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MEASURING INSULARITY AS A STATE OF NATURE. IS THERE A CASE OF BAD GEOGRAPHY?

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Measuring insularity as a state of nature. Is there a case of bad geography? [1]

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Abstract

The first goal of this work is to collect available physical geographic data on islands and to elaborate measures of insularity. We then evaluate whether and when insularity can become 'bad' geography in terms of poor economic performance. We find that two important dichotomies are present: states that are islands (full insularity) perform worse than countries that have islands (partial insularity). Within the group of island-states, isolation is the crucial dimension associated with low GDP, less the dispersion of the land. Instead, being coastal and having islands is associated with better results than only having direct access to the sea.

Keywords: Islands, Landlocked, Coastal, Insularity Measures, Cross-Country Income Distribution.
Jel classification: F10

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1. Introduction

A large proportion of the least developed countries are in a 'bad geography' condition in terms of accessibility to world markets. *Bad* translates into a lower inter-connectivity imposed by past and present physical geography, leading to lower incomes, slower growth and less trade. The focus on how geography correlates with development began with Gallup, Sachs and Mellinger (1999); since then, variants of new economic geography, trade theory and growth theories have been applied to highlight the nexus between geographic location, trade and national wealth.

The first goal of this paper is to measure insularity as a state of nature. Insularity by itself is not a condition of 'bad geography'. According to both empirical and theoretical literature, the most immediate case of bad geography is the lack of direct access to the sea. One of four countries in the world is landlocked; in Africa, it is one of three countries. With respect to insularity, its association with size and remoteness render it a crucial factor that may hamper development (Briguglio, 1993; 1995; 2004). In fact, having direct access to the sea is *the* geographical condition that has been found to be the most advantageous for the economy of a country: coastal countries are wealthier (Bloom and Williamson, 1998) and experience 30% more trade than landlocked countries (Limao and Venables, 2001).

In this paper, we initially aim to measure different states of insularity. The second goal is to determine whether the heterogeneity in an insular state is associated with heterogeneous outcomes in terms of income. Extreme cases of insularity may be correlated with poor economic outcomes, as is the case for landlocked countries. Apart from these extreme cases, there are intermediate states of insularity that must be measured and distinguished from the straightforward coastal country condition.

In a recent report, the World Bank (2010) emphasized that landlocked economies are affected more by the high degree of unpredictability in transportation than by the high cost of freight services. In other words, it is primarily a question of the surrounding context. The need to transit in another country's territory can become a condition of 'bad geography' because both exogenous and endogenous factors are likely to raise the total costs of logistics more than the isolated role of transport costs. In fact, some factors are out of a landlocked country's control. The issue of unpredictability is also pertinent to the geography of islands. Islands are completely surrounded by sea. This

total land discontinuity raises costs by eliminating alternatives in the connection system of an island and by raising the level of uncertainty for the remaining alternatives. The small and remote nature of island countries should be considered in view of these characteristics, revealing the crucial physical difference between islands and coastal countries.

To deepen our argument, the first crucial issue is the measure of insularity. Thus far, the existing empirical literature has simply selected small island countries[2] (for example, works on small island developing states, SIDS). Alternatively, the existing trade literature isolates islands from other countries with the use of a simple dummy in employing a gravity model controlling for certain geographical conditions (in more recent models, the effect is captured by a country fixed effect). The first task of this work is to collect available data on the islands and to elaborate some measures of insularity for all countries in the world. This task is not easy because information on islands is rare and dispersed. We primarily used two sources, the United Nations Environment Programme (UNEP) and World Island Info.

Beginning with basic information on the number of islands and the percentage of land on islands, we have constructed different measures aimed at capturing the heterogeneity of insularity. If the complete discontinuity of the land imposes a cost (i.e., limiting connectivity with other countries), then an increase in the number of islands raises costs. A second dimension that increases costs is distance. Therefore, we consider the dispersion of the land in more than one island and a measure of their remoteness with respect to either the nearest mainland or the nearest other islands. These two dimensions can be used to order countries according to their degree of insularity. In combining these two dimensions, the world appears to be divided into three groups of countries: fully insular (island-states), partially insular and not insular.

The first critical dichotomy occurs between countries (as national states) that *are* islands and countries that *have* islands. In the first case, islands are countries; in the second case, islands are regions or smaller territorial units belonging to a country. Within the group of island-states, we focus on the critical dimension of insularity. According to existing literature, three dimensions are involved in the economic fragility associated with an insular condition: smallness, remoteness and vulnerability. In this work, we examine the dispersion of the territory (which is connected to size, specifically more dispersed territory

[2] Bertram (1993); Cole (1993).

throughout many islands is associated with smaller average size) and the remoteness with respect to the nearest land (isolation). Our results suggest that the last point is the most critical: the economic performance of island-states that are more isolated is similar to that of landlocked countries.

Countries that *have* islands (but are not islands) constitute a small group of all economies in the world. Their limited number is outweighed by a larger share of income. When we examine the distribution of income and trade within this small group of countries, their superior performance within the wide group of coastal countries is clear. Our initial results suggest that this small sample of economies can bolster the fortunes of coastal countries. These countries perform better than countries with null or negligible degrees of insularity when considering the distribution of per capita income.

Another challenging case involves, distinguishing two cases of non-insular countries: states that do not have any 'relevant' insular territory but have access to a coast have completely different geographic conditions than countries without a coastline (landlocked). We delineate two cases of null insularity (landlocked and coastal) from cases of negligible insularity (less than 2% of insular land of total territory). On average, the three groups show significant differences in the distribution of the two examined variables. Being landlocked represents the worst case, whereas coastal countries are found to perform better, and having some land on an island is associated with even higher income.

We find that insularity is a condition that cannot be defined as a disadvantage *tout court*. A more distant and dispersed island-state appears to suffer in terms of lower gross domestic product (GDP) per capita. The position of such countries in terms of income distribution is similar to that of landlocked economies. Therefore, size is related to the dispersion of territory in many islands. Although we can confirm that landlocked countries are the weakest economic group, coastal countries are a rather heterogeneous group. Having some degree of insularity provides economic benefits. According to Armstrong et al., (1998) and Bertram and Karagedikli (2004), there are several reasons that insularity may lead to growth opportunities, the facility to build social capital, tourist appeal and the possibility for success in policy implementation.

Section 2 reviews insularity characteristics and economic conditions in the existing literature. We then discuss the available data and provide novel measures for distinguishing different insular conditions in Section 3. In Section 4 we categorize all of the countries in the world according

to their insular measure and study the distribution of per capita income across groups and over time. Section 5 concludes the paper.

2. Definitions in the literature

2.1 *Being an island*

According to the definition provided by Eurostat (1994), an island is a piece of land with the following specific characteristics: a) has a surface area of at least 1 km²; b) is permanently inhabited by a significant population (more than 50 inhabitants); c) is not linked to the mainland by permanent structures; d) is separated from the European continent by a stretch of water at least 1 km wide; and e) does not contain a capital city of one of the member-states.

The nature of the challenges confronted by islands makes them peculiar relative to the mainland states (Read, 2004). In the case of islands, the burden caused by peripherality is exacerbated by the insularity condition. Along with geographical characteristics, the topography of islands can have critical economic growth effects (Briguglio, 1995; Dommen and Hein, 1985)[3].

2.2 *Characteristics of insularity: smallness, remoteness and vulnerability*

The peculiarity of the economic challenges encountered by islands, together with considerable variability in the existing economic performance among islands, has fostered a debate among economists regarding the nature of the challenges confronted by islands and the consequences of these challenges. One first question is whether the adverse effects on growth are caused by insularity *per se* rather than by small size. According to one strand of literature, smallness *per se* does not represent a challenge, as there is evidence of small states performing well. Rather, the combination of smallness and other geographical characteristics (such as being an island, landlocked or mountainous) is relevant. However, according to another strand of literature (i.e., Armstrong and Read, 1995), the adverse effect of insularity on small size is negligible; from this perspective, it is smallness rather than insularity *per se* that affects growth.[4]

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[3] The interest at the EU level on insularity stems from the simple fact that islands confront a condition of substantial backwardness which is stable in time; both at the national or regional level their GDP is below the EU average.

[4] Armstrong and Read, (1995) analyzed Western Union, whereas Armstrong et al., (1996, 1998) and Armstrong and Read, (2000, 2002) analyzed a global data

In the following, we will define the three dimensions concurrent to defining islands: smallness, remoteness and vulnerability.

Smallness

The major implication regarding smallness refers to the limited size of domestic markets because it negatively affects the possibility of islands having agglomeration economies, economies of scale and agglomeration dynamism.

In addition, small economies also pay higher transportation costs because of the relatively small volume of cargo, small cargo units and the need for bulk breaking.

Remoteness

According to Borgatti (2007), remoteness can be defined as the average weighted distance between two countries, with weights reflecting the absorptive capacity of the partner country.

The reasons behind the negative effect of remoteness on trade are connected to transport. Indeed, transport costs have decreased over time as a result of advances in technology and the construction of new infrastructure, especially in the EU. However, islands still tend to confront costs that are difficult to reduce; the most important cost is represented by high per-unit transport costs. Such costs are high primarily because islands are constrained in using air and sea transport, which can often operate under monopoly conditions.[5]

Vulnerability

Vulnerability, which is defined as the potential of a system to be damaged by exogenous effects (Briguglio, 1995), in addition to smallness and remoteness, represents one of the main factors affecting an island's economic and social development

Islands are indeed more vulnerable than the mainland, as they are more exposed to exogenous shocks (economic and environmental) from which they have relatively low resilience to withstand and recover.

2.3 *Economic consequences of insularity and empirical evidence*

As Armstrong and Read (2004, 2006) noted, at least eight economic

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set.

[5] In the case of islands, the effect of remoteness is enhanced by smallness. As stated above, a small economy requires relatively small and fragmented cargoes with higher per-unit costs. Moreover, small islands are likely to be excluded from major sea and air transport routes, which may give rise to delays and make it difficult for islands to exploit the advantages of more technologically advanced means of transport.

challenges can be identified as affecting small states and islands: the small size of the domestic market; the limited resource base; the limited land area; a strong migration phenomenon; a narrow domestic output, export and import market; vulnerability (Briguglio, 1995; Atkins et al., 2000); the consequences of trade; and exacerbated fiscal policies.

According to a wide strand of literature (Armstrong et al., 1998; Easterly and Kraay, 2000; Bertram and Karagedikli, 2004), the insularity condition is not always related to poor economic performance. Indeed, there are several reasons that insularity may lead to growth opportunities: an island's' high degree of structural openness to trade and high dependence on exports may lead to export-led growth strategies; the pursuit of a niche sectoral growth strategy may lead to high standards of living as adequate policies are implemented[6] (Armstrong and Read, 1995; 2002; Armstrong et al., 1998); being an island *per se* is appealing for tourists; and it is easier to build social capital in a small territory than in a larger territory.

With regard to empirical evidence, there is no clear view regarding the effects of insularity on the economic performance of islands. Indeed, even if an island's performance is far below the EU average (especially in terms of unemployment and GDP per capita), the empirical evidence does not indicate a clear negative effect of being an island on several indicators of performance.

3. Measures of insularity

This paper aims to measure different degrees of insularity.[7] Although island-states are the primary focus, the novel part of our exercise is providing and testing a measure of insularity for countries that *are not* islands but *have* islands. We construct a metric based on the information of each habited island in their territorial sovereignty; we collect data for

[6] Policies supporting a key export sector as the situation improves must be able to rapidly move to another niche sector when the first sector has been well exploited.

[7] At the country level, data on land characteristics along different dimensions are already available because of their use in earth science. From CIESIN at Columbia University (http://sedac.ciesin.columbia.edu/place/datasets.jsp). Data such as PLACE data provide national aggregates of geospatial data collection on population, landscape and climate estimates. This type of information has been used to describe land characteristics by Puga (2012), who uses the term 'ruggedness' to refer to precise geographic characteristics of the land.

each island belonging to a country but we sum the available information to arrive at one line of information at the country level. Existing empirical exercises isolate the case of island-states into one homogeneous group. In the gravity equation, for example, islands and landlocked countries are supposed to trade less, all other things being equal. However, the mere distinction of islands does not provide any further indication of how the insular state is a key geographic factor impeding trade or other economic activity. In our view, geography has a different implication for an island belonging to a larger state (a region) compared with an island-state. By examining island-states here, we attempt to understand which natural characteristic of being an island (isolation, dispersion or concentration of the land) is correlated with lower economic activity. Moreover, by considering partial insularity, we seek to determine whether the presence of islands in coastal states is associated with different economic results.

3.1 Data sources

At the international level, there is no complete database that shows the number of all islands included within the territory of each state of the world, including the area of the island, the population and other useful data. Therefore, the task of collecting data on all islands in the world per country is not easy. However, four websites contain the largest and most extensive amount of information, data and statistics relating to the islands of the world[8]:

- http://www.worldislandinfo.com/
- http://islands.unep.ch/
- http://www.worldatlas.com/
- http://www.globalislands.net/

For the aims of this study, we primarily used the first two sites because they presented more detailed information in terms of the number of islands, the area and other data that are useful as potential measures of insularity (e.g., an isolation index). A full presentation of the four data sources is shown in Appendix A.[9]

[8] These websites are recommended by the IGU (International Geographical Union) Islands Commission as the most complete and reliable websites in terms of data quality.

[9] Appendix A also explains how the information from the two sources has been merged.

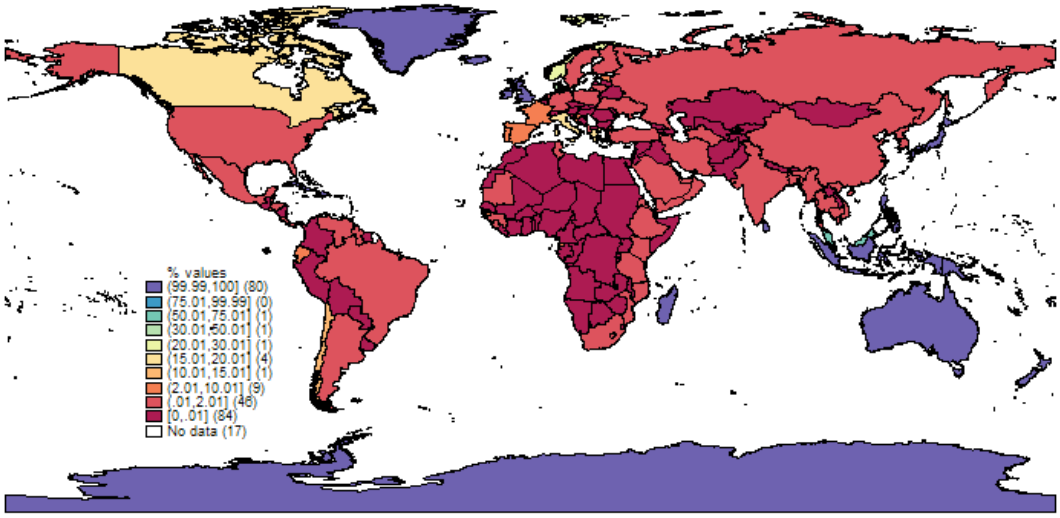
3.2 Measures related to insularity

3.2.1 Number of islands and percentage of island territory

For each country, the initial available information consists of the following:

- the number of islands by country (ranging from zero to 136 islands)
- the percentage of the territory of the country represented by islands (in square km)[10]

Map 1. Percentage of island territory



Source: Own elaboration on our insularity dataset

The values shown on the map for the second measure largely reveal a dichotomy: violet (island-states) and red (20% or lower level of insularity) countries. There is no differentiation within and between islands and countries that have only a portion of their land on islands. Moreover, the zero value is associated with different cases (landlocked and coastal).

Beginning with these two measures, we can distinguish the following:

[10] Data are available for island-states and countries that have some of their territory in islands. Among this second group, some countries have a negligible portion of territory on islands. As shown subsequently, these particular countries are more similar to coastal countries.

state islands (100% territory on islands, which we will term full insularity); countries that are not islands but that have islands (whose second indicator is less than 100, which we term partial insularity); countries whose insularity is negligible because they have a small percentage of territory on islands (less than 2% of territory); and countries that do not have islands (coastal or landlocked).

Based on these two measures, we have a clear indication of the crucial dimensions of insularity: the number of islands is a measure of territorial dispersion (the level of insularity should increase with the number of islands), and the percentage of island territory can measure the 'partial' level of insularity for countries that have islands but are not island-states.

3.2.2 Heterogeneity of island-states

More information is available to capture differences across island-states; we can distinguish archipelagos[11] and small island developing states[12] (four SIDS are not island-states[13]).

At the island level, more information that is useful for distinguishing different cases of insularity is available from UNEP: an isolation index, a coastal index and a threat index.[14] Table 1 illustrates the data for the 30 most isolated island-states in the world. Bouvet Island occupies the maximum value on the isolation index at a country level, followed by Saint Helena and the U.S. Miscellaneous Pacific Islands. The UNEP website provides the isolation index for more than 500 islands by employing an island perspective rather than a country perspective: the most isolated island in the world is Easter Island, with an isolation index of 149.00.

For island-states, these indices are an indication of the severity of the insularity condition and can therefore be used to evaluate the movement of income with the increase of the insular condition. For countries with a partial level of insularity, we constructed unweighted averages of the isolation and coastal indices. We also constructed weighted measures using each island's area (in km^2) as weight, but no significant change was

[11] An archipelago is a landform consisting of a chain or cluster of islands. They typically occur in the open sea; less commonly, a large land mass may neighbor them (Source: http://www.wordiq.com/definition/Archipelago).

[12] Source: United Nations, http://www.un.org/special-rep/ohrlls/sid/list.htm.

[13] Belize, Guinea-Bissau, Guyana, Suriname (Source: United Nations, http://www.un.org/special-rep/ohrlls/sid/list.htm).

[14] See Appendix A.

observed. Clearly, such measures cannot be attributed to all of the territory but only to the proportion that is insular.

Table 1. Isolation and coastal index for the 30 most isolated island-states in the world

Island	Isolation index	Coastal index
Bouvet Island	125.00	n.a.
Saint Helena	113.00	0.3992
US Miscellaneous Pacific Islands	112.00	n.a
French Polynesia	107.73	1.0093
Pitcairn	106.25	3.4698
Cook Islands	104.43	1.4648
Cocos (Keeling) Islands	103.00	n.a.
Kiribati	101.45	n.a.
Norfolk Island	101.00	0.8152
Nauru	97.00	0.8357
Niue	97.00	0.2488
Micronesia	96.23	0.8861
American Samoa	94.14	1.7601
Marshall Islands	93.38	n.a.
Tokelau	92.33	n.a.
Bermuda	91.00	2.2137
Mauritius	91.00	0.3371
Wallis and Futuna	87.00	0.6847
Samoa	87.00	0.1397
Fiji	86.74	0.4393
Guam	86.00	0.2819
Northern Mariana Islands	83.00	0.7548
French Southern Territories	82.38	0.5958
Tuvalu	82.11	3.7917
Palau	81.50	0.3841
Christmas Island	79.00	n.a.
Tonga	77.32	1.9904
South Georgia and the South Sandwich Islands	76.45	0.1883
British Indian Ocean Territory	74.00	3.0160
New Zealand	73.73	1.1610

Source: Own elaboration on our insularity data set / UNEP data

All of the island-states that are listed in the table above are included in our insularity data set (composed of 232 countries), which counts 84 island-states. In the following table, we summarize the most important statistics of the isolation index.[15] As shown in Table 2, the maximum value of the index is 125, the median value is 59, and 86 or above is the value reported by the 25% most isolated island-states.

Table 2. Isolation index for island-states (summary statistics)

Statistic	Value
Mean	59.38
Min	3.00
Max	125.00
Median	49.29
25 percentile	39.00
75 percentile	86.37

Source: Own elaboration on our insularity data set

3.2.3 Dispersion of territory

The above indicators aid in differentiating island-states. To differentiate countries that have a partial insular condition, we constructed an indicator that combined the information on the amount of island territory with information on whether the territory is concentrated or dispersed in many islands. This compositional index is comprised of two parts: the number of islands that constitute 95% of insular territory and the percentage of insular territory.

Such an indicator can distinguish different levels of insularity:

- the second part will be less than 100 for countries that are not island-states (partial insularity), but their index will increase if their insular land is dispersed over many islands
- all island-states (full insularity) will have a second part equal to 100, whereas the first part of the indicator will relate to the degree of dispersion of the total land on islands. In this way,

[15] Our calculations (graphs and tests) in paragraph 4 are not performed on the entire insularity sample because of incomplete information on GDP per capita. The sample for which we have both insularity and GDP data is composed of 201 countries. Because the countries with missing data are primarily island-states, the statistics that are applied to perform calculations for the most isolated island-states are different because they are derived from a reduced sample. See Appendix C for information on sample composition.

island-states will be distinguished by whether their land is concentrated or dispersed over several islands. In the second case, the indicator will assume larger values[16]

The table below shows the main summaries referring to the first part of the composite indicator, noting the differences between the entire sample (232 countries) or just the 84 island-states.

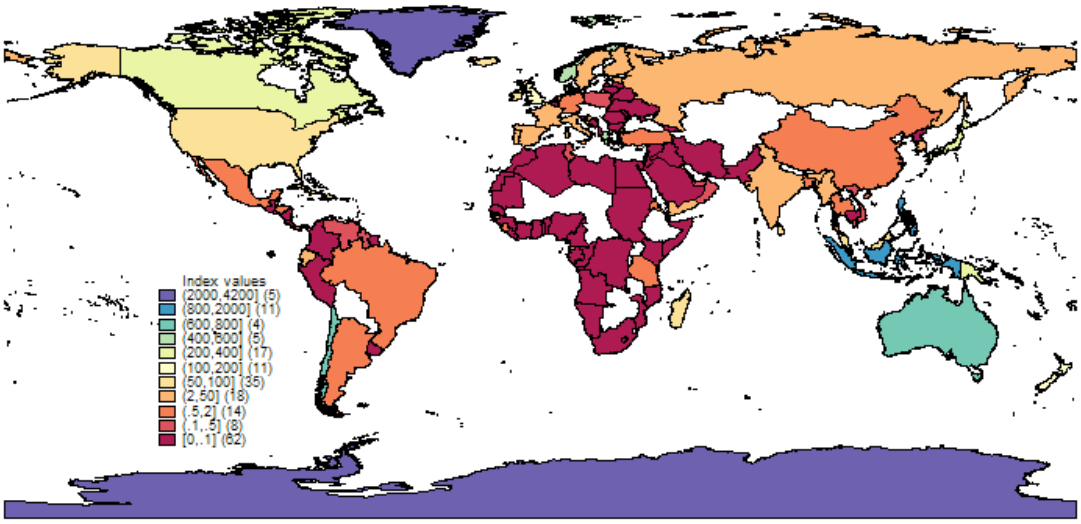
Table 3. Number of islands representing 95% of insular territory (summary statistics)

Statistic	All sample	Island-states
Mean	3.45	4.85
Min	0.00	1.00
Max	63.00	42.00
Median	1.00	2.00
25 percentile	0.00	1.00
75 percentile	3.00	4.00

Source: Own elaboration on our insularity data set

[16] As a further indicator, we can divide the composite for the size of the country, thus yielding a weight for the size.

Map 2. Composite indicator for non-landlocked countries



Source: Own elaboration on our insularity data set

4. Gdp and insularity

4.1 Box plot

The box plot, also known as a whiskers plot, is a non-parametric graphical method of displaying robust statistics on many important aspects of a distribution.[17] Box plots make it possible to compare data sets or distributions that refer to different groups, thus allowing us to

[17] The idea is to depict the variables using five numerical statistics: the smallest observation (MIN), the lower quartile (Q1), the median (Q2), the upper quartile (Q3) and the largest observation (MAX). The plot also shows the outliers. These five summaries are important for the proper interpretation of the box plot. The box contains 50% of the observations. The median is indicated by the line in the box; the upper edge (upper hinge) is the upper quartile and indicates 75% of the data set, and the lower edge is the lower quartile and indicates 25% of the distribution. The ends of the vertical lines are also called 'whiskers', and they show the minimum and maximum data values (unless outliers are present in which case the whiskers extend to a maximum of 1.5 times the inter-quartile range). The points outside of the ends of the whiskers are outliers or suspected outliers. Given these features, box plots display two common measures of the variability or spread in a data set: the total and interquartile range.

observe the major trends in the data set by portraying the scores for multiple groups next to one another.[18]

We apply the box plot analysis to study the GDP distribution across different conditions of insularity. We distinguish four groups of national states: landlocked, coastal countries (which do not have islands), countries with negligible insularity (those with less than a 2% share of land in islands), countries that have islands (partial insularity in which at least 2% of the total land is on islands; the maximum value in our group is 60% for Malaysia) and island-states. In the existing literature, the primary distinction is between landlocked and coastal countries; our aim is to distinguish within the group of coastal countries, according to their degree of insularity (none, negligible or partial) and to consider states that are islands separately. Graph 1 compares the levels of GDP per capita across the various groups; the table below reports the number of countries in each group during each time period according to data availability. The GDP data are obtained from the World Development Indicators (2012).

As noted in the literature, economic performance improves when we switch from landlocked countries (i.e., 0% level of insularity and no sea access) to coastal economies. Other facts are worth noting: (1) given the median within the heterogeneous group of coastal countries, economies that have islands perform better; (2) dispersion in income distribution is quite high across all groups except countries with partial insularity; and (3) there is a clear and evident time persistence in the shape of distributions.

The statistical significance of our descriptive evidence is tested by performing a two-sample Kolmogorov-Smirnov test.[19]

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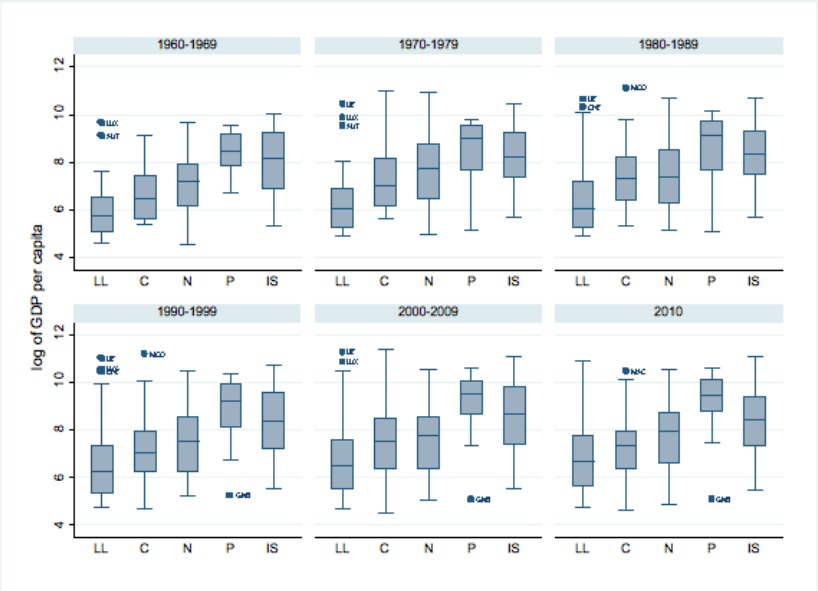
[18] In comparing the box plots across groups, one can simply conclude that the 'box' area for one group is higher or lower than that for another group. This comparison is analogous to stating that one group tends to have higher scores than another. To the extent that the boxes do not overlap, the groups are quite different from one another. We also conduct statistical tests in order to test whether distributions across groups show statistically significant differences.

[19] The test is non-parametric and by making no assumptions about the distribution of the data, we attempt to determine whether two compared groups differ significantly. The null hypothesis is that the two distributions belong to the same distribution; in other words, they are not significantly different. The alternative hypothesis is separated into two possibilities: the GDP (per capita) for Group 1 contain smaller values than for Group 2, or the reverse.

The results of the test applied to the distribution of per capita income confirm that the landlocked condition is the worst situation. Table 4, which reports test results on GDP per capita, shows that countries with a portion of their territory on islands perform better than other countries: the GDP level gradually decreases as insularity decreases. The ranking is P > IS > N > C > LL: when the insularity level increases, the GDP increases, but having only a portion of territory on an island is better than having 100% island territory.

Graph 1. Level of GDP per capita (LL=landlocked, C=coastal, N=negligible, P=partial and IS=island-state)



Source: Own elaboration on our insularity data set and on WDI (2012) Database

Period	LL	C	N	P	IS
1960-1969	18	23	32	12	22
1970-1979	20	28	34	13	36
1980-1989	31	33	43	15	46
1990-1999	36	37	50	17	53
2000-2009	36	38	50	17	54
2010	35	33	46	16	43

Table 4 Kolmogorov-Smirnov test on the level of GDP: comparing groups in the same decade

			1960 -1969	1970-1979	1980-1989	1990-1999	2000-2009	2010
LL	COMPARED TO	C	<	<	<	<	<	n.s.d.
LL		N	<	<	<	<	<	<
LL		P	<	<	<	<	<	<
LL		IS	<	<	<	<	<	<
C		N	n.s.d.	n.s.d.	n.s.d.	n.s.d.	n.s.d.	n.s.d.
C		P	<	<	<	<	<	<
C		IS	<	<	<	<	<	<
N		P	<	<	<	<	<	<
N		IS	<	n.s.d.	<	<	<	n.s.d.
P		IS	n.s.d.	n.s.d.	n.s.d.	n.s.d.	n.s.d.	>

where n.s.d.= not significantly different

Source: Own elaboration on our insularity data set and on WDI (2012) Database

Table 5 Kolmogorov-Smirnov test on the level of GDP: comparing the same group over the decades

			LL	C	N	P	IS
1960-1969	COMPARED TO	1970-1979	n.s.d.	n.s.d.	n.s.d.	n.s.d.	n.s.d.
1960-1969		1980-1989	n.s.d.	<	n.s.d.	n.s.d.	n.s.d.
1960-1969		1990-1999	n.s.d.	n.s.d.	n.s.d.	n.s.d.	n.s.d.
1960-1969		2000-2009	n.s.d.	<	n.s.d.	<	n.s.d.
1960-1969		2010	n.s.d.	n.s.d.	<	n.s.d.	n.s.d.
1970-1979		1980-1989	n.s.d.	n.s.d.	n.s.d.	n.s.d.	n.s.d.
1970-1979		1990-1999	n.s.d.	n.s.d.	n.s.d.	n.s.d.	n.s.d.
1970-1979		2000-2009	n.s.d.	n.s.d.	n.s.d.	n.s.d.	n.s.d.
1970-1979		2010	n.s.d.	n.s.d.	n.s.d.	n.s.d.	n.s.d.
1980-1989		1990-1999	n.s.d.	n.s.d.	n.s.d.	n.s.d.	n.s.d.
1980-1989		2000-2009	n.s.d.	n.s.d.	n.s.d.	n.s.d.	n.s.d.
1980-1989		2010	n.s.d.	n.s.d.	n.s.d.	n.s.d.	n.s.d.
1990-1999		2000-2009	n.s.d.	n.s.d.	n.s.d.	n.s.d.	n.s.d.
1990-1999		2010	n.s.d.	n.s.d.	n.s.d.	n.s.d.	n.s.d.
2000-2009		2010	n.s.d.	n.s.d.	n.s.d.	n.s.d.	n.s.d.

where n.s.d.= not significantly different

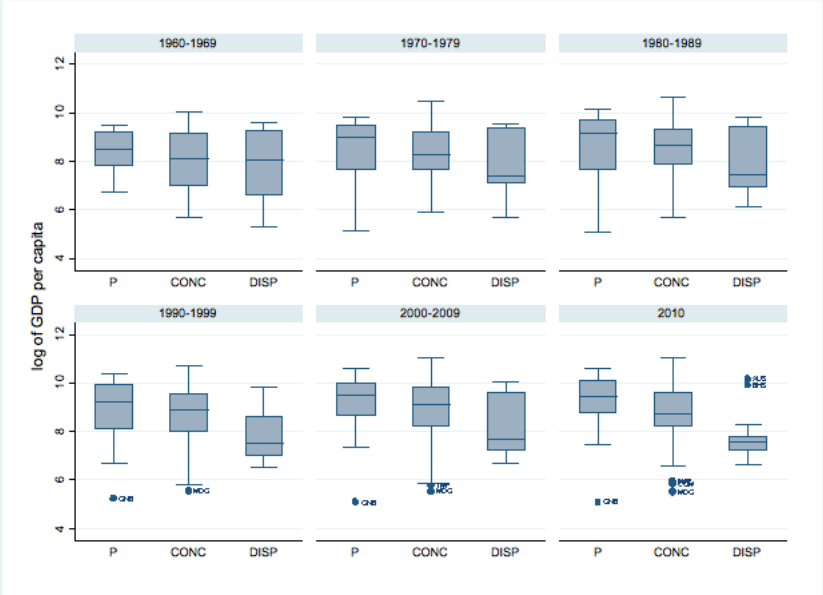
Source: Own elaboration on our insularity data set and on WDI (2012) Database

Therefore, we can verify whether group distributions were significantly different from one another (test across groups, Tables 4) and whether the same distribution has changed over the decades (test across periods, Tables 5). We indicate with the < and > signs whether the distribution of the group or of the time period in the left column is smaller or larger, respectively, than the distribution of the group on the right side; n.s.d. denotes that the distributions of the two groups or of the two time periods are not significantly different.

In the following graph, we compare the partial insularity of island-states using a definition related to the dispersion of the land.[20] We define an island-state as concentrated when the number of islands representing 95% of the insular territory is 5.65 islands or fewer, and we classify it as dispersed when its territory is composed of more than 5.65 islands. Having a land dispersed over more islands represents a disadvantage for the per capita GDP level. Furthermore, partial insularity is always a better status than being an island-state: overlooking the sea and having non-negligible islands represents an advantage and is associated with a better condition. The Kolmogorov-Smirnov tests across groups show that for the level of GDP, especially in the early decades, there are no statistically significant differences between a condition of partial insularity and a concentrated island-state. However, when we compare dispersed island states with partial and concentrated island-states, we observe that dispersed and fragmented territories perform worse (Table 6). Table 7 tests whether the distributions have changed over time.

[20] As previously noted, the statistics used here to calculate the more concentrated and more dispersed island-states consider the reduced samples (i.e., the countries for which we have both insularity and performance information). The results do not change if the threshold values used are those calculated for all sample and are presented in Table 3.

Graph 2. Levels of GDP per capita (P=partial, CONC=not dispersed island-states and DISP=dispersed island-states)



Source: Own elaboration on our insularity data set and on WDI (2012) Database

Period	P	CONC	DISP
1960-1969	12	16	6
1970-1979	13	27	9
1980-1989	15	33	13
1990-1999	17	37	16
2000-2009	17	37	17
2010	16	29	14

Table 6. Kolmogorov-Smirnov test on the level of GDP: comparing groups in the same decade

			1960 -1969	1970-1979	1980-1989	1990-1999	2000-2009	2010
P	COMPARED TO	CONC	n.s.d.	n.s.d.	n.s.d.	n.s.d.	n.s.d.	n.s.d.
P		DISP	n.s.d.	n.s.d.	>	>	>	>
CONC		DISP	n.s.d.	n.s.d.	>	>	>	>

where n.s.d.= not significantly different

Source: Own elaboration on our insularity data set and on WDI (2012) Database

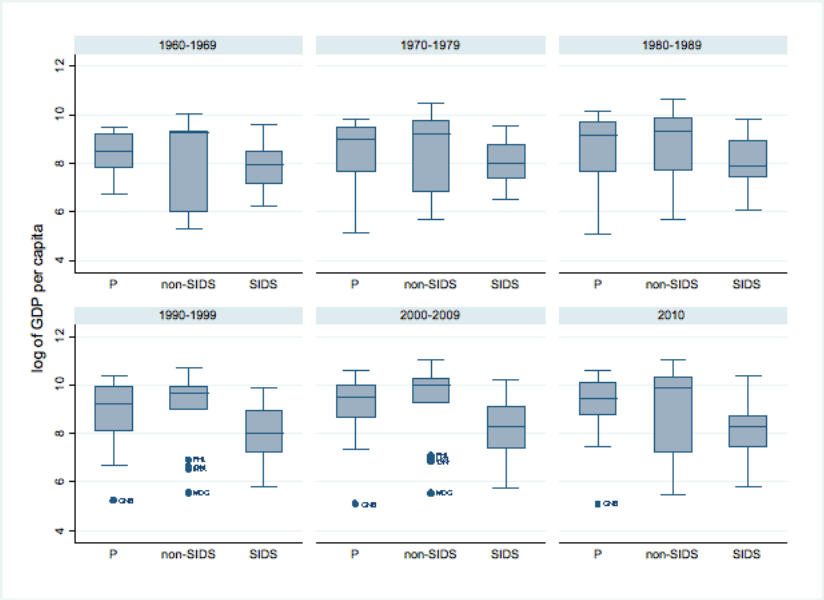
Table 7. Kolmogorov-Smirnov test on the level of GDP: comparing the same group across decades

			CONC	DISP
1960-1969	COMPARED TO	1970-1979	n.s.d.	n.s.d.
1960-1969		1980-1989	n.s.d.	n.s.d.
1960-1969		1990-1999	n.s.d.	n.s.d.
1960-1969		2000-2009	n.s.d.	n.s.d.
1960-1969		2010	n.s.d.	n.s.d.
1970-1979		1980-1989	n.s.d.	n.s.d.
1970-1979		1990-1999	n.s.d.	n.s.d.
1970-1979		2000-2009	n.s.d.	n.s.d.
1970-1979		2010	n.s.d.	n.s.d.
1980-1989		1990-1999	n.s.d.	n.s.d.
1980-1989		2000-2009	n.s.d.	n.s.d.
1980-1989		2010	n.s.d.	n.s.d.
1990-1999		2000-2009	n.s.d.	n.s.d.
1990-1999		2010	n.s.d.	n.s.d.
2000-2009		2010	n.s.d.	n.s.d.

where n.s.d.= not significantly different

Source: Own elaboration on our insularity data set and on WDI (2012) Database

Graph 3. Levels of GDP per capita (P=partial, SIDS=SIDS island-states and non_SIDS=non SIDS island-states)



Source: Own elaboration on our insularity data set and on WDI (2012) Database

Period	P	SIDS	non-SIDS
1960-1969	12	13	9
1970-1979	13	21	15
1980-1989	15	30	16
1990-1999	17	36	17
2000-2009	17	36	18
2010	16	31	12

Table 8. Kolmogorov-Smirnov test on the level of GDP: comparing groups in the same decade

			1960 -1969	1970-1979	1980-1989	1990-1999	2000-2009	2010
P	COMPARED TO	SIDS	n.s.d.	>	n.s.d.	>	>	>
P		non-SIDS	n.s.d.	n.s.d.	n.s.d.	n.s.d.	n.s.d.	n.s.d.
SIDS		non-SIDS	n.s.d.	<	<	<	<	<

where n.s.d.= not significantly different

Source: Own elaboration on our insularity data set and on WDI (2012) Database

Table 9. Kolmogorov-Smirnov test on the level of GDP: comparing the same group across decades

			SIDS	non-SIDS
1960-1969	COMPARED TO	1970-1979	n.s.d.	n.s.d.
1960-1969		1980-1989	n.s.d.	n.s.d.
1960-1969		1990-1999	n.s.d.	<
1960-1969		2000-2009	n.s.d.	<
1960-1969		2010	n.s.d.	n.s.d.
1970-1979		1980-1989	n.s.d.	n.s.d.
1970-1979		1990-1999	n.s.d.	n.s.d.
1970-1979		2000-2009	n.s.d.	<
1970-1979		2010	n.s.d.	n.s.d.
1980-1989		1990-1999	n.s.d.	n.s.d.
1980-1989		2000-2009	n.s.d.	n.s.d.
1980-1989		2010	n.s.d.	n.s.d.
1990-1999		2000-2009	n.s.d.	n.s.d.
1990-1999		2010	n.s.d.	n.s.d.
2000-2009		2010	n.s.d.	n.s.d.

where n.s.d.= not significantly different

Source: Own elaboration on our insularity data set and on WDI (2012) Database

In Graph 3, we distinguish between three different types of insularity: countries with partial insularity, SIDS island-states and other island-states. Not all SIDS are island-states; there are four countries that are not islands. SIDS countries are considered a separate group in the literature because of their peculiar condition.[21] It is no surprise (Graph 3) that the non-SIDS group has, on average, better performance than SIDS. With respect to the tests, we find that the GDP level distributions (Table 8) for countries with a condition of partial insularity and non-SIDS island-states are not significantly different, but both groups have a greater distribution than the SIDS island-states. In Tables 9, we compute the K-S test across periods: there are few statistically significant differences in GDP, but in those rare instances, the previous value is always smaller than the subsequent.

To gain more insight into extreme geographic conditions, we compare landlocked countries with more isolated islands; we use four different comparisons, depending on whether we consider GDP in levels or growth rates. In our reduced insularity-performance data sets, we define an island-state as more isolated when it has an isolation index higher than 69.96. These values identify the upper quartile of the isolation index distribution across island-states.[22] Because specific attention is given to landlocked countries in the literature, our question is whether the condition of remoteness of some island-states is analogous to landlocked status. As noted in the introduction, both the empirical and theoretical literature argues that the most immediate case of 'bad' geography is the lack of direct access to the sea – being landlocked. Our goal is to understand whether the performance of this sub-group of isolated island-states differs from that of landlocked countries.

Graph 4 (left-hand side) shows that, in terms of GDP level, being a landlocked country is even less advantageous than being an isolated

[21] SIDS must confront further challenges in addition to the island-state condition, such as sustainable development; a growing population; limited resources; remoteness; susceptibility to natural disasters; vulnerability to external shocks; excessive dependence on international trade; fragile environments; high communication; energy and transportation costs; irregular international transport volumes; and disproportionately expensive public administration and infrastructure (http://www.unohrlls.org/en/sids/43).

[22] Changing the threshold (using, for example, mean or median) does not change the results: such a change yields the same results reported in Graph 4.

island. The first row of Table 10 confirms that the landlocked group distribution is smaller than the other distribution. When we examine GDP growth (right-hand side of Graph 4) landlocked countries appear to grow more than island-states; the second row of Table 10 shows that the two distributions are not significantly different. In performing the test across periods, we find no statistically significant difference in the distributions for GDP (Table 11).

Table 10. Kolmogorov-Smirnov test on the level and growth of GDP: comparing groups in the same decade

				1960-1969	1970-1979	1980-1989	1990-1999	2000-2009	2010
level of GDP	**LL**	**COMPARED TO**	**IS_more**	<	<	<	<	<	<
growth of GDP				n.s.d.	n.s.d.	n.s.d.	n.s.d.	>	>

where n.s.d.= not significantly different

Source: Own elaboration on our insularity data set and on WDI (2012) Database

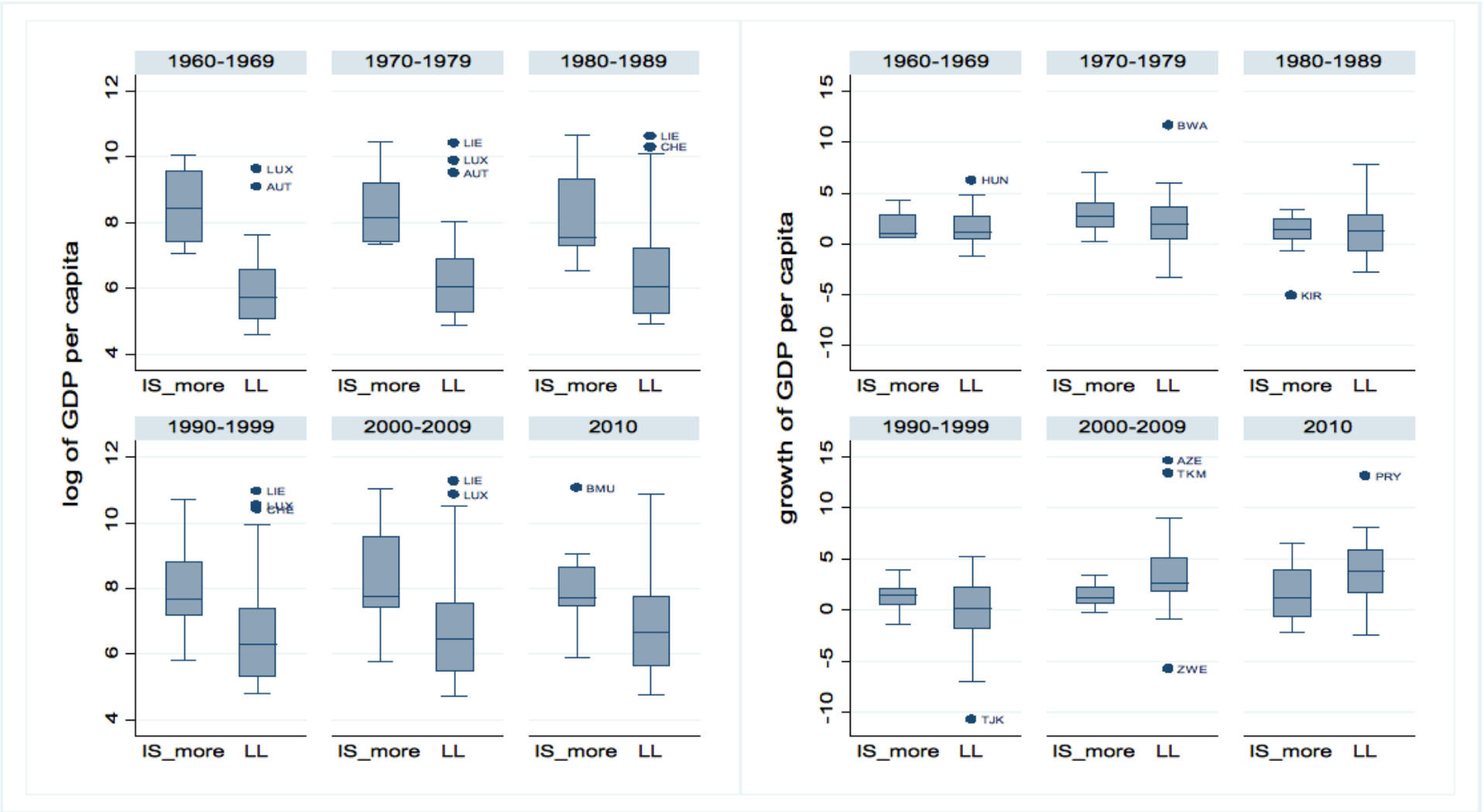
Table 11. Kolmogorov-Smirnov test on the level and growth of GDP: comparing the same group across decades

			level of GDP	growth of GDP
1960-1969	COMPARED TO	1970-1979	n.s.d.	n.s.d.
1960-1969		1980-1989	n.s.d.	n.s.d.
1960-1969		1990-1999	n.s.d.	n.s.d.
1960-1969		2000-2009	n.s.d.	n.s.d.
1960-1969		2010	n.s.d.	n.s.d.
1970-1979		1980-1989	n.s.d.	n.s.d.
1970-1979		1990-1999	n.s.d.	n.s.d.
1970-1979		2000-2009	n.s.d.	n.s.d.
1970-1979		2010	n.s.d.	n.s.d.
1980-1989		1990-1999	n.s.d.	n.s.d.
1980-1989		2000-2009	n.s.d.	n.s.d.
1980-1989		2010	n.s.d.	n.s.d.
1990-1999		2000-2009	n.s.d.	n.s.d.
1990-1999		2010	n.s.d.	n.s.d.
2000-2009		2010	n.s.d.	n.s.d.

where n.s.d.= not significantly different
Source: Own elaboration on our insularity data set and on WDI (2012) Database

Our evidence suggests that the condition of isolated island-states is similar to landlocked status: there are no substantial differences between a dispersed and isolated island-state and a country without access to the sea; both are conditions of bad geography, even if being a landlocked country is a more disadvantageous condition.

Graph 4 Level and growth of GDP per capita (IS_more=more isolated island-states and LL=landlocked)



Source: Own elaboration on our insularity data set and on WDI (2012) Database

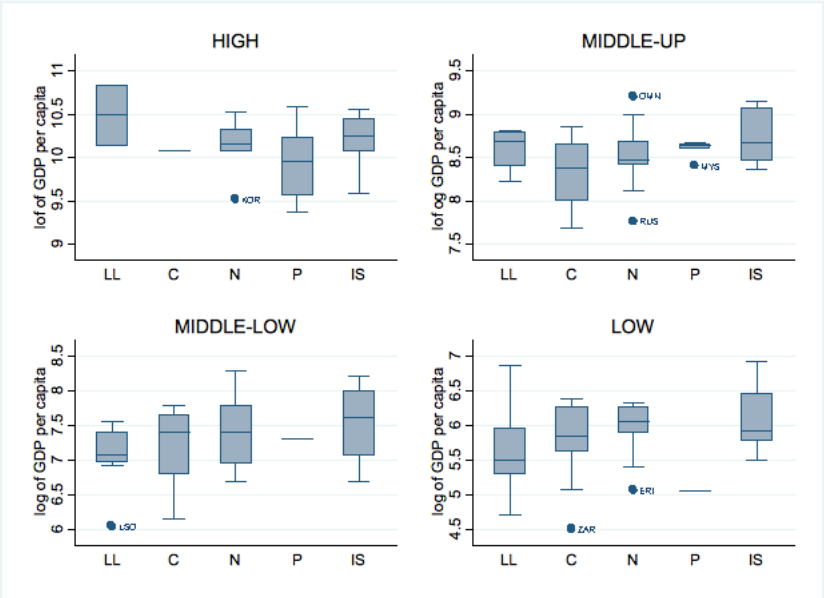
	LEVEL OF GDP PER CAPITA						GROWTH OF GDP PER CAPITA					
	1960-1969	1970-1979	1980-1989	1990-1999	2000-2009	2010	1960-1969	1970-1979	1980-1989	1990-1999	2000-2009	2010
LL	18	20	31	36	36	35	18	20	31	36	37	36
IS_more	4	7	11	14	15	12	4	8	12	13	14	12

4.2 Sensitivity analysis: sub-grouping by World Bank income category

The results illustrated above suggest a clear pattern in income and trade distributions across groups of countries distinguished by their geography linked to their insularity condition. The natural question is whether our grouping precisely captures grouping in income categories. We use the most recent World Bank income categories, which classify economies in the world as high income, upper-middle income, lower-middle income and low income.[1] Is bad geography still important when income begins to grow? Is geography relevant for countries with high income levels? As shown in the previous box plots, the outliers for landlocked countries are Switzerland and Liechtenstein.

[1] For operational and analytical purposes, the World Bank's criterion for classifying economies is gross national income (GNI) per capita. Based on its GNI per capita, every economy is classified as low income, middle income (subdivided into lower middle and upper middle) or high income (source: http://data.worldbank.org/about/country-classifications). Countries with a GNI per capita above $10,725 were classified as 'high income countries' in 2006. For 'low income countries' the threshold was under $876. Finally, if the GNI per capita were between $3,466 and $10,725 or between $876 and $3,465, then the country was classified as 'upper-middle income' and 'lower-middle income' respectively.

Graph 5. Level of GDP per capita, 2000-2009 (LL, C, N, P and IS)



Source: Own elaboration on our insularity data set and on WDI (2012) Database

Because the World Bank income categories refer (in our insularity data set) to 2006, we account for GDP in 2000-2009. As shown in Graph 5, geography loses importance at the high income levels: all groups have mean values that are close to one another. Unfortunately, the groups do not have the same number of observations. By contrast, when we examine low income countries, geography is relevant to performance.

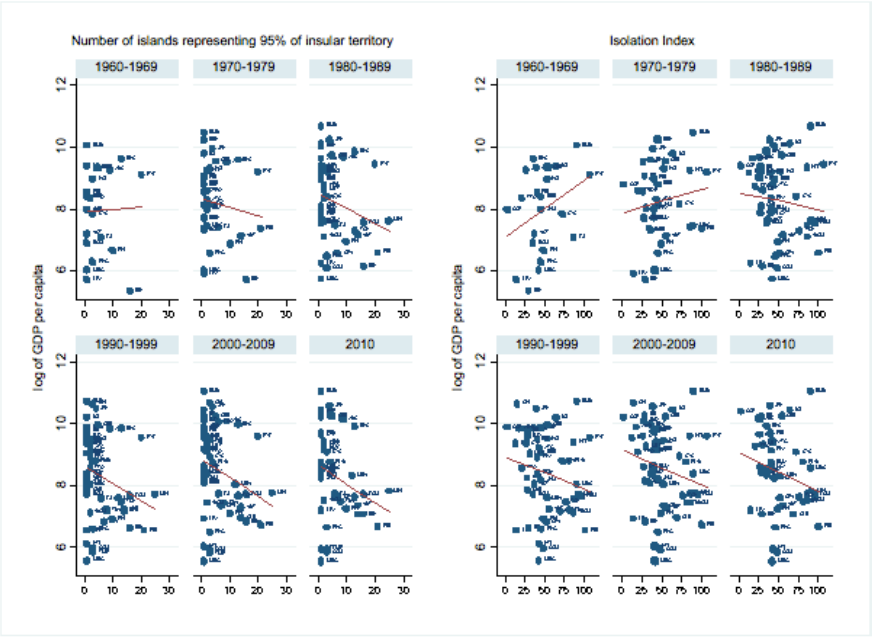
4.3 What is relevant in the full insularity condition?

What is the crucial issue with insularity? We provide evidence that the economic performance of islands differs; clearly some islands perform better than others. Previous descriptions suggest that being an island-state is less advantageous than being a country with islands. To identify the heterogeneity across insular states, we used the definitions in the existing literature (SIDS) and we attempted to isolate characteristics that exacerbate the insular state. If being surrounded by the sea implies a higher cost for smaller economies, then having land dispersed over many islands should be associated with higher costs. If the cost of being insular is linked to the level of remoteness, then a measure of isolation should

work better.

The following scatter graphs combine both measures with GDP per capita. Simple correlations, as in Graph 6, would indicate that both aspects are negatively correlated with income per capita. The situation has also changed over time; in the early years, the chosen characteristics linked to insularity were associated with better performance, but they began to have a negative effect over time. Furthermore, there were missing data for the early decades. A clear negative correlation is not evident when a simple measure of size (such as land area) is used.[24]

Graph 6. Level of GDP per capita, dispersion measure and isolation index (island-states)



Source: Own elaboration on our insularity data set and on WDI (2012) Database

[24] When we examine GDP growth the negative effect is confirmed: insularity conditions inhibit countries growth in all decades. When we distinguish island-states into archipelagos and SIDS, the results for island-states are confirmed: the effects of insularity have changed over the years and have tended to become negative with respect to performance. See Appendix D.

5. Conclusions

There is an evident case of bad geography for countries that have no direct access to the sea. This paper provides novel evidence on the measures of insularity and the manner in which they are related to primary economic performance indicators. Beginning with the basic information on the number of islands and the percentage of land on an island, we constructed different measures aimed at capturing the heterogeneity of the insular condition. If the complete discontinuity of the land imposes a cost (limiting the connectivity with other countries), then an increase in the number of islands increases costs. A second dimension that increases costs is distance. Therefore, we considered the dispersion of the land in more than one island and a measure of their remoteness with respect to either the nearest mainland or other islands. These two dimensions can be used to rank countries according to their degree of insularity. In combining these two dimensions, the world appears to be divided into three groups of countries: fully insular (island-states), partially insular and non-insular countries.

The first critical dichotomy is between countries (as national states) that are islands and countries that have islands. In the first case, the islands are countries themselves; in the second case, the islands are regions (or smaller territorial units) belonging to countries. Within the group of island-states, we focus on the critical dimension of the insularity condition. According to the literature, three dimensions constitute the economic fragility associated with the insular condition: smallness, remoteness and vulnerability. In this work, we examined the dispersion of territory (which is connected to size: more dispersed territory in many islands is associated with smaller average size) and remoteness with respect to the nearest land (isolation). Our results suggest that isolation is the critical factor. The performance of more isolated island-states is similar to that of landlocked countries.

Countries that have islands (but are not islands) constitute a small sub-group of world economies. Their limited number is outweighed by a larger share in terms of income. When we examine the distribution of income within this small number of countries, it is clear that they perform better within the wide group of coastal countries. Our initial results suggest that this smaller sample of economies bolsters the fortunes of coastal countries. These countries perform better than countries with null or negligible degrees of insularity.

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Appendix A: Sources of data and insularity data set creation

To build our insularity data set, we primarily used two sources of data: World Island Info and UNEP.

World Island Info is more detailed in terms of the number of countries and surfaces (area in square km) of each island.

UNEP, while providing information on a smaller number of nations and a lower accuracy level with respect to the area of smaller islands (the data are often absent), is more detailed in terms of the number of islands for each nation and reports the isolation index for 552 islands, along with the shoreline and the coastal indices for most of the islands. Furthermore, inhabitant information (although not updated) for each island is also provided.

The World Island Info website (http://www.worldislandinfo.com/) aims to provide the most accurate information on the world's islands. Thousands of maps, reference works, books, web sites and articles are available. As sources routinely contradict one another, they judge their accuracy based on the following weights:

1. Detailed topographic maps, photos and visits
2. Official mapping and statistical agencies
3. High-credibility reference sources (e.g., Encyclopedia Britannica) and scientific articles
4. Journalism and high-quality travel references (e.g., Moon and Lonely Planet)
5. Popular books and television
6. Informal Internet sources and interviews

The website provides various sources of information on 475 islands (including river and lake islands) in 187 countries (including countries under the administration of larger countries), divided into different sections, such as the following:

- Principal world islands and groups (not distinguished by country)
- The 100 largest islands in the world and the largest islands by continent
- A list of the main island for each country (with the name and area in square kilometers or square miles); this list includes only one island (the largest and most important) for each country
- A focus for selected countries (Australia, Canada, Chile, Indonesia, New Zealand, Russia, the United Kingdom and the

United States). The focus lists the most important islands for each country mentioned above

The UNEP source belongs to the website http://islands.unep.ch/. It is a compilation of geographic, environmental and socio-economic information on almost 2,000 islands in approximately 150 countries, territories and administrative units, with islands developed by UNEP. The island coverage is uneven: some regions and groups are covered in detail, whereas others are characterized by a deficiency in available data. This website provides various sources of data and information on islands by country, including the following:

- Name of islands
- Island area
- Isolation index
- Coastal index
- Threat index
- Risk of sea level rise

The data and information are organized into several sections, including islands by country, alphabetical indices of islands, islands by land area, islands by altitude and islands by ocean.

The isolation, coastal and threat indices provide useful information on islands, ranking them according to specific geographical features.

The isolation index is defined as the square root of the distances to the nearest equivalent or larger island the nearest island group or archipelago, and the nearest continent. When information on one of these does not exist, the next higher distance is repeated, except in the case of small satellite islands that are close to much larger land masses (source: http://islands.unep.ch/indicat.htm#Isolation).

The coastal index is the length of the shoreline divided by the land area. Such information is available for a smaller number of islands (source: http://islands.unep.ch/indicat.htm#Coastal Index). We did not use this index.

The threat index is the measure of the risk of natural or human catastrophes that could threaten human welfare, seriously damage the economy or endanger endemic species or protected areas, thus increasing the importance of adequate conservation action (scale: 0 to 6). One point is given for each of the major categories of large-scale catastrophic threats to the island environment: cyclones (hurricanes or typhoons), volcanic eruptions, earthquakes, tsunamis (tidal waves), landslides, severe drought, susceptibility to major fires and high risk of

oil spills (source: http://islands.unep.ch/indicat.htm#Vulnerability). We did not use this index.
We used limited amounts of information from the World Atlas. The website http://www.worldatlas.com provides various geographical information and data pertaining to islands. All maps, graphics, flags, photos and original descriptions are copyrighted by and created by Graphic Maps, d/b/a the Woolwine-Moen Group, unless otherwise noted and/or directly linked to the source. Certain statistical data are gathered from numerous public domain reference materials, and every effort is made to be as accurate as possible when disseminating information on any worldwide destination or subject.

Because the aim of this work was to determine how first nature geography is correlated to economic outcomes, we proceeded as follows. First, we collected insularity information from our two main sources. Because information on performance is not available at an island level, we aggregated all insularity information and data at the country level, creating and organizing a new data set by country. The dataset included the following information:

- Country land area (Source: WDI)
- Number of islands (Source: own elaboration on World Island Info and UNEP data)
- Total island area (Source: own elaboration on World Island Info and UNEP data)
- Percentage of country area represented by islands (Source: own elaboration on World Island Info and UNEP data)
- Number of islands representing 95% of the insular territory (Source: own elaboration on World Island Info and UNEP data)
- Compositional index: number of islands representing 95% of the insular territory * percentage of the insular territory (Source: own elaboration on World Island Info and UNEP data)
- Dummy island-state: 1 if a country is an island-state (Source: own elaboration)
- Dummy archipelago: 1 if a country is an archipelago (Source: own elaboration)
- Dummy partial island-state: 1 if an island-state shares its island territory with another country (Source: own elaboration)
- Dummy SIDS: 1 if a country is a SIDS (Source: own elaboration)

- Dummy partial insularity: 1 if a country has a percentage of insular territory higher than or equal to 2 and less than 100% (Source: own elaboration)
- Dummy coastal: 1 if a country overlooks the sea but has no islands (Source: own elaboration)
- Dummy negligible: 1 if a country has negligible islands (Source: own elaboration)
- Unweighted isolation index (Source: own elaboration on UNEP data)
- Weighted isolation index: isolation index weighted on the island area (Source: own elaboration on UNEP data)
- Unweighted coastal index (Source: own elaboration on UNEP data)
- Weighted coastal index: coastal index weighted on the island area (Source: own elaboration on UNEP data)

We verified the countries that were and were not included in the GDP data (WDI, 2012); based on the results of this step, we aggregated countries to include as many countries as possible.

The insularity data set is composed of 156 countries (19 included only in World Island Info, 5 included only in UNEP and 132 belonging to both). All 156 countries had observations that were useful for our purpose of insularity information.

We then merged the insularity data set with the geographical Sedac-PLACEII data set composed of 228 observations (countries), including 76 variables concerning morphological land characteristics along several dimensions (elevation, climate zone, biome class and distance from coast). We constructed and obtained a single insular-geographical data set composed of 232 countries (11 with only insular information, 76 with only geographical information and 145 with both insular and geographical information). We used then information from World Atlas to assign to countries (76) with only geographical information the insular information (all variables listed above).

Finally, we merged the insular-geographical data set (232 observations) with a per capita GDP data set, obtaining a data set of 201 countries. It is important to note that information on the GDP per capita does not exist for 31 countries.

The 31 countries for which the information on GDP does not exist are the following: American Samoa, Anguilla, Antarctica, Bouvet Island, British Indian Ocean Territory, the British Virgin Islands, Christmas

Island, the Cocos (Keeling) Islands, the Cook Islands, the Falkland Islands, French Southern Territories, Gibraltar, Guam, the Heard and McDonald Islands, the Democratic People's Republic of Korea, Montserrat, Nauru, the Netherlands Antilles, Niue, Norfolk Island, the Northern Mariana Islands, Occupied Palestinian Territory, Pitcairn, Serbia and Montenegro, the South Georgia and South Sandwich Islands, Saint Helena, Saint Pierre and Miquelon, Tokelau, the Turks and Caicos Islands, the U.S. Miscellaneous Pacific Islands, Wallis and Futuna.

The 201 observations in the GDP-insular data set can be divided as follows: 57 island-states, 17 countries with partial insularity, 90 coastal countries (38 with zero insularity and 52 with negligible insularity) and 37 landlocked countries. It is important to note that two landlocked countries (Turkmenistan and Ethiopia) have islands.

Appendix B: Assumptions and techniques concerning some countries

In collecting data on islands, our purpose was to create a data set with as many countries as possible and to include countries for which we had GDP information; in other words, our aim was to assure that WDI data matched the insular-geographical data.

To avoid excluding observations from our data set, we aggregated some countries into larger countries or into groupings for which we had trade data.

China includes:

- Taiwan

Denmark includes:

- Faeroe Islands

France includes:

- France
- French Guiana
- Guadeloupe
- Martinique
- Mayotte
- Reunion

Norway includes:

- Svalbard and Jan Mayen Islands

The UK includes:

- UK
- Isle of Man
- Channel Islands
- British Virgin Islands

The U.S. includes:

- U.S.
- Puerto Rico
- U.S. Virgin Islands

- Wake Island

Give the availability of GDP data we have also considered Puerto Rico, the U.S. Virgin Islands, the Isle of Man, the Channel Islands and the Faeroe Islands as separate countries.

For the U.S., the information about GDP exists for the aggregation that includes the U.S. + Puerto Rico + U.S. Virgin Islands.

For France, the information about GDP exists for the aggregation that includes France + DOM + TOM.

Appendix C: The composition of the insular-GDP data set

As explained in Appendix A, the insular-GDP data set is composed of 201 countries. To distinguish countries based on insular-geographical features, we used different dummies to separate countries into five main groups: island-states, countries with partial insularity, coastal countries, countries with negligible insularity and landlocked countries. Within the group of island-states, we distinguished archipelagos, SIDS and states that share their island-state with another country.

The insular-GDP data set is composed of the following:

- **57 island-states** (Antigua and Barbuda, Aruba, Australia, the Bahamas, Bahrain, Barbados, Bermuda, Brunei Darussalam, Cape Verde, the Cayman Islands, the Channel Islands, Comoros, Cuba, Cyprus, Dominica, the Dominican Republic, East Timor, the Faeroe Islands, Fiji, French Polynesia, Greenland, Grenada, Haiti, Iceland, Indonesia, Ireland, the Isle of Man, Jamaica, Japan, Kiribati, Madagascar, the Maldives, Malta, the Marshall Islands, Mauritius, Micronesia, New Caledonia, New Zealand, Palau, Papua New Guinea, Philippines, Puerto Rico, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Samoa, Sao Tome and Principe, the Seychelles, Singapore, the Solomon Islands, Sri Lanka, Tonga, Trinidad and Tobago, Tuvalu, the United Kingdom, Vanuatu, the Virgin Islands (U.S.))
- **17 partial** (Canada, Chile, Croatia, Denmark, Ecuador, Equatorial Guinea, Estonia, France +DOM + TOM, Greece, Guinea-Bissau, Hong Kong, Italy, Kuwait, Malaysia, Norway, Svalbard and Jan Mayen, Portugal, Spain)
- **38 coastal** (Algeria, Andorra, Belarus, Belgium-Luxembourg, Benin, Bosnia and Herzegovina, Bulgaria, Cameroon, Congo, the Congo Democratic Republic, Cote d'Ivoire, Gabon, Gambia, Georgia, Ghana, Iraq, Israel, Jordan, Latvia, Liberia, Macau, Moldova, Monaco, Morocco, Namibia, Nicaragua, Nigeria, Pakistan, Peru, Qatar, Romania, San Marino, Senegal, Slovenia, Suriname, Syria, Togo, Uruguay)
- **52 negligible** (Albania, Angola, Argentina, Bangladesh, Belize, Brazil, Cambodia, China, Colombia, Costa Rica, Djibouti, Egypt, El Salvador, Eritrea, Finland, Germany, Guatemala, Guinea, Guyana, Honduras, India, Iran, Kenya, the Republic of Korea, Lebanon, Libya, Lithuania, Mauritania, Mexico, Mozambique,

Myanmar, the Netherlands, Oman, Panama, Poland, the Russian Federation, Saudi Arabia, Sierra Leone, Somalia, the Southern African Customs Union, Sudan, Sweden, Tanzania, Thailand, Tunisia, Turkey, Ukraine, the United Arab Emirates, USA + Puerto Rico + US Virgin Islands, Venezuela, Vietnam, Yemen)

- **37 landlocked** (Afghanistan, Armenia, Austria, Azerbaijan, Bhutan, Bolivia, Botswana, Burkina Faso, Burundi, the Central African Republic, Chad, the Czech Republic, Ethiopia, Hungary, Kazakhstan, Kyrgyzstan, the Laos People's Democratic Republic, Lesotho, Liechtenstein, Luxembourg, Macedonia, Malawi, Mali, Mongolia, Nepal, Niger, Paraguay, Rwanda, Slovakia, Swaziland, Switzerland, Tajikistan, Turkmenistan, Uganda, Uzbekistan, Zambia, Zimbabwe)

Within the island-states group, we count the following:

- **32 archipelagos** (the Bahamas, Bermuda, Cape Verde, the Cayman Islands, the Channel Islands, Comoros, Cuba, the Faeroe Islands, Fiji, French Polynesia, Indonesia, Japan, Kiribati, the Maldives, Malta, the Marshall Islands, Micronesia, New Caledonia, New Zealand, Palau, the Philippines, Puerto Rico, Saint Kitts and Nevis, Saint Vincent and the Grenadines, Samoa, Sao Tome and Principe, the Seychelles, the Solomon Islands, Tonga, Tuvalu, Vanuatu, the Virgin Islands (U.S.)
- **38 SIDS** (Antigua and Barbuda, Aruba, the Bahamas, Bahrain, Barbados, Cape Verde, Comoros, Cuba, Dominica, the Dominican Republic, East-Timor, Fiji, French Polynesia, Grenada, Haiti, Jamaica, Kiribati, the Maldives, the Marshall Islands, Mauritius, Micronesia, New Caledonia, Palau, Papua New Guinea, Puerto Rico, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Samoa, Sao Tome and Principe, the Seychelles, Singapore, the Solomon Islands, Tonga, Trinidad and Tobago, Tuvalu, Vanuatu, the Virgin Islands (U.S.)
- **10 partial island-states** (Brunei Darussalam, Cyprus, the Dominican Republic, East Timor, Haiti, Indonesia, Ireland, Papua New Guinea, Malaysia, the United Kingdom)

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