loss, all else being equal, however, is very small.

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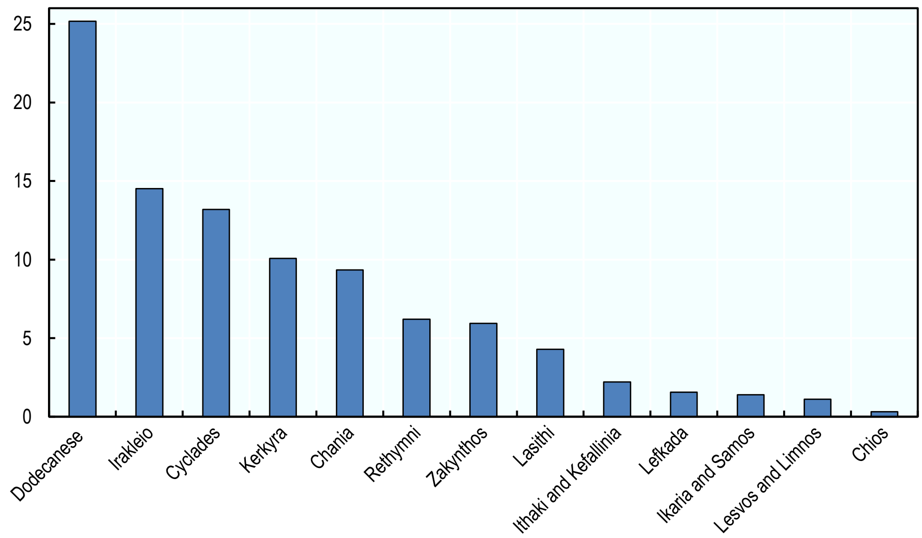
Despite the limited findings of policy interest, this analysis can nonetheless help inform policy discussions in Greece and help guide future research. For example, it confirms the suspected limitations of GDP as a dependent variable. This approach may be more usefully employed for very remote islands, such as those in the mid-Atlantic or South Pacific, where insularity costs are so extreme that they prevent economic activity from occurring. However, in countries such as Greece where insularity costs are lower, the additional costs faced by island economies may be obscured by the benefits of insularity, particularly tourism.

*Descriptive statistics provide complementary evidence of the cost of insularity*

Although econometric analysis is limited due to insufficient data, several descriptive statistics are available for island territories in Greece and provide additional insights into the cost of insularity. The number of overnight stays is one such indicator that suggests that island regions in Greece are particularly exposed to the costs of congestion, stress on local infrastructure and the impacts of seasonality that are associated with tourist activity (Figure 5). On average, TL3 regions hosted approximately 2.8 million overnight stays in 2023 (Eurostat, 2024[27]; Eurostat, 2024[31]).

## Figure 5. Overnight stays in island TL3 regions, millions, 2023




Note: Includes short stays on collaborative economy platforms.
Source: Author's elaboration based on (Eurostat, 2024[27]) and (Eurostat, 2024[31])

A more instructive measure is the number of overnight stays per permanent resident. This illustrates the impact of tourists in relation to the non-tourist economy and the local population. In the Dodecanese, the most touristed region in absolute terms, this equates to 208 nights per resident compared to only 1.6 in Chios, the least visited. However, Kerkyra was the highest region on this measure with 259 overnight stays per resident and the Cyclades, although very high in absolute terms, received only 43 per resident.

Housing costs and availability, based on average prices per square metre, show a more mixed picture. Throughout Greece, the average sales price was equal to EUR 2 558 per m² in 2024, exceeding most island regions (Centarium, 2025[32]). However, the Cyclades (EUR 3 800), Lefkada (EUR 3 269) and Chania (2 750) had more expensive housing (Spitogatos, 2024[33]). For rental properties, island territories are also generally below the national average of EUR 10.11 per square metre. The Cyclades (EUR 15.33) was the only region with substantially high rent, although data was unavailable for Lefkada.

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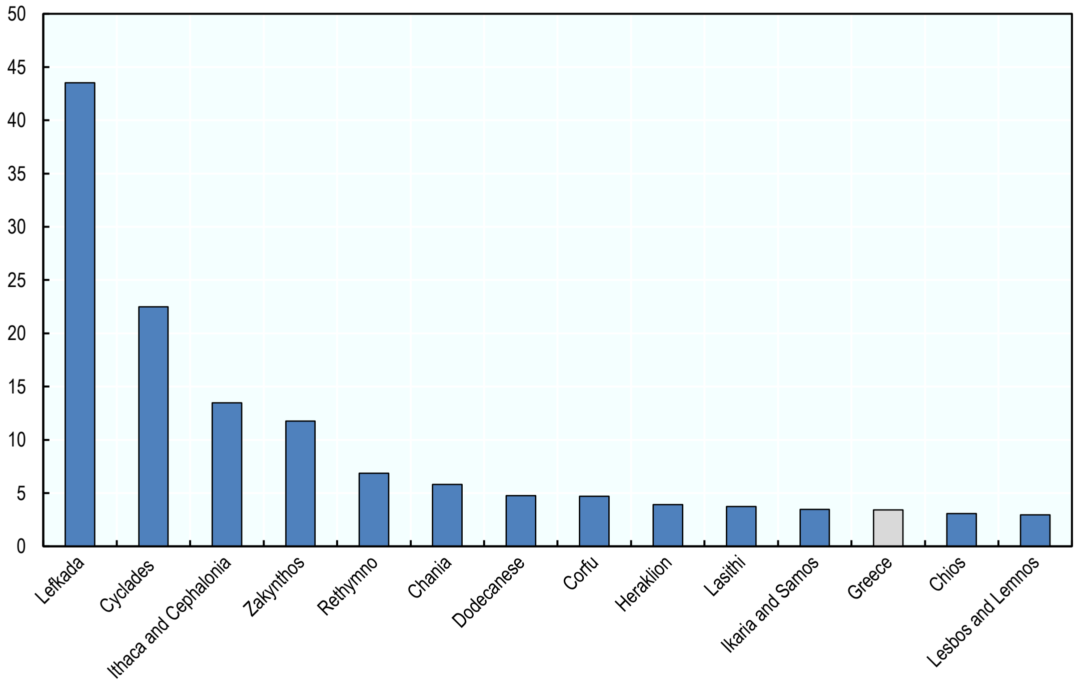
The supply of new housing, a key determinant of housing costs, also ranges widely across island territories (Figure 6). In 2023, the island region of Lefkada was the most successful, with 43.5 dwellings constructed for every 1 000 residents (Hellenic Statistical Authority, 2023[34]). The Cyclades, Ithaca and Cephalonia, and Zakynthos were also well above the national average of 3.4, and no island regions were significantly lower. This suggests that the housing market on Greek islands is functioning well relative to its permanent population. However, island economies are highly seasonal, and the existing housing stock may not be adequate to accommodate local inhabitants and tourist visitors simultaneously.

## Figure 6. Dwelling completions per 1 000 residents, 2023

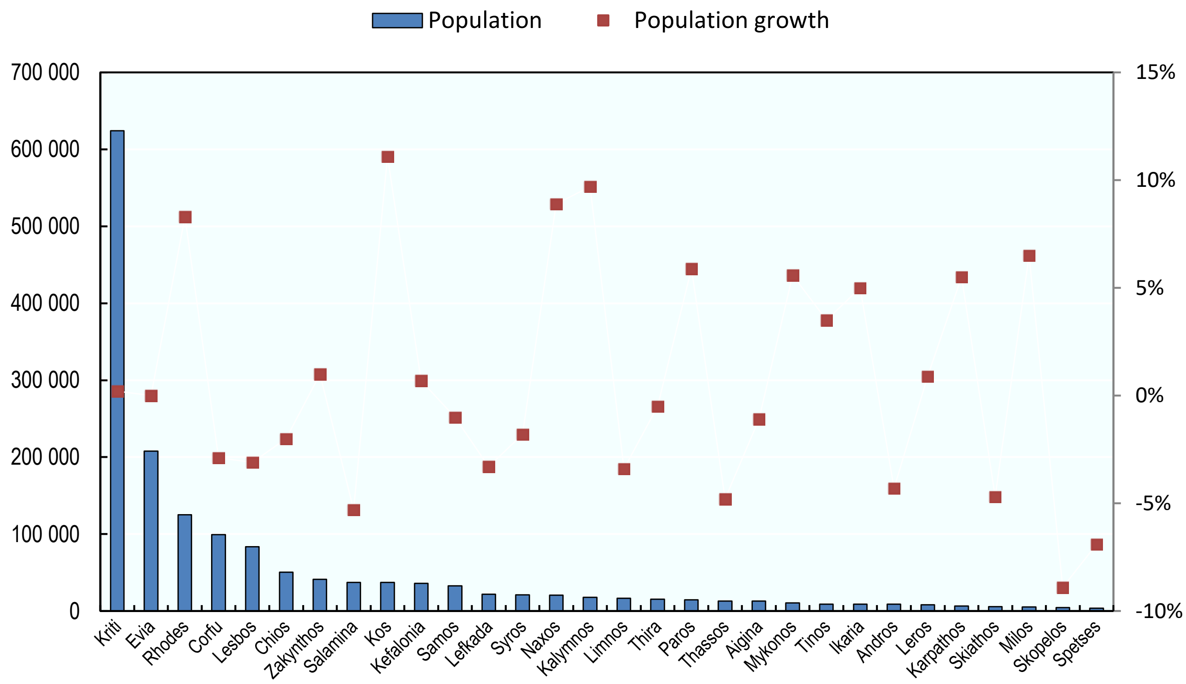



Source: Author's elaboration based on (Hellenic Statistical Authority, 2023[34]).

The demography of island territories is also broadly aligned with Greece as a whole with the median age of island residents 42.6 well below the national average of 44.1 (Eurostat, 2024[35])). The younger population suggests that health expenses would be lower, skills shortages less severe and mobility between jobs greater – all positive attributes that could help to boost competition and reduce costs. Population density, which can help increase productivity and improve the efficiency of service delivery, is less favourable on islands. Even with the TL3 regions that include Athens excluded, island regions (71.9 per km²) are still less dense than the regional average (75.8km²).

The population growth of islands in Greece is also complicated by the varied experience of individual islands (Figure 7). Between 2011 and 2021, 15 out of the 30 largest islands experienced positive population growth (Hellenic Statistical Authority, 2024[36]).. Among the 15 which experienced declines, there was no apparent correlation between size and population decline, with significant declines (>2.5%) occurring in large, medium, and small islands.

**Figure 7. Island population and change, 2021**




Note: Total population on left vertical axis, average population growth 2011-21 on right vertical axis. Includes largest 30 islands by population.
Source: Author's elaboration based on (Hellenic Statistical Authority, 2024[36]).

Additional indicators at the TL2 level add further evidence that costs may be higher on island territories. The number of tertiary-educated residents in all four island regions, for example, is lower compared to the national average of 34.3% (OECD, 2024[37]). In the South Aegean it is only 20.1%, suggesting that skilled labour is more scarce and therefore more expensive, all else being equal. The number of physicians per capita provides additional evidence of this scarcity. Compared to the 6.6 physicians per 1 000 residents available throughout Greece, it is considerably lower in the Ionian Islands (5.3), the North Aegean (4.0) and the South Aegean (3.9) (OECD, 2023[38]).

### *The cost of transport ranges widely across island territories*

Maritime transport plays a critical role in Greece, allowing the movement of cargo and people among islands and the mainland. In 2024, approximately 41 million passengers and 143 million tonnes of cargo passed through Greek ports (Hellenic Statistical Authority, 2025[39]). At the island level, the passenger statistics in Q3 2024 further demonstrate the importance of maritime connections. For example, in Paros (600 000 embarkations), Thira (440 000) and in Mykonos (400 000), ferry transport in the summer peak is heavily utilised, particularly by tourists (Hellenic Statistical Authority, 2025[39]). Unloaded freight at the island ports of Heraklion (560 000 tonnes) Rhodes (272 000) and Thassos (190 000) in Q3 2024 further demonstrates the importance of maritime transport and that, in aggregate, shipping costs should be significant on Greek islands with large populations.

Remoteness data, based on the distance and travel times to the nearest mainland port, provides additional evidence of insularity costs and their variance (KEPE, 2025[40]). Using this data, the average time cost of travel to a mainland port has been estimated (Figure 8). These estimates demonstrate that for all businesses and residents living on islands, there is a substantial time cost to access the mainland. Further, for large islands (those with more than 10 000 residents), there is a wide range of travel time costs, with

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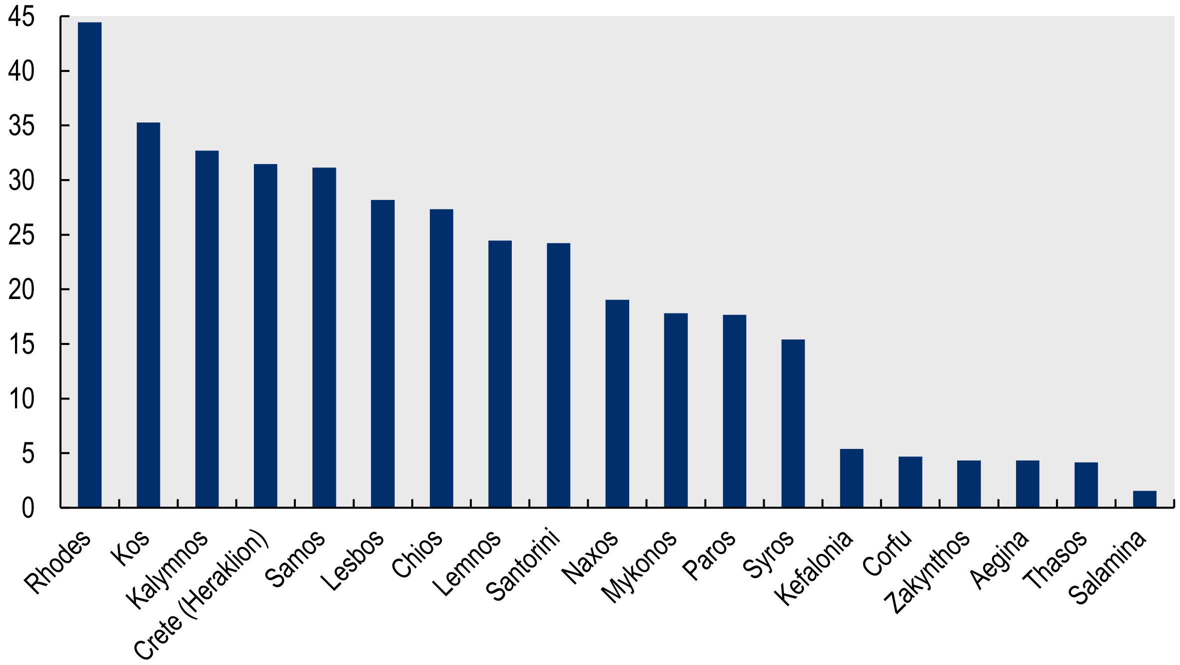
travel from Rhodes costing more than 10 times than from Salamina. This is based on the estimated average time required to travel to a mainland port and the Greek hourly minimum wage (as a measure of opportunity cost), but due to data limitations, does not take into consideration ferry price tickets. It can therefore be assumed that the actual cost of travel would be much higher if the financial cost of ferry tickets and the inconvenience cost of delays, cancellations and the infrequency of ferry schedules were included in the estimate.

**Figure 8. Estimated travel time cost (EUR) per mainland trip for large islands**




Note: Islands with more than 10 000 residents.
Source: Author's elaboration based on (Tsekeris, 2023).

*The transport equivalent policy provides additional insights into insularity costs*

Established in 2018, the transport equivalent policy was created to compensate small and medium-sized businesses that travel from island locations to the mainland (General Secretariat of the Aegean and Island Policy, 2018[41]). The policy uses a formula to determine the amount of the financial payment that takes into consideration the journey time and cost of a comparable bus journey if it was available. In 2021, for example, EUR 31.5 million was distributed to island businesses, and the compensation eligible to each island varied significantly. Ereikoussa, a remote island near the Albanian border, received the highest compensation relative to transport costs, equal to 70% of the total freight transport costs of eligible companies. On Tinos, however, only 30% of costs were compensated, the lowest recorded.

The compensation paid to firms across all islands in Greece further demonstrates how varied higher costs are for Greek islands. Not only are these costs significant, estimated to be equal to between 30% and 70% of the overall transport costs, the transport equivalent policy further highlights that costs are more severe in remote, outlying and less well-connected islands. The amount paid per island is also not strongly related to the proportion of compensation allocated due to small islands being generally less well-connected by

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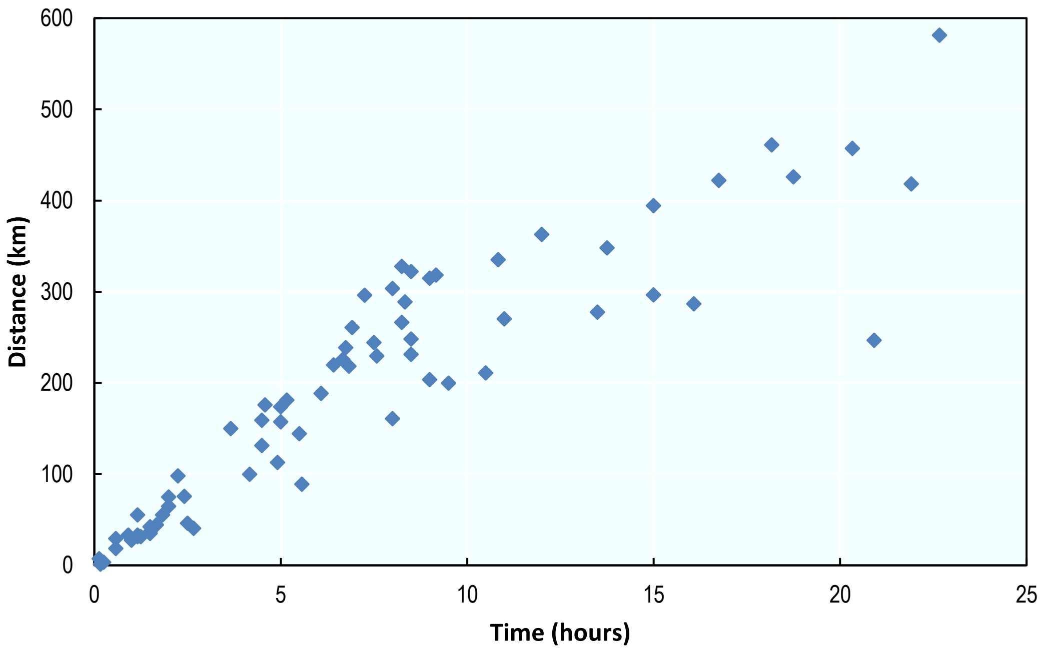
ferry routes. These smaller, less-accessible islands receive high rates of compensation but make up a relatively small amount of the total payments made due to their low populations.

The travel time and distance between islands and the mainland, key factors that determine the compensation paid, is broadly in proportion (Figure 9). Several islands, including Lemnos, Lesbos and Oinousses, have longer journey times compared to islands at a similar distance from the mainland, possibly due to slower speeds or more complex routes. But in general, travel time is linearly related to distance. This suggests that the quality of ferry services available to most island residents is similar and that geography rather than policy decisions (i.e. investment in new ferries) are the primary cause of variation in transport costs.

### Figure 9. Time and distance from the mainland




Note: Estimated time and distance from nearest mainland port.
Source: Author's elaboration based on (KEPE, 2025[40])

The econometric evidence for Greece provides only limited proof of insularity costs at the regional level, likely reflecting the concentration of tourism on certain islands that offset structural disadvantages such as remoteness and higher service delivery costs. The findings imply that policy interventions should focus on targeted investment for very remote islands with limited tourism activity, particularly the improvement of transport connectivity. Further, demand-side policies, such as those aiming to broaden the tourist season, and the collection of better island-level data, could help improve management of island infrastructure and assets in the short term and improve measurement of the cost of insularity in the long term.

### *Swedish islands face high transport costs, but land costs remain ambiguous*

Transport costs can be a significant barrier to economic activity on Swedish islands and include not only the price directly paid for a trip but also include costs related to its duration and inconvenience (Box 2). However, it is important to note that ferry ticket prices are indirectly subsidised by the government and therefore do not ultimately reflect the total cost of insularity. This is particularly relevant for Öckerö, where ferries are free for passengers and vehicles but are ultimately funded by taxpayers. Further, as the analysis focused on large islands and the main ferry providers, it did not consider the costs of using private boats or small transport providers. Due to the limitations on data for small islands, analysis is focused on Gotland and Öckerö, which account for more than half of the total Swedish island population.

The total estimated economic costs per trip to the mainland offer an initial indication of the challenges faced by citizens and businesses on Gotland and Öckerö (Table 10). It is important to note that this indicator captures not only the financial costs, such as ticket prices, but the overall economic costs of a ferry trip, as estimated by the OECD, including time and inconvenience costs. Generally, the total sum of ferry-related costs for a trip from Gotland are higher than for trips from Öckerö, reflecting higher ticket prices, longer trip duration and less frequent services. For instance, the journey from Gotland to Nynäshamn takes 195 minutes, whereas the crossing from the Hönö terminal in Öckerö to Lilla Varholmen on the mainland takes 15 minutes. In addition, the ferry from Gotland only departs twice a day, whereas the ferry from Hönö departs several times an hour on average. These factors contribute to higher time and inconvenience costs for businesses and inhabitants on Gotland. Another major factor that explains the difference is that, in contrast to Gotland, ferry trips from Öckerö are free of charge.

In addition to cross-island differences, there are also cost differences between businesses and inhabitants on both islands. In Gotland, businesses face approximately EUR 200 higher costs than passengers (Table 10). Businesses in Öckerö only face slightly higher costs due to the short duration of the ferry trip. These are driven by the higher inconvenience costs faced by businesses as they have a lower ability to utilise their waiting and inconvenience time and, in the case of Gotland, by additional freight costs.

## Table 10. Ferry-related economic costs for both islands per trip

| | Gotland | Öckerö |
|---|---|---|
| Passengers | SEK 1386 (EUR 124) | SEK 108 (EUR 10) |
| Businesses | SEK 3556 (EUR 324) | SEK 127 (EUR 12) |

Note: For the case of Gotland, the indicator is based on ticket prices for residents of Gotland. As ferries are free of charge, the ferry-related costs for Öckerö include time and inconvenience costs only. Calculation of prices in EUR are based on the exchange as of 12.05.2025 (1 SEK = 0.091 EUR)
Source: Author's elaboration with data from (Destination Gotland, 2025[42]), (Destination Gotland, 2025[43]).

The economic costs of ferry travel can be decomposed into three components: financial costs, time costs and inconvenience costs (Figure 10). Financial costs are the monetary costs of travel, as imposed on travellers to use ferry services through ticket prices and associated charges. Time costs are the aggregate time required for travellers to complete a journey using the service based upon current schedules, with adjustments for seasonal variation. Inconvenience time is an estimate of the waiting, delays and cancellations that the average traveller can expect to experience per journey, which adds to the total time required (and therefore cost) of each journey. Government subsidies, although significant, were not available in a form that could be precisely applied to estimate their costs per route, per passenger or per journey and have therefore been excluded. The costs of operation, which should be approximately commensurate with long-term ticket revenue and subsidies received, are also not included in the estimates. Further, the capital costs of ferry boats, ports and supporting infrastructure are not included, and the overall societal cost of transport can therefore be assumed to be greater than what is detailed in the estimates per trip.

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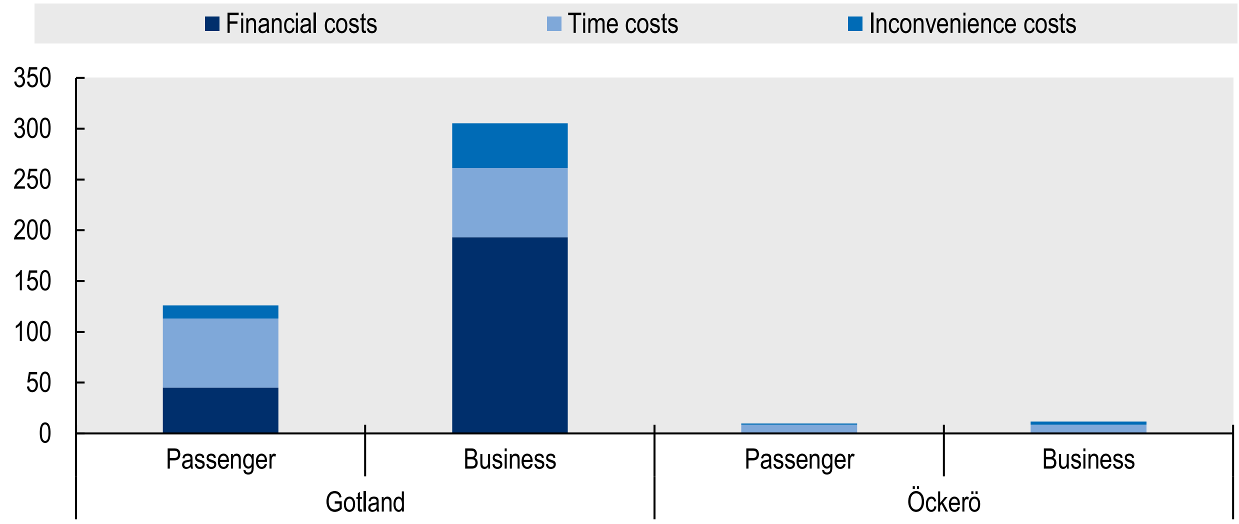
## Figure 10. Decomposition of ferry travel costs, EUR




Note: One-way trip. Financial costs are zero in Öckerö.
Source: Author's elaboration with data from (Destination Gotland, 2025[42]), (Destination Gotland, 2025[43]).

All costs included in the estimator – financial, time and inconvenience – could potentially be altered by, and are the present-day result of, government policy decisions. Higher subsidies, additional service frequencies, and more efficient port facilities, for example, could be provided by government to reduce the cost of travel for Swedish businesses and passengers. Conversely, without the substantial investment of government currently in place, the costs per journey would be significantly higher.

Alongside the mean travel cost, a comparison of several variables of interest for island and mainland municipalities provides further insights on economic costs (Table 11). These show that the means for both island regions separately (column 2 and 3), and the mean of both island regions taken together (column 4), generally exceed the mainland average (column 5) and the national average (column 6). On most indicators, average island costs are greater than the mainland and national averages.

## Table 11. Mean values of cost variables of Swedish islands and municipalities

| Variable | Gotland | Öckerö | Island average | Mainland average | National average |
|---|---|---|---|---|---|
| Transport cost - passenger (EUR) | 162 | 157 | 159 | 120 | 120 |
| Transport cost - business (EUR) | 341 | 159 | 250 | 120 | 121 |
| Property price - tenant-owned apartments (EUR per sqm) | 3 186 | 4 265 | 3 726 | 1 603 | 1 618 |
| Property price - single-family-home (EUR per sqm) | 3 087 | 4 341 | 3 714 | 2 055 | 2 066 |
| Annual rent (EUR per sqm) | 114 | 114 | 114 | 103 | 103 |

| | | | | | |
|---|---|---|---|---|---|
| Average purchase price (EUR) | 331 513 | 533 442 | 432 478 | 241 627 | 242 944 |
| Assessed buildings value (EUR) | 191 555 | 319 137 | 255 346 | 145 206 | 145 965 |

Note: The business and passenger transport cost indicator reflects the costs for a trip to Stockholm. Calculation of prices in EUR are based on the exchange as of 12.05.2025 (1 SEK = 0.091 EUR). Average annual rent, purchase price and assessed building values based on one and two-dwelling building units only.
Source: (Kolada, 2025[21])

The absolute and relative differences in means between island and mainland municipalities further illustrates the additional costs applicable to Swedish islands (Table 12). Positive values indicate that, on average, islands face higher costs than mainland municipalities. For example, the average annual rent on island municipalities is EUR 10.9, or 10.5%, higher, per square metre, than the mainland average.

## Table 12. Mean difference between island and mainland municipalities

| Variable | Difference in EUR | Difference in % |
|---|---|---|
| Transport cost passenger | 39.3 | 32.7 |
| Transport cost business | 129.8 | 107.9 |
| Property price tenant-owned appartements (per sqm) | 2 122.4 | 132.4 |
| Property price single-family-home (per sqm) | 1 659.1 | 80.7 |
| Annual rent (per sqm) | 10.9 | 10.5 |
| Average purchase price for one- and two-dwelling buildings | 190 850.1 | 78.9 |
| Assessed buildings value for one- and two-dwelling buildings | 110 140.3 | 75.0 |

Note: Calculation of princes in EUR are based on the exchange as of 12.05.2025 (1 SEK = 0.091 EUR). Annual rent for all rented dwellings.
Source: (Kolada, 2025[21])

For passengers, the cost of a trip to Stockholm is similar whether they are travelling from Gotland or Öckerö. As described above, the ferry-related costs are higher for a trip from Öckerö, however, the trip includes a longer journey by road on the mainland than a trip from Gotland. For businesses in Gotland, a trip to Stockholm is more expensive than a trip from Öckerö, reflecting the higher financial and inconvenience costs for businesses in Gotland. When comparing island and mainland municipalities, travelling to Stockholm is more expensive for businesses and passengers on islands than for those on the mainland, which provides further evidence of additional insularity costs.

In addition to transport costs, there are significant differences in housing and land costs. Evidence drawn from interviews and workshops with experts from Öckerö and Gotland suggests that the high cost of housing is a significant challenge for many of Sweden’s island communities. Compared to Gotland, housing and land are more expensive in Öckerö across all indicators. For instance, property prices for both tenant-owned apartments and single-occupancy houses in Öckerö are more than 30% higher than in Gotland. Further, the data provides initial evidence that rents and house prices on islands are higher than in mainland municipalities, as islands are more expensive across all land and housing indicators. For

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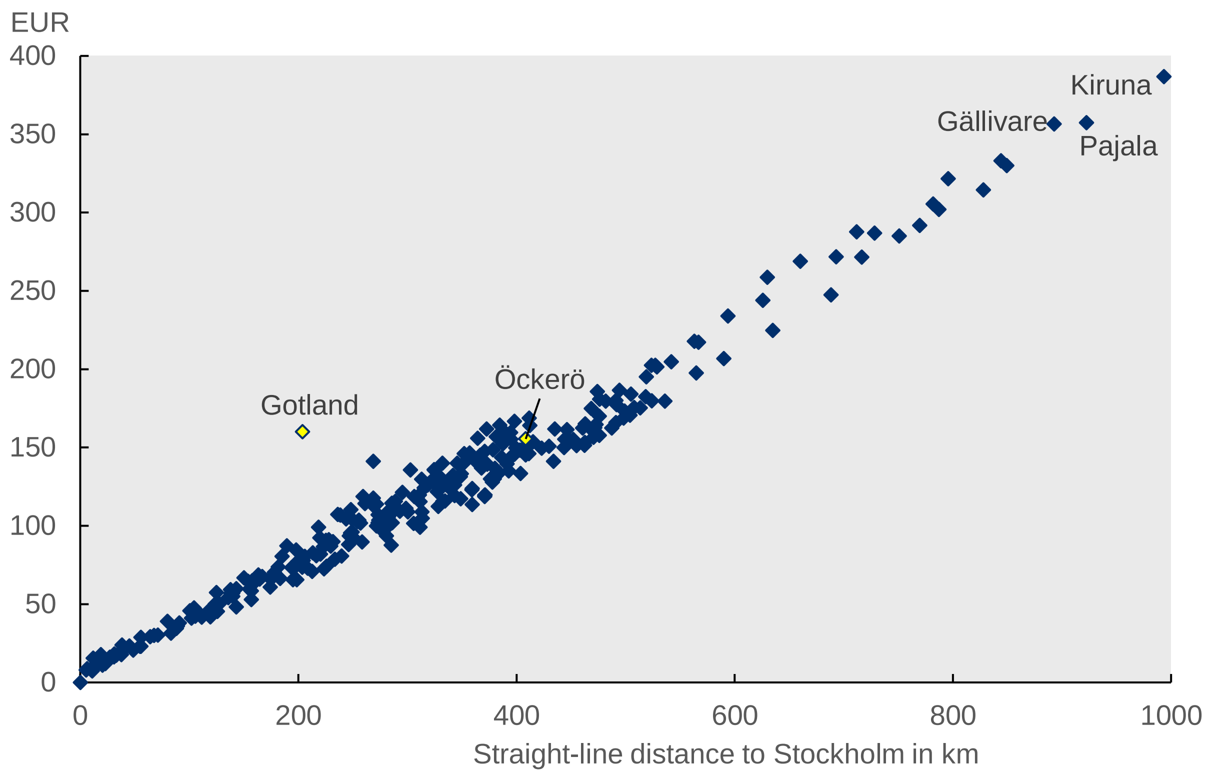
example, single family homes and tenant-owned apartments are around twice as expensive on islands compared to mainland municipalities. Even when considered individually, the land- and transport-related cost indicator for each island is higher than the mainland average. Further, property and land prices on islands are higher than the average coastal municipality.

The positive relationship between the distance of a municipality from Stockholm and average transport costs for passengers and businesses suggests that some component of high transport costs for islands is due to remoteness rather than insularity (Figure 11, Figure 12). Throughout Sweden, individuals and businesses located in municipalities that are more distant from Stockholm face higher transport costs for a trip to Stockholm, reflecting the higher expenses for fuel or electricity and higher time costs for long-distance trips. In addition, these figures also highlight that the high transport costs for passengers and businesses on Swedish islands[6], especially Gotland, are not only driven by their distance from the capital but reflect the burden of ferry-related costs. Enterprises on Gotland face similar transport costs to those in the outermost northern municipalities such as Gällivare or Pajala. In other words, even though Gotland is closer to Stockholm than more than half of the Swedish municipalities, businesses in Gotland face the fourth highest transport cost burden due to their ferry-related economic costs. Although transport costs are lower for a trip from Öckerö, ferry-related costs still have a significant impact on passengers and businesses, as they incur an additional cost on top of travel costs for the rest of the trip to Stockholm on the mainland.

### Figure 11. Estimated average transport costs for passengers per municipality




Source: Author's elaboration

[6] The analysis only focuses on the two islands that are also municipalities. See methodological section above for additional detail.

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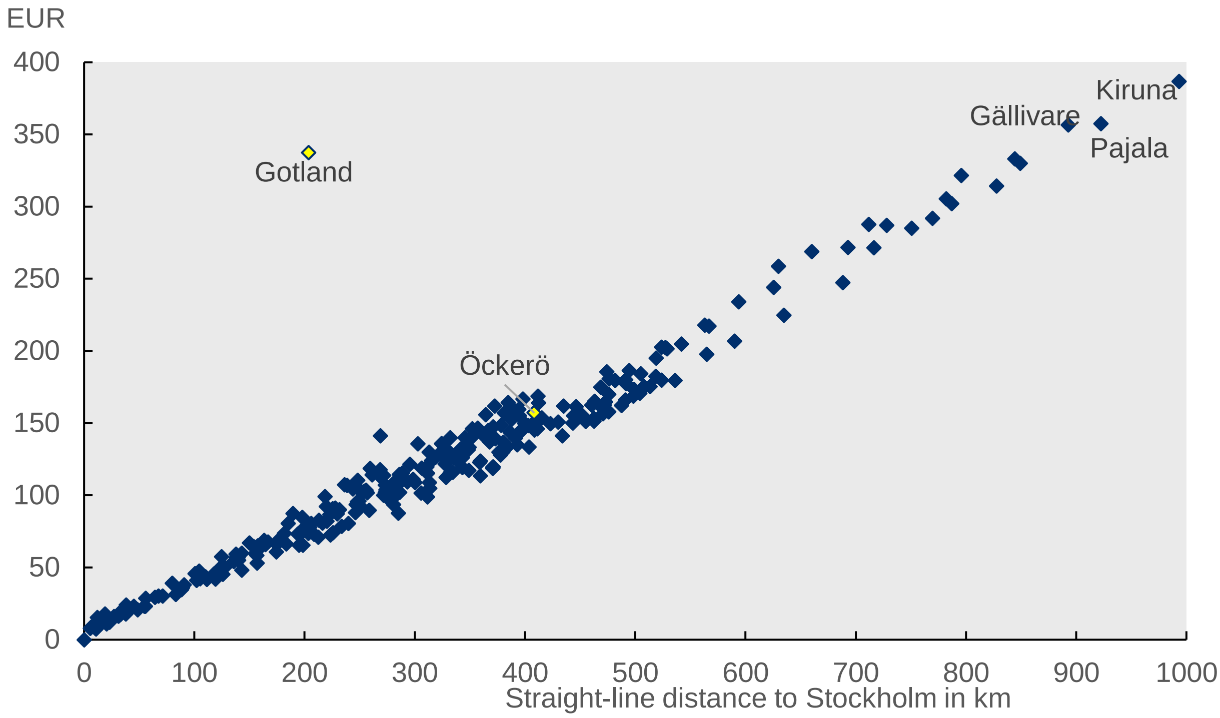
## Figure 12. Estimated average transport costs for businesses per municipality




Note: Cost estimate assumes use of a medium-sized transport vehicle.
Source: Author's elaboration.

As a next step, regression analysis was employed to assess if the transport and land-related costs are significantly higher on Swedish islands, after controlling for geographic variables and the degree of remoteness. A simple linear regression model was used to investigate whether the transport and land costs on island municipalities are higher than in similar mainland municipalities. The sample of the analysis consisted of 289 municipalities (two of which are island municipalities), excluding Stockholm as it is the destination for the transport cost calculation and therefore has a transport cost value of zero. The main specification to analyse whether transport costs on island municipalities are significantly higher than in comparable municipalities is given by the following equation:

$$\log(\text{Transport costs}_i) = \beta_0 + \beta_1 \cdot \text{Island dummy}_i + \beta_2 \cdot \text{Distance to Stockholm}_i + \beta_3 \cdot \text{Distance to closest big city}_i + \beta_4 \cdot \text{Land area}_i + \beta_5 \cdot \text{Forest coverage}_i + \beta_6 \cdot \text{Arable land}_i + \beta_7 \cdot \text{Shoreline}_i + \beta_8 \cdot \text{Population density}_i + \varepsilon_i$$

The dependent variable, transport costs, denotes the cost of travelling to Stockholm from each municipality. It is logarithmically transformed to improve the distribution of the residuals, reduce the influence of outliers and to enable a clearer interpretation of the associations of being an island with transport costs in percentages. The model uses heteroscedasticity robust standard errors (HC1). The main coefficient of interest, $\beta_1$, captures the relationship between the island dummy variable (1 if a municipality is an island) and the dependent variable. Following the theoretical framework described above, the main specification includes controls for the geography and degree of remoteness of each municipality. Including these controls in the regression reduces bias, ensuring that the cost difference between islands and comparable mainland municipalities in terms of transport costs does not capture inter-municipal differences regarding remoteness or geographic characteristics, such as the proportion of arable land. For example,

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simply including an island dummy in the regression without additional controls could mean that the association of the island dummy with transport costs is partly driven by the fact that islands are generally more remote from Stockholm than other municipalities, which would lead to an overestimation of the actual association (upward bias). In other words, including control variables in the regression ensures that islands are compared to similar mainland municipalities and helps to disentangle whether the unique features of being an island are associated with higher costs, or whether these costs are related to factors affecting all remote regions.

The coefficients $\beta_2$ and $\beta_3$ reflect the relationship between remoteness, operationalised as the straight-line distance to Stockholm and the travel time to the closest city with more than 100 000 inhabitants in km. They can be interpreted as follows: The coefficient of transport costs increases by $e^{\beta_2}$% for every additional kilometre of distance to Stockholm, holding all other variables constant. In other words, one must exponentiate the coefficient to interpret it as percentage change[7]. Given how the transport indicator is constructed, driving time to Stockholm is positively associated with transport costs, as longer trips incur higher costs. $B_4$ reflects the association of transport costs and land area size. The coefficients $\beta_5$ and $\beta_6$ represent association of the shares of forest coverage and arable land of the total land area in each municipality. $\beta_7$ and $\beta_8$ are the coefficient of the variables which controls for the length of the shoreline and the population density of each municipality. ε represents the error term. $\beta_0$ is a constant that reflects the transport costs if all variables in the equation are zero. Overall, the aim of the model is to explain the variance in travel costs across Swedish municipalities and to compare the two island municipalities with similar municipalities on the mainland.

The main specification to analyse if land and housing costs on island municipalities are significantly higher than in comparable municipalities is given by the following equation:

$$\begin{aligned}\log(\text{Housing and land cost}_i) &= \beta_0 + \beta_1 \cdot \text{Island dummy}_i + \beta_2 \cdot \text{Distance to Stockholm}_i + \beta_3 \cdot \text{Time to closest big city}_i + \beta_4 \\ &\cdot \text{Land area}_i + \beta_5 \cdot \text{Forest coverage}_i + \beta_6 \cdot \text{Arable land}_i + \beta_7 \cdot \text{Shoreline length}_i + \beta_8 \\ &\cdot \text{Population density}_i + \varepsilon_i\end{aligned}$$

The sample for the regression analysis of the land and housing costs comprises 280 municipalities, excluding 10 municipalities with missing values. The model uses heteroscedasticity robust standard errors (HC1). The model tests the following four dependent variables independently: Property price for tenant-owned apartments per sqm, property price for single-family homes per sqm, annual rent per sqm of all rented dwellings, the purchase price for one- and two-dwelling buildings and the assessed value for one- and two-dwelling buildings. The interpretation of the coefficients is similar to that of the equation above, since all the dependent variables have also been transformed using a logarithmic function. The coefficient of interest is $\beta_1$, which captures the association between the island dummy variable (1 if a municipality is an island) and housing and land costs. $\beta_0$ is a constant reflecting housing costs when all of the equation's variables are zero. The $\beta_2$ and $\beta_3$ coefficient reflects the relationship between a municipality's straight-line distance to Stockholm and the travel time to the closest city with more than 100 000 inhabitants and housing costs. A positive coefficient would suggest that all other things being equal, housing and land costs are higher in more remote municipalities. $\beta_4$ reflects the association with land area size of the municipality. The coefficients $\beta_5$ and $\beta_6$ reflects the association of the dependent variables with the two topography variables, i.e. the share of forest coverage and arable land in a municipality. $\beta_7$ and $\beta_8$ represent the coefficients for variables concerning the length of the shoreline and population density, respectively. The error term is represented by ε.

There are three important points to note regarding the regression analysis. First, the analysis aims to estimate the association between being an island and transport- and land-related costs, while taking into

[7] For every 1 unit increase in the independent variables (e.g. the island dummy), the dependent variable (e.g. transport costs) change by $(e^{\beta} - 1) \cdot 100\%$.

account key geographical and remoteness characteristics. Although causal identification is limited due to potential unobservable factors, such as the quality of roads, including relevant controls, such as the distance to Stockholm and the share of forest coverage, enables meaningful comparisons to be made between islands and similar mainland municipalities.

Second, the analysis sheds light on the ultimate determinants (e.g. geography) rather than the proximate, policy-sensitive determinants (e.g. economic development) that explain variation in the dependent variables. Excluding variables relating to the institutional and economic characteristics of a municipality, e.g. population and GDP, ensures that the difference between islands and similar mainland municipalities is estimated more precisely, since these variables are also likely to be a consequence of island geography. The analysis generally does not aim to develop a model that best explains inter-municipal variation in transport and land and housing costs. If that were the objective, economic and institutional variables likely to explain the variation in the dependent variables would also need to be considered.

Third, it is important to note that the computed transport cost indicators mainly reflect distance to Stockholm and ferry costs related to the islands. Therefore, this approach could also be interpreted as deconstructing the indicator, since the island dummy and remoteness control variable explain almost all of the variation in the transport indicator. In summary, the analysis provides insights into the additional costs associated with being an island, given observable geographic features, and offers a robust benchmark for identifying disparities between island and mainland municipalities.

The results of the regression analysis for the transport indicators show that the island dummy is statistically significant and positively associated with higher costs (Table 13). It reports the estimated association between the island dummy and transport-related costs for residents and businesses, controlling for municipality size, remoteness, geographical characteristics and population density.

### Table 13. Regression analysis of transport costs, passengers and businesses

| | *Dependent variable:* Log (Transport_cost_passenger) | |
|---|---|---|
| | Passenger | Business |
| | (1) | (2) |
| Island dummy | 0.980*** | 1.443*** |
| | (0.134) | (0.246) |
| Distance to Stockholm | 0.004*** | 0.004*** |
| | (0.0002) | (0.0002) |
| Travel time to closest big City | 0.0003 | 0.0004 |
| | (0.0004) | (0.0004) |
| Land area | -0.00004*** | -0.00004*** |
| | (0.00001) | (0.00001) |
| Forest coverage | 0.009*** | 0.009*** |
| | (0.003) | (0.003) |
| Arable land | 0.010*** | 0.009*** |
| | (0.003) | (0.003) |
| Shoreline length | -0.011 | -0.029 |
| | (0.025) | (0.027) |
| Population density | -0.0002** | -0.0002*** |
| | (0.0001) | (0.0001) |
| Constant | 5.092*** | 5.132*** |
| | (0.264) | (0.264) |
| Robust Standard Errors | HC1 | HC1 |
| Observations | 289 | 289 |
| $R^2$ | 0.883 | 0.883 |
| Adjusted $R^2$ | 0.880 | 0.879 |

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| | | |
|---|---|---|
| Residual Std. Error (df = 280) | 0.272 | 0.273 |
| F Statistic (df = 8; 280) | 264.689*** | 263.709*** |

Note: Standard errors in parentheses. *p<0.1; **p<0.05; ***p<0.01

The coefficients of the regression models suggest that Swedish islands are associated with higher transport costs. The coefficient of the island dummy in both models are significant at the 1% significance level. For inhabitants on islands, the average cost for a trip to Stockholm is 166% higher compared to similar municipalities on the mainland. On average, for businesses on the two islands a trip to Stockholm costs 323% more compared to similar municipalities on the mainland. It is important to note that these costs reflect the overall economic costs (including time and inconvenience costs), rather than just the financial costs of ticket prices. The coefficients of the two regression models are higher than the differences of the mean transport costs between island and mainland municipalities displayed in (This is because the regression model controls for the distance to Stockholm and therefore compares island municipalities with municipalities that have a similar distance to the capital. The regression findings support the initial findings presented in Figure 12.

Across all models, the control variables generally behave as expected, with travel time to Stockholm strongly and positively associated with higher transport costs. A one kilometre increase in the distance to Stockholm is associated with 0.4 percent higher transport costs in both models. As anticipated, a value of $R^2$ above 0.87 indicates that the model fit is exceptionally high due to the constructed nature of the dependent variable.

Overall, the descriptive results suggest that the inhabitants and businesses on Swedish islands face significantly higher transport costs than those in mainland municipalities. In addition, the econometric findings suggest that being an island is associated with higher transport costs even when the potential effects of remoteness and geography, which islands share with other remote regions, are controlled for. The econometric analysis helps to determine whether the unique features of being an island are associated with higher costs, or whether these costs are related to factors affecting all remote rural regions. This provides tentative evidence of the structural disadvantage that island economies face due to their geographic isolation and disconnection from the mainland. Travelling from the islands to the mainland incurs costs for tickets and in terms of time and inconvenience, particularly relevant for businesses. These costs cannot be easily reduced by changes in government policy but the scheduling of ferry services, the costs of tickets, the level of subsidies provided are determined by long-term policy decisions and tendering agreements with ferry service providers.

Additionally, the analysis suggests that both islands face unique transportation constraints. Citizens and businesses on Gotland rely on long-distance ferry services, which result in higher costs per trip than those experienced in Öckerö. Öckerö's lower transportation costs per trip are driven not only by its closer proximity to the mainland, but also by policy differences. These include free services and a higher frequency of ferries, which reduce the cost burden for businesses and inhabitants. More generally, this suggests that transport costs for islands are not a deterministic result of geographical characteristics but can be influenced by island-sensitive policies. However, it is important to note that in both cases the transport costs are subsidised by the government. Therefore, ticket prices reflect the direct cost borne by businesses and passengers for each tip trip but are only an approximation of the structural disadvantages island economies are facing. Further research could involve a sensitivity analysis to determine whether altering the assumptions underlying the transport cost calculation affects the econometric estimates.

### *The econometric evidence regarding the cost of housing is inconclusive*

The results of the regression analysis for land and housing indicators provides less conclusive results (Table 14). Each column corresponds to a model with a different dependent variable capturing land and

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housing prices. With the exception of the property prices of tenant-owned houses, all the island dummy coefficients are negative. This suggests that all other things being equal, islands have lower land- and housing-related costs. However, none of the island dummy coefficients are significant, even at the 10% level. It is therefore not possible to conclude from this analysis that islands are associated with lower, or higher, land prices. As expected, housing prices and rents decrease with distance from Stockholm and the closest city with over 100 000 inhabitants, indicating that housing costs are lower in more remote areas. Forest coverage and arable land are also negatively related to the dependent variables, which potentially captures the fact that housing prices are lower in rural areas as a high share of forest coverage or arable land could be considered as a proxy for being a rural region.

## Table 14. Regression models: Land and housing costs

| | **Tenant price** | **Detached price** | **Annual rent** | **Purchase price** | **Buildings value** |
|---|---|---|---|---|---|
| Island dummy | 0.29920 | -0.13635 | -0.03031 | -0.12724 | -0.15436 |
| | (0.51922) | (0.45683) | (0.08702) | (0.42772) | (0.47466) |
| Distance to Stockholm | -0.00113*** | -0.00101*** | -0.00025*** | -0.00096*** | -0.00100*** |
| | (0.00036) | (0.00019) | (0.00005) | (0.00020) | (0.00022) |
| Time to closest big city | -0.00183 | -0.00137** | -0.00026* | -0.00132* | -0.00178** |
| | (0.00136) | (0.00066) | (0.00014) | (0.00072) | (0.00079) |
| Land area | -0.00000 | -0.00000 | 0.00000 | -0.00001 | -0.00001 |
| | (0.00005) | (0.00002) | (0.00000) | (0.00002) | (0.00002) |
| Forest coverage | -0.02912*** | -0.02322*** | -0.00444*** | -0.02308*** | -0.02554*** |
| | (0.00453) | (0.00246) | (0.00079) | (0.00269) | (0.00283) |
| Arable land | -0.01532*** | -0.01280*** | -0.00255** | -0.01250*** | -0.01481*** |
| | (0.00576) | (0.00311) | (0.00099) | (0.00342) | (0.00364) |
| Shoreline length | -0.01470 | 0.01814 | -0.00260 | 0.01623 | 0.01169 |
| | (0.05998) | (0.03733) | (0.01054) | (0.04030) | (0.04127) |
| Population density | -0.00011 | -0.00008* | -0.00002 | -0.00003 | -0.00006 |
| | (0.00008) | (0.00005) | (0.00002) | (0.00005) | (0.00006) |
| Constant | 12.01549*** | 11.93021*** | 7.44956*** | 16.64975*** | 16.35904*** |
| | (0.41925) | (0.23493) | (0.08119) | (0.25555) | (0.27013) |
| Num.Obs. | 280 | 280 | 280 | 280 | 280 |

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| | | | | | |
|---|---|---|---|---|---|
| R2 | 0.353 | 0.588 | 0.460 | 0.585 | 0.578 |
| R2 Adj. | 0.334 | 0.576 | 0.444 | 0.572 | 0.565 |
| F | 48.919 | 56.866 | 25.734 | 56.215 | 58.662 |
| Std.Errors | HC1 | HC1 | HC1 | HC1 | HC1 |

Note: $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Property price estimates are based on the transfer of apartments owned by tenant-owner associations, the purchase price of detached houses (housing without shared walls with an adjoining dwelling), the purchase price for all one or two dwelling buildings, and the assessed value of buildings with either one or two dwellings,
Source: Author's elaboration

As set out in the conceptual and analytical framework, the unique geographical and institutional features of islands, potentially mediated through higher transportation costs, could impact other sectors of island economies. The descriptive and econometric results for land prices and housing are ambiguous. On average, property prices, rents and building values are higher on islands than in mainland municipalities. However, after adjusting for geographic distance and other features, no significant differences were found between islands and comparable mainland municipalities across all housing and land indicators. However, these findings should be interpreted with caution as the sample contains only two island regions, and both have very different housing markets.

Overall, the econometric evidence for Sweden clearly demonstrates that transport costs are higher in island municipalities compared to mainland counterparts. Land and housing indicators also point to higher property prices and rents, on average, though the small sample of only two island municipalities limits the precision of this finding. These findings highlight the importance for a broadening of the evidence base, including exploring the creation of island-level land valuation data and providing greater transparency on the subsidies and operational performance of island ferry services.

## Policy implications

### *For Croatia*

- The municipal needs and service obligations of island communities, based on annual expenditure, appear to be greater than their mainland equivalents. Additional spending is particularly high in health, public order, and housing. Further investigation on how insularity specifically affects these cost items could help determine if additional resources should be allocated to island municipalities and, if justified, to which outcomes these should be tied.
- The distinction between costs for coastal and island municipalities, based on municipal expenditure, is ambiguous. This suggests that some of the factors that affect both types of communities – tourism-based economies, congestion, seasonality and exposure to maritime environmental challenges – may be driving island costs. Improved monitoring of service delivery outcomes and efficiency, such as costs per capita or per unit, could help better delineate coastal costs from insularity costs.
- Transport costs for outlying islands, based on a small sample, are significantly higher than for those in close proximity to the mainland. Inclusion of the average journey time, journey frequency, and journey cost for passengers in the island indicators would greatly improve understanding of this relationship and allow a more evidence-based framework of island typology to be developed.

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### *For Greece*

- Greek islands are economically strong and do not appear to be experiencing lower productivity in comparison with mainland regions. Further, Greek islands have, with some exceptions, comparable demographics and housing markets. Efforts to offset the costs of insularity should therefore be targeted at more explicitly geographic challenges such as water infrastructure, transport, spatial planning and disaster preparedness.
- Tourism, and the related phenomena of seasonality, are particularly influential on island costs in Greece. Not only do surges in the summer population put pressure on infrastructure and housing, but adequate competition for island goods and services is also difficult to maintain throughout the year. Broadening or flattening the tourist season, for example through the regulation of cruise ship arrivals or levies on tourist accommodation during peak times, could help to soften the impact of seasonality.
- Transport costs to access Greek islands are high and appear to be greater for more remote, outlying and poorly-connected islands. An aggregated database that compiled the frequencies of ferry schedules, the average ticket cost for both island and non-island residents, and the subsidies provided by the national government would enable a more robust measurement of whether the transport equivalent policy is suitably designed to offset island costs.

### *For Sweden*

- Transport costs are exceptionally high for island businesses and residents and remain a significant barrier to economic development. The economic costs of maritime transport are not only financial, through the cost of tickets charged to ferry users, but also impose significant time burdens and inconvenience. The transportation of goods by truck from Gotland to Stockholm, for example, faces comparable costs to an exclusively road-based journey from above the arctic circle.
- Island transport services funded by government are not fully transparent and the overall cost of transport may therefore be even higher than estimated. The exact quantity of direct and indirect maritime transport subsidies provided by national, regional and municipal governments to island communities each year is unquantified. In particular, "free" ferries are financially supported by government, somewhat obscuring the overall economic costs on society. The costs imposed on households living on remote islands without ferry connections, therefore requiring private maritime transport, are also in addition to the estimates made in this paper.
- Land costs appear to be higher on islands, but the econometric evidence is inconclusive and other factors other than insularity may be partly responsible. In particular, the possibility that land costs are comparable to coastal localities on the mainland cannot be tested or rejected due to the small sample size of island territories. Island-level land valuation data, or the development of new analytical units that groups together small and remote islands, is required to both broaden the size and improve representativeness of the sample.

## Conclusion

The evidence from all three case study countries, taken in aggregate, suggests that costs for businesses, households and governments are generally higher on island territories. These additional costs can be demonstrated by a range of individual descriptive statistics, economic modelling of transport costs and econometric analysis – and appear to be higher across a range of policy areas. However, a single, replicable analytical approach to measurement of the cost of insularity that can be applied to multiple countries, captures all relevant costs and has sufficient data to support it remains elusive.

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Although a single, cross-country measure of the cost of insularity is not yet available, island economies in Croatia, Greece and Sweden exhibit a clear set of shared cost patterns that stem from the same root cause of insularity. Across all three countries the dominant, observable cost is transport, which manifests as ferry tickets, freight surcharges, additional travel time and inconvenience. These costs in turn raise the price of almost all island goods and services and affect every island stakeholder. Housing costs, primarily driven by extraordinary seasonal demand, limited developable area and high levels of protection for natural and cultural heritage are also evident across the three case study countries. Higher average prices for government services on islands, especially for those such as infrastructure provision, health and education that can benefit from economies of scale, are also borne out by the available evidence.

These common cost types also have significant policy implications. Most immediately, island transport costs are demonstrably higher and less predictable than they first appear due to the hidden costs of travel time, subsidised prices and inconvenience. Housing and land costs, due to several factors including seasonality, tourism, land scarcity, and land-use regulations, may require extraordinary supply (e.g. faster development approvals) and supply (regulations on short-term rentals) responses to improve affordability for island residents. And local government expenditure, all else held constant, appears to be higher on island territories, suggesting additional funding is required maintain an even standard of service delivery between island and non-island locations.

Future research can also build on and improve the approaches explored in this paper. For example, the collection of data from smaller islands in Sweden, and their use as either individual territorial units or groups, would enable a broader sample and support more precise econometric estimates of land and transport costs. The availability of additional indicators in Greece and Croatia at the municipal level would be equally valuable, allowing a more in-depth evaluation of costs such as land and infrastructure to be assessed. For all three countries, additional geographic data would also allow more sophisticated control variables to be incorporated into the analysis. Measurements of topography, arability, coastline length, climate, and land type are not always available and could enable fairer comparisons between islands and non-islands. The straight-line distance to the coast, distances to essential services such as airports, and the distances to major cities in neighbouring countries could also provide complementary measures of remoteness and improve precision.

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## ANNEX 1.A. Summary statistics: Croatia

### Table 15. Summary statistics of Croatian municipalities used in econometric analysis

| Variable | n | Min | Median | Mean | Max | SD |
|---|---|---|---|---|---|---|
| Government expenditure per capita (USD PPP) | 553 | 597 | 1 536 | 1 761 | 5 943 | 832 |
| Distance to Zagreb (km) | 553 | 13 | 148 | 149 | 411 | 87 |
| Distance to county seat (km) | 553 | 0 | 22 | 25 | 88 | 15 |
| Cropland share (%) | 553 | 0 | 9 | 21 | 89 | 24 |
| Land area (km²) | 553 | 6 | 67 | 101 | 967 | 109 |
| Population density (per km²) | 553 | 2 | 41 | 86 | 2 489 | 178 |

Note: n=number of observations. SD is standard deviation. Mean is unweighted average.
Source: Author's elaboration with data from (Državni zavod za statistiku, 2025[22]), (OECD, 2024[19]) and (OECD, 2025[23]).

*Expanded descriptive Statistics*

### Table 16. Mean municipal expenditure for island, mainland, and coastal municipalities

| Variable | Island only (n= 46) | Island incl. mainland (n= 59) | Mainland (n= 507) | Coastal (n= 75) | National average (n= 553) |
|---|---|---|---|---|---|
| Total municipal revenue in USD PPP per capita | 2 534 | 2 414 | 1 527 | 2 322 | 1 622 |
| Protected areas (%) | 56.3 | 57.0 | 29.7 | 46.0 | 32.0 |
| Population density (population per km²) | 54.5 | 101.2 | 88.8 | 197.6 | 86.0 |
| Tourism arrivals per year | 73 445 | 128 995 | 48 736 | 176 877 | 51 816 |
| Tourism nights per year | 441 651 | 612 369 | 223 811 | 865 203 | 250 965 |
| Tourism Intensity (tourist nights per 100 inhabitants) | 17 667 | 16 176 | 5 281 | 19 714 | 6 825 |

Note: n=number of observations. Unweighted averages.
Source: Author's elaboration with data from (Državni zavod za statistiku, 2025[22]), (OECD, 2024[19]) and (OECD, 2025[23])

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### *Models with different island dummy*

As discussed, there is an alternative way to conceptualise the island dummy in the regression. The models presented throughout the paper treat all 46 Croatian municipalities that include only island territory as islands, and all other municipalities as non-islands. To test the robustness of this approach, the following specifications use an expanded dummy variable that treats all 59 municipalities with some island territory (including those with both mainland and island territory, as well as the municipalities on the Pelješac peninsula) as islands. Among others, the island dummy in this second approach therefore includes Dubrovnik, Split and Zadar municipalities as islands. This model includes the same dependent variable (government expenditure) and controls and also employs heteroscedasticity-robust standard errors (HC1).

Similar to the more strict island dummy presented in the main part of the report, the coefficients below indicate that having island territory is significantly associated with higher government expenditure. However, once the coastal dummy is included, this association becomes statistically insignificant.

## Table 17. Model specification with expanded Island dummy

| | *Dependent variable:* log (Gov_expenditure) | | | |
|---|---|---|---|---|
| | Model 1 | Model 2 | Model 3 | Model 4 |
| Has Island | 0.429*** | 0.222*** | 0.224*** | 0.033 |
| | (0.051) | (0.066) | (0.065) | (0.076) |
| Distance Zagreb | | 0.001*** | 0.001*** | 0.001*** |
| | | (0.0002) | (0.0002) | (0.0002) |
| Distance county seat | | 0.001 | 0.001 | 0.001 |
| | | (0.001) | (0.002) | (0.001) |
| Cropland share | | -0.003*** | -0.003*** | -0.002** |
| | | (0.001) | (0.001) | (0.001) |
| Land area | | 0.0005*** | 0.0004*** | 0.001*** |
| | | (0.0001) | (0.0001) | (0.0001) |
| Population density | | | -0.0002 | -0.0003** |
| | | | (0.0001) | (0.0001) |
| Coastal dummy | | | | 0.322*** |
| | | | | (0.068) |
| Constant | 7.334*** | 7.160*** | 7.190*** | 7.174*** |
| | (0.018) | (0.045) | (0.049) | (0.048) |
| Observations | 553 | 553 | 553 | 553 |
| $R^2$ | 0.098 | 0.213 | 0.217 | 0.257 |
| Adjusted $R^2$ | 0.097 | 0.206 | 0.208 | 0.248 |
| Residual Std. Error | 0.402 (df = 551) | 0.377 (df = 547) | 0.376 (df = 546) | 0.367 (df = 545) |
| F Statistic | 59.977*** (df = 1; 551) | 29.592*** (df = 5; 547) | 25.217*** (df = 6; 546) | 26.981*** (df = 7; 545) |

Note: *p<0.1; **p<0.05; ***p<0.01

### *Explanation of transport cost calculation*

To provide a preliminary insight into the transport costs faced by citizens and businesses on different types of Croatian islands, the ferry-related transport cost for a diverse set of five Croatian municipalities have been analysed. The method uses similar assumptions as the transport analysis for the Swedish case. The overall ferry-related costs include financial costs, time costs and inconvenience costs. Due to limited data availability and the high number of Croatian islands, the analysis focusses on the ferry-related transport costs and does not include a comparison with mainland municipalities. The table below summarises the approach undertaken to analyse transport costs.

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## Table 18. Transport costs calculation

| | Financial costs | Time costs | Inconvenience Costs |
|---|---|---|---|
| Island component (ferry) | Ticket prices<br>• The prices for passenger tickets, passenger car tickets (for cars under 5 m long) and business car tickets (for cars over 5 m long) provide the basis to calculate the financial transport costs for each municipality. The prices were collected from the Agencija Zolpp website. | Economic costs of travel time<br>• The calculation is based on the duration of a ferry trip to the mainland and assumptions about queuing times, as well as the average minimum wage.<br>• The travel time data was collected from the Agencija Zolpp website.<br>. | Economic costs related to the inconvenience of ferry travel<br>• General Inconvenience costs are based on the average frequencies of ferries per day, average delay and cancellation rates based on cancellation and delay data of other countries, and assumptions on how businesses and passengers can utilise time lost due to cancellations and delays. For example, it is assumed that businesses can utilise inconvenience time less effectively than passengers, who may be more flexible.<br>• The ferry frequency data taking into account seasonal fluctuations was collected from the Agencija Zolpp website. |

Source: (Agency for Coastal Liner Maritime Transport, 2025[25])).

## Table 19. Characteristics of islands used in the transport calculation

| | Brač | Dugi Otok | Lošinj | Šipan | Ugljan |
|---|---|---|---|---|---|
| | | | | | |
| Population | 13 812 | 7 039 | 5 629 | 1 695 | 482 |
| Land Area (km²) | 395.44 | 74.37 | 51.05 | 113.31 | 16.22 |
| Population Density | 34.90 | 94.60 | 110.30 | 15.00 | 29.70 |
| Frequency of Shipping Lines | 13.86 | 19.25 | 23.26 | 7.14 | 5.71 |
| Expenditure per capita | 345.10 | 443.70 | 312.70 | 119.60 | 47.70 |

Source: (Ministry of Regional Development and EU Funds, 2024[2]).

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## ANNEX 1.B. Summary statistics (TL3): Greece

### Table 20 Greece summary statistics

| Variable | n | Min | Median | Mean | Max | SD |
|---|---|---|---|---|---|---|
| GDP per capita (EUR) | 52 | 13 600 | 18 700 | 20 494.2 | 47 400 | 6 755 |
| Island (dummy) | 52 | 0 | 0 | 0.3 | 1 | 0 |
| Distance to Athens (km) | 52 | 0 | 262 | 234.8 | 414 | 121 |
| Land area (km²) | 52 | 67 | 2 336 | 2 539.4 | 6 640 | 1 723 |
| Mountainous area (dummy) | 52 | 0 | 1 | 0.8 | 1 | 0 |
| Coastal area (dummy) | 52 | 0 | 1 | 0.8 | 1 | 0 |
| Population density (per km²) | 52 | 10 | 50 | 649.6 | 11 265 | 2 122 |

Note: n=number of observations of TL3 regions.
Source: (Eurostat, 2025[44]; Eurostat, 2023[28]; Eurostat, 2023[45]; Eurostat, 2021[26])).

### *Regression with inclusion of additional islands*

### Table 21. Regression findings with expanded island dummy (incl. Lefkada and Euboea)

| | Baseline | Including geography | Including demography |
|---|---|---|---|
| Island dummy | 0.01248 | 0.13964* | 0.13744 |
| | (0.07649) | (0.08267) | (0.08218) |
| Distance to Athens | | -0.00146*** | -0.00120*** |
| | | (0.00028) | (0.00034) |
| Land area | | -0.00001 | -0.00000 |
| | | (0.00002) | (0.00002) |
| Mountain dummy | | -0.04302 | 0.03279 |
| | | (0.09064) | (0.07781) |
| Coastal dummy | | -0.12542 | -0.08752 |
| | | (0.09399) | (0.09458) |
| Population density | | | 0.00003 |
| | | | (0.00003) |
| Constant | 9.88339*** | 10.36175*** | 10.16438*** |
| | (0.04690) | (0.15974) | (0.18729) |
| Observations | 52 | 52 | 52 |
| R2 | 0.000 | 0.420 | 0.445 |
| R2 Adj. | -0.020 | 0.357 | 0.371 |
| F | 0.027 | 5.401 | 4.946 |
| Std.Errors | HC1 | HC1 | HC1 |

Note: Observations are all TL3 regions. *p < 0.1, ** p < 0.05, *** p < 0.01
Source: Author's elaboration.

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## ANNEX 1.C. Summary statistics: Sweden

### Table 22. Summary Statistics of Swedish Municipalities

| Variable | Obs | Min | Median | Mean | Max | SD |
|---|---|---|---|---|---|---|
| Transport cost (passenger) | 290 | 0 | 118 | 120 | 391 | 72 |
| Transport cost (business) | 290 | 0 | 118 | 121 | 391 | 73 |
| Annual rent (EUR per km²) | 290 | 70 | 100 | 103 | 196 | 15 |
| Property price tenant-owned appartements (EUR per km²) | 280 | 15 | 1 373 | 1 618 | 6 493 | 1 195 |
| Property price single-family-home (in EUR per km²) | 290 | 311 | 1 661 | 2 066 | 7 573 | 1 313 |
| Average purchase price for one- and two-dwelling buildings (EUR) | 290 | 36 218 | 186 868 | 242 944 | 1 162 889 | 174 433 |
| Assessed buildings value for one- and two-dwelling buildings (EUR) | 290 | 19 292 | 107 562 | 145 965 | 696 878 | 110 172 |
| Land area (km²) | 290 | 9 | 670 | 1 404 | 19 162 | 2 437 |
| Arable land (%) | 290 | 0 | 8 | 15 | 80 | 17 |
| Shoreline length (in km/land area) | 290 | 0 | 1 | 1 | 13 | 1 |
| Population density (per km²) | 290 | 0 | 29 | 165 | 6,483 | 610 |
| Straight-line distance to Stockholm (km) | 290 | 0 | 310 | 314 | 993 | 191 |
| Travel time to city >100k (min) | 290 | 0 | 67 | 92 | 434 | 76 |

Note: Obs represents number of observations and includes all municipalities.
Source: (Kolada, 2025[21]).

### *Sources for transport indicator*

### Table 23. Transport cost indicator

| | Financial costs | Time costs | Inconvenience Costs |
|---|---|---|---|
| **Island component (ferry)** | Ticket prices<br>• The calculation is based on ticket prices for a trip using the commuter card for residents, as well as for businesses using vehicles (under 6 metres for passengers and over 6 metres for businesses. Link to source: Destination Gotland).<br>• The commuter card is an annual charge. To estimate the price per trip, the model assumes that a card owner will make one (one-way) journey to the mainland per week.<br>• Öckerö: Ferry travel is free for | Economic costs of travel time<br>• General: The calculation is based on the duration of a ferry trip to the mainland and assumptions about queuing times, as well as the average hourly wage of manual workers.<br>• Gotland: The travel time to the mainland is calculated by taking the weighted mean of the travel times to Nynäshamn and Oskarshamn from Visby. 30 mins are allocated for queuing, with an additional 12 minutes for summer | Economic costs related to the inconvenience of ferry travel<br>• General Inconvenience costs are based on the average frequencies of ferries per day, average delay and cancellation rates based on cancellation and delay data of other countries, and assumptions on how businesses and passengers can utilise time lost due to cancellations and delays. For example, it is conservatively assumed that businesses can utilise general inconvenience time |

| | | | |
|---|---|---|---|
| | businesses and passengers. | months.<br>• Öckerö: The travel time to the mainland is calculated by taking the weighted mean of the travel times from Björkö and Hönö to Lilla Varholmen. 15 minutes are allocated for queuing, with an additional 6 minutes for summer months. | less effectively (at 50%) than passengers (90%), who may be more flexible.<br>• Gotland: Data on ferry frequencies was collected from the Destination Gotland website. Over the year, an average of 2.8 journeys per day to Nynäshamn and 1.3 journeys per day to Oskarshamn are scheduled. It is assumed that 75% of passengers travel to Nynäshamn and 25% to Oskarshamn.<br>• Öckerö: Data on ferry frequencies was collected from the Swedish Transport Administration website. Approximately 72 services to Hönö and 24 services to Björkö are scheduled per day.<br>• 3% of journeys are assumed to be delayed. Average delay (as a share of journey) is assumed to be 10%.<br>• Service cancellation rate is assumed to be 1% of all journeys to account for weather, mechanical and industrial action events. |

**Simplified island component calculation:**

**Island component** = Financial costs (cost per passenger + cost per vehicle) + Time costs ((average journey time + average queuing time)*average wage) + Inconvenience costs ((expected lost time due to cancellation, delays, time until next service)*utilisation rate*average wage)

| | | | |
|---|---|---|---|
| **Mainland component (car)** | Fuel, electricity and depreciation costs<br>• Based on internal distance and travel data from settlements in Swedish municipalities to the country's largest cities, as well as an assumption regarding economic costs (including fuel, electricity and depreciation per kilometre), an indicator reflecting the cost of travelling to Stockholm was calculated for each municipality.<br>• The travel time for Öckerö and Gotland excludes the time spent on a ferry and only reflects the mainland travel time. | Economic costs of travel time<br>• General: Calculation is based on the duration of trip by road in a private vehicle to Stockholm and average hourly earnings.<br>• Calculations assume an average speed of 70km/hour based on a sample of journeys to Stockholm from 15 different municipalities tested on Google Maps. | • Because travelling by car is flexible (there are no delays or restricted travel frequencies), inconvenience costs are expected to be zero. |

**Simplified mainland component calculation:**

**Mainland component** = Financial costs (mean drive time*average driving speed*average fuel cost per km*average vehicle depreciation per km) + Time costs (mean drive time*average wage)

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