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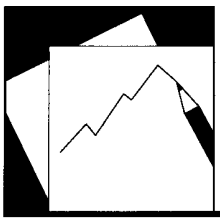

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Small Island States in the Pacific: the Tyranny of Distance?

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Small Island States in the Pacific: the Tyranny of Distance?

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Abstract

This paper seeks to document key characteristics of small island states in the Pacific. It restricts itself to a limited number of indicators which are macro-orientated – population, fertility of land, ability to tap into economies of scale, income, and geographic isolation. It leaves aside equally important but more micro-orientated variables and development indicators. We show that small island states in the Pacific are different from countries in other regional groupings in that they are extremely isolated and have limited scope to tap economies of scale due to small populations. They often have little arable land. There is empirical evidence to suggest that these factors are related to income growth.

JEL Classification Numbers: I32, O11, O18, O40, O56, O57

Keywords: Small states, microstate, economies of scale, geographic isolation

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I. INTRODUCTION

The purpose of this paper is to consider features of small island states in the Asia-Pacific region and to document some of the key characteristics that set them apart from small states in other regions. The paper restricts itself to a limited number of general indicators which are largely macro-orientated. In particular, it considers population size, income per capita, the fertility of land, and ability to tap into economies of scale. It also makes an attempt to capture the degree of geographic isolation confronted by some countries. As a result, we leave aside equally important but more micro-orientated variables (such as telecommunications or electricity generation) as well as development indicators (such as literacy or infant mortality rates). We show that small island states in the Pacific are typically different from countries in other regional groupings in that they are extremely geographically isolated and have limited scope to tap into economies of scale due to small populations. The degree of smallness can complicate the interpretation of income per capita, and the lack of fertile land constrains the opportunities to diversify food sources away from imports for some countries. The cursory empirical evidence presented appears consistent with our prior that most of these factors are important determinants of economic outcomes in small states.

Small states in other parts of the world have their own characteristics that lead to somewhat different set of factors that might be associated with vulnerability to shocks. These may or may not have been taken into consideration in the work presented below, which employs a far less than exhaustive set of potential indicators. So while the scope of this paper is purposely limited to the countries of principal interest for this study, it may provide a basis for more comprehensive future research.

The remainder of the paper is organized in the following manner. Sections II to VI discuss a number of key macro-related variables in the context of small states. These cover the definition of small states in terms of population size, constraints in the ability to take advantage of economies of scale, income per capita as a measure of poverty, the relationship between land fertility and import replacement through agriculture, and perhaps most importantly, the degree of geographic isolation. Section VII summarizes these indicators by means of a simple and transparent ranking. This section also makes an attempt to relate the ranking to actual economic outcomes. Finally, some concluding remarks are offered in Section VIII.

II. DEFINING SMALL STATES BY POPULATION

There is no universally accepted definition of what makes a country small. Relevant metrics include population, size of the land or territory (including maritime zones), and Gross National Income (GNI).[2] However, since population is usually correlated with other variables

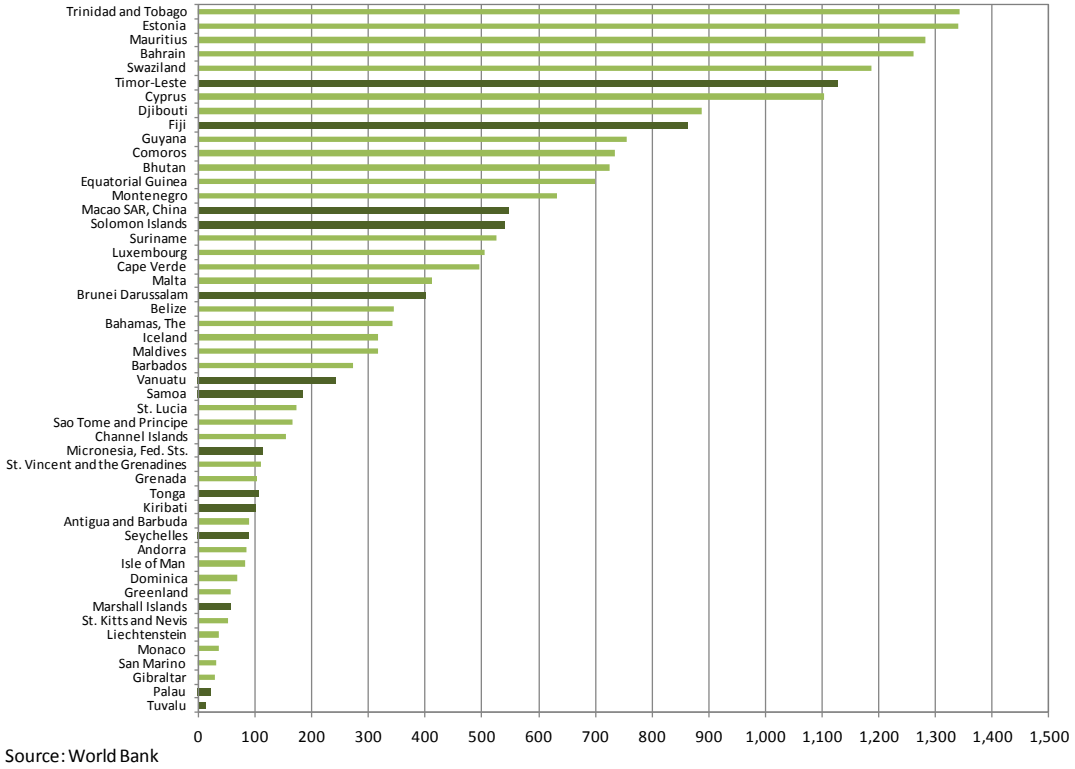
[2] Given the importance of remittances and transfer payments as sources of income in many of these countries, GNI is generally accepted as a more appropriate measure than the value added measured by Gross Domestic Product. See also Appendix I for metadata.

like GNI in most countries, the number of residents is often used as the measure that defines smallness. The World Bank defines a small state as one with a population of less than 1½ million people (World Bank, 2007), but also notes that no definition, whether it be population, geographic size, or income, is likely to be fully satisfactory. In practice, any threshold used has an arbitrary element and larger states that lie outside this definition will share some of the characteristics or vulnerabilities of smaller countries.

Using World Bank data, we are able to derive a consistent data set for a preliminary analysis of a sample of 50 small states (refer also to Appendix I).[3] The smallest of these is Tuvalu in the Asia-Pacific region with a population of only around 10,000 people. The largest is Trinidad and Tobago in the Caribbean with around 1.3 million people. In Figure 1 these 50 countries are ranked by population. Those in the Asia-Pacific region, which are the subject of this paper, are highlighted in a darker color.

Figure 1: Small States - Population

States with population less than 1.5 million, thousands of persons



Source: World Bank

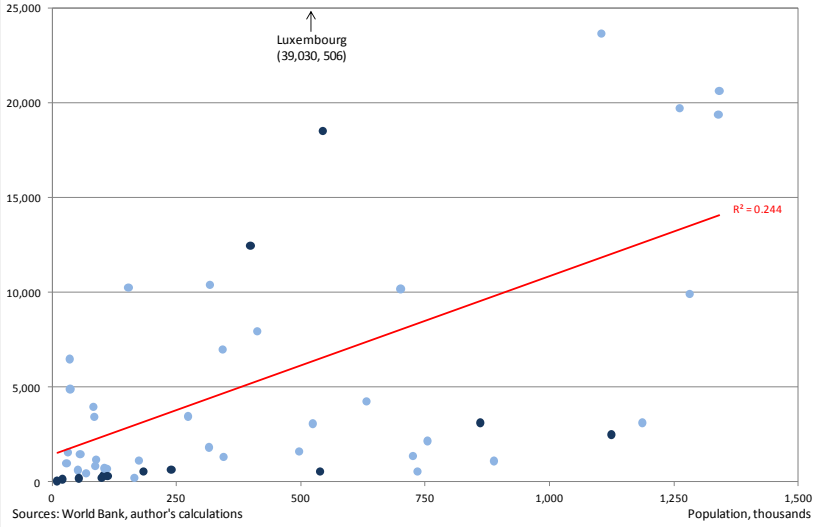
[3] Fifteen countries in the raw World Bank database were excluded from the initial sample of 65 on the basis that comparable data for other variables of interest, mainly GNI, were not available. This included American Samoa, Aruba, Bermuda, Cayman Islands, Curacao, Faeroe Islands, French Polynesia, Guam, Mayotte, New Caledonia, Northern Mariana Islands, Sint Maarten (Dutch part), St. Martin (French part), Turks and Caicos Islands, and Virgin Islands (U.S.).

Of the 10 smallest states listed, four are in Europe and Central Asia, three are small island states in the Pacific (Tuvalu, Palau, Marshall Islands), two are in Latin America and the Caribbean, while Greenland represents an outlier not easily classified to any region. The difficulty of defining aspects of smallness is usefully illustrated by examining these extremely small countries (sometimes referred to as microstates). While the number of people residing in each country is indisputably small, they can be quite heterogeneous in terms of other economic indicators that make differentiation between small states important. For example, while the population of Monaco is around three times larger than that of Tuvalu, GNI per capita is almost 40 times larger. Indeed, of the 10 smallest countries in this sample, only Dominica is considered to be eligible under the income criteria for both concessional borrowing from the International Development Association (IDA) and also currently qualifies for the International Monetary Fund's Poverty Reduction and Growth Trust (PRGT).[4] Extremely small populations are therefore not always systematically related to income, but in some cases raise a number of other relevant idiosyncratic considerations.

III. Lacking Economies of Scale

Generally speaking, the relationship between population and total income appears to be positive. This is not surprising given that labor is a major input into the production process and a larger workforce can produce a greater number of goods and services, for higher total income. Figure 2 shows this relationship for the small state sample and plots a simple trend line, which admittedly has only weak explanatory power. The Asia-Pacific region is again highlighted by a darker color.

Figure 2: Relationship between Population and GNI



[4] Under the IDA framework the exceptional circumstances of the Marshall Islands and Tuvalu are recognized by an exemption for the income per capita threshold that allows them access to IDA loans. The IMF currently does not make such exemptions for the PRGT. Refer to IDA (2001), IMF (2009), and IMF (2012).

Since population is only one of many factors that determine income, the distribution of countries around the trend is relatively wide. Indeed, there appears to be a tendency to deviate further as population increases. Several outliers to the relationship are notable, with Luxembourg generating the largest GNI despite a relatively small population.[5] There is a confluence of attributes that makes some countries able to overcome the barriers of having a small resident workforce. In the case of Luxembourg, specialization in the provision of high value added financial services is possible due to a number of unique features, including very close proximity to highly skilled labor markets and infrastructure in neighboring countries, notably Germany and France. A significant share of the people employed in Luxembourg does not reside in the country itself, but instead commute daily from neighboring towns across the national border. Similarly, centers for trade and commerce like Macau are able to generate higher income than countries of similar size with less of this type of economic activity. The key feature of such trade hubs tends to be strategic location on major trade and shipping routes which act as gateways to major markets.

The small island states in the Pacific tend to lack the attributes enjoyed by financial centers and trade hubs. They are typically considerable distances away from the major labor markets that are better equipped to supply a more skilled workforce, like Australia and New Zealand (see also Section VI on Geographic Isolation). Geography also precludes sharing of infrastructure with more developed neighbors. Indeed, basic infrastructure may need to be duplicated if populations are dispersed, as they are in countries comprising groups of islands. Furthermore, they are usually not en route of the major shipping lanes which connect major producers with markets and are therefore unlikely candidates for establishing trade hubs. Nonetheless, there are certain types of financial services which are less closely linked to geographic location, such as business registrations or incorporations and registration of international cargo ships, which small Pacific islands are not precluded from pursuing.

A. Fixed costs spread over narrow base

One implication of small population is that total income, and therefore the tax base, might be so small that the fixed costs associated with the provision of public goods and services have to be spread across a very narrow base. As a result, fixed costs may represent an unusually high share of national income. One consequence might be that there is insufficient tax revenue to secure the public provision of basic health services, transportation, or government administration. These constraints often result in small administrations that lack the capacity to function efficiently. The degree to which this is an issue varies between countries.

This is an argument related to economies of scale in that the provision of public goods and services might not be possible at the quantity necessary to minimize the average cost, and thereby gives rise to inefficient outcomes that are most difficult to overcome in extremely small countries. Another relevant consideration might be the expense incurred in building infrastructure resilient to frequent natural disasters and adverse weather conditions.

[5] For a more detailed discussion of the economic factors that allow countries such as Luxembourg and Liechtenstein to overcome the disadvantages of their smallness, see Martins and Winters (2004).

Table 1: Percentage Deviation from Small State Median Income

Median GNI of small state sample was US$1,719 million, 2010. Countries ordered by population as in Figure 1.

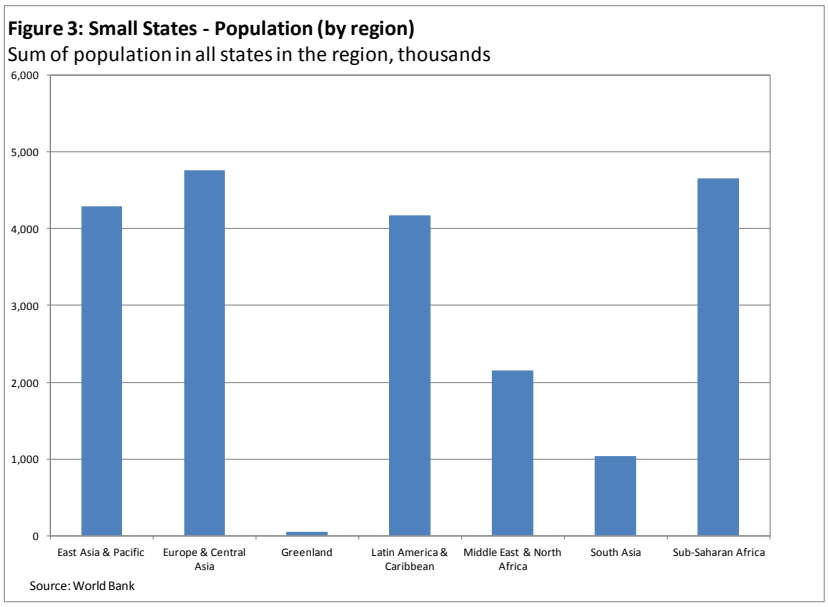
Country	Per cent below	Per cent Above
Tuvalu	-97.3	
Palau	-92.2	
Gibraltar	-43.6	
San Marino	-8.5	
Monaco		276.9
Liechtenstein		185.3
St. Kitts and Nevis	-64.2	
Marshall Islands	-88.6	
Greenland	-14.7	
Dominica	-73.3	
Isle of Man		131.1
Andorra		100.6
Seychelles	-50.8	
Antigua and Barbuda	-32.0	
Kiribati	-88.4	
Tonga	-80.1	
Grenada	-57.9	
St. Vincent and the Grenadines	-60.0	
Micronesia, Fed. Sts.	-82.3	
Channel Islands		495.8
Sao Tome and Principe	-88.4	
St. Lucia	-33.6	
Samoa	-68.1	
Vanuatu	-63.1	
Barbados		100.9
Maldives		5.8
Iceland		503.9
Bahamas, The		305.7
Belize	-23.6	
Brunei Darussalam		624.9
Malta		363.0
Cape Verde	-5.8	
Luxembourg		2,170.6
Suriname		79.0
Solomon Islands	-67.9	
Macao SAR, China		977.9
Montenegro		147.8
Equatorial Guinea		492.3
Bhutan	-20.8	
Comoros	-68.0	
Guyana		25.9
Fiji		81.7
Djibouti	-35.7	
Cyprus		1,276.2
Timor-Leste		45.0
Swaziland		81.5
Bahrain		1,046.9
Mauritius		477.4
Estonia		1,026.9
Trinidad and Tobago		1,099.9

Sources: World Bank, author's calculations

One simple way to make an assessment about the opportunity available to reap economies of scale is to calculate the percentage deviation of each country's GNI from the median of the small state sample.[6] It allows calibration of which states are the smallest and therefore the most likely to be lacking in the ability to exhaust economies of scale. The calculations are shown in Table 1. While very small states like Tuvalu and Palau are more than 90 percent smaller than the sample median, others are considerably better placed. It is notable that of the small countries in the Pacific, almost all are so small that scope to access economies of scale could be a significant issue. Only Timor-Leste, Macau, and Fiji were larger than the median income of US$1.7 billion in 2010.

B. Scope for regional cooperation

Notwithstanding the country-specific constraints on accessing economies of scale, there may however be scope to improve the position of small states through regional cooperation (see also Hausmann, 2001). A number of small states could come together to form a larger common market for goods and service, or share access to certain types of infrastructure. Figure 3 sums the population of all countries in each region to derive a regional aggregate as an indication of the potential for cooperation.



In terms of the scope for cooperation in building scale based on the aggregate number of people in each region, Pacific islands do not appear to be at a disadvantage relative to other regions. Instead, it would seem that small states in South Asia, as well as the Middle East and North Africa are the most limited in tapping into the benefits from cooperation – assuming

[6] To investigate this issue more fully, factors such as different fixed costs arising from characteristics such as dispersion of the population and accessibility to service providers (e.g. health care) would have to be considered.

that they are also somehow unable to cooperate with larger neighbors.[7] Greenland may be of less concern due to its special relationship with Denmark.

Nonetheless, there may be many other barriers that represent obstacles to effective cooperation. Some of these might be cultural, language, distance between countries, legal structure, political, and other forms of heterogeneity among neighboring states, which will differ according to region. On the other hand, there are a number of regional forums that facilitate policy coordination and discussion. This has certainly been the case for some time in the Pacific.[8]

IV. INCOME PER CAPITA

Income per capita is an important variable, not least because it is often used as a proxy indicator for poverty and aid eligibility. For example, IDA eligibility is principally determined on a threshold related to GNI per capita which is reviewed periodically.[9] Eligibility for the IMF's PRGT takes its cue from IDA and is therefore similarly based on income per capita.

However, as with the separate consideration of total income and population in relation to the possible inability of very small states to access economies of scale, income per capita might also suffer from being an imperfect indicator. Take for example an extremely small state. It might generate sufficient income from the sale of fishing licenses and remittances to rank relatively highly in terms of income per capita because the total income numerator is shared across a very small population denominator. Nonetheless, it might find itself in a situation where total income is so small that it proves prohibitively expensive for the government to provide adequate health services domestically. If a substantial part of that higher income per capita therefore has to be allocated toward expensive medical services in another country, the remaining disposable per capita amount available to households for consumption and saving might be significantly lower. In this simple example it is easy to recognize that assessments based on income per capita alone can be misleading.[10] This problem becomes more pronounced as the denominator in the calculation takes an extremely small value.

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[7] For small states in the Pacific, the scope for greater integration with Australia and New Zealand might hold the most promise.

[8] The peak coordinating body in the region is the Pacific Islands Forum which facilitates the Forum Economic Ministers Meeting (FEMM). This type of cooperation has resulted in the formulation of the Pacific Plan, the Pacific Agreement on Closer Economic Relations, several agreements on trade, and discussion about action on climate change. There is also coordination of technical assistance and training through the Pacific Financial Technical Assistance Center (PFTAC). For a concise summary of the Pacific Plan, refer to Brown (2001).

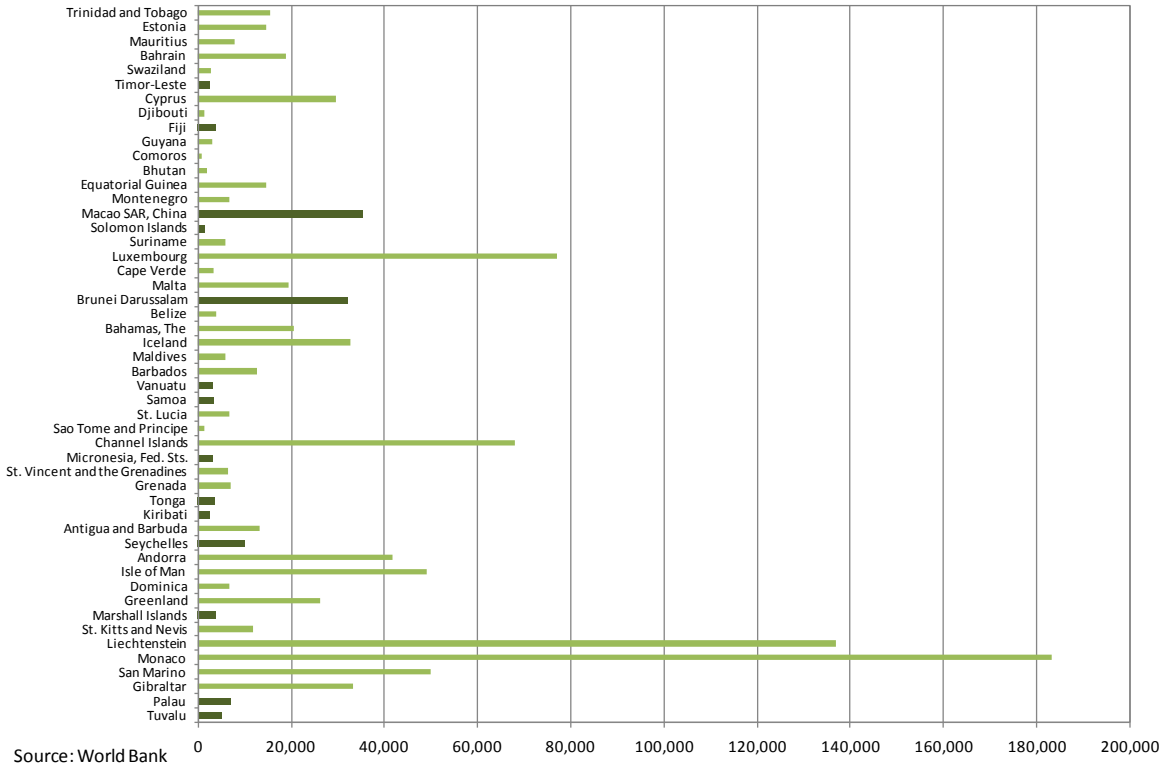
[9] Refer to IDA (2001). While income is the main criterion adopted by the World Bank, there is scope for special considerations and exemptions to this threshold in exceptional circumstances.

[10] Given that income thresholds are used as a proxy for welfare, it might also be that in the presence of significant vulnerabilities and risk aversion, welfare is notably lower than implied by income per capita.

Figure 4 plots the per capita income for the sample of small states. One consideration is that while this sample is restricted to small states, there are many countries with populations that exceed the 1½ million threshold but have per capita income much smaller than several of the countries depicted. This is typically attributable to a very small numerator relative to a very large denominator in the calculation. It therefore becomes important to understand the determinants of income per capita when making policy decisions.

Figure 4: Small States - Gross National Income per Capita

Current US dollars, 2010. Countries ordered by population as in Figure 1.



Source: World Bank

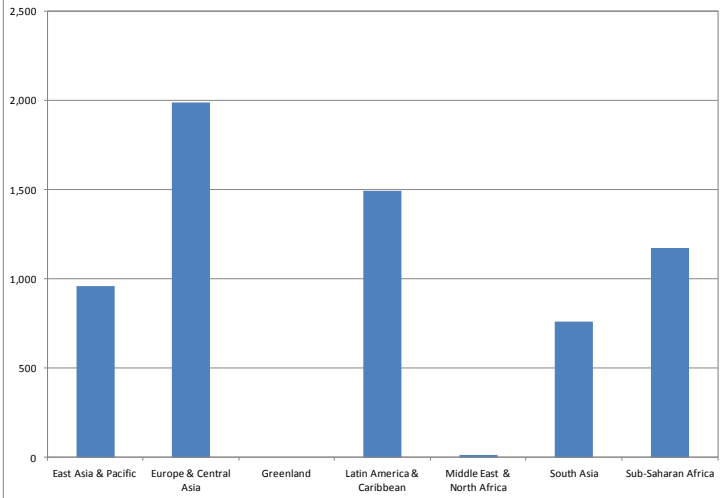
The top decile of five small states with the highest GNI per capita is entirely comprised of European countries (Monaco, Liechtenstein, Luxembourg, Channel Islands, San Marino). The proximity to neighboring countries, access to their workforce, infrastructure, and the nearest continent may well be important explanatory factors in the scope to overcome disadvantages associated with being small (Martins and Winters, 2004). It also raises the need for consideration of multiple vulnerabilities for some small states. While it might be feasible to routinely overcome one or even two types of exposure, once countries are disadvantaged by several such factors, it becomes less likely that they can overcome all of them all the time and escape the adverse consequences of their vulnerabilities.

V. SCOPE FOR IMPORT SUBSTITUTION THROUGH AGRICULTURE

Another common feature of small states is that despite sometimes very large overall land masses, they typically have very little fertile or arable land available for cultivation.[11] One reason why this might be considered to be an important macro-related indicator for countries is because it could be related to the ability to substitute for imports of foodstuffs. Countries may well be more exposed to balance of payments crises if they have a heavy dependence on imports of food as a result of inadequate conditions to foster domestic agriculture. The most striking example of this is Greenland, where an extremely large landmass is very sparsely populated (see Table 2). The vulnerabilities resulting from excessive dependence on imports of foodstuffs was sharply underscored in recent years when food prices rose sharply (Colmer and Wood, 2012; Sheridan et al, 2012).

In terms of the square meters per capita available for cultivation, some countries are in a considerably worse position than others. Five states in the sample have no arable land at all (Macao, Greenland, Monaco, Gibraltar, Tuvalu). Several Pacific islands suffer from very infertile soil, or in some cases, no soil at all. Many consist of nothing more than coral or sand and Tuvalu stands out as being particularly infertile and unsuitable for agriculture. On the other hand, some of the larger Pacific islands like Fiji, Samoa, Tonga, and Timor-Leste are relatively fertile, especially when compared to some states in Africa. On average, the states in the Pacific may not be as infertile as desert countries in the Middle East and North Africa or Greenland, but they are notably more infertile than small countries in Europe or Latin America and the Caribbean (Figure 5).

Figure 5: Small States - Fertility of Land (by region)
Average m^2 per capita in the region



Sources: World Bank, author's calculations

[11] This is not surprising given that if the land were very fertile and able to support a larger number of people, it would probably be more densely populated.

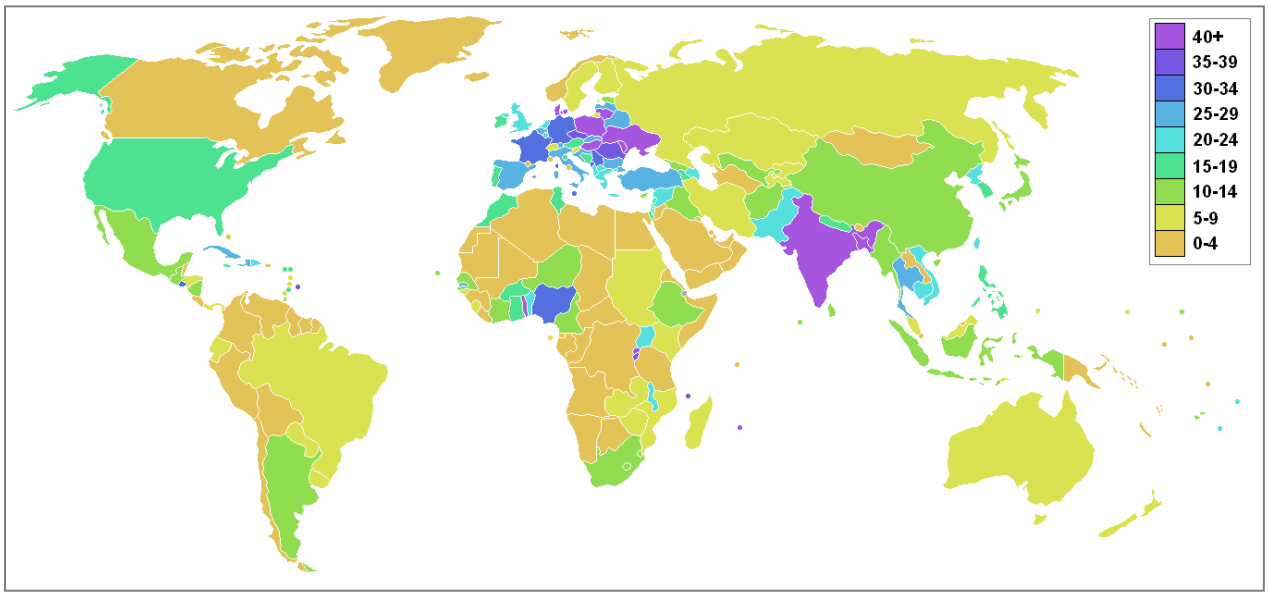
Table 2: Scope for Agriculture
As at 2009. Countries ordered by population as in Figure 1.

Country	Total land mass km²	Non-Arable Land km²	Arable Land km²	Arable Land m² per capita
Tuvalu	30	30	0	0
Palau	460	450	10	488
Gibraltar	10	10	0	0
San Marino	60	50	10	317
Monaco	2	2	0	0
Liechtenstein	160	130	30	833
St. Kitts and Nevis	260	220	40	763
Marshall Islands	180	160	20	370
Greenland	410,450	410,450	0	0
Dominica	750	690	60	886
Isle of Man	570	520	50	603
Andorra	470	460	10	118
Seychelles	460	450	10	116
Antigua and Barbuda	440	360	80	902
Kiribati	810	790	20	201
Tonga	720	560	160	1,538
Grenada	340	320	20	191
St. Vincent and the Grenadines	390	340	50	457
Micronesia, Fed. Sts.	700	680	20	180
Channel Islands	190	150	40	261
Sao Tome and Principe	960	860	100	605
St. Lucia	610	580	30	172
Samoa	2,830	2,580	250	1,366
Vanuatu	12,190	11,990	200	835
Barbados	430	270	160	585
Maldives	300	260	40	127
Iceland	100,250	100,180	70	221
Bahamas, The	10,010	9,930	80	233
Belize	22,810	22,110	700	2,031
Brunei Darussalam	5,270	5,240	30	75
Malta	320	240	80	194
Cape Verde	4,030	3,430	600	1,210
Luxembourg	2,590	1,970	620	1,226
Suriname	156,000	155,420	580	1,106
Solomon Islands	27,990	27,830	160	297
Macao SAR, China	28	28	0	0
Montenegro	13,450	11,720	1,730	2,740
Equatorial Guinea	28,050	26,730	1,320	1,885
Bhutan	38,390	37,640	750	1,033
Comoros	1,860	1,060	800	1,089
Guyana	196,850	192,650	4,200	5,567
Fiji	18,270	16,670	1,600	1,859
Djibouti	23,180	23,160	20	23
Cyprus	9,240	8,370	870	788
Timor-Leste	14,870	13,220	1,650	1,468
Swaziland	17,200	15,450	1,750	1,475
Bahrain	760	750	10	8
Mauritius	2,030	1,160	870	679
Estonia	42,390	36,430	5,960	4,449
Trinidad and Tobago	5,130	4,880	250	186

Source: World Bank

The regional findings described above are not particularly surprising given the geographic location of states in the sample. European countries stand out as having the most arable land and with the few significant exceptions of India and Nigeria the rest of the world has less agriculturally productive land (Figure 6).[12] There are of course several smaller exceptions to this.

Figure 6: Arable Land
Per cent of total landmass



Source: CIA World Factbook

Trade with highly agriculturally productive countries is one possible way to overcome the domestic constraints that some small states face. Some of the important factors in determining that possibility are access to alternative resource endowments that can be traded and the proximity to such trading partners. While Pacific island states might be able to trade fish stocks, or use the revenue from selling fishing rights, they remain disadvantaged by their relative geographic isolation which raises transport costs and can even prove prohibitive to gaining market access (see below).

VI. GEOGRAPHIC ISOLATION

The most distinguishing characteristic of small Pacific islands is how remote they are, not only from the nearest continent, but also from neighboring countries. While technological progress has allowed countries to overcome barriers such as those related to effective communication, distance remains a key challenge to overcome when physical factors are important. The transport costs associated with trade and commerce are therefore commensurately higher as distance increases (Commonwealth Secretariat and World Bank

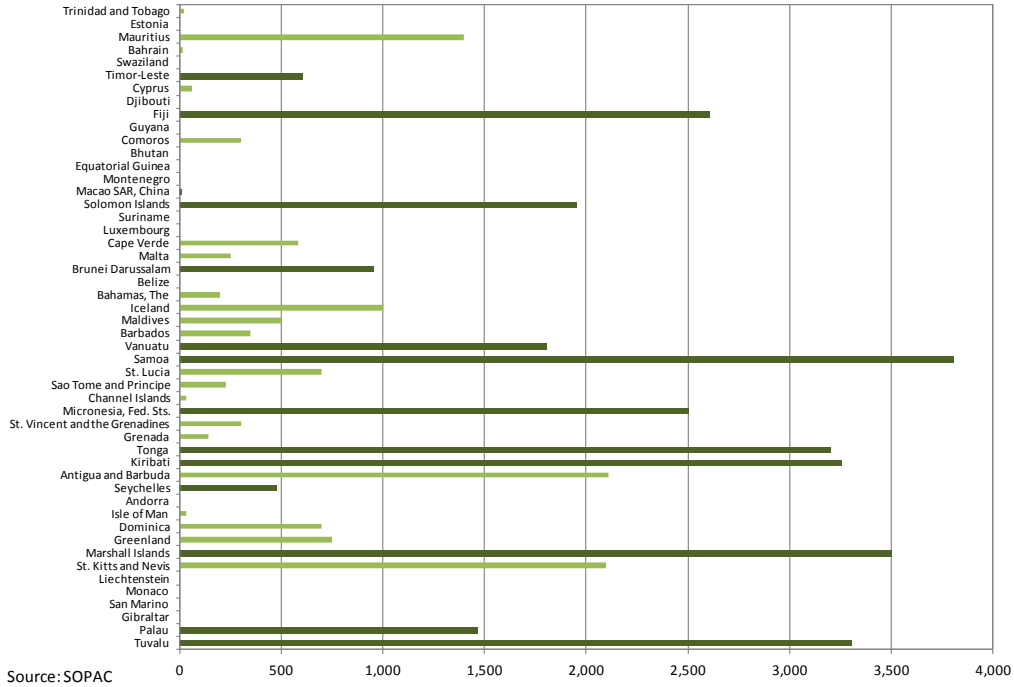
[12] We acknowledge that while some countries in the Northern Hemisphere may at face value appear to be quite arable, their proximity to the Arctic Circle severely curtails the ability to foster a productive agricultural sector.

Joint Task Force on Small States, 2000; and Zhu, 2012).[13] This problem is compounded by import dependence, especially for foodstuffs due to non-arable land, discussed earlier. In Martins and Winters (2004), it is shown that small economies might not even be suitable locations for tourism unless they have specific comparative advantages that allow them to charge substantially higher prices to overcome cost disadvantages. Furthermore, since this geographic isolation is closely associated with dispersion of many small islands in the Pacific Ocean, there is also a link to the susceptibility of these states to natural disasters such as tsunamis and hurricanes. The environmental challenges also extend to issues associated with rising sea levels and global warming, although some of these issues are held in common with other regions, especially the Caribbean where small states are vulnerable to similar environmental pressures. Appendix I lists some relevant indicators such as the isolation sub index (EVI-13) of the Environmental Vulnerability Index calculated by SOPAC and the UNEP.

In the sample of small states, Samoa, Marshall Islands, Tuvalu, Kiribati, and Tonga are some of the most isolated states in the world (Figure 7). Each is more than 3,000 kilometers from the nearest continent, Australia.

Figure 7: Small States - Distance to Nearest Continent

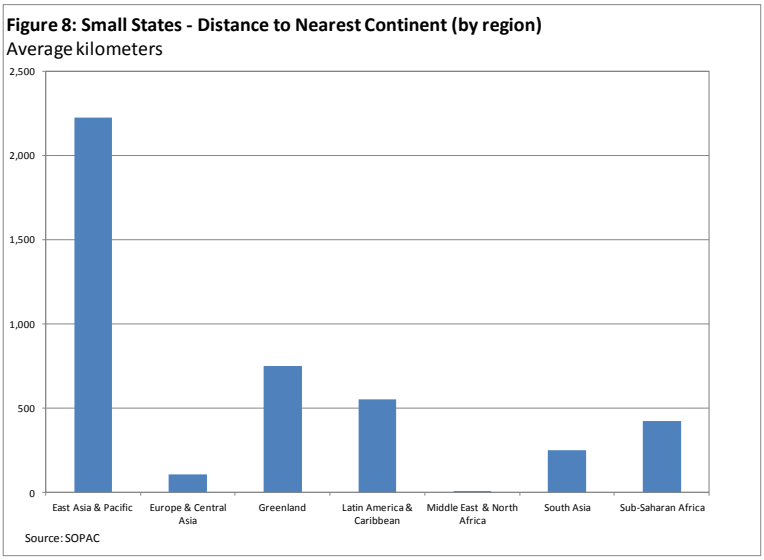
Kilometers. Countries ordered by population as in Figure 1.



Source: SOPAC

[13] Many of the most remote countries, for a variety of reasons, do not export any goods. As a consequence, container ships that deliver imports in the first leg of the journey have no rolling stock for the return leg. This raises the cost of delivering containers. Many smaller island countries also do not have sufficient infrastructure for the larger, more efficient, container ships to dock. Furthermore, since fuel is a major part of shipping costs, imports that require substantial maritime distances to be crossed expose the importing country even further to the fluctuation in the price of fossil fuels.

The vulnerability represented by their geographic isolation therefore notably differentiates small islands in the Pacific from many of the other small states in the sample. The average distance to the nearest continent for Pacific islands is more than four to five times that applicable to the average country in the Caribbean or Sub-Saharan Africa (Figure 8). On the other hand, small states in Europe or Northern Africa and the Middle East are considerably less isolated on the measure used here.[14]



When considering the issue of isolation, additional factors that are somewhat beyond the scope of this paper are worth alluding to briefly. In Mayer and Zignago (2011) the authors calculate a more comprehensive measure of remoteness by including not just the single distance between a country and the nearest continent, but by measuring the distance between each country and all other countries in their sample of 224 countries. This metric lends further support to the finding that small Pacific island states are particularly isolated. The main driving factor is that these states are not only far away from the nearest continent but are widely dispersed over a vast area of ocean and therefore also very far away from each other and all other countries.[15] An interesting further augmentation of the data is to weight these distances by GDP to capture how physically far removed countries are from major

[14] Once again caution is required when making inferences from the data. While the measure of distance used here is favored because it is simple and transparent, there are alternative ways to consider isolation. A country may be isolated not because of distance but because it is landlocked and surrounded by politically unstable neighbors that are subject to civil unrest. Financial isolation or connectivity to telecommunications might also be important variables.

[15] On this measure even relatively heavily populated developed countries can be considered to be remote from the rest of the world. New Zealand stands out as the single most distant country from all others in the world based on these calculations. Ranked at number 15, Australia is also very remote, but in part due to its size, resource endowments, and colonial ties, has been able to overcome this disadvantage more effectively than most small states. In the interest of brevity, these data and the author's calculations are not shown in this paper but can be freely obtained from Mayer and Zignago (2011).

world markets (Chen et al, 2012). Once again, this augmentation makes small states in the Pacific even worse off. Even though Australia has a very large land mass (it is the sixth largest country in the world), it has a relatively small population and therefore also represents a much smaller market than the large neighbors (such as China, the euro area, or the United States) to some small states. This consideration of distance from major markets is also relevant to some countries in Africa even though the state might be on the actual continent, and could change some of the results shown above.

VII. VULNERABILITY RANKING

A simple way of summarizing this type of information is to rank states according to how they are positioned relative to other small states on the factors discussed in this paper. The aim is to keep the summary indicator as simple and transparent as possible. From the outset we note the tradeoffs involved. Mechanical indices can never fully reflect the complexities and changing dynamics involved in the interaction between these variables. Additionally, there are limitations that arise from the inputs into the calculations being far from exhaustive in their description of small states. Nevertheless, we hope to convey some of the key characteristics that set small Pacific islands apart from small states in other regions.

A. Ranking small states

We use each variable discussed in the paper and calculate how every small state ranks relative to all others. For example, if we rank the sample of 50 states according to population size, one might consider the smallest state as being the most vulnerable. The country with the smallest population, Tuvalu, is given an index ranking of 50 and the country with the largest population, Trinidad and Tobago, is given an index ranking of one. Larger numbers therefore indicate greater relative vulnerability on the indicator in question.[16] Similarly, countries with the least amount of arable land per capita might be vulnerable, as would be the countries that are the furthest away from the nearest continent and most isolated. Countries with the smallest absolute US dollar level of GNI are probably less able to reap economies of scale in the provision of public goods and services and could be disadvantaged. Similarly, those with the lowest income per capita might typically be considered to be relatively poor and therefore exposed to adverse shocks that cannot be easily absorbed without assistance from the international community.

We try to capture vulnerability by synthesizing the measures discussed above into an index. An aggregate summary ranking is achieved by calculating the equally weighted average across the five individual indicator rankings used in this simple study.[17] The result is a broad reflection of which states in the sample are the most vulnerable. Table 3 provides the details of the calculations and ranking.

[16] There may also be advantages in dealing with some of the non-linearities in the data by employing this ranking methodology.

[17] There is no reason to presume each of the five indicators discussed in this paper are of equal importance as is implied by the weighting employed. However, the paper does not presume to estimate the relevant preference function, as this would differ by region and country.

Table 3: Ranking by Indicator

	Population	Arable land	Distance	GNI	GNI/Capita	**Average**
	Vulnerability Rank (1-50)	Vulnerability Rank (1-50)	Vulnerability Rank (1-50)	Vulnerability Rank (1-50)	Vulnerability Rank (1-50)	**Vulnerability Rank average**
Tuvalu	50	50	48	50	33	**46.2**
Kiribati	36	34	47	46	45	**41.6**
Marshall Islands	43	28	49	48	35	**40.6**
Micronesia, Fed. Sts.	32	38	44	45	41	**40.0**
Palau	49	26	39	49	29	**38.4**
Solomon Islands	16	30	41	40	49	**35.2**
Sao Tome and Principe	30	23	24	47	48	**34.4**
Tonga	35	7	46	44	37	**33.8**
Samoa	28	10	50	42	39	**33.8**
St. Kitts and Nevis	44	21	42	39	22	**33.6**
Seychelles	38	42	29	35	23	**33.4**
Greenland	42	47	35	28	13	**33.0**
Vanuatu	27	18	40	38	42	**33.0**
St. Lucia	29	39	34	32	28	**32.4**
Dominica	41	17	33	43	26	**32.0**
Gibraltar	48	49	15	34	9	**31.0**
St. Vincent & the Grenadines	33	27	27	37	30	**30.8**
Grenada	34	36	22	36	25	**30.6**
Maldives	25	40	30	25	32	**30.4**
Antigua and Barbuda	37	16	43	31	20	**29.4**
Djibouti	8	44	13	33	47	**29.0**
Comoros	11	14	26	41	50	**28.4**
Cape Verde	19	12	31	26	38	**25.2**
Monaco	46	48	14	14	1	**24.6**
San Marino	47	29	11	27	5	**23.8**
Andorra	39	41	12	19	7	**23.6**
Brunei Darussalam	21	43	36	7	11	**23.6**
Barbados	26	25	28	18	21	**23.6**
Fiji	9	6	45	20	36	**23.2**
Timor-Leste	6	9	32	23	44	**22.8**
Iceland	24	33	37	8	10	**22.4**
Bhutan	12	15	9	29	46	**22.2**
Malta	20	35	25	12	15	**21.4**
Isle of Man	40	24	19	17	6	**21.2**
Bahamas, The	23	32	23	13	14	**21.0**
Mauritius	3	22	38	11	24	**19.6**
Channel Islands	31	31	20	9	4	**19.0**
Belize	22	4	4	30	34	**18.8**
Liechtenstein	45	19	10	15	2	**18.2**
Macao SAR, China	15	46	16	6	8	**18.2**
Suriname	17	13	8	22	31	**18.2**
Bahrain	4	45	17	4	16	**17.2**
Swaziland	5	8	6	21	43	**16.6**
Trinidad and Tobago	1	37	18	3	17	**15.2**
Guyana	10	1	1	24	40	**15.2**
Montenegro	14	3	3	16	27	**12.6**
Cyprus	7	20	21	2	12	**12.4**
Equatorial Guinea	13	5	5	10	18	**10.2**
Luxembourg	18	11	7	1	3	**8.0**
Estonia	2	2	2	5	19	**6.0**

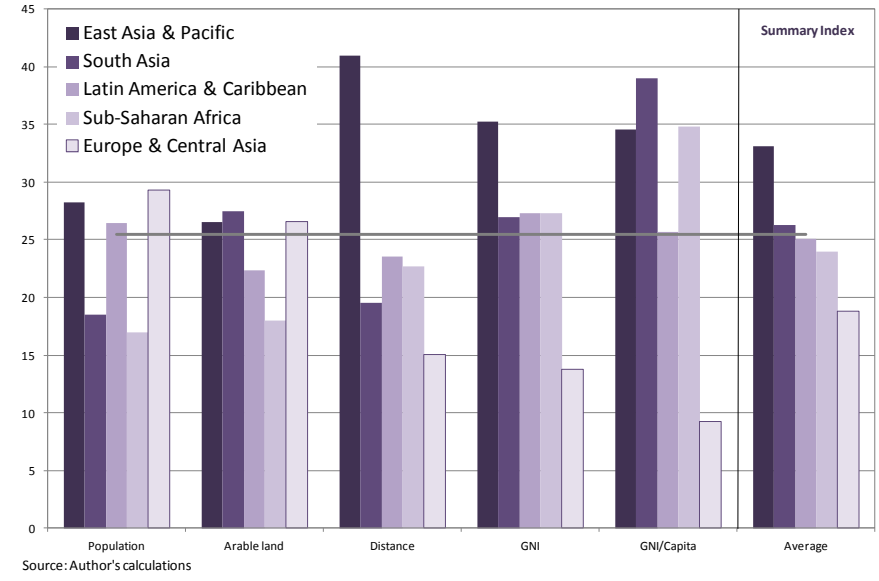
Source: Author's calculations

According to this metric, Tuvalu is the most vulnerable small state in the sample. It has a very small population, no arable land, it is very isolated, and has little scope for accessing economies of scale in the provision of public goods and services on account of its small GNI. These are all factors that more than offset its more favorable ranking in terms of income per capita.

At the other extreme is Estonia. In the small states context, it has a relatively large population, land is very fertile, it is surrounded by many close neighbors on the European continent, and total gross national income is relatively high. These factors more than offset a relatively low ratio of income per capita. This outcome is not intended to imply that Estonia, or other countries in the sample, do not face other substantial vulnerabilities. Instead, it is simply a reflection of how states compare based on just the five indicators chosen to illustrate the relative position of small states in the Pacific.

Broadly speaking, we can reach some tentative conclusions about average regional characteristics of small states (Figure 9).

Figure 9: Regional Vulnerability by Indicator



Small States in the Pacific are the most vulnerable on a number of counts considered in this paper. This is in part driven by several common vulnerabilities such as isolation, but also by the extreme exposure of some states in the region on several additional indicators of vulnerability. They are particularly isolated, and lack the ability to reap economies of scale. They also generally have low income per capita, small populations, and little arable land. Compared with other regions, they rank worse than the average of 25.5 on all measures considered. [18] Small states in Latin America and the Caribbean, South Asia, and Sub-Saharan

[18] However, there are some states in the region that do not appear notably more exposed than those in other regions.

Africa are probably somewhat less vulnerable to the factors considered here. These regions appear to have a common degree of overall exposure. Small countries in Europe would appear to be the least disadvantaged in this sample – a result in large part driven by a number of outliers that are highly developed and rich countries that happen to have small populations but do not appear particularly disadvantaged by this characteristic. It is therefore worth keeping in mind that other small European countries are less fortunate, and that for the Caribbean, South Asia, and Africa we might be doing a poor job of capturing other forms of vulnerability.

B. Empirical link to real economic outcomes

In order to conduct a preliminary investigation of the relationship between the potential vulnerability indicators for small states and real economic outcomes, we fit a series of simple linear regressions. The growth rate in GNI is therefore the dependent variable we are trying to explain using indicators of vulnerability.

Economic outcomes are proxied by annualized nominal growth in GNI measured in US dollar terms between 2001 and 2010. The data are annual and therefore only nine observations are available for most countries. Three countries (Montenegro, Sao Tome and Principe, Timor-Leste) have fewer observations than this and Gibraltar had to be dropped from the sample of 50 countries due to lack of time series data. We also note the high likelihood of cross-correlation between growth outcomes during the recent financial crisis, given that it represents a common shock to all countries in the sample, albeit with different intensities.

To investigate the usefulness of ranking countries by their degree of vulnerability, we fit separate regressions using each of the five vulnerability indicators shown in Table 3 (population, land, distance, income, income/capita).[19] Since states are ranked according to their relative degree of vulnerability in each of these indicators, we attempt to capture the relationship between growth and vulnerability. Our prior is to find a negative relationship between the relative degree of vulnerability exhibited by a state and the average growth rate it is able to achieve. For example, we would expect that a high ranking on distance – which by construction indicates that the state is relatively isolated – would result in lower growth outcomes than for states that are less isolated.

A closer look at the regressions (Table 4) indicates that the slope coefficient for almost all individual indicators is consistent with the expected negative relationship between relative vulnerability and growth. A notable exception is income per capita, which indicates a weak positive relationship with growth. Possible explanations for why lower income per capita might be associated with faster growth could relate to structural factors such as developing countries typically being able to grow more rapidly than more developed countries (which would also tend to have higher income per capita). More realistically, the relationship between income per capita and growth is probably not a very meaningful indicator –

[19] See also Gallup et al (1999), and Kuznets (1960).

especially in the case of microstates – and this is reflected in a statistically insignificant relationship as indicated by the P-value on the variable.[20]

Table 4: Relationship between Vulnerability Ranking and Growth

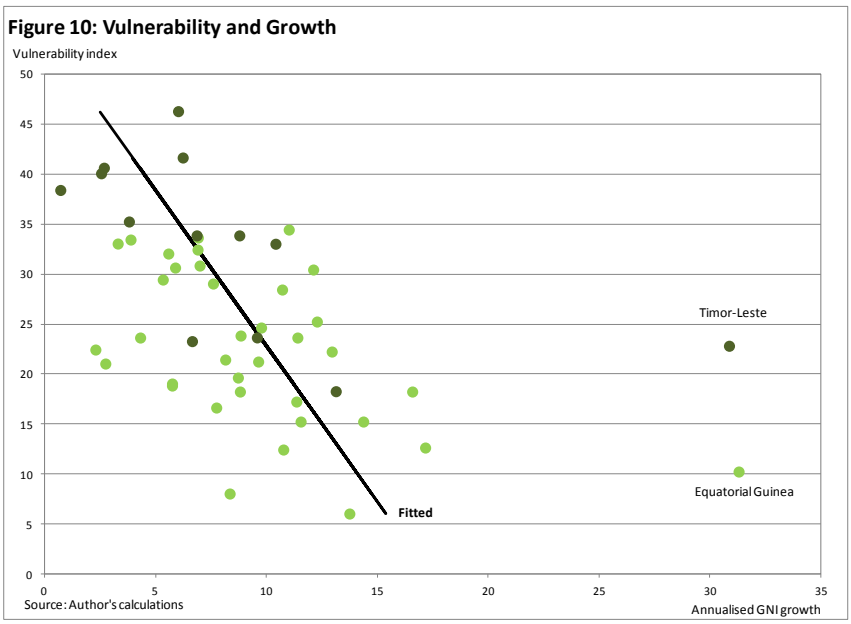
Ranking according to the ith indicator of vulnerability #	Slope coefficient	P-value		RMSE(ith)	RMSE(ith)/ RMSE(index)
population	-0.19	0.0006	**	5.15	1.0158
land	-0.16	0.0063	**	5.40	1.0651
distance	-0.18	0.0015	**	5.25	1.0355
income	-0.14	0.0167	*	5.50	1.0848
income/capita	0.02	0.6899		5.84	1.1519
index	-0.32	0.0003	**	5.07	1.0000
Memorandum item: index-ex ^	-0.23	0.0000	**	2.96	0.5838

Notes to regression:
- # Sample excludes Gibraltar due to data availability
- ^ Additional exclusions: (i) income per capita in the calculation of the index, (ii) outliers (Timor-Leste and Equatorial Guinea).
- * Significance at the 5 percent level
- ** Significance at the 1 percent level

A number of other interesting findings include that the most statistically significant (P-value) explanatory variables for growth are the size of the population, the degree of isolation measured by distance to the nearest continent, and the fertility of land.[21] As a result, the ratio of the Root-Mean-Square Error (RMSE) relative to the benchmark model fitted for the overall average *index* is lowest for these three core indicators. Furthermore, the combination of all indicators into the summary *index* yields the best fit. In part, this is because more variation and information is reflected by the *index* to explain the dependent variable, but we would also argue that the combination of vulnerabilities is important in influencing economic outcomes. It is clearly more difficult to register consistently good economic performance when exposed to a significantly larger number of sources for adverse shocks. This relationship is plotted in Figure 10. As in previous figures, the states in the Asia-Pacific region are depicted in a darker color.

[20] Other considerations worth bearing in mind are whether one would necessarily expect a relationship between income per capita and average growth outcomes, or whether the relationship is significantly more complicated than the treatment afforded to it in this paper.

[21] Redding and Venables, 2004, show that the geography of access to markets is statistically significant and quantitatively important in explaining cross-country differences in per capita income.



The fitted relationship indicates the expected negative relationship between the degree of vulnerability and growth outcomes for small states, but is significantly affected by two outliers on growth (Timor-Leste, Equatorial Guinea).[22] One interpretation of the clustering of Pacific states in the top left hand quadrant of the Figure would be that their relatively high degree of vulnerability does indeed impede their economic performance by dragging average growth lower.

As a final illustration, we refit the equation using a recalculated average ranking index which excludes income per capita on the basis that its explanatory value was found to be statistically insignificant, and drop the two outliers from the sample.[23] The results are shown in Table 4 as *index-ex*. Not surprisingly, the fit improves dramatically. The RMSE is significantly smaller and improves on the aggregate average *index* of vulnerability by more than 40 percent in explaining average growth outcomes.[24]

VIII. CONCLUDING REMARKS

This paper cannot assert that small states in the Pacific are absolutely more vulnerable than small states in other regions – the scope is simply too narrow to address this question

[22] Both of these states enjoyed extraordinarily rapid income growth due to significant oil and gas exploration projects, as well as rising fuel prices during the period 2001 to 2010.

[23] Dropping the two outliers can also be justified on the grounds that they are almost 4 standard deviations away from the sample mean.

[24] An informative contrast to the findings presented here and the literature more generally is Easterly and Kraay (2000), where the authors find no empirical evidence of such relationships and conclude that small states should receive the same policy advice as larger countries.

adequately. It does, however, show that on the limited number of macro-orientated indicators considered in this study, most small Pacific islands rank as being particularly exposed to adverse shocks relative to their peers in other regions. We find that population size, distance from the nearest continent, arable land, and scope to exploit economies of scale are all statistically significant in explaining economic outcomes in small states. The combination of these vulnerabilities into an overall index lends support to the idea that a confluence of vulnerabilities is also important in determining growth outcomes.

Small island states in the Pacific are disadvantaged because they are sometimes extremely small in terms of population and consequently limited in being able to access economies of scale in the production of goods and services. The quality of soil is often not very good, and as a result, they can be exposed to the disadvantages that follow from being heavily dependent on the import of foodstuffs. These are all relevant considerations that present important challenges for small states in the region and progress, to varying extent, is being made on overcoming aspects of these disadvantages.

It is, however, the extreme degree of isolation of most small states in the Pacific which is quite unique in defining their vulnerabilities on several facets. While technological progress has helped to bridge the communication chasm, when it comes to physical considerations in areas such as trade, commerce, and labor mobility, significant barriers with economic consequences are not only important but also unlikely to be resolved in the foreseeable future. Furthermore, as a result of their geography, small states in the Pacific face a number of environmental challenges such as tsunamis, hurricanes, and rising sea levels. The tyranny of the sheer distances involved is therefore likely to remain a key challenge in the Pacific and will also remain on the forefront of informed policy makers' minds for some time to come.

Small and Vulnerable States

Country name	Regional classification	Population As @ 2010	Arable land As @ 2009	EVI-13 Isolation	Distance to closest continent	Closest continent	GNI Current prices As @ 2010	GNI/Capita Current prices As @ 2010	GNI/Capita PPP basis As @ 2010
	Region	Thousands	m2/capita	Index (1-7)	km	Name	US$ million	US$	US$
Tuvalu	East Asia & Pacific	10	0.0	7	3,300	Australia	47	4,760	5,351
Palau	East Asia & Pacific	20	488.5	6	1,463	Asia	134	6,560	11,000
Gibraltar	Europe & Central Asia	29	0.0	1	0	Europe	969	33,151	38,217
San Marino	Europe & Central Asia	32	317.1	1	0	Europe	1,572	49,866	35,163
Monaco	Europe & Central Asia	35	0.0	1	0	Europe	6,479	183,150	182,990
Liechtenstein	Europe & Central Asia	36	832.6	1	0	Europe	4,903	137,070	151,189
St. Kitts and Nevis	Latin America & Caribbean	52	763.3	7	2,100	South America	615	11,740	15,850
Marshall Islands	East Asia & Pacific	54	370.1	7	3,500	Australia	197	3,640	3,003
Greenland	Greenland	57	0.0	5	750	North America	1,466	26,020	25,604
Dominica	Latin America & Caribbean	68	885.5	5	697.5	South America	458	6,760	11,990
Isle of Man	Europe & Central Asia	83	603.4	2	30	Europe	3,972	48,910	47,926
Andorra	Europe & Central Asia	85	117.8	1	0	Europe	3,447	41,750	36,113
Seychelles	Sub-Saharan Africa	87	115.6	5	475	Africa	845	9,760	21,210
Antigua and Barbuda	Latin America & Caribbean	89	901.8	7	2,110	South America	1,169	13,170	20,240
Kiribati	East Asia & Pacific	100	200.9	7	3,250	Australia	200	2,010	3,530
Tonga	East Asia & Pacific	104	1,537.6	7	3,200	Australia	342	3,280	4,580
Grenada	Latin America & Caribbean	104	191.4	4	140	South America	724	6,930	9,890
St. Vincent and the Grenadines	Latin America & Caribbean	109	457.3	4	300	South America	688	6,300	10,830
Micronesia, Fed. Sts.	East Asia & Pacific	111	180.1	7	2,500	Australia	304	2,730	3,490
Channel Islands	Europe & Central Asia	153	260.8	2	30	Europe	10,241	67,960	66,781
Sao Tome and Principe	Sub-Saharan Africa	165	604.6	4	225	Africa	199	1,200	1,920
St. Lucia	Latin America & Caribbean	174	172.4	5	697.5	South America	1,142	6,560	10,520
Samoa	East Asia & Pacific	183	1,365.5	7	3,800	Australia	549	3,000	4,270
Vanuatu	East Asia & Pacific	240	834.5	7	1,800	Australia	633	2,640	4,320
Barbados	Latin America & Caribbean	273	585.4	4	350	South America	3,454	12,660	19,000
Maldives	South Asia	316	126.6	5	500	Asia	1,818	5,750	8,110
Iceland	Europe & Central Asia	317	220.5	6	1,000	Europe	10,381	32,710	27,680
Bahamas, The	Latin America & Caribbean	343	233.3	4	200	North America	6,973	20,610	24,800
Belize	Latin America & Caribbean	345	2,030.8	1	0	North America	1,313	3,810	6,210
Brunei Darussalam	East Asia & Pacific	399	75.2	6	950	Asia	12,461	31,800	50,180
Malta	Europe & Central Asia	413	193.7	4	250	Europe	7,958	19,270	24,840
Cape Verde	Sub-Saharan Africa	496	1,209.7	5	580	Africa	1,620	3,270	3,820
Luxembourg	Europe & Central Asia	506	1,225.7	1	0	Europe	39,030	77,160	61,790
Suriname	Latin America & Caribbean	525	1,105.5	1	0	South America	3,077	5,920	7,680
Solomon Islands	East Asia & Pacific	538	297.3	7	1,950	Australia	552	1,030	2,210
Macao SAR, China	East Asia & Pacific	544	0.0	2	2	Asia	18,527	34,880	45,220
Montenegro	Europe & Central Asia	631	2,739.6	1	0	Europe	4,260	6,750	12,930
Equatorial Guinea	Sub-Saharan Africa	700	1,884.6	1	0	Africa	10,182	14,540	23,750
Bhutan	South Asia	726	1,033.1	1	0	Asia	1,361	1,870	4,990
Comoros	Sub-Saharan Africa	735	1,088.8	4	300	Africa	550	750	1,090
Guyana	Latin America & Caribbean	754	5,566.7	1	0	South America	2,164	2,870	3,450
Fiji	East Asia & Pacific	861	1,859.1	7	2,600	Australia	3,123	3,630	4,510
Djibouti	Middle East & North Africa	889	22.5	1	0	Africa	1,105	1,270	2,460
Cyprus	Europe & Central Asia	1,104	788.3	3	60	Asia	23,655	29,430	30,300
Timor-Leste	East Asia & Pacific	1,124	1,467.5	4	600	Australia	2,493	2,220	3,600
Swaziland	Sub-Saharan Africa	1,186	1,475.5	1	0	Africa	3,119	2,630	4,840
Bahrain	Middle East & North Africa	1,262	7.9	2	15	Asia	19,714	18,730	24,710
Mauritius	Sub-Saharan Africa	1,281	679.0	6	1,400	Africa	9,925	7,750	13,960
Estonia	Europe & Central Asia	1,340	4,448.9	1	0	Europe	19,371	14,460	19,760
Trinidad and Tobago	Latin America & Caribbean	1,341	186.4	2	20	South America	20,625	15,380	24,040

Appendix II. Data Sources and Metadata

Arable Land – Sourced from The World Bank, *Open Data* as at 2010. Available via Internet: http://data.worldbank.org/

Arable land includes land defined by the Food and Agriculture Organization (FAO) as land under temporary crops (double-cropped areas are counted once), temporary meadows for mowing or for pasture, land under market or kitchen gardens, and land temporarily fallow. Land abandoned as a result of shifting cultivation is excluded.

Environmental Vulnerability Index, EVI-13, Distance to Closest Continent, Closest Continent – Sourced from SOPAC and UNEP, 2005.

This indicator captures the proximity of a country to the nearest continent. Note that if a country is within a continent, this value is zero. Isolated countries may have a greater risk of loss of ecosystem types and species during periods of stress if they are far away from refuges and sources of re-colonization. Isolated countries are also likely to support fewer species than those which are close to large continents, or bio-geographic centers of radiation. Additionally, there is less chance of genetic interchange (part of genetic resilience) in isolated areas. The likelihood of isolation being an important part of a country's ecological resilience would be especially important if there are interactions with on-going human impacts. Countries close to sources of re-colonization are likely to be less at risk of permanent species losses, compared with those far away, particularly if they are small or fragmented.

Gross National Income (GNI), current US dollars – Sourced from The World Bank, *Open Data* as at 2010. Available via Internet: http://data.worldbank.org/

GNI (formerly GNP) is the sum of value added by all resident producers plus any product taxes (less subsidies) not included in the valuation of output plus net receipts of primary income (compensation of employees and property income) from abroad. Data are in current U.S. dollars. GNI, calculated in national currency, is usually converted to U.S. dollars at official exchange rates for comparisons across economies, although an alternative rate is used when the official exchange rate is judged to diverge by an exceptionally large margin from the rate actually applied in international transactions. To smooth fluctuations in prices and exchange rates, a special Atlas method of conversion is used by the World Bank. This applies a conversion factor that averages the exchange rate for a given year and the two preceding years, adjusted for differences in rates of inflation between the country, and through 2000, the G-5 countries (France, Germany, Japan, the United Kingdom, and the United States). From 2001, these countries include the Euro area, Japan, the United Kingdom, and the United States.

Gross National Income (GNI) per capita, current US dollars – Sourced from The World Bank, *Open Data* as at 2010. Available via Internet: http://data.worldbank.org/

GNI per capita (formerly GNP per capita) is the gross national income, converted to U.S. dollars using the World Bank Atlas method, divided by the midyear population. (Additional notes see also under GNI).

Gross National Income (GNI) per capita, Purchasing Power Parity (PPP) – Sourced from The World Bank, *Open Data* as at 2010. Available via Internet: http://data.worldbank.org/

GNI per capita based on purchasing power parity (PPP). PPP GNI is gross national income (GNI) converted to international dollars using purchasing power parity rates. An international dollar has the same purchasing power over GNI as a U.S. dollar has in the United States. GNI is the sum of value added by all resident producers plus any product taxes (less subsidies) not included in the valuation of output plus net receipts of primary income (compensation of employees and property income) from abroad. Data are in current international dollars.

Some values estimated by author using GDP and GDP per capita data from the CIA World Factbook. Available via Internet: https://www.cia.gov/library/publications/the-world-factbook/

Population – Sourced from The World Bank, *Open Data* as at 2010. Available via Internet: http://data.worldbank.org/

Total population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship--except for refugees not permanently settled in the country of asylum, who are generally considered part of the population of their country of origin. The values shown are midyear estimates.

Regional Classification of States – Sourced from The World Bank, as at April 2012. Available via Internet: http://siteresources.worldbank.org/DATASTATISTICS/Resources/CLASS.XLS

Geographic classifications and data reported for geographic regions are for low-income and middle-income economies only. Low-income and middle-income economies are sometimes referred to as developing economies. The use of the term is convenient; it is not intended to imply that all economies in the group are experiencing similar development or that other economies have reached a preferred or final stage of development. Classification by income does not necessarily reflect development status.

Land Area – Sourced from The World Bank, *Open Data* as at 2010. Available via Internet: http://data.worldbank.org/

Land area is a country's total area, excluding area under inland water bodies, national claims to continental shelf, and exclusive economic zones. In most cases the definition of inland water bodies includes major rivers and lakes.

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