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Asian and European Middle Powers: A Comparative Analysis on Energy Security and Naval Forces

by
Davide Ghermandi
University of Bologna

Abstract

Through a formalization of the working definitions of Middle Power and seapower, the paper tries to show the existence of a correlation between the energy dependence of energy supplies by sea and the “use of navies”. This latter concept has been formalized through the creation of a Navy Use Index (NUI) that underlines the importance of navies and naval forces for the states included in the sample.

The final aim is to answer the research questions on “why” and “how” the naval instrument is important as a foreign policy means to secure and protect the essential energy supplies from abroad, highlighting the theoretical link between energy security and seapower and analysing the existence of regional differences between Asian and European middle powers.

Keywords

• Middle Power • Energy Security • Military • Navy • Naval Forces • Navy Use Index • Seapower •

Introduction¹

This paper tries to analyse for a sample of states defined “maritime middle powers” the existence of a correlation between the dependence on Liquefied Natural Gas (LNG) supplies by sea and the seapower of each of these countries.

Energy security has always been a key concern among developed economies, especially after the dramatic events of 1973 and the oil crisis that followed. At the same time, in countries where navies have a long history, the naval instrument has always provided to decision-makers a flexible tool to pursue their foreign policy goals around the world, energy security included (Kearsley, 2001). While academic literature on energy security and, separately, seapower is fairly abundant, few studies tried to understand the correlation between energy dependence and the use of military forces and in particular naval forces. Furthermore, the main focus of previous works has been on the United States’ policy about energy security in the Middle East and, more recently, on China economic activities in Africa and Middle East as well. Few have written on the way middle powers act – and how their navies act – in order to guarantee their energy supplies and how this actions are affected by the rate of energy dependence from abroad.

For this reason the final aim of this work is to answer the research questions on “why” and “how” the naval instrument is important as a foreign policy means for middle powers to secure and protect the fundamental supply of energy from abroad, highlighting the theoretical link between energy dependence and seapower through the creation of a quantitative model. While the overall project is wider and considers for example even the dependence on foreign oil transported by sea and a qualitative part that will try to explain and analyse the results of the quantitative part, in these pages will be addressed only the correlation between the natural gas dependence, the use of naval forces and the development of the quantitative model.

¹ This is a follow-up paper of a work presented by the author at the ISA’s 58th Annual Convention held in Baltimore, MD at the end of February 2017 and represents a part of the author’s PhD thesis to be discussed at the University of Bologna at the beginning of 2018. Some parts of these pages are taken from the aforementioned paper. Work in progress – please do not quote. Comments and feedback are welcome: davide.ghermandi@unibo.it.

Methodological Approach and Research Development

About Seapower

From a theoretical standpoint the preliminary hypothesis of this research states that the more a country is dependent on seaborne energy supplies, the more this country will use its navy and naval forces as foreign policy means to pursue energy security, secure the Sea Lines of Communication (SLOC) and improve the relations with exporting countries through naval diplomacy and other activities, such as maritime capacity building operations. Furthermore these states will assign to navies a more active role as a means of foreign policy compared to others services, as well as more resources – in relative sense – than states with a lower rate of energy dependence from abroad.

Considering the vital importance that energy supplies have for states and their economies and that a prolonged disruption to these flows and supplies can provoke severe damage to the entire economic system, producing social unrest and putting at risk the independence of the state on the international scene, it can be reasonably assumed that the energy dependence on energy supplies from the sea is one of the most important reason – although not the only one – for which states tend to maximize their seapower in order to protect this essential flows coming from the sea.

However evaluating the importance that states give to navies goes well beyond measuring the single number of ships or the total amount of national budget allocated for naval forces, but is a more complex process that involves the very real definition of national seapower and an attempt to measure it after having formalized a working definition.

Seapower is an elusive and contested notion and Alfred T. Mahan himself, an American naval officer who coined the term in the XIX century, didn't define it very explicitly and what he meant has largely to be inferred, leaving room for subjective interpretations and misunderstandings (Till 2009: 20).

Hence the first part of the project will be focused on the definition of the terms of seapower, naval power and maritime power. After a brief review of the literature on the issue, in these pages will be adopted a working definition only for the term seapower, just mentioning the academic debate on the definitions of naval and maritime power.

Several scholars give the same definition to both terms seapower and naval power, highlighting only the military dimensions of these words (navy, warships, naval forces, naval bases, etc), disregarding all the other dimensions of the human life at sea (industrial, economic, scientific, etc). Others tend to focus their attention on a wider perspective, including all the dimensions that are not strictly correlated with the military. Till (2009: 20-22) states very clearly his position on the difficulties in defining seapower:

There seem to be three reasons for the difficulty. The first is purely to do with English semantics, and that is the limits of the words available to describe sea-related things. Some of them are adjectives without nouns (“maritime”, “nautical”, “marine”), others are nouns without adjectives (“sea”, “seapower”). Sometimes there are nouns that have adjectives (“ocean/oceanic”, “navy/naval”) but they tend toward greater specificity. Unfortunately this semantic awkwardness makes the consistent use of words very difficult.

The second reason is a matter of more substance. The “power” part of the word “seapower” itself has generated enormous attention in academic analysis of international politics. What does power actually mean? Some analyst focus on *inputs* – in other words the characteristics that make countries or people powerful (having military or economic strength for example). Others concentrate on *outputs* – a country is powerful because others do what it wants. Power can be either potential, or consequential – or, commonly, both! To add to the confusion, power can sometimes be applied specifically to particular countries (the “great powers”). Not surprisingly, there is a tendency to avoid the word if possible.

Third, people *do* actually mean different things by the labels they use – in the sense that they wish either to include or to exclude various phenomena related to the sea. “Maritime” activity for example is sometimes taken to concern only navies, sometimes navies operating in conjunction with the ground and air forces, sometimes navies in the broader context of all activities relating to the commercial, non-military use the sea, and sometimes inevitably the word “maritime” covers all three possibilities.

Till concludes embracing the wider definition of seapower which includes not only the military dimension but all the human activities affecting and affected by the sea:

(...) is the simple point that there is more to seapower than grey painted ships with numbers on the side. Seapower also embraces the contribution that the other services can make to events on land or in the air. Seapower also includes the non-military aspects of the sea use (merchant shipping, fishing, marine insurance, shipbuilding and repair and so on) since these contribute to naval power and since they can also influence the behaviour of other people in their own right.

From this perspective Till agrees with Mahan when, while omitting to provide a formal definition, tries to identify some specific elements of seapower (2011 [1890]: 15):

Seapower includes not only the military strength afloat, that rules the sea or any part of it by force of arms, but also the peaceful commerce and shipping from which alone a military fleet naturally and healthfully springs, and on which it securely rests.

It's worthwhile to provide the position of Admiral Gorshkov, former Chief of Staff of the Soviet Navy, that in defining seapower states (1976: 1-3):

In the definition of the sea power of the state we include as the main components possibilities for the state to study (explore) the ocean and harness its wealth, the status of the merchant and fishing fleets and their ability to meet the needs of the state and also the presence of a navy matching the interest of this state, since antagonistic social systems exist in the world.

(...) The material expression of that aspect of the sea power of the state, which is linked with the economy of the country, is offered by the merchant, fishing and research fleets, the science of the ocean ensuring study and exploitation of its riches, the various branches of industry extracting and processing the gifts of the ocean and also staffs of scientists, designers, engineers and technicians and the renewed army of seafarers with its diverse, complex and prestigious branches. At the same time sea power, naturally together with other components, also includes the ability of our armed forces to protect the country from threat of attack from the oceans. This aspect of sea power assumes greater importance the greater the military threat to our security.

Gorshkov in his "mahanian" definition of seapower that includes the non-military dimensions is even more explicit:

(...) This in no way means that the sea power of the country depends only on the real fighting strength of the navy. It must be regarded primarily as the capacity of the state to place all the resources and possibilities offered by the ocean at the service of man and make full use of them to develop the economy, the health of which finally determines all facets of the life of our country including its defence capability. In this context the concept of sea power to a certain degree is identified with the concept of the economic power of the state. Accordingly sea power may be regarded as a constituent part of economic power. Just as the latter determines military power, sea power, mediated by the economy of the state and exerting an influence on it, carries within it an economic and military principle.

Kane e Lonsdale (2012: 137-138), by contrast, favour a more limited approach:

(We will adopt) a more restrictive approach, and thereby use the term sea power to discuss the use of military power at or from the sea for the attainment of policy objectives. While it is undoubtedly the case that non-military maritime assets play a role in power exercised at or from the sea, in strategic terms this role is limited. (...) By restricting our definition of sea power to military capabilities and activities, we avoid the problem of defining sea power so broadly that it ceases to have a strong profile in strategic terms.

Another different perspective is wisely provided by Sakhuja (2011: 4) that says:

In its narrower scope, sea power is understood as a “navy” for distant interventions and is synonymous with warships, submarines, aircraft carriers and navies. At the other end of the spectrum, it is broadly understood as the ability of a state to use the sea to its optimum. It has also been argued that a great sea power may not be a maritime power although one follows from the other. In that context, sea power is defined as a state that has formidable naval capabilities (ships, submarines, shipping in support of the military for specific missions) and maritime power is defined as the state that makes widespread access to the seas, to sea resources for economic purposes that in turn provide the state with a significant position in its power relations. Thus there is no necessity for a maritime power to develop a navy and in theory a great sea power need not necessarily be a maritime power. However, historical evidence tells us that maritime powers do develop their navies to safeguard their interests and project power.

The standpoint that will be adopted in this paper embraces the wider definition of seapower, considering the term in relation to all the dimensions that affects the activities at sea (military, economic, scientific, etc), but with a particular focus and emphasis on the military dimension, considered by the author of this paper the most important element of a state’s seapower. In this regard the term maritime power on the contrary, emphasizing the economic dimensions, assigns a smaller role to the military component, while the term naval power is strictly correlated only with the military dimension, omitting completely to consider all the other elements that affect the life at sea (economic, industrial, scientific, etc) (Kirchberger 2015: 21; Dutch Government 2015; Kane e Lonsdale 2012: 137; Danish Government 2010).

It’s useful to mention Tangredi’s position on the issue (2002b: 29):

The term *sea power* is not exclusively synonymous with naval warfare. It is a much broader concept that entails at least four elements: the control of international trade and

commerce; the usage and control of ocean resources; the operations of navies in war; and the use of navies and maritime economic power as instruments of diplomacy, deterrence, and political influence in time of peace. Unlike the concepts of land power or air power, which are generally defined only in military terms, sea power can never be quite separated from its geo-economic purposes. Navies may be the obvious armed element of sea power. However, maritime shipping, seaport operations, undersea resources (such as oil), fisheries, and other forms of commerce and communications through fluid mediums can all be seen as integral to a nation's sea power.

(...) In a broad sense, *modern sea power* can be defined as the combination of a nation-state's capacity for international maritime commerce and utilization of oceanic resources, with its ability to project military power *into* the sea, for the purposes of sea and area control over commerce and conflict, and *from* the sea, in order to influence events on land by means of naval forces. As noted, this broad concept is often challenged by a more narrow view of sea power as a military concept, that form of military power that is deployed at or from the sea.

About this last assertion in the past years appeared a tendency to emphasize the military dimension of seapower especially in several official documents (U.S. Department of the Navy 2007, 2015). This relatively new trend reinforces the working definition of seapower chosen in this paper that includes all the dimension of human activities but gives a preeminent role to the military one.

About Middle Powers

This project aims specifically to understand how and why middle powers are influenced in the use of their navies and naval forces by energy dependence and how this dependence affects their seapower.

In order to do this a formal definition of middle power is needed, with the aim of selecting a group of states that will compose the sample for the quantitative analysis. As frequently occurs in social sciences the concept of middle power is elusive and disputed and the academic literature on the issue, although abundant, is contradictory and it doesn't provide a classification scheme universally accepted (Valigi, 2014). The three main schools of thought are based on the capabilities-based approach, behaviour-based approach and functional-based approach and each of them try to identify the main features of the states to be considered middle powers, but each approach has important elements that contradict the others, producing a very complex and inconsistent theoretical framework (Dong-Min 2015; Cooper 2013; Giacomello and Verbeek 2011; Holbraad 1984). This is not the place to contribute to this academic debate but in any case we need a working definition in order to have a starting point to select our sample. As of interest for this work, and to avoid to get involved in this tricky discussion, a useful approach could be to narrow the perspective, considering only a particular category of middle powers,

the naval middle powers. This choice, although with the introduction of some subjective elements of judgment, allows to concentrate the selection of the sample only among countries that have similar navies and naval forces and, therefore, similar operational capabilities. Furthermore, starting with a relatively small sample, provides the basis for a future wider research.

Clearly, as it is argued that exists a correlation between energy dependence, seapower and the use that states do of their navies and naval forces, only maritime middle powers that have navies are considered, therefore excluding landlocked states.

The main criteria used by various analysts for evaluations of total naval development and strength are typically force structure (i.e. type, age, and number of vessels); sustainability (i.e. the ability to keep naval forces on station), function and capability (the navy's primary task, maximum mission capability and geographic reach), flexibility (i.e. the variety and number of missions that can be undertaken concurrently as determined by surplus forces or redundancy), and access to state-of-the-art technology (Kirchberger 2015: 59; Till 2009: 114-115).

In the present study will be adopted the classification based on operational capabilities created by Kirchberger (2015) through which she divides all the existing 149 naval forces (navies, coastguards or riverine forces) in ten categories² reflecting 2013 data, drawing part of her classification framework from a previous work of Todd and Lindberg (1996). The key aspects of the classification are depicted in Table 1 and the data are taken by Kirchberger (2015: 59) from *Jane's Fighting Ships 2014*, *Jane's World Navies* and *The Naval Institute Guide to Combat Fleets of the World, 16th ed.* by Eric Wertheim and then she cross-checked the sources for consistency.

As Kirchberger (2015: 59) clearly put it:

it is important to keep in mind that this classification system is only a heuristic tool for structuring reality. Of course, any classification system will inevitably be found to have minor or major flaws if checked carefully on a case-by-case basis, and each naval rank represents a rather broad spectrum itself. (...) The purpose of this exercise, after all, is not to degrade any one country, but rather to make the extremely complex world of naval development more easily accessible to research.

² Kirchberger in her book (2015) mentions only part of the classification used in this paper. The complete ranking has been provided to the author by Sarah Kirchberger, Institute for Security Policy at Kiel University, with a written communication on December 10th, 2016.

	Rank	Designation	Typical Inventory	Defining Capabilities
BLUE WATER NAVIES	1	Global-reach power-projection	All larger ship types in high numbers	Multiple, regular, sustained power projection missions globally
	2	Limited global-reach power-projection	CVN, other aviation-capable ships, many SSN/SSK, support ships	At least one major power-projection operation globally in addition to homeland defense
	3	Multi-regional power-projection	CVL, other aviation-capable ships, SSN/SSK, enough support ships	Power-projection missions in regions beyond own EEZ in addition to homeland defense
	4	Regional power-projection	Aviation-capable ships (DD, FF), submarines, some support ships	No at-sea fleet air support other than organic helis, thus limited to area of land-based aircraft range for power-projection missions
NON - BLUE WATER NAVIES	5	Regional offshore coastal defense	Smaller ships (FF, Corvettes), no underway replenishment	Coastal defense operations at least in own EEZ and slightly beyond
	6	Inshore coastal defense	Only smaller ships (Corvettes, FAC)	Confined to inner reaches of own EEZ
	7	Regional offshore constabulary	Lightly armed OPV, PB, PC for CG-type duties	Geographic reach like Rank 5, but maritime policing instead of defense
	8	Inshore constabulary	Only Patrol Boats and Patrol Craft	Confined to missions well within own EEZ
	9	Inland waterway	Patrol Craft	Waterborne riverine defense of landlocked states
	10	Token	Often only one or two small craft	Only very basic constabulary capabilities, if any

TABLE 1 – Source: Kirchberger (2015), based on the original work of Todd and Lindberg (1996), *Navies and Shipbuilding Industries: The Strained Symbiosis*, Westport, Conn. et al.: Praeger.

According to Kirchberger’s classification in 2013 the only navy ranked in Rank 1 was the United States navy, followed by the French and British navies both ranked in Rank 2. The most striking element is that China in 2013 was in Rank 4, the lowest of the so called blue water navies, and this is mainly due “to a lack of fleet air support resulting from the still-nascent carrier capability, that forced China to be included in the same category with such seemingly disparate naval powers as Japan, Australia, South Korea, Pakistan, and Taiwan, notwithstanding the marked differences in their respective fleet sizes and force structures. In this system, fellow BRIC states India, Russia and Brazil rank even higher than China due to an already operational carrier capability, which is the defining criterion that separates Rank 3 from Rank 4” (Kirchberger 2015: 61).

Notwithstanding the questionable positioning of China – even though with a transparent and coherent methodology – the results derived from the ranking of the other states are less debatable.

For the purpose of this project are included in the sample only the states ranked in Rank 2, 3 and 4 – the so called blue water navy – that are reasonable expression of maritime middle powers with the operational capabilities to act systematically far from their own borders and beyond the Exclusive Economic Zone (EEZ)³.

³ An Exclusive Economic Zone (EEZ) is a concept adopted at the Third United Nations Conference on the Law of the Sea (1982), whereby a coastal State assumes jurisdiction over the exploration and exploitation of marine resources in its adjacent section of the continental shelf, taken to be a band extending 200 miles from the shore (OECD website).

As the aim of the project is to demonstrate the correlation between the energy dependence and the use of navy and considered that usually seaborne energy supplies come from very far from the importer's shores⁴, the choice to exclude navies that are not able to operate systematically close to the exporter or along the main SLOCs seems reasonable. Hence, the sample is composed of 27 states that have their navies classified as blue water navies and ranked between Rank 2 and Rank 4 according to Kirchberger's classification. Even though China has been classified in Rank 4, due to its military apparatus' strength and dimension and the magnitude of its economic indicators, although the PLA-navy it's not comparable with the US navy – which is the only one ranked in Rank 1 – for the purpose of this project it can't be considered a middle power, and for this reason it has been excluded from the sample. At this regard the operational capabilities of the PLA-Navy from 2013 – the time when Kirchberger made her classification – up today have quite changed. For instance in 2015 a Chinese official white paper on military strategy decreed a big shift that offers a glimpse of the country's changing maritime objectives, now deemed as important as the traditional strategy of focusing the attention on the land borders (Kynge et al., 2017). Furthermore in the recent past China has conducted “complex drills” with its carrier group and naval aviation in South China Sea that show an increase in crew training and seaworthiness of its fleet (Ruwitch, 2017). The exclusion of China reduces the number of states included in the sample to 26 (Table 2).

COUNTRY	KIRCHBERGER RANK (2013)	COUNTRY	KIRCHBERGER RANK (2013)
Argentina	4	Norway	4
Australia	4	Pakistan	4
Brazil	3	Peru	4
Canada	4	Poland	4
Chile	4	Portugal	4
China	4	Russia	3
Denmark	4	Singapore	4
France	2	South Africa	4
Germany	4	South Korea	4
Greece	4	Spain	3
India	3	Taiwan	4
Italy	3	Turkey	4
Japan	4	United Kingdom	2
Netherlands	4		

TABLE 2: Countries included in the sample

⁴ In general, for example, LNG transport is more advantageous compared to pipeline trading if the transportation distance is more than 3000-4000 km.

Creating a statistical indicator: the Navy Use Index (NUI)

Following the formalization of the working definitions of seapower and middle power it is possible to introduce the theoretical framework of the real core of this paper that is the creation of the quantitative model. The sample of the analysis is composed of 26 worldwide states with blue water navies according to Kirchberger's classification, each of them with different rates of energy dependence from abroad.

As aforementioned in these pages will be discussed only the preliminary findings of the quantitative analysis that shows a correlation between the imports of Liquefied Natural Gas (LNG), the "use of navy" and the relative seapower of the countries included in the sample. The main purpose is to focus the attention of the reader on the methodological approach used to create a statistical indicator that summarize the relative importance that states give to navies and their seapower.

Hence this section aims to identify in a formal way and as objective as possible a measure that can be used to identify the real amount of seapower that a nation has and the relative importance that a state gives to its navy.

Seapower is a very heterogeneous concept that involves several complex elements related to the state (military, foreign policy, economic policy, etc) and to a multitude of others economic and non-economic actors. According to Mahan there are six principal conditions that affect the seapower of nations (2011 [1890]: 16):

- 1) Geographical position;
- 2) Physical conformation, including, as connected therewith, natural productions and climate;
- 3) Extent of territory;
- 4) Number of population;
- 5) Character of the people;
- 6) Character of the government, including therein the national institutions.

The details of his thought will not be explained in these pages, although it seems pretty clear that the elements that Mahan highlighted were very specific of his time and in today globalised world there are much more elements that affect a nation's seapower and the use that a state does of its naval forces. In particular the first four elements are related with some innate features of the state that are more or less hardly variable. The last two, on the contrary, are more flexible and their change can have a direct impact on how a navy is shaped and how the naval forces of this specific state act.

Hence, understanding how the energy dependence from foreign supplies by sea affects the ways through which states use their navies and naval forces, estimating part of their seapower, is a pretty challenging task. Before introducing the methodological approach chosen for creating the statistical indicator that tries to summarize the "use of navy" and the states' seapower, an explanation for the definition of energy dependence is needed.

In this paper will be considered only the net imports of Liquefied Natural Gas (LNG)⁵ that are expressed as a percentage of the total amount of natural gas that each country has to import to satisfies its internal consumption. The period of interest is the decade that goes from 2005 to 2015, the latest year for which the full data on international energy trade are available as of this writing.

The beginning of the XXI century is a very important period for the international trade of LNG due to the significant increase of the volume traded – in particular outside Asia – partly because of the growth of the number of spot and short-term contracts that allowed the market to be more flexible and partly due to the increase of oil price in the world market that forced states to find alternative sources of energy (Clô 2014; Repetto and Gugliotta 2012), so it seems a good choice the year 2005 as the first year of the period of interest for this study. During the years prior the beginning of the XXI century the percentage of the LNG traded was roughly the 5% of the total production compared to almost 30% of the natural gas transported by pipeline (ENI 2006: 229). The volumes were so low – in particular towards the Western countries – that it is not significant to analyse the correlation between the dependence on LNG and the use of naval forces before 2000's, but in the follow-on of this project the historical perspective will be broaden with the addition of oil.

Furthermore the building of warships takes several years, from the funding of the naval program to the commissioning of the new ships, therefore ten years is the minimum period to analyse a potential change in a state's naval policy.

The main source of these data is the *BP Statistical Review of World Energy* – related to 2005 and 2015 – that provides the data needed for all the countries in the sample with some minor exceptions. These missing data are taken from the *ENI World Oil & Gas Review* – related to 2005 and 2015 – and then cross-checked for consistency with the information provided by the International Energy Agency (IEA) and the *U.S. Central Intelligence Agency – The World Factbook*.

All these sources provide data about the LNG internationally traded that is normally transported by sea, even though sometimes exports are by railway. Unfortunately these data are not disaggregated from the main figures, nevertheless these quantities are small⁶ and can be considered negligible. Hence it is assumed that all the LNG imports are transported by sea.

After the formalization of the framework of LNG dependence used in this work, it is needed go back to the beginning of these pages. As part of the initial assumption of this project it is argued that to an higher threshold of energy dependence rate corresponds an higher interest of that state for its naval forces. To demonstrate this assertion a quantitative research on the selected sample of “maritime middle powers” is needed to find a correlation between energy dependence – defined for the purpose of this

⁵ Net LNG imports are calculated as total natural gas use less internal production and imports by pipeline, each measured in Billions of Cubic Metres (bcm).

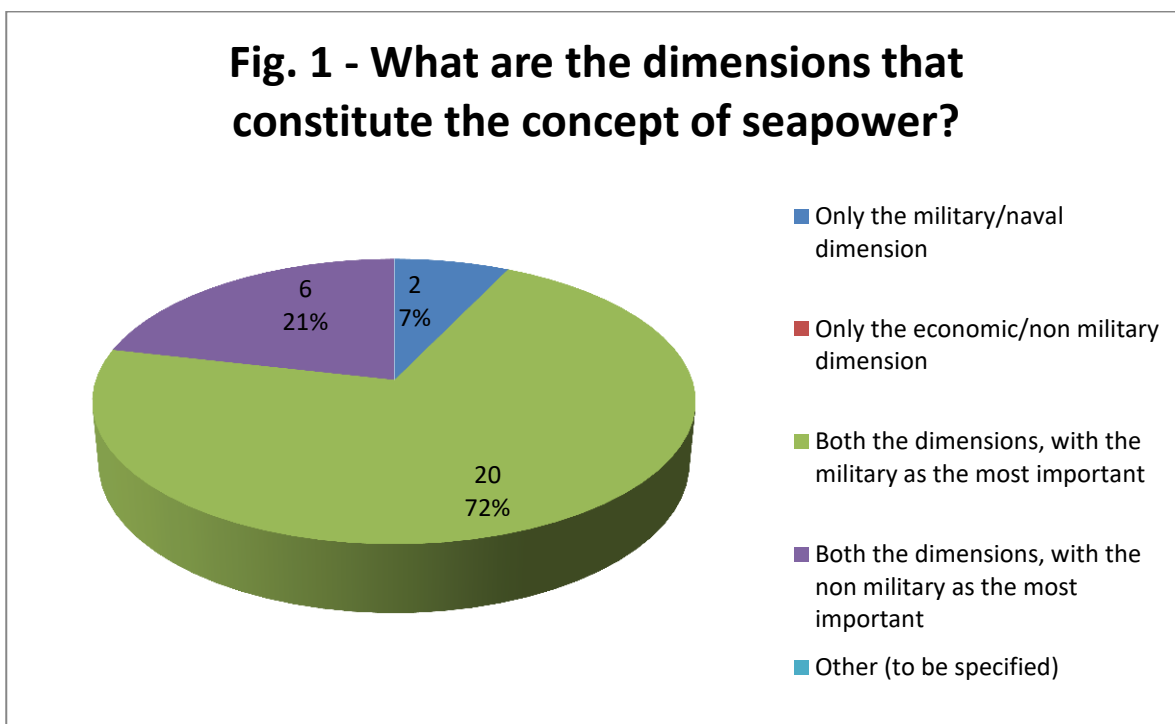
⁶ This information has been provided to the author by the International Energy Agency Statistics Office on December 2nd, 2016 with a written communication.

study as the Independent Variable or Explanatory Variable (EV) – and the Navy Use Index (NUI) – a composite indicator defined as the Dependent Variable (DV).

In order to create the Navy Used Index an online survey among 45 Italian naval officers has been carried out with the aim of identify the single indicators to be included in the index. From the 45 officers who were invited by email, 28 participated in the online survey with a response rate of 62,2%.

The officers, with a seniority in the Italian navy between 12 and 16 years of active duty and in possession at least of a Master’s degree, were invited to answer to several questions in which they had the possibility to indicate the elements they thought were important to highlight the importance for a state of its navy and naval forces.

For the sake of brevity only the results of the two most significant questions will be shown in these pages. In particular they were asked to specify the main dimensions that constitute the concept of seapower (Fig. 1).



The 7% of the officers that have answered to the survey wrote that the only dimension that constitute the seapower of a state is the military-naval dimension, while the 21% of them underlined the importance of both the military and non-military dimensions with a more significant role to the latter.

A striking majority of the 28 officers that accepted to answer the survey (72%) chose to identify the concept of seapower as composed of both the military and the economic dimensions, with the former as the most important. These answers are fully consistent with the working definition of the concept of

seapower adopted in the first pages of this paper that underlines the superior position of the naval dimension within the broad term of seapower.

The fact that naval officers have been asked to identify the aspects that constitute the seapower of a nation and that most of them identified the naval dimension as the most important – although not the only one – can raise some eyebrows for some sort of bias that might exist among the interviewees due to their position and personal background. However, as a correspondence between the answers given in the survey and the working definition of seapower showed at the beginning of this paper⁷ and based on the established academic literature on the issue exists, this worry can be reasonably dismissed.

The second most significant question (Fig. 2) in the survey had the purpose of identify the elements needed to operationalize through a quantitative approach the concept of seapower and the importance of a navy. The officers have been asked to write in the form of short answer a minimum of two and a maximum of four elements that in their opinion are the most useful to quantify the concept of seapower. Clearly, as we are talking about a very complex concept that involves several dimensions and aspects of a state's power, limiting the number of answers that could be given forced the interviewees to rank the elements that they thought were important. As the officers could give more than one answer, this question collected 107 answers, that highlighted different elements with clearly different shades of meaning.

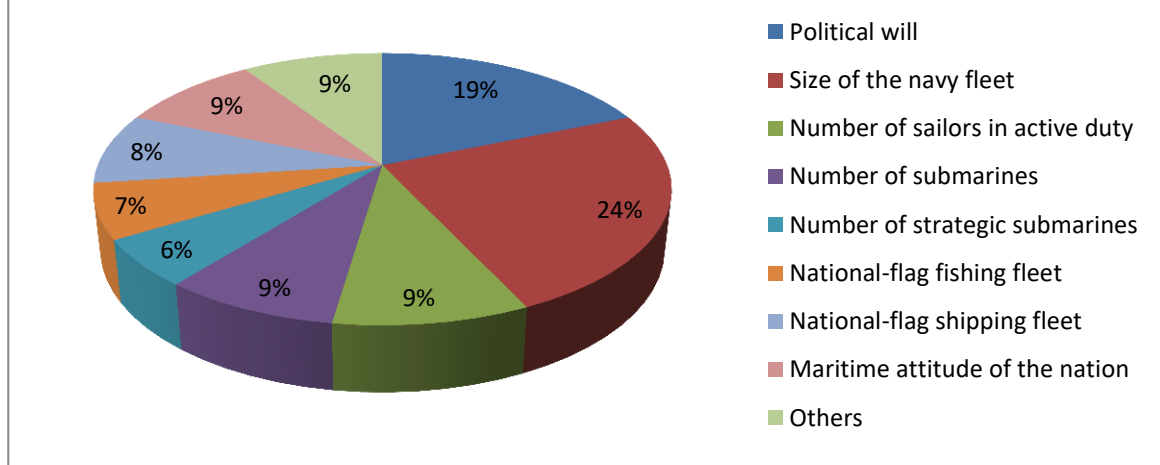
In order to use effectively the answers the author grouped the elements provided by the officers in 8 categories – so if one interviewee wrote the “number of frigates and destroyers” and another officer wrote a more generic “number of warship”, both these answers have been included in the category “size of the navy's fleet”.

All the elements that received less than six answers by the interviewees have been considered less significant by the author and therefore are not specified and have been included in the category labelled “Others”. For example the presence of a national off-shore energy industry has been identified by four officers, therefore it has been included in the category “Others”.

The “political will” – the second most important element according to the survey after the “size of the navy's fleet” and one of the element that in Mahan's view affects the seapower of a state – is an element that is not considered as it's not feasible to operationalize to be included within the index. Furthermore the physical-material hardware (ships, submarines, sailors, etc.) might be considered an effective proxy for “political will” as it could be implied that a state that has a huge number of warships or submarines has a strong “political will” or attitude toward naval affairs.

⁷ The working definition of seapower used in this work has been formalized before the survey, and in particular for the paper presented by the author at the 58th ISA's Annual Convention in February, 2017. The online survey among the Italian naval officers has been conducted in April, 2017.

Fig. 2 - The most important elements to operationalize the concept of seapower and the importance of a Navy



Following the results of the online survey and the unavoidable simplifications introduced by the author in order to use effectively the elements obtained, these are the single indicators used to create the Navy Use Index for every single state in the sample and, with the exception of the last indicator, are all extracted from *The Military Balance 2016* published by the International Institute of Strategic Studies. The classification of the type of ships is provided by IISS as well:

1. Number of Principal Surface Combatants;
2. Number of Submarines;
3. Number of Ballistic Missile Submarines (SSBN);
4. Number of Replenishment Oilers;
5. Number of Patrol and Coastal Combatants per 1000 km of coastline;
6. Percentage of seamen in relation to overall military;
7. Number of seamen per 1000 inhabitants;
8. UN Liner Shipping Connectivity Index.

The principal aims of the NUI are twofold: firstly quantify the operational capabilities of the navies in the sample, operationalizing some complex concepts through the introduction of some methodological simplifications; and secondly, but at the same time, to show the state's consideration for its naval forces compared to other services, highlighting the aspiration of that state to obtain a significant seapower. For these reasons the Navy Use Index doesn't reflect the mere strength or power of every single navy, but tries to provide a picture of both side of a coin simultaneously. On one side the NUI takes into account some material hardware of a navy (number of ships, submarine, etc.), while on the other side it

considers the relative importance given to a particular navy by its state (the number of sailors compared to other services and the number of sailors per 1000 inhabitants can be considered proxies for the naval attitude of that state), without neglecting – in accordance with the working definition provided – the non-military dimension of seapower that in this research is expressed by the United Nations Liner Shipping Connectivity Index.

The methodological choice of selecting the sample of states according to a classification that includes only maritime middle powers could open the door to some selection bias (King, Keohane and Verba 1994: 139-150), having used one key element of seapower – the military dimension – that in the present project is considered an essential part of the dependent variable (DV). However, considering the broad spectrum of every single rank and the much broader spectrum between states included in Rank 2 and states included in Rank 4, the navies considered have very different capabilities and resources (i.e. British navy vs. Peruvian navy) – consequently the DV varies considerable in quantity – and for this reason it might be assumed that the selection process used doesn't introduce any selection bias.

The NUI introduces some simplifications with the subsequent inevitable approximations, but systematic simplifications is a crucial step to useful knowledge (King, Keohane e Verba 1994: 43) and one of the reasons to use an index is that it boils down extensive, complex data into a seemingly understandable summary form (Cooley 2015: 28).

Although the creation of composite indicators and indices is a widespread practice today – Bandura (2005) surveyed 130 indices that rank or assess countries according to some measure in areas such as openness, competitiveness, development and security – there are several drawbacks.

In the literature about indicators there are criticism on the opportunity of aggregating multiple data sources and creating indices, raising questions over the capability of understanding subtle changes or trends in the indicators used at the beginning of the aggregation process (Cooley e Snyder 2015: 182).

Furthermore, the reduction of a complex, multidimensional reality to a single number is admitted by most to be susceptible to criticism (Bhuta, 2015) but is an inevitable step to operationalize the complex concepts of seapower and the “use of navy”. This process introduces some inevitable subjective elements – such as the way to determine weights and aggregation methods and the selection process of the single indicators underlying the NUI itself, even though the survey conducted among experts reduce this specific risk – but this does not necessarily lead to rejection of the validity of composite indicators, as long as the entire process is transparent, clearly assessable and recognizable and allows different researchers to improve the theoretical approach used in creating the index (OECD 2008: 33; Corbetta 2003: 70).

Despite the potential pitfalls of using a composite indicator in showing and explaining complex concepts there are some undeniable pros – such as the capability to summarise complex and multi-dimensional realities in a much easier way than a series of many separate indicators (OECD 2008, Maggino 2006) – that make the development of the NUI very useful.

From a methodological standpoint we can divide the single indicators in only three macro categories: Equipment and Heavy Weapons, Personnel and the last one that includes only the UN Liner Shipping Connectivity Index. This choice is motivated by the fact that choosing too different indicators from each other means that the resulting composite indicator – the NUI in our case – would be very weak in describing the phenomena it purports to measure (Maggino 2006: 109). One important element to be included would have been the part of GDP allocated to the navy compared to other services. Unfortunately this disaggregated figure from the overall military budget it's not provided by the major international organizations or think tanks⁸ and the only way out would have been to dig into the different national budget, an option not feasible for a sample of 26 different states.

EQUIPMENT AND HEAVY WEAPONS:

This section includes the indicators from one to five. The total number of naval units and submarines that a state has is an important element to estimate part of the national seapower and the strength of a navy. Designing a model, as already said, introduces some simplifications such as the fact that in this model is not considered the level of efficiency of the ships or the time spent at sea or on maintenance and the level of training of the crews as well.

In any case these important elements are frequently classified and scarcely assessable in an objective way from an external standpoint. Although it's not considered the mean age of the ships of a navy, and the correlated efficiency – frequently classified as well – the mere quantity provides a proxy indication for the quantity of resources that are devoted to the navy.

The number of Principal Surface Combatants represents the backbone of every fleet and this is the type of unit that are able to conduct operations and activities far from their own shores, such as surveillance, maritime interdiction operations, monitoring shipping routes, etc. well beyond the own EEZ.

The number of SSBN and conventional submarines are two indicators that show an important part of a navy structure. Due to its intrinsic nature submarines are the best means to carry out maritime intelligence activities and sea denial operations, two essential elements of the military dimension of seapower. Furthermore, the presence of a nuclear deterrent has historically increased the national power and the existence of SSBN is an essential part of both national and naval strategies (Kearsley, 2001).

The number of the replenishment oilers is one of the most important indicators chosen in this study because this type of ship allows navies to extend significantly both the range and the capability of conducting prolonged activities at sea, showing a political willingness of the state to have a capable blue water navy. In this count are included only the replenishment oilers classified by IISS as AO (AOR) or AORL, Auxiliary Oiler and Small Auxiliary Oiler respectively.

⁸ In this regard the author had an email exchange with the Stockholm International Peace Research Institute (SIPRI) on November 17th, 2016 and with the Bonn International Center for Conversion (BICC) on November 21st, 2016. The latter publishes the Global Militarization Index.

The fifth indicator shows the importance that the state gives to the control of its own shoreline and territorial waters. In this count are included only ships that belong to the navy, therefore excluding coast guard's naval units or ships that belong to others paramilitary organizations. The coastline of each country is taken from the *U.S. Central Intelligence Agency – The World Factbook*.

All the indicators just mentioned are then normalized using the formula $(x-\text{min})/(\text{max}-\text{min})$, with min and max representing, respectively, the lowest and the highest value among the states of the sample for each category.

PERSONNEL:

The percentage of seamen compared to the overall military manpower is a key element in showing the importance that the navy has for a specific country. In this regard a simplification that can be considered a flaw is that, as already mentioned, it is not considered the mean age of the fleet. Traditionally, older ships are less technologically advanced and, therefore, require a greater number of sailors to be used. Paradoxically, an higher number of seamen could mean older ships and, therefore, a less effective naval force.

Nevertheless, the aim of this indicator is to demonstrate the importance that a state gives to its navy in terms of personnel – and consequently of resources allocated – and therefore the negative effects of this flaw can be reduced.

Similar considerations can be done for the number of sailors per 1000 inhabitants. This indicator has the principal aim of showing the relative importance of navies among the states of the sample revealing one dimension of the “maritime character” of the population. In this regard the presence of the conscription in some states of the sample might introduce some sort of bias, altering the value of the indicator without representing a stronger “maritime attitude” of the nation.

For both the indicators the data are referred only to navy personnel – excluding therefore coast guard sailors or others paramilitaries – and the data about the civil populations and the number of seamen are both taken from *The Military Balance 2016*.

Both the indicators are then normalized using the formula $(x-\text{min})/(\text{max}-\text{min})$, with min and max representing, respectively, the lowest and the highest value among the states of the sample for indicator.

UNITED NATIONS LINER CONNECTIVITY INDEX (UNLCI):

This indicator is developed by the United Nations Conference on Trade and Development (UNCTAD) with the aim of “capturing a country's integration level into global liner shipping networks” and is “based on five components of the maritime transport sector: number of ships, their container-carrying capacity, maximum vessel size, number of services, and number of companies that deploy container ships in a country's ports. For each component a country's value is divided by the maximum value of each component in 2004, the five components are averaged for each country, and the average is divided

by the maximum average for 2004 and multiplied by 100. The index generates a value of 100 for the country with the highest average index in 2004. The underlying data come from Containerisation International Online⁹.

“The necessity of a navy, in the restricted sense of the word, springs, therefore, from the existence of a peaceful shipping, and disappears with it, except in the case of a nation which has aggressive tendencies”

It was a central tenet of Mahan’s thought (2011 [1890]: 14) to stress the importance of the seaborne trade for navies and the non-military dimension of a state seapower and, in this regard, the UNLCI is an important proxy measure. Furthermore, Kirchberger (2015: 63) strongly emphasizes the link between naval and commercial dimensions:

“It seems reasonable to assume, therefore, that the level of integration into world trade is a relatively reliable indicator of a country’s propensity for building highly capable naval forces. This idea was already advocated in the late nineteenth century, when British organizations such as the London Chamber of Commerce held that a country’s naval strength and share of world trade should be directly proportional, and that maintenance costs for a navy were “akin to an insurance premium on the trade to be protected”.

Hence it’s seem reasonable to include the UNLCI within the Navy Use Index in order to take into account the non-military dimension of seapower. To allow the comparison and the aggregation with the other indicators, the UNLCI is normalized using the formula $(x - \min) / (\max - \min)$, with min and max representing, respectively, the lowest and the highest value among the states of the sample.

WEIGHTING:

One of the most debatable issue about composite indices is the weight of the underlying single indicators. Weights can have a significant effect on the overall composite indicator but show the relative importance given to every single indicator by the researcher and, therefore, necessarily involve the introduction of an arbitrary component (Mazziotta and Pareto, 2013).

In order to weight the single indicators the results of the online survey and the approach used by the *Global Militarization Index*¹⁰ published by the Bonn International Center for Conversion have been used

⁹ <http://data.worldbank.org/indicator/IS.SHP.GCNW.XQ> and <http://unctadstat.unctad.org/wds/TableViewer/summary.aspx>, accessed January 3rd, 2017.

¹⁰ <http://gmi.bicc.de/20>

as the main reference but in any case some subjective evaluations have been introduced based on the considerations of the previous pages. Table 3 shows the weight for each indicator:

Number of principal surface combatants	5
Number of submarines	3
Number of ballistic missile submarines (SSBN)	1
Number of replenishment oilers	5
Number of patrol and coastal combatants per 1000 km of coastline	0,5
% Navy manpower in relation to overall military	3
Navy sailors per 1000 inhabitants	1
UN Liner Shipping Connectivity Index	1
Table 3: Indicators and weighting factors	

In order to calculate the final score, the weighted single indicators were added together and table 4 show the ranking of the states in the sample in 2015 and the values of the NUI in 2005:

Rank (as 2015)	Country	NUI (2015)	NUI (2005)	Rank (as 2015)	Country	NUI (2015)	NUI (2005)
1	Singapore	93,05	46,25	14	Brazil	8,35	5,75
2	South Korea	32,30	24,63	15	Germany	8,26	9,70
3	Taiwan	22,72	27,93	16	Italy	7,67	8,15
4	Russia	16,33	16,66	17	Spain	7,11	9,84
5	India	14,35	9,72	18	Argentina	6,97	6,31
6	Japan	11,76	11,90	19	Greece	6,91	5,09
7	Portugal	10,51	10,24	20	Chile	6,84	6,39
8	Pakistan	10,42	6,02	21	Poland	6,35	19,52
9	UK	10,22	8,99	22	Australia	5,59	5,98
10	France	10,05	13,07	23	Canada	4,15	5,36
11	Peru	8,70	9,42	24	Norway	3,42	3,03
12	Netherlands	8,65	6,96	25	Denmark	3,36	6,75
13	Turkey	8,65	8,27	26	South Africa	3,18	7,51

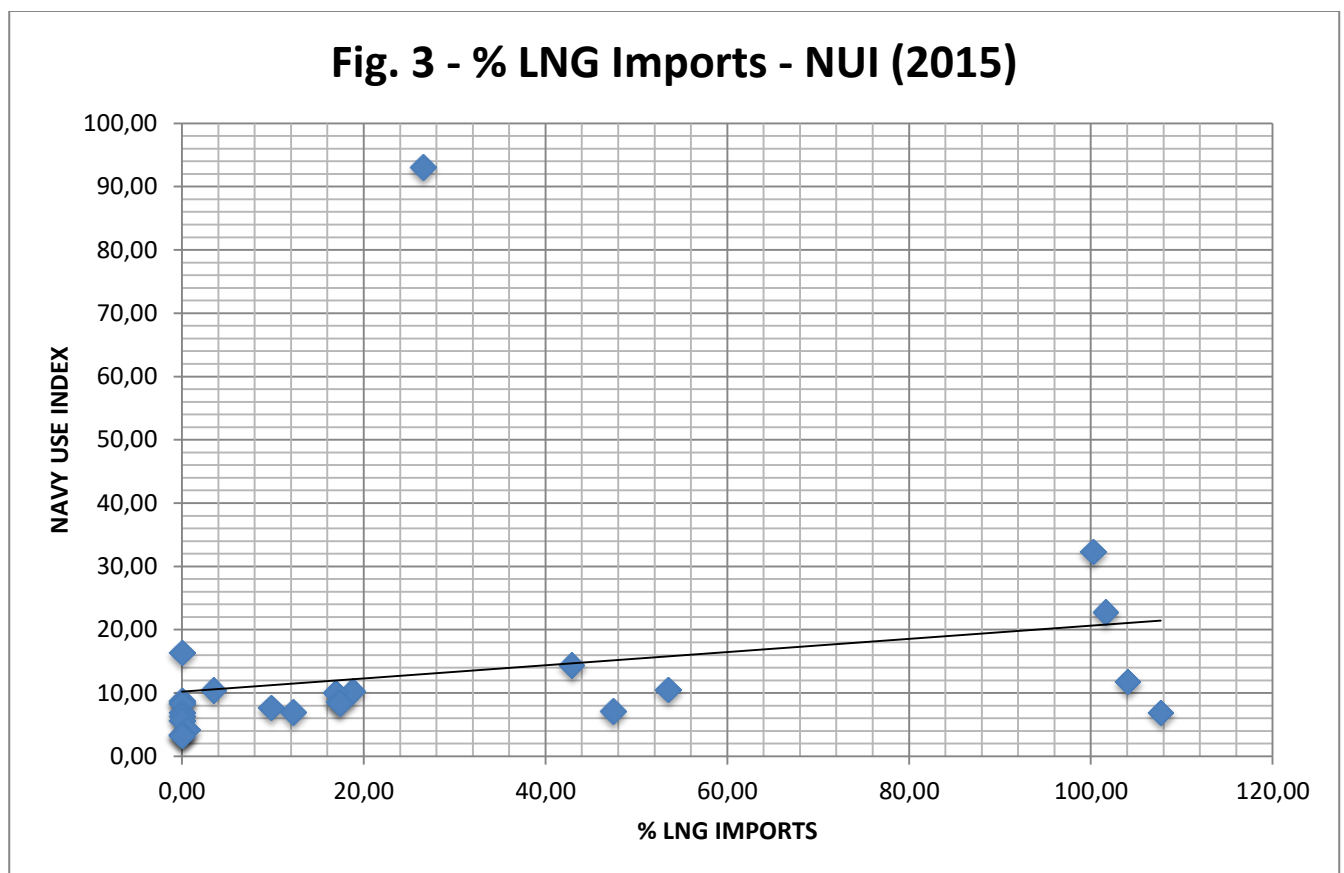
Table 4: Ranking according to Navy Use Index - 2015

Following the NUI values obtained for the selected sample we need to correlate this value with the relative dependence on LNG for every single country and the Pearson's correlation coefficient is the most common correlation coefficient. The scatterplot in figure 3 shows the results in relation to the LNG energy dependence – our Explanatory Variable (EV) – on the X axis and the NUI – our Dependent Variable (DV) – on the Y axis for 2015, while the figure 4 shows the same for 2005.

Both the scatterplots show that the points of the sample cluster around the regression lines fairly regularly, that means that a correlation between our variables might exist. However if we compute the correlation we find a disappointing 0.35 for 2005 and an even more disappointing 0.22 for 2015.

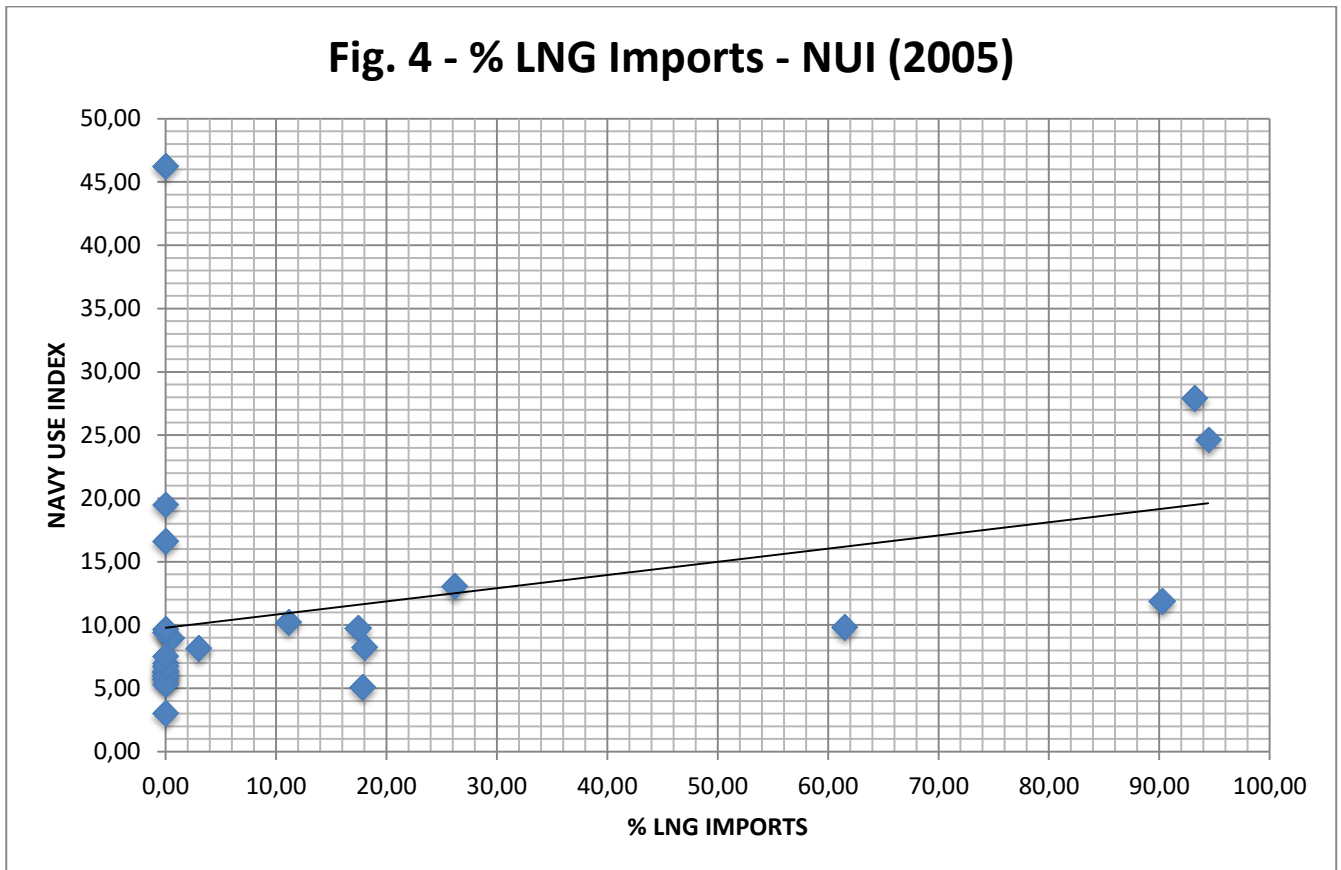
One consideration has to be done. If we look at the graphs we find that the points scatter fairly evenly around the regression lines with the exception of one outlier in the upper part of both the scatterplots, that corresponds to Singapore. This country has a dependence rate on LNG of roughly 25% and a striking value of the Navy Use Index of 93,05 ranking first in the sample in 2015, while in 2005 it has a NUI of 46,25 and virtually no imports of LNG.

If we remove Singapore from the data we find that the remaining 25 points show a correlation of 0.61 in 2015 and 0.68 in 2005 that can be considered according to the literature a “moderate correlation” (Howell 2011, Evans 1995).



But why Singapore is such an outlier and why we should omit the presence of this small city-state of approximately 5.000.000 people? In 2005 Singapore had no imports of LNG and all the natural gas needed was provided by pipeline from Malaysia and Indonesia (ENI 2006: 225), however the government was well aware of the country’s dependence on maritime trade for its economic survival and for this reason had begun years before an ambitious naval programme aimed to the protection of the SLOCs (IISS 2006: 254) that, compared to other states with similar social and economic indicators, was disproportionately large.

Fig. 4 - % LNG Imports - NUI (2005)



Moreover 10 years later according to IISS (2016: 286) Singapore's armed forces are the best equipped in Southeast Asia and they spend alone roughly 3% of the total amount of defence spending in Asia. In the *Global Militarization Index 2016*¹¹ (GMI) Singapore ranks in the 2nd position of 152 countries all over the world after Israel (and ranks in the 1st position in Asia). Furthermore, Singapore is described as a country whose military is equipped with modern weapons systems and is very large considering its total population size (Mutschler 2016: 10).

Another important element that allows Singapore to get the highest values of NUI is the disproportionate number of Patrol and Coastal Combatants (PCC) per 1000 km of coastline. For example in 2015 this indicator has a value of 181,35 – where South Korea, the second in the ranking for this element, has only 48 PCC per 1000 km of coastline. The combination of these aspects makes Singapore a strong outlier and shows the main weakness of the Pearson's coefficient, that is the great effect of the extreme observation that can affect significantly the results about the very existence and the magnitude of the correlation (Howell 2011: 206-208; Wilcox 2005: 383-388). Therefore it seems reasonable to adopt the common practice of discarding the outlier and apply the Pearson's correlation using the remaining data (Wilcox 2016: 215).

¹¹ "The GMI depicts the relative weight and importance of the military apparatus of one state in relation to its society as a whole" from https://www.bicc.de/uploads/tx_bicctools/GMI_2016_e_2016_01_12.pdf accessed on January 4th, 2017.

Another element that emerges from the scatterplots is that some countries import more LNG than their overall internal consumption (i.e. in 2015 South Korea 100,23%, Taiwan 101,63%; Japan 104,06 and Chile 107,69%). This is due to variations in stocks at storage facilities and liquefaction plants, together with unavoidable disparities in the definition, measurement or conversion of gas supply and demand data and, to a smaller degree, to natural gas in transit for other countries (BP 2016: 20-29).

Preliminary Conclusions and Research Developments

A still valid definition of energy security is “to assure adequate, reliable supplies of energy at reasonable prices and in ways that do not jeopardize major national values and objectives” (Yergin 1988: 111).

This is what essentially the United States navy did during the so-called “tankers war” between Iran and Iraq at the end of the 1980’s, contributing to the free flows of oil from the Persian Gulf allowing the re-flagging of international tankers threatened by numerous attacks from the belligerent countries (Karsh, 2002).

This is only one example among many others in which a super power’s navy protected the seaborne trade of energy, but what about middle powers?

The results presented in the previous pages show the existence of a positive moderate correlation in our sample of 25 states – excluding Singapore – between the dependence on natural gas transported by sea and the Navy Use Index of 0,61 in 2015 and 0,68 in 2005.

Even though the Pearson’s correlation coefficient doesn’t indicate, due to its intrinsic nature, a direct causal link between two variables – that means that we can’t be sure that to an higher value of the energy dependence corresponds an higher value of the NUI *because* the former causes an increase in the importance of the navy for that state or that a government wants to pursue an higher level of seapower *because* is dependent on seaborne energy supplies. Furthermore, the results could be driven by the impact of a third (or more) unknown or omitted variables or, in the worst case scenario, this correlation might be completely spurious. In any case it would be hard to affirm that the need to secure and protect seaborne energy imports is the *only* reason for which a state builds and uses its navy. Navies are a mere expression of a nation’s power and the intrinsic nature of the naval instrument – such as the multi-role capabilities – allows decision-makers to use it for a multitude of purposes.

Nevertheless the academic literature on the issue shows that energy security is a key concern for states and navies are one of the main means to protect and assure the free flow of energy supplies from the sea (Kirchberger 2015; Till 2012; Tangredi 2002a; Karsh 2002; Deese 1979).

Furthermore, the preliminary findings of this research could be underestimated due to the well-known phenomenon of free-riding. According to this thought some states, and in particular Western middle powers but even China and several developing countries, spend wittingly less money and allocate less resources to their armed forces in general and navies in particular exploiting the US navy as guarantor of the freedom of navigation – universally acknowledged as a public good – and of the free flow of energy

commodities transported by sea, that for natural gas amounts to more than a third of the total global trade (Chapman and Khanna 2004; Chyong 2016: 42). For Western states this issue is framed within the larger burden-sharing debate that affect NATO and shows a real problem in handling the military spending policy among countries that historically relied on the United States for their defence during the Cold War and now are reluctant to spend more money on their armed forces (Chalmers 2001; Chan 2016). Hence, as of interest, without the free-riding phenomenon we could reasonably expect higher values of the NUI and therefore even an higher correlation between energy dependence and the Navy Use Index.

Some considerations can be drawn about regional differences that emerged from the data. For the sake of brevity only 2015 will be considered – similar conclusions could be done for 2005, even though the volumes of LNG traded were lower – and some elements about these differences are shown in figure 5. As most of the countries included in the sample are in Eurasia (52%) and only 24% are in Asia-Pacific, if we consider the countries that have a NUI value higher than the mean of the sample we find that almost all Asian countries considered are within this category (20%), while only 16% of the Euro-Asian countries have a NUI value higher than the mean of the whole sample¹². This remark assumes a stronger meaning if we consider that the Asia-Pacific region includes the biggest importers of LNG such as Japan, South Korea, China and India (ENI 2016: 74), even though these figures could be affected by the geopolitical tensions in the region that only partly involve energy issues and for this reason a qualitative in-depth analysis has to be carried out in order to better understand these results.

Nevertheless if we look further the data we find that the 16% of Asian countries have a dependence on LNG imports that is higher than the mean of the whole sample compared to only a 8% of the Eurasian countries and to an even more negligible 4% of American countries.

As regards the importance of navies and naval force to protect the Energy Sea Lines of Communication (ESLOC) it is worthy of mentioning the study carried out by Kosai and Unesaki (2016) that formalized a quantitative approach to measure the maritime security related to energy sea routes. Without detailing the process used by the two Japanese scholars¹³, they found that the energy sea routes that involve the Asia-Pacific region – and in particular those that connect Asian countries with oil and gas producers in the Persian Gulf – are the most dangerous in the world (Fig. 6) and this seems to buttress the preliminary hypothesis of this research.

¹² With the term Eurasia it is considered Europe plus Turkey and Russia.

¹³ They used the following indicators to measure the risks of 17 major sea routes: chokepoint risk, piracy risk and ship loss risk.

Fig. 5 - Regional differences (2015)

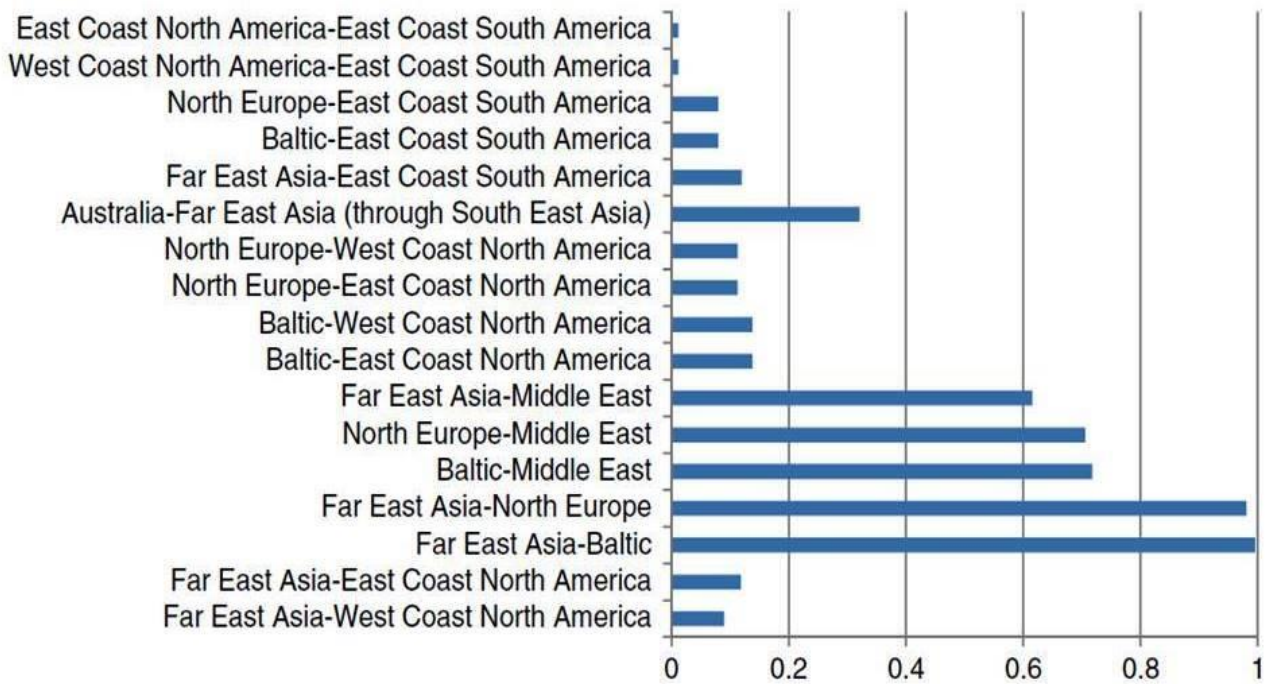
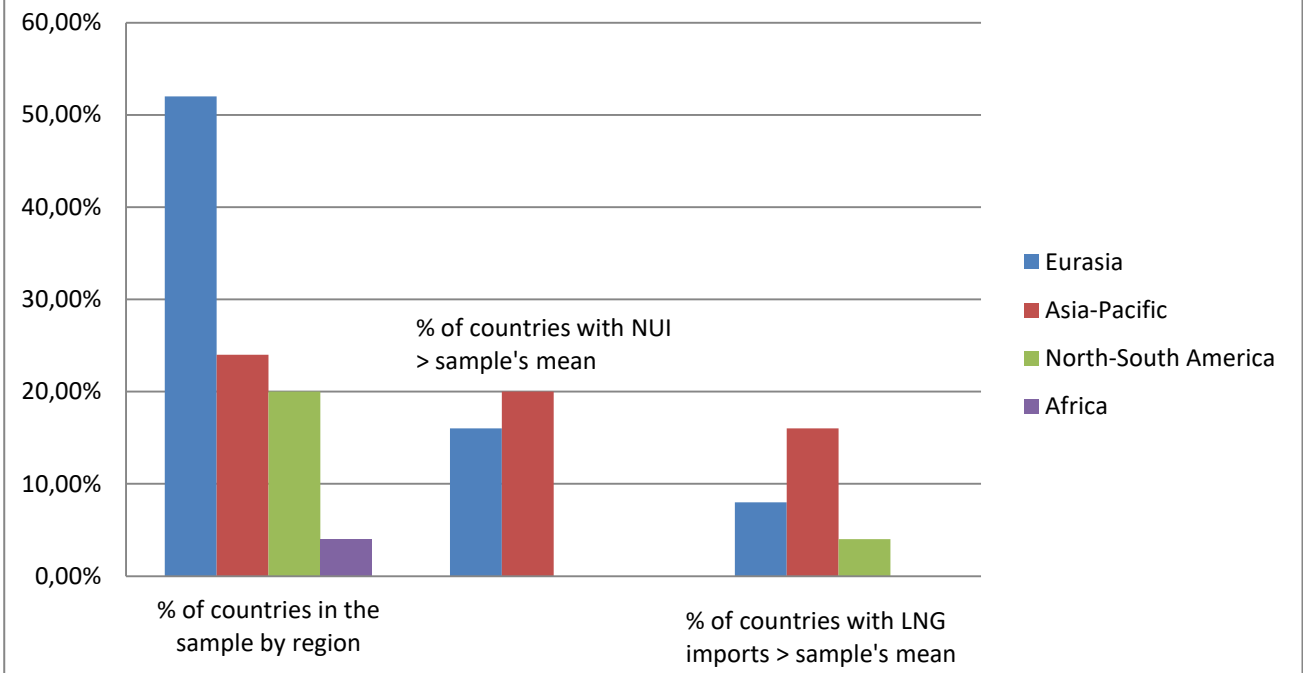


Fig. 6 - Maritime Security Index (MSI): a higher value indicates a worse vulnerability of maritime security.

Source: Kosai and Unesaki (2016) - «*Conceptualizing maritime security for energy transportation security*»

In conclusion, considering the literature on the issue and that the results presented in the previous pages show that this correlation might be real, it's worthwhile to analyse further the likely causes to better understand the theoretical link between the energy dependence and the use of navy.

In the follow-up of the project the analysis will be extended and deepened, alongside the natural gas, to crude oil imports by sea, studying if some differences between these two commodities exist and how states behave, broadening the perspective – in particular for oil – to an even wider historical standpoint. Finally, a qualitative analysis will try to explain the results obtained in the quantitative part, analysing selected case-studies in order to understand how their navies operate and act in relation to their country's energy security policy, trying to provide the answers to the research questions of this project.

Bibliography

Bandura, Romina (2005), *Measuring Country Performance and State Behaviour: A Survey of Composite Indices*, Background Paper, New York, Office of Development Studies – United Nations Development Programme.

Bhuta, Nehal (2015), *Measuring stateness, ranking political orders: Indices of state fragility and state failure*, in Cooley Alexander e Snyder Jack (2015) ed., *Ranking the World*, Cambridge, Cambridge University Press, Ch. 4.

BP (2006), *Statistical Review of World Energy*, London, BP.

BP (2015), *Statistical Review of World Energy*, London, BP.

BP (2016), *Statistical Review of World Energy*, London, BP.

Chalmers, Malcolm (2001), *The Atlantic burden-sharing debate – widening or fragmenting?*, in “International Affairs”, Vol. 77 nr. 3, 569-585.

Chan, Sewell (2016), *Donald Trump’s Remarks Rattle NATO Allies and Stoke Debate on Cost Sharing*, in “The New York Times” online, July 21, 2016, accessed January 2nd, 2017.

Chyong, Chi-Kong (2016), *On the Future of Global LNG Trade and Geopolitics*, in Colombo S., Harrak M. El, Sartori N. (2016) ed., *The Future of Natural Gas*, Hof van Twente, European Energy Review, Ch. 2.

Chapman Duane e Khanna Neha (2002), *An Economic Analysis of Aspects of Petroleum and Military Security in the Persian Gulf*, in “Contemporary Economic Policy”, Vol. 19 nr. 4, 371-381.

Chapman Duane e Khanna Neha (2004), *The Persian Gulf, Global Oil Security and International Security*, Working Paper 2004-15, Ithaca, Department of Applied Economics and Management – Cornell University.

Clô, Filippo (2014), *Il gas naturale liquefatto: evoluzione di un mercato sempre più globale*, in Verda (2014) a cura di, *Energia e geopolitica*, Milano, Istituto per gli Studi di Politica Internazionale, Ch. 7.

Cooley Alexander e Snyder Jack (2015) ed., *Ranking the World*, Cambridge, Cambridge University Press.

Cooley, Alexander (2015), *The emerging politics of international rankings and ratings: A framework for analysis*, in Cooley e Snyder (2015) ed., *Ranking the World*, Cambridge, Cambridge University Press, Ch. 1.

Cooper Andrew and Mo Jongryn (2013), *Middle Power Leadership and the Evolution of G20*, in “Global Summitry Journal, Vol. 1, 1-14.

Corbetta, Piergiorgio (2003), *Social Research: Theory, Methods and Techniques*, London, SAGE Publications.

Danish Government (2010), *An Integrated Maritime Strategy*, Copenhagen, Danish Maritime Authority.

- Deese, David A. (1979), *Energy: Economics, Politics and Security*, in “International Security”, Vol. 4 nr. 3, 140-153.
- Dong-Min, Shin (2015), *A Critical Review of the Concept of Middle Power*, in <http://www.e-ir.info/2015/12/04/a-critical-review-of-the-concept-of-middle-power/>, accessed November 23rd, 2016.
- Dutch Government (2015), *The Dutch Maritime Strategy 2015-2025*, The Hague, Directorate for Maritime Affairs.
- ENI (2006), *World Oil & Gas Review 2006*, Rome, ENI Spa.
- ENI (2008), *World Oil & Gas Review 2008*, Rome, ENI Spa.
- ENI (2016), *World Oil & Gas Review 2016*, Rome, ENI Spa.
- Evans, James D. (1995), *Straightforward Statistics for the Behavioural Sciences*, Forest Lodge, Brooks/Cole Publishing.
- Giacomello Giampiero and Verbeek Bertjan (2011) ed., *Italy's Foreign Policy in the Twenty-First Century*, Plymouth, Lexington Books.
- Gorshkov, Sergei G. (1976), *The Sea Power of the State*, Oxford, Pergamon Press.
- Holbraad, Carsten (1984), *Middle Powers in International Politics*, London, Macmillan Press Ltd.
- Howell, David C. (2011), *Fundamental Statistics for Behavioural Sciences*, 7th Ed., Belmont, Wadsworth.
- International Institute for Strategic Studies – IISS (2006), *The Military Balance*, London, Routledge.
- International Institute for Strategic Studies – IISS (2016), *The Military Balance*, London, Routledge.
- Kane Thomas M. and Lonsdale David J. (2012), *Understanding Contemporary Strategy*, Oxon, Routledge.
- Karsh, Efraim (2002), *The Iran-Iraq War 1980 – 1988*, Oxford, Osprey Publishing.
- Kearsley, Harold J. (2001), *Il potere marittimo ed il XXI secolo*, Roma, Edizioni Forum di Relazioni Internazionali.
- King Gary, Keohane Robert O. and Verba Sidney (1994), *Designing Social Inquiry*, Princeton, Princeton University Press.
- Kirchberger, Sarah (2015), *Assessing China's Naval Power*, Berlin, Springer Publisher.
- Kosai Shoki and Unesaki Hironobu (2016), *Conceptualizing maritime security for energy transportation security*, in “Journal of Transportation Security”, Vol. 9 nr. 3, pp. 175-190.
- Kynge, James et al. (2017), *How China rules the waves*, January 12th, 2017, <https://ig.ft.com/sites/china-ports/>, accessed January 18th, 2017.
- Lieberman, Evan S. (2005), *Nested Analysis as a Mixed-Method Strategy for Comparative Research*, in “American Political Science Review”, Vol. 99 nr. 3, 435-452.

- Maggino, Filomena (2006), *Gli indicatori statistici: concetti, metodi e applicazioni*, Firenze, https://flore.unifi.it/retrieve/handle/2158/328151/7940/ASTRIS_6_-_Gli_Indicatori_Statistici_-_concetti%20c_metodi_e_applicazioni.pdf, accessed November 18th, 2016.
- Mazziotta Matteo and Pareto Adriano (2013), *Methods for Constructing Composite Indices: One for All or All for one?*, in “Rivista Italiana di Economia, Demografia e Statistica”, Vol. LXVII nr. 2, 67-80.
- Mazziotta Matteo and Pareto Adriano (2016a), *Methods for Constructing Non-Compensatory Composite Indices: A Comparative Study*, in “Forum for Social Economics”, Vol. 45 Nr. 2, 213-229.
- Mazziotta Matteo and Pareto Adriano (2016b), *On a Generalized Non-compensatory Composite Index for Measuring Socio-economic Phenomena*, in “Social Indicators Research”, Vol. 127, 983-1003.
- Mahan, Alfred T. (2011 [1890]), *The Influence of Sea Power Upon History, 1660-1783*, Kindle Edition.
- Mutschler, Max M. (2016), *Global Militarization Index 2016*, Bonn, Bonn International Center for Conversion.
- OECD (2008), *Handbook on Constructing Composite Indicators*, Paris, OECD Publishing.
- Repetto Gian Paolo and Gugliotta Agata (2012), *Mercato internazionale del GNL: recenti dinamiche dei prezzi spot e dei rapporti domanda/offerta*, in “Newsletter del GME”, nr. 52 agosto, pp. 30-33.
- Ruwitch, John (2017), *China Navy confirms carrier conducted drills in South China Sea*, January 3rd, 2017, <http://www.reuters.com/article/us-southchinasea-china-navy-idUSKBN14N01D>, accessed January 3rd, 2017.
- Sakhuja, Vijay (2011), *Asian Maritime Power in the 21st Century: Strategic Transactions*, Singapore, ISEAS Publishing.
- Tangredi, Sam J. (2002a) ed., *Globalization and Maritime Power*, Washington D.C., NDU Press.
- Tangredi, Sam J. (2002b), *Globalization and Sea Power: Overview and Context*, in Tangredi Sam J. (2002a) ed., *Globalization and Maritime Power*, Washington D.C., NDU Press, Ch. 1.
- Till, Geoffrey (2009), *Sea Power: A guide for the Twenty-First Century*, 2nd ed., London, Routledge.
- Till, Geoffrey (2012), *Asia's Naval Expansion*, London, International Institute for Strategic Studies.
- Todd Daniel and Lindberg Michael (1996), *Navies and Shipbuilding Industries: The Strained Symbiosis*, Westport, Praeger.
- U.S. Department of the Navy (2007), *A Cooperative Strategy for 21st Century Seapower*.
- U.S. Department of the Navy (2015), *A Cooperative Strategy for 21st Century Seapower*.
- Valigi, Marco (2014), *Le medie potenze. Una questione teorica aperta*, in “Quaderni di Scienza Politica”, Nr. 2 Anno XXI Sept., 89-108.
- Van Evera, Stephen (1997), *Guide to Methods for Students of Political Science*, New York, Cornell University Press.
- Verda, Matteo (2014) a cura di, *Energia e geopolitica*, Milano, Istituto per gli Studi di Politica Internazionale.

Wilcox, Rand R. (2005), *Introduction to Robust Estimation and Hypothesis Testing* 2nd Ed., Burlington, Elsevier Academic Press.

Wilcox, Rand R. (2016), *Comparing dependent robust correlation*, in “British Journal of Mathematical and Statistical Psychology”, Vol. 69, 215-224.

Yergin, Daniel (1988), *Energy Security in the 1990s*, in “Foreign Affairs”, Vol. 67 nr. 1, 110-132.