UNIVERZITA KARLOVA V PRAZE

FAKULTA SOCIÁLNÍCH VĚD

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Applicability of Systemic Approach to the Analysis of Geostrategic Importance of a Transborder Region: the Arctic Case

Disertační práce

Praha 2016

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Datum obhajoby: **Září 2016**

Bibliografický záznam

VALKOVÁ, Irena. *Applicability of Systemic Approach to the Analysis of Geostrategic Importance of a Transborder Region: the Arctic Case*. Praha, 2016. Disertační práce. Univerzita Karlova. Fakulta sociálních věd. Institut politologických studií. Katedra politologie. Vedoucí práce PhDr. Michael Romancov, Ph.D.

Anotace (abstrakt)

Cílem této disertační práce je představení nového přístupu k empirické a systémové geopolitické analýze již probíhajícího teritoriálního sporu v Arktidě, tykajícího se snahy dvou států, Dánska a Ruska, o rozšíření hranic svých výlučných ekonomických zón do centrální části Arktického oceánu. Tento přístup zahrnuje do sebe spojení geografické, právní a politologické analýzy s kvantitativní výzkumnou metodologií a ve výsledku představuje mezioborovou studii. Rovněž nabízí empirické poznatky o dlouhodobém sociálně-geografickém vývoji v regionu (1993-2013) a uvádí faktografické údaje o zisku či ztrátě území každého z účastníků konfliktu, plynoucí z různých verzí finální podoby řešení daného sporu. Kolísání souhrnné sociálně-geografické moci každého účastníka konfliktu v důsledku manipulace geografickou moci v centrálním Arktickém oceánu slouží jako základ pro odvození klíčových odměn, plynoucích z každého alternativního řešení daného teritoriálního sporu. Tyto odměny jsou zavedeny do grafického modelu řešení konfliktu o třech hráčích (Dánsko, Rusko, Svět). Na základě různých kombinací strategií účastníků sporu jsou pak navrhnuta možná stabilní řešení, jejichž optimalita je taky posouzena. Dále jsou představeny alternativní scénáře budoucího strategického vývoje nejsevernějšího regionu na základě výsledků koaliční analýzy, včetně podmínek pro jejich nejpravděpodobnější uskutečnění.

Abstract

The purpose of this dissertation is to demonstrate a new empirical and systemic geopolitical approach to the study of the ongoing territorial dispute in the Arctic resulting from the desire of two nation states, Denmark and Russia, to extend their own northernmost limits of the Exclusive Economic Zone to the central part of the Arctic Ocean. This approach combines geographic, legal and political analytical perspectives with quantitative research design to produce an inter-disciplinary study. Empirical evidence on the long-term socio-geographic development in the region (1993-2013) is provided together with information on particular territorial gains and losses for all decision-makers that arise in a number of potential scenarios (options). Variation in each decision-maker's aggregate national socio-geographic resource, as implied by particular

territorial modifications in the central part of the Arctic Ocean, serves as a basis for derivation of nontrivial payoffs on each option in the dispute. These payoffs are introduced into a three-player graph model for conflict resolution (Denmark, Russia, and the World) and stable dispute solutions are suggested on the basis of different combinations of decision-makers' strategies, whose optimality is evaluated as well. Finally, alternative scenarios of future strategic developments in the region are suggested on the basis of coalition analysis, including the conditions under which their realization appears to be the most probable.

Klíčová slova

Arktida, empirická geopolitická analýza, kontinentální šelf, výlučná ekonomická zóna, mořské právo, Rusko, Dánsko

Keywords

The Arctic, empirical geopolitical analysis, continental shelf, Exclusive Economic Zone, law of the sea, Russia, Denmark

Prohlášení

Prohlašuji, že jsem předkládanou práci zpracovala samostatně a použila jen uvedené prameny a literaturu.

V Praze dne 11. 07. 2016 Irena Valková

Contents

Abbreviations

AC	Arctic Council
AMAP	Arctic Monitoring and Assessment Programme
BEAC	Barents Euro-Arctic Council
CAN	Canada
CINC	Composite Index of National Capability
CLCS	Commission on the Limits of the Continental Shelf (United Nations)
CNP	Comprehensive National Power (Japan, China)
CS	Continental shelf
DNK	Denmark
EEZ	Exclusive Economic Zone
EU	European Union
FIN	Finland
FTA	Free Trade Area
GIS	Geographic Information System
GMCR	Graph Model for Conflict Resolution
GMR	General metarationality
IBRU	International Border Research Unit
ISA	International Seabed Authority
ISL	Iceland
ITLS	International Tribunal for the Law of the Sea
LAEA	Lambert azimuthal equal-area projection
NATO	North American Treaty Organization
NAFTA	North American Free Trade Area
nm	nautical miles
NOR	Norway
NORDCAPS	Nordic Coordinated Arrangement for Military Peace Support
NORAD	North American Aerospace Defense Command
NSI	National Security Index (India)
OLCS	Outer Limits of the Continental Shelf
R	Individual rationality (Nash)
RUS	Russian Federation
SEQ	Sequential stability
SMR	Symmetric metarationality
SWE	Sweden
TPR	Trans-Polar Route
LOS Convention	United Nations Convention on the Law of the Sea
USA	United States of America

Figures and tables

Preface and Acknowledgements

"As Napoleon said, to know a nation's geography is to know its foreign policy"
— Robert D. Kaplan.[1]

This research is motivated by a number of puzzles. First, is the recent desire of Denmark and Russia to extend own continental shelf in the Central Arctic Ocean really threatens altering the existing world balance of power, or all warnings on the catastrophic implications of the so-called 'new scramble for the Arctic' that frequently appear in mass media channels are mere exaggerations? Second, if formal, game theoretical modeling is to be applied to the search of solutions to this potential dispute, is there any objective way to obtain concrete values of the decision-makers' payoffs, i. e. make this information much less speculative, given the fact that no Arctic claimant state has provided a concrete value of its claimed area in sq km (for an unknown reason)? Third, could such a conflict have any solutions that would be acceptable to all parties, to two claimant states and the rest of international community?

The purpose of this dissertation is to introduce a new empirical and systemic geopolitical approach to the study of an ongoing territorial dispute in the Central Arctic Ocean. This new methodology combines geographic, legal and political analytical perspectives with quantitative research design in order to offer a truly inter-disciplinary study. Empirical evidence on the long-term socio-geographic development in the region (1993-2013) is provided together with information on particular territorial gains and losses for three decision-makers (Denmark, Russia, and the rest of international community) that arise in a number of potential alternative dispute resolution options. Variation in each decision-maker's aggregate socio-geographic resource, as implied by particular territorial modifications in the central part of the Arctic Ocean, serves as a basis for derivation of nontrivial payoffs on each option in the dispute. These payoffs are introduced into a three-player graph model for conflict resolution and stable dispute solutions are suggested based on different combinations of decision-makers' strategies, whose optimality is evaluated as well. Finally, alternative scenarios of future strategic developments in the region are suggested on the basis of rational coalitions among the decision-makers and conditions under which their realization appears to be the most probable are offered.

[1] KAPLAN, Robert D. *The Revenge of Geography: What the Map Tells Us about Coming Conflicts and the Battle Against Fate*. New York: Random House Trade Paperbacks, 2012; p. 60.

This dissertation should be of interest to high-level decision-makers in Denmark, Russia and all other countries of the world interested in the Arctic politics, as well as in the EU and NATO. It should also be of interest to scholars of geopolitics and political geography, social polar research, and international negotiation and decision analysis.

This research was supported, in part, by the Specific Academic Research Project 265502 (*Problems of the Legitimacy of Political Decision-making at the Beginning of the 21st. Century*), Specific Academic Research Project 260230 (*Changes and Impacts of Political Institutions*), and Research Project 122215 (*Positions within the Arctic Geopolitical System: Social Network Analysis of Exchanges in Economic, Military and Socio-demographic Spaces*) funded by the Charles University Grant Agency (2015/2016).

A number of individuals has influenced my thinking on geopolitical analysis and thus contributed importantly to this research. I wish to thank specifically my academic supervisor, Michael Romancov, for active guidance, hours of interesting discussions and lots of patience; Konstantin Plokhotnikov, for inspiration and continuous training in applied statistical analysis; Natálie Rajnochová, for linguistic support; Petr Kohoutek, for realization of cartographic part of analysis in the Geographic Information System; Jan Kofroň for critical evaluation of all stages of research; Rami Kinsara, Oskar Peterson, Keith Hipel and Marc Kilgour, for *GMCR+* that makes possible an intuitive and user-friendly modeling of complicated, multi-player and multi-strategy interstate conflicts; and Gyula Csurgai, for a brilliant introduction to geostrategic analysis that caught me so much to become my perception and understanding of geopolitics as both science and art of statecraft.

There are also many from whom I had the honor to learn from: Martin Riegl, Leonhardt van Efferik, Bořívoj Hnízdo, Markéta Žídková, Jakub Landovský, Michal Parízek, Hrishabh Sandilya, Nuno Albino Morgado, Bohumil Doboš and Vlastimil Bernas, to name a few, and the whole team of the Department of Political Science, Institute of Political Studies of the Faculty of Social Sciences, Charles University in Prague, for the constant intellectual and material support.

I also thank my husband and my son for love, patience and faith in my work.

The analysis, views and interpretations presented here are the sole responsibility of the author and do not necessarily reflect the views of the abovementioned experts, nor do they represent the official position of Institute of Political Studies, Faculty of Social Sciences, Charles University in Prague.

Irena Valková

Prague, 2016

Introduction

The Arctic region occupies a unique place within the system of international relations. First, the unprecedented and continuously increasing rate at which the polar multiyear ice has been melting is one of the stable characteristics of the beginning of the twenty-first century. Second, together with the Antarctic, it has been a 'no man's land' for most of human history and, because it is yet to emerge as an international region, the effect of historical and symbolic factors is minimal. Third, besides Japan, all major global players located in the Northern Hemisphere are active participants to the intraregional political discourse. Fourth, the region is rich in living and non-living natural resources, from abundant fish stock and approximately 10 per cent of the world freshwater, to substantial hydrocarbon reserves available for surveying, mining, and exporting. Fifth, the region's relative location on the world map implies a buffer position between the main rivals of the Cold War and the commercial efficiency of the polar sea routes (the Northwest Passage, the Northern Sea Route, and, in the long-term, the Transpolar Route). Finally, several decades ago the strategic role of the region in global politics started to change. While it had been an exclusively military-strategic location within the bipolar system of international relations, today the 'attractiveness' of the Arctic to the global community is defined, additionally, by its socio-economic potential.

Within the so-called 'Arctic Eight' group[2] two states, Denmark and Russia, have explicitly expressed their intentions to extend their own jurisdiction over vast areas of the central part of the Arctic Ocean. Both states have ratified the United Nations Convention on the Law of the Sea (the LOS Convention) and both have already submitted their territorial claims over international waters above their extended continental shelves in the Arctic and provided specific coordinate points delimiting the area, to the United Nations

[2] Canada, Denmark, Finland, Iceland, Norway, Russia, Sweden and the United States – countries whose land and/or water territories actually lie within the Arctic Circle.

Commission on the Limits of the Continental Shelf (CLCS). However, Denmark and Russia are not alone in 'turning their attention northward'. Being part to the Convention, Canada has submitted its own claim on the basis of an extended continental shelf, but the submitted text provides coordinate points only in the Atlantic Ocean, not in the Arctic. It is explicitly stated that specification of the claimed area in the Arctic would be made in a short time (to date, it still has not been made). The United States, the fourth state whose potential claim in the Arctic Ocean is routinely replicated in political maps delimiting the sovereignty claims in the Central Arctic Ocean by a range of cartographic agencies[3] and news channels,[4] have not yet ratified the LOS Convention and, therefore, in legal terms, cannot submit any claims to the CLCS.

On the one hand, these claims overlap in two areas contingent to the geographic North Pole – the one where the Danish claim intersects with the (potential) Canadian claim, and another, much larger area, where the Danish claim overlaps with the Russian claim. On the other hand, if we turn to the dialogue between these countries and the international community (the rest of the 'Arctic Eight' group, more than twenty non-Arctic states that which have indicated their readiness to participate in regional politics, and that part of mankind that is not yet interested in the northernmost region) regarding the level of satisfaction of the latter with a prospect of the annexation of the last unexploited part of the world ocean by only two (or, potentially, four) countries, the stakes are high. Some provocative military maneuvers have already taken place, leaving the major regional actors puzzled by a fundamental question: *Who has the right to exploit the Central Arctic Ocean?*

For its significant part, the current international legal framework, the LOS Convention (1982), provides a clear answer to this question: a state's sovereignty decreases with increasing distance from the coast so that no country may unilaterally exploit natural resources beyond 200 nautical miles (nm) from the baseline. However, if a coastal state provides sufficient evidence that the claimed area is sea above, and contigeous to, the 'submarine ridge', it has the right, given a positive recommendation from CLCS, to draw a new maritime border line that would be exactly 350nm from the baseline, according to Paragraph 5 of Article 76 of the LOS Convention. But Paragraph 6 of the same article states that if the claimed area is above, and contiguous to, the 'submarine elevation', the

[3] Among others, Map of Arctic sovereignty claims [online]. *IBRU*, 2015 [accessed 2016-02-23]. Available at: https://www.dur.ac.uk/ibru/resources/arctic.
[4] Among others, Denmark challenges Russia and Canada over North Pole [online]. *BBC*, 2014 [accessed 2016-01-04]. Available at: http://www.bbc.com/news/world-europe-30481309.

delimitation may not fall under the limit of 350nm from the baseline. Thus, in legal terms, in order to extend one's own jurisdiction over the Arctic international waters beyond 350nm from the baseline, both Denmark and Russia must provide evidence that the Lomonosov ridge and the Alpha-Mendeleev ridge are submarine elevations. To make things even more complicated, the final decision on the maritime boundary is still left to the claimant state, and the latter decides to move seaward its own maritime borders either in accordance with, or contrary to (following a 'do-it-alone' strategy), the recommendation of the CLCS. Therefore, although public international law provides a framework for regional dispute resolution, it is still unable to accommodate situations in which the decision-makers take unilateral action.

The Arctic claimant states are heterogeneous in their objective and subjective power characteristics. They benefit from different degrees of available social resources (such as military and economic strength), geographic resources (such as land- and sea area, climate and compactness of territory) and symbolic resources (such as the power of historical connection to the particular region) while forming their strategies in the confrontational game over the limits of their northernmost sovereignty. Because this conflict might be resolved both peacefully or by force, it is important to know all the stable resolutions. One way to do so is to derive the decision-makers' dispute preferences from fluctuations in their socio-material and geographic resources as implied by the changing strategic environment. *Is there any definite and stable solution, or is the Arctic destined to become an area of continuous interstate struggle?* The vast research on the polar problematic, whose presence in (geo)political literature has almost tripled in the last decade,[5] does not provide a clear answer to this question.

Apart from a series of issue-specific institutional reports, most scientific works incorporate either the actor-specific perspective or a theme-specific perspective in search of the causes and consequences of territorial conflict in the region. In both cases, the results either highlight the diversity of polar geography (Dowdeswell and Hambrey 2002, Woodford 2003, Stein 2008), or describe the evolution of Arctic regional cooperation (Chaturvedi 1996, Koivurova 2009, Exner-Pirot 2012, Hough 2013), or summarize the expected geopolitical effects from the changing environment (Anderson 2009, Chapman 2011, Ostreng et al. 2013). At the same time, numerous textbooks on regionalism still do not offer a hint of how to understand the heterogeneity in state aggregate capabilities

[5] Based on the average appearance of 'Polar-' and 'Arctic-'/'Antarctic-' and 'Geopolitics' in Jstor, WoS and Questia platforms in 1990, 2000, and 2010.

among the Arctic actors in their intraregional strategies. Apart of a comprehensive empirical introduction to the functioning of the Arctic geopolitical system by Knell (2008), draft scenarios of the region's development in the near future by Brigham (since 2007), and three applications of game theory to regional geopolitics by Cole, Izmalkov and Sjöberg (2014), a rigorous attempt to combine these issues – such as deducing the Arctic actors' regional policy preferences from fluctuations in their socio-geographic power base, and using these preferences to systematize the strategic dispute resolution – is still missing in the literature.

This study contributes to the ongoing geopolitical and political geographic research and polar studies in several distinct ways. First, we link geographic, legal and political analytical perspectives with quantitative research methodology to produce a truly inter-disciplinary study. Second, we provide empirical evidence on the long-term socio-geographic development in the region (1993-2013) and on particular territorial gains and losses for all decision-makers produced in different potential dispute resolution options. We do so by deriving the value of the payoff for each decision-maker and each option in the dispute from the variation in the former's aggregate national resources as implied by particular territorial modifications in the central part of the Arctic Ocean. Third, we search for stable dispute resolutions based on different combinations of decision-makers' strategies, and evaluate whether these solutions are optimal under all definitions of multi-participant dispute stability. Fourth, we search for rational coalitions among the decision-makers. Finally, we suggest alternative scenarios of future strategic developments in the region and conditions under which their realization appears to be the most probable.

At the theoretical level, we evaluate the general contribution of a systemic, positivist and quasi-experimental research design in neoclassical geopolitical and political geographic analysis and demonstrate its effectiveness on the study of the ongoing northernmost territorial dispute. We search for dynamic elements in the complex regional geopolitical system and use them as structural foundations in the strategic analysis of the current geostrategic situation and when developing alternative scenarios for the future development. After describing the way in which the decision-makers define their preferences in the territorial conflict, we evaluate the impact of geography on their aggregate socio-material power base. By doing so, we are able to understand whether it is rational for the decision-makers to escalate and depart from the status quo and to assess feasibility of all dispute resolutions these decision-makers are confronted with. Finally,

we explain the benefits of deriving rational coalitions between the decision-makers from strategic dispute resolution modeling.

This work implies a two-stage analysis. First, we identify the major Arctic decision-makers, the situations that these decision-makers are confronted with, and their aggregate power base. Next, we derive the value of each decision-maker's dispute payoff from each situation from the variation in this power base due to particular territorial changes in the region. Second, we model the northernmost territorial conflict by determining the optimal solutions and suggesting the potential rational alliances among the decision-makers.

The manuscript is structured as follows. In Chapter One, we define, geographically and legally, the international waters in the Arctic, summarize the potential gains that motivate the Arctic actors to attempt to change status quo, systematize the northernmost territorial dispute in terms of three essential strategic conflict resolution parameters (decision-makers, options and decision-makers' preferences over options), and present the research aims, questions and testable hypotheses. Chapter Two is theoretical; after presenting the ongoing research of the Arctic in classic and contemporary theory of geopolitics, we turn to game-theoretic treatment of the polar dispute, the formation of the decision-makers' preferences on the basis of their aggregate socio-geographic resources, and the contribution of systemic and quasi-experimental modeling to the neoclassical geopolitical and political geographic analysis of territorial disputes. The attention then shifts to individual parameters of the state power index and evaluation of the response of the latter to geographic manipulation resulting from alternative dispute resolutions.

Chapters Three and Four provide the empirical tests for the logic suggested in Chapter 2. In Chapter 3 we use *STATISTICA_10* to ensure that our replication of the Composite Index of National Capability (CINC) in the 'social' part of our index (called '$SocR$') is effective, i.e. the cross-index variation for 187 nation states is statistically insignificant. Then, we test whether cross-time variation in the absolute values of the $SocR$ index for 187 states is statistically significant (1993–2013). Then we add the geographic factor and summarize the absolute and relative adjustments in the aggregate power base index (called '$SocGeoR$') due to geography, and again check for cross-temporal variations, and calculate the 'cost of compromise' – Best alternative to a negotiated agreement (BATNA) – available to each decision-maker. In Chapter Four we use the results of state power analysis, together with selected core assumptions on strategic negotiation, internal logic of the game theory, and technical capabilities of graph model for conflict resolution in

GMCR+, to search for stable solutions and rational coalitions in the Arctic territorial dispute.

The concluding chapter is divided into practical and theoretical parts. The former part suggests lessons and policy implications for both the Arctic claimant states and the international community and offers alternative scenarios of strategic development in the region and the probability of their realization. The latter part critically evaluates the major strengths and weaknesses of the suggested methodology; discusses its applicability to the neoclassical geopolitical and political geographic analysis and contemporary social polar research; and contrasts these results against the findings of contemporary polar geopolitical literature based on different epistemologies and research designs.

Chapter 1

The Northernmost Interstate Dispute

The northernmost interstate dispute has three fundamental conceptual characteristics. First, the 'northernmost' implies a regional, geographic perspective. Second, 'interstate' means that the problem is situated in the domain of international politics – a social milieu where public international law applies to the relationship between the sovereign nation states. Third, 'dispute' reflects the conflictual nature of this relationship.

The region is a very broad concept. Regions can be found at all political levels. Defining their limits is probably the most challenging task for a researcher focusing on the spatial differences among distinct locations (Romancov, 2007, p. 420). In political geography, the term usually refers to two basic types of areas that are defined by historical, cultural, economic, social or political distinction from the surrounding area (Gallaher et al. 2009, Cihelkova 2007, Lantsov 2009, Csurgai 2009). The first is a world-region, such as South Asia or the Caribbean basin, which is composed of multiple states, and is organized around specific geographic subdivisions.[6] The second type of region is typically a much smaller area at the sub-national level frequently associated with strong local ethnic identity, such as East Timor or Catalonia (Dahlman, 2009, p. 210).

In addition, there exist pan-regions – large (and usually continental) spaces with certain politico-civilizational elements that distinguish them from other regions, such as Latin America or the Middle East. Transnational political regions reflect the integration of political and cultural factors of two or more states, such as the African Maghreb or Scandinavia. Finally, transborder regions, which effectively ignore national sovereignty, limiting the function of state borders, but instead connect border areas of at least two states into a single political unit, such as the Chaco region encompassing territories of Argentina, Bolivia and Paraguay (Hnízdo, 1995, pp. 64-91). The Arctic is a transborder region; to Northerners (i.e. indigenous populations) it is a distinct region generating a

[6] For example, the Cold-War division (First, Second and Third Worlds), socio-economic development (global North and South) or newly formed regional associations (the European Union).

unique polar identity and a single political unit. To Southerners (i.e. states bordering the region) the area consists mostly of the ocean that is open to external power projection (Osherenko and Young 1989).

This chapter introduces the geopolitical complexity of the dispute over international waters in the central part of the northernmost ocean, defines its physical settings and introduces international public law regulating interstate relations in areas beyond national jurisdiction and governing the attempts of two sovereign states, Denmark and Russia, to move their existing maritime borders beyond 200nm of their Exclusive Economic Zones (EEZ). Next, we discuss the three primary components of the Arctic dispute (the decision-makers, the options and the preferences) and present the aims, questions and testable hypotheses of the present study.

1.1 International waters in the Arctic

1.1.1 The geographic settings

The first step to define and systematize the physical environment of the northernmost High Seas is to identify the wider geographic region to which they belong – the Arctic – an open, complex system depending, internally, on the balance between land, coastal and marine resources, and, externally, on the atmosphere, oceans and rivers that feed it (Ahlenius et al., 2010, p. 12). However, there exists no universally-accepted physical delimitation of the Arctic, and such definition is a task that depends upon the subject of investigation and technical capability of the researcher (Chaturvedi, 1996, p. 13). The majority of definitions[7] derive directly from the region's geo-physical characteristics. The region's northern limit is defined as the geographic North Pole ($90°N$), but this is of no help in delineating the Arctic's southern limit, as the geographic and ecological borders do not coincide.

The most popular ecological terrestrial delineators are the tree line (north of which trees cannot grow), flora and fauna boundary, and permafrost limit (north of which the

[7] Apart from (objective) environmental definitions of the Arctic region there also exists one prominent (symbolic) non-environment definition, which relies on comparison with Antarctica – the 'sector approach'. It is the domestic Canadian and Russian definition that limits the Arctic region at 60° northern latitude, analogous to the Antarctic delineation of 60° southern latitude (Keskitalo, 2004, p. 32). However, it is not recognized beyond the handful of countries for which it is convenient in constructing the alternative mental maps of the region, and believed to be irrelevant by many scholars since the Arctic and the Antarctic are too different regions to be cross-referenced (Chaturvedi 1996, Glassner 1990, Dowdeswell and Hambrey 2002, Keskitalo 2004).

soil remains frozen throughout the year). In the marine environment, the boundary is usually seen in areas where cool Arctic Ocean water meets warmer, saltier water. The July +10°C isotherm line (north of which the mean temperature in July is no higher than +10°C) applies to both the terrestrial and marine Arctic. However, because all ecological definitions suffer from fundamental weaknesses,[8] geographers prefer straight-line boundaries, such as parallels of latitude and meridians, and therefore work with the Arctic Circle, whose exact delineation falls on 66°33′ northern latitude, everywhere on the globe at a distance of 2655km from the geographic North Pole.

Instead of adopting yet another approach to determine the geographic extent of the region, we define the latter in a manner compatible with other (geo)political research on the Polar Regions. We integrate the environmental and geographic definitions and consider all maritime and terrestrial area with at least one percent of territory north of the Arctic Circle (66°33′44″), as well as the +10ºC July isotherm and the tree line, to be a part of the Arctic.[9] Based on this definition, the region includes the vast, northernmost coastal parts of North America, Europe and Asia, comprising twenty-three sub-national administrative units or "Arctic provinces" of seven sovereign states[10] and one nation state[11] that surround the world's smallest ocean (14 million sq. km) – see Figure 1-1.

The Arctic Basin. The enclosed Arctic Ocean is connected to the North Atlantic water mass through the Fram Strait and the Barents Sea via the Norwegian seas and Greenland, and as well as through the Canadian Arctic Archipelago and Baffin Bay, and to the Pacific Ocean through the Bering Strait and the Bering Sea (Jones, 2001, p. 139). The northernmost ocean is a complex geological system, and Figure 1-2 demonstrates its core features. It is defined by the mid-Atlantic Ridge, which separates Svalbard from northeast

[8] The alpine regions (wherever these may be) are physically and biologically similar to polar areas (Young 1992); while the tree line, mean temperature, and marine boundary of the Arctic all not only lie significantly farther north in northern Europe than in North America, but they are not actual lines, but rather broad ecological zones 50-100 km wide (Keskitalo 2004). Also, because the changing climate is dramatically altering the Arctic physical space (AMAP 2009), environmental delineation cannot be used when producing scenarios of future developments.

[9] Conceptualization of the Arctic delimitation is not the ultimate goal of this analysis, and maintaining consistency in the aggregation of empirical data is of primary importance in any quantitative research. Therefore, for technical reasons, the administrative division on land as of 2010 applies throughout the entire period under consideration.

[10] Newfoundland and Labrador, the Northwest Territories, Quebec, Nunavut, Yukon (Canada); Greenland (Denmark); Lapland, North Ostrobothnia (Finland); Finnmark, Nordland, Svalbard including Jan Mayen, Tromsø (Norway); Arkhangelsk and Nenets, Chukchi, Karelia, Komi, Krasnoyarsk, Murmansk, Sakha/Yakutia, Yamal-Nenets (Russia); Norrbotten, Västerbotten (Sweden); and Alaska (the United States). Apart from imposing administrative borders on land, the coastlines of some of these provinces also generate the exclusive economic zones of the Arctic states (Valko, 2014, pp. 103).

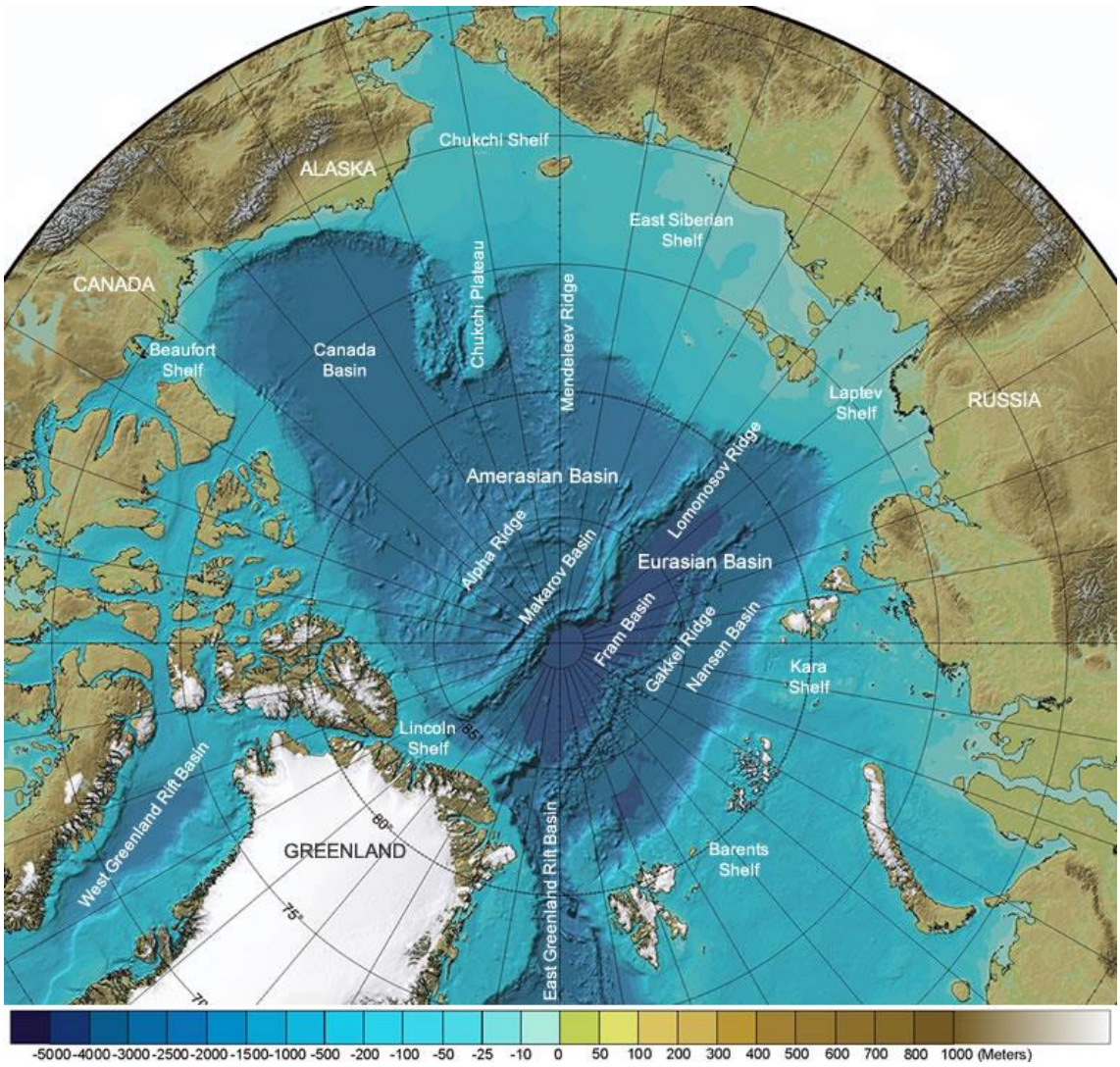
[11] Iceland.

Greenland, continues towards the North Pole, becomes the Nansen-Gakkel Ridge and rises approximately 2000m above the seabed. Running parallel, the 1800km-long Lomonosov Ridge (the major submarine ridge of the Arctic Ocean going beneath the pole itself) connects Ellesmere Island on the continental shelf of North America with the New Siberian Islands on the Eurasian continental shelf and rises 3000m above the seabed. Another parallel undersea ridge is the 200–450km-wide Alpha Cordillera/Mendeleyev Ridge – a rugged submarine mountain chain arc extending from Ellesmere Island to Wrangel Island and rising to almost 2700m over the seabed (Sale, 2008, p. 37).

Figure 1-1. The Arctic region

Source: ArcticStat, 2015, modified by the author according to Ahlenius et al., 2010 (UNEP/GRID-Arendal).

Figure 1-2. The Arctic Basin



Source: King, 2016.

Three underwater ridges define the Arctic deep oceanic basins. The Lomonosov Ridge divides the ocean into two physio-graphically complex basins, Eurasian Basin and Amerasian Basin. The first includes the approximately 3000m-deep Nansen Basin (located between the Nansen-Gakkel Ridge and the Barents Sea) and the 4280m deep Fram Basin[12] (lying between the Nansen-Gakkel Ridge and the Lomonosov Ridge).

The second is constituted by the 4000m-deep Makarov Basin (fenced by the Alpha Cordillera/Mendeleyev Ridge and the Lomonosov Ridge) and the 3800m deep Canada

[12] The geographic North Pole is located above the Fram Basin near its juncture with the Lomonosov Ridge (Encyclopedia Britannica, 2015).

Basin (located between the Alpha Cordillera/Mendeleyev Ridge and Canada/Alaska), the largest sub-basin of the Arctic Ocean (Encyclopedia Britannica, 2015). These deep basins are surrounded by shallower marginal seas that are defined by the mainland and islands bordering them[13] lying above the extensive continental shelves.

The continental shelves account for approximately 35 percent of the total area of the Arctic Ocean but only two percent of its water volume (Sale, 2008, p. 37). Being part of the Eurasian shelf, the Siberian shelf is the widest in the world.[14] The seas overlying it – the Barents Sea, the Kara Sea, the Laptev Sea, the East Siberian Sea, and the Chukchi Sea – are mostly shallow, measuring only 10-20m deep. In contrast, the North American continental shelf is less extensive but much deeper: Baffin Bay and the Beaufort Sea are 1000m and 3000m deep, respectively, while the depth of the Greenland Sea and the Norwegian Sea exceeds 2000m (ibid).

On the surface, the regional landscape is extremely diverse: it varies from pack and drift ice to rugged shores, flat coasts, hills, glaciers, mountains surpassing 3500m above sea level[15] and includes the seismically active areas[16] (Ahlenius et al., 2010, p. 7). Much of the central part of the ocean is covered by a vast cap of perennial ice[17] for most of the year. There are two major reasons why the long Arctic summer[18] does not melt the sea ice. Firstly, the sun in the region is always at a low angle in the sky, so there is a significantly small energetic input per unit of area. Secondly, not all of the radiation reaching the Earth is absorbed – some is reflected due to the albedo effect.[19] Some part of the Arctic ice is drifting, due either to local sea movements or to macro-drifts.[20] The rate of evaporation is much lower in comparison to tropical seas. Large Siberian and Canadians rivers bring fresh water into the Arctic Ocean, which than becomes part of the

[13] The Barents Sea is located between Svalbard, Franz Josef Land and Novaya Zemlya; the Kara Sea – between Novaya Zemlya and Severnaya Zemlya (alternatively, between Novaya Zemlya and Taimyr Peninsula); the Laptev Sea – between Severnaya Zemlya and New Siberian Islands; the Chukchi Sea – between the Chukchi Peninsula, Wrangel Island and northern Alaska; Baffin Bay – between Baffin Island and Greenland; the Greenland Sea – between Greenland and Svalbard; the Norwegian Sea – north of the western coast of Norway; the East Siberian Sea – west of Wrangel Island; and the Beaufort Sea – north of Alaska and Canada's Yukon and Northwest Territories (Sale, 2008, pp. 37-38).
[14] The width of the Siberian shelf reaches 900km.
[15] Gunnbjornsfjeld Peak, 3708 m (Greenland, Denmark).
[16] Verkhoyanskiy Mountains (Siberia, Russia).
[17] Ice that does not melt from season to season and is more than two years old.
[18] Due to equatorial inclination the sun is visible continuously in the region for six months a year ('Arctic summer'), while for the other six months it does not rise above the horizon ('Arctic winter').
[19] Darker surfaces absorb more of the incident radiation than lighter surfaces. Dark soils absorb 90 percent of radiation and reflect only 10 percent. For the ice of the Greenland ice sheet these figures are reversed. Clouds also reflect radiation. As the low-level stratus dominates in the Arctic during summer, its albedo reaches 70 percent (Sale, 2008, p. 73).
[20] Transpolar Drift, Polar Ice Current, Beaufort Gyre, and Siberian Ice Current.

glaciers. The relief implies a limited connection and outflow to surrounding oceanic waters with higher salinity. In result, the Arctic sea ice has the lowest salinity among all oceans[21] (Sale, 2008, p. 17).

Climate. The severity of climate varies across the region. It is coldest and driest in the areas that lie further from the influence of the relatively warm waters of the Atlantic and Pacific Oceans, while the interior is very cold.[22] During late winter and spring, storms occasionally bring warm air masses from the south. The Arctic is a cloudy region, especially during the summer when low-level stratus clouds dominate. The cloudiest area is the Atlantic Arctic (80 percent of which is covered with clouds almost constantly throughout the year). In contrast, the sunniest places are inland Greenland, Alaska and the Canadian Arctic islands.

The maritime parts are connected to the region's mainland, whose larger portion is underlain by permafrost,[23] through the hydrological cycle. Warm ocean currents bring heat and moisture to the air and frontal activity, provoking an increase in precipitation, usually in the form of snowfall, in the maritime areas. It decreases as one moves north: the southern part of Iceland, southern Alaska and parts of the Norwegian coast receive 3000mm of precipitation each year, while inland areas with continental climates and lower temperatures receive less than 150mm (National Snow and Ice Data Center, 2011, p. 1). The Central Arctic Basin is a polar desert with the annual precipitation not exceeding 130mm.

The Siberian continental climate experiences much higher wind speeds in winter than in summer, the result of which is that the latter are cool whilst the former are cold. In contrast, the Atlantic Arctic has a maritime climate. It is dominated by the North Atlantic Drift, which gives rise to cool winters and warm summers, even as far from the Atlantic as in Franz Josef Land. As the northern Pacific is colder than the Atlantic, the area has higher wind speeds. Consequently, Alaska is generally cold in winter and warm in summer (Sale, 2008, p. 74). Within the Canadian Arctic, temperatures are relatively high near the southern tip of the Baffin Bay, as it is climatically similar to the Atlantic. However, moving north, temperature decreases: the mean annual temperature in Ikaluit

[21] Although the Arctic Ocean has only about one percent of the earth's volume of seawater, it receives around 11 percent of total freshwater.
[22] The lowest temperatures have been recorded at the *North Ice* station in Greenland, –66,1 °C; and at *Oymyakon* in the Verkhoyanskiy region of north-east Siberia, –77,8 °C (Sale, 2008, pp. 75-76).
[23] Ground that does not thaw for two or more years, whose thickness can reach up to 1000m, as it does on the North Slope of Alaska.

is –9 ºC, but it drops to –20ºC in Eureka on the Ellesmere Islands (Dowdeswell and Hambrey, 2002, pp. 65-68).

Svalbard is the warmest archipelago in the region as a result of the Norwegian Current. The mean annual temperature in Longyearbyen, Svalbard's main settlement, is –6ºC. But inland areas, distanced from favorable maritime conditions, experience much lower mean temperatures. The mean temperature at Gloermerniy Station (Severnaya Zemlya), 3500km east of Svalbard, is –16ºC. Similarly, the capital of Greenland, Nuuk, on the west coast of the island has a mean air temperature of –0.8ºC, while that at Ittoqqortoormiit on the east coast is –6.4ºC.

The Eurasian seas differ substantially. While the Barents Sea has the mildest climate due to the effect of the North Atlantic Drift (the mean surface temperature in January is –10ºC), the Kara Sea is much colder (–30ºC). Some areas also remain ice-free during the summer, as does the southern part of the Barents Sea, which is affected by the North Atlantic drift; the Laptev Sea, receiving a relatively warm freshwater from the Siberian rivers; or the Chukchi Sea, whose water temperature is regulated by warmer water entering the Bering Strait.

Arctic freshwater exists in still, frozen, and running forms. When the massive glaciers of the ice age receded, a vast system of lakes and wetlands in depressions in the landscape emerged throughout the region.[24] Greenland glacier[25] and smaller glaciers in Franz Josef Land, Novaya Zemlya, and Severnaya Zemlya store vast amounts of fresh water (Baldursson, 2011, p. 3). The mean freshwater input to the Arctic Ocean is as high as 40 percent per year and is dominated by four rivers – the Mackenzie, Lena, Yenisei, and Ob. The freshwater export from the Arctic Ocean goes mainly through the Canadian Arctic Archipelago and via the Fram Strait (Serreze et al., 2006, pp. 1, 3). There is an interaction between the fresh water provided by the rivers, the existing sea water, and the melting ice within a large-scale freshwater cycle.

Since snow provides insulation against the severe cold of winter, "topographic relief has major implications for vegetation distribution and nutrient cycling, and therefore for both plants and wildlife" (Ahlenius et al., 2010, p. 8). Regional vegetation includes a wide range of plant life with unique adaptations to the harsh climate.[26] At low altitudes, rich

[24] These lake and wetland systems cover 8,5 percent of Sweden and 10 percent of Finland.
[25] Greenland glacier, 1.7 million sq km, constitutes 12 percent of the total ice in the world (second in size after the Antarctic ice cap).
[26] Taiga forests of pine, spruce, willow, birch and poplar, flat tundra, steppe landscapes, wetlands, and cliffs are fringed at their bases by rich vegetation fertilized over decades by the droppings of nesting seabirds.

flora is present and, although the flowering period is less than two months, insects do emerge. However, compared to other regions of the world, bio-diversity is low and the relations between the Arctic species[27] are relatively simple. At the same time, the migratory trends are significant. Mammals, birds and fish migrate to the Arctic in summer to feed and breed at the sea ice margins, coastal zones, estuaries and wetlands, and during the winter they go south.[28]

Recent scientific research has revealed the staggering pace of climate change in the region. In September 2012, the sea ice extent was 49 percent below the 1979-2000 average for that month, while in September 2014 it covered an area approximately 1800 thou. sq. km smaller than the historical 1979–2000 average for that month – a difference of more than twice the size of Texas. At the same time, the proportion of multiyear sea ice[29] has declined dramatically, from more than 30 percent of September ice in the 1980s to 8 percent in 2014 (US_EPA, "Arctic Sea Ice", 2015). Although the percentage of ice only one or two years old is steadily growing, such overall thinning of the ice means that the Arctic is losing ice faster than accumulating it and, consequently, it is even more vulnerable to further melting.

Further melting occurs due to the positive feedback mechanism. When the ice melts, heat from the sun is fully absorbed by the ocean, instead of being reflected off the white surface and back into space. This speeds up the warming of the ocean waters and, consequently, leads to even greater ice melting. According to Knell, throughout centuries, the system's self-regulation had allowed for relatively consistent levels of ice, as the system's negative feedback (via 'flywheel' and 'gateways')[30] had been compensating for seasonal increases in temperature (Knell, 2008, p. 9). However, the recent melting of the ice strengthens the positive feedback without strengthening the negative feedback, so a fragile balance between the two has been irrevocably altered.

The melting of the multiyear ice cap is transforming the Arctic physical environment. Probably the most dramatic changes are observable in the atmospheric circulation patterns, whose transformation increases the exposure to storms, widens the coastal erosion

[27] The polar bear, musk ox, lemming, fox, hare, caribou, reindeer, glaucous gull, fulmar, little auk, kittiwake, seal, whale, walrus, polar cod, squid, benthic fish, prawn, mussel, snail, etc.
[28] No other place on Earth receives so many migratory species from nearly all corners of the planet.
[29] Ice five years or older .
[30] The 'flywill' is a process whereby large volumes of water are first trapped in the clockwise flow of the Beaufort Gyre, and then released into the North Atlantic. The 'gateways' are the exit points (Fram, Davis and Hudson Straits), which are bi-directional; they simultaneously send Arctic waters into the North Atlantic and let the warmer Atlantic waters into the Arctic basin (Knell, 2008, p. 9).

(Ahlenius et al., 2010, p. 33), and alters the existing shape of the region's ecosystem. Plants are starting to grow more vigorously and densely (AMAP, 2009, p. 5). On the one hand, species dependent on the current climate are becoming extinct, while the number of incidents wherein large numbers of walruses come ashore has been steadily growing (Gunitskiy, 2008, p. 263). Finally, as the region warms up, "the probability of the introduction of invasive species through, for example, the dumping of ballast water from other regions as well as oil spills" has been steadily growing (Ahlenius et al., 2010, p. 34).

Natural resources. The region holds substantial reserves of hydrocarbons, base metals, precious materials, and radioactive elements.[31] Approximately 61 large oil and natural gas fields have been discovered within the Arctic Circle in Siberia, Alaska, the Canadian Northwest Territories, and the Northern Counties of Norway. 43 of the 61 large Arctic fields are located in Russia (35 of these fields, 33 natural gas- and two oil fields, are located in the West Siberian Basin). Of the 8 remaining large Russian fields, five are located in the Timan-Pechora Basin, two are in the South Barents Basin, and one is in the Ludlov Saddle. Among the 18 large Arctic fields outside Russia, 6 are in Alaska, 11 are in Canada's Northwest Territories, and one is in Norway (Budzik, 2009, p. 4).

Some hydrocarbon deposits had already been discovered in the mid-20th century, such as the Prudhoe Bay field on the North Slope of Alaska, the northern part of the Norman Wells in the Mackenzie Delta in Canada, or the Tazovskoye field and Urengoy basin in the Yamal-Nenets Autonomous Okrug in Russia. Other fields – the Sverdrup Basin, Melville Island, and Sabine Peninsula at Nunavut in Canada; the Norwegian Snohvit and Russian Shtokman fields in the Barents Sea; and the Nakhodka gas field in the Yamal Peninsula – were not known until the late 1970s-1980s.

In 2008, the United States Geological Survey completed a quantitative assessment of undiscovered conventional oil and gas resources in 25 Arctic provinces north of the Arctic Circle. Scientists concluded that more than 70 percent of undiscovered oil resources were thought to be situated in five provinces: Arctic Alaska, the Amerasia Basin, the East Greenland Rift Basins, the East Barents Basins, and West Greenland-East Canada; while

[31] Besides oil and gas, the following non-living resources are present in the region: coal (Norway, Greenland, and Russia); iron ore (Sweden, Finland, and Greenland); copper (Sweden, Finland, Russia, and Canada); nickel (Russia); silver (Sweden and Finland); lead (Sweden, Finland, Greenland, Alaska, and Canada); zinc (Sweden, Finland, Greenland, Alaska, and Canada); gold (Sweden, Finland, Greenland, Russia, Alaska, and Canada; platinum in Greenland and Russia); diamonds (Russia and Canada); uranium (Sweden and Greenland); molybdenum (Greenland); sand and gravel (Canada); and also tin, gemstones and apatite (Russia) (Lindholt, 2006, pp. 30-35).

more than 70 percent of undiscovered natural gas was thought to be concentrated in the West Siberian Basin, the East Barents Basins, and the Arctic Alaska. It was further estimated that approximately 84 percent of the undiscovered energy resources were to be found offshore. The total mean undiscovered conventional oil and gas resources of the Arctic were estimated to be around 90 billion barrels of oil; 1669 trillion cubic feet of natural gas, and 44 billion barrels of natural gas liquids (Bird et al., 2008, p. 4).

The Central Arctic Ocean is less endowed with deposits of non-living natural resources than the marginal seas adjacent to the coastlines of the Arctic states. In contrast to the area delimited by Axel Heiberg Island, Melville Island and the northern edge of Devon Island, where the probability of new energy deposit field was considered to be as high as 100 percent, this probability for the Beaufort Sea is estimated to be between 50 and 99 percent and drops to only 10 percent further north. Contrary to the maritime areas contiguous to Greenland's coastline between Nord and Daneborg, and between Knud Rasmusen Land and the location opposite to the Canadian Alert (no name exists so far), where the probability of new energy deposits vary from 50 and 99 percent; the latter was not higher than 10 percent for the central part of the northernmost ocean. Similarly, the probability of new deposits for areas contiguous to the Arctic coastline of Alaska is also thought to be nearly 100 percent, while this figur is not higher than 10 percent in the contiguous international waters of the Central Arctic Ocean. Only the High Seas facing the Eurasian part of the region are expected to contain real and significant energy resources; the probability thereof rises to almost 50 percent in some areas (see Appendix A).

At the same time, the Arctic marine ecosystems hosts over 2000 species of algae, thousands of microbes and over 5000 animal species, including unique species (such as the polar bear and narwhal), commercially valuable fish species, and large populations of migratory birds and marine mammals (Arctic Biodiversity Assessment 2013). The Arctic Ocean is home to about 240 species of marine and diadromous fish.[32] Most of them are benthic or demersal (i.e. live closely to the sea floor); few are pelagic (i.e. move freely in the water column); and some are both demersal and pelagic. Large populations of capelin, cod, sand lance, herring, halibut, plaice, snow crab, and northern shrimp can be found in Central and Eastern parts of the Canadian Arctic. The waters adjacent to Greenland are rich in northern prawns, halibut, lumpfish, snow crab, and cod. The waters neighboring

[32] The reported number of species differs among authors due to the shifting of the Arctic ecological border over time and the discovery of new species.

Alaska are full of salmon, halibut, shellfish, and ground-fish (approximately 75 percent walleye pollock). The northwest part of the Arctic Ocean (next to the Russian coastline) is full of cod, herring, saithe, capelin, northern shrimp and halibut; while in the northeast part mainly ground-fish (approximately 90 percent walleye pollock) is abundant (*Arctic Ocean Diversity*, 2015).

In sum, the geography within the Arctic Circle is extremely heterogeneous: some areas are colder; others are cloudier; and some contain certain natural resources that are absent in other locations. Apart from the disturbing effects of ice melting, there are certain physical elements holding the Arctic system together. These include the second lowest mean atmospheric and sea temperatures on Earth,[33] the highest latitudes, 'Polar days' and 'Polar nights' with the sun rising (or not rising, respectively) above the horizon continuously for six months, visual (such as the aurora borealis) and auditory effects (such as the acoustical mirages) between 60 and 72 degrees northern latitude; and a number of other unique geophysical features. Despite the potential change of climate, it is unlikely that these characteristics would disappear in the medium- (and even in the long-) run.

1.1.2 The legal settings: the relevance of the LOS Convention

The beginning of the national states' quest for internal and external sovereignty dates back to the 1648 Peace of Westphalia, following a long and painful journey from overlapping medieval authorities towards a modern world of mutually exclusive territorial jurisdictions (Jackson, 2007, pp. 5-8). Derived from the Westphalia model, the contemporary system of international relations still assumes a permanent binary divide between land and water. The former is understood as a solid and stable place of human habitation, in which areas are divided and bounded into state territory. The latter is fluid and mobile. Because it cannot be easily divided, controlled, settled upon, and even properly marked, water is fundamentally *external* to social life and state territory (IBRU and UA, *Ice Law Project*, 2015). Strandsbjerg (2012, p. 829) provides a striking summary of this fundamental difference:

> While boundaries at land have typically been concerned with the divisions of jurisdiction, passage, taxation rights, language, religion, and identity between different rulers and societies, boundaries at sea have […] been about dividing a common sphere from a sovereign, or territorial sphere.

[33] After the Antarctic, the coldest continent on Earth (Walton et al. 2013).

Since 1608, when Hugo Grotius introduced the Freedom of the Seas Doctrine,[34] the oceans were used in a 'non-rival' way – one country's use for navigation did not impede another country's ability to navigate, while another important activity of the high seas, fishing, was considered inexhaustible (Holmes, 2008, p. 324). The legal situation changed dramatically in 1994, when the United Nations Convention on the Law of the Sea (the LOS Convention, UNCLOS)[35] entered into force. Incorporating a number of preceding agreements,[36] it brought a comprehensive codification of the international law of the sea so that, whilst there are no categories of degrees of sovereignty for land areas (i. e. sovereignty is absolute), in the sea "…there are a number of maritime zones […], horizontal, vertical and functional, over which States exercise varying degrees of sovereignty or jurisdiction" (Grassner, 1990, p. 18). Figure 1-3 illustrates how state sovereignty decreases with growing distance from the territorial sea baseline, according to Part VI, Part XII and Part XIII of the LOS Convention.

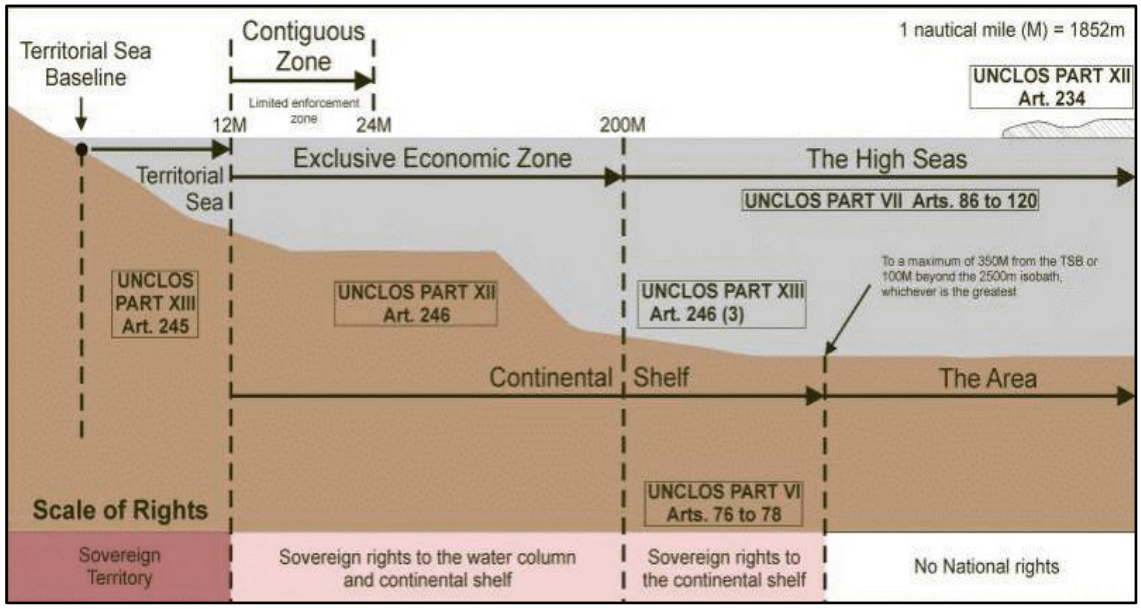
Repeating virtually verbatim Article 4 of the 1958 Territorial Sea and Contiguous Zone Convention, Article 7 of the LOS Convention left the definition of the national baseline to the coastal states. The general rule, which is respected by the absolute majority of the Convention signatories, suggests considering the baseline as the furthest seaward extent of the low-water line or, "…[i]n localities were the coastline is deeply indented and cut into, or if there is a fringe of islands along the coast in its immediate vicinity, the method of straight baselines[37] joining appropriate points may be employed in drawing the baseline" (Article 7 of Part II of the LOS Convention). Appendix B demonstrates the major rules of baseline definition.

Within the internal waters – the body of water on the landward side of the national baseline – the coastal states are free to set laws, regulate usage and use any living/non-living natural resources, while foreign vessels have no right of passage. A territorial sea

[34] More on the Grotian legal system can be found in Glassner, Martin I. *Neptune's Domain: A Political Geography of the Sea*. London: Unwin Hyman, 1990.
[35] The full text of the LOS Convention is available at:
http://www.un.org/depts/los/convention_agreements/texts/unclos/closindx.htm.
[36] The initial legal configuration of the LOS Convention was determined in four Conventions signed during the UNCLOS I Conference in Geneva (1958): the Convention on the High Seas (in force: 1962), the Convention on the Territorial Sea and Contiguous Zone (in force: 1964), the Convention on the Continental Shelf (in force: 1964), and the Convention on Fishing and Conservation of Living Resources of the High Seas (in force: 1966).
[37] For a straight baseline method to be justified on the grounds that the particular coast is deeply indented and cut into, three criteria must be satisfied: (a) the baseline segments accounting for at least 70 percent of the total length of the relevant baselines have at least a 6:10 ratio of coastal penetration to segment length; (b) a coastline has at least three significant indentations in any given locality; and (c) no individual straight baseline segment exceeds 48nm in length (USDS, 1987, p. 6).

is different; up to 12nm (22km) from the baseline, the littoral state is still free to set laws, regulate use, and use any resource; however, foreign vessels are now given the right of innocent passage,[38] and military crafts are allowed transit passage.[39]

Figure 1-3. Maritime zones and the associated articles of the LOS Convention



Source: Law of the Sea, *National Oceanography Centre in Southampton*, 2015.

The state has full sovereignty rights over the archipelagic waters (as in the internal waters), but foreign vessels have the right of innocent passage through them (as in the territorial seas). Beyond the 12nm (22km) limit, there is a further 12nm (22km) from the territorial sea border line, the contiguous zone, in which a state can continue to enforce laws in four specific areas: customs, taxation, immigration and pollution, in the case that an infringement occurred, or is about to occur, within a state territory or in its territorial waters. The Exclusive Economic Zone (EEZ) extends to 200nm (370km) from the baseline. Within this area, the coastal nation has sole exploitation rights over all resources (fish, minerals and energy). Foreign nations are free to lay submarine pipelines and cables, navigate and overflight, however, the last two are subject to the regulation of the coastal states (Churchill and Lowe, 1999, pp. 60-92, 132-163).

[38] Innocent passage means passing through territorial waters in an expeditious and continuous manner, which is not prejudicial to the good order or the security of the littoral state (e.g., weapons practice, polluting, fishing, and spying are not 'innocent'), and submarines and other underwater vehicles are required to navigate on the surface and to fly their flags. Nations can also temporarily suspend innocent passage in specific areas of their territorial seas, if doing so is essential for the protection of their security.
[39] Naval vessels are allowed to maintain postures that might be illegal in territorial waters (i.e. have weapons onboard).

In addition to defining the marine spaces under jurisdiction of the nation states, the LOS Convention defines the ones beyond national jurisdiction – international waters – consisting of the high seas and the Area. In the wider Arctic region, three maritime areas are considered international waters: one larger polygon of approximately 2,8 million sq. km[40] of (frozen) waters adjacent to the geographic North Pole and whose landward limit is 200nm from the baselines of five Arctic states;[41] one smaller polygon in the Norwegian Sea and the Greenland Sea with an arc around the Norwegian EEZ; and another smaller polygon in the Barents Sea locked between the Russian EEZ and the Norwegian EEZ (Sea Around Us, *Interactive Map*, 2015). Figure 1-4 maps the boundary of international waters in the central part of the Arctic Ocean (for a visual representation of two other cases see Appendix C).

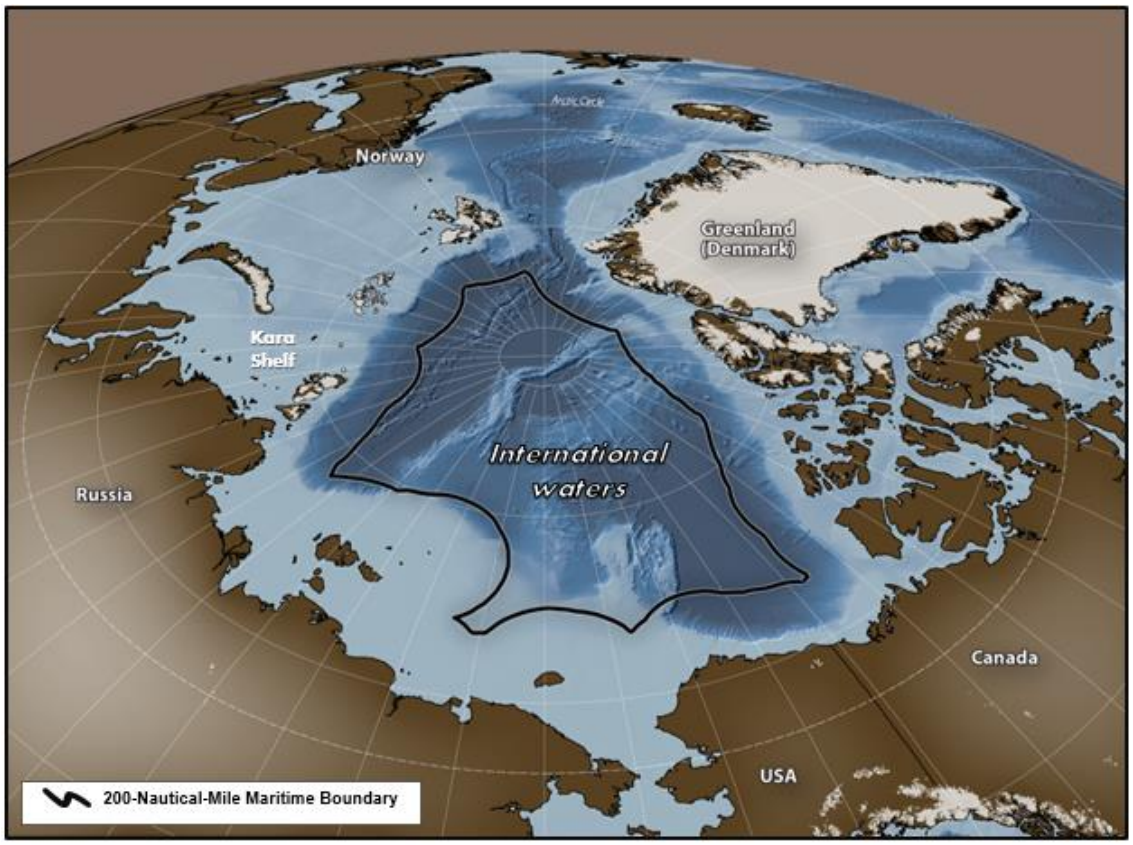
On the one hand, according to Article 86 of Part VII of the Convention, the High Seas are all parts of the sea "that are not included in the exclusive economic zone, in the territorial sea or in the internal waters of a State, or in the archipelagic waters of an archipelagic State".[42] In other words, if a costal state has established own EEZ, the landward limit of the High Seas is the seaward limit of its EEZ. However, if the coastal state has not yet claimed its own EEZ, the landward limit of the High Seas is the seaward limit of the adjacent territorial sea (Tanaka, 2012, p. 150). Although the high seas are governed by the principle of freedom (freedom from national jurisdiction[43] and freedom of activities[44]) it does not mean that there is no legal order there. The latter is ensured by the principle of the exclusive jurisdiction of the flag state.[45]

On the other hand, Article 1(1) of the LOS Convention defines the seabed and ocean floor and subsoil thereof beyond the limits of national jurisdiction as the Area. In the legal sense, the landward limit of the Area is the continental shelf: it either starts at the 200nm-

[40] PEW Fisheries Map Book, 2014, p. 3; based on *Bathymetry*, BCAO (www.ngdc.noaa.gov/mgg/bathymetry/arctic/) and *Maritime Boundary*, International Boundaries Research Unit, (www.dur.ac.uk/ibru/resources/arctic/).
[41] Canada, Denmark, Norway, Russia, and the United States.
[42] Full text of Part VII of the LOS Convention (1982) is available at: http://www.un.org/depts/los/convention_agreements/texts/unclos/part7.htm.
[43] Article 89 of the LOS Convention (1982) says: "No State may validly purport to subject any part of the high seas to its sovereignty".
[44] Article 87(1) of the LOS Convention (1982) states that all states (coastal and landlocked) are eligible, inter alia, to practice freedom of (a) navigation, (b) overflight, (c) laying submarine cables and pipelines (subject to Part VI), (d) construction of artificial islands and other installations permitted under international law (subject to Part VI), (e) fishing (subject to conditions specified in Section II), and (f) scientific research (subject to Part VI and Part XIII).
[45] The state granting a vessel the right to sail under its flag has the exclusive jurisdiction over it. Two exceptions exist: (1) right to visit and (2) right of hot pursuit (Tanaka, 2012, p. 152).

distance from the respective baseline, or at the limit of the continental margin extending beyond 200nm (Tanaka, 2012, p. 170). In contrast to the High Seas, the Area is governed by the principle of the common heritage of mankind,[46] an innovative principle in the law of the sea introducing mankind as an emerging actor of international relations (Tanaka, 2012, p. 150). The legal configuration of the Area is governed by two other legal elements: non-appropriation[47] and peaceful use.[48]

Figure 1-4. International waters of the Central Arctic Ocean



Source: *International Arctic program*, Pew Charitable Trusts, 2014.

[46] Article 140 of Part XI of the LOS Convention (1982) says: "Activities in the Area shall (…) be carried out for the benefit of mankind as a whole, irrespective of the geographical location of States, whether coastal or land-locked, and taking into particular consideration the interests and needs of developing States and of peoples who have not attained full independence or other self-governing status recognized by the United Nations in accordance with General Assembly resolution 1514 (XV) and other relevant General Assembly resolutions… The Authority shall provide for the equitable sharing of financial and other economic benefits derived from activities in the Area through any appropriate mechanism, on a non-discriminatory basis", in accordance with other provisions of the LOS Convention and related agreements.

[47] Article 137 (1) of the LOS Convention (1982) states: "No State shall claim or exercise sovereignty or sovereign rights over any part of the Area or its resources, nor shall any State or natural or juridical person appropriate any part thereof. No such claim or exercise of sovereignty or sovereign rights nor such appropriation shall be recognized."

[48] Article 141 of the LOS Convention (1982) states: "The Area shall be open to use exclusively for peaceful purposes by all States, whether coastal or land-locked, without discrimination and without prejudice to the other provisions of this Part."

Disputes may be resolved in the International Tribunal for the Law of the Sea (ITLS) – an independent judicial body composed of twenty one independent members[49] – holding with jurisdiction over any disagreement concerning the interpretation or application of the LOS Convention, and over all matters specifically provided for in any other agreement conferring jurisdiction on the ITLS.[50] The latter is open to both countries and/or international organizations, both members and non-members of the Convention, and state enterprises and private entities "(…) in any case expressly provided for in Part XI or in any case submitted pursuant to any other agreement conferring jurisdiction on the Tribunal which is accepted by all the parties to that case".[51] To date, twenty-four cases have been submitted to the Tribunal but none of them have directly addressed the overlap of sovereignty claims in the central part of the Arctic Ocean.[52]

Eight Arctic states have signed the LOS Convention, and all except one have managed to ratify it.[53] Although the United States helped shape the initial reading of the Convention and its subsequent revisions (Scheiber, 2009, p. 4), it was able to protect its own maritime interests successfully without ratifying it (Rogers, 2012, p. 1). To date, the country is not party to the Convention, mainly (but not only) due to the domestic rejection of the terms of Part XI of the treaty concerning deep seabed and mining of potentially valuable metals in the Area.[54] In practice, the United States has accepted all but the Part XI provisions of the LOS Convention as customary international law.[55] In other words, in all matters besides the seabed, the country acts as if it were part of the Convention, but on a unilateral basis. In terms of maritime delimitation it means that the United States measures the boundaries from the official national baselines[56] to the seaward limit of the territorial sea

[49] The members are elected from persons enjoying the highest reputation for fairness and integrity and of recognized competence in the field of the law of the sea.
[50] Article 21 of the LOS Convention (1982).
[51] Article 20 of the LOS Convention (1982).
[52] The complete list of cases submitted to the Tribunal is available at: https://www.itlos.org/cases/list-of-cases.
[53] Iceland in 1995; Finland, Norway and Sweden in 1996; Russia in 1997; Denmark in 2004; and Canada in 2003.
[54] On the history of the Unites States' attitude to the legal codification of the international law of the sea, see Scheiber, Harry N. "Introduction: Perspectives on the History of U.S. Non-Ratification of the U.N. Convention on the Law of the Sea, and on the Prospects for an Early Reversal". Publicist, vol. 1 (2009).
[55] See Proclamation No. 5030,"Exclusive Economic Zone of the United States of America" (1983), 48 FR 10605: http://www.archives.gov/federal-register/codification/proclamations/05030.html.
[56] Following the general baseline approximation rule highlighted in the Convention, the United States defines its own baselines as the low-water lines along the coast as marked on the National Oceanic and Atmospheric Administration nautical charts and in accordance with the respective articles of the LOS Convention.

(12nm), contiguous zone (24nm), exclusive economic zone (200nm), and maritime boundaries with adjacent or opposite countries.

In sum, any exploitation of the seabed beyond the 200nm-limit of one's own EEZ is highly controversial, as the LOS Convention automatically allows no nation state to autonomously exploit the natural resources beyond this limit. Instead, a coastal state is supposed to cooperate with the International Seabed Authority (ISA) which acts on behalf of the international community, unless the former proves that the respective resources lie within its continental shelf, which can, exceptionally, extend a state's right of exploitation beyond the EEZ.

1.1.3 Claiming international waters in the Arctic

Public international law governing the attempts of nation states to legalize their own sovereignty claims fully respects (and reflects) the difference between land and water: the legal framework for claiming the former is fundamentally different from claiming the latter. The typical situation for the first case would be the competition between State A and State B, which are usually contiguous to each other, over a given territory (settled or unsettled); while in the second case, one nation state or a group of states may deal not only with another nation state or group of states, but also with the entire international community.

Paragraphs 5 and 6 of Article 76 of the LOS Convention define, in Strandsbjerg's words, "the legality of dividing a common sphere from a sovereign sphere" in the Arctic sovereignty game, based on the presence of a specific geological phenomenon, the extensive continental shelf:

> [Paragraph 5] The fixed points comprising the line of the outer limits of the continental shelf on the seabed, […] either shall not exceed 350nm from the baselines from which the breadth of the territorial sea is measured or shall not exceed 100nm from the 2500m isobath, which is a line connecting the depth of 2500m.
>
> [Paragraph 6] Notwithstanding the provisions of paragraph 5, on submarine ridges, the outer limit of the continental shelf shall not exceed 350nm from the baselines from which the breadth of the territorial sea is measured. *This condition does not apply to submarine elevations that are natural components of the continental margin, such as its plateau, rises, caps, banks and spurs* [our emphasis].[57]

[57] Full text of Article 76 of the LOS Convention (1982) is available at: http://www.un.org/depts/los/convention_agreements/texts/unclos/closindx.htm.

To establish the outer limits of a continental shelf and to extend one's own maritime boundary beyond the 200nm-limit, a coastal state should submit an official claim, including sufficient supportive technical evidence and a set of distinct delimitation point coordinates, to the Commission on the Limits of the Continental Shelf (CLCS, the Commission),[58] within 10 years of ratification of the LOS Convention.[59] Under the terms of the Convention, any physical maritime border extension by a coastal state can only occur if the Commission's recommendations are permissive (and such extension shall be final and binding). The Commission consists of twenty-one members elected for a term of five years that are "experts in the field of geology, geophysics or hydrography, elected by States Parties to the Convention from among their nationals, having due regard to the need to ensure equitable geographical representation, who shall serve in their personal capacities".[60] The current composition of the Commission will last until June 2017. The Commission has two main functions. First, it considers the materials submitted. Second, it provides scientific and technical advice, if requested by the coastal state during preparation of such data.[61] To date, the Commission has received 77 submissions from LOS Convention coastal signatories,[62] some of which belonged to the Arctic states.

In Russia, the LOS Convention entered into force in April 1997. The first official claim considering information on extension of the limits of country's outer continental shelf beyond 200nm from the baselines was submitted to CLCS in December 2001. In the section concerning the Arctic Ocean, it included the shelf of the Arctic marginal seas, part of the Eurasian Basin (the Nansen Basin, the Amundsen Basin, the Podvodnikov Basin, and the Gakkel Ridge), and the Central Amerasian Basin (the Makarov Basin and the Complex of the Central Arctic Submarine Elevations including the Lomonosov Ridge, Mendeleev-Alpha Rise, Mendeleev and Chukchi basins, and Chukchi Plateau).[63] In June 2002, the Commission responded with a request for additional technical evidence in support of the claim as, according to the materials provided by Russia, neither the

[58] Submissions are made through the Secretary-General of the United Nations (Article 76 of the LOS Convention).
[59] Article 4 of Annex II of the LOS Convention (1982). The original time limit of 10 years had been extended at the 10th Meeting of States Parties on 29 May 2001 as a reaction to concerns voiced by developing countries regarding the difficulty of complying with it.
[60] Article 2 of Annex II to the LOS Convention (1982).
[61] Article 3 of Annex II to the LOS Convention (1982).
[62] The complete list of submissions to the Commission is available at: http://www.un.org/Depts/los/clcs_new/commission_submissions.htm.
[63] Full text of the 2001 Russia's submission is available at: http://www.un.org/Depts/los/clcs_new/submissions_files/submission_rus.htm.

Lomonosov Ridge nor the Alpha-Mendeleev Ridge Complex could be considered submarine elevations under the current reading of the LOS Convention.[64]

Thirteen years later Russia submitted revised information concerning international waters in the Central Arctic Ocean, including detailed scientific evidence, a set of fixed delimitation point coordinates and the methods of their calculation,[65] in accordance with this recommendation. At the same time, Russia reserved the right to introduce amendments to this partially-revised submission that could be based on new or additional research data and could provide changes to the presented outer limits of the country's continental shelf in the northernmost ocean. To date, the Commission has not yet adopted any recommendation regarding Russia's latest submission.

The Kingdom of Denmark and the Government of Greenland[66] jointly submitted the information on the limits of the continental shelf beyond 200nm from the baselines of northern Greenland, including detailed scientific evidence, a set fixed delimitation point coordinates and the methods of their calculation, to the Commission, in December 2014. The claimed area was defined "(…) on the Eurasia side of the Lomonosov Ridge, as extension to the 200nm line of Norway (Svalbard) at one end and to the 200nm line of the Russian Federation at the other; and, on the Amerasia side of the Lomonosov Ridge, as extension to the 200nm line of Canada at one end and to the 200nm line of the Russian Federation at the other" (Executive Summary of the Partial Submission to CLCS by Denmark and Greenland, 2014, p. 16).[67] Similarly to Russia, Denmark reserved the right to introduce amendments to the current submission based on additional scientific research and new data on the outer limits of the continental shelf. To date, the Commission has not yet adopted any recommendation regarding the latest reading of Denmark's submission.

[64] The actual submissions to the CLCS are available at: http://www.un.org/Depts/los/clcs_new/submissions_files/submission_rus.htm.

[65] The executive summary of the 2015 revised submission by Russia is available at: http://www.un.org/Depts/los/clcs_new/submissions_files/rus01_rev15/2015_08_03_Exec_Summary_English.pdf.

[66] Geographically, the mainland Danish Kingdom is not part of the Arctic, but Greenland is. The northeast coastline of the latter is, in fact, the nearest to the North Pole. Although still under Danish jurisdiction, Greenland practices self-government of judicial affairs, policing, and natural resources, and Greenlanders are recognized as a separate people under international law (since June 2009). Nevertheless, Denmark is still responsible for foreign affairs and defense matters. Because the claim over international waters in the Central Arctic Ocean is based on the idea that the Lomonosov Ridge is an extension of Greenland, and since the claim is part of the country's foreign and security affairs, the information was submitted to the Commission by both the Kingdom of Denmark and the Government of Greenland.

[67] Full text of Denmark and Greenland's submission is available at: http://www.un.org/Depts/los/clcs_new/submissions_files/submission_dnk_76_2014.htm.

The three remaining Arctic-Five states (Canada, the United States and Norway) do not have an official claim over Arctic international waters. Canada's partial submission dates back to 2013, when it provided the Commission with information on own outer limits of the continental shelf beyond 200nm from the baselines in the Atlantic Ocean.[68] Although Canada did not deny its intention to claim Arctic international waters, it was explicitly stated in the text that specification of the claimed area in the Arctic Ocean would be made in a short time (to date, it is still absent). In legal terms, in contrast to international waters in the Atlantic Ocean, Canada did not claim any in the Arctic Ocean.

Unlike Canada, which has the option of submitting an Arctic claim to the Commission, the United States has not yet ratified the LOS Convention. Consequently, the country cannot, technically, submit any information to the Commission on its own limits of the continental shelf beyond 200nm from the baselines in the Arctic Ocean. Nevertheless, the potential new northernmost maritime areas of Canada and the United States are routinely replicated in political maps of the region delimiting the sovereignty claims by a range of cartographic agencies.[69]

Norway submitted information on the limits of the continental shelf beyond 200nm from own baselines in three separate areas in the North East Atlantic and the Arctic (the Loop Hole in the Barents Sea, the Western Nansen Basin, and the Banana Hole in the Norwegian Sea) to the Commission,[70] in November 2006. Three years later the Commission responded with an official recommendation in the affirmative.[71] At the moment, Norway has no outstanding territorial claim in the Arctic Ocean.

Claiming Arctic international waters is, in many ways, problematic. The Commission can only give highly technical recommendations and the ultimate decision on the location of the maritime boundary is left to the claimant state. In other words, the applicant state may or may not comply with the Commission's recommendations. At the same time, due to the harsh climate, lack of technology, and many centuries of ignorance among policy makers, the Arctic Ocean floor is the least explored seabed on Earth. Similarly to one

[68] Full text of the 2013 Canada's submission relating to the Atlantic Ocean is available at: http://www.un.org/Depts/los/clcs_new/submissions_files/submission_can_70_2013.htm.
[69] For example, the Arctic map by International Border Research Unit, Durkham University, available at: https://www.dur.ac.uk/ibru/resources/arctic/.
[70] Full text of the 2006 Norway's submission is available at: http://www.un.org/Depts/los/clcs_new/submissions_files/submission_nor.htm.
[71] Full text of the Commission's recommendations on the 2006 Norway's submission is available at: http://www.un.org/Depts/los/clcs_new/submissions_files/nor06/nor_rec_summ.pdf.

historical solution of maritime delimitation, the 1494 Treaty of Tordesillas,[72] the demarcation again becomes a question of cartography and surveillance.

The potential danger comes from the fact that it is expected that the outer limits of the continental shelf established by a coastal state based on the Commission's recommendations are final and binding. Could the CLCS recommendation be biased? Although, officially, it is based on a neutral, geophysical analysis, there always exists a danger that "(…) scientists will seek to interpret the data in a way that is as beneficial as possible for extended Continental Shelf claims while staying within what is scientifically credible" (Strandsbjerg, 2012, p. 834). The number of the LOS Convention signatories exceeds 180, but there are only twenty-one members in the CLCS (although there are members from Denmark, Russia and Canada). In other words, scientists from 159 countries are not directly participating in evaluation of the Arctic states' claims and they have to rely on the judgements of geologists, geophysicists and hydrographs in the Commission with a different country of origin (the current composition of the CLCS is in Appendix D).

The Commission has no mandate either to determine maritime boundaries between coastal states or to settle disputes unless the coastal states accept it, but that is not the case for Canada, Denmark and Russia. If it concludes that the claims of several countries over the same Arctic area (overlapping claims) are justified, then it is up to these states themselves to reach an agreement on use of the territory. In addition, keeping in mind that the United States has not ratified the LOS Convention and, therefore, is still not bound by its provisions, the dispute solution function of the latter only relates to Norway, which, in turn, does not have an actual application to the Commission regarding the central part of the Arctic Ocean. Finally, keeping in mind the shrinking of the multiyear ice layer, expected growth in the number of icebergs, and an 'unspoken rule' that water is water whether in its liquid or solid state, the legal status of the Arctic ice remains undetermined (IBRU and UA, Ice Law Project, 2015).

Given these shortcomings, the current international legal framework does not provide the Arctic states with a single, universal solution to the regional sovereignty dispute, but a number of alternative solutions. We now turn to the systematization of the dispute over international waters in the Central Arctic Ocean in terms of the major dispute participants,

[72] The 1494 Treaty of Tordessilas demarcated Spanish and Portuguese territory by drawing a line from pole to pole to 100 leagues (approximalety 280nm) west of the Cape Verde Islands. Spain was granted control of lands discovered west of the line, and Portugal gained rights to new lands to the east.

dispute solutions, and individual preferences of the decision-makers over these possible solutions.

1.2 The dispute: decision-makers, options, preferences

According to Fearon, any international conflict, viewed from the perspective of states, can only arise *rationally* under any of the following conditions: (1) information asymmetry; (2) poor commitment; or (3) dispute over an indivisible good (1995, p. 381). We eliminate the first two conditions (i.e., we assume perfect information and no problem of commitment among the decision-makers) and focus on the last condition, indivisibility of a given disputed territory.

In the majority of interstate territorial disputes, including the one in the Central Arctic Ocean, one (or more) state(s) attempt(s) to extend its own power base at the expense of other state(s). Players have diametrically opposed interests. In game-theoretic terms, it is a confrontational, zero-sum interaction: "there is no room for compromise, probably leaving the dispute to devolve into a war of attrition. Naturally, if there is no way to compensate a player for a loss of this sort, the problem does not have a bargaining range. One side wins and the other loses" (Bueno de Mesquita, 2010, p. 7).

How can the Arctic territorial dispute be evaluated in a manner compatible with systemic, quasi-experimental modeling? Game theory provides a significant range of powerful techniques for analyzing this type of interstate conflict, starting with a non-modified (and still the most cited) version by von Neumann and Morgenstern (1944) and ending with rather recent complex mixed-methods multi-player modeling algorithms.[73] In all cases, a typical dispute resolution model consists of three components: (a) the decision-makers, (b) a set of options available to each decision-maker and (c) the payoff of each option based on relative preference of each decision-maker. Let us define these parameters.

[73] Some of the most popular techniques are discussed in Chapter 2.

1.2.1 Decision-makers

To make the system more shock-sustainable,[74] we perform a flexible selection of decision-makers. Since their inception in late 19th century, the social sciences have been dominated by a state-centric epistemology. Among the social scientific disciplines, political science (including geopolitical theory and theory of international relations) has been the most explicitly state-centric (Brenner, 1999, p. 46). Although the critical approaches did enrich the theory with the analysis of non-state, supra- and sub-national actors (O'Tuathail 2003), for the purpose of the current formally-defined and hard data-based research, the 'critical' methodology remains, so far, insufficient (Haverluk, Beauchemin and Mueller, 2014, p. 33).

It is reasonable to respect the state-centric approach, wherein the states are politically sovereign and economically self-propelled entities, and state territoriality is understood as the basic reference point in terms of which all sub- and supra-state processes are classified.[75] Although bureaucratically granular, the nation state is assumed to make rational strategic choices on a similar basis as does the rational individual, and this understanding of the selected unit of analysis is very common in research on international politics (Allan and Dupont, 1999, p. 25). The government-in-power of a nation state is viewed in this analysis as the ultimate actor of international relations – the final decision-maker in the judicial sense. Viewing international politics as a complex, semi-anarchical system comprised of nation states, as many as 193 decision-makers[76] can perform the function of the decision-maker in any particular international territorial dispute. The decision-makers do not exist in vacuum. Apart from being influenced by their surroundings (i.e. by other, non-Arctic issues), they are also constantly influenced by each other. Due to a state-centric approach, state-initiated and institutionalized international interactions (economic, military, demographic, and diplomatic links) are viewed as the only connections between the decision-makers.

In the Arctic conflict, we distinguish between initiating and reacting decision-makers. On the one hand, the two states that, to date, have submitted information on the limits of their own continental shelves in the Arctic Ocean beyond 200nm from the baselines, a detailed scientific evidence, a set fixed delimitation point coordinates and the methods of

[74] The ability of a system to absorb change and adjust itself to a new environment.
[75] See Chapraude (1999) and Gourdin (2010).
[76] As of 2015, the United Nations has 193 active member states. The actual UN member state base is available at: http://www.un.org/en/members/index.shtml.

their calculation, to the CLCS, are the initiating decision-makers: the current reading of their submissions poses direct challenge to the status quo due to the intention to move seaward the existing borders of international waters in the Central Arctic Ocean. On the other hand, there exists a third, cumulative player – mankind (the international community, 'the World'). The nation states belonging to this group are the reacting decision-makers; they have to react to the intentions of Denmark and Russia to change the status quo. This cumulative player, which enjoys the separate category of an international actor regarding the Area in the LOS Convention, consists of three types of nation states. First, there exist other Arctic states with potential interest in the Arctic international waters – Canada and the United States. Although neither has yet made an official Arctic claim, they may do so in future due to their direct geographic contingency to the central Arctic Ocean. Without this geographical contingency, no territorial claim over all water above the Arctic continental shelves is technically possible under the LOS Convention.

This is the case of the second category of decision-makers, which consists of the remaining Arctic states with no claim over the northernmost international waters, due to the lack of geographical justification for such a claim: Finland, Iceland, Norway and Sweden. Despite the inability to claim international waters in the Arctic, these countries are physically present within the Arctic region[77] and are part of many regional institutionalized relations, including permanent membership status in the Arctic Council, the primary circumpolar high-level intergovernmental forum addressing issues faced both by the Arctic governments and the indigenous people of the North.[78] Third, there are the remaining nation states; more than twenty non-Arctic states which have indicated their readiness to participate in regional politics, and states not yet interested in the Arctic region – the rest of international community. Under the LOS Convention, these remaining decision-makers have some rights over international waters, including the ones in the Arctic Ocean (see Subsection 1.1).

1.2.2 Options

Because the current international legal framework does not provide the decision-makers with a uniform solution to the regional sovereignty dispute, but with a number of

[77] As defined in Subsection 1.1.1.
[78] The Arctic Council was established by the Ottawa Declaration in 1996. Full text is available at: http://library.arcticportal.org/1270/1/ottawa_decl_1996-3..pdf.

alternative solutions, it is necessary to define all strategic situations the players are confronted with. In all cases we see the same Central Arctic Ocean but with new area polygons of different shapes, which constitute the northernmost international waters defined on the basis of different geographic settings. The first question is: what territorial configuration constitutes an option in the conflict studied? In the Arctic sovereignty dispute an option is a new geographic situation when two claimant states, Denmark and Russia, make a simultaneous action. It is not necessary for these two actors to act in the same way, but it is necessary for them to act at the same time.

The next question is: do the decision-makers realize the existence of other claims over the same territory? If yes, do they agree with a common procedure for finding a solution (or, in strategic, dispute resolution terms, do they agree with 'the rules of the game')? The claimed area defined in Denmark and Russia's submissions to the CLCS does overlap. Following the standard procedure, in March 2014 Denmark, along with Greenland and Russia, exchanged diplomatic notes claiming that the final delimitation is be performed in accordance with the CLCS recommendation.[79] Denmark's submission manifests its intention to determine the final delimitation through bilateral agreements after the CLCS produces the recommendation over its continental shelf claim (Executive Summary of the Partial Submission to CLCS by Denmark and Greenland, 2014). Russian submission states:

> [f]inal delimitation of the continental shelf of the Russian Federation in the Arctic Ocean with the Kingdom of Denmark, Canada, the Kingdom of Norway, and the United States shall be carried out in accordance with the provisions of Article 83 of the Convention (after the adoption of Commission recommendations on the Submission of the Russian Federation for establishment of the OLCS in the Arctic Ocean). (Executive Summary of the Revised Submission to CLCS by Russia, 2015, pp. 11-12).

Consequently, given the current reading of the LOS Convention, and the readiness of Denmark and Russia to respect CLCS recommendations and 'the rules of the game', the decision-makers are confronted with three possible geographic situations or, in game-theoretic terms, options. First, an initiating player may recall its own submission to

[79] If an overlap of claims over the continental shelf occurs in several submissions, the general practice is: when one state makes submission to the Commission, the other state immediately forwards to the Secretary-General of the UN a diplomatic note that says: (a) a state does not object to the Commission considering the submission of the other state and make recommendations thereon; (2) the recommendations made by the Commission in respect of the submission of one state shall be without prejudice to the rights of the other state in the course of the Commission's consideration of its own submission; and (c) the recommendations with respect to any state shall not prejudice the delimitation of the continental shelf between the two states – see *Executive Summary of the Partial Submission to CLCS by Denmark and Greenland, 2014*, and *Executive Summary of the Revised Submission to CLCS by Russia, 2015.*

preserve the current legal definition of international waters in the Arctic ('Status quo'). Second, the former may limit the original claim only to area that is determined by the seaward extension of EEZ to 350nm from national baselines, in accordance with Para. 5 of Article 76 of the LOS Convention ('Compromise'). Finally, the initiator may annex the total claimed area, in accordance with Para. 6 of Article 76 of the treaty ('Full annexation').

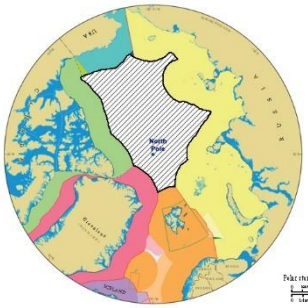
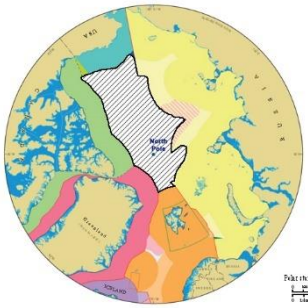
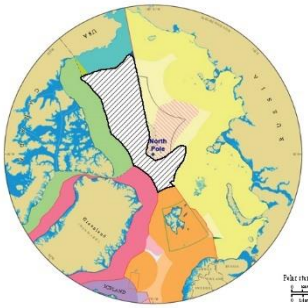
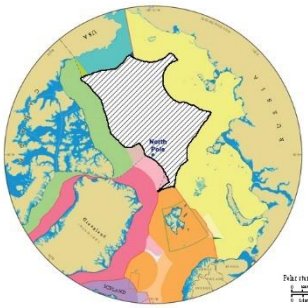
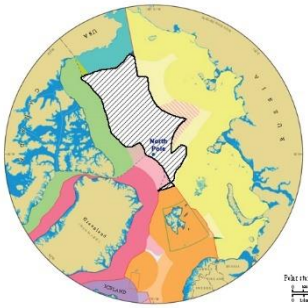
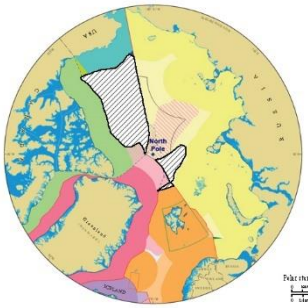
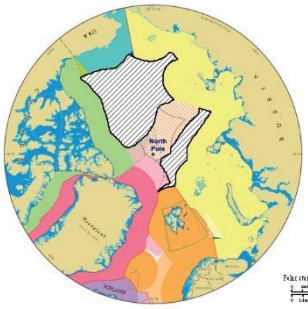
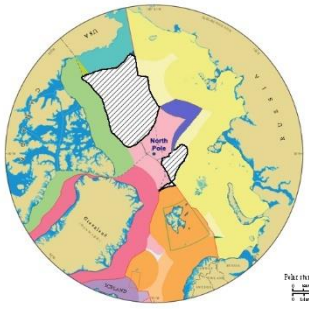
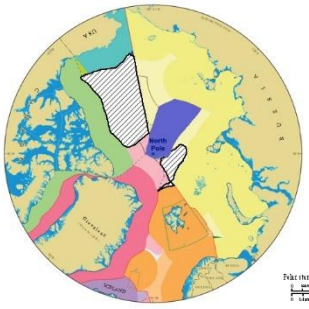
If Denmark and Russia manage to form a functional coalition (let's call it Alliance a), and the rest of the world forms its own coalition (Alliance b), the game would have three options based on the abovementioned situations ('Alliance a vis-a-vis Alliance b'): 'status quo', 'compromise', and 'full annexation'. In the first case, the geographic situation in the central Arctic Ocean if both Denmark/Greenland and Russia recall their own submissions before the Commission publishes the recommendation regarding their submissions. Because the claimants add no new territory and the international community loses none, technically, the status quo is preserved. In the second case, both Denmark/Greenland and Russia annex area defined by the seaward extension of their EEZ to 350nm from the baselines in accordance with para. 5 of Article 76 of the LOS Convention, effectively breaching the status quo. In the third case, both claimant states annex all claimed area in accordance with para. 6 of Article 76 of the LOS Convention, breaching the status quo again; the area of overlap can constitute a condominium[80] or a joint development zone.[81] However, if the two initiating decision-makers do not form a full coalition, the Arctic sovereignty game has $3\text{^}2 = 9$ options.[82] They are presented in Figure 1-5 (for a better resolution see 33).

Options I, V and IX illustrate, respectively, the aforementioned 'status quo', 'compromise' and 'full annexation' situations. The remaining six options (II, III, IV, VI, VII, and VIII) represent new geographical situations with two claimant states not fully coordinating their actions. In Option II, Denmark/Greenland withdraws its own submission, while Russia annexes an area defined by the seaward extension of its EEZ to 350nm from own baselines in accordance with para. 5 of Article 76 of the LOS Convention. In Option III Denmark/Greenland withdraws its own submission while

[80] A political territory (usually a border area) over which several powers formally agree to share equally dominium (in sovereignty), i. e. exercise the rights jointly, not dividing it into 'national' zones (e.g., Antarctica that is governed by parties to the Antarctic Treaty with consulting status).
[81] A zone of 'equal distribution' of the resources discovered therein (e.g. Jan Mayen zone shared by Iceland and Norway) – Bundy, 1994, p. 38.
[82] Each of n decision-makers can find himself in 3 situations ('status quo', 'compromise', 'full annexation'), hence the total number of combinations equals $3\text{^}n$.

Russia annexes the entire section of international waters it has claimed in the Arctic (in accordance with para. 6 of Article 76 of the Convention). In other words, one country, Russia, alters the status quo.

Figure 1-5. Nine options in the Arctic sovereignty game

Option I † - Status quo	Option II †	Option III †
		
Option IV †	**Option V † - Compromise**	**Option VI †**
		
Option VII †	**Option VIII †**	**Option IX †◦ - Full annexation**
		
† *- shaded area shows international waters belonging to the mankind (LOS Convention, 1982)*		
◦ *- area of sovereignty claim overlap is in violet – potential condominium/joint development zone*		

Source: author, based on the LOS Convention (1982) and *"Map of Arctic sovereignty claims"* (IBRU, 2015).

The situation is exactly opposite in Options IV and VII; while Russia withdraws its own submission, Denmark/Greenland annexes either an area defined by the seaward

extension of its EEZ to 350nm from the baselines (in accordance with para. 5 of Article 76 of the Convention) or the entire claimed area (in accordance with para. 6 of Article 76 of the Convention), respectively. Again, one country, Denmark, alters the status quo. The remaining Options VI and VIII illustrate scenarios in which two countries simultaneously alter the status quo with a differentiated gain on their side (and, consequently, differentiated loss on the side of international community). In the first case, Denmark/Greenland annexes an area defined by the seaward extension of its EEZ to 350nm from the baselines (in accordance with para. 5 of Article 76 of the Convention), while Russia annexes the entire claimed area in the central Arctic Ocean (according to para. 6 of Article 76 of the Convention). In other words, both claimant states realize territorial gains, but Russia gains more than Denmark. The second case demonstrates the territorial configuration after Russia annexes an area defined by the seaward extension of its EEZ to 350nm from the baselines according to para. 5 of Article 76 of the Convention, while Denmark/Greenland annexes the entire section of international waters it has claimed in the Central Arctic Ocean following para. 6 of Article 76 of the LOS Convention.

If we add into the game the third cumulative decision-maker (the international community), the latter would be faced with with $3\text{^}3 = 27$ options. Adding one more player (if, for example, a coalition forms within international community becoming the fourth decision-maker) brings the total to $3\text{^}4 = 81$ options. However, if no coalition is formed within international community, i.e. if we remain on the level of individual nation states, there is $3\text{^}187 = 1{,}666E + 89$ options.

1.2.3 Preferences

The decision-makers derive their unique preferences over all dispute options from various combinations of marginal utility. The utility of each dispute option is the present value of the payoff to the decision-maker so that uncertain future payoffs are translated into the agent's current wealth. Consequently, "(…) there is a monotonic increasing (but not necessarily linear) relationship between the option's value and the agent's utility. The consequence is that, provided the price of the option is right – any utility-maximizing choice by the agent is also maximizing the value of the option, and vice-versa" (Ziegler, 2004, p. 9). Defining the value of each option in the Arctic sovereignty dispute is therefore the last, and the most problematic, component of our formal dispute modeling. It is

problematic because, contrary to the 'obvious' options, where the researcher can introduce preferences with at least an ordinal order, (s)he does not know them in 'unobvious' options. Let us illustrate the difference between 'obvious' and 'unobvious' options.

A visual analysis of maps in Options I-IX identifies the 'obvious' options with ordinal preferences of the decision makers; given the indivisibility of contested good, the value of Denmark and Russia's preference for annexing the entire section of international waters to which each has laid claim in the Central Arctic Ocean (para. 6 of Article 76 of the LOS Convention) is maximal, while the value of withdrawing their own submissions, leading to preservation of the status quo, is minimal. It is also reasonable to assume that the value of 'compromise', i.e. annexation of only of areas defined by the seaward extension of their EEZ to 350nm from their own baselines, is somewhere between the two.

In other words, Denmark prefers all scenarios where it annexes the entire section is has claimed of international waters in the Arctic in accordance with para. 6 of Article 76 of the LOS Convention (Options VII, VIII and IX) to all scenarios in which it annexes only an area defined by the seaward extension of its EEZ to 350nm from national baselines according to para. 5 of Article 76 of the LOS Convention (Options IV, V and VI), and prefers this to scenarios where it withdraws its own submission (Options I, II and III). Preferences for Russia are similar; it prefers all scenarios in which it annexes the entire section of international waters it has claimed in the Arctic in accordance with para. 6 of Article 76 of the LOS Convention (Options III, VI and IX) to all scenarios in which it annexes only area generated by the seaward extension of its EEZ to 350nm from national baselines according to para. 5 of Article 76 of the LOS Convention (Options II, V and VIII), and prefers this to scenarios in which it recalls its own submission (Options I, IV and VII).

The preferences of international community are exactly the opposite; the value of options in which Denmark and Russia annex all claimed sections of international waters in the Central Arctic Ocean (para. 6 of Article 76 of the LOS Convention) is minimal, while the value of the scenario in which these two countries withdraw their own submissions and preserve status quo, is maximal. And, similarly to the case of the initiating decision makers, the value of 'compromise', i.e. Denmark and Russia annexing only an area defined by the seaward extension of their EEZ to 350nm from their own baselines, is in between. In other words, the international community prefers 'status quo'

(Option I as the full status quo, and Options II, III, IV and VII as partial status quo – i.e. the preservation of the status quo by at least one initiating decision maker) is preferred to 'compromise' (Option V as full compromise and Options II, IV, VI, and VIII as partial compromise on the side of at least one initiating decision maker) and 'compromise' is preferred to 'full annexation' (Option IX as total annexation by both claimant states and Options III, VI, VII, and VIII as partial annexation of all claimed area by at least one claimant state).

In contrast to Options I, V and IX, for which the order of preferences can be set up, intuitively, for both the claimant states and international community; Options II-IV and VI-VIII are 'unobvious'; we cannot know, for example, whether the international community prefers Option IV to Option II, or Option III to Option V, or Option VIII to Option VII. There are, in fact, 12 more such option combinations with 'unobvious' value.[83]

How the value of payoff for each individual option in the Arctic sovereignty dispute to be computed? In this research we use a range of rigorous analytical techniques to calculate these values not only for the aforementioned 'obvious' options, but for all dispute options including 'unobvious' ones, in order to understand what solutions are available in the northernmost territorial dispute, and which of them are optimal.

1.3 Aims, questions and testable hypotheses

Given the distinct set of both initiating and reactory decision makers, nine scenarios resulting from alternative readings of the LOS Convention, and individual preferences of the decision makers regarding these scenarios, the Central Arctic Ocean territorial dispute constitutes a classic multi-player zero-sum game. However, because the decision makers and individual scenarios, but not the decision makers' preferences, are known, it is not technically possible to start game modeling without prior estimation of this unknown parameter. In other words, before running any equilibrium and coalition analysis, is it necessary to understand on the basis of which actor-specific attributes and general logical premises, the one may derive player preferences over the potential dispute resolution

[83] The total number of all pairs of 'unobvious' options (II–IV and VI–VIII) to be ranked in terms of payoff value is 15, according to a so-called "n choose r" rule: $C(n,r) = n!/(r!\,(n-r)!)$, for $0 \leq r \leq n$, where r is the number of sample elements (in our case $r = 2$ because we consider a pair of options); and n is the number of elements in a larger set of distinguishable objects (in our case $n = 6$, as we consider six 'unobvious' options). In this computation, order does not count and repetitions are not allowed.

options in the given dispute. Since the studied decision makers constitute political entities with rather different attitudes to risk and uncertainty, at the level of theory, the majority of traditional mono-causal arguments based on the general notion of rationality (e.g., realist balance-of-power and power preponderance theories) seem to overestimate the impact of individual state attributes in policy preference formation. Instrumental, multi-variable state capability models and state power indices are less affected by this operational limitedness, and the one comprising of both social and geographic material attributes is a good candidate to serve as the starting analytical point in the search for the decision-makers' preferences in the Arctic territorial dispute, for two reasons.

First, the social part of the composite index of state capability allows to identify and rank the decision-makers according to their superiority in three major human-based parameters, all related to the conflictual environment in the so-called "Arctic question": economic prosperity, military advancement and demographic strength. Second, the geographic part of such composite state power index allows to compare the decision-makers according to three core physical parameters that are also relavant to the studied dispute: land and sea area, compactness and relative location. By combining social and physical reality it is possible to evaluate the environment both strategically (i.e. within the framework of willingness and opportunity[84]) and cross-temporarily, in order to derive the decision-makers' regional policy preferences in the rigorous and neutral way. Identification of these preferences, that are stable in time, then allows to model the Arctic game and search for potential coalitions between its major participants, under the principle of general actor rationality and the expected utility argument.

Given this aforementioned analytical configuration of the northernmost interstate sovereignty conflict, this study aims to contribute to the ongoing geopolitical research, foreign policy analysis and polar studies by:

- offering an inter-disciplinary study which links geographic, legal and political analytical perspectives with quantitative research methodology;
- providing the empirical evidence on the long-term geopolitical development in the region;
- analyzing the specific territorial gains and losses for all decision-makers from each of nine game options presented in Figure 1-5;

[84] See Sub-section 2.3.2.

- deriving the value of payoff for each decision-maker and each option in the Arctic sovereignty dispute from variation in the former's aggregate national resource (social and geographic) due to specific territorial changes in the central part of the Arctic Ocean;
- finding optimal solutions for conflict resolution in the Arctic dispute based on different combinations of decision-makers' strategies;
- finding rational coalitions among the decision-makers of the Central Arctic Ocean dispute;
- offering alternative scenarios of future strategic developments in the region and conditions under which their realization is the most probable.

In order to accomplish these goals, we answer the following research questions:

Q_1. How can a systemic, positivist and quasi-experimental research design contribute to geostrategic analysis of the northernmost sovereignty dispute?

Q_2. In order to realize which scenario will most likely prevail in future, what dynamic elements of the Arctic geopolitical system should be assessed?

Q_3. How does each decision-maker define own preferences in the game?

Q_4. How is the aggregate power base of each decision-maker influenced by geographic factors?

Q_5. Is it rational for the decision-makers to depart from the status quo?

Q_6. How feasible are the scenarios the decision-makers are confronted with?

Q_7. In which cases is it possible that a rational coalition between the Arctic claimant states and/or between the Arctic claimant states and the members of international community emerges?

The work implies a two-stage analysis. First, we identify the aggregate power base for each decision-maker and derive the value of payoff of each decision-maker and each option in the Arctic sovereignty dispute from variation in this power base due to particular territorial changes in the Arctic Ocean, in Chapter Three. Second, we model the northernmost sovereignty conflict in order to determine the optimal solutions to the dispute and suggest the potential rational alliances among the dispute decision-makers, in Chapter Four.

Although the first stage is mostly inductive and we work with some of the aforementioned research questions (specifically, Q_3 and Q_4), three hypotheses on the decision-makers' power base are tested:

H_1. Cross-temporal variation in the absolute values of the $SocR$ index for 187 states is statistically significant.[85]

H_2. Cross-temporal variation in the absolute values of the $SocGeoR$ index for 187 states is statistically significant.[86]

H_3. The effect of changes in the area of the Arctic EEZ over the $SocGeoR$ index is different from zero.[87]

When dealing with multiplayer conflict modeling in the second stage of research, we answer the remaining research questions (Q_5, Q_6 and Q_7) and test two more hypotheses:

H_4. There exists at least one equilibrium in the game that is stable under all solution concepts.[88]

H_5. There exists at least one rational coalition between the decision-makers in the Arctic territorial dispute.[89]

1.4 Chapter summary

This chapter has introduced the geopolitical complexity of the Arctic dispute over international waters in the central part of the Arctic Ocean. We have defined the physical reality of the contested terrfitories in the context of a wider Arctic region, and summarized those parts of public international law that regulate international relations in areas beyond national jurisdiction and govern the attempts of particular nation states to move, seaward, the existing maritime borders. Then, we presented the Arctic territorial dispute through three primary components of a typical conflict resolution model: a set of decision makers, a set of options available to each decision maker, and the option payoffs for each decision maker, based on the relative preference of the latter. Finally, we presented the aims, questions and testable hypotheses of our research. In the next chapter, we present the vital theory behind the research.

[85] Null hypothesis is: cross-temporal variation in the $SocR$ index is statistically insignificant.
[86] Null hypothesis is: cross-temporal variation in the $SocGeoR$ index is statistically insignificant.
[87] Null hypothesis is: the influence of changing area of the Arctic EEZ over the $SocGeoR$ index is zero.
[88] Null hypothesis is: no equilibrium exists in the game that is stable under all solution concepts.
[89] Null hypothesis is: there exists no coalition between the decision-makers in the Arctic territorial dispute.

Chapter 2

Theoretical Configuration

Territorial disputes between the nation states are as old as the nation states themselves. Throughout time, hundreds of them had been successfully settled, and dozens are still waiting for final resolution.[90] Referring to the results of the empirical research of Vasquez (1993, 1995, 1996), Hensel concludes: although many types of issues are salient enough to lead to war, territorial issues are especially salient and especially likely to do so. Because of tangible, intangible, and/or reputational importance, interaction over territorial issues is fundamentally different from interaction over other issues (Hensel, 2012, p. 11). Not only are territorial conflicts more escalatory (Vasquez and Henehan 2001) but, due to the risk of future attempts to regain the once lost areas, they are argued to be more difficult to resolve (Bowman 1946). Depending on how the states attempt to settle territorial issues, they may or may not escalate their disagreements to the threshold of a militarized conflict or war. What *structural* factors make a state prefer offensive war to diplomacy in such conflicts?

This chapter introduces theoretical configuration of the current study of the Arctic dispute over international waters in the central part of the northernmost Ocean, by (1) summarizing the role of the Arctic in geopolitical theory, (2) evaluating the existing game-theoretic research on conflict and cooperation in the northernmost region and discussing the process of foreign policy preference formation and systemic and quasi-experimental modeling, and (3) introducing social and geographic resources of states, and ways of manipulating of the geographic resources of states as assigned by the legal settings of the northernmost dispute. By doing so, we understand how a systemic, positivist and quasi-experimental research design contributes to geostrategic analysis of the northernmost sovereignty dispute (Q_1 in Subsection 1.3), and what dynamic elements

[90] For historical and contemporary interstate militarized disputes, see *Correlates of War, MID Data set, v4.01* (http://www.correlatesofwar.org/data-sets/MIDs) and *CIA – The World Factbook* (https://www.cia.gov/library/publications/the-world-factbook).

of the Arctic geopolitical system should be assessed in order to detect the most probable scenario for the future (Q_2 in Subsection 1.3).

2.1 The Arctic in geopolitical theory

Although human development in the wider Arctic region has been of interest to social science scholars already in the 18th century (Laptev, Cheluskin and Chekin 1742; Scoresby 1799); the discussion of it in terms of interstate conflict and cooperation has started to appear systematically in scientific literature only in 1980s (Bloomfield 1981, Griffiths 1988, Scrivener 1989) – a decade when the formalization of the international public law governing areas beyond national jurisdiction culminated in the conclusion of the United Nations Convention on the Law of the Sea, and when the technical mapping of the Arctic Ocean seabed started to provide the inputs necessary for a truly meaningful circumpolar analysis. In addition to the region's geophysical uniqueness – remoteness, hostile weather, and perennial and seasonal ice cover, the conceptual delay was further fueled by the fact that "…unlike more familiar regions, such as Southeast Asia, the Middle East, or South America, the Arctic consists largely of segments of nation states whose political centers of gravity lie, for the most part, far to the south" (Einarsson et al., 2004, p. 18).

Apart from popular rhetoric, which is frequently misleading, what is a rationale behind the conflict in the Central Arctic Ocean region, given the fact that the latter is a frozen and remote body of water and its exploitation is associated with enormous costs? Although social polar research is now on its rise, the positions are manifold. Some scholars point to the irreversibility of ice melting (American Meteorological Society 2012) and call the Arctic a next geopolitical 'hot spot' (Keskitalo 2004, Chapman 2011), or even label the Arctic Ocean 'the future Mediterranean of the air' (Fifield and Pearcy 1944). Others successfully falsify the economic rationale behind the majority of commercial projects in the region[91] and question the very idea of treating the Arctic as a distinct region at all, as the idea is little more than an artificial social construct that requires serious manipulation of the facts to seem credible (Stefansson Arctic Institute

[91] The Arctic maritime transit routes are not commercially viable due to high insurance premiums, lack of infrastructure, shallow depth of some passages, and harsh weather conditions (Jakobson 2010); while the economic benefits of Arctic oil and natural gas production are seriously constrained by the distribution of natural resources, global energy prices, exploration costs, and associated environmental issues (Budzik 2009).

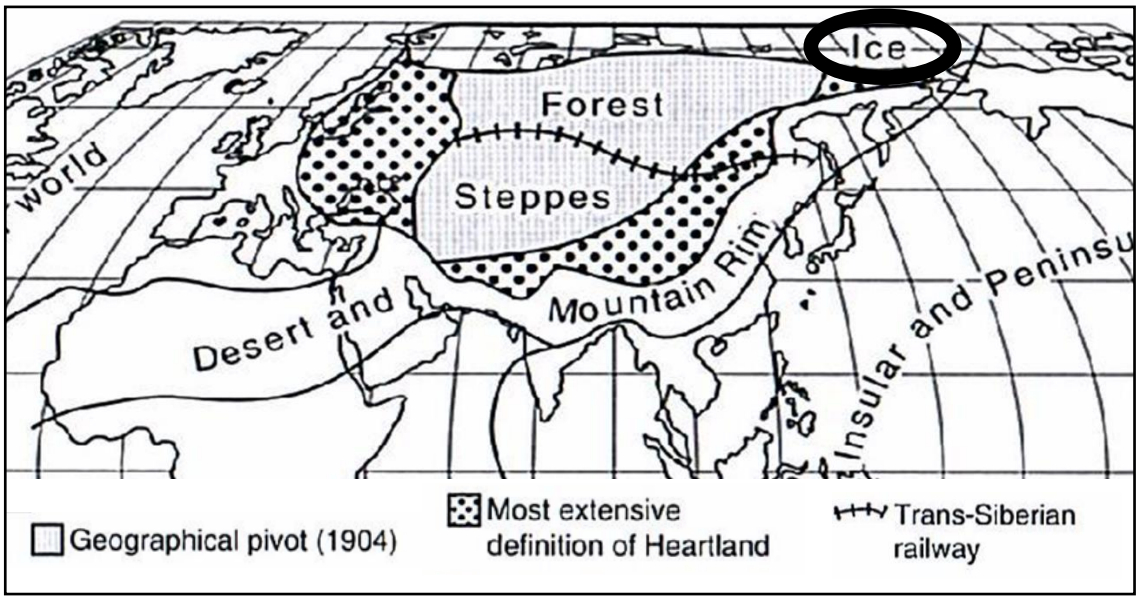
2004). Before allying with any position, it is necessary to evaluate all conceptual background of the Arctic dispute in geopolitical theory.

Until very recently, the Arctic region did not serve as the primary object of study to thinkers belonging to geopolitical branch of social sciences. However, it does not mean that the former and the latter had nothing in common. Not directed towards the study of the northernmost region, the rise of classical geopolitical theory and strategic thinking (similarly to the rise of realism in international relations) fundamentally influenced the socio-political development in the Arctic. Following Mahan's idea that "…naval supremacy was the prerequisite to ascendancy in the world political order" (Sumida, 2003, p. 39), Mackinder searched for ways for Great Britain to maintain its global maritime supremacy during the post-Columbian Age, when no lands were left to conquer, the world political system was closed, and the dominant form of power was that coming from the continental mass (Kearns, 2009, p. 146). In the famous *The Geographical Pivot of History* (1904) Mackinder asked: "Is not the pivot region of the world's politics that vast area of Euro-Asia which is *inaccessible to ships* [my emphasis]… [but] is today about to be covered with a network of railways?" (Mackinder, 1904, p. 37). Without going too deep into the heartland theory, given the fundamental 'seapower versus landpower' dualism in classical geopolitical thought, the main tension comes from the fact that the northern part of Eurasia was not accessible by other countries' fleet through the 'Icy Sea' – the Arctic Ocean – see Figure 2-1. Although Mackinder did not offer a sufficiently advanced analysis on the role of the 'Icy Sea' in his theory, the latter made a giant impact on the further development of the Arctic – since the 1940s, it has been intensively militarized.

Several subsequent classical geopolitical theories promoted the view of the Arctic as a strategic location. Already during the Second World War Renner suggested that not the Eurasian landmass but the northernmost ocean was the pivotal world arena of movement, since there existed not only the Mackinder's Heartland, but also a smaller, Anglo-American pivot. The Arctic Ocean is located between the two pivots, making them vulnerable towards each other. The Arctic is therefore the key to world control (Renner 1942). In the same spirit, De Seversky (1942) concluded that the Polar Regions were the new zones of global geopolitical tension. The Arctic was particularly significant because, if the projection is changed from Mercator (as in Figure 2-1) to a polar azimuthal equidistance (as in Figure 1-1), it comprised the shortest air route between Eurasia and North America (Flint, 2006, p. 22). In line with realist assumptions, the vision of the

Arctic as a future Mediterranean of the air became "…[an] idea that contained all the elements of probability" (Fifield and Pearcy, 1944, p. 181). Similarly, the region's maritime space gained strategic significance – the ice was not a big problem for nuclear submarines for the major Cold War adversaries (Hnízdo, 1995, p. 57). Not only did it accommodate the Iron Curtain, but it was also a place where the main rivals, the United States and the Soviet Union, shared a common border of approximately 2500km (Blake, 2007, p. 98).

Figure 2-1. Arctic ice as a necessary condition in the Heartland argument



Source: author, based on Kearns (2009).

Both the German and Russian classical schools of geopolitical thought belong to the tellurocratic tradition. The former, whose main postulates were manifested by General Haushofer, imported the talassocratic idea that the Arctic was a strategic location: "...from Sir Halford Mackinder, Haushofer seized upon the concept of the heartland" (Herwig, 2003, p. 220). The latter, dominated by Eurasianists, did not find any support among Soviet leaders, mainly because of the German origin of geopolitical terminology, and became an official taboo in the Soviet Union (Solovyev, 2005, p. 129). However, at the conceptual level, Germans and the Soviets understood the particular role of the Arctic region in the same way as did British and Americans – as a strategic, although frozen, global gateway. That is why, during World War I and World War II, the Arctic was so crucial for supply convoys and, later, submarines (Holmes, 2008, p. 325). In sum, the Arctic was one of the primary strategic locations within the Cold-War system of

international relations, in line with the main arguments of the classical school of geopolitical thought.

In the post-Cold War era of international politics, the Arctic was among the first regions to experience geopolitical transition. If a Cold-War world order was more or less stable set of international, geographically-based power relations (Taylor, 1990), the post-Cold War period marked 'geopolitical disorder' – the decline of postwar bipolarity, yet without any alternative (O'Loughlin, 1994, p. 92). The new multipolar system promised equality among all international actors, leaving no rationale for imperialism: "…cooperation, not security competition and conflict should have become the defining feature of relations among great powers" (Mearsheimer, 2001, p. 360). However, the idealistic scenarios did not realize in the Arctic Ocean. Burdened with legacy of heavy militarization, it entered the new era of global politics characterized by ozone layer destruction, climate shifts, finite natural resources, topsoil erosion, deforestation, and the oceans' inability to be both food producer and waste receptacle. Pollution was produced at a rate that far exceeded nature's capacity to render it harmless, and many species were assumed to become extinct (Chaturvedi, 1996, p. 1). Can new strategic settings be explained solely by classical, geographically-deterministic geopolitical concepts? In the twenty-first century, geopolitics cannot be limited to geographical factors, despite the fact that "…because humans are physical beings who occupy space and have physical needs geography cannot be dethroned from its central position in the international sphere" (Walton, 2007, p. 101).

The advocates of a now dominant critical (or postmodern) approach[92] attempt to move 'beyond' the classical geopolitics and view the latter as a much broader and more complex problematic than is acknowledged in the traditional understanding of the concept: "[g]eography is an inescapably social and political geo-graphing, an 'earth writing'…[It is] a cultural and political writing of meanings and politics of states" (O'Tuathail, 2003, pp. 109-110). The critical geopolitical assessment of the Arctic is not rare. However, to date, scholars are almost exclusively interested in the question of how the meaning of 'places' and 'geopolitical space' is constructed in regional political discources (Dodds and Ingimundarson 2012, Manicom 2013, Wilson Rowe and Blakkisrud 2014). Unfortunately, the critical tradition is still too heterogeneous to offer a single formal model of comprehensive analysis of intraregional relations. In fact, such uniform

[92] The critical approach now dominates the geopolitical research in the United States geography departments (Haverluk et al., 2014, p. 19).

formalization is considered a wrong way of researching geopolitics. Other fundamental circumstances also prevent us from working with critical geopolitical methodology. Not only is not the latter primarily interested in the non-hegemonic states (as are the majority of Arctic states), but, more importantly, it pays too little attention to material environmental variables (Criekemans, 2009, p. 40).

We agree with Haverluk, Beauchemin and Mueller (2014): as both classical and critical geopolitics have turned into political movements with own, internal (and limiting) ideology, leaving the primacy of conceptual consistency behind, a neo-classical geopolitical approach relying on "the enduring role of geography in global conflict and economic development" (2014, p. 20) is necessary. This new thinking corresponds to geographical possibilism: geography is one of many possible conditional factors in international relations, but it has a facilitating rather than a pure effect (O'Loughlin and Anselin 1993). Humans have to make decisions among possible choices. Modern geopolitics is diachronic: it is an active process of constituting the world order rather than an accounting of permanent geographical constraints, where the nature of competition moves from the military-political sphere to the economic dimension (Corbridge and Agnew 1991). This is true for the Arctic. Recent geopolitical analysis indicates the tendency of non-geographic and non-military variables supplementing the traditional, geography- and military-related parameters describing the strategic setting in the region (Sale and Potapov 2010, Zellen 2009, Keskitalo 2004, Knell 2008).

2.2 Game theory?

Even though a limited number of experts on Arctic geopolitics has been working on formal regional conflict research with elements of forecasting,[93] prediction of specific events in the central part of the Arctic Ocean still remains to be performed, due to an interplay of a too big number of factors, too heterogeneous results of qualitative analysis and, simultaneously, and a still missing general statistical procedure. In this study we model (and predict) the changes in the Arctic geostrategic space using the internal logic of the game-theoretic approach and applied statistical analysis. Game theory proved to be

[93] For example, in 2007 Brigham offered four scenarios of the region's development by 2040 – "Globalized frontier", "Adaptive frontier", "Fortress frontier" and "Equitable frontier" – based on global climate change, transportation systems, resource development, indigenous Arctic peoples, regional environmental degradation, the Arctic Council efficiency, and the overall geopolitical issues facing the region (Brigham, 2007, p. 27).

a successful method in a range of social studies of geostrategic conflicts in global regions (Madani and Hipel 2007; De Mesquita 2009; Cole, Izmalkov and Sjoberg 2014). Striving for a stronger technical consistency, we define geostrategic analysis as a derivative of geopolitical analysis aimed at discovering the relationship between the physical space and the classical strategic behavior of a nation state occupying this space.

The development of geostrategic conflict in the Arctic has several distinct game-theoretic characteristics. Firstly, it can be viewed, in line with classical realism, as a zero-sum game – a dispute in which one player extends own power base (territorial possession) at the expense of other players. This argument goes in line with reasoning of many scholars that predict a conflict in the Arctic (Smith and Giles 2007, Fata 2009, Chapman 2011). On the other hand, it may also be viewed as a positive-sum game that allows plugging in bargaining, agreeing, maneuvering, compromise into a theoretical consideration (Říchová, 2000, p. 113), following a liberal perception of Arctic as an arena of international cooperation (Chaturvedi 1996, Keskitalo 2004, Exner-Pirot 2012, Hough 2013). Secondly, it may be viewed as a mixed strategy game with several co-existing scenarios, starting with the one of pure conflict and ending with the one of pure cooperation. Thirdly, players are interconnected via numerous channels, i. e., they simultaneously play more than one game,[94] and any solution of a particular game cannot be evaluated without reference to other games the actors are participating in (Říchová, 2000, p. 115).

Game-theoretic treatment of the Arctic conflict is now on its rise. Among many analyses, two deserve attention for the particular conceptual and practical contribution to the understanding of geopolitical tensions in the region. Relying on a contest form of a bargaining model to study a litigation procedure, Ansink (2011) comes to conclusion: because the Arctic states defend their claims by investing in a so-called 'ammunition' (as financing of underwater expedition), the probability of severe conflict is lower when a central authority (as the LOS Convention) evaluates the claims. In this case, the costs to the participants are reduced and the likelihood of an agreement is increasing (Ansink, 2011, p. 1). These results emphasize the core importance of strong governing institutions in the region.

Cole, Izmaikov and Sjoberg (2014), on the other hand, review a series of salient Arctic issues with global implications (management of open-access fisheries, opening Arctic

[94] Concept of nested games.

areas for resource extraction, and effectivity of environmental regulation of this extraction). The authors provide insights to help reach socially preferred outcomes, namely, side payments – a kind of compensation from one party of a conflict to another – as a core mechanism "…for reaching a more biologically, culturally and economically sustainable Arctic future", and, when signals misrepresent Arctic players' true characteristics, intervention by an external actor (Cole, Izmaikov and Sjoberg, 2014, p. 9). However, neither work provides a transparent and dynamic analysis of the dispute over international waters of the Central Arctic Ocean.

2.2.1 Graph model for conflict resolution

Which game theoretic technique is appropriate in modeling of the Arctic dispute? The non-modified (and still the most cited) version of game theory offered by von Neumann and Morgenstern (1944) is not an option, as in the Arctic we deal with a multiplayer game. At the same time, if we consider that, subjectively, the governments of the Arctic states continue perceiving each other through the lenses of Cold War-politics – 'Russia versus the Rest' logic – the analysis may rely on the experience of multiple games of chicken[95] between the rivals at times of bipolar confrontation, if we assume that the Arctic states believe in each other's rationality and their own ability to predict the behavior of their counterparts. Both approaches are, however, subject to criticism if applied to modern international conflicts.[96]

Among the available research templates, graph model for conflict resolution (GMCR), seems to be the most effective approach to the analysis of multiplayer territorial disputes, even if the latter occur in as remote seas as the central part of the Arctic Ocean. Invented more than a decade ago,[97] and being successfully applied within a range of social disciplines,[98] the framework is a collection of analytical procedures allowing to design, run and interpret real and hypothetical developments in international relations through

[95] The game of chicken is one of the primary frameworks for modeling a conflict. The game is zero-sum (non-cooperative): while each player prefers not to concede to the other, the worst possible outcome occurs when both players do not concede. This game had frequently been used to describe the Cold War-logic of mutual assured destruction and the emergence of brinkmanship during the 1962 Cuban Missile Crisis (Drulák, 2003, p. 99).

[96] Enjoying a long tradition and solid conceptual connectedness to economics and Bayesian decision analysis, non-cooperative game theory by von Neumann and Morgenstern (1944) suffers from several serious problems: (a) decision-makers must know the order of the action (but it should not necessarily happen); (b) preferences must be represented by real-valued utilities (which are sometimes exceptionally hard to quantify; and (c) predominance of bipolar (two-player) logic.

[97] See Kilgour et al. (1987).

[98] See Kilgour (2007) for an impressing compilation of GMCR applications in social sciences.

evolutionary multi-player games. GMCR is a user-friendly and flexible tool for modeling and analysis of strategic decision making: it is fast, accurate, reliable and multi-faceted and can be used in Windows-based *GMCR+* software. The algorithms reconstruct games with ordinal preferences of the decision-makers – a player may only compare utilities of each of the repeating games, but does not know their numerical value. The research template simultaneously allows to evaluate, systematically, a multilateral conflict that is not limited in time.

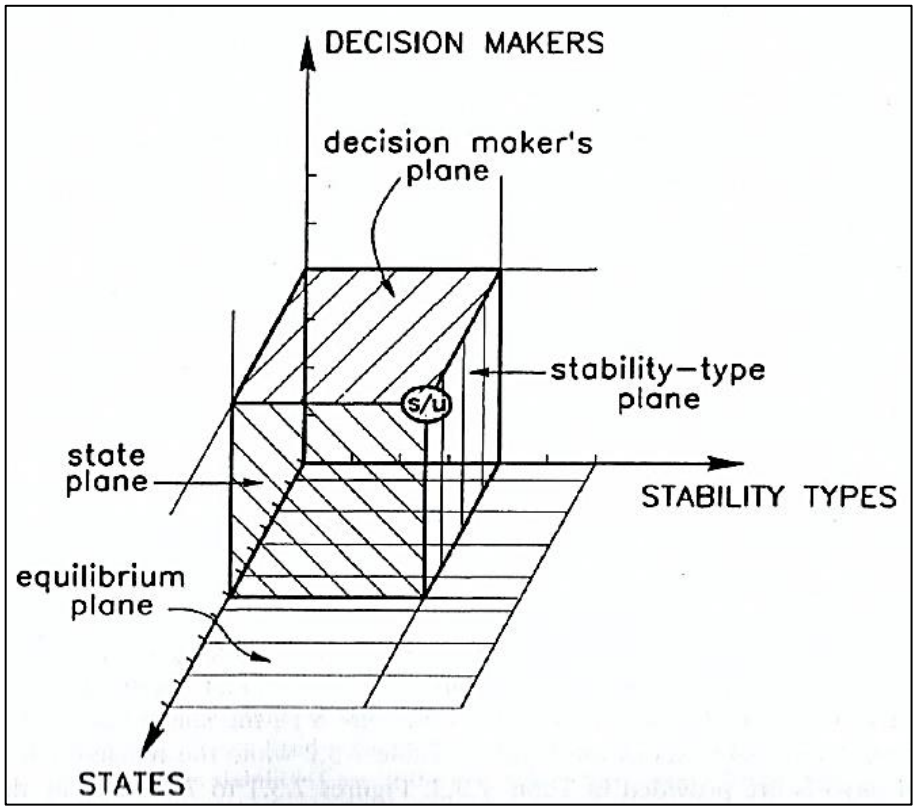
The general game-theoretic procedure consists of three stages: modeling, analysis and interpretation of results. The modeling phase depicts a given conflict by a sum of three components – decision-makers (actors), options and preferences. Each actor is able to influence other actors by own actions (moves) either unilaterally or in coalition. Every combination of actors' strategies (i.e., a sum of all moves of all actors) constitutes a feasible solution (called a feasible state). But not all states are feasible, and infeasible states are removed from the analysis by an introduction of particular logical constraints. The analysis becomes limited to the feasible states. Next, the reactory moves– answers to the strategies of other actors – are introduced into the model, reflecting the transitive character of conflict development through the equilibria evolution. That is so because a diagram model requires only a simple ordinal arrangement of actors' stable preferences of feasible options, from a least preferred option to the most preferred one. Then, the irreversible moves (decisions) of the actors are defined. The game assumes that making any unilateral seaward moving of own maritime borders in the Arctic Ocean, is irreversible and a country which decided to make such a move would not decide to alter own possessions in future.

The analysis phase provides the feasible states of equilibrium using a calibrated model of conflict resolution (stability analysis) in order to find solutions to the main research problem. As demonstrated in Figure 2-2, stability is defined on the intersection of the decision-maker plane, state (solution) plane and equilibrium plane. The resulting *solution concept* defines the vectors of *interactive decision making* as searches for compromise solutions.

For an *n*-player conflict, the goal is to understand whether a feasible state is stable for each actor according to six types of stability: Nash stability (*R*), general metarationality (*GMR*), symmetric metarationality (*SMR*), sequential stability (*SEQ*), limited-move

stability (L_h), and nonmyopic stability (*NM*).[99] All of them are formally defined in Chapter Four. What follows is a brief introduction of all analytical procedures allowed by GMCR. Under Nash stability (individual rationality *R*), player *i* expects that player *j* stays at any state *i* moves to, and, consequently, that any state *i* moves to will be the final state. The initial state *k* is stable if *i* cannot move from *k* to any state *i* prefers. In other words, no player has anything to gain by changing only his own strategy. Nash player has a one move distant horizon.

Figure 2-2. Graph model for conflict resolution – structure of stability



Source: Kilgour, Hipel and Fang, 1993, p. 195.

In general metarationality (*GMR*) models, the behavior of a 'conservative' player – the one considering all possible reactions to his own move but ignoring own possible counterreactions –implies that a state *k* is stable if player *i* expects that the other players (n-1) will respond to hurt *i*, if it is possible for them to do so, by a sequence of unilateral moves.[100] A general metarational player has, therefore, a horizon of two moves away. Symmetric metarationality (*SMR*) defines stability more restrictively: now player *i* not

[99] More on the forms of stability analysis might be found in Madani and Hipel, 2007.
[100] Player *i* anticipates that the conflict ends after player *j*'s move and that *j*'s move (a 'sanction') is chosen with no regard to *j*'s payoffs.

only considers all possible reactions to his own move but also expects that he will have a chance to counterreact (k_3) to player *j*'s response (k_2) to *i*'s original move (k_1).[101] His horizon is now three moves away.

Sequential stability condition (*SEQ*) is similar to *GMR*, but includes only 'credible sanctions' (k_2): a state is sequentially stable for a player if the latter is unwilling to accept any unilateral improvement from his state because a unilateral improvement by the opponent may result in a less preferred state (for the original player) than the initial state. Next, a limited-move stability (L_h) operationalizes the method of anticipation[102] and assumes that a rational player chooses an alternative "[…] which yields the preferred anticipated state" (Kilgour, Hipel and Fang, 1993, p. 57). A player has no incentive to deviate from a given state unilaterally, under the appropriate stability criterion, and a state is an equilibrium if all players simultaneously accept that it is stable. This type of analysis allows working with two cases of decision-maker behavior: (1) the original player participates in the response sequence and (2) the original player does not participate in the response sequence. In other words, a player with an original initiative is able to make other moves later in the process.

Finally, being a limiting case of L_h (i.e. the horizon now increases without bound), nonmyopic stability (*NM*) assumes that the players look ahead and anticipate where a process might end up in case they were allowed to make several sequential moves and counter-moves starting from any status quo position (Kilgour, Hipel and Fang, 1993, p. 78). Because the definition of L_h has two cases, *NM* definition has two cases as well.

Table 2-1. GMCR – solution concepts and human behavior

Type of stability	Foresight	Disimprovement
Nash stability (R)	Low	Never
General metarationality (GMR)	Medium	By opponents
Symmetric metarationality (SMR)	Medium	By opponents
Sequential stability (SEQ)	Medium	Never
Limited-move stability (L_h)	Variable	Strategic
Nonmyopic stability (NM)	High	Strategic

Source: Kilgour, Hipel and Fang, 1993, p. 14.

[101] Player *i* anticipates that the conflict ends after his counter-reaction and with no regard to *j*'s payoffs.
[102] See Kilgour, 1985.

In a qualitative sense, six solution concepts can be differentiated according to two criteria, foresight and strategic disimprovement – see Table 2-1 above. *Foresight* is the ability of an actor to think about possible moves that could take place in future. An actor with a high foresight imagines many moves and countermoves into the future when assessing where the conflict could end up because of an initial unilateral move on his part. That is why the foresight is low for Nash stability but very high for the nonmyopic stability.

Strategic disimprovement, on the other hand, means that a particular actor may opt to move, temporarily, to a worse state in order to reach a more preferred state. Disimprovements by opponents is an opposite reflection of the same situation: other actors may put themselves in worse positions to block unilateral improvements by a given actor. Why not to focus on just one type of stability, Nash equilibrium, that is analytically powerful enough to be a basic building block of the theory of games (Binmore, 2007, p. 12)? According to the authors of the GMCR technique, "a state which is stable under one solution concept may not be stable under another solution concept unless the former solution concept is a subset of the latter one. A given equilibrium is stronger if it is stable under more solution concepts" (Kilgour, Hipel and Fang, 1993). In other words, such a state is stable for decision-makers that are heterogeneous in terms of risk tolerance and behavior – a situation which might have occur in the Arctic.

Two post-modeling analyses are usually performed: sensitivity analysis and coalition analysis. Sensitivity analysis reveals whether the model works properly and how sensitive it is to different parameters. The model can be run many times with different preference adjustments. Without software, the modeler cannot physically analyze models with many decision-makers, options and feasible states. For instance, in some stages of the sensitivity analyses, the total number of feasible states can reach hundreds and thousands – much more than a human brain can ever approach. During the sensitivity analysis, as Madani and Hipel point out, "[…] by understanding the relationship between the changes in the results based on the changes in the assumptions, the modeler can better comprehend the problem, the internal relationships between parameters of the model and the dynamic nature of the problem" (Madani and Hipel, 2007, pp. 6-8).

To find out which coalitions are helpful to the actors to benefit from preferred equilibria, coalition analyses are frequently performed. For a coalition to be formed, at least two decision-makers have to select the same option. The software may find all states which are not stable for the decision-makers in coalition; however, it does not tell which

parties should form a coalition (i.e., it does not give information about the nature of such coalitions). To identify meaningful coalitions, additional analysis is performed in Chapter 4. The existence of such coalitions is an important indicator of regional conflict potential as it allows the participants to move from a less preferred to a more preferred state. At the same time, similarly to a core representative of a post-WWII French geopolitical tradition, Yves Lacoste, we insist on the necessity to 'play' with scales, i.e. to allow coalitions on both the global and local levels of spatial analysis (i.e. between the individual countries and between individual countries and international community as a whole), since these can represent different, and sometimes extremely heterogeneous, geopolitical configurations (2012, p. 26). Such heterogeneity necessarily implies differentiated strategy and policy planning.

As any game-theoretic model, graph model for conflict resolution requires three specific inputs to work properly: a set of decision-makers, a set of options, and a set of preferences of each decision-maker over each option. For the Arctic sovereignty dispute, all these components are introduced in Subsection 1.2. Because we do not know the value of payoffs in the studied dispute, we now turn to theory of game preference formation.

2.2.2 Formation of game preferences

Opting for game-theoretic methodology means basing the research on two core assumptions. First, the players are fully aware of the rules of the game. They realize the nature of interaction (and, in general, realize that the game exists) and it rules, own capabilities and capabilities of other players. Second, while choosing whether to act or not, the decision-makers rely on cost-benefit analysis and attempt to maximize their expected utility. Imported from neoclassical economics, perfect rationality implies a purposeful calculation of all strategic options, subject to the constraints of technology and endowments. But, due to information asymmetry and time constraint, the decision-makers in the social world are not able to calculate payoffs for all potential options that may arise. One of the most respected specialists in methodology of economic research, Mark Blaug, summarizes how economists solve this problem:

> In common parlance, rationality means acting with good reasons and with as much information as possible or, in somewhat more formal terms, consistently applying adequate means to achieve well-specified ends. For the economist, however, rationality means choosing in accordance with a preference ordering that is complete and transitive, subject to perfect and costlessly acquired information; where there is uncertainty about future outcomes, rationality means maximizing expected utility, that is, the utility of an outcome multiplied by the probability of occurrence (Blaug, 1992, p. 229).

As Bueno de Mesquita, one of the major proponents of the expected utility theory, points out, even if real decision-makers do not always consciously and explicitly make calculations, they inherently *act* [original emphasis] as if they make such calculations (Bueno de Mesquita, 1989, p. 145). Dalby translates this understanding of actor rationality into the language of geopolitics by stressing that, still in line with the classical geopolitics of the first half of the 20th century, states tend to act "…as autonomous spatially defined entities struggling with other similar entities in attempts to enlarge their power by increasing their control of the territory" (Dalby, 1990, p. 40). The five core assumptions of rational foreign policy decision making are:

i. Decision-makers order alternatives according to their preferences;
ii. Decision-makers know the intensity of their preference (intensity being known as utility);
iii. The order of preference is transitive (if *A* is preferred to *B* and *B* is preferred to *C*, then *A* is preferred to *C*);
iv. Decision-makers select the strategy that yields the highest expected utility and the lowest costs (i.e., they opt for initiating war only if expected gains are larger than expected losses);
v. Decision-makers consider alternative means of achieving desirable ends in terms of the product of the probability of achieving alternative outcomes and the utility associated with those outcomes (Bueno de Mesquita, 1989, p. 144).

The last assumption needs additional clarification. In terms of conflict potential, the expected utility argument, in contrast to majority balance-of-power theories[103] and power preponderance theories,[104] insists that focusing on (hard- and soft-) power alone is not enough, as no one responds to risks or to uncertainty in the same way. Because the decision-makers may be risk acceptant or risk averse, the utility does not grow only out of available capabilities, but also out of the government's proneness to (avanturistic) unilateral moves. As a result, rational actors can "…choose to wage war even when their subjective (or real) prospects of victory are very small if they care enough about the issues in question" (Bueno de Mesquita, 1989, p. 155).

By providing 'microfoundations for macrobehavior' (Stein, 1999, p. 203) the strategic-choice framework gives additional insights on the nature of state preferences. Frieden

[103] Gulick (1955), Morgenthau (1973), Waltz (1979).
[104] Organiski and Kugler (1980), Giplin (1981), Modeski and Morgan (1985).

suggests to distinguish between preferences and strategies: "in any given setting, an actor prefers some outcomes to others and pursues a strategy to achieve its most preferred possible outcome. …However, within any given interaction, preferences and strategies must be distinct, and preferences need to be held constant for the given interaction" (1999, p. 41). Moreover, to make the dispute modeling possible, players' preferences over outcomes should be given and players' strategy choices (or preferences over strategies) should be missing (Hausman, 2012, p. 50-53). The Arctic sovereignty game satisfies this condition: the preferences over the outcomes are known (and discussed in Sub-section 1.2 as 'Options'), but the preferences over strategy are unknown, as many different combinations of actors' mutual interaction are possible, given the fact that the current reading of international public law does not provide a definitive solution to the claims raised by the coastal states.

The five abovementioned rationality assumptions can be strengthened with a fundamental analytical element of a tacit theory of preference – the default (payoff) principle, which defines the players' initial strategic choice:

vi. Players prefer a (comprehensive) outcome x to another outcome y to exactly the same extent that they prefer the *result* (the 'culmination outcome') $x*$ that x involves to the *result* y $*$ that y involves (ibid.).

In other words, a player's preferences do not depend exclusively on his own results but on the results for all the players. The theory also allows for non-self-interested (altruistic) preferences to occur in the multi-player strategic interaction (Fehr and Schmidt, 1999). Despite the fundamental critique from a number of influential experts on strategic choice theory,[105] Bruce Bueno de Mesquita's expected utility argument is still empirically true in postulating that "alliances are less important when third parties are weak compared to initial belligerents and are more important when third parties are relatively strong compared to initial belligerents" (Bruce de Mesquita, 1989, p. 159). In the Arctic sovereignty game that could mean a potential alliance between Canada, Denmark, Russia and the United States against the international community to be less important for the former if their capability constraints generally tend to be low but become more important when the capability constraints tend to grow.

[105] The blank parts in Bruce Bueno de Mesquita's approach exist at both the technical and analytical levels. They range from simple mathematical errors (among others, factorial computation) to a hugely vulnerability of the model's predictions under conditions of "severe uncertainty" to what Naseem Taleb calls the Black Swan phenomena (Taleb, 2007, pp. 137-164).

Apart of the abovementioned assumptions, the game-theoretic methodology can say very little about the *nature* of state preferences. As Hausman points out, game theorists rarely talk about preferences among strategies, mainly because "preferences are subjective states that, jointly with beliefs, cause and justify behavior… game theory takes over only *after* [original emphasis] preferences over comprehensive outcomes are specified" (Hausman, 2012, p. 33, 54). The formation of preferences is therefore fundamentally external to the game-theoretic analysis. Because the nature of preference is beyond the epistemological scope of game theory, it is necessary to leave the quantitative world and search for the origins of state preferences in the social science.

Scholars usually specify state preferences in three ways: either by assumption, by observation, or by deduction (Frieden, 1999, p. 53). Assuming preferences is the easiest analytical strategy: for example, general actor rationality implies that all actors have essentially identical wealth-maximizing preference. Variation of outcomes results from actors with identical preferences finding themselves in different strategic settings. However, the origin of actors' preferences in the Arctic dispute cannot be simply reduced to individual rationality and wealth-maximization criterion, which is extrapolated to non-economic dimensions of regional geostrategic reality (see Subsection 2.3 for a summary on constant and variable factors of geostrategic analysis).[106]

Another way of specifying state preferences is to observe them. This inductive approach implies an investigation of official statements and/or actions of the nation and of its policy makers, whose results are used to impute the functional equivalent of a national preference (Frieden, 1999, p. 58). However, this analytical strategy suffers from a significant shortcoming of being unable to differentiate between the outcome and the strategic response to the setting, when observing the behavior of states. As a result, the one may get misleading conclusions on *real*, not the declared, state preferences. The wider problem, which is also present in the Arctic regional political discourse, relates to misleading results of regional policy content analysis:

> A scholar might set out to investigate the impact of German national goals (preferences) on the coming of World War II… He might look at the actions and statements of German leaders in the years before the war and find a myriad of peace offerings and expression of pacific sentiments. Like British and French policy makers at the time, the scholars would be remiss to

[106] The simplified assumption in economics on the profit- (wealth-) maximization is dissatisfying in the study of the Arctic sovereignty (or any) dispute for three major reasons: (a) in international politics we face heterogeneous actors, and there is a very little ground to assume they have identical preferences; (b) even if there do exist principal homogeneous actors in international politics, no unambiguous preference can be assumed for them; and (c) the study of international politics means a multiplicity of issues on many dimension, while economics is about market interactions (Frieden, 1999, p. 56-57).

> conclude (or "induce) from this that German preferences were for the status quo and peace…[But] So long as German actions and statements were colored by prior German calculations of their potential impact (as we would expect them to have been), we cannot use them to draw conclusions about German preferences nor can we use preferences thus arrived at to explain outcomes (Frieden, 1999, p. 60).

The final way to specify state preferences is to deduce, or derive, them on the basis of a preexisting theory. In this case the features of actor are known, and theory predicts that, in a determined context, these features lead to a particular set of preferences, so that "as actor's features vary or the context varies, the actor's preferences vary in ways anticipated by theory" (Frieden, 1999, p. 61). A natural implication is: if theories about preferences are accurate, they should be able to explain variations over time and across units. Deducing preferences is probably the most analytically sufficient option, for two major reasons. First, the existence of numerous alternative interpretations of social reality (realist, liberal, critical) indicates an absence of a uniform set of preference assumptions in the study of international politics the scholars rely on. Deduction in this case is the only possible way to detour theoretical heterogeneity (notwithstanding the fact that an error may now come from individual theories state preferences are deduced from). Second, "preferences deduced in this way are expected to vary long with conditions that are more readily or 'objectively' assessed than the preferences themselves" (Frieden, 1999, p. 62). And, deducing preferences seems to be more accurate strategy for identifying *structurally-implied* preferences than assuming or observing them.

2.2.3 Best Alternative to a Negotiated Agreement

No matter which strategy for game preferences definition is selected (assumption, observation, or deduction), it is necessary for the researcher to understand *preferences over what* to search for, and in which strategic bargaining configuration to position the given dispute. In other words, the constructed state preference model should have been conceptually linked to, and fully reflect, not only game options of the studied territorial dispute, but also the bargaining settings, which may be either rule-compliant (in line with cooperative and positive-sum negotiation) or rule-changing (reflecting a conflictual and zero-sum negotiation).

"Do not put all eggs in one basket." This old proverb reflects the wisdom not only on the financial markets, but also in international disputes. If, in line with the traditional, adversarial 'positional bargaining' model of bargaining focused on dividing existing

resources, the decision-maker brings only one proposal to the table, (s)he may end up with a no deal at all. This is exactly what we observe, to date, in the Arctic territorial dispute: neither of the claimant states officially introduced their alternative solutions if current submissions do not get a positive response from the CLCS, notwithstanding the fact that, to have a stronger bargaining position, it is appropriate to have the alternative plan(s) waiting in the wings. In other words, by failing to offer available options during the negotiation the Arctic decision-makers ignore the fact that "[h]aving a good alternative empowers you with the confidence to either reach a mutually satisfactory agreement, or walk away to a better alternative" (Negotiation Experts, 2016, p. 1+).

How to determine which alternative is the best? First, if the decision-makers attain own goals in distributive manner, they transform 'the positional bargaining' into 'the interest-based bargaining'. Second, they calculate the tangible value of the alternative options available. The best option has the highest value. In the bestselling *Getting to Yes* (a product of the Harvard Negotiation Project), Fisher, Ury and Patton call the alternative option with the highest value the 'Best Alternative to a Negotiated Agreement' (BATNA) – point of leverage in negotiations, a Red Line which cannot be crossed; and suggest calculating its tangible value and evaluating its strength prior to the start of negotiation (1992, pp. 97-106). The BATNA is a unilateral option not depending on the consent of the other party, and BATNA that the decision-maker is not willing and able to execute is a bluff. [107]

A strong BATNA increases the negotiating power: if disposing with a good alternative, the decision-maker does not have to concede that much, i.e. (s)he does not care as much if no deal is got, and can push the dispute adversary harder. In contrast, if the best alternative brings little or no gain, the other side can increase own demands, and there are not that many ways to reject them since a better option is not available. Consequently, rational decision-makers view BATNA as the ultimate mechanism for deciding whether and/or when to walk away from the negotiation table, try to improve own BATNA whenever possible, and know BATNA of other decision-makers.

To deduce game preferences, we evaluate the response of a composite resource base of each decision-maker to manipulation of the Arctic geographic resource – the total claimed area by Denmark and Russia in the Central Arctic Ocean and also the compromise solutions (which constitute BATNA). To work with a composite resource

[107] The decision-maker should not accept a worse resolution than its BATNA.

base of a state, we apply the systemic approach. To manipulate the geographic resource of a state, we perform a quasi-experimental design.

2.2.3 Making sense of systemic and quasi-experimental modeling

Ontologically, this research is strictly positivist: we perceive reality as something external to our theories about it. At the same time, we do not deny the critical approach declaring that, whereas things exist 'out there', all researchers are human beings and therefore their own presence influence what they are trying to measure. A 'neutral', cross-national framework is, in fact, the only possible strategy that significantly reduces the 'disturbances' arising from hidden biases that, as in any research, come from the fact all scholars have own countries of origin and cultural backgrounds. A quantitative and empirical character of research forces to define all variables firmly, so each decision-maker enjoys relatively the same objective attention.[108]

Epistemologically, the analysis is based on systemic logic that allows the analytical process to be perceived through the prism of allocating the complex social reality (the whole) as a system of interconnected elements and then integrating these elements back into the whole. According to Plokhotnikov (2012, p. 18) this version of elementary modeling might be presented in diagram form as in [1]:

$$Whole \rightarrow System\ of\ elements \rightarrow Whole' \qquad [1]$$

Multi-dimensional and systemic assessment remains popular among scholars of social science because it allows, firstly, to widen the spectrum of traditional analytic quantitative and qualitative methodology and, secondly, to improve the validity of forecasting (Borishpolets, 2010, p. 141). In the realm of geopolitics, Csurgai (2009, p. 48) points to identity conflicts, 'de-structured states', resource wars, minority issues, and economic rivalries, all of which require nothing else but an interdisciplinary approach that integrates the multiple causes and dimensions of conflict. In 2000, interdisciplinary research was more popular among non-academic researchers than among academics (Hakim, 2000, p. 176). We bring multi-dimensionality back to the academic agenda by incorporating theoretical essentials from physical and human geography, political science, international relations, negotiation theory, game theory, and international law.

[108] The amount and origin of empirical data.

Although systemic modeling first appeared in natural sciences (biology) it has been successfully applied in many branches of social sciences, including geopolitics (Marinchenko, 2009, p. 24). First and foremost, it is an ancient idea. Greek and medieval philosophers did not ignore the system of organized totality, which could not be simply reduced to the sum of its parts. At the same time, the concept of complexity did not allow Aristotelian science to be successful in understanding the physical world. In fact, it was Galileo who abandoned reference to the All and, therefore, enabled real progress in Western physics. Reductionist (mono-causal) methods boomed in the 18th and 19th century, but, from the beginning of the 20th century, the tendency to conceive holistic interdependence returned to all sciences: within a system, any modification of a unit or variable was supposed to have direct or indirect effects on other units. The turning point was clearly in sociology, where Talcott Parsons, inspired by cybernetics, came up with the action theory, wherein politics was understood as a functional sub-system within a society (Říchová, 2007, p. 169). Every social phenomenon was treated as a structured and limited complex of social relations, with both internal and external dynamics (Kubátová, 2006, p. 94).

The systemic approach became a powerful methodological tool in political science as many scholars believed that it was relatively neutral (Říchová, 2007, p. 169). Some authors even claim that, in fact, it is the best approach ever imagined when comparing heterogeneous political systems (Berg-Schlosser and Stammen 2000). David Easton (1957), probably the first and best-known advocate of systemic thinking in political science, started using it as a central means of understanding how political systems operate. Three components are assumed to be part of system: (a) definite actors – individual or collective decision-makers; (b) definite links of interdependence between the actors; (c) definite borders that clearly distinguish the system from its surroundings. Easton assumed the system's inputs (everything that is imported into the system from its surroundings), outputs (everything that is exported from the system to its surroundings), and feedback as the means of understanding how the system and its surroundings interact with, and affect, each other (Easton, 1957, p. 384).

The system as such is not alien to the discipline of international relations to which geopolitics relates the most (Romancov, 2007, p. 408). Despite a different objects of research[109] positivists - realists and neo-realists, liberalists and neo-liberalists, followers

[109] Realists and neo-realists focus on the balance of power (Kissinger 1957) and power preponderance (Gilpin 1987), liberals and neo-liberals – on international institutions, regimes and transactions (Mitrany

of the British school - all agree that a system of international relations exists, and its nature is anarchical. Neither do the advocates of normative (critical) approach ignore the systemic features of international politics.[110]

Recent attempts to apply systemic modeling to geopolitics belong to the contemporary stream of the French tradition, whose main goal is to reconstruct the strategic behavior of participants of the global (regional/local) system. In order to be successful, these scholars react to criticism of systemic modeling in other fields of social sciences, especially in the realm of international relations. On the one hand, classical international relations theories – Realism, Liberalism, Marxism, and Functionalism – have a common feature: they constrain the interpretation of international relations to oversimplified reductionist (mono-causal) research designs. The outcomes then fail to reflect the complexity of the contemporary world system. That can lead to a 'mistaken diagnostics' of the state of international affairs (i. e. a distorted reflection of reality) and, consequently, inappropriate policy advice (Csurgai, 2009, p. 48). On the other hand, structure-driven theories of international relations tend to focus too much on the question of balance (Dussouy, 2010b, p. 179). Clearly, geopolitical analysis cannot use systemic approaches from other branches of social sciences without modification.

Specifically tailored for hitting the complexity of modern conflicts, the logic of the structuralist approach is the only epistemology in geopolitical theory to rely on when studying multi-actor territorial disputes. Segregating the complex space into individual action spaces and then merging these spaces back into one complex perspective allows for the most accurate reflection and prediction of strategic developments in the global regions.

Dussouy's 'Global Interpretation Method of the World' (2010) is a recent realization of systemic analysis in the field of geopolitics that has already provoked a wide academic discussion.[111] The idea is that "...no two-dimensional map can capture the multi-scalar intersection of physical, demographic, strategic, socio-economic, and cultural-ideological forces at work in the geopolitical arena; instead, we need to think in terms of the

1943, Keohane 1984), and followers of the British school – on international society as an alternative to an international regime (Bull 1977).

[110] For instance, Immanuel Wallerstein's World System theory assumes that within the modern era of capitalist world-economy, state interactions are governed by unseen systemic forces; international relations can be either the capitalist world-economy or empire, where the former is a short-term, transitory stage before the latter emerges (Wallerstein 1977).

[111] Other attempts to produce a systemic geopolitical analysis belong to Cohen (1963, 1973, and 2003) Taylor (1999).

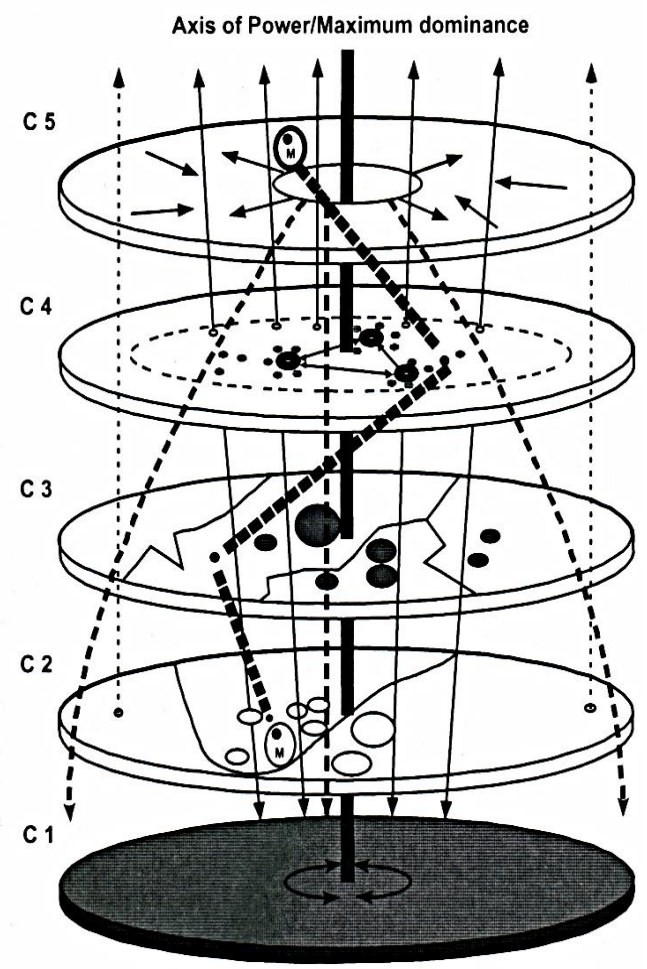
interaction of all these things in different places and under varying circumstances" (Murphy, 2010, p. 151).

According to Dussouy, it is not possible to adopt a strictly axiomatic approach because "...it is impossible, in all social sciences, to practice any sort of a priori verification" (Dussouy, 2010a, p. 136). A hypothetical-deductive aspect and an empirical-inductive aspect are, in fact, complementary approaches. Without attempting to produce a general theory, Dussouy presents a "...methodology for gathering data that can serve as the basis for an empiric-inductive theory" (Cohen, 2010, p. 163). The global system is segregated into five distinct geopolitical action fields: demo-political space; diplomatic-military space; socio-economic space dealing with globalization (these three forming the geopolitical infrastructure); physical, natural space; and symbolic, idealistic and cultural space – see Figure 2-3. The first four spaces form the system's objective structure and the last one is its subjective component. In order to discover the transforming tendencies, each space is subject to a spatial analysis and extraction of structural logic and the obstacles each space faces (Dussouy, 2010a, p. 143). Power is introduced through the central vertical axis connecting all five spaces, and via inter-dimensional relations of incertitude, dominant or otherwise, between the individual action spaces. The author suggests three distinct dimensions of analysis (local/global, war/peace, heterogeneity/homogeneity) and three dynamics (assimilating homogeneity, the antagonistic equilibrium of heterogeneity, and the adaptive homogeneity).

The rationale behind choosing Dussouy's model when searching for initial resource constraints the Arctic sovereignty game is relatively solid. The conceptual strength is in broadness of the scope allowing to capture almost any imaginable dimension in geopolitical practice, so that "…viewing any geopolitical topic against the model could highlight which physical, structural and ideological realms are being emphasized and which are being taken for granted" (Murphy, 2010, p. 155).

The model is based on axioms that have been widely accepted in scientific literature (Cohen, 2010, pp. 157-60) and it is a relatively simple method of systematization that can be applied not only globally, but regionally as well. Finally, it offers a unique research perspective: "yet attention to how we might approach the study of geopolitics methodologically and theoretically has not been matched by a literature encouraging consideration of the potential influences on geopolitical developments that exist within the global system" (Murphy, 2010, p. 155).

Figure 2-3. Global Interpretation Method of the World



The five horizontal fields

C5 – symbolic field
A dominant dimensional logic, Western ideology and various contradictory logics (integrisms, nationalisms)

C4 – Economic field
A dominant dimensional logic, the globalization of the market, from the three poles of the triad and under the action of multinationals and different contradictory logics.

C3 – Diplomatico-strategic field
A dominant logic of fragmentation, with the presence of one super-power and the contradictory logics of reduction and fragmentation.

C2 – Demographic space
Dominating regional dis-equilibriums with mass effects (power and immigration).

C1 – Physical space
Space for the mixing of dimensional logics and for the fixation of structural positions.

The dominance effects between the fields

Relations of dominating incertitude
- → of economic essence
- ⋯→ of ideological essence
- - - → of demographic or political essence

Variability of the position of an actor from a dimension to another.

M - - -

The line linking the different points symbolizes the power of the actor.

Source: Dussouy, 2010a, p. 143.

On the other hand, this approach is subject to three streams of criticism. Firstly, Saul Cohen cannot agree with Dussouy's rejection of developmentalism (Cohen, 2010, p. 161). Secondly, Alexander Murphy (2010, pp. 152-4) questions the general connections in the

model ("what variables are to be included into the analysis?", "under what circumstances is one layer more important than the others?") and the author's ignorance of different scales of political ideology ("adding them to an already complex model would risk making it almost incomprehensible").

Thirdly, Jervis (2010, p. 170) adds that similar problems can be successfully solved by other methods of research, for example by game theory. In reaction to this criticism, we suggest that, enriched with a formal model of assessing the geopolitical variables from four horizontal fields (C1-C4 on Figure 2-3), the abovementioned logic is relevant for the construction of state preferences in the sovereignty dispute in the region.

Systemic geopolitical analysis can be further strengthened by an experimental research design – a rigorous technique for examining the cause of particular phenomena which is gaining more and more interest from social scientists[112] and whose primary defining characteristics is intervention by the researcher in the data-generating process so that "the variation in the data is partly a consequence of the researcher's decisions at the design stage before the data are measured" (Morton and Williams, 2010, p. 341). While true experiments are common in natural science laboratories, hardly they can be used in the study of the social world without modification, mostly because of a problematic random division of studies cases into treatment and control groups. The most popular approach in social sciences is quasi-experimenting,[113] when scholars satisfy the majority of conditions for a true experiment (i.e. they employ treatments, outcomes, and sample units) but do not use sample randomization methods to assign subjects to sample groups, as the latter already exist and are chosen "(…) because of this existing structure or cohesiveness" (McNabb, 2009, p. 127).

The standard quasi-experimental research procedure is to manipulate one or more independent variables that is hypothesized to affect one or more dependent variables (the outcome), within the non-randomly assigned groups. However, because the control groups may differ from the treatment group in ways other than implied by manipulation of the given independent variable(s), many of these ways could be, in fact, alternative explanations for the change in the outcome. Consequently, to get more valid estimates, the latter must be ruled out:

[112] The number of experimental studies per decade in three major mainstream journals of political science in the United States – *The American Political Science Review*, *American Journal of Political Science* and *Journal of Politics* – grew from less than five in 1960s to more than 45 in 1990s (Morton and Williams, 2010, pp. 339-340).
[113] The term was popularized by Campbell and Stanley (1963).

> The researcher has to enumerate alternative explanations one by one, decide which are plausible, and then use logic, design, and measurement to assess whether each one is operating in a way that might explain any observed effect. The difficulties are that these alternative explanations are never completely enumerable in advance, that some of them are particular to the context being studied, and that the methods needed to eliminate them from contention will vary from alternative to alternative and from study to study.
> (Shadish, Cook and Campbell, 2001, p. 14)

Quasi-experiments with non-random treatment can be strong or weak. In the first case, the change is exogenous – this happens when the treatment is assigned randomly at some higher grouping level, or the treatment assignment occurs in some other way that is largely unrelated to the studied characteristics, while in the second case the modeled change is endogenous ('internal', whose selection risks now being administered in a way that creates bias). Striving for a strong experiment, the researcher must therefore ensure satisfaction of two conditions: (1) exogenous variation in the key explanatory variables and (2) compatibility of comparison groups (Meyer, 1994, p. 10).

The one-group pretest-posttest design is one of the simplest quasi-experimental study designs that are frequently used in social research.[114] A single pretest measurement is taken, an intervention is implemented, and a posttest measurement is taken. The formal definition is presented in [2]:

$$y_{it} = \alpha + \beta d_t + \epsilon_{it} \,, \qquad [2]$$

where y_{it} is the outcome of interest for unit i in period t, t=0,1 and i=1,…, N; d_t is a dummy variable for being in the treatment group (i.e. d_t=1 if t=1 and o otherwise); and β is the true causal effect of the treatment on the outcome for this group. Consequently, in the absence of the treatment, β would be zero, i.e. there would be no difference in the mean of those in group 0 and group 1: $E[\epsilon_{it}|d_t] = 0$. If this condition holds, an unbiased estimate of β can be obtained as in [3]:

$$\hat{\beta}_d = \Delta\bar{y} = \bar{y}_1 - \bar{y}_0 \,, \qquad [3]$$

where the bar indicates an average over the individual units and the subscript on y presents the time period (Meyer, 1994, p. 13).

[114] Other quasi-experimental designs without control groups are: one-group posttest-only design, one-group pretest-posttest design using a double pretest, one-group pretest-posttest design using a nonequivalent dependent variable, or removed-treatment design. When control groups are used, the research designs are: posttest-only design with nonequivalent groups, untreated control group with dependent pretest and posttest samples, untreated control group design with dependent pretest and posttest samples using a double pretest, untreated control group design with dependent pretest and posttest samples using switching replications, or interrupted time-series design.

Going back to Dussouy's model visualized in Figure 2-3, quasi-experimenting can have the form of (1) revealing the status quo composition of geostrategic spaces (C1-C5), and (2) evaluating the effects from the intentional manipulation of the composition of one or more geostrategic spaces (C1-C5) that would give more capability or resource to some units at the expense of some other units. At the same time, when searching for state preferences in the Arctic sovereignty game, a pretest could be the material social and geographic capability ranking of nation states as observed in the by status quo situation, an increase of EEZ in the Central Arctic Ocean by the selected claimant states could serve as intervention, and posttest could be the material social and geographic capability ranking of nation states following the intervention (including a pretest allows acquiring information about what the relative power of states would have been had the intervention not occurred). Before realizing such intervention on the basis of a differentiated maritime area of selected Arctic states (Options II-IX in Subsection 1.2), it is important to understand how to reveal the capability of states as implied by the social and geographic resource, and how to evaluate this capability in time and cross-nationally.

2.3 Resource-based preferences in the Arctic game

Definition of state power is the first analytical step in identifying the resource-based preferences of each decision-maker in the Arctic dispute. What factors should the research model be based on? Following the logic of Nye's 'smart power approach',[115] we believe that the optimal strategy of the rational decision-makers is necessarily based on a combination of power capabilities, because,

> …power is one's ability to affect the behavior of others to get what one wants. There are three basic ways to do this: coercion, payment, and attraction. Hard power is the use of coercion and payment. Soft power is the ability to obtain preferred outcomes through attraction. If a state can set the agenda for others or shape their preferences, it can save a lot on carrots and sticks. But rarely can it totally replace either (Nye, 2009, p. 1).

We accept Criekeman's definition of geopolitical analysis as a scientific study aimed to investigate the interaction between politically acting humans and their surrounding territoriality (in its physical-geographical, human-geographical and spatial dimensions) that is located on the middle way between two disciplines, political geography and international relations (Criekemans, 2009, p. 9). Because "[g]eopolitics has had a

[115] Smart power approach is actively promoted in the *Center for Strategic and International Studies* (Washington DC).

tendency towards a more empirical-inductive approach, with theory sometimes appearing as a weak spot [while] [t]he opposite is true for international relations, which tends towards a more theoretical-deductive approach, with lack of empiricism sometimes appearing as a weak spot" (Höhn, 2011(b), p. 37), integration of national power-related considerations from both disciplines might be promising. We start searching for the variables reflecting state power to be used as the starting point for the derivation of the decision-makers' capabilities in the Arctic sovereignty game in both theoretical domains: we start with human-related, social indicators of state strength appearing in power equations in Foreign Policy Analysis, and then adding geographic indicators of state strength as suggested in contemporary, neo-classical geopolitical research.

2.3.1 State power and Foreign Policy Analysis

Because relative advancement in strategic resources is widely acknowledged as one of the key factors determining the outcomes of conflicts in international politics (Danilovic, 2002, p. 71), a significant number of state power formulas has been proposed, all based on different sets of objective and subjective indicators for measuring, and contrasting, state power. No unified answer to the question of what *structural* factors are to be studied in order to get the most accurate reflection of state power exists so far, as different theoretical streams within the domain of international relations still focus on different, and usually mutually exclusive, independent variables. They all miss the most important perspective: state power originates in complex political processes, which reflect, and derive from, a unique mixture of various power resources of nation states. On an imaginary scale, this mixture is located somewhere in between the two ideal states. The first describes international relations in classical terms of political realism (i.e. in all dispute areas, military force is the first most effective means of achieving own goals). The second reflects a situation when global political system operates under complex interdependence (i.e. in some dispute areas, military force is not anymore an effective means of achieving goals) (Crane, 1997, p. 31).

Informed by empirical investigation and aimed to make at least part of one's knowledge generalizable and, within certain limits, applicable cross-nationally (Hudson and Vore, 1995, p. 215), the comparative branch of Foreign Policy Analysis has already considered an impressive number of domestic and international factors as determinants of state policy preference. Viewing decisions taken in specific situations (as action,

inaction, or indecision) as explanandum, and factors that influence foreign policy decision making as explanans (Hudson, 2014, pp. 4-8), a broad range of resources had been used as independent variables in models describing a state's involvement in international disputes, starting with narrow, mono-causal and single-variable explanations (as the role of climate change,[116] geographical proximity,[117] military capability[118] or economic well-being[119]) and ending with wide, systemic explanations based on both external and domestic resources of a state (Klaveren, 1992, p. 177). External (international) variables influencing foreign policy are, usually, the structure of international system and/or behavior of other states. Internal (domestic) variables are, usually, either agent resources (geographic, economic, military, demographic, and diplomatic); or the political context (domestic political system, development strategy, and cultural and historical factors); or the type of the decision-maker (governmental or non-governmental).

The conceptual foundations of systemic multivariable analysis of state capability distribution were introduced in three classical seminal works on theory of political realism. Firstly, in *Politics Among Nations* (1948) Morgenthau considered the simultaneous interplay of physical geography, natural resources (raw materials and food), industrial capacity, military strength (quality and quantity of armed forces, effectivity of leadership and technological advancement), distribution of population, national character and morale, and quality of government and diplomacy, as the essence of national strength (Morgenthau, 1967, pp. 106-158). Secondly, in *The War Potential of Nations* (1956), Knorr drew to a wide variety of factors belonging to three distinct categories: economic capacity, administrative competence, motivation to war (Knorr, 1956, p. 41). Thirdly, in *Theory of International Politics,* Waltz further promoted the idea of multivariable analysis and proposed a model for deriving state capability from the size of population and territory, resource endowment, economic capability, military strength, political stability and competence (Waltz, 1979, p. 192). Despite substantial theoretical contribution, these works offered little in terms of research operationalization: either the particular variables, or the inter-variable linkages, were not further specified. Keeping in mind that no one responds to risks and uncertainty in the same way (Bueno de Mesquita

[116] See Hsiang (2013), for a brilliant summary on the effect of climate change on conflict in international relations.
[117] See Hensel (2000) for modeling the effect of geography on the interstate dispute involvement.
[118] Among others, gross military capability (Claude 1962, Deutsch 1968), military expenditures (Alcock and Newcombe 1970), and the size of naval forces (Modelski and Thompson 1987).
[119] Among others, national income (Davis 1954, Organski 1958), Gross National Product (Hitch and McKean 1960), and consumption of fuel and electric energy (Russett 1968).

1989), at the level of theory, the majority of traditional mono-causal arguments (not necessarily originally realist, but frequently used in tests of realist balance-of-power[120] and power preponderance theories[121]) seemed to overestimate the impact of individual state attributes in policy preference formation and underestimate the inter-variable configuration.

In reaction to this operational limitedness, other scholars attempted to create instrumental state capability models and state power indices. To do so, they turned to the quantitative world and started using (non-)linear multivariable analysis and straightforward power equations and, usually, equal weights of the measured parameters of state strength. Not intending to discuss every single power equation existing up to date (whose number is almost 70 with the number of variables varying from two to 236, and that, in many cases, repeat each other)[122] we offer a short overview of the multi-variable state power equations reflecting the variety of approaches to the analysis of state power in Table 2-2.

The first attempt to produce a multivariate state power equation dates back to 1741, when Süßmilch proposed to define state power on the basis of multiplication of population and population density in the first volume of his magnum opus *Die Göttliche Ordnung in den Veränderungen des menschlichen Geschlechts, aus der Geburt, dem Tode und der Fortpflanzung desselben erwiesen*. In the second half of the 18th century there was a consensus that the welfare and power of the country was directly proportional to its population hence, if the aim of the state was to increase its power, the population had to increase (Höhn, 2011(a), pp. 280-281).

In the 20th century a number of additional variables starts to be treated as determinants of state power capability. In *Die mineralischen Bodenschätze als weltpolitische und militärische Machtfaktoren* (1936), Friedensburg evaluates the military power of state[123] according to the product of state population and self-sufficiency in natural resources (Höhn, 2011(a), pp. 283-4). Then, taking a liberal position on the interest of states in their self-preservation to act through international institutional networking and focusing on the "organic view of international relations emphasizing the interrelation of things and

[120] According to the balance-of-power theory, systemic instability and war should not occur between two equally capable powers (Morgenthau 1948, Gulick 1955, Waltz 1979).
[121] According to power-preponderance theory, systemic instability and war do not decrease, but increase during periods of power parity when there are power-shifts between major participants in the system (Organiski and Kugler 1980, Giplin 1981, Modeski and Morgan 1985).
[122] A brilliant compilation of all state power equations might be found in Höhn (2011(b)).
[123] Focus on security was dictated by specific historical circumstances of the interwar period.

events" (Rummel 1975), Wright refers to *The Foundations of National Power* edited by Sprout and Sprout (1945) and suggests that the power position of countries to depend to four parameters: active armaments, military potential, national morale, and international reputation (in other words, coercion and persuasion are complimentary). The author constructs six value capability dimensions to evaluate state strength. The latter is defined by military (war) potential, which, in turn, is the product of the total population and total domestic energy production in the given country. He does not provide any justification for making the formula this way apart from stating that energy production is a better parameter of national power than unexploited energy resources, because the latter could not be utilized in the course of war (Höhn, 2011(b), p. 82).

Table 2-2. Selected multivariable national power equations.

Author(s)	National power equation	Abbr.	Variables description
Süßmilch (1741)	$Power = Pop * PD$	[i]	Pop is population; PD is population density
Friedens-burg (1936)	$MP = NatRes * Pop$	[ii]	MP is military power; $NatRes$ is self-sufficiency in natural resources; Pop is population
Wright (1955)	$MP = Pop * Engy$	[iii]	MP is military potential; Pop is population; $Engy$ is energy production
German (1960)	$State\ Power\ = N(L + P + I + M)$	[iv]	L is the use of territory; P is the use of workforce; I is the use of resources; M is military personnel (in million); N is nuclear strength (2 if nuclear armed, 1 if not)
Fucks (1965)	$State\ Power\ = \frac{\left(EP^{\frac{1}{3}}\right)+\left(SP^{\frac{1}{3}}\right)}{2}$	[v]	E is energy production; P is population; S is steel production
Alcock and New-combe (1970)	$State\ Power\ =$ $\mathrm{RP} = -8.85 + 0.67\ \mathrm{POP}_{\mathrm{rank}} + 0.47\ (\mathrm{GNP}\ /\ \mathrm{POP})_{\mathrm{rank}}$	[vi]	POP is population; GNP is Gross National Product
Singer and Small (1972)	$State\ Power\ = \frac{(tpop+upop+sp+fc+mb+saf)}{6}$	[vii]	$tpop$ is total population; $upop$ is urban population; sp is steel production; fc is fuel/coal production; mb is military budget; saf is military personnel

Singer, Bremer and Stuckey (1972)	$Composite\ Index\ of\ National\ Capability$ $(CINC) = \frac{TPR + UPR + ISPR + ECR + MER + MPR}{6}$	[viii]	TPR is total population ratio (country to world); UPR is urban population ratio (country to world); $ISPR$ is iron and steel production ratio (country to world); ECR is primary energy consumption ratio (country to world); MER is military expenditure ratio (country to world); MPR is military personnel ratio (country to world)
Beckman (1984)	$State\ Power = \frac{[steel + (pop * pol\_stab)]}{2}$	[ix]	$steel$ is the percentage of world steel production; pop is the percentage world population; pol_stab is the political stability score
Lebovic (1985)	$Combined\ Capability\ Rank\ (CC) = (mil\ A + mil\ B)\ x\ (eco\ A + eco\ B)$	[x]	mil is military capability of state A and state B; eco is their economic capability
Economic Planning Agency, Japan (1987)	$Comprehensive\ National\ Power\ \#\ 1$ $(CNP\_1) = \frac{(CC + SC + EC)}{3}$	[xi]	CC is capability of contribution to international society in conditions of international cooperation, SC is capability of survival to independently ensure national survival against foreign threats, EC is enforcement capability to influence countries outside international systems to participate in them
Rosen and Jones (1988)	$State\ Power = N + So + Sy$	[xii]	N represents a state's natural attributes (geographic location, land area, population, mineral wealth, energy, arable land, water); So is state's social attributes (self/other images, leadership, popular support); and Sy represents a state's synthetic attributes (industrial development, military capacity)
Huang (1989)	$Y_t = K_t \times (H_t)^{\alpha} \times (S_t)^{\beta}$	[xiii]	Y is comprehensive national output, K is coordinated coefficient, H is "mass" of CNP, S is "acceleration" of CNP, t is time, α is hard elasticity index, β is soft elasticity index

Cline (1994)	$State\ Power = (C + E + M) * (S + W)$	[xiv]	C is critical mass (territory + population); E is economic strength; M is military strength; S is strategic purpose; W is national will
Chang (1999/ 2004)	$Comprehensive\ National\ Power\ \#\ 2$ $(CNP\_2) = \frac{CM + E + M}{3}$ $CM = \frac{i's\ POPU}{World\ total} * 100 + \frac{i's\ AREA}{World\ total} * 100$ $E = \frac{i's\ GNP}{World\ total} * 200;\ M = \frac{i's\ ME}{World\ total} * 200$	[xv]	CM is Critical mass, $POPU$ is total population, $AREA$ is total area, E is economic strength, GNP is Gross National Product, M is military strength, ME is military expenditures
Caro (2000)	$Power\ exponent\ =$ $\mathrm{T}^{0.42} \times \mathrm{GNP@PPP}^{0.72} \times \mathrm{NC}^{0.20} \times \mathrm{DE@PPP}^{0.53}$	[xvi]	T is technology, $GNP@PPP$ is GNP at PPP, NC is nuclear capacity, $DE@PPP$ is defense expenditures at PPP
Davutoğlu (2001)	$Geopolitical\ and\ geoeconomic\ power\ coefficient\ =$ $(SV\ +\ PV\ ) \times SZ \times SP \times S\dot{I}$ $SV\ =\ t + c + n + k$ $PV\ =\ ek + tk + ak$	[xvii]	SV represents constant factors; PV are changing factors; SZ is strategic thought; SP is strategic planning; $S\dot{I}$ is political will; t is history; c is geography; n is population; k is culture; ek is economic power; tk is technological power; ak is military power
National Security Council Secreta-riat, India (2002)	$National\ Security\ Index\ =$ $\frac{(\ HDI\ +\ RDI\ +\ GDPPI\ +\ DEI\ +\ PI\ )}{5}$	[xviii]	HDI is Human Development Index, RDI is Research and Development Index, *GDPPI* is GDP Performance Index, *DEI* is Defense Expenditure Index, PI is Population Index
Ageev (2004)	$Integral\ Power\ Indicator\ =$ $(\ M\ +\ T\ +\ NR\ +\ P\ +\ 1.5\ E\ +$ $C\&R\ +\ S\&E\ +\ A\ +\ FP\ )\ /\ 9.5$	[xix]	M is management, T is territory, NR is natural resources, P is population, E is economy, $C\&R$ is culture and religion, $S\&E$ is science and education, A is army (armed forces), FP is foreign policy (geopolitical environment)
Zarghani (2006)	$National\ Power\ =$ $(\ EC\ +\ PL\ +\ CL\ +\ SC\ +\ MI\ +\ TR\ +$ $ST\ +\ TN\ +\ AS\ )\ /\ 9$	[xx]	EC is economical factor, PL is political factor, CL is cultural factor, SC is social factor; MI is military factor, TR is territorial factor, ST is scientific and technological factor, TN is trans-national factor, AS is astro-space factor

Sułek (1990–2010)	General Power = $D^{0.652} \times L^{0.217} \times p^{0.109}$ Military Power = $W^{0.652} \times S^{0.217} \times p^{0.109}$	[xxi]	D is gross domestic product, L is population, p is area of a political unit, W is military expenditures, S is number of soldiers in active service
Kim, Kim and Wang (2013)	$National\ Power\ Index$ $(NPI_m) = \sqrt{RPI * HDQ} = \sqrt{RPI} * \sqrt{HDQ}$ $RPI = \frac{Log(N) - Log(N_{min})}{Log\,(N_{max}) - Log(N_{min})}$; $HDQ = \frac{HDI}{HDI_{max}}$	[xxii]	RPI is raw population index, N is the population size, HDQ is human development quotient, HDI is human development index

Source: author's compilation.

Next, summing the use of territory, workforce, resources, and military personnel, and multiplying by the nuclear strength,[124] the nonlinear multivariable world power index by German ('German index') became probably the most complex aggregate indicator consisting of a multitude of variables, a series of scoring schemes and instances in which judgements are to be made (German, 1960, pp. 138-144). Somewhat simpler nonlinear multivariable index was proposed by Fucks in 1965. Three summational variables (size of population, energy production, and steel production) were arranged in one of nine formulas for measuring national power all of which were transformations of one another (Fucks, 1965). In contrast, Alcock and Newcombe developed a linear measure to assess national capability: they first regressed three variables (GNP per capita, population and population density), and then ranked states according to their power scores in the context of popular perceptions of state power (1970, pp. 335-343).

Linear modeling of state power was further promoted in *Correlates of War project* lead by David Singer. Together with other scholars, he suggested two alternative measures of state power, one based on absolute strength derived from simple average of six indicators (total population, urban population, steel production, fuel/coal production, military budget, and military personnel), and another based on relative strength derived from a modified set of parameters transformed into country to world ratio (total population ratio, urban population ratio, iron and steel production ratio, primary energy consumption ratio, military expenditure ratio, and military personnel ratio) (Singer and Small 1972; Singer, Bremer and Stuckey 1980). Lebovic (1985) moved the search for rules of operationalization a bit further by relying on rank theory when analyzing the level

[124] Emphasis on nuclear capability in early IR works reflects the historical circumstances of the Cold War.

of (conflict- or cooperation-based) interaction between pairs of states, as derived from their national capabilities. For a strictly dyadic perspective, it is assumed that the higher the total rank of a pair, the more the units in the pair interact (1985, p. 54). The use of the product of different dimensions of capability implies a whole more than the sum of its parts, based on the actions and reactions or the relationship between units.[125]

The abovementioned power equations focus is real national assets (material), not the perceived ones (symbolic). A number of scholars have attempted to overcome the present ignorance of the subjective sources of state power. State power equation by Beckman simultaneously implied the study of material factors (the percentage of world steel production and the percentage world population) and intangible parameters (political stability score) to derive national power (Beckman 1984). Similarly, in the bestselling book *Logic of International Relations*, Rosen and Jones consider a simultaneous interplay of natural attributes of states (geographic location, land area, population, mineral wealth, energy, arable land, water) and their social (self/other images, leadership, popular support) and synthetic (industrial development, military capacity) attributes (1988, pp. 260-68).

Ray Cline provides a formula for power potential in *World Power Assessment: a Calculus of Strategic Drift* (1985) that combines material factors – 'critical mass' consisting of population, land, and position; economic capability; and military capability – with two intangible categories, 'strategic purpose' (goals and objectives) and 'will' (elite and popular support for purposes).

While in the Western IR tradition no new attempts to develop aggregate state power measures have been made since Cline's state power index (1994), in part "because such aggregate measures have been perceived as having reached the limits of their success" (Tellis, 2000, p. 31), the work did not stop in the non-Western political science. The technocratic post-WWII political system of Japan was based on formal and informal mechanisms to support and guide the country's manufacturing interests and therefore produced the demand for construction of state power equations that would allow cross-national and cross-temporal comparisons. The Economic Planning Agency published the results of holistic research of national strength in *Japan's Comprehensive National Power: Japan's Rising National Power and Expected International Roles* (Economic Planning Agency 1987, cited in Höhn, 2011(b), p. 199). This study suggested the first

[125] The combination of two middle rank nations is weighted above the combination of a high and low nation, while the summation of ranks would give these pairs an identical value.

power relation in the Sino-Japanese Comprehensive National Power (CNP) index as a simple average of state's capability of contribution to international society in conditions of international cooperation, its ability to survive against foreign threats, and its capability to influence countries outside of international systems to start participating in them – in accordance with the logic of economic interdependence. Pillsbury also discusses this work as one of three major foreign methods used by Chinese CNP analysts, the other two being the formulas introduced by Fucks and Cline (Pillsbury, 2000, p. 225).

In 1989 Huang further strengthens the abovementioned perception of state power with the dynamic perspective of flows, in spirit of Newton's third law of motion.[126] He first divides the CNP index system into four subsystems (the material power (hard) index system, the spiritual power (soft) index system, the coordinated power index system, and the environmental index system). Next, the author differentiates between (a) the material (hard) power determining the level of state development and consisting of natural resources, economics, science and technology, and national defense; and (b) the symbolic (soft) power determining the level of stability in the country and consisting of 'national embodiment', foreign affairs, and culture and education. While the coordinated power reflects macro adjustment and control, the system's constraint, the environmental subsystem, includes the international environment, natural environment, and social environment (Höhn, 2011(b), p. 203).

Then, Chang suggests deriving CNP from a simple average of 'critical mass' (consisting of the country to world ratio for population and area), economic strength (consisting of the country to world ratio for gross national product) and military strength (consisting of the country to world ratio for aggregate military expenditures) to be able to classify nations into four groups: superpower(s), great powers, middle (regional/intermediate) powers, and small powers (2004, p. 16). Another state power equation from Asian scholars, the Indian National Security Index (NSI) is, in fact, "…an adaptation of the Sino-Japanese CNP concept" with the only unique contribution dictated by the social reality in India (overcrowding and mass poverty) which makes the analysts emphasize human development and, later, ecology, in the multivariable state power equation (Höhn, 2011(b), p. 231). The most recent version of CNP belongs to the National Power Project team lead by Jae-On Kim. Its national power index (NPI) has two

[126] A force is a push or a pull that acts upon an object as a results of its interaction with another object. In other words, forces result from interactions.

components, one based on population size and another based on the human development quotient (Kim, Kim and Wang, 2013, pp. 83-140).

On the other side of the globe, a number of scholars attempted to design more operational approaches by assigning, on the basis of trial and error, different weights to different independent variables in state power equations. French economist Jean-Yves Caro connects state power to the issue of defense budgets. Opposing the 'essentialist and doctrinal' approach regarding national strength, he suggests a more operational analysis based on the comparison of a simple sum of ranks of ten countries in four variables: population, gross national product (purchasing power parity), international trade, and defense budget (again, purchasing power parity) (Caro, 1999, pp. 123−129). A more sophisticated power equation capturing both socio-economic and military factors[127] was proposed with assigned weights for a varying number of selected independent variables that had been checked for strong Pearson correlation of power scores proposed in in the survey conducted at the *Institut des hautes études de défense nationale* (FR) in 1998 (Caro 2000, pp. 87−109). Attempting to construct a power equation with unequally weighted variables, Miroslav Sułek differentiates between the 'objective' General Power (i.e. independent in terms of political power) and the 'subjective' Military Power (i. e. dependent on political decisions) and derives, deductively, the power exponents for a political unit in the production function (Sułek 2010, p. 4).

However, given certain weaknesses of working with specific power coefficients, other scholars still prefer working with equally weighted variables. The Turkish politician Ahmet Davutoğlu goes back to equal indicator weighting and a unique mix of material (geographic, economic, technologic and military power) and subjective (strategic thought and planning, political will, history and culture) parameters in his state power formula in *Stratejik Derinlik: Türkiyenin Uluslararası Konumu* (Davutoğlu 2001).[128]

Alexander I. Ageev also suggests the Russian version of composite state power index with no weight coefficients apart from economic dimension (that is weighted 1.5 times higher than other indicators). In the bestselling multi-author monograph *Rossiya v prostranstve i vremeni* (2004) he defined geopolitical strength of Russia with help of the 2000 years of the country's history, quantum logic[129] and a consequent strategic matrix

[127] The effect of nuclear capacity was not cleary discussed (Höhn, 2011(b), p. 150).
[128] Other scholars uses Davutoğlu's power equation but assigns own weights to indiidual components (e.g., Aslanli 2009).
[129] Ageev is not the only author thinking about quantum theory while analyzing international relations – see Plokhotnikov K. E. *Normativnaya model globalnoy istorii*. Moscow: Moscow State University, 1996;

consisting of nine tangible and intangible state integral strength parameters (management, territory, natural resources, population, economy, culture and religion, science and education, armed forces, and foreign policy and geopolitical environment), equal weighting, enneagram[130] visualization, and scenario planning (Kuzyk et al. 2004, pp. 11-44). However, in contrast to a relatively detailed rules of operationalization, the approach offered a rather limited theoretical justification for the selection of these nine factors of analysis.

The pioneer attempt to quantify state power in the Arab World belongs to the Iranian political geographer Sayed Hadi Zarghani, which, together with his PhD supervisor Mohammad Reza Hafeznia and other colleagues from the Tarbiat Modares University, suggested another, less technocratic set of nine equally weighted 'faces' of state power (economic, territorial, political, scientific and technological, social, cultural, military, astro-space, and transnational) with standardized scores for 86 corresponding variables (Hafeznia 2006, cited in Höhn, 2011(b), p. 170). The biggest problem with the suggested index is that it does not survive the reality check: based on these calculations, as of 2008, neither Brazil nor India are part of the top ten countries, in contrast to Canada, Australia and Spain (Hafeznia et al. 2008) – result reflecting inadequacy of the quantification methodology.

In sum, no indisputably credible power index yet exists. The selection of variables and inter-variable relations usually follows one of several trends. First, the traditional way of analyzing state power within the domain of political realism is to focus on disparities in the power base of nation states that are defined through material capabilities (with military force being the central component of power but also including other manifestations of 'hard capital' of a state, as the share of labor force to the total population, significance of natural resources deposits, or the extent of industrial might).

Second, a constantly expanding group of scholars belonging to constructivist tradition of international relations theory suggest, quite similarly to the advocates of critical geopolitics, to focus on social power of states which derives from the constructed (and de-constructed) identity (Wendt 1999). According to DaVinha, it has long been understood that "…the way individuals perceive their geographic environment is

Plokhotnikov, K. E. *Eskhatologicheskaya strategicheskaya iniciativa: Istoricheskiy, politicheskiy, psychologicheskiy i matematicheskiy kommentarii*. Moscow: Moscow State University, 2001; Plokhotnikov, K. E. *Metod i iskusstvo matematicheskogo modelirovaniya: kurs lektsiy*. Moscow: Flinta, 2012.

[130] Geometric figures with nine edges.

important to foreign policy decision-making and policy-making" (2011, p. 133). The symbolic power of states – the soft capital – on the one hand, is a derivate of their material power. On the other hand, it is a force operating in tandem with material forces but is not entirely dependent on them (Hafner-Burton and Montgomery, 2009, pp. 28-29). Keeping in mind that, even within one country, two different think tanks can generate completely different discourses on the Arctic future (Efferink, 2011, p. 1), Dijkink suggests five specifying characteristics of the geopolitical codes – intellectual tools for practicing statecraft: time/space models of the world, national myths, territorial narratives, active/passive approach of international relations and reactions to international crises (1998, p. 293). Other authors suggest applying psychological and sociological methods when assessing, cross-nationally, the role of soft capital attributes in foreign policy making (Gordon, Jupp and Byrne 1989). Again, apart from rather advanced problem conceptualization, no state power equation based solely, or partly, on intangible capabilities of nation states and able to differentiate states based on their symbolic capability, has been suggested.[131]

Third, not only there exist both material and symbolic sources of state power, but there are also systemic forces at the level of international system that are fundamental enough to intensify the material strength of some countries and make their bargaining position even stronger and, in contrast, prevent other states from realizing their internal power potential by effectively neutralizing it. Similarly to Environmental Possibilists of the interwar period, followers of the liberal argument on economic interdependence[132] insisted that states were powerful if they held a strong (i.e. central) structural position in effective international networks of (economic, military, and demographic) interstate exchange. The idea that growing interdependence fosters cooperative political relations has gained considerable popularity and empirical support.[133] Economic exchange and military conquest are substitute means of acquiring the resources needed to promote own political security and economic growth at the level of nation states (e.g., Staley 1939). If

[131] Although Cline's equation does include intangible parameters ('strategic purpose' and 'national will'), it is exactly their inclusion that has been criticized the most for making the aggregate power index "…neither scientific nor precise" (Chang, 1999, p. 11). Because of a too little subjective parameter formatization both the Economic Planning Agency's power equation [xi] and Huang's equation [xiii] cannot be used in the cross-national comparison of state power.

[132] The invention of the liberal concept of interdependence argument dates back to Angel (1914), Delaisi (1925) and Muir (1933). For an excellent introduction to the interdependence argument, see Baldin (1979).

[133] This claim has been used to justify the formation of the European Economic Community; Richard Nixon's opening to China; Willy Brandt's *Ostpolitik*; and Henry Kissinger's concept of détente with the Soviet Union (Mansfield and Pollins 2003).

the foreign trade of a state grows, there are fewer incentives to promote political security and economic growth through territorial expansion (Rosecrance 1986). At the level of the country-pair, or dyad, commercial openness generates efficiency gains that make private traders and consumers dependent on foreign markets.[134] Because militarized conflict risks disrupting economic relations among participants and canceling the gains from trade, highly interdependent actors are interested in avoiding military conflicts (Mansfield and Pollins, 2003; Polachek and Seiglie 2007; Spolaore and Wacziarg 2009). Economic interdependence increases contacts and promotes communication between governments, as well as private actors in different countries, and rising communication is expected to foster cooperative political relations (Viner 1951, 261; Hirschman 1977; Stein 1993).

However, empirical results in the existing research implies that, without material gains, the peace-promoting effect of interdependence is significantly weakened (Martin, Mayer and Thoenig, 2010, p. 1+). Interdependence matters *only* in dyads with both states being democratic, i.e., consisting of democratic institutions and their associated constraints on the government (e.g., Gelpi and Grieco 2003). Democratic form of government is the first condition limiting the effectivity of economic interdependence in a dyadic interstate relationship. The empirical tests also indicate that the interdependence claim holds *only* for nation-pairs comprised of advanced industrial societies, but not for developing countries, because domestic economic conditions mediate the impact of interdependence on the probability of bilateral hostility (e.g., Hegre 2000). The level of industrialization is, therefore, the second condition limiting effectivity of economic interdependence as proxy of state strength. In addition, rather than fostering cooperation, increased interdependence may generate political discord.[135] Even more widespread is the argument that "economic exchange has no strong bearing on the high politics of national security"

[134] Empirical evidence suggests that, in the post-WWII era, the various and complex transnational connections and interdependencies between states have been increasing (although with different tempo in different countries), while the use of military force and power balancing have been decreasing but remaining important (Keohane and Nye, 1997, pp. 122-132). In fact, for a rather small number of countries (as of 2010, only 35), benefits of being central in the global networks are mainly two: good information supply and strong reach, both functional and extra-functional (Bruijn and E. Heuvelhof, 2008, p. 43). At the same time, staying on periphery can bring opportunities to the non-central actor wishing to destabilize the status quo: in case the network is against the strategy of the latter, he is more indifferent to the 'pressure' coming from the network. In other words, more 'painless' maneuvering is possible.

[135] Realists criticize the interdependence argument by pointing to the fact that unfettered economic flows can undermine national security (Hirschman 1980), while shifts in power relations dictated by differences in potential gains from trade are potential sources of military conflict (Gilpin 1981, Mearsheimer 1990). Following this logic, states do have political reasons to minimize their economic vulnerability vis-a-vis international community, and military expansion is a way to achieve this end (Liberman 1996). Finally, a number of studies falsifies the causal relationship between economic interdependence and interstate conflict (Buzan 1984, Ripsman and Blanchard 1996/1997).

(Mansfield and Pollins, 2003, p. 1+). Such conceptual heterogeneity of sources of state power fully reflects a prominent and always present structure-agency dilemma in the theory of international relations.[136] Although we focus on internal power parameters of the nation states (agents), we emphasize the complementarity of structure and agency: while the structure does influence human behavior, and this influence is different for different individual units, the agents' own strength (geographic, social and symbolic) does determine the actual position of this unit within the social structure. In other words, although we construct the decision-makers' preferences in the Arctic dispute according to twelve agent-based geographic and social variables, i.e. do not consider directly the structure-based factors like actors' centrality in the networks of intrastate flows and institutionalized ties, we assume the effectiveness of the latter to be reflected in the studied variables.[137] In the Arctic dispute, (economic) interdependence between the initiating decision-makers is too ineffective[138] in defining foreign policy preference, to be introduced as a variable into the model. And, even if interdependence were a significant source of power in the Arctic dispute, to date, no power equation with such independent variable has been suggested.

2.3.2 State power and geopolitical theory

Although traditional geopolitics is not the only analytical approach focused on the elements of national power, it is classical geopolitics that is primarily responsible for introduction of area as proxy determining state strength in global politics, which serves as the primary theoretical justification for incorporating the geographic factor into the human-defined power equations. The classical geopolitical theory considers either a total

[136] Functionalists and Marxists determine that social life primarily with social structure and explain individual activities as an outcome of structure. In contrast, phenomenological sociologists and symbolic interactionists insist on the ability of individuals to construct and give meaning to social life.

[137] For instance, if the country trades well on international markets (or benefits from many institutionalized agreement links), the value of its Gross Domestic Product would be higher than without trade (institutionalized links).

[138] Viewed from the position of regional integration, there exist four necessary conditions for link effectivity: (a) the same link connects dispute participants; (b) network connecting dispute participants is effective, e.g. preferential relationship coincides with higher volumes of bilateral exchange (trade, military exchange, etc.); (c) nation-pair consists of advanced industrial societies; and (d) nation-pair consists of democratic states). Only one dyadic link between the four participants of the Arctic dispute satisfies all four conditions – NAFTA, and only Canada and the United States (both being semi-central position in the global regional trade agreement network) are likely to prefer cooperation to offensive war in the bilateral dispute, due to the power of economic interdependence. In all other cases (Russia, the most peripheral actor, and Denmark, the most central actor), centrality in global regional trade agreement network does not necessarily imply an economic interdependence-driven foreign policy preference.

geographical determinism (Ratzel, Kjellen, Haushofer) or substantial geographic determinism (Mahan, Mackinder, Spykman).[139]

In contrast, the critical (poststructuralist) tradition focuses on cultural and social aspects of power in international relations (Ó Tuathail, Agnew, Dalby). Most frequently associated with French interwar geography (Paul Vidal de la Blache) and history (Lucien Febvre) and based on numerous historical examples of international relations defined peacefully by the means of international cooperation,[140] environmental possibilism is a counter-argument to geographically-deterministic perception of international politics: man is an *active* agent in environment. The function of natural space is to provide not only certain limitations[141] on human action, but also options (opportunities), whose number grows with the development of knowledge and technological capability of a given cultural group ("genre de vie"). Consequently, the only 'real' geographical problem relates to design a 'proper' utilization of opportunities provided by natural environment. In other words, we live in the world of opportunities, not necessities.

The idea of environmental possibilism has started to emerge in the western literature already in 1960s. Within the 'ecological triad' mechanism invented by Harold and Margaret Sprout, "…[t]he initiative lies with the man, not with the milieu which encompasses him. Possibilism rejects the idea of controls, or influences, pressing man along a road set by Nature or any other environing condition… The milieu is conceived as a set of opportunities and limitations" (Sprout and Sprout, 1965, p. 434). This logic inspires more recent applications of possibilism in geopolitical analysis. According to Harvey Starr's agent-structure configuration for opportunity and willingness, "both opportunity (possibilism) and willingness (probabilism and cognitive behavioralism) are

[139] In the German, tellurocratic tradition, Friedrich Ratzel views international politics as a continuous and natural struggle for space, with state strength determined by two geographic parameters, space ('raum') and position ('lage'), with all other national attributes being their derivatives, and mentions Süßmilch's work in his *Politische Geographie* as an example of the size of population is politically overestimated (1897). Rudolf Kjellen assumes the state to be more than a mere sum of judicial articles but defines state power on the basis of its geographical embeddedness (1900). Taking state organicism and Social Darwinism to extreme, Karl Haushofer focuses on geography, recognizes no international legal system or morality and views boundaries as temporary stops in the continuing geopolitical struggle (1925, 1928). In the Anglo-Saxon, thalassocratic tradition,, in 'Sea power doctrine' Alfred Mahan defines state strength on the basis of three geographic and three non-geographic factors: geographical location vis-à-vis the sea, natural aspects (e.g. the nature of coastline), territorial width and length of the coastline, population, national character (commercial?), and government policy (1890). Suggesting to analyze state strength holistically, Halford Mackinder focuses on geography, natural resources, and technology as determinants of national power (1902, 1904/1905). Similarly, in the 'Rimland thesis', Nicholas Spykman offers the global vision in which the geographical position of the United States plays a pivotal role (1942).

[140] Ancient and Medieval emporia – self-sufficient maritime trade networks in Europe and Asia.

[141] Possibilists do not deny the overall presence of geographic constraints, but the latter are not considered as the primary determinants of the human behavior.

necessary for understanding behavior… The environment must be permissive, and the acting unit must choose" (Starr, 2013, p. 435).

Three authors belonging to the contemporary structuralist branch of French school of geopolitics provide the most comprehensive list of constant and variable attributes of states to be considered in geopolitical analysis – see Table 2-3. Chapraude defines geopolitical analysis as the study of the 'desire for power' of states in relation to its physical and human geographical characteristics, so that a state power depends on two factors, geographic conditions (both material geographical position and discursive geographical representations of populations) and absolute strength (qualitative and quantitative human, military and economic factors) (2007, p. 17). Roughly one half of these factors is assumed be constant and half to vary.

Gourdin defines power as capability (capability to act, capability to make others act, capability to prevent others from acting, capability to refuse to act). Any war (rivalry) can be systematized in terms of causes, actors, stakes, and consequences; and the main research focus is directed towards the definition of the main features of the contested territory, people that live on this territory, and motivations of these people (and also of people from outside the territory that are also involved in the rivalry). Thirty factors, divided into four categories, are suggested to be part of the analysis (Gourdin, 2010, pp. 248-262).

Finally, similarly to Chapraude, Csurgai proposes the geopolitical system to consist of both constant and variable components. The objective components are elements of physical geography, availability of natural resources, boundary specifics, ethnic composition and demography, socio-economic factors, and strategies of actors.[142] The subjective components reflect the specifics of the question of identity, shape of geopolitical representations ('mental maps'), and historical heritage. The goal is to identify the individual attributes, and interaction, of these factors. By doing so, "geopolitical analysis can respond to the need of using a multidimensional method to interpret the complexity of contemporary international relations" (Csurgai, 2009, pp. 48, 51).

[142] Instead of putting strategy of actors and all constant/variable factors of geopolitical analysis in Csurgai's analysis on the same analytical scale, we consider actors' strategies to derivate from national preferences that, in turn, are controlled by actors' material and virtual capabilities in the region – see Chapter 3.

Table 2-3. Factors of systemic geopolitical analysis.

Patrice Gourdin (2010)			
Territory	*Population*	*Representations*	*External actors*
Maps	Demography	Symbolic places	'Friend and Foe' reasoning
Geographical situation	Tribal or clan-related dividing lines	National sentiments	Economic interests
Mountains-valleys	Ethnic dividing lines	Disputed elements of history	Territorial claims
Climate	Linguistic dividing lines	Resistance against oppression	International obligations
Vegetation	Religious dividing lines	Messianic tendencies	Strategic objectives
Natural resources	Socio-economic dividing lines	Desire for power	Regional power ambitions
Cities-towns-villages	Cultural dividing lines		Non-state actors that operate within the law
Boundary symbols	Political rivalries		Illegal non-state actors

Aymeric Chauprade (1999)	
Constant factors	*Variable factors*
Physical geography (rivers, mountains, islands, etc.)	Geographical changes
Human geography (identity, ethnicity, religion, language)	Technological progress
The need for for/rivalry over natural resources	Authority of states

Gyula Csurgai (2009)			
Physical geography	Geopolitical representations	Ethnic composition	Socio-economic factors
Natural resources	Identity factors	Demography	Historical factors
Boundaries	Strategy of actors		

Source: Gourdin (2010), Chapraude (1999), Csurgai (2009), compiled by the author.

Because the French school is, traditionally, idiographic and non-quantitative,[143] neither author (1) specifies individual indicators that should reflect the abovementioned factors of geopolitical analysis in the most effective way, and (2) suggests the nature of the relationship between the variables (linear/non-linear). One way to compensate for this missing operationalization framework is to integrate neo-classical geopolitical theory and neorealist branch of international relations theory.

The cross-national nature of our analysis allows no meaningful quantification of symbolic parameters for all nation states in the world. We do not consider intangible

[143] See Lacoste, Yves. *Dictionnaire de Geopolitique*. Paris: French and European Pubns, 1993.

factors in the model (although summarize the symbolic potential of the Arctic states in Chapter 3) but consider them as integral parts of material socio-geographic national capability as, for instance, "…the process of maintaining high productivity or large armed forces involves the intangible factors that show how capable a nation is of mobilizing resources and realizing its potential power" (Chang, 1999, p. 21). In other words, subjective power of states is an integral part of each studied material variable. What material factors are to be studied to reveal absolute and relative strength the Arctic decision-makers in the northernmost territorial dispute? In the next stage of research, we integrate the internal logic of neoclassic geopolitical theory and Foreign Policy Analysis to define state power model parameters and inter-parametric relations.

2.3.3 Social and geographic power of states

Conceptualization of state power in (neo)classical geopolitical theory and (neo)realist tradition in the theory of international relations is based on different parameters. In the first case, main emphasis is still put on objective manifestation of physical geography. In the second case, primary focus is given to socio-material manifestation of state power. In this research, we suggest state power to derive from a simple unweighted average of a range of factors belonging to two broad categories of national resource, social and physical.

On the one hand, a number of social capabilities make some states powerful and others states weak. Firstly, military power is still the primary means of the manifestation of political power and an imprescriptible element of research, allowing to predict the major interstate conflict resolution patterns (Knell, 2008, p. 21) and reflect the constant military justification of the national sovereignty rights over land and sea area. The disparity in military power is usually observed in the cross-national and cross-temporal analysis of states' armed forces personnel, number of conventional and non-conventional weapons; satellites, radars and missiles; elements of air-, ground-, and naval- forces – all components of Dussouy's C3 field. Military capacity appears, although in different variants, in all power equations presented in Table 2-2 except [i], [v], [vi], [ix], [xi], [xiii] and [xxii][144] but not in the research frameworks suggested by Gourdin (2010), Chapraude (1999) and Csurgai (2009).

[144] In [i], [v], [vi], [ix] and [xxii] military potential is not considered at all; while in [xi] and [xiii] it is too implicit to be considered an undisputable part of the state power equation.

Secondly, in the world of the 21st century, a state's capacity to project power also depends on its economic potential (Dussouy's C4 field). Without national material wealth, a state cannot maintain an effective political and military strategy. The recent rise of geoeconomics as a distinct branch of political science evidences that a comprehensive theoretical and methodological reflection of economic globalization is about to form (Kochetov 2010). As globalization accelerates, geoeconomic strategies to achieve a state's international goals (e.g. to enlarge zone of influence) is, in many cases, more efficient than the use of military force (Csurgai, 2009, p. 75). Modern political science integrates knowledge from several branches of economic science[145] in order to consider, among others, absolute and relative wealth of states, center-periphery economic disparity, the level of industrial development, the sector and spatial distribution of economic activities, bilateral trade flows (exports/imports), taxation, specifics of the labor force, the legal business environment, or the inflow of foreign direct investments. Economic capacity is directly present, usually in the form of gross product or industrial might, in all national power equations[146] (Table 2-2), and is part of the research frameworks suggested by Gourdin's 'socio-economic dividing lines' and Csurgai's 'socio-economic factors'.

Finally, because population is one of two primary conditions for a state sovereignty (Jackson 2007), its role in the state power equations in Table 2-2 is not underestimated. Neither international strategy can be realized without an adequate human resource. The demographic processes can provoke interstate migration flows, lead to social unrest, and even cause an outbreak of a secession movement – having a dramatic impact on Dussouy's C2 field (Csurgai, 2009, pp. 76-77). Interstate social movements and incentives may lead to either cooperation or conflict, or both, depending on the goals of policy-makers. The analysis can include data on the total number of residents, ethnic composition, natural growth rate, and life expectancy of the population, the level of urbanization and unemployment, social exclusion, percentage of displaced persons, literacy rates, and availability of technical equipment of educational and medical institutions. Demographic strength appears in all national power equations except [x], [xi], [xiii], [xvi] and [xx],[147] and is an integral part of the research frameworks suggested by Gourdin (2010), Chapraude (1999) and Csurgai (2009).

[145] Macroeconomics and international political economy.
[146] In the state power equations [xi] and [xiii], the economic factor is considered indirectly (e.g., as a capacity to contribute to global cooperation, or as a comprehensive national output).
[147] In the state power equations [x] and [xvi], military potential is not considered at all; while in equations [xi], [xiii] and [xx] it is too implicit to be considered an undisputable part of the state power equation.

On the other hand, geopolitical theory suggests to search for disparities in constant and variable[148] factors of physical geography, because policy makers still "…elaborate efficient strategies to seize the opportunities provided by favorable geographic factors and reduce the vulnerabilities caused by certain geographic constraints" (Csurgai, 2009, p. 54). A physical configuration of space is powerful enough to define, unilaterally, the initial human-related strategic balance in a given international region and, therefore, to have a major impact on geopolitics in periods of peace as well as in war (Csurgai, 2009, p. 52). Size, shape, topographic distribution of territory, location, climatic conditions and deposits of natural resources – all elements defining Dussouy's C1 space (Figure 2-3) – are to be included into the model. Land and sea area under national jurisdiction is, probably, the first morphological characteristics of a state influencing its functioning and international behavior. Not only is territory one of two fundamental conditions for state sovereignty (Jackson 2007) but it the most evident realization of state capability whose acquisition and maintenance requires mobilization of all sorts of material and symbolic national resources. In other words, bigger states are more powerful in their ability to successfully preserve a once won larger portion of our planet, than are smaller states: "[b]ecause the total land [and maritime] area of the world is limited, and it contains the bulk of the resources on which progress is based, a state that has larger area than another obviously has a chance to find a greater percentage of such resources within its borders. But these known resources themselves are not evenly distributed" (Glassner and Fahrer, 2004, p. 64). Land territory appears in power equations [iv], [xii], [xiv], [xv], [xvii], and [xix] - [xxi], and is present in research frameworks suggested by Gourdin (2010), Chapraude (1999) and Csurgai (2009). Neither power equation considers EEZ area as independent variable but it can be observed (although rather implicitly) in Gourdin's 'geographical situation' and Chapraude and Csurgai's 'physical geography' categories of state power.

Another fundamental morphological characteristic of a state is its shape, because it is "a fundamental spatial characteristics of concern in geographic investigation" (Maceachren, 1985, p. 53). Surprisingly, the individual aspects of shape of state territory shape has not been yet used in analytical attempts to construct aggregate state power indices. Among many aspects of shape, compactness of territory is probably the most

[148] Due to a continuing melting of the Arctic ice, even though elements of the natural space may seem relatively constant in comparison to other, human-constructed elements (e.g. economic, demographic); they are still in a state of flux.

important aspect of geographic shape and "has been given the greatest attention due to its potential applicability to a broad range of geographic problems" (ibid.). State strength derives from advantages of being compact, i.e. to have all points of the boundary lying at about the same distance from the geometrical center of the state.[149] First, the boundary is the shortest possible in terms of the area enclosed. Second, because there are no protruding parts (as major islands or peninsulas) the establishment of effective infrastructure and communications to all parts of the country is easier than under any other shape. Consequently, all other factors held constant, an effective state control is theorized to be more easily maintained in compact country than in country with any other shape (Glassner and Fahrer, 2004, p. 65), due to more efficient transportation system, better accessibility of services and more homogeneous regions (Maceachren, 1985, p. 53).

There exists a multitude of measures grasping compactness of state territory varying in reliability and computational complexity. The earliest attempts to develop a state compactness index (dating back to the first half of the 19th century) relied on perimeter to area ratios, i.e. length of state borders (including coastline) to total land area. Although attractive in terms of computational simplicity, the perimeter/area ratio suffers from the so-called fractal paradox[150] and unnecessary index variation due to variation in state size, which must be always addressed by the researcher. Neither power equation considers compactness of state shape as independent variable although it is again, implicitly, part of in Gourdin's 'geographical situation' and Chapraude and Csurgai's 'physical geography'.

Climate is another geographic factor defining state power in international politics studied by scholars belonging to the contemporary neoclassical geopolitics that analyze, cross-nationally, the 'biomes of power' (Barnett 2004, Haverluk 2010; Haverluk, Beauchemin and Mueller 2014). Another way to reflect climatic condition of states is to work with a single indicator, average latitude – the exact country midpoint on a flat rectangular projection map. In what sense average latitude reflects state power? In his book on the history of the wealth and poverty of nations, Landes highlights how physical conditions in the tropics represent significant barriers to economic development (Landes 1998). In a series of empirical tests, Masters and McMillan observe nonlinearity in the correlation between latitude and economic growth and come to conclusion that, between

[149] Circle is the most compact shape.
[150] Due to fractal-like properties of measurement, the length of the border depends on the method used to measure it.

zero and 30 degrees, and above the 40-degree line, the distributions appear flat, while between 30 and 40 degrees, national income does rise with average latitude (although this could result from distortions from latitude averaging in each country)[151] (2001, p. 1). No national power equation considers climatic conditions as independent variable although it is part of Gourdin's 'geographical situation' and, implicitly, Chapraude and Csurgai's 'physical geography'.

It is important to integrate geographic and social resources of states to get the most accurate representation of state strength in the Arctic dispute, since these resources are complementary. For instance, geography and security are fundamentally interconnected variables, due to "...the use of spatial dimensions in the logic of armed conflict, the application of geographic reasoning in the conduct of war and in the organization of the disposition of national defense" (Csurgai, 2009, p. 81). Similar level of geographic importance is observable in the economic and demographic configuration of the nation states. Even more important is the fact that, because a state that is strong in socio-material capability does not necessarily imply large area, studying only social manifestations of state power without geography adds no value to the existing state power equations presented in Table 2-2, which either do not they consider geographic resource at all, or include only one geographic indicator, area; while climatic conditions and compactness of territory are completely ignored. Because the existing theory still does not allow a non-trivial assignment of weights to geographic and social variables, it is still reasonable to use the same weights for these two sources of state power.

2.3.4 Manipulating the geographic power of states

To manipulate the geographic resource of states, it is necessary to introduce the variable that would allow such manipulation, either in the form of initial inclusion of this variable in which the studied geographic shifts are studied cross-temporarily, or by introduction of a new variable, which would reflect the new geographic condition, cross-parametrically. When the first way is chosen, the model of state power should include one or several integral issue-specific variables (issue means the geographic approximation of a given territorial dispute), whose value is manipulated (it is the same as when the physician prescribes a higher dose of medication to a patient). The logic of the second way is similar, however, the manipulation occurs not in one of integral

[151] Oil exporters, city-states, or communist states are outliers.

variables, but because a new variable is introduced, and this new variable constitutes the only manipulation (now, in addition to the existing medication, the physician prescribes new pills the patient did not take before).

The choice of either research strategy is arbitrary. Given the specifics of the Arctic sovereignty dispute, we believe that the geographic shifts initiated in each of nine game options (see Subsection 1.2.2) can be studied cross-temporarily, i.e. to have Arctic area introduced into the model prior to any manipulation. By doing so, it is possible to register the absolute and relative variation in the aggregate state power index implied by shifts in Arctic-specific indicator(s). This variation can be used to calculate the decision-makers' gains from status quo (that are naturally zero), or from seaward extension of own maritime boundary beyond 350nm from the baseline on the basis of Para. 6 of Article 76 of the LOS Convention ('full seizure'), or from seaward extension of own maritime boundary up to 350nm from the baseline on the basis of Para. 5 of Article 76 of the Convention ('compromise'). The values of index variation appearing in 'full seizure' game options indicate how high are the stakes in the game, in both the initiator and reacting decision-makers. The values of state power index variation appearing in some game options then constitute the cost of making concessions – BATNA (introduced in Section 2.2). Game preferences, the last unknown parameter in the Arctic game, can be finally deduced from the payoffs of each decision-maker in order to run the conflict resolution model.

2.4 Chapter summary

What does theory tell us about war-prone strategies in territorial dispute resolution? Is there a research model with uniform variables and inter-variable linkages allowing deriving state preferences? In order to answer these questions, this chapter introduces theoretical configuration of a systemic geopolitical analysis of the dispute over international waters in the Central Arctic Ocean. We start with a brief introduction to the function of the Arctic in the classic and contemporary geopolitical theory. Then, we discuss the existing game-theoretic research on conflict and cooperation in the Arctic region and search for adequate ways of deduction of game preferences on the basis of decision-makers' material capabilities, in neoclassical geopolitical theory and Foreign Policy Analysis. Next, we introduce social and geographic resources that reflect the power of nation states in the system of international relations, best alternative to a negotiated agreement (BATNA), and ways of manipulating of the geographic resources

of states – the EEZ area of two claimant states, Denmark and Russia. In the next chapter, we model the composite index of socio-geographic resources of states and understand how the Arctic geographic manipulation affects an absolute and relative strength of 187 nations states.

Chapter 3

State Power in the Arctic Dispute

In the broader context of time–space geography, the constrained material resources limit the state in action, either due to biological needs, as hunger; or due to restricted facilities, as landlockedness (Golob and Regan 2001; and Axhausen in D. Ettema and H. Timmermans, 1997). In the realms of international politics, "...the most successful states ... match their geostrategy to the underlying geopolitical reality" (Grygiel, 2006, p. 1). According to Lykke, ends (objectives), ways (concepts for accomplishing objectives), and means (resources for supporting these concepts) are three dimensions upon which the national strategy rests. If any dimension is out of balance, the risk is too big and the strategy collapses (Lykke et al., 2001, p. 1+).

In the context of the northernmost territorial dispute, the level of own and adversaries' relative socio-geographic superiority is the means each rational decision-maker takes into consideration while ordering preferences over alternative conflict resolution options. The decision-makers imply strategies that appropriately balance the ends, ways, and means by, in the first place, evaluating own and other decision-makers' available resources. And, in order to decide whether a given actor prefers to make concessions in the northernmost dispute, it is necessary to obtain and contrast the strength of resource endowment of both the claimant states and the rest of humankind.

Keeping in mind all theoretical considerations presented in the previous chapter, we start working with global attributive data on the long-term socio-geographic development (1993-2013) of all Arctic decision-makers, construct the composite index of socio-geographic resources of states ($SocGeoR$) and evaluate its stability cross-temporarily. Then, we calculate the particular territorial adjustments appearing in different dispute resolution options (Options I-IX in Figure 1-5) and manipulate the $SocGeoR$ index by changing the EEZ area in the model. Although not part of the index, a retrospective of the symbolic power potential associated with the Arctic region is presented in a separate subsection. Finally, we derive the value of payoff of each decision-maker and each option

in the dispute from variation in the former's aggregate national resource as implied by particular territorial modifications in the central part of the Arctic Ocean.

3.1 Research Mechanics

3.1.1 Dataset

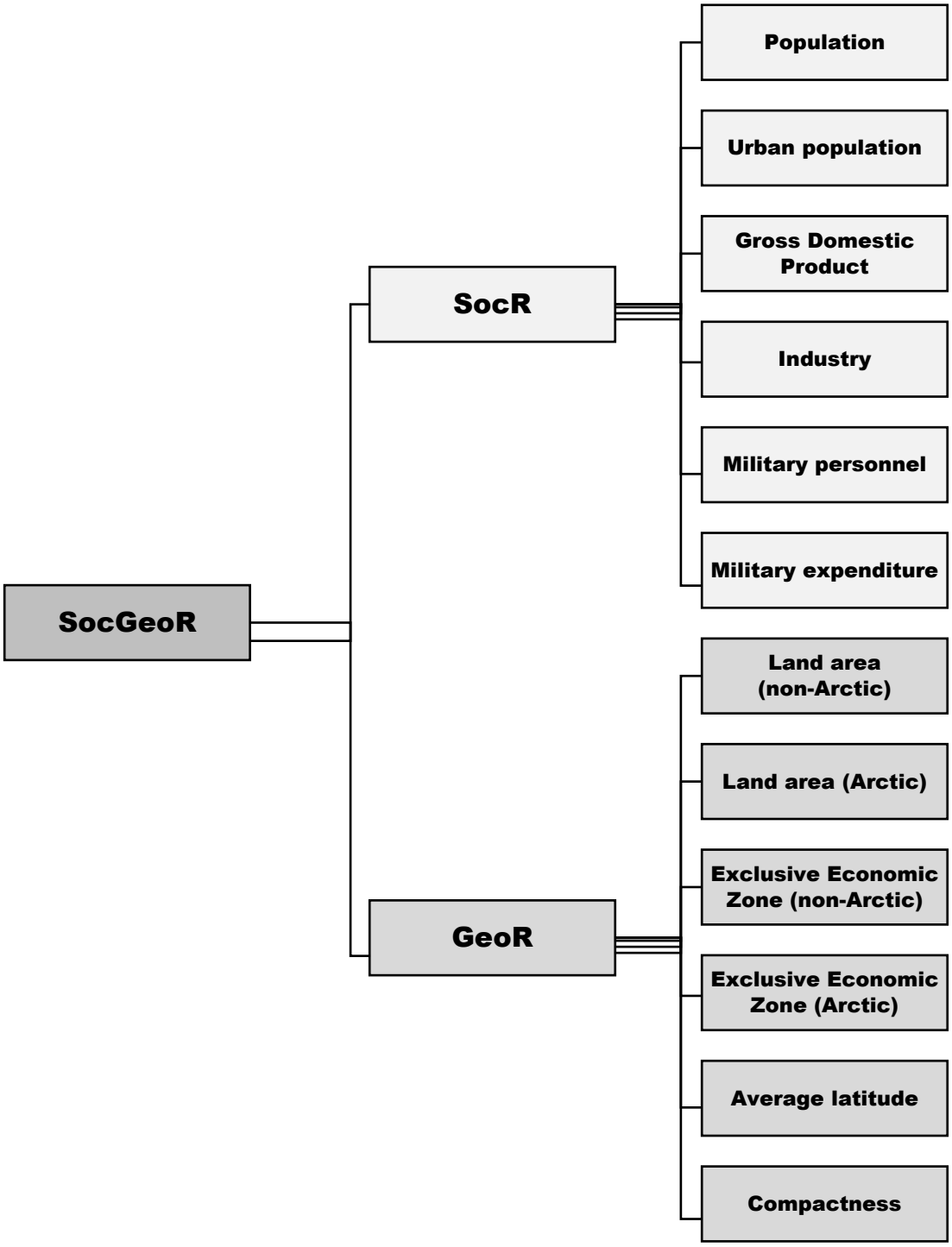
Adjusted to the regional specifics, the State Social and Geographic Resource dataset (SocGeoR) is a global cross-national dataset comprising of 187 cases (the nation states)[152] and twelve variables describing each state's endowment with social material and physical resources. Figure 3-1 demonstrates two categories of state resources and corresponding variables.

The choice of variables and inter-variable linkages is not random. Together, two equally weighted groups of variables represent social and geographic power of states. The social power is represented by six variables replicating, to a great extent, the Composite Index of National Capability (CINC) – power equation [viii] in Table 2-2 (Singer, Bremer and Stuckey, 1972, pp. 19-48). We have chosen CINC for three reasons. First, modeling state socio-material power is not the primary goal of this work. Second, no essential difference between the multivariable indexes is observable in state power ratings, because "needless additional data and arithmetic computation have been introduced without an[y] increase in payoff" (Merritt and Zines, 1989, p. 26). Third, instead of creating yet another power equation to determine the absolute and relative strength of states, we define the latter in a manner that is compatible with traditional approaches in contemporary political

[152] Afghanistan, Albania, Algeria, Andorra, Angola, Antigua and Barbuda, Argentina, Armenia, Australia, Austria, Azerbaijan, Bahamas, Bahrain, Bangladesh, Barbados, Belarus, Belgium, Belize, Benin, Bhutan, Bolivia, Bosnia and Herzegovina, Botswana, Brazil, Brunei Darussalam, Bulgaria, Burkina Faso, Burundi, Cabo Verde, Cambodia, Cameroon, Canada, Central African Republic, Chad, Chile, China, Colombia, Comoros, Dem. Rep. of Congo, Rep. of Congo, Costa Rica, Cote d'Ivoire, Croatia, Cuba, Cyprus, Czech Republic, Denmark, Djibouti, Dominica, Dominican Republic, Ecuador, Egypt, El Salvador, Equatorial Guinea, Eritrea, Estonia, Ethiopia, Fiji, Finland, France, Gabon, Gambia, Georgia, Germany, Ghana, Greece, Grenada, Guatemala, Guinea, Guinea-Bissau, Guyana, Haiti, Honduras, Hungary, Iceland, India, Indonesia, Iran, Iraq, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kazakhstan, Kenya, Kiribati, Dem. Rep. of Korea, Rep of Korea, Kuwait, Kyrgyzstan, Laos, Latvia, Lebanon, Lesotho, Liberia, Libya, Liechtenstein, Lithuania, Luxembourg, Macedonia, Madagascar, Malawi, Malaysia, Maldives, Mali, Malta, Marshall Islands, Mauritania, Mauritius, Mexico, Moldova, Monaco, Mongolia, Montenegro, Morocco, Mozambique, Myanmar, Namibia, Nepal, Netherlands, New Zealand, Nicaragua, Niger, Nigeria, Norway, Oman, Pakistan, Palau, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Poland, Portugal, Qatar, Romania, Russian Federation, Rwanda, Samoa, San Marino, Saudi Arabia, Senegal, Serbia, Seychelles, Sierra Leone, Singapore, Slovak Republic, Slovenia, Solomon Islands, South Africa, Spain, Sri Lanka, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Sudan, Suriname, Swaziland, Sweden, Switzerland, Syria, Tajikistan, Tanzania, Thailand, Togo, Tonga, Trinidad and Tobago, Tunisia, Turkey, Turkmenistan, Tuvalu, Uganda, Ukraine, United Arab Emirates, United Kingdom, United States, Uruguay, Uzbekistan, Vanuatu, Venezuela, Vietnam, Rep. of Yemen, Zambia, Zimbabwe.

geography and Foreign Policy Analysis (see Subsection 2.3) and is arithmetically transparent and used frequently in contemporary conflict research.

Figure 3-1. Two categories of state power and corresponding variables



Source: author.

Among the existing multivariable power equations, CINC is probably the most widely used.[153] The index has two major weaknesses. First, it only considers the time span of 1816-2007, which is, in fact, an outdated perspective for the one considering the contemporary territorial dispute in the Arctic. Because, in 2016, data from 2007 is not anymore relevant, in this study we attempt to compensate for the outdatedness of the original CINC by (almost entirely) replicating it to extend the time span to 2013 – the year with the latest available global data at the WDI database (WDI 2016).

We consider four original CINC indicators: population,[154] urban population,[155] military expenditure and military personnel. At the same time, we make the index

[153] Based on average appearance of "CINC" in *Jstor*, *WoS* and *Questia* publication platforms in 2000 and 2010.

[154] Total population is based on the *de facto* definition of population appearing in (1) World Population Prospects, UN Population Division, (2) Census reports and other statistical publications from national statistical offices, (3) Demographic Statistics by Eurostat, (4) Population and Vital Statistics Reports, UN Statistical Division, (5) International Database of the U.S. Census Bureau, and (6) Statistics and Demography Programme, Secretariat of the Pacific Community. Despite relative popularity, this indicator suffers from a number of methodological limitations when used in a cross-national analysis. First, comparability of population indicators is limited by differences in the concepts, definitions, collection procedures, and estimation methods. Second, the quality and reliability of official demographic data are fundamentally affected by the government commitment to full and accurate enumeration and census agencies' independence from political influence. Third, migration significantly distorts the indicator as the standards for the duration and purpose of international moves qualifying as migration vary from country to country. Fourth, total population does not reflect age- and education-based classification of population (that have a direct connection to the quality of the labor force). Finally, in some cases, the cohort component method is used (i.e. estimation and projection of population based on fertility, mortality, and net migration data) and it imports data from sample surveys that are often too small/limited in coverage to be considered as reliable as the census data (WDI Database, 2016). However, given the existence of a long-term conceptual linkage between population and demographic strength in development literature (Mandishona, 1987, p. 69), cross-national and cross-temporal data availability, and great differences among the developing and developed countries in the qualitative (age- and education-related) classification of population, total population is still the most effective quantitative demographic indicator (WDI Database, 2016). Its unmodified version is used in the current analysis in full accordance with the CINC methodology.

[155] Urban population is estimated as ratios of urban to total population applied to the World Bank's estimates of total population. It is one of the most popular parameters in estimation of the impact of demography on economic growth (Tolley 1987, Mason 1989, Moomaw 1996, Henderson 2003). However, it suffers from a number of limitations when used in cross-national and cross-temporal comparisons. On the one hand, aggregation of urban and rural population may not necessarily add up to total population because of difference in country coverage. There is no consistent and universally accepted standard for distinguishing urban from rural areas, as some countries define urban areas on the basis of the presence of certain infrastructure and services, while others designate urban areas according to the administrative arrangements. On the other hand, hundreds of towns have been reclassified as cities in recent years, and urbanization in developing countries is much greater than in developing countries (WDI Database, 2016). In result, the original positive effect of urbanization on the quality of the labor force may not necessarily hold true in the contemporary global demographic condition as, in many areas, poverty tends to grow faster in urban than in rural areas (particularly, modern urban slums end up lacking basic services and being overcrowded, polluted and dangerous). At the same time, there still exists a well-established conceptual bridge between urban population and national development (Kötter and Friesecke, 2009, pp. 1-3). Also, due to cross-national and cross-temporal data availability, and because cities still offer a more favorable setting for the resolution of social and environmental problems; generate jobs and income; deliver education, health care and other social services; provide opportunities for social mobilization; and assume lower infrastructure-related costs than rural areas (WDI Database, 2016), the level of urbanization still

'healthier' by changing the iron and steel production of country ratio and the primary energy consumption ratio to Gross Domestic Product[156] and share of industry in GDP.[157] We leave the perspective of coal and steel production performance because it is not such a sharp indicator of state power as it used to be in the interwar and post-WWII period (recall the origins of the European Coal and Steel Community). The situation is even more complicated given no meaningful data on coal and steel production. At the same time, the volume of national energy consumption cannot be any longer considered as another indicator of state economic strength, because empirical testing shows that (a) lower mean temperatures in winter[158] and (b) being member of the Organization of

influences the quality of the labor force and therefore can be used as an indicator of (potential) demographic strength in the cross-national and cross-temporal analysis, in full accordance with the CINC methodology.

[156] According to the 2008 United Nations System of National Accounts, gross domestic product is usually measured as the sum of value added (less the value of intermediate goods and services consumed in production, before accounting for consumption of fixed capital in production), at constant prices, by households, government, and industries operating in the given economy, and it accounts for all domestic production, no matter if domestic or foreign institutions generate this income. GDP statistics suffers from a number of methodological limitations. Among others, it does not include barter and cash transactions that take place outside of recorded market places (underground economic activity). Also, GDP recording does not consider changes in leisure/human costs of production of output, changing quality of the latter, or harmful side effects associated with it (e.g., pollution). Neither does the GDP measurement reflect the "nonmarket production" (output produced but not exchanged for money) – European Environmental Bureau, 2007, pp. 5-6. Nevertheless, GDP leads the list of ten most common and vital economic indicators used in developmental analysis, and its vital importance is proved by the fact that the U.S. Federal Reserve uses the real GDP, together with other indicators, to adjust its monetary policy (American Association of Individual Investors, 2003, p. 1) and, in terms of cross-national and cross-temporal data availability, this indicator is still the most effective one among all economic indicators (WDI Database, 2016).

[157] According to the 2008 United Nations System of National Accounts, value added by industry is measured at basic prices, and its oigin is determined by the International Standard Industrial Classification divisions 10-45, revision 3. Share of industry in GDP suffers from a number of methodological limitations if used in a cross-national comparison. First, in most developing countries industrial output is not measured through regular censuses and surveys of firms, so the risk of measurement distortion is much greater than in developed countries where censuses and surveys are widespread. Second, the choice of sampling unit varies from country to country, usually being either the enterprise (where responses are usually based on financial records) or the establishment (where production units are recorded separately). Third, in countries with ongoing process of privatization of industrial production facilities, a significant number of firms fail to report, and these activities are to be collected using techniques other than classic surveys of firms. Fourth, high share of industry in GDP of a given nation state may not be due to a real advancement in industrial production, but because other sectors (agriculture and services) are very small – a common problem when working with ratio. Finally, because service-intensive construction is not reported separately (i.e. it cannot be removed from industrial production measurement), the set of countries benefiting from high share of Industry in GDP is economically diverse (oil-rich economies, tourism-oriented economies, etc.), and the indicator does not report on the cyclical nature of economic activity to a satistactory extent (WDI Database, 2016). Nevertheless, because the level of industrialization reflects a number of national development characteristics, including the nature of employment, social well-being, technological development, capital inflow, and urbanization (United Nations Industrial Development Organization, 2004, pp. 3-7) and, in terms of cross-national and cross-temporal data availability, share of industry in GDP is one of the most effective indicators of economic strength of the country (WDI Database, 2016), it is used in the current analysis. Incorporation of the industrial production per capita into our model did not produce any difference to the final socio-geographic coefficient of state power, if compared to the simple share of industry in GDP, therefore we prefer the latter version of the parameter due to a better data availability for 1993 and 1998.

[158] r =-0.3918 (for energy consumption per capita and the average temperature of the coldest month in the year), p =0.000, n =178.

Petroleum Exporting Countries (OPEC) [159] correlates with higher energy consumption per capita (Chang, 2004, p. 16). In other words, the only way to use the CINC meaningfully is to replicate it changing its (outdated) economic parameters into other, more aggregate indicators of economic strength of the country – gross product and share of total industrial production in the gross product.

Five variables – *Land (Arctic), Land (non-Arctic), EEZ (Arctic), EEZ (non-Arctic)* and *Compactness* – are the full analytical inventions of the author, and the rest have been culled from national statistical databases, World Bank's WDI databank, the circumpolar statistical database *ArcticStat*, *Encyclopedia Britannica*, CIA *World Factbook*, *Sea Around Us*, climatic dataset by Masters and McMillan (2001), *International Border Research Unit*, IISS and *the Military Balance, Correlates of War* NMC v4.0 dataset and SIPRI *Military Expenditure* dataset. All data is standardized. In most cases, we define the variables according to their specification in the codebooks for the related datasets. Those interested in the exact configuration of all variables should therefore refer to the original documentation found in aforementioned public datasets. What follows is a brief description of the configuration of variables:

- *Population (thou. persons)* – all residents regardless of legal status or citizenship except for refugees[160] (mid-year estimates). We use the following data standardization rule: given *m* nation states and *n* indicators (variables) there exists a matrix of values $x_{i,j}$, $i = 1,\ldots,m$; $j = 1,\ldots,n$. A matrix of sub-indices $In_{i,j}$, $i = 1,\ldots,m$; $j = 1,\ldots,n$ is constructed in [3]:

  $$In_{i,j} = \frac{100 * Total\ country}{Total\ world}$$, where $In_{i,j}$ is the desired sub-index. [3]

  [Source: National population censuses in WDI Databank Series SP.POP.TOTL]
- *Urb_Pop (thou. persons)* – all people living in urban areas calculated using World Bank population estimates and urban ratios from the United Nations *World Urbanization Prospects*. The data standardization rule is in [3]. [Source: National statistical offices in WDI Databank Series SP.URB.TOTL]
- *GDP (Mil. const. 2005 USD)* – sum of gross value added by all resident producers at purchaser's prices in the economy plus any product taxes and minus any subsidies not included in the value of the products, with no deduction for depreciation of

[159] $p = 0.055$.
[160] Refugees are not permanently settled in the country of asylum and are considered to be part of the population of their country of origin.

fabricated assets or for depletion and degradation of natural resources.[161] The data standardization rule is in [3]. [Source: World Bank national accounts data, and OECD National Accounts in WDI Databank Series NY.GDP.MKTP.KD]

- *Industry (Percent of GDP)* – value added[162] in mining, manufacturing,[163] construction, electricity, water, and gas (ISIC divisions 10-45) determined by the International Standard Industrial Classification (ISIC), revision 3 and based on World Bank national accounts data and OECD National Accounts data files, recalculated from GDP and percent of GDP data, in million constant 2005 USD. The data standardization rule is in [3]. [Source: World Bank national accounts data, and OECD National Accounts in WDI Databank Series NV.IND.TOTL.ZS, NY.GDP.MKTP.KD]
- *Mil_pers (thou. persons)* – active duty military personnel (Army, Navy, Air Force), including paramilitary forces if the training, organization, equipment, and control suggest they may be used to support or replace regular military forces. The data standardization rule is in [3]. [Source: IISS and *the Military Balance* in WDI Databank Series MS.MIL.TOTL.P1]
- *Mil_exp. (Mil. 2005 USD)* – all current and capital expenditures[164] on the armed forces, including peacekeeping forces; defense ministries and other government agencies engaged in defense projects; paramilitary forces, if these are judged to be trained and equipped for military operations; and military space activities (based on the NATO definition), recalculated from GDP and percent of GDP data, in million constant 2005 USD. The data standardization rule is in [3]. [Source: IISS and *the Military Balance* in WDI Databank Series MS.MIL.XPND.GD.ZS, NY.GDP.MKTP.KD]
- *Land (non-Arctic, thou. sq. km)* – total land area excluding area under inland water bodies, national claims to continental shelf, and exclusive economic zones,[165] and excluding the area defined as 'Arctic' in Subsection 1.1.1. The 'Arctic' land area is a sum of all land area (including inland water and glaciers) delimited by provincial (sub-national) boundaries and/or coastlines; as defined in the respective

[161] Dollar figures for GDP are converted from domestic currencies using 2005 official exchange rates.
[162] Net output of a sector after adding up all outputs and subtracting intermediate inputs calculated without making deductions for depreciation of fabricated assets or depletion/degradation of natural resources.
[163] Also reported as a separate subgroup.
[164] Including military and civil personnel, retirement pensions of military personnel and social services for personnel; operation and maintenance; procurement; military research and development; and military aid (in the military expenditures of the donor country); and excluding the civil defense and current expenditures for previous military activities, such as for veterans' benefits, demobilization, conversion, and destruction of weapons.
[165] In most cases the definition of inland water bodies includes major rivers and lakes.

administrative divisions. The data standardization rule is in [3]. [Source: Food and Agriculture Organization, *ArticStat* // WDI Databank Series AG.LND.TOTL.K2]

- *Land (Arctic, thou. sq. km)* – sum of all land area (including inland water and glaciers) delimited by provincial (sub-national) boundaries and/or coastlines; as defined in the respective administrative divisions, excluding area under national claims to continental shelf, and exclusive economic zones. Non-Arctic states receive zero. The data standardization rule is in [3]. [Source: Food and Agriculture Organization, ArticStat // WDI Databank Series AG.LND.TOTL.K2]
- *EEZ (non-Arctic, thou. sq. km)* – area of Exclusive Economic Zone (EEZ) under the jurisdiction of each nation state excluding EEZs in the Arctic Ocean. EEZs in the Arctic Ocean recalculated for each northernmost province according to the length of its coastline and summed up for each Arctic state. Arctic-only[166] and landlocked states receive zero. The data standardization rule is in [3]. [Source: *Sea Around Us, DaftLogic, Advanced Google Maps Distance Calculator*]
- *EEZ (Arctic, thou. sq. km)* – area of EEZ under the jurisdiction of the Arctic state generated by the coastline of each province facing the Arctic Ocean,[167] recalculated for each northernmost province according to the length of its coastline and summed up for each Arctic actor. Non-Arctic and landlocked states receive zero. The data standardization rule is in [3]. [Source: *Sea Around Us*, *DaftLogic*, *Advanced Google Maps Distance Calculator*]
- *Fav_Ave_Lat (0--1)* – a favorable average latitude of a state (equivalent to a midpoint on a flat rectangular projection map), as deviation from Equator in degrees.[168] This average latitude is coded to discriminate in favor of points located between the Tropic of Cancer (23,43719°) and the Arctic Circle (66,5622°) in the Northern Hemisphere, and between the Tropic of Capricorn (23,43719°) and the Antarctic Circle (66,5622°) in the Southern Hemisphere, as "1". In all other cases we assign a zero value. We standardize data in the following way: given m nation states and n indicators (variables) there exists a matrix of values $x_{i,j}$, $i = 1,\ldots,m$; $j = 1,\ldots,n$. A matrix of desired sub-indices $In_{i,j} = 1, \ldots, m;\ j = 1, \ldots, n$, is constructed in [4]:

[166] Iceland.
[167] Arctic Sea, part of NW Atlantic, Barents Sea, Kara Sea, Laptev Sea, East Siberian Sea, Chukchi Sea, Beaufort Sea.
[168] The latitude and longitude for each location is converted into Cartesian coordinates (x, y, z). These coordinates are then multiplied by the weighting factor and summed. A line is drawn from the center of the earth out to this new coordinate (x, y, z). The geographic midpoint is where this line intersects the earth surface.

$$In_{i,j} = \frac{x_{i,j} - \min\limits_{1 \le j \le n} x_{i,j}}{\max\limits_{1 \le j \le n} x_{i,j} - \min\limits_{1 \le j \le n} x_{i,j}}$$, where $i = 1,\ldots,m$; $j = 1,\ldots, n$. [4]

The value of the sub-index $In_{i,j} = 1, \ldots, m;\ j = 1, \ldots, n$, varies from 0 to 1. Value that is close to 0 is proximate to the minimal value $\min\limits_{1 \le j \le n} x_{i,j}$, while being close to 1 signals proximity to maximum value $\max\limits_{1 \le j \le n} x_{i,j}$. [Source: Masters and McMillan (2001) // CIA, *World Factbook*]

- *Compact (0--1)* – index of state compactness calculated as a ratio of state's area to the area of the circle those length equals the length of state's borders[169] (land borders and coastline):

$$K = \frac{4 * \pi * S}{L^2},$$ [5]

where K is a state compactness index; S is state area; L is the length of state borders, and π is 3,14159265359. The data standardization rule is in [4]. [Source: CIA *World Factbook*]

Because obtaining longitudinal dyadic data is problematic, and creating a new dataset is too time consuming, the dataset does not provide data for every single year. Instead, similarly to Snijders, we observe the data at a number of discrete time points but assume "…an unobserved network evolution going on between these time points" (Snijders, 2005, pp. 215-6) and focus on the following five years: 1993, 1998, 2003, 2008, 2013.

2.1.2 Measurement

After obtaining the individual parameters of state endowment with global and local social material and geographic resources, we set up the measurement algorithm:

(1) There exists a matrix of values $x_{i,j}$, $i = 1,\ldots,m$; $j = 1,\ldots,n$, with m nation states and n parameters (variables).

(2) At a given level of approximation, for a number of reasons,[170] we grant equal weights to twelve social material and geographic sub-indices within the aggregate state capability index.

[169] Due to a neglectible variation for a sample of 187 nation states between 1993 and 2013, this parameter is fixed at 2013 values.

[170] Because geopolitical theory, in general, is not focused on finding the actual 'weight' of specific dimensions within the complex geopolitical system, we refer to the basic assumption of the inferential logic: we assume no variation in this weight. The analysis of the results of the empirical test allows modifying the initial assumption, based on any quasi-experimental research design template.

(3) The aggregate index $SocRi$ with $i = 1,\ldots,m$, is a sum of six social material resource indices $In_{i,j}$, $i = 1,\ldots,m$; $j = 1,\ldots,n$, divided by the number of studied indices, i.e. by 6:

$$SocR_i = \frac{\sum_{j=1}^{n} In_{i,j}}{6} \quad [6]$$

Index $SocR_i$ varies from zero to the aggregate value $Total\ world$. When $SocR_i \rightarrow 0$, sub-indices $In_{i,j} = 1, \ldots, n \rightarrow 0$, i.e. the studied parameters have the lowest values. In contrast, when $SocR_i \rightarrow Total\ world$, all sub-indices $In_{i,j} = 1, \ldots, n \rightarrow Total\ world$, i.e. all indicators have the highest values.

(4) The aggregate index $SocGeoR_i$ with $i = 1,\ldots,m$, is a sum of six social material resource indices and six geographic indices $In_{i,j}$, $i = 1,\ldots,m$; $j = 1,\ldots,n$, divided by the number of studied indices, i.e. by 12:

$$SocGeoR_i = \frac{\sum_{j=1}^{n} In_{i,j}}{12} \quad [7]$$

Index $SocGeoR_i$ varies from zero to the aggregate value $Total\ world$. When $SocGeoR_i \rightarrow 0$, sub-indices $In_{i,j} = 1, \ldots, n \rightarrow 0$, i.e. the studied parameters have the lowest values. In contrast, when $SocGeoR_i \rightarrow Total\ world$, all sub-indices $In_{i,j} = 1, \ldots, n \rightarrow Total\ world$, i.e. all indicators have the highest values.

(5) The aggregate *absolute* geographic effect on the $SocR$ index is h_i:

$$h_i = SocGeoR_i - SocR_i \quad [8]$$

(6) Finally, using simple algebraic transformations we find the rank of each state in $SocRi$ and $SocGeoR_i$ ($SocRank_i$ and $SocGeoRank_i$, respectively), to reveal the aggregate *relative* geographic effect on $SocRank$, H_i:

$$H_i = SocRank_i - SocGeoRank_i \quad [9]$$

Values of h_i and H_i vary from zero to max. In comparative perspective, when h_i and $H_i \rightarrow 0$, the extent of impact of geographic parameters on relative social material resource rank is minimal. In contrast, when h_i and $H_i \rightarrow max$, geographic parameters dramatically alter the social material rank of a state, either positively (i. e. endowment with a 'strong' geographic resource improves a state's relative strength in social material resource) or negatively (i. e. lack of a 'strong' geographic resource lowers a state's relative strength in social material resource).

3.2 Composite Index of State Social Resources (SocR)

3.2.1 Compatibility check: SocR versus CINC

Before evaluating the positive and negative gains from geography in absolute and relative state capability we test whether the expected compatibility of $SocR$ and CINC indices is statistically significant. Table 3-1 demonstrates the Top-30 CINC and $SocR$ ranks (the full list of $SocR$ and CINC indices for 187 nation states in 1993, 1998, and 2003 is in the electronic Appendix F).

For each panel year where the values of both indices are available (1993, 1998, 2003) we test whether the variation of $SocR_i$ and $CINC_i$ values is statistically significant. Given that the studied variables of $SocR_i$ and $CINC_i$ are expressed in different units, for a greater convenience we standardize these values and calculate the standard scores z:[171]

$$z_i = \frac{x_i - \bar{x}}{\sigma_{x_i}}, \qquad [10]$$

where $\bar{x}$ is the average value of x_i and σ_{x_i} is the standard deviation.

Next, we use the absolute values of $SocR_i$ and $CINC_i$ to find the Pearson product-moment correlation coefficient r_i:

$$r_i = \frac{\mathrm{n}(\sum SocR_i CINC_i) - (\sum SocR_i)(\sum CINC_i)}{\sqrt{[\mathrm{n}\sum SocR_i^2 - (\sum SocR_i)^2][\mathrm{n}\sum CINC_i^2 - (\sum CINC_i)^2]}} \qquad [11]$$

where i is the given panel year; n is the number of pairs of scores; $\sum SocR_i CINC_i$ is the sum of the products of paired scores; $\sum SocR_i$ is the sum of $SocR_i$ scores; $\sum CINC_i$ is the sum of $CINC_i$ scores; $\sum SocR_i^2$ is the sum of squared $SocR_i$ scores; and $\sum CINC_i^2$ is the sum of squared y scores.

To evaluate whether the observed relative differences in state wealth are statistically significant, we additionally calculate Spearman's rank correlation coefficient ρ_i :[172]

$$\rho_i = 1 - \frac{6\sum d_i^2}{n(n^2-1)}, \qquad [12]$$

where i is the given panel year and d_i is the difference between state ranks according to $SocRi$ and $CINC_i$.

[171] This standardisation brings values of level 0, spread of 1, and no units and, simultaneously, makes no difference to the shape of a distribution.

[172] The Spearman correlation coefficient is the Pearson correlation coefficient between the ranked variables.

Table 3-1. The Top-30 Ranking, CINC versus SocR, 1993, 1998, 2003

1993				**1998**				**2003**			
CINC Top-30		**SoM Top-30**		**CINC Top-30**		**SoM Top-30**		**CINC Top-30**		**SoM Top-30**	
Country name	CINC Rank	Country name	SoM Rank	Country name	CINC Rank	Country name	SoM Rank	Country name	CINC Rank	Country name	SoM Rank
United States	1	United States	1	China	1	United States	1	China	1	United States	1
China	2	China	2	United States	2	China	2	United States	2	China	2
India	3	Japan	3	India	3	India	3	India	3	India	3
Japan	4	India	4	Japan	4	Japan	4	Japan	4	Japan	4
Russian Federation	5	Germany	5	Russian Federation	5	Germany	5	Russian Federation	5	Germany	5
Germany	6	Russian Federation	6	Germany	6	France	6	Germany	6	United Kingdom	6
United Kingdom	7	France	7	Brazil	7	United Kingdom	7	Korea, Rep.	7	France	7
Brazil	8	United Kingdom	8	Korea, Rep.	8	Russian Federation	8	Brazil	8	Russian Federation	8
Korea, Rep.	9	Italy	9	France	9	Italy	9	United Kingdom	9	Italy	9
France	10	Brazil	10	United Kingdom	10	Brazil	10	France	10	Brazil	10
Italy	11	Korea, Rep.	11	Italy	11	Korea, Rep.	11	Italy	11	Korea, Rep.	11
Ukraine	12	Mexico	12	Turkey	12	Indonesia	12	*Portugal†*	12	Indonesia	12
Turkey	13	Indonesia	13	Ukraine	13	Mexico	13	Ukraine	13	Mexico	13
Indonesia	14	Turkey	14	Indonesia	14	Turkey	14	Indonesia	14	Spain	14
Korea, Dem. Rep.	15	Spain	15	Mexico	15	Spain	15	Turkey	15	Turkey	15
Canada	16	Canada	16	Pakistan	16	Canada	16	Pakistan	16	Pakistan	16
Mexico	17	Pakistan	17	Iran, Islamic Rep.	17	Pakistan	17	Iran, Islamic Rep.	17	Canada	17
Pakistan	18	Saudi Arabia	18	Canada	18	Saudi Arabia	18	Mexico	18	Iran, Islamic Rep.	18
Spain	19	Korea, Dem. Rep.	19	Spain	19	Iran, Islamic Rep.	19	Korea, Dem. Rep.	19	Saudi Arabia	19
Iran, Islamic Rep.	20	Iran, Islamic Rep.	20	*Taiwan†*	20	Korea, Dem. Rep.	20	Spain	20	Egypt, Arab Rep.	20
Taiwan†	21	Vietnam	21	Korea, Dem. Rep.	21	Australia	21	Canada	21	Korea, Dem. Rep.	21
Saudi Arabia	22	Netherlands	22	Saudi Arabia	22	Egypt, Arab Rep.	22	Egypt, Arab Rep.	22	*Australia ◊*	22
Vietnam	23	Australia	23	Egypt, Arab. Rep.	23	Netherlands	23	Saudi Arabia	23	Nigeria	23
Poland	24	Ukraine	24	Poland	24	Poland	24	*Taiwan†*	24	*Netherlands ◊*	24
Egypt, Arab Rep.	25	Egypt, Arab Rep.	25	Vietnam	25	Nigeria	25	Nigeria	25	Thailand	25
Australia	26	Poland	26	Australia	26	Ukraine	26	Vietnam	26	Bangladesh	26
South Africa†	27	Thailand	27	Thailand	27	*Bangladesh ◊*	27	Bangladesh	27	Vietnam	27
Netherlands	28	Nigeria	28	Netherlands	28	Thailand	28	Thailand	28	Poland	28
Nigeria	29	*Bangladesh ◊*	29	Nigeria	29	Vietnam	29	*Myanmar†*	29	*Colombia ◊*	29
Thailand	30	*Philippines ◊*	30	South Africa	30	South Africa	30	Poland	30	Ukraine	30

† - does not appear in SoM Top-30

◊ - does not appear in CINC Top-30

Source: author.

The results of the correlation analysis provide evidence on high and stable compatibility of $SocR$ and CINC indices[173] in both absolute and relative dimensions of evaluation of state social resources.[174] First, in 1993, the Pearson coefficient r_{1993} is 0,925 for the absolute values of the CINC Top-30 and the $SocR$ Top-30 (for 187 states r_{1993}=0,971). In 1998 it slightly rises to r_{1998}= 0,940 (for 187 states r_{1998}= 0,958) and in 2003 it is 0,959 (for 187 states r_{2003}= 0,945). Second, in 1993 the Spearman's rank correlation coefficient ρ_{1993} is 0,939 for the relative capabilities of states according to the CINC Top-30 and the $SocR$ Top-30 rankings (for 187 states ρ_{1993} is as high as 0,988). In 1998 it decreases to ρ_{1998}=0,922 (for 187 states ρ_{1998}= 0,986) and in 2003 it drops to ρ_{2003} = 0,882 (but for 187 states ρ_{2003} still equals 0,985).

In all studied panel years, r_i < 1 and $\rho_i < 1$, i.e. all sample points do not fall exactly on a positively-sloped prediction line but are very close to it. This is mainly due to the difference in two economic parameters. On the one hand, while CINC index works with the primary energy consumption ratio, $SocR$ index is based on the evaluation of the Gross Domestic Product. Not limited by the shortcomings of energy consumption perspective (see Subsection 3.1.1) cross-national comparison of GDP produces a more nuanced picture of the actual efficiency of all resident producers for each given economy, not only in energy-intensive manufacturing (e.g. chemical, iron, steel, glass and paper production), but also in non-energy-intensive manufacturing (e.g. plastics, wood and machinery production) and non-manufacturing (e.g. construction, mining and agriculture). Voting for this parametric change allows effectively coping with the climatic 'noise': all states (not just the northern ones naturally consuming more electricity) are now judged in the same, geographically nondeterministic way.

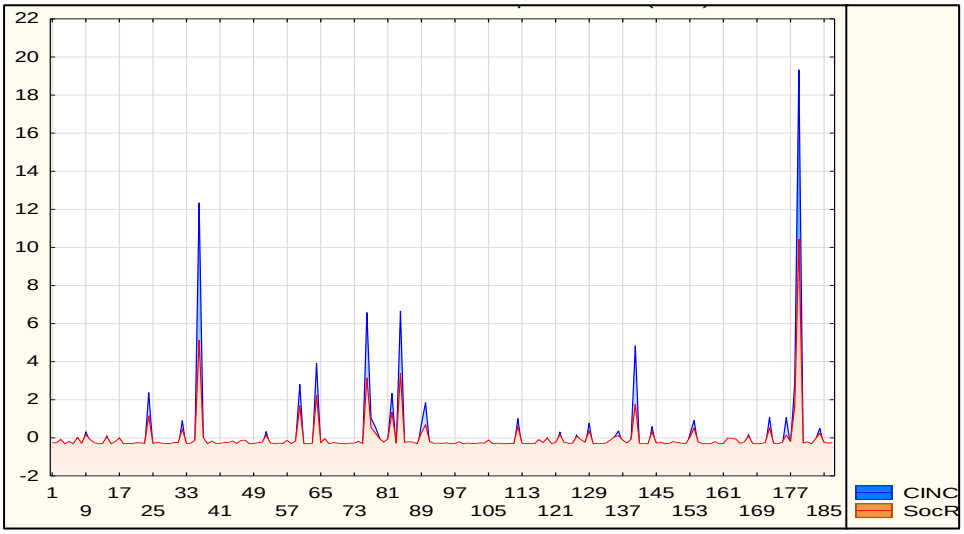
On the other hand, while the CINC index focuses on iron and steel production of country ratio, $SocR$ index works with the share of value added from all industrial production in state's Gross Domestic Product. Accumulating all activities defined as ISIC divisions 10-45 the alternative $SocR$ parameter includes not only iron and steel production, but other core industrial activities as mining, manufacturing, construction, electricity, water, and gas production). This widening of the scope removes the 'noise' from industry-dominated economies (in relation to agriculture- and services-dominated

[173] The correlation treats variable *A* and variable *B* symmetrically: the prediction equation using variable *A* to predict variable *B* has the same correlation as the one using varable *B* to predict variable *A* (Agresti and Finlay, 2009, p. 271).
[174] Correlations are significant at p <0,05.

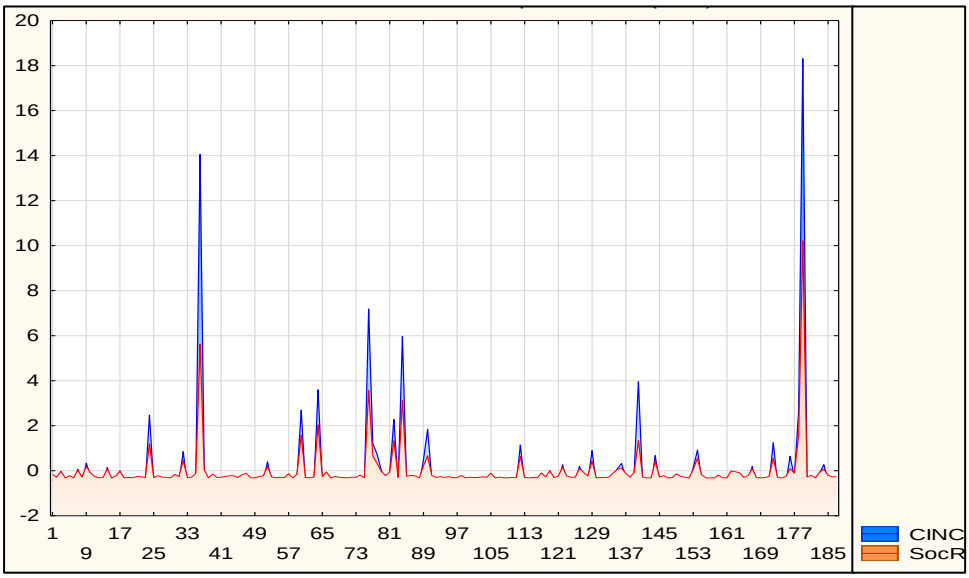
economies) and, simultaneously, allows capturing the potential comparative strength of states given their involvement in the extraction and/or production of energy resources. As a result, in the global perspective, $SocR$ index suffers less from distortions coming from the existence of strong outliers than CINC index. We illustrate the difference for 1993, 1998 and 2003 in Figure 3-2 with three stacked plots of multiple variables.

Figure 3-2. $SocR$ index versus CINC index, 187 nation states, 1993-2003

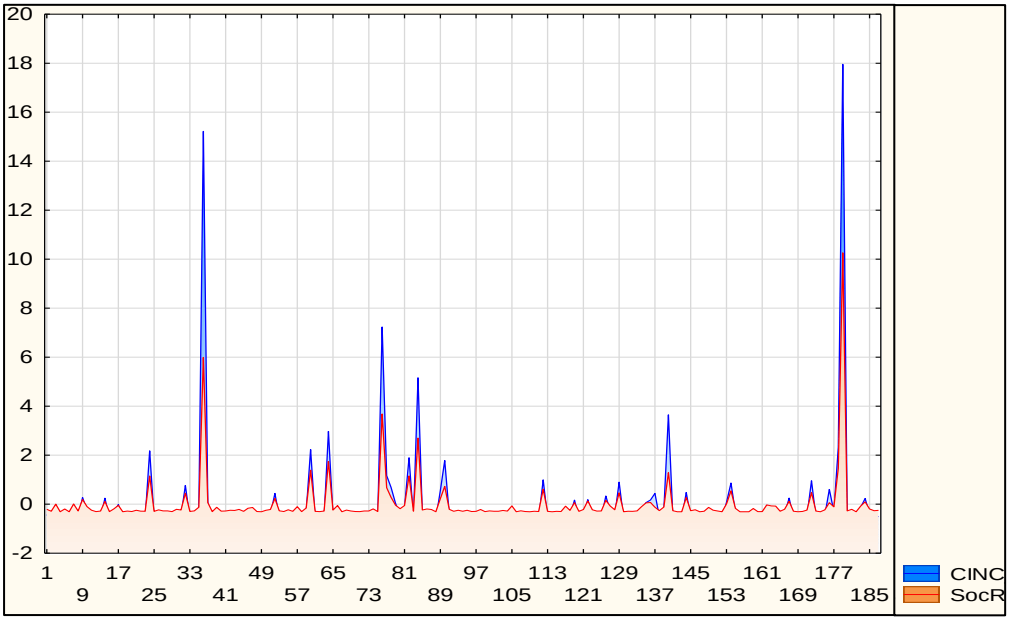
1993



1998



2003



Source: author.

When 187 nation states are placed, in the alphabetic order, on axis x of the plot and the standardized values of $SocR$ and CINC indices are marked on axis y of the plot it is evident that both indices reveal very similar capability distribution and same outliers – the most powerful states, and this coincidence is stable in time. However, these most powerful states receive a much higher score in CINC index, than in $SocR$ index. Consequently, $SocR$ index tends to blur the gap between the strongest states (outliers) and the world average.

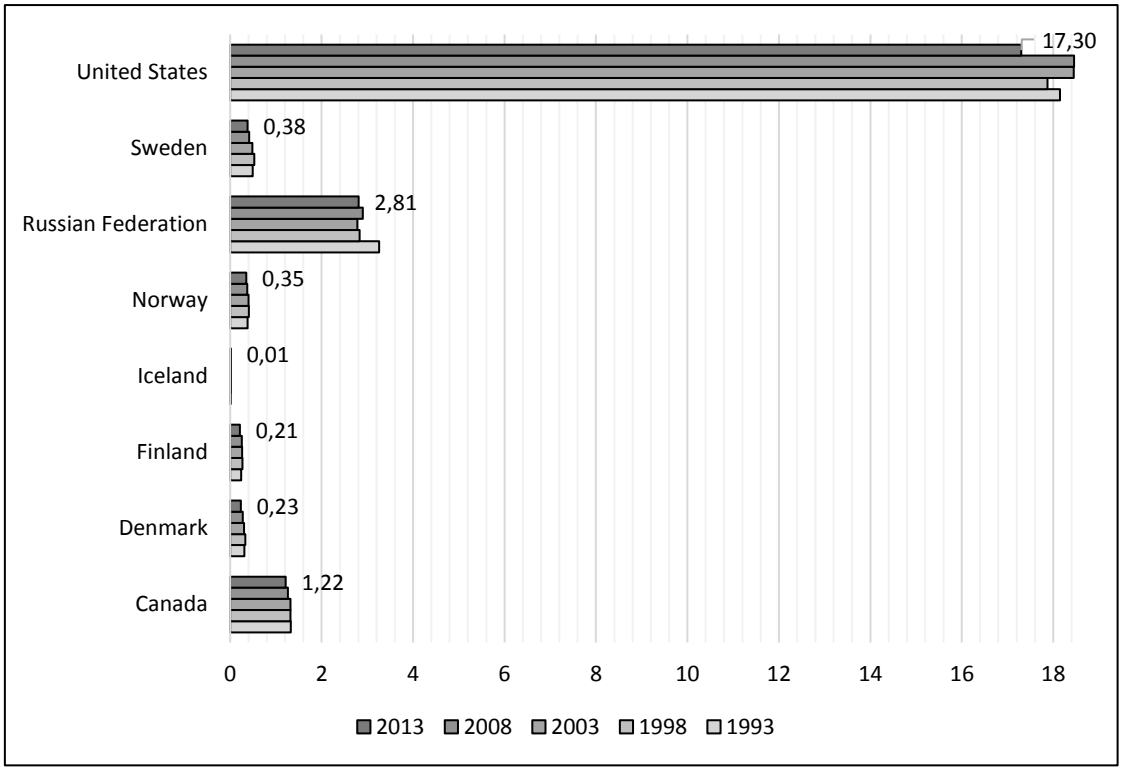
Despite the minor variation and slightly negative trend in the strength of association the correlations are still very high (not less than 0,881 in all studied cases[175]) hence the association between the two sets, $SocR$ and $CINC$, is strong. We conclude that the data is strongly consistent with the null hypothesis given $p >$0,999. The size of the difference relative to the variation in the sample data (difference represented in units of standard error) is minimal: $t <$0,001. Put another way, statistically, the evidence in support of the null hypothesis is great. That means that $SocR$ index effectively replicates the CINC index and we can now proceed to the calculation of the composite index of social and geographic state resources.

[175] Absolute versus relative assessment; Top-30 versus global sample; years: 1993, 1998, 2003.

3.2.2 Social power of the Arctic states

The modern Arctic is a place where two material worlds, subsistence world and globalized world, meet each other. The former tends to exhibit features of the least-developed economies, as it tends "…to become monocultures oriented toward the supply of raw materials to industries located elsewhere" (Young, 1992, p. 222). The latter penetrates the region from the south, mainly via resource extraction companies and military forces, their personnel and elements of infrastructure. As a result, all Arctic states now dispose with information systems sufficient to their needs, as "…all states have national broadcast, Internet, magazine, newspaper, and press agency capabilities" (Knell, 2008, p. 55). However, the Eurasian and North American parts of the Arctic tend to differ in the level of human development on both global and local (Arctic) level – see Figure 3-3 and Figure 3-4.

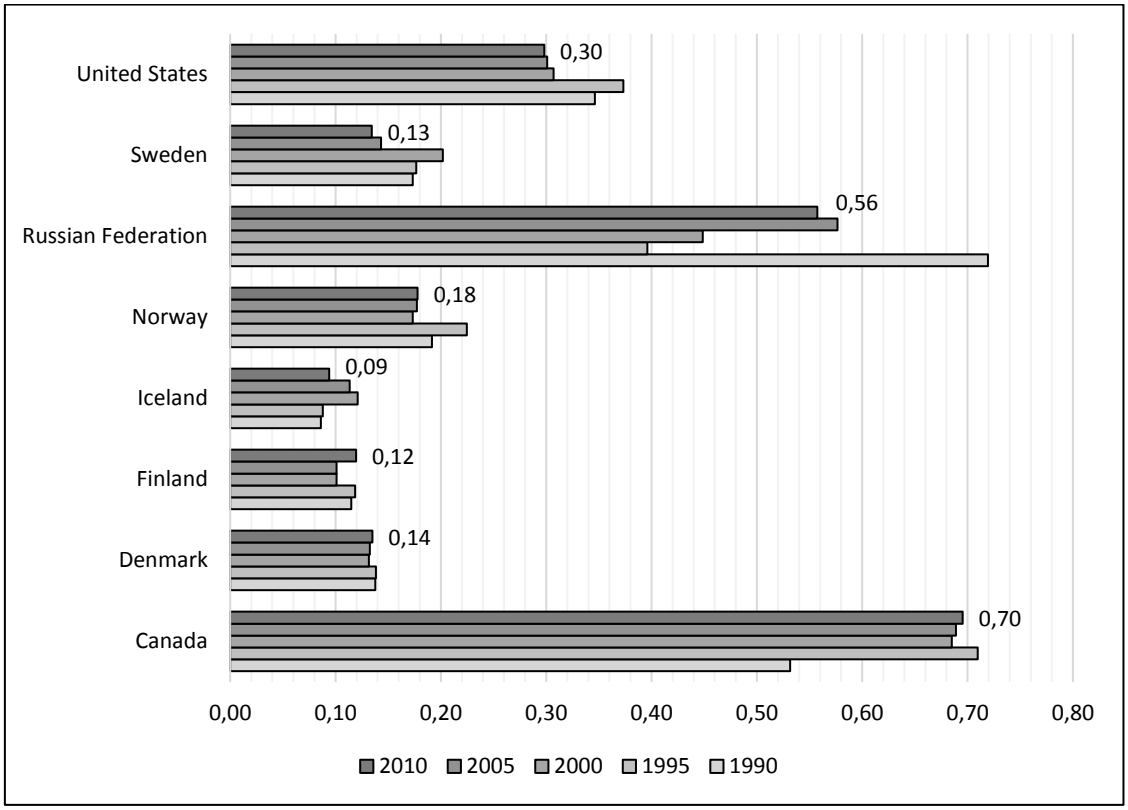
Figure 3-3. $SocR$ index, the Arctic states, 1993-2013, global perspective



Source: author.

Notwithstanding a minor variation in the studied variables[176] dictated by a differentiated availability of hard data, Figures 3-3 and 3-4 demonstrate a different endowment of the Arctic states with global and local (polar) social material resource. On the global level, the Arctic nations form three clusters. The first includes the most socially powerful states in the world with not less than 10 percent of the world total. This cluster is currently lead by the United States – as of 2013, 17,2 percent of aggregate demographic, economic and military resource originated in the United States. Although not the first in demographic terms (but third in total population, total urban population and number of active military personnel after China and India) the United States is the first country in gross product, total industrial output and annual military expenditure) not only among the Arctic nations, but also globally.

Figure 3-4. Social power of the Arctic states, 1990-2010, local perspective



Source: author.

[176] In the first case (global perspective, Figure 3-3), social material power of states comprises of total population, urban population, gross domestic product, industry as a share of gross product, annual military expenditure and total number of military personnel, as of 1993, 1998, 2003, 2008 and 2013. In the second case (local perspective, Figure 3-4), social material power of states comprises of total regional population, total regional indigenous population, gross regional product, share of agriculture/industry/services in the gross regional product, total number of military bases in the northernmost region, share of annual military expenditures (recalculated according to area in the Arctic), and the number of active membership links in the regional integration frameworks, as of 1990, 1995, 2000, 2005 and 2010.

Russia, the first initiator decision-maker in the Arctic sovereignty game, belongs, together with Canada, to the second cluster. Its aggregate demographic, economic and military resource reaches 2,8 percent of total social material power in the world. The latter derives from relatively high ranks in three sources of social power: as of 2013, it was 9th in total population, 7th in urban population, 14th in gross domestic product, 11th in industrial output, 5th in military personnel and 7th in military expenditure. Together with the remaining Arctic nations, Denmark, the other initiator decision-maker in the northernmost territorial dispute, is part of the third cluster – a (numerous) group of countries with aggregate social resource lower than one percent of total social resource in the world. Denmark's aggregate demographic, economic and military resource constitutes only 0,2 percent of total social material power in the world. The latter derives from relatively low ranks in all three sources of social power: in 2013, it was 108th in total population, 86th in urban population, 28th in gross domestic product, 37th in industrial output, 107th in military personnel and 39th in military expenditure. Consequently, while Russia is the most powerful in terms of demographic and military potential, but not in economic, it is exactly opposite for Denmark.

Although not part of the power index, the picture on the local, Arctic level is different. If the sample is again divided into clusters, the group with the highest local social resources (>50 percent) includes Russia and Canada[177] but not the United States.[178] Apart of two indicators of the state's economic strength, demographic and military resources were the highest in Russia in 2010.[179] All other Arctic states, including Denmark and the United States, dispose much lower social material resources and their resource constrains are therefore higher than that of Russia and Canada. Danish resources are limited in all components of social power: Greenland's GRP is fishing-oriented, with no extraction and/or production of energy resources, its population is the smallest in the region, and military presence is limited as well.

The difference in the Arctic states' social power on the global and on the local level is dictated by the specifics of human activity in the northernmost region. First and foremost, hydrocarbon and mineral resources, the main interests of profit-makers in nearly a half of

[177] Mainly due to the inclusion of Quebec province of Canada into research, Canadian GRP is almost twice bigger than the one of Russia.
[178] In comparison to the global resource constraint of the United States, Alaska's social resource constraint is five times higher.
[179] The share of production of natural resources in the gross regional product, population, regular armed forces and number of military bases.

the Arctic states, are subject to cyclic economic activity. As the profitability of Arctic extraction depends on global oil and natural gas markets, it therefore ceases to be profitable when oil prices per barrel drop below 100 USD (Knell, 2008, p. 32). Nevertheless, the 1989 prediction of Osherenko and Young on the nature of Arctic economy proves to be correct: "[t]hough the Arctic may never emerge as a great center of manufacturing industries, the region is destined to become a major source of raw materials of critical importance to advanced industrial societies both in the Arctic rim states and in other Northern Hemisphere states (1989, p. 45).

In comparison to other Arctic nations, Russia is "…the only Arctic state that has established a true northern economy" (Knell, 2008, p. 31) because, after discovering significant deposits of natural gas, oil, and minerals in the vast regions of Western and Eastern Siberia in late 1940s, the Soviet Union managed to construct and operationalize the Northern Sea Route (NSR) along all its Arctic coasts, from the Barents Sea to the Bering Strait. Either during the ice-free time of the year, or with help of icebreakers, NSR allows, among others, transport of raw materials (timber, minerals) to Arkhangelsk and Murmansk; and equipment and other supplies to northern parts of Central and Eastern Siberia. Currently, in terms of "…production, output, manpower, number of settlements, geographical scope of activity, and composition and range of activities, the Northern Sea Route and its adjacent land territories" are the most exploited areas in the whole of the Arctic" (Ostreng, 1999, p. 3). As of 2010, the fuel industry, including oil and gas extraction and mining, is the largest single industry in the Russian Arctic (53,2 percent of gross regional product), with more than 85 percent of Russian natural gas coming from a single province, Yamal-Nenets. Transportation of petroleum via pipelines generates an additional 7 percent of regional product. Besides, more than two percent of the world's coal extraction takes place in the Russian Arctic (Lindholt, 2006, p. 94). In contrast to the GDP, which grew by 7 percent, the absolute value of gross regional product demonstrates the decline by almost one percent since 1990 (WB, *WDI Database*, 2015).

The Greenlander economy, which constitutes less than one percent of Danish GDP in 2010 (*Statistics Denmark*, 2015), is based on fishing (with cold-water shrimps as the most important species[180]), which turns out to be the largest industry (18 percent of regional product), followed by education, health, and social work (16 percent). Although on-shore oil and gas extraction in Greenland is shrinking, it generates less than 0,1 percent of gross

[180] The export of shrimps alone accounts for about 50 percent of total export value.

regional product and is therefore considered to be zero. The absolute value of gross regional product increased by 16,3 percent since 1990 (WB, *WDI Database*, 2015).

As defined in Section 1.1.1, the Arctic is home to some 21 million inhabitants. Approximately one third of them lives in indigenous communities, while two thirds are newcomers (Ahlenius et al., 2010, p. 14). The Kalaallit Inuit constitute the majority among one hundred people living in Greenland, (*ArcticStat,* 2015). Thule is the largest settlement within the Arctic Circle. In absolute terms, Greenlander population grew by only two percent since 1990 (*ArcticStat,* 2015), while the overall population of Denmark increased by 7 percent (WB, *WDI Database*, 2015). In contrast, more than nine million people live in the Russian Arctic (6,8 percent of the total population in Russia), with indigenous northerners[181] forming less than 10 percent of it (*ArcticStat,* 2015). Murmansk, Severomorsk, Monchegorsk, Severodvinsk, Kandalaksha, Apatity, Vorkuta, Pechora, Salekhard, Novy Urengoi, Norilsk, Talnah, and Kajerkan are the main agglomerates of the Russian Arctic. In absolute terms, local population grew by 16 percent since 1990 (*ArcticStat*, 2015), in contrast to overall population decrease of 3 percent at the state level (WB, *WDI Database*, 2015).

Until relatively recently, conventional military forces (i.e. ground forces, coast guards) were of little use in the polar climate. As the Arctic states did not expect a sudden attack via the icy ocean[182], and physical survival of the indigenous inhabitants had been the only security concern for more than forty centuries,[183] the Arctic states maintained a minimum military alignment consisting of local soldiers with 'proper' equipment (skis and guns). The number of fully-functioning military installations built before 1900 constitutes less than one percent of their number in the 2000 (see Appendices F and G). The advancement of military technology in early years of the 20th century and the subsequent rise of nuclear technology allowed the Arctic states to develop the region's for air and maritime routes (starting with war supplies) and utilize its strategic location for operation their nuclear long-range ballistic missiles and submarines. A practical realization of its "…irreducible strategic significance" (Osherenko and Young, 1989, p. 17), the region's limited ground forces and coast guards gradually turned into complex defense systems consisting of regular air-, navy-, and land bases, training facilities, surveillance and control centers.

[181] Nenets, Komi, Mansi, Khanty, Selkups, Kets, Dolgans, Enets, Nganasans, Evenks, Yakuts, Yukagirs, Chukchi, Koryaks, Evens, and Siberian Yupik.
[182] Early maritime technologies did not allow the vessel to overcome the icy sea.
[183] The earliest inhabitants of North American Central and Eastern Arctic belonged to the 'Arctic Small Tool Tradition', which settled at Bristol Bay, Alaska, around 2500 B.C.

However, the active manpower, operating facilities, and military spending differs significantly among the Arctic actors.

Despite recent calls for greater autonomy of Greenland, Denmark is still fully responsible for the defense of the island. There are six military facilities on Greenland and they constitute 24 percent of total military facilities of the country (*Defense Command Denmark*, 2015), so does the manpower and local defense expenditure. Island Command Greenland maintains and enforces maritime sovereignty. The Coast Guard, which carries out search and rescue operations, is also under Danish command, though staffed largely by the local population. The Royal Danish Navy operates a Sirius Sledge Patrol in Daneborg. The United States Air Force's northernmost overseas possession, Thule Air Base, is also located on the eastern side of Greenland. As of 2010, the Danish Forces dispose with 26,5 thousand people and spend 4,8 billion USD on regional defense (IISS *The Military Balance 2010*, p. 126; SIPRI *Military Expenditure Dataset*, 2015).

Russia operates 41 regular military bases in its Arctic provinces (the highest number among all Arctic states), and they represent 29,1 percent of total military facilities in the country (*Ministry of Defense of the Russian Federation*, 2015), so does the manpower and local defense expenditure. The Russian military control over, and defense of, the region is realized primarily with ballistic missiles. By the end of 2010, 24 satellites of the Glonass system – an ambitious attempt to maintain sovereignty through satellite navigation – should come into full operation. The main function of the Russian Strategic Rocket Forces (SRF) is similar to that of the American USSTRATCOM: to defend Russia's territory from an attack, and attack an enemy's offensive nuclear weapons, military facilities, and infrastructure. Russian ground-based intercontinental and intermediate-range nuclear missiles can easily reach the coastal areas of North America via the Arctic Ocean. The Northern Fleet is another way of controlling the region: virtually all of Russia's largest naval bases are located within the Arctic Circle. The largest base is located on the Kola Peninsula, and support bases stretch from Murmansk to Archangelsk. Besides, the country relies on 13 nuclear-powered attack submarines. Although ground forces are extensive (and active) in other sub-regions of Russia, they do not serve as the primary means of maintaining military control in the Arctic, mainly due to the lack of infrastructure and the harsh climate. As of 2010, Russian Armed Forces dispose with approximately one million people and spend 72,9 billion USD on regional defense (IISS *The Military Balance 2010*, p. 222; SIPRI *Military Expenditure Dataset*, 2015).

3.2.3 Index stability analysis

To evaluate the stability of social material power of states cross-temporarily, we first perform a Chí-square testing to understand whether $SocR$ values are distributed normally. The results for 1993, 1998, 2003, 2008 and 2013 are presented in Appendix G. Despite the fact that central limit theorem in the probability theory suggests that the distribution of data tends to normality if the number of observed cases is sufficient (i.e. exceeds 100), $SocR$ values for 187 nation states do not follow normal (Gaussian) distribution – in all cases, Chí-square values are significantly greater than the critical values. Therefore, we use a non-parametric, Wilcoxon matched pairs test[184] together with a correlation analysis, on the absolute values of $SocR$ in 1993 and 2013 for 187 nation states.

First, with a population of N pairs of measurements in 1993 and 2013, we test the median of the difference for statistical significance using the following implementation of the test statistic W (the sum of the signed ranks):

$$\sum_{i=1}^{N_r}[sgn(x_{2,i} - x_{1,i}) \cdot R_i], \qquad [13]$$

where $x_{1,i}$ and $x_{2,i}$ are the matched pair measurements, N_r is the reduced sample size (exclusion of pairs with $|x_{2,i} - x_{1,i}| = 0$), sgn is the sign function, and R_i is the rank.

The following hypotheses have been constructed:

Null hypothesis (H_{1_0}):	**The cross-temporal variation in SocR index is statistically insignificant.**
Alternative hypothesis (H_{1_1}):	**The cross-temporal variation in SocR index is statistically significant.**

Second, we check the results using the Pearson product-moment correlation coefficient r_k:

$$r_k = \frac{n(\sum SocR_x SocR_y) - (\sum SocR_x)(\sum SocR_y)}{\sqrt{[n\sum SocR_x^2 - (\sum SocR_x)^2][n\sum SocR_y^2 - (\sum SocR_y)^2]}}, \qquad [14]$$

where x is 1993; y is 2013; n is the number of pairs of scores; $\sum SocR_x SocR_y$ is the sum of the products of paired index values for 1993 and 2013; $\sum SocR$ is the sum of $SocR$ values; $\sum SocR_x^2$ is the sum of squared $SocR$ values in 1993; $\sum SocR_y^2$ is the sum of

[184] Alternative to the paired Student's t-test when the data cannot be assumed to be normally distributed.

squared index values in 2013; $\sum SocR_x^2$ is the sum of squared $SocR$ values in 1993; and, finally, $\sum SocR_y^2$ is the sum of squared index values in 2013.

For the sample of 187 nation states, the median $SocR$ index fluctuation from 1993 to 2013 is not statistically significant:[185] p-value under the Wilcoxon matched pairs test equals 0,036258 (T=7237, Z=2,094 for N=187) hence, because 0,036 is greater than p=0,01, the null hypothesis cannot be rejected. At the same time, because for 187 states $r_{1993/2013}$ = 0,9437, even though the minor changes in the absolute social power ranks of the nation states have occurred between 1993 and 2013, these changes were mainly related to the non-Arctic countries (on the local level the situation is not different: $r_{1990/2010}$ = 0,9226 for the eight Arctic states). In other words, the endowment with social material power is stable in time and we consider the contemporary social situation in the region not deviating from the 2013 situation to such an extent that derivation of preferences in the ongoing territorial dispute would not be meaningful.

3.3 Composite Index of Socio-geographic Resources (SocGeoR)

3.3.1 The geographic effects of being the Arctic state

In this part of research, we evaluate the overall impact of geography on the social material power of the Arctic states. The geographic situation north of the Arctic Circle has been briefly introduced in Subsection 1.1.1. We now turn to the results of quantification of six parameters of physical geography within the Composite Index of Socio-geographic Resources ($SocGeoR$) – both non-Arctic and Arctic land- and EEZ area, compactness of state shape and average latitude. The data reflect the geographic strength of 187 states in the world – in Dussouy's words, "[a] space for the mixing of

[185] The median difference in $SocR$ values in 1993 and 1998 is not statistically significant under p=0,001: p-value under the Wilcoxon matched pairs test equals 0,005 (T=6713, Z=2,80 for N=187) hence, because 0,005 > 0,001, the null hypothesis is not rejected. This case represents probably the most significant median variation among all studied cases as null hypothesis holds true only is p=0,001. In terms of validity of null hypothesis, the situation is not different for 1998 – 2003 median index variation: p-value under the Wilcoxon matched pairs test equals 0,625 (T=8427, Z=0,488 for N=187), which is greater than the critical value of p=0,01. For the 2003-2008 case, p-value under the Wilcoxon matched pairs test equals 0,045 (T=7305, Z=2,002 for N=187), which is again greater than the critical value of p=0,01. Finally, the 2008-2013 variation is not statistically significant as well: p-value is 0,049 (T=7334, Z=1,963 for N=187), which is again greater than the critical value of p=0,01.

dimensional logics and for the fixation of structural positions" (Dussouy, 2010(a), p. 143) – which has been ignored in the majority of state power equations (see Table 2-2).

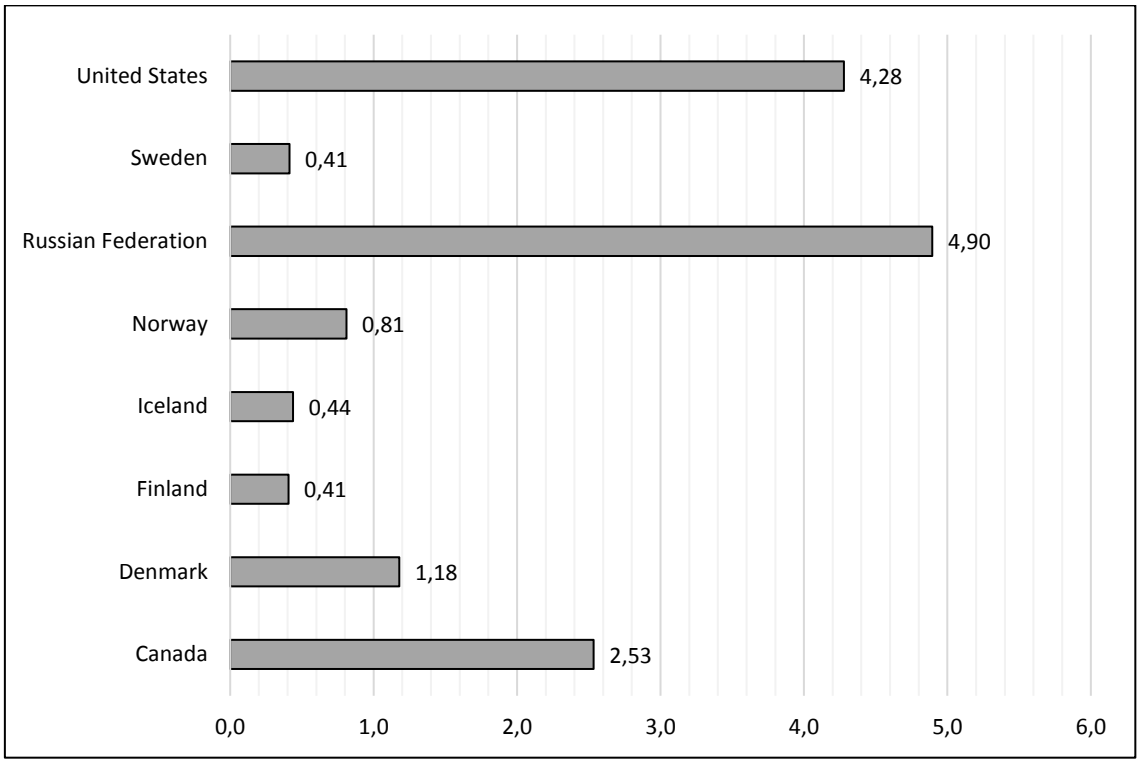
The Arctic physical space consists of two configurations, one originating on land, and the other one arising at sea. Similarly to the developments in the social material world, neither on the global nor on the local (polar) level of approximation geographic material capability is not equally distributed among the Arctic states. We first compare the Arctic states according to the aggregate physical resource consisting of four equally-weighted parameters (land area, EEZ, compactness, average latitude), and then divide two parameters, land area and EEZ, into four (Arctic land area, non-Arctic land area, Arctic EEZ and non-Arctic EEZ), to highlight the importance of being physically 'present' in the northernmost region given the fact that international legal resolution of the Arctic territorial dispute is based first and foremost on geographical proximity.[186] In result, six equally-weighted variables are considered in the geographic part of the $SocGeoR$ index. Despite a minor variation in the studied parameters[187] given by differentiated availability of data, Figure 3-5 and Figure 3-6 demonstrate the striking difference between the global and the local (Arctic) perspective.

On the global level, given the extraordinary size of the country, Russia ranks first among the Arctic states in the constant geographic strength, followed by the United States, Canada, Denmark, Norway, Iceland, Sweden and Finland. These results originate from the aggregation of total land area (Arctic and non-Arctic), total EEZ (Arctic and non-Arctic), state shape compactness and average latitude indicating a temperate climate at the country's midpoint. Although Russia's aggregate physical capability is mainly defined by land area, 16,377 million sq km (WDI Databank, 2016), which is almost twice bigger than area of Canada (9,093 million sq km) and even 7,5 times bigger than that of Denmark (including Greenland, 2,209 million sq km) and favorable average latitude in the country midpoint, this superiority is controlled by a rather low index of state shape compactness (equaling 0,07 since Russia is, in fact, a prolonged state), and 'only' the fourth place in the rating after the United States, France and Australia in total EEZ.

[186] Any state with unfavorable topography (i.e. no geographical proximity to the disputed area in the Central Arctic Ocean) cannot extend the outer limits of own continental shelf beyond 200nm from the national baselines (LOS Convention, 1982).

[187] In the first case (local perspective, Figure 3-6), physical material power of states comprises of total land area, total area of EEZ, index of state shape compactness and average latitude, constant between 1993 and 2013. In the second case (global perspective, Figure 3-5), physical material power of states comprises of total land area within the Arctic Circle, Arctic Ocean-related EEZ, average temperature in January and July and relative location, as of 1990, 1995, 2000, 2005 and 2010 (the variation is due to the varying average temperature) – data from Valko, 2016, pp. 176-180.

Figure 3-5. Aggregate physical power of the Arctic states, global, 1993/2013 (constant)



Source: author.

In contrast, Denmark, the second initiator decision-maker in the Arctic game, ranks eleventh in the global rating of the most geographically-capable states, lagging behind nine other nation states including two potential decision-makers in the northernmost dispute, the United States[188] and Canada.[189] Denmark enjoys high values of three out of four studied parameters (the 12th largest land area due to the inclusion of Greenland, the 15th biggest EEZ, and favorable average latitude at the country's mainland midpoint). These values effectively compensate the unfavorable shape of state territory (the index of compactness is only 0,0118) and the country turns out to be geographically 'stronger' than 177 nation states.

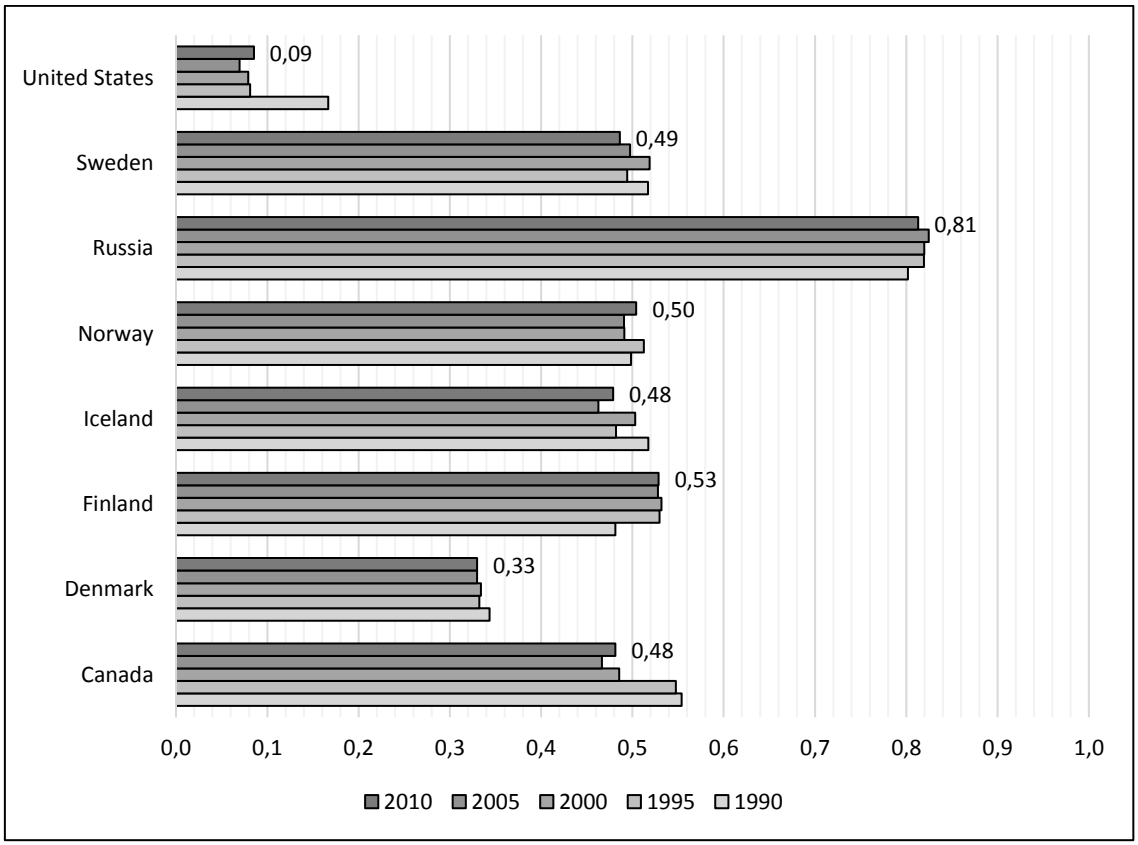
On the local, Arctic level, the picture is different (see Appendix H for data aggregation methodology). Russia is the most powerful state: in 2010, the aggregate power index reaches 0,81 – the highest value given the maximum possible value of 1. In sharp contrast,

[188] The United States rank second in social geographic power due to high values of two studied parameters (fourth largest land area, the biggest EEZ, and favorable average latitude at the country midpoint) together with moderate values of total land area (which is the fourth largest in the world) and lack of a favorable shape of state territory (the index of compactness is only 0,1383).

[189] Canada ranks fifth in the global geographic power due to relatively high values of three studied parameters (second largest land area, seventh largest EEZ, and favorable average latitude at the country midpoint) that beat the lack of a favorable shape of state territory (the index of compactness is only 0,0032).

the local geographic strength of the United States is the lowest: in 2010, its composite physical resource is 0,08 (i.e., less than 10 percent of the total). The local physical resource for the six remaining Arctic states in 20010 varies from 0,32 (Denmark) to 0,52 (Finland). In other words, while Russia's physical resource north of the Arctic Circle is, indisputably, the highest, the one of Denmark does not even reach 40 percent of the total.

Figure 3-6. Aggregate physical power of the Arctic states, local, 1990-2010



Source: data from Valko, 2016, p. 184.

The area of Greenland constitutes approximately 90 percent of total state land area of Denmark –2,1 million sq. km, 1,7 million sq. km of which is ice-covered (CIA *World Factbook*, 2015). The air distance between the state capital city, Copenhagen, and the North Pole is 1,5 thousand km greater than the mean distance from the Greenlandic capital/administrative centers to the North Pole, which is 2,3 thousand km (Time-and-Date *Distance Calculator*, 2015). In contrast to the Canadian North, winter on Greenland is relatively mild and summer is cool: the average temperature in January is -3,2°C, and in July it is +9,2°C. The difference in average temperature between Greenland and Denmark in general is not that sharp: the average surface temperature in January in

ten most populous cities is 4°C higher than on Greenland, while in July it is 4°C higher compared to average temperature on Greenland (*Weatherspark*, 2015).

Eight Russian Arctic provinces (Yamal-Nenets, Murmansk, Karelia, Komi, Arkhangelsk and Nenets, Chukchi, Krasnoyarsk, Sakha/Yakutia) account for 48,2 percent of total state land area – slightly more than 8,2 million sq. km (*Rosstat*, 2015). The air distance between the state capital city, Moscow, and the North Pole is only 700 km greater than the mean distance between the province capital/administrative centers and the North Pole, which is 3,8 thousand km (Time-and-Date *Distance Calculator*, 2015). The average temperature in January at 12 weather stations in all polar provinces is the third lowest among all Arctic states, -19,9°C, while in July it is +15,7°C. There exists some difference in average temperature between the Arctic provinces of Russia and Russia in general (the average surface temperature in January in ten most populous Russian cities is significantly higher in January, -10,5°C, while in July it is very similar to the Canadian local July temperature, +19,2°C (*Weatherspark*, 2015).

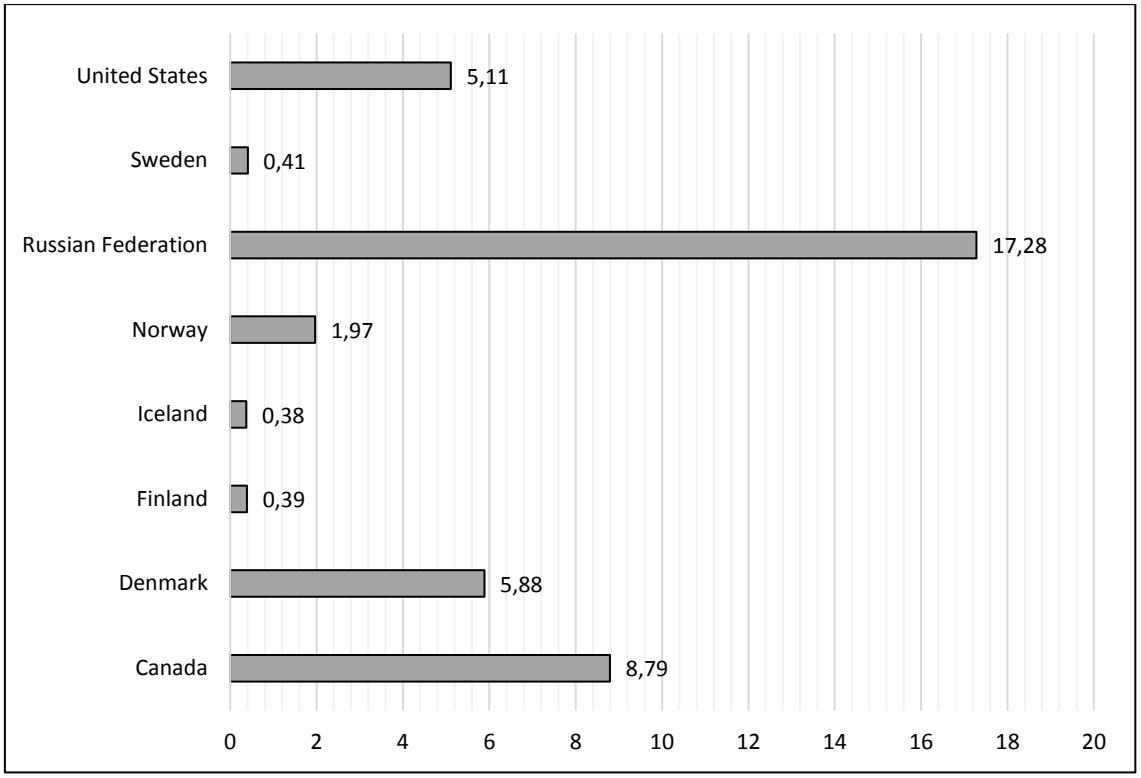
EEZ of Greenland spans over 2,2 million sq. km and it constitutes 84,6 percent of total EEZ area of Denmark (*Sea Around Us*, 2015). Out of 389 thousand sq. km of continental shelf area under jurisdiction of Denmark, almost 70 percent is contingent to the coastlines of Greenland, 2,2 million sq. km (Ibid.). The average sea temperature in January at 5 weather stations on Greenlandic coastlines is -1°C, and in July it is +2,8°C. The difference in average temperature between Greenland and Denmark in general is especially sharp in the summer: while the average sea temperature from 17 weather stations on all coasts of Denmark (Arctic and non-Arctic) is 4,4°C higher than in Greenlandic sea locations in January, while in July it is almost 15°C higher (*Sea Temperature*, 2015).

The area of Arctic-related EEZ of Russia is 4,5 million sq. km (the biggest in the whole region) and it constitutes approximately 56 percent of total EEZ area of Russia (*Sea Around Us*, 2015). Out of 4 million sq. km of continental shelf area under jurisdiction of Russia, more than 87 percent of it is generated by the Arctic provinces, namely 3,5 million sq. km – also the biggest area observed in the Arctic (Ibid.). The average sea temperature in January at 10 weather stations on Russian Arctic coastlines is -0,2°C, and in July it is +6,8°C. The difference in average temperature between the Arctic provinces and Russia in general is not that evident: the average sea temperature on all sea coasts of Russia (Arctic and non-Arctic) detected on 25 weather

stations is less than 2°C higher than in Arctic-only sea locations in January, while in July it is 7,5°C higher (*Sea Temperature*, 2015).

In the SocGeoR index, differentiation of land- and EEZ area into Arctic and non-Arctic based on the definition of the northernmost region in Subsection 1.1.1 allows us approximating the otherwise universal state power index to the Arctic sovereignty dispute. Figure 3-7 demonstrates the global geographic situation when the Arctic area as introduced into the model (the non-Arctic states receive zero values for two out of six studied parameters, the total Arctic land area and Arctic Ocean-related EEZ).

Figure 3-7. $GeoR$ index (emphasis on the Arctic), global, 1993/2013



Source: author.

Adding value to the sovereign rights of the Arctic states over land and sea areas north of the Arctic Circle makes no difference in the relative superiority of Russia in its physical strength – the value of $GeoR_{RUS}$ is 17,28 (which is a maximum value). Given the size of the Russian Arctic land (approximately 8,3 million sq. km, or 45 percent of the total land area in the region) and Arctic Ocean-related EEZ (4,5 million sq. km, or 30,7 percent of total Arctic EEZ), Russia ranks first among the Arctic states in the constant geographic

strength, followed by Canada[190] ($GeoR_{CAN}$ = 8,79) and Denmark ($GeoR_{DNK}$ is 5,88). Mainly due to the size of Greenland and the volume of EEZ generated by its coastlines, Denmark, the second initiator decision-maker in the Arctic game, now ranks third instead of eleventh (hence adding two Arctic-related variables gives Denmark 11-3=7 additional positions, and leaving behind such a powerful Arctic state as the United States[191] with $GeoR_{USA}$ of 5,11) in the global ranking of the most geographically-capable states. The aggregate land area in the Arctic belonging to Denmark equals 2,1 million sq. km (11,7 percent of the total land in the Arctic) and its EEZ in the Arctic Ocean is almost 2,8 million sq. km (24,5 percent of total EEZ in the Arctic Ocean).

In sum, two additional, Arctic-related indicators, Arctic land and Arctic EEZ, change the global configuration of the material geographic power of states. While the non-Arctic states automatically receive zero in both cases (i.e. the total value of their GeoR indices may not be higher than 4 while 6 is the maximum), the Arctic states do enjoy these two additional parameters. While in some cases (Denmark and Canada) the relative position of state was improved by this change, other states either retain the position (Russia) or even worsen (the United States).

3.3.2 Socio-geographic power of the Arctic states

After considering, separately, the social and the geographic components of the aggregate state power index we turn to their integration. The indices of socio-geographic material power of the Arctic states are shown in Figure 3-8. For a complete list of results for 187 countries see the Appendix F (electronic).

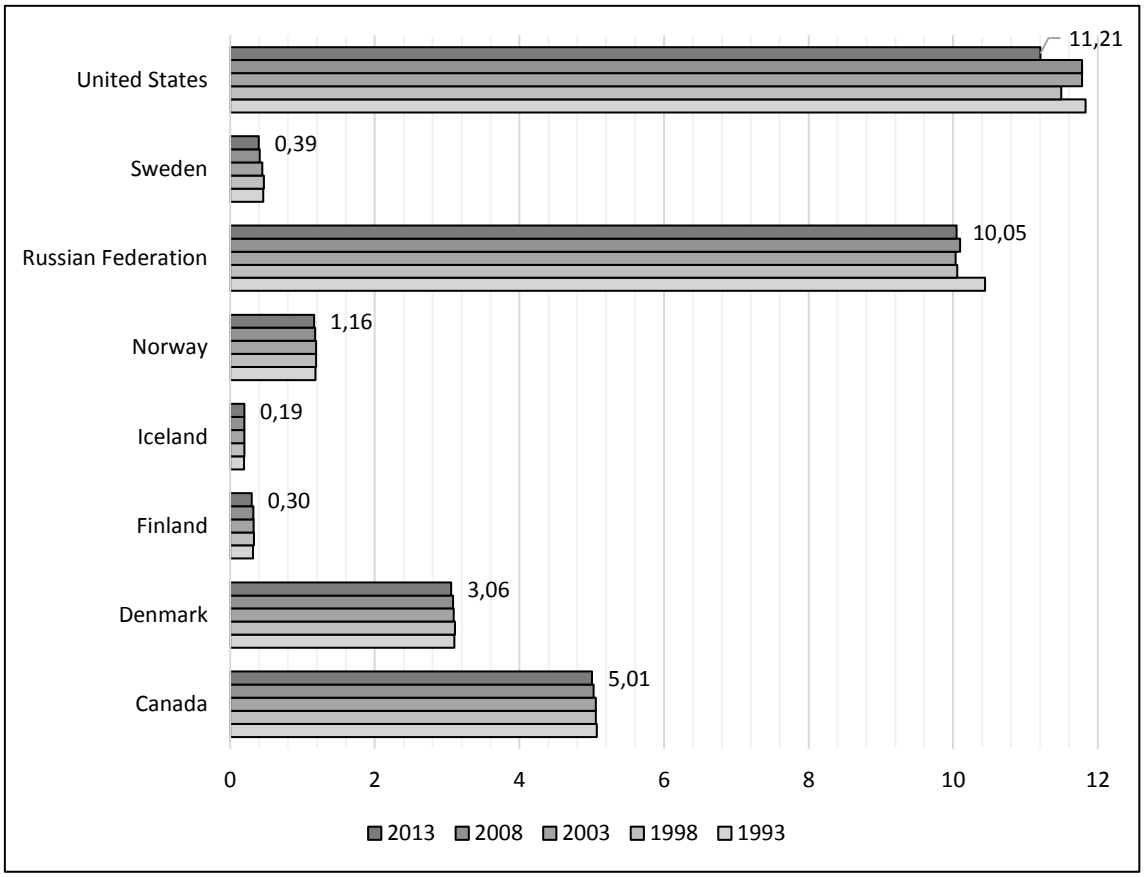
As of 2013, $SocGEoR_{RUS}$ is 10,05. This value makes Russia the second most powerful state among the Arctic-Eight states and also among the 187 nation states. In both cases the only country that is more socio-geographically powerful is the United States ($SocGEoR_{USA}$ is 11,21 – the maximum value for 2013). In contrast, Denmark, another initiator decision-maker in the Arctic sovereignty game, disposes with a modest socio-geographic material strength (in 2013, $SocGEoR_{DNK}$ = 3,06). This value implies the

[190] The area of Canada's land in the Arctic equals 5,8 million sq. km (31,8 percent of the total land in the Arctic) and its EEZ in the Arctic Ocean is 1,6 million sq. km (14 percent of total EEZ in the Arctic Ocean). Adding Arctic-related variables improves the position of Canada (initially being the fifth geographically most powerful state to just second).

[191] The area of the United States' land in the Arctic equals 1,5 million sq. km (8,3 percent of the total land in the Arctic) and its EEZ in the Arctic Ocean is 0,5 million sq. km (4,4 percent of total EEZ in the Arctic Ocean). Adding Arctic-related variables slightly disimproves the position of the United States (finitially being second geographically most powerful state and now becoming the fourth).

fourth most powerful position among the Arctic states (after the United States, Russia and Canada) and the sixth position in the 187 nation states power rating (after the United States, Russia, China, Canada and India).

Figure 3-8. SocGeoR index, global, the Arctic states, 1993-2013



Source: author.

Table 3-2 demonstrates the absolute and relative geographic effect on the social material power of the Arctic states between 1993 and 2013. In the first case, we consider the numerical change in the final index as implied by an introduction of the geographic component. In the second case, we compare the position of each state in the social power rating and socio-geographic power rating. Positive values indicate the positive effect of geography (i.e. a state's position has strengthened), negative values reflect the negative effect of geography (i.e. a state's position has weakened), and zero change means the geography has no effect (i.e. a state's position has not changed). It is possible that the absolute change is positive, while the relative change is negative, and vice versa. This happens when, in absolute terms, the country becomes more powerful, but other states

simultaneously became even more powerful – a situation in which any absolute gain is effectively cancelled.

Table 3-2. Geographic effect on social material power, the Arctic states, 1993-2013

STATE	1993		1998		2003		2008		2013	
	Absolute	Relative	Absolute	Relative	Absolute	Relative	Absolute	Relative	Absolute	Relative
CAN	3,7260	+12	3,7391	+12	3,7393	+13	3,7665	+13	3,7890	+13
DNK	2,7830	+44	2,7770	+46	2,7919	+50	2,8035	+50	2,8265	+54
FIN	0,0715	0	0,0598	+3	0,0632	+5	0,0673	+6	0,0885	+9
ISL	0,1817	+77	0,1809	+72	0,1812	+75	0,1804	+74	0,1812	+73
NOR	0,7926	+30	0,7814	+28	0,7828	+27	0,7974	+32	0,8098	+33
RUS	6,8457	+4	7,2279	+6	7,2519	+6	7,1907	+4	7,2383	+4
SWE	-0,0515	+1	-0,0591	+2	-0,0395	0	-0,0036	+3	0,0125	+2
USA	-6,7192	0	-6,3808	0	-6,6686	0	-6,6698	0	-6,0929	0

Source: author.

Between 1993 and 2013, Russia has been gaining power due to geography, in both absolute and relative terms. In 1993, it was sixth in terms of social material power but, due to the first place in the global geographic rating, its overall position was second among the Arctic states and among the 187 nation states. In 1998-2003, being eighth in social power it was still second when the geographic power as taken into consideration. In 2008-2013 the country returned to the 1993 power position (sixth in social material power and second in socio-geographic power among both the Arctic states and the 187 nation states).

The geography-implied changes in the state power index of Denmark is somewhat more dramatic. In 1993, it was 51st in terms of social material power but, due to the third place in the global geographic rating, its overall position was seventh among the Arctic states and fourth among the 187 nation states. In 1998, being 53rd in social power it was still seventh when the geographic power as taken into consideration (and still fourth among the Arctic states). In 2003 and 2008, it was 56th in global social material rating and the favorable geography made it be the sixth among the 187 nation states. Finally, in 2013 the country was even less powerful in social dimension (the 60th in the global rating) but geography still made it be the sixth most powerful state.

In sum, without geography (due to the existence of Greenland), Denmark has no significant power that would be compatible with the strength experienced by the most powerful states in the world. The same cannot be said about Russia: even without favorable geography the country has been continuously belonging to the Top-10 countries of the world in terms of socio-geographic material strength. We now turn to the cross-temporal analysis of the SocGeoR index stability.

3.3.3 Index stability analysis

Similarly to the $SocR$ case, the results of the Chí-square testing for 1993, 1998, 2003, 2008 and 2013 indicate that $SocGeoR$ values for 187 nation states do not follow normal (Gaussian) distribution – in all cases, Chí-square values are significantly greater than the critical values (see Appendix G). Consequently, to evaluate the stability of socio-geographic material power of states cross-temporarily, we perform two kinds of statistical analysis, the non-parametric Wilcoxon matched pairs testing for the median difference and the correlation analysis, on the absolute values of $SocGeoR$ in 1993 and 2013 for 187 nation states. First, we perform the Wilcoxon matched pairs testing using equation [13] to determine if cross-temporal $SocGeoR$ index variation is statistically significant. The following hypotheses have been constructed:

Null hypothesis (H_{2_0}):	**The cross-temporal variation in SocGeoR index is not statistically significant.**
Alternative hypothesis (H_{2_1}):	**The cross-temporal variation in SocGeoR index is statistically significant.**

First, for the global sample of 187 nation states, the median $SocGeoR$ index fluctuation from 1993 to 2013 is not statistically significant:[192] p-value under the Wilcoxon matched pairs testing equals 0,036 (T=7237, Z=2,094 for N=187) hence, because 0,036 > 0,01, the

[192] The median difference in $SocR$ values in 1993 and 1998 is not statistically significant under p=0,001: p-value under the Wilcoxon matched pairs test equals 0,005 (T=6713, Z=2,80 for N=187) hence, because 0,005 > 0,001, the null hypothesis is not rejected. This case represents probably the most significant median variation among all studied cases as null hypothesis holds true only is p=0,001. In terms of validity of null hypothesis, the situation is not different for 1998–2003 median index variation: p-value under the Wilcoxon matched pairs test equals 0,625 (T=8427, Z=0,488 for N=187), which is greater than the critical value of p=0,01. For the 2003-2008 case, p-value under the Wilcoxon matched pairs test equals 0,045 (T=7305, Z=2,002 for N=187), which is again greater than the critical value of p=0,01. Finally, the 2008-2013 variation is not statistically significant as well: p-value is 0,049 (T=7334, Z=1,963 for N=187), which is again greater than the critical value of p=0,01.

null hypothesis cannot be rejected. Second, we search for the Pearson product-moment correlation coefficient r_m:

$$r_m = \frac{n(\sum SocGeoR_x SocGeoR_y) - (\sum SocGeoR_x)(\sum SocGeoR_y)}{\sqrt{[n\sum SocGeoR_x^2 - (\sum SocGeoR_x)^2][n\sum SocGeoR_y^2 - (\sum SocGeoR_y)^2]}}, \quad [15]$$

where x is 1993; y is 2013; n is the number of pairs of scores; $\sum SocGeoR_x SocGeoR_y$ is the sum of the products of paired index values for 1993 and 2013; $\sum SocGeoR$ is the sum of $SocGeoR$ values; $\sum SocGeoR_x^2$ is the sum of squared $SocGeoR$ values in 1993; $\sum SocGeoR_y^2$ is the sum of squared index values in 2013; $\sum SocGeoR_x^2$ is the sum of squared $SocGeoR$ values in 1993; and, finally, $\sum SocGeoR_y^2$ is the sum of squared index values in 2013.

Because in neither case the observed p-value overcomes the critical p-value, the null hypothesis remains valid: the cross-temporal median variation in $SocGeoR$ index is statistically insignificant. The results of the correlation analysis confirm these findings: the cross-temporal variation in social material power ranking is minimal: for 187 states $r_{1993/2013}$ = 0,9883 (and for eight Arctic states $r_{1993/2013}$ = 0,9998). Even though the minor changes in the absolute social power ranks of the nation states have occurred between 1993 and 2013, this variation mainly relates to the non-Arctic countries (quite similarly to cross-temporal variation of the $SocR$ index). In other words, the endowment with socio-geographic material power is stable in time and we consider the contemporary social situation in the region not deviating from the 2013 situation to such an extent that derivation of preferences in the ongoing territorial dispute would not be possible.

3.4 Symbolic power in the Arctic game

The modern Arctic is a place where the material and symbolic worlds of the Arctic states meet each other. Although not part of the $SocGeoR$ index, the symbolic power of the Arctic game decision-makers does influence, indirectly, the process of preference formation[193] and is therefore worth of mentioning. The symbolic affiliation of the Arctic actors with the northernmost region is defined by a simultaneous interplay of two groups

[193] The favorable symbolic affiliation with the game option intensifies the preference over this option. In other words, in a situation when two options promise the same payoff, a player would prefer an option with a higher symbolic value, all other conditions being equal. At the same time, a player endowed with a strong symbolic power risks being less instrumentally-rational in 'putting business before pleasure' in the decision making than a player with no such symbolic potential. This issue is further considered in Chapter 5.

of parameters, strength of historical connection to the Arctic, and the wider context of economic, military and territorial situation of each Arctic state. At this stage we do not differentiate between local and global perspectives due to a non-existence of trustworthy data for the development on the local level.

We consider the following individual indicators: (1) Arctic state's area of national sector (pre-UNCLOS division of the Arctic Ocean); (2) total number of claimed areas (on land and at sea) by each Arctic state; (3) attitude to conflict – number of times each Arctic state participated in international militarized conflicts between 1990 and 2010; (4) effective autarky; (5) Human Development Index (HDI) as a summary measure of human development; (6) number of active international United Nations peacekeeping missions where each Arctic state deploys troops or has military observers in 2010; (7) number of active international non-UN peacekeeping missions where each Arctic state deploys troops or has military observers in 2010; and (8) the strength of historical affiliation of each Arctic actor to the polar landmass and waters – the number of years since the official establishment of sovereignty in the Arctic region until 2010 – see Table 3-3 (data gathering methodology is in Appendix H).

Similarly to the Canadian case, when the Arctic is an integral part of national symbolic sentiment,[194] the historical affiliation of Denmark with Greenland is based on both the existence of national sector in the region of approximately 3 million sq. km that is 353,2 thou. sq. km less than total Danish EEZ including Greenland (Bartsits, 2000, p. 1) and establishment of own sovereign rights over it which dates back to the Treaty of Kiel (1814) that granted Denmark control over the Faroes, Iceland and Greenland (Hough, 2013, p. 9). However, in contrast to Canada, the rate of economic self-sufficiency

[194] Historically, Canada is 'equipped' with both the Arctic sector, which accounts for 4,3 million sq. km, that is more than twice larger than the area of state's Arctic-only EEZ and 1.5 times greater than the total state EEZ (Bartsits, 2000, p. 1); and more than a century of sovereign rights in the region – in 1892 Canada acquired full sovereignty from the United Kingdom, so the British claim over the Canadian Arctic archipelago and northern mainland turned into the Canadian claim (Hough, 2013, p. 9). At the same time, the rate of economic self-sufficiency (autarky) in 2010 is the third highest among all Arctic states. In practice, it means that 70 percent of Canada's GDP is generated without foreign trade (WB, *WDI Database*, 2015/2016). The generalized quality of life in Canada, measured by 2010 Human Development Index (HDI), is the highest in the region (UNDP, *Human Development Report*, 2010, p. 143). In terms of military symbolism, Canada is the third most active Arctic-8 state in asserting own foreign policy goals by military means of coercion: between 1990 and 2010, she participated in international militarized conflict 17 times (Correlates of War, *MIDB_4.01*, 2015), while the number of active peacekeeping missions under the aegis of the United Nations outweighs the number of non-UN missions (IISS, *The Military Balance 2010*, pp. 442-447; 448-452). Finally, in 2010 Canada had 7 active territorial claims, all occurring at its borders: Dixon Entrance, Beaufort Sea, Strait of Juan de Fuca, Gulf of Maine (Machias Seal Island and North Rock), Northwest Passage and Hans Island (CIA *Country Report*, 2015).

(autarky) in Denmark in 2010 is the lowest among four Arctic actors: 'only' 53,4 percent of GDP is generated without trade with other countries (*WDI Database*, 2015).

Table 3-3. Arctic states' symbolic resources, 2010

Arctic state	Arctic Sector	Active claims	Att_ conflict	Autarky	Life_ Quality	Deployments abroad		History
						UN	Non-UN	
	Million sq. km	Number	Particip.in int. conflicts 1990-2010	Percent of GDP	HDI 2010	Number of active missions	Number of active missions	Age of Arctic sovere-ignty in years
CAN	4,3	7	17	70	0,9	6	5	118
DNK	3	2	8	53,4	0,8	8	4	196
FIN	0	0	3	62	0,9	5	7	66
ISL	0	1	2	51,7	0,8	0	1	93
NOR	2,7	1	10	65,5	0,9	6	5	90
RUS	9,3	6	60	74,9	0,7	8	5	84
SWE	0	0	3	56,6	0,8	3	7	105
USA	1,7	8	73	85,9	0,9	5	14	143

Source: author.

The generalized quality of life in Denmark, measured by 2010 HDI, is one of the highest in the region (UNDP, *Human Development Report*, 2010, p. 143). In military terms, Denmark is the least active Arctic actor of the polar sovereignty game: between 1990 and 2010, she participated in two international militarized conflicts 17 times (Correlates of War, *MIDB_4.01*, 2015), while the number of active peacekeeping missions under the aegis of the United Nations outweighs the number of non-UN missions (IISS, *The Military Balance 2010*, pp. 442-447; 448-452). Finally, in 2010 Denmark had two active territorial claims, all occurring at its borders: Hans Island and the continental shelf of the Faroe Islands (CIA *Country Report*, 2015).

In contrast to the United States that are less historically affiliated with the Arctic,[195] Russia's symbolic resources in the region are, probably, the most significant. On the one

[195] According to the Sector theory, the United States's Arctic sector consists of 1,7 million sq. km, that is 6,64 times less than total state EEZ but 3,4 times more than Alaska-related EEZ (Bartsits, 2000, p. 1) and establishment of own sovereign rights over Alaska in 1867, when the latter was purchased from Russian Empire (Hough, 2013, p. 9). In comparison to all other Arctic states, the rate of economic self-sufficiency (autarky) of the United States in 2010 is the highest among four Arctic actors: as much as 85,9 percent of GDP is generated without foreign trade (*WDI Database*, 2015). The generalized quality of life in the United States, measured by 2010 HDI, is the highest in the region (UNDP, *Human Development Report*, 2010, p. 143). In military terms, the United States is the most active Arctic actor of the polar sovereignty game reaching own foreign policy goals by military means of power: between 1990 and 2010, they participated in a international militarized conflict 73 times (Correlates of War, *MIDB_4.01*, 2015), while the number of active peacekeeping missions under the aegis of the United Nations was smaller than the number of non-UN missions (IISS, *The Military Balance 2010*, pp. 442-447; 448-452). Finally, in 2010 United States had

hand, the country's Arctic sector significantly exceeds the sectors of other Arctic states: it is as big as 9,3 million sq. km – twice greater than the total area of Russia's Arctic-based EEZ (Bartsits, 2000, p. 1) and officially annexing all lands lying between the eastern and western extremities of own mainland and the North Pole in the USSR Decree of 1926 (Hough, 2013, p. 12). The rate of economic self-sufficiency (autarky) in Russia in 2010 is the second highest in the region: 74,9 percent of GDP is generated without the foreign trade (*WDI Database*, 2015). However, the quality of life in Russia, measured by 2010 HDI, is the lowest not only among the four Arctic actors, but also in the whole northernmost region (UNDP, *Human Development Report*, 2010, p. 144). On the other hand, Russia is the second most active Arctic actor of the polar sovereignty game asserting own foreign policy goals by military means: between 1990 and 2010, she participated in two international militarized conflicts 60 times (Correlates of War, *MIDB_4.01*, 2015), while the number of active peacekeeping missions under the aegis of the United Nations outweighed the number of non-UN missions (IISS, *The Military Balance 2010*, pp. 442-447; 448-452). Finally, in 2010 Russia had 6 active territorial claims, all occurring at its borders: Malozhemchuzny Island, Azov Sea, Strait of Kerch, Tuzla Island, Sarych and Aibga and surrounding area (CIA *Country Report*, 2015).

Figure 3-9 demonstrates the results of calculation of the Arctic states' aggregate index of symbolic resource SR_i with $i = 1,\ldots,m$, is a non-weighted sum of eight social symbolic resource indices $Ssn_{i,j}$, $i = 1,\ldots,m$; $j = 1,\ldots,n$, each standardized according to [4]. Index SR_i varies from zero to 8. When $SocRi \rightarrow 0$, sub-indices $In_{i,j} = 1, \ldots, n \rightarrow 0$, i.e. the studied parameters have the lowest values. In contrast, when $ocRi \rightarrow 8$, all sub-indices $In_{i,j} = 1, \ldots, n \rightarrow 8$, i.e. all indicators have the highest values.

Similarly to Canada[196] and the United States,[197] Russia is strongly endowed with social symbolic resource – its aggregate symbolic power index SR_{RUS} equals 4,69 due to the biggest national sector in the northernmost ocean, second biggest in the number of participation in military conflict and more than 70 percent of GDP generated without foreign trade and, simultaneously, the lowest quality of life in the region. Russia's

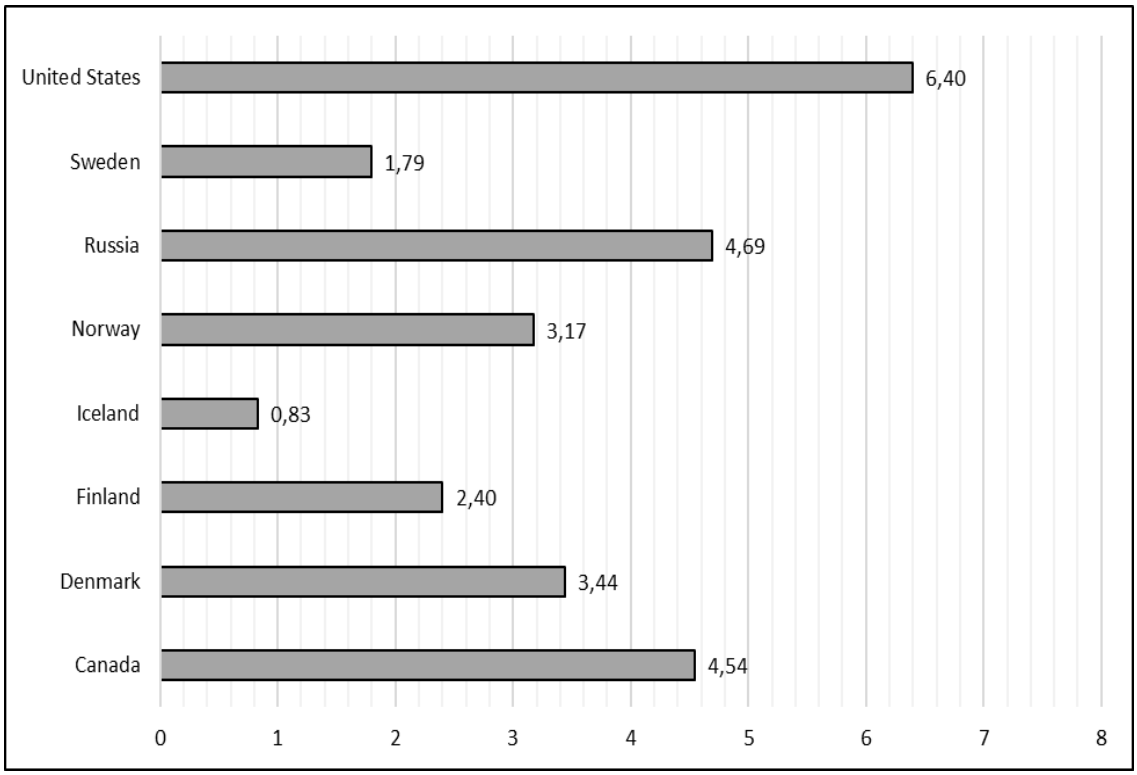
more active territorial claims than all other Arctic states: Dixon Entrance, the Beaufort Sea, the Strait of Juan de Fuca, Machias Seal Island, North Rock, the Northwest Passage, Bajo Nuevo Bank and the maritime boundary with Bahamas (CIA *Country Report*, 2015).

[196] Canada enjoys the second largest share of the Arctic Ocean according to the Sector theory, she is relatively active in participation in international militarized conflicts, and her level of autarky is third highest in the region.

[197] The United States are an absolute leader with 5 resource parameters out of 8 having the maximum value of 1 (these two being the number of active international UN peacekeeping missions deploying troops / having military observers, and the strength of historical affiliation).

symbolic resource is slightly higher than the one of Canada (SR_{CAN} = 4,54) but still approximately 1,3 smaller than the one of the United States (SR_{USA} = 6,40).

Figure 3-9. Index of the aggregate symbolic power, the Arctic states, 2010



Source: author.

Denmark, the second initiator decision-maker in the Arctic game, belongs to another group of the Arctic states with the index values not reaching value 4 (i.e. 50 percent of the total maximum symbolic resource): SR_{DNK} = 3,44. Even though the quality of life in Denmark is the highest in the region, the symbolic capability is lowered by modest number of active territorial claims (only 2, while Russia has 6); less frequent participation in international militarized conflicts (again, just 8 occasions, in contrast to 60 for Russia); and a much lower level of autarky (53,4 percent of GDP generated without foreign trade, versus 74,9 in case of Russia).

3.5 Manipulation of Arctic EEZ and game preferences

After obtaining the values of $SocGeoR$ index and differentiating the Arctic decision-makers according to their endowment with the long-term aggregate strategic material

resources in both absolute and relative terms, we turn to manipulation of Arctic EEZ variable to understand changes such manipulation can bring to this state power index. These specific changes are then used to derive the individual payoffs in the Arctic game for all studied options except the one reflecting the status quo (Options I-VIII on Figure 1-5).

For an unknown reason, neither the Danish nor the Russian actual submission to the CLCS states the exact area in sq. km generated by the respective sets of submitted coordinates. This missing information sometimes appears in mass media outputs,[198] the numbers are never properly cited. However, this data is required to operationalize the decision-makers' payoffs in the case of 'Full annexation' by either one of the initiator decision-makers in Options III, VI, VII, VIII, or by both Denmark and Russia in Option IX (see Figure 1-5).

In addition, the exact area implied by the 350-nm extension of the Danish and Russian outer limits of the continental shelf is not even considered in the official submissions to the CLCS, and no sets of delimiting coordinates are available, probably because the officials in both countries do not view such an extension as a deserved compromise solution to the ongoing Arctic dispute. However, without this data it is not physically possible to operationalize the decision-makers' payoffs in the case of 'Compromise' by either one of the decision-makers in Options II, IV, VI, VIII, or by both Denmark and Russia in Option V (see Figure 1-5).

In order to save the research from an integral, wrong data-implied measurement distortions from either unjustified data from mass media (when the delimiting coordinates, but not official data on area and measurement, is available), or from missing data, and to increase the reliability of resulting calculations, the author decided to outsource the geographic measurement from Petr Kohoutek from A.D.R. GIS-SERVICE Co. (Kohoutek, 2016). After defining the legal borders of the ocean areas, ArcGIS software was used by Petr Kohoutek to process (i.e. generate and visualize) the layers

[198] Compare, for example, *National Geographic News*, "Russia's Arctic Claim Backed By Rocks, Officials Say", 2007 (http://www.businessinsider.com/russia-to-un-we-are-claiming-463000-square-miles-of-the-arctic-2015-8), *Business Insider*, "Russia to UN: We are claiming 463,000 square miles of the Arctic" (http://news.nationalgeographic.com/news/2007/09/070921-arctic-russia.html) and *High North News*, "Russia's Arctic Claim Backed By Rocks, Officials Say", 2016 (http://www.highnorthnews.com/russia-presents-1-2-million-square-kilometers-arctic-claim-to-the-un/) – in neither case the specific area values are properly cited, measurement procedures are explained (including the inevitable calculation distortions), and therefore cannot be used in rigorous research.

representing the desired polygons.[199] Because the analysis inputs are presented in geographic coordinates, they had to be converted into the rectangular system of coordinates that is maximally suitable for the calculation of area. The Lambert azimuthal equal-area (LAEA) projection has been chosen since this version of mapping from a sphere to a disk does not produce a distortion of area.[200]

Given the differentiation in the availability of the initial data, two distinct methods of calculation were used to reveal the claimed areas in sq. km. First, the area was derived from the 350 nm distance from the national baselines – as an area limited by two lines distanced 200 nm and 350 nm from the baselines.[201] In this case the layer of international borders is first transformed from the system of geographic coordinates into the Lambert azimuthal equal-area coordinate reference system, then two buffer layers of the area content (200 nm and 350 nm from the baselines) are created, and the difference between these two layers – area limited by 200 nm and 350 nm lines – is used from calculation of area of the desired polygons. These areas of Denmark and Russia are visualized in Figure 3-10.

Second, the desired area was enumerated from the sets of coordinates that had been published as appendices to the official submissions by Denmark and Russia to the CLCS.[202] In this case the geographic coordinates were transformed into the geographic shapes for the Geographic Information System (GIS) modeling in the ArcGIS. Next, these layers had been transformed into LAEA projection. Finally, the desired 'compromise' areas for both Denmark and Russia were derived from the overlap of these layers. These areas of Denmark and Russia are visualized in Figure 3-11.

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[199] As the factual area calculations were made by Petr Kohoutek, the author of this manuscript is not responsible for any potential measurement-related distortions.

[200] Although the shape is minimally distorted (less than 2 percent) within 15°from the focal point, beyond that limit the distortion in angles tends to grow. This type of map projection is usually used to calculate population density (area) and political boundaries (area); also for oceanic mapping for energy, minerals, geology, and tectonics (direction); for displaying entire continents and polar regions (because it can handle large areas); equatorial aspect (Africa, Southeast Asia, Australia, the Caribbean, and Central America) and the oblique aspect (North America, Europe, and Asia) – see the online ArcGIS Guide Book (http://desktop.arcgis.com/en/arcmap/10.3/guide-books/map-projections/lambert-azimuthal-equal-area.htm).

[201] When the exact definition of the national baseline is not available (this is the case of the Denmark and Russia's official submissions to the CLCS), the following definition is used in the LOS Convention (1982): "baseline is a normal low-water line along the coast as marked on large-scale charts officially recognized by the coastal state; or, when the coastline is deeply indented, has fringing islands or is highly unstable, straight baselines not longer than 24 nm joining appropriate points are used to define the national baseline" (Aseev, 2007, p. 32) – see Appendix B.

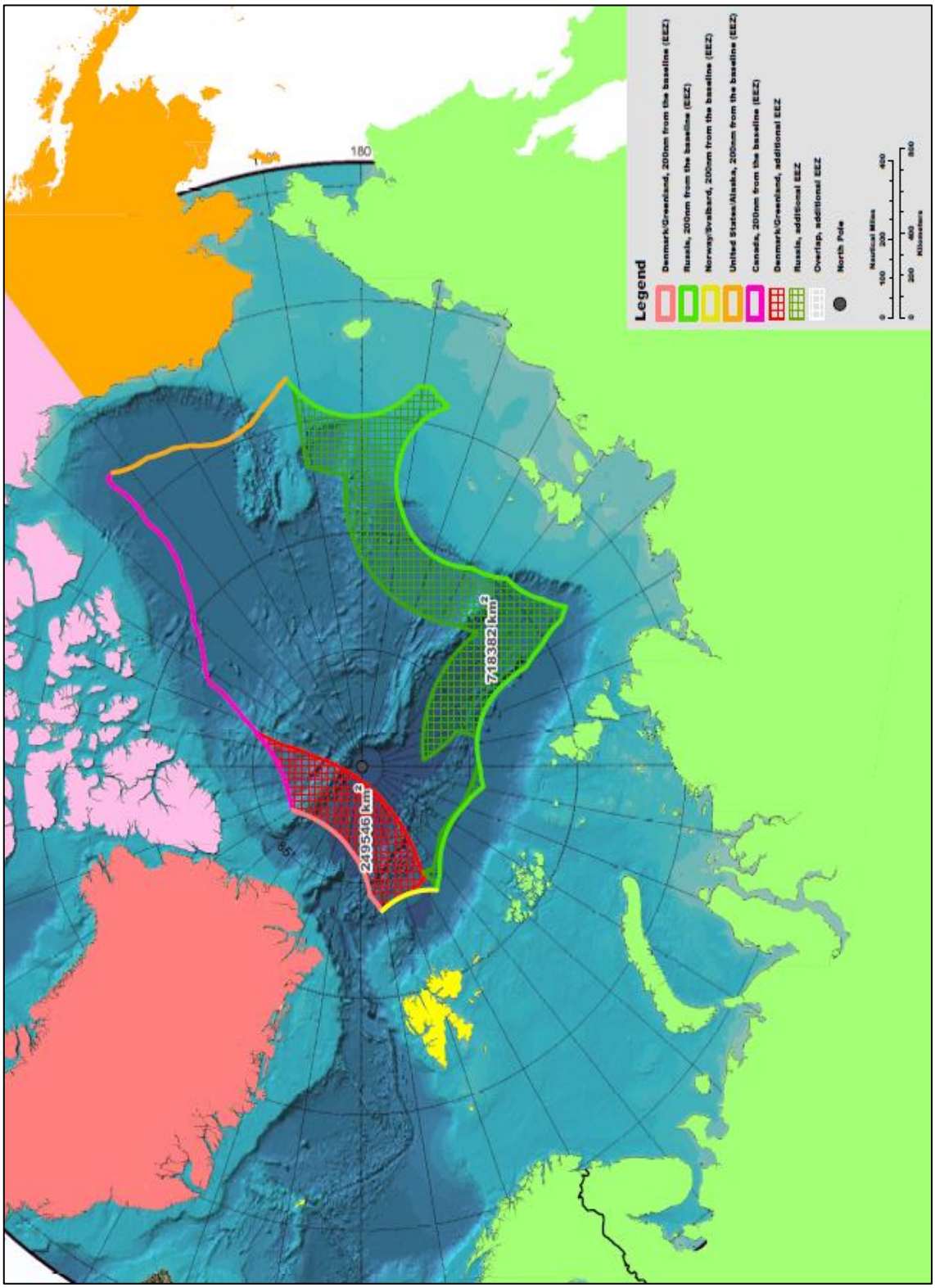
[202] In the submitted text by Denmark/Greenland, these geographic coordinates are listed on pp. 20-49 of the *Executive Summary of the Partial Submission to CLCS by Denmark and Greenland*, 2014. In the submission of Russia, the geographic coordinates are listed on pages 31-34 of the *Executive Summary of the Revised Submission to CLCS by Russia*, 2015.

In addition to the visualization of the claimed territory in the Central Arctic Ocean, Figure 3-10 and Figure 3-11 demonstrate the exact areas in sq. km generated by the abovementioned delimitation procedure. In the first case, there is no overlap in the claims because Denmark and Russia extend the outer limits of own continental shelf to the maximum of 350 nm from the national baselines in accordance with Para. 5 of Article 76 of the LOS Convention (1982). The area (potentially) claimed by Denmark is shown in shaded pink and equals 249,546 thou. sq. km, while the one (potentially) claimed by Russia is shown in shaded green and is almost three times larger and equals 718,382 thou. sq. km.

In the second case, two countries extend the outer limits of own continental shelf in accordance with Para. 6 of Article 76 of the Convention. Because the claimed areas overlap near the geographic North Pole, the claimed territory is always a sum of colored shaded area (pink in case of Denmark and green in case of Russia) and the white shaded area of the overlap. Consequently, the area claimed by Denmark equals 319,855 + 570,287 = 890,142 thou. sq. km; while the one claimed by Russia is 664,051 + 570,287 = 1 234,338 thou. sq. km.

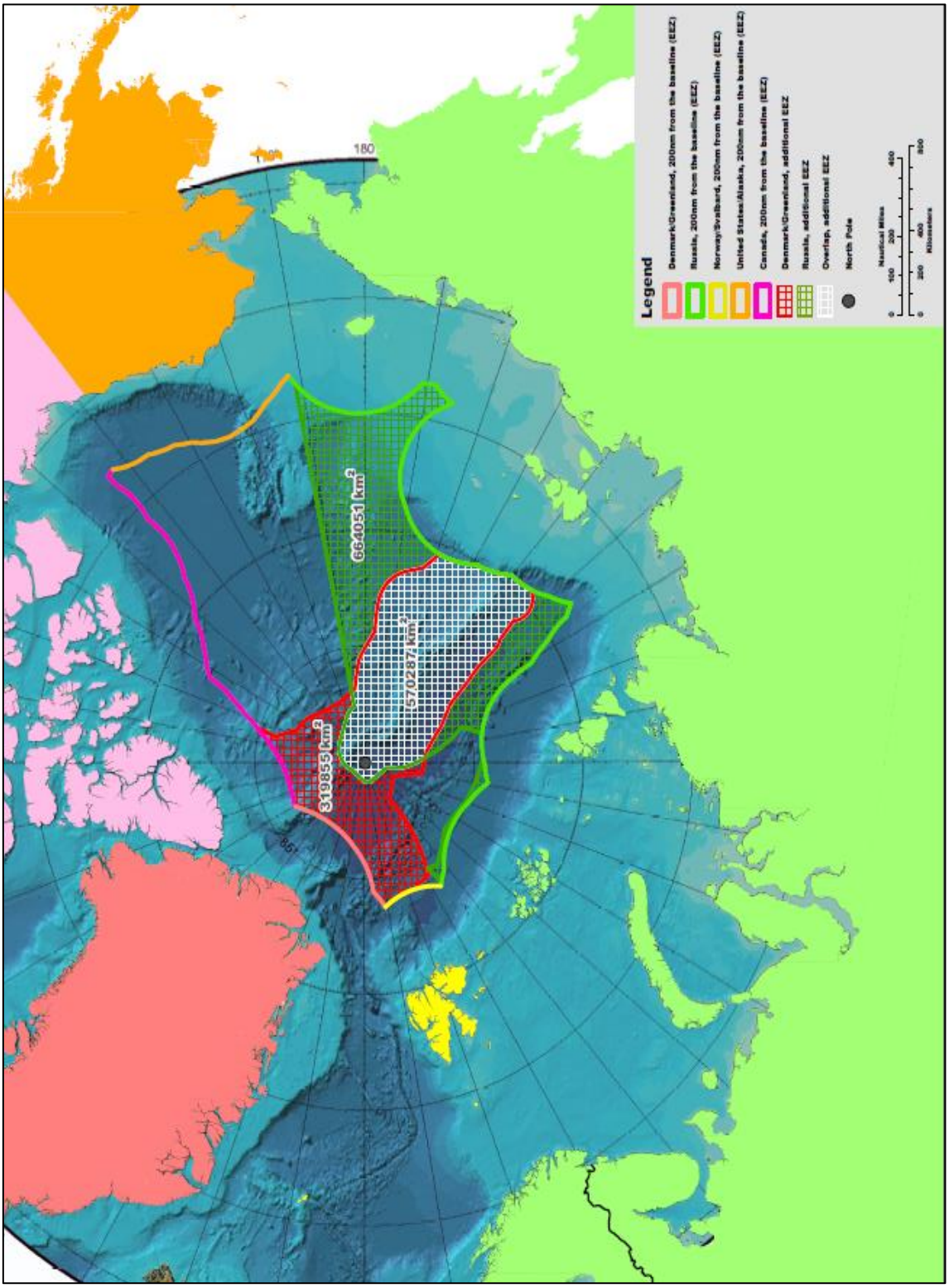
After obtaining the unique area information we start calculating the Arctic EEZ territorial configurations in the Options II-IX in Figure 1-5. In Option II, while Denmark recalls own submission, Russia annexes additional 718,4 thou. sq. km hence its total Arctic EEZ increases from 4 541,5 thou. sq. km to 5 259,9 thou. sq. km. In Option III, while Denmark still adds nothing due to a recall of own submission, Russia annexes all claimed portion of international waters in the Arctic – i.e. adds 1 234,3 thou. sq. km – so its total EEZ in the Arctic now grows from 4 541,5 thou. sq. km to 5 775,8 thou. sq km. This implies that the country's global EEZ would equal 8,8 million sq. km making Russia the third after the United States (12,2 million sq. km) and France (11 million sq. km) in the total area of EEZ (Sea Around Us, Interactive Map, 2015).

Figure 3-10. Extension of EEZ borders in the Arctic Ocean to 350nm from the baseline – Denmark/Greenland and Russia



Source: author, Kohoutek (2016).

Figure 3-11. Maximal extension of EEZ borders in the Arctic Ocean – Denmark/ Greenland and Russia



Source: author, Kohoutek (2016).

The situation is exactly opposite in Option IV: Russia adds zero area of EEZ by recalling own submission in the Arctic, but Denmark annexes 249,546 thou. sq. km generated by seaward extension of EEZ to 350 nm from the baselines of Greenland, so its total Arctic EEZ grows from 2 184,2 thou. sq. km to 2 433,7 thou. sq. km. In Option V, both Denmark and Russia move their northernmost maritime borders 150 nm seaward from the existing EEZ delimitation of 200 nm from the baselines (this is a compromise solution of simultaneous extension to 350 nm from the baselines). By doing so, the area of Denmark's Arctic EEZ grows to 2 433,7 thou. sq. km, while Russia's Arctic EEZ increases to 5 259,9 thou. sq. km.

In Option VI, Denmark annexes area generated by seaward extension of EEZ to 350nm from the baselines (i. e. gets, in total, 2 433,7 thou. sq. km of Arctic EEZ by adding 249,546 thou. sq. km), while Russia annexes all claimed area in the central Arctic Ocean (i. e. gets 5 775,8 thou. sq km of the Arctic EEZ by adding 1 234,338 thou. sq. km). Although both claimant states realize a significant territorial gain, Russia's Arctic EEZ becomes approximately twice bigger than the one of Denmark, since the Russia adds approximately five times more water area than does Denmark.

Option VII implies a different geographic configuration: Russia recalls own submission adding zero area to the existing EEZ, while Denmark annexes 890,142 thou. sq. km in the Central Arctic Ocean. Its total Arctic EEZ grows from 2 184, thou. sq. km to 3 056,1 thou. sq. km, and its global EEZ rises from 2,5 million sq. km to 3,4 million sq. km, i.e. changing from the 15th place to the 12th place in the global rating of states according to EEZ (see the *Glob_Geo* part of the electronic Appendix I).

In Option VIII, Russia annexes area generated by 350nm extension of EEZ limit to the north adding 718,382 thou. sq. km and increasing the total Arctic EEZ from 4 541,5 thou. sq. km to 5 259,9 thou. sq. km; while Denmark annexes all claimed portion of international waters in the Central Arctic Ocean – 890,142 thou. sq. km – making the total Arctic EEZ reach 3 056,1 thou. sq. km (instead of 2 184,2 thou. sq. km). Finally, in Option IX Denmark and Russia move their northernmost maritime borders to the maximum seaward limits of their claimed ocean polygons as appearing in the executive summaries of their submissions to the CLCS (this is a 'full annexation' solution). By doing so, Denmark adds 890,142 thou. sq. km to its EEZ area; while Russia adds 1 234,338 thou. sq. km. In result, Denmark's Arctic EEZ area grows to 3 056,1 thou. sq. km, while Russia's extended EEZ in the Arctic reaches 5 775,8 thou. sq. km.

In sum, different options of the Arctic game imply different absolute and relative positions of the Arctic initiator decision-makers in the endowment with the EEZ resource. While status quo situation in Option I gives no real territorial gain to any of the decision-makers, all other Options (II-IX) imply positive gains for at least one of them. Table 3-4 demonstrates territorial gains for both Denmark and Russia arising as a result of realization of each of nine options in the Arctic sovereignty game (Options I-IX), in both local (Arctic) and global terms.

Table 3-4. Territorial gain/loss of Denmark, Russia and the international community in the Arctic game options (in thou. sq. km)

Game Option	Denmark			Russia			International community		
	Actual gain / loss	Arctic EEZ	Global EEZ	Actual gain / loss	Arctic EEZ	Global EEZ	Actual gain / loss	Arctic EEZ	Global EEZ
I	0	2 184,2	2 551,1	0	4 541,5	7 566,7	0	2 973,5	116 291,4
II	0	2 184,2	2 551,1	718,4	5 259,9	8 285,1	-718,4	2 255,1	115 573
III	0	2 184,2	2 551,1	1 234,3	5 775,8	8 801	-1234,3	1 739,2	115 057,1
IV	249,5	2 433,7	2 800,6	0	4 541,5	7 566,7	-249,5	2 724	116 041,9
V	249,5	2 433,7	2 800,6	718,4	5 259,9	8 285,1	-967,9	2 005,6	115 323,5
VI	249,5	2 433,7	2 800,6	1 234,3	5 775,8	8 801	-1 483,8	1 489,7	114 807,6
VII	890,1	3 056,1	3 441,2	0	4 541,5	7 566,7	-890,1	2 083,4	115 401,3
VIII	890,1	3 056,1	3 441,2	718,4	5 259,9	8 285,1	-1 608,5	1 365	114 682,9
IX	890,1	3 056,1	3 441,2	1 234,3	5 775,8	8 801	-2 124,4	849,1	114 167

Source: author.

It is obvious from Table 3-4 that international community loses EEZ area in all options that challenge the status quo (II-IX). But are these losses statistically significant? We perform a series of paired t-test to determine if the EEZ manipulation in Option IX (option with the most significant territorial change – see Table 3-4) effectively changed the $SocGeoR$ index of (a) 187 states, (b) eight Arctic states, and (c) five Arctic states directly facing the Arctic Ocean. The following hypotheses has been constructed:

Null hypothesis (H_{3_0}):	**The effect of the changed area of Arctic EEZ over the SocGeoR index is zero**.
Alternative hypothesis (H_{3_1}):	**The effect of the changed area of Arctic EEZ over the SocGeoR index is different from zero**.

We start by evaluating statistical significance of sea area manipulation on the normalized data for the EEZ area. With a population of n pairs of measurements in 1993 and 2013, we test the mean of the difference for statistical significance using the following implementation of t:

$$t = \frac{\bar{d} - \mu_{d_0}}{\frac{s_d}{\sqrt{n}}}, \quad [16]$$

where $\bar{d}$ is the sample mean difference; μ_{d_0} is the hypothesized mean difference; S_d is the standard deviation of the sample; and n is the number of sample differences.

Neither for 187 states, or for eight Arctic states, or for five Arctic states, the effect of manipulated EEZ area of Denmark and Russia in Option IX is not statistically significant when compared to status quo. Then, we search for the effect of Arctic EEZ manipulation over the Global EEZ. For 187 states, for eight Arctic states, and even for five Arctic states, the effect of manipulated EEZ area of Denmark and Russia in Option IX is not statistically significant when compared to status quo. Next, we test the effect of Arctic EEZ manipulation in Option IX over the $GeoR$ index in Option I for statistical significance. Similarly to the case of the Global EEZ variable, for 187 states, for eight Arctic states, and even for five Arctic states, the effect of manipulated EEZ area of Denmark and Russia in Option IX is not statistically significant when compared to status quo.

Finally, we search for the significance of the effect of manipulation of Arctic EEZ over the aggregate socio-geographic resource of states ($SocGeoR$). And, similarly to the case of the Global EEZ variable and $GeoR$ index values, for 187 states, for eight Arctic states, and even for five Arctic states, the effect of manipulated EEZ area of Denmark and Russia in Option IX is not statistically significant when compared to status quo. In other words, because the EEZ manipulation in Option IX does not effectively change either the Global EEZ, the GeoR index, or the SocGeoR index of 187 states, eight Arctic states, and five Arctic states directly facing the Arctic Ocean, the null hypothesis is confirmed. The results of statistical testing are provided in Appendix J.

In sum, although in all cases when status quo is changed, thousands, and even millions, of sq km of the northernmost high seas are at stake, the overall effect of manipulation of the Arctic EEZ on the aggregate index of the socio-geographic power of states is marginal: annexation of the claimed areas in the Central Arctic Ocean does not change the balance of power among both the initiating and reacting Arctic decision-makers, although the visual analysis of the Arctic Ocean maps seems to indicate the opposite

(Figures 3-10 and 3-11). Quite logically, the narrower is the scope of a study, the more such an effect of the Arctic EEZ manipulation tends to the critical value that divides insignificant values from the significant ones. In other words, the geographic effect seems to end up closer to the critical value when the normalized data for the EEZ is considered, in contrast to the aggregate index of the socio-geographic power index, $SocGeoR$, consisting of eleven other independent variables in addition to the Arctic EEZ variable.

Although the ranking of states according to these new values do not change, and the variation in the absolute values of $SocGeoR$ index is minimal (and statistically insignificant), we are still able to detect the changes in the absolute socio-geographic power of three Arctic decision-makers, Denmark, Russia and the remaining participants of international community (185 nation states) as implied by different options of regional dispute resolution.

We define the payoffs for Options II-IX of three major actors of the Arctic game, Denmark, Russia and the international community, as the changes in the 2013 $SocGeoR$ index resulting from manipulation of one of twelve its integral variables – the Artic EEZ. The results of such $SocGeoR$ index recalculation are presented in Table 3-5, and all details might be found in the electronic Appendix I.

Table 3-5. Payoffs in the Arctic game, Denmark, Russia, and the international community (option with the highest gain/loss in italics)

Game Option	Denmark		Russia		International community	
	SocGeoR	Change from status quo / Payoffs in the Arctic game	SocGeoR	Change from status quo / Payoffs in the Arctic game	SocGeoR	Change from status quo / Payoffs in the Arctic game
I	3,0582	0	10,0462	0	82,0884	*0*
II	2,9288	-0,1294	10,3518	+0,3056	81,9122	-0,1762
III	2,8464	*-0,2118*	10,5465	*+0,5003*	81,8	-0,2884
IV	3,2201	+0,1619	9,9484	-0,0978	82,0243	-0,0641×
V	3,0828	+0,0246	10,2534	+0,2072	81,8566	-0,2318
VI	2,9951	-0,0631	10,4483	+0,4021×	81,7494	-0,339
VII	3,5907	*+0,5325*	9,7244	*-0,3218*	81,8777	-0,2107
VIII	3,4374	+0,3792×	10,0269	-0,0193	81,7285	-0,3599
IX	3,3388	+0,2806	10,2214	+0,1752	81,6326	*-0,4558*
× is the decision-maker's BATNA						

Source: author.

Keeping in mind that the nature of the Arctic territorial dispute is zero-sum, different decision-makers have sharply different game payoffs. First, Option III is the most beneficial for Russia, as it gives the country the highest absolute gain in the state power index: the latter annexes all claimed area (in accordance with para. 6 of Article 76 of the LOS Convention), while Denmark unilaterally recalls own submission. As a result, the $SocGeoR_{RUS}$ adds 0,5003 to the status quo value in Option I. This situation is simultaneously the least favorable for Denmark: by giving up own attempt to extend own sovereignty in the Arctic, the country accepts its Arctic Ocean counterpart to annex all claimed area stretching from the Russia's EEZ directly to the geographic North Pole. As a result, $SocGeoR_{DNK}$ loses 0,2118 (if compared to the status quo area in Option I).

Second, Option VII is the most beneficial for Denmark, as it gives the country the highest absolute gain in the state power index, as the latter annexes all claimed area, while Russia recalls own submission. As a result, the $SocGeoR_{DNK}$ adds 0,5325 to the status quo in Option I. This situation is logically the least favorable for Russia: by giving up own attempt to get any additional EEZ area, the country accepts its Arctic Ocean counterpart to annex all claimed area stretching from Denmark's EEZ to the Russia's EEZ directly though the geographic North Pole. As a result, $SocGeoR_{RUS}$ loses 0,3218 if compared to the status quo in Option I.

Thirdly, preferences of international community are quite different from the ones of Denmark and Russia. The most beneficial option is now status quo, when both Denmark and Russia recall own submissions to the CLCS so that the existing shape of the Arctic international waters is preserved (see Figure 1-4). In contrast, if both countries annex all claimed area (in accordance with para. 6 of Article 76 of the LOS Convention) the aggregate socio-geographic power of the remaining 185 nation states is 0,4558 lower and, is only 0,2318 lower if Denmark and Russia annex only area generated by seaward extension of EEZ to 350nm from own baselines (in accordance with para. 5 of Article 76 of the Convention).

The problem discussed in Subsection 1.2 – missing order of preferences of Denmark, Russia and international community in 'unobvious' cases (Options II-IV and VI-VIII) – is now resolved. These missing game preferences are products of individual payoffs and their order is based on the profit-maximization criterion: a rational decision-maker prefers an option with the highest payoff. The payoffs are, in turn, derived from the absolute increase/decrease in $SocGeoR$ index for the respective decision-makers.

For Denmark, the order of options, from the least preferred to the most preferred one, is: III, II, VI, I, V, IV, IX, VIII, and VII. In other words, recalling own submission when Russia annexes all claimed portion of international waters in the Arctic is the worst scenario for the country. If Denmark recalls own submission but Russia annexes area generated by seaward extension of EEZ to 350nm from own baselines is the second worst option. The situation is a better if Denmark annexes area generated by seaward extension of EEZ to 350nm from the baselines, while Russia annexes all claimed area in the central Arctic Ocean. Status quo comes next being more preferred than these three scenarios and separating the abovementioned unfavorable options from the favorable options.

The coordinated compromise, when both Denmark and Russia annex areas generated by seaward extension of EEZ to 350nm from their respective baselines, is preferred more than status quo. Even better scenario is when Russia recalls own submission, but Denmark annexes area generated by an extension of EEZ to 350 nm from the baselines of Greenland; however, it is still less preferred than the case of a full coordinated annexation, when both Denmark and Russia annex all claimed areas in the Arctic Ocean and agree with shared sovereignty over the area with an overlap in their claims. Even better is the situation when Denmark annexes all claimed portion of international waters in the Central Arctic Ocean, while Russia annexes area generated by 350nm extension of EEZ limit to the north – that is Denmark's BATNA. Finally, the most preferred option for Denmark is when the latter annexes all claimed area, while Russia recalls own submission.

For Russia, the order of game options in the Artic game, starting with the least preferred and ending with the most preferred, is: VII, IV, VIII, I, IX, V, II, VI, and III. That implies a rating of preferences that is quite opposite to the one of Denmark. Now, the worst scenario is when Russia recalls own claim, while Denmark annexes all claimed area in the Central Arctic Ocean. The second worst case is when Russia adds zero area of EEZ by recalling own submission, and Denmark annexes area generated by seaward extension of EEZ to 350 nm from the baselines of Greenland. A more favorable situation occurs when Russia annexes area generated by seaward extension of EEZ to 350nm from the baselines, but Denmark annexes all claimed portion of the Arctic Ocean. These three options are unfavorable to Russia as the status quo situation is graded higher in terms of payoff. Similarly to the case of Denmark, status quo with a zero territorial gain separates three unfavorable options from the favorable ones.

The first such favorable option, but with the lowest positive payoff, is the scenario in which both Denmark and Russia annex all claimed areas in the Arctic Ocean and agree

with shared sovereignty over the area with an overlap in their claims. A higher payoff to Russia comes from scenario when both Denmark and Russia annex areas generated by seaward extension of EEZ to 350nm from their respective baselines. Even more preferred is the scenario when Russia annexes area generated by seaward extension of EEZ to 350nm from own baselines, while Denmark completely recalls own submission. However, the outcome of Denmark annexing area generated by seaward extension of EEZ to 350nm from the baselines and Russia annexing all claimed area in the central Arctic Ocean promises an even higher payoff and is therefore the second most preferred option for Russia – it is Russia's BATNA. Finally, the most preferred option with the highest aggregate state power addition is the one when Denmark unilaterally recalls own submission and Russia annexes all claimed portion of international waters in the northernmost ocean.

Finally, preferences of the World – the reacting decision-maker consisting of 185 nation states – are ordered in the following way, starting with the least preferred option and ending with the most preferred one: IX, VIII, VI, III, V, VII, II, IV, and I. Logically, the scenario when both Russia and Denmark annex all claimed area in the ocean is the worst as international community 'loses' approximately 1,5 million sq. km of the high seas to these two countries. A situation in which Russia annexes area generated by 350nm extension of EEZ limit and Denmark annexes all claimed portion of international waters in the central part of the ocean is the second worst scenario. A little better is the opposite situation: Denmark annexes area generated by seaward extension of EEZ to 350nm from the baselines, while Russia annexes all claimed area.

Next, the scenario in which Russia annexes all claimed area, while Denmark unilaterally recalls own submission produces a less negative payoff and is therefore preferred more than the abovementioned cases; however, it is still less preferred than a coordinated compromise, when both Denmark and Russia annex areas generated by seaward extension of EEZ to 350nm from their respective baselines. Even smaller drop in aggregate socio-geographic resource of 185 nation states occurs if Russia recalls own submission, while Denmark annexes all claimed area and is therefore preferred more. Even better scenario, in terms of payoff, is based on Denmark recalling own submission, while Russia annexes area generated by seaward extension of EEZ to 350nm from national baselines, although a situation when Russia adds zero area of EEZ by recalling own submission and Denmark annexing area generated by seaward extension of EEZ to 350 nm from the baselines of Greenland produces a lesser drop in the aggregate socio-

geographic power – this option is international community's BATNA. Finally, status quo scenario, when both Denmark and Russia recall own claims in the Central Arctic Ocean, is the most preferred option – the actual payoff is zero, but, given the fact that all other options have negative impact on the aggregate power of 185 nation states, it is the best choice for the international community.

3.6 Chapter summary

Keeping in mind the theoretical configuration of a systemic geopolitical analysis of the dispute over international waters in the Central Arctic Ocean, in this chapter we have analyzed global attributive data on the long-term socio-geographic development (1993-2013) of all Arctic decision-makers, constructed the composite index of geographic ($GeoR$) and socio-geographic ($SocGeoR$) resources of states, and evaluated the stability of the latter cross-temporarily. Although the cross-temporal variation in $SocGeoR$ index is, in general, not statistically significant, the observed minimal differences in data is given not by the manipulation of Arctic EEZ variable, but due to the minor variation in social material power of states (SocR index) – note almost identical results of Wilcoxon matched pairs tests for media differences for 1993-2013 variation in $SocR$ index (Subsection 3.2.3) and $SocGeoR$ index (Subsection 3.3.3).

Next, we mapped the polygons of Denmark and Russia's claim according to para. 5 and para. 6 of Article 76 of the LOS Convention, calculated the areas at stake and their overlap, and discovered the particular territorial adjustments appearing in different dispute resolution options (Options I-IX). By doing so, we were able to manipulate the $SocGeoR$ index through the change of the Arctic EEZ variable in the state power model. Next, we tested this manipulation for statistical significance and found no particular influence of the changed area of EEZ in the Arctic on the relative position of Denmark and Russia in the global socio-geographic power rating.

Although not part of $SocGeoR$ index, a retrospective of the symbolic power potential associated with the Arctic region was also presented in a separate subsection. Finally, we demonstrated the way in which the value of payoff of each of three decision-makers (Denmark, Russia and the World) and each option (I-IX) in the northernmost dispute may be derived from variation in the decision-makers' aggregate national resources as implied by particular territorial modifications in the central part of the Arctic Ocean, and identified the value of the decision-makers' BATNA.

Chapter 4

Analysis of Conflict Potential in the Arctic

"The search for knowledge is a quest for accurate description, explanation and prediction"
— Bruce Bueno de Mesquita.[203]

Does the Arctic territorial dispute have any rational solutions? Given the selected set of major dispute participants, strategies they may imply, and ability to rank the individual preferences of the decision-makers over these strategies, are rational coalitions between them possible? Keeping in mind the results of the analysis of state power analysis as implied by manipulation of Arctic EEZ in case of Denmark and Russia, we turn to integration of the selected assumptions on strategic negotiation, internal logic of the game theory, graph modeling methodology and technical capabilities of Windows-based *GMCR+* software, to present our own interpretation of how a generic version of the Arctic territorial dispute might be rigorously studied through the search for stable solutions and rational coalitions between the decision-makers. After presenting the dataset and the measurement procedures, we turn to the results of the equilibrium, coalition and sensitivity analyses.

4.1 Research mechanics

4.1.1 Dataset

The dataset for modeling of the Arctic territorial dispute consists of two initiating decision-makers, Denmark and Russia, one reacting decision-maker, the World (defined in Subsection 1.2.1 as the international community) consisting of 185 nation states; seven distinct strategies these decision-makers choose from (Denmark and Russia each having three strategies to choose from, and the World having just one strategy); a set of strategy prioritization rules for each decision-maker, and a set of logical rules for removing the

[203] BUENO DE MESQUITA, Bruce. The Contribution of Expected-Utility Theory to the Study of International Conflict. In: MIDLARSKY, M. I., ed. *Handbook of War Studies*. Boston: Unwin Hyman, 1989. ISBN 978-0415611008.

infeasible states from the model. The decision-makers and game strategies are presented in Table 4-1.

Table 4-1. Decision-makers (DMs) and their strategies in the Arctic territorial dispute

DMs	Strategy description	Strategy code name
Denmark	Recall own submission to the CLCS (i.e. preserve status quo)	'Add 0 km'
	Annex areas generated by seaward extension of EEZ to 350nm from its respective Greenland's baselines	'Add 249,5 thou. sq km'
	Annex all claimed portion of international waters in the Central Arctic Ocean as appearing in the *Executive Summary of the Partial Submission to CLCS by Denmark and Greenland* (2014)	'Add 890,1 thou. sq km'
Russia	Recall own submission to the CLCS (i.e. preserve status quo)	'Add 0 km'
	Annex areas generated by seaward extension of EEZ to 350nm from its respective northernmost national baselines	'Add 718,4 thou. sq km'
	Annex all claimed portion of international waters in the Central Arctic Ocean as appearing in the *Executive Summary of the Revised Submission to CLCS by Russia* (2015)	'Add 1234,4 thou. sq km'
World	Agree with the decision of the initiator decision-makers (Denmark and Russia) to act, either in accordance with the CLCS Recommendation or without it	'Accept'

Source: author.

The decision-makers' preferences are prioritized, in ordinal manner,[204] according to the payoff of Denmark, Russia and the World and each option in the northernmost dispute from the fluctuation in the decision-makers' aggregate national resources as implied by particular territorial modifications in the central part of the Arctic Ocean, and controlled for the differentiated value of the decision-makers' BATNA (see Table 3-5 in the previous Chapter). In all cases, the acceptance of a given situation by the World is part of the preference configuration – no rational initiating decision-maker wants confrontation with the rest of international community due to the 'Arctic question', either in the form of open military conflict, or in the form of indirect pressure (trade sanctions) – both Denmark and

[204] Although we dispose with concrete values of payoffs for each decision-maker of each of nine possible situations (demonstrated in Table 3-5), i.e. preferences may be cardinal, for the purpose of current modeling it is enough to be able to rank them ordinally, starting with the most preferred one and ending with the least preferred one.

Russia state in their official submissions to the CLCS that the final delimitation of their respective continental shelves in the Arctic Ocean would be carried out in accordance with the provisions of Article 83 of the Convention and after the adoption of Commission recommendations on their submissions for establishment of the northernmost OLCS (Executive Summary of the Partial Submission to CLCS by Denmark and Greenland, 2014; Executive Summary of the Revised Submission to CLCS by Russia, 2015). Neither does the World wants this confrontation as it brings additional expenses no country wishes automatically to deal with. In other words, for all three decision-makers the acceptance of the situation by the world is rational and, therefore, beneficial. The decision-makers, the situations, and the value of assigned preference weighting[205] for each situation are presented in Table 4-2.

Table 4-2. Preferences of the decision-makers

DMs	*Situations*	*Preference weighting*
Denmark	Denmark adds 890,1 thou. sq km; Russia adds 0 km; and the world accepts it	256
	Denmark adds 890,1 thou. sq km; Russia adds 718,4 thou. sq km; and the world accepts it	128
	Denmark adds 890,1 thou. sq km; Russia 1234,4 thou. sq km; and the World accepts it	64
	Denmark adds 249,5 thou. sq km; Russia adds 0 km; and the world accepts it	32
	Denmark adds 249,5 thou. sq km; Russia adds 718,4 thou. sq km; and the world accepts it	16
	[STATUS QUO] Denmark adds 0 km; Russia adds 0 km; and the world accepts it	8
	Denmark adds 249,5 thou. sq km; Russia adds 1234,4 thou. sq km; and the world accepts it	4
	Denmark adds 0 km; Russia adds 718,4 thou. sq km; and the world accepts it	2
	Denmark adds 0 km; Russia adds 1234,4 thou. sq km; and the world accepts it	1
Russia	Russia adds 1234,4 thou. sq km; Denmark adds 0 km; and the world accepts it	256
	Russia adds 1234,4 thou. sq km; Denmark adds 249,5 thou. sq km; and the world accepts it	128
	Russia adds 718,4 thou. sq km; Denmark adds 0 km; and the world accepts it	64

[205] The program only allows ordinal preference input and therefore the weighting is assigned automatically: it doubles the value with each additional preference input. The ordinal preferences of all decision-makers are imported from Chapter 3.

	Russia adds 718,4 thou. sq km; Denmark adds 249,5 thou. sq km; and the world accepts it	32
	Russia 1234,4 thou. sq km; Denmark adds 890,1 thou. sq km; and the World accepts it	16
	[STATUS QUO] Russia adds 0 km; Denmark adds 0 km; and the world accepts it	8
	Russia adds 718,4 thou. sq km; Denmark adds 890,1 thou. sq km; and the World accepts it	4
	Russia adds 0 km; Denmark adds 249,5 thou. sq km; and the world accepts it	2
	Russia adds 0 km; Denmark adds 890,1 thou. sq km; and the world accepts it	1
World	[STATUS QUO] Denmark adds 0 km; Russia adds 0 km; and the world accepts it	256
	Denmark adds 249,5 thou. sq km; Russia adds 0 km; and the world accepts it	128
	Denmark adds 0 km; Russia adds 718,4 thou. sq km; and the world accepts it	64
	Denmark adds 890,1 thou. sq km; Russia adds 0 km; and the world accepts it	32
	Denmark adds 249,5 thou. sq km; Russia adds 718,4 thou. sq km; and the world accepts it	16
	Denmark adds 0 km; Russia adds 1234,4 thou. sq km; and the world accepts it	8
	Denmark adds 249,5 thou. sq km; Russia adds 1234,4 thou. sq km; and the world accepts it	4
	Denmark adds 890,1 thou. sq km; Russia adds 718,4 thou. sq km; and the world accepts it	2
	Denmark adds 890,1 thou. sq km; Russia 1234,4 thou. sq km; and the world accepts it	1

Source: author.

Given the abovementioned configuration of decision-makers, their strategies (options), and preferences of the decision-makers over individual strategies (options), the number of all possible states equals 128, and 110 infeasible states are removed from the analysis as a result of the following logical restrictions:

- Denmark simultaneously adds 0 km, 249,5 thou. sq km, and 890,1 thou. sq km;
- Denmark does not act at all (i.e. neither adds 0 km, or 249,5 thou. sq km, or 890,1 thou. sq km);
- Denmark simultaneously adds 0 km and 249,5 thou. sq km;
- Denmark simultaneously adds 249,5 thou. sq km and 890,1 thou. sq km;
- Denmark simultaneously adds 0 km and 890,1 thou. sq km;

- Russia simultaneously adds 0 km, 718,4 thou. sq km, and 1234,4 thou. sq km;
- Russia does not act at all (i.e. neither adds 0 km, or 718,4 thou. sq km, or 1234,4 thou. sq km);
- Russia simultaneously adds 0 km and 718,4 thou. sq km;
- Russia simultaneously adds 718,4 thou. sq km and 1234,4 thou. sq km;
- Russia simultaneously adds 0 km and 1234,4 thou. sq km.

4.1.2 Measurement

After defining the decision-makers, options, and option prioritization rules for the three-player Arctic territorial dispute, the solution concepts are introduced into the model.[206] In order to answer the questions Q_5 and Q_6 (Section 1.3), for all combinations of the decision-makers' strategies, we construct the null hypothesis against which the alternative hypothesis is tested:

Null hypothesis (H_{4_0}):	**No equilibrium exists in the game that is stable under all solution concepts.**
Alternative hypothesis (H_{4_1}):	**There exists at least one equilibrium in the game that is stable under all solution concepts.**

The basic logic behind GMCR stability concepts has been summarized in Subsection 2.2.1. What follows is a formal definition of four of them used in *GMCR+* decision support system,[207] as appears in Fang, Hipel and Kilgour (1993, pp. 69-79):

Nash stability. Under this stability criterion formalized by Nash (1950, 1951), the initial state k is Nash-stable (R) iff player i cannot move from state k to any other state player i prefers, given that this player i expects that player j stays at any state player i moves to, and that any state that player i moves to is the final state (no unilateral improvement is possible from this state). Individual (Nash) stability does not consider the other players'

[206] Given the observable context of the Arctic territorial dispute, we do not consider the situation when one player holds such a strong position that it can be considered to be an ultimate leader so that other players are followers – a case when the so-called von Stackelberg equilibrium search is appropriate (von Stackelberg 1934).

[207] GMCR+ works with the following solution concepts: Nash stability (R), General metarationality (GMR), Symmetric metarationality (SMR), Sequential stability (SEQ), Simultaneous stability (SIM) – the strategic impact of two or more decision-makers moving together at the same time from a given state (Kinsara, 2014, p. 9). This type of solution is used instead of the original limited-move stability and nonmyopic stability, either alone, or in combination with sequential stability (SEQ).

possible responses to a unilateral improvement, so there is no difference between the two-player and *n*-player definitions.

General metarationality. As defined by Howard (1971), general metarationality (GMR) is defined as a situation in which the decision-maker *i* expects that other decision-makers $(N - i)$ – in the Arctic dispute case, the two other decision-makers – will respond by trying to damage i, if they are able to do so, by a sequence of unilateral moves. At the same time, the decision-maker i realizes that the dispute would finish after the other decision-makers have responded. The adversaries of the decision-maker i ignore their own payoffs in realizing their response moves. If a unilateral improvement from a given state k is identifiable, then it is possible to determine is the unilateral improvement is sanctioned.

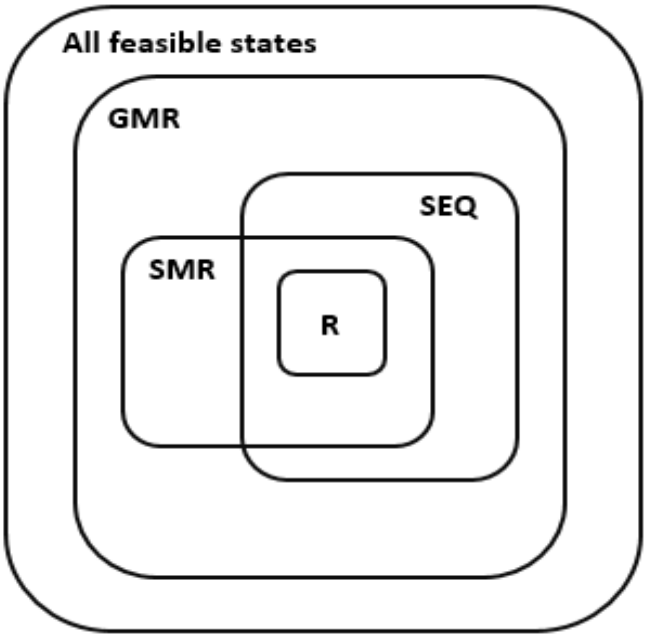
Symmetric metarationality. As defined in Howard (1971), a symmetric metarationality (SMR) for a two-player game may be modified for a *n*-player game is the following way: the decision-maker i expects that he would have the chance to counter-respond (k_3) to the other decision-makers' response (k_x) to the original move (k_1); and realizes that the dispute would be resolved after this counter-response.

Sequential stability. As defined by Fransel and Hipel (1979, 1984), sequential stability (SEQ) is defined as a situation, in which the decision-maker i is effectively deterred from making unilateral improvement(s), since a sequence of individual unilateral improvements by other decision-makers could produce a less preferred state to the original decision-maker than the initial state. The main difference between (GMR) and (SEQ) is in the existence of sanctions that, in (SEQ), must be credible.

For the *n*-player games, the logical relationships between these solution concepts have been originally highlighted by Kilgour, Hipel and Frazer (1984) and further advanced in Kilgour and Hipel (2005), and are presented in Figure 4-1. Many combinations of stability may be observed. For example, a state that is Nash stable (R) is part of the sequentially stable state (SEQ) and symmetric metarational state (SMR) that are, in turn, part of a general metarational state (GMR). Different stability definitions describe the nature of the decision-maker: SMR and GMR describe very conservative players that assume to be sanctioned all the times when the adversaries are able to sanction him, no matter if these sanctions would bring more harm than benefit to the latter. Under SEQ, the decision-maker also expects sanctions from the adversaries, but only in case these sanctions would

not harm these adversaries to an extent that makes them irrational (Kilgour and Hipel, 2005, p. 446).

Figure 4-1. The interrelationships of GMCR solution concepts



Source: Excerpt from Fang, Hipel and Kilgour, 1993, p. 118.

In the next stage of research, we analyze the possibility of rational coalition(s) between the decision-makers and answer Q_7 (Section 1.3) by constructing the null hypothesis against which the alternative hypothesis is tested:

Null hypothesis (H_{5_0}):	**No rational coalition exists between the decision-makers in the Arctic territorial dispute**.
Alternative hypothesis (H_{5_1}):	**There exists at least one rational coalition between the decision-makers in the Arctic territorial dispute**.

To identify rational coalitions between the decision-makers, *GMCR+* assumes at least two decision-makers to select the same option. The software does not give information about the nature of these coalitions since it deals with states, not the decision-makers. To eliminate illogical coalitions we evaluate all of them for meaningfulness and feasibility. Finally, to understand the relationship between our basic assumptions on the one hand, and the dynamics of dispute modeling on the other hand, and to reveal whether the model works properly and how sensitive it is to differentiated parameter settings, we let the model run two groups of logical adjustments: irreversibility of moves and option prioritization rules.

4.2 Graph model for conflict resolution in the Arctic

4.2.1 Equilibrium analysis

Table 4-3 demonstrates 18 feasible states of the Arctic territorial dispute, found by *GMCR+*, including the payoffs[208] for each decision-maker. It also demonstrates individual types of stability: "C" as stability for conservative players that do not risk even if risking is reasonable in terms of payoffs (*GMR* and *SMR*-only stability), and "S" as stability for standard players that do risk if risking is reasonable (stability under all solution concepts). Each decision-maker can say either Yes (Y) or No (N) to own available options, and the combination of Ys and Ns produces a possible state of the game. Holding the condition of irreversibility for any movement away from status quo for both Denmark and Russia (see Subsection 2.2.1), 9 states are unstable under all conditions (from state 1 to state 9), 9 states are partially stable under GMR and SMR (from state 10 to state 18), but only four states are strongly stable under all solution concepts (states 14, 15, 17, and 18).

State 14, which is strongly stable under all definitions of stability, represents the functional compromise between Russia and Denmark – it is Option V at Figure 1-5. In this scenario, the payoff for Russia, Denmark and international community is 7, 6, and 6, respectively. Although there are scenarios promising higher payoffs for individual decision-makers, their combination in state 14 is among the highest among the feasible states so that no decision-maker feels too dissatisfied. State 18, which is also strongly stable (i.e. satisfies all *GMCR+* definitions of stability), is another example of a strongly-stable functional coalition between Russia and Denmark – it is Option IX at Figure 1-5. This scenario produces another set of payoffs for Russia, Denmark and the World (6, 8, and 2, respectively) that are now much less favorable to international community than state 14. State 15 (when Russia adds 1234,3 thou. sq km, Denmark adds 249,5 thou. sq km, and the world accepts it) representing Option VI at Figure 1-5 is also a strongly-stable solution for the Arctic dispute. In this case, the payoff for Russia, Denmark, and the world is 9, 4 and 4, respectively. However, in this case Russia benefits much more than the other two decision-makers. Similarly, state 17 (when Russia adds 718,4 thou. sq km, Denmark adds 890,1 thou. sq km, and the world accepts it) representing Option VIII

[208] Because the program only allows ordinal preference input and the preference weighting is assigned automatically, the individual payoffs of each decision-maker is assignied automatically as well.

in Figure 1-5 is also stable under all solution concepts. The payoff for Russia, Denmark and international community is now 4, 9 and 3. In other words, Denmark benefits the most from this scenario, and it is slightly less beneficial to the world than state 15.

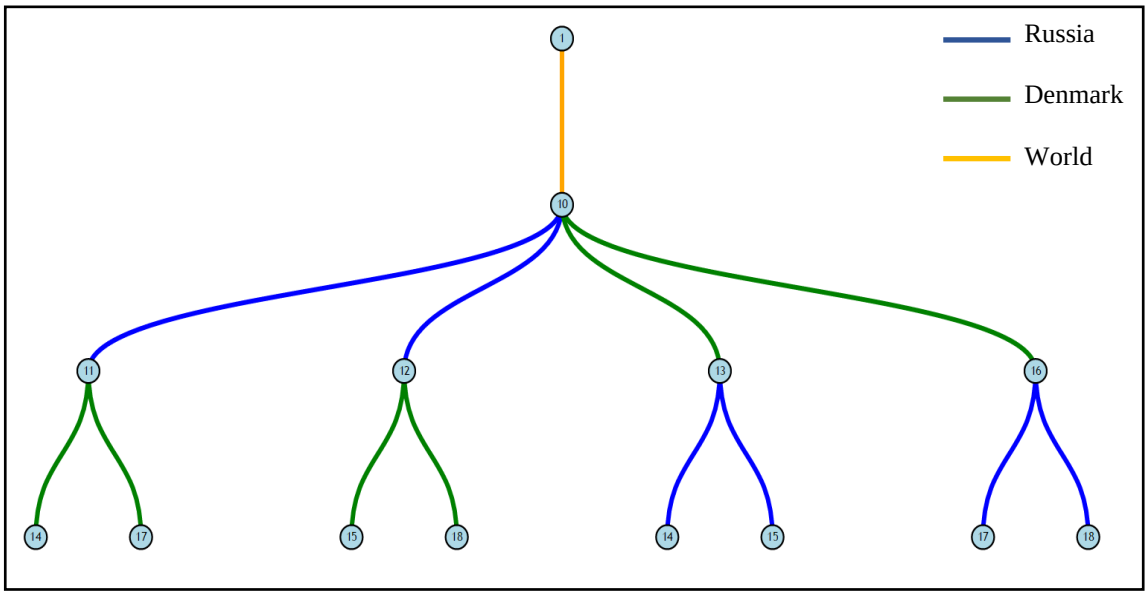
Table 4-3. Equilibria of the Arctic territorial dispute

DMs	Options	All feasible states																	
		Unstable states									**Stable states (Equilibria)**								
Russia	Add 0 km	Y	N	N	Y	N	N	Y	N	N	Y	N	N	Y	N	N	Y	N	N
	Add 718,4 thou. sq km	N	Y	N	N	Y	N	N	Y	N	N	Y	N	N	Y	N	N	Y	N
	Add 1234,3 thou. sq km	N	N	Y	N	N	Y	N	N	Y	N	N	Y	N	N	Y	N	N	Y
Denmark	Add 0 km	Y	Y	Y	N	N	N	N	N	N	Y	Y	Y	N	N	N	N	N	N
	Add 249,5 thou. sq km	N	N	N	Y	Y	Y	N	N	N	N	N	N	Y	Y	Y	N	N	N
	Add 890,1 thou. sq km	N	N	N	N	N	N	Y	Y	Y	N	N	N	N	N	N	Y	Y	Y
World	Accept	N	N	N	N	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y
Payoff for Russia		1	1	1	1	1	1	1	1	1	5	8	10	3	7	9	2	4	6
Payoff for Denmark		1	1	1	1	1	1	1	1	1	5	3	2	7	6	4	10	9	8
Payoff for the World		1	1	1	1	1	1	1	1	1	10	8	5	9	6	4	7	3	2
State number		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Stability type “C” or “S” ×		-	-	-	-	-	-	-	-	-	C	C	C	C	S	S	C	S	S
× “C” is stability for conservative decision-makers; “S” is stability for standard decision-makers																			

Source: author.

Figure 4-2 demonstrates the tree diagram for unilateral improvements for the decision-makers. From the status quo situation (state 1) the World can only unilaterally improve to the same status quo situation, which becomes accepted by the latter (state 10). From state 10, Russia may unilaterally improve either to a situation when it adds 718,4 thou. sq km and Denmark adds 0 km and the World accepts it (state 11 that increases Russia’s payoff from 5 to 8), or to a situation when it adds 1234,3 thou. sq km, Denmark adds 0 km, and the world accepts it (state 12, which increases Russia’s payoff from 5 to 10). Unilateral improvements of Denmark are very similar to the ones of Russia: from state 10, it may either move to a situation when it adds 249,5 thou. sq km, while Russia adds 0 km, and the world accepts it (state 13), or to a situation when it adds 890,1 thou. sq km, Russia adds 0 km, and the world accepts it (state 16). However, neither of these states are strongly stable: only very conservative decision-makers are assumed to agree with them, because these states only satisfy SMR and GMR conditions.

Figure 4-2. Tree diagram for unilateral improvements for all decision-makers



Source: author.

As a next step, from the unfavorable situation when the first initiating decision-maker adds 0 km, while another initiating decision-maker does add EEZ in the Arctic, there are several ways of unilateral improvement. From state 13 (when Russia adds 0 km, while Denmark adds 249,5 thou. sq km, and the world accepts it), Russia may improve either to state 14 (when Russia adds 718,4 thou. sq km, Denmark adds 249,5 thou. sq km, and the world accepts it, so that Russia's payoff increases from 3 to 7), or to state 15 (when Russia adds 1234,3 thou. sq km, Denmark adds 249,5 thou. sq km, and the world accepts it, so that its payoff increases from 3 to 9). From state 16 (when Russia adds 0 km, Denmark adds 890,1 thou. sq km, and the world accepts it), Russia can improve either to state 17 (when Russia adds 718,4 thou. sq km, Denmark adds 890,1 thou. sq km, and the world accepts it, so that Russia's payoff increases from 2 to 4), or to state 18 (when Russia adds 1234,3 thou. sq km, Denmark adds 890,1 thou. sq km, and the world accepts it, so that its payoff increases from 2 to 6).

Also facing two unfavorable scenarios, Denmark also have several ways of unilateral improvement. From state 11 (when it adds 0 km, while Russia adds 718,4 thou. sq km, and the World accepts it) it can either move to state 14 (when Denmark adds 249,5 thou. sq km, Russia adds 718,4 thou. sq km, and the world accepts it, so that Denmark's payoff increases from 3 to 6), or to state 17 (when Denmark adds 890,1 thou. sq km, Russia adds 718,4 thou. sq km, and the world accepts it, so that Denmark's payoff increases from 3 to

9). From state 12 (when it adds 0 km, Russia adds 1234,3 thou. sq km, and the world accepts it) Denmark may move either to state 15 (when it adds 249,5 thou. sq km, Russia adds 1234,3 thou. sq km, and the world accepts it; so that Denmark's payoff increases from 2 to 4), or to state 18 (when Denmark adds 890,1 thou. sq km, Russia adds 1234,3 thou. sq km, and the world accepts it; so that Denmark's payoff increases from 2 to 8).

Given the existence of four states that are strongly stable under all *GMCR+* solution concepts, the null hypothesis ($_{5\_0}$) is falsified and the alternative hypothesis ($_{5\_1}$) is confirmed. There exists at least one state in the game that is stable under definitions of stability summarized in Subsection 4.1.2. Each of them represents a mixture of Russia and Denmark's simultaneous change from status quo (state 10).

4.2.2 Coalition analysis

The decision support system *GMCR+* runs coalition analysis to reveal all states that constitute a rational coalition for at least two decision-makers and to allow understanding which coalitions are helpful for the decision-makers to gain from preferred equilibria. Table 4-4 demonstrates the coalitions and the ways the decision-makers can benefit from equilibria through alliancing (the sum of payoffs in each state is calculated automatically by the program on the basis of preference weighting presented in Table 4-2). The decision-makers having an arrow to the right of certain options are assumed to be part of an alliance that can give them a possibility to move from a less preferred equilibrium to a more preferred equilibrium.

Because state 14 represents a strongly stable functional compromise between Russia and Denmark (being Option V at Figure 1-5), it is a potential coalition between the initiating decision-makers and the international community, as the payoff for the latter is the highest in comparison to other strongly stable states 15, 17 and 18 (the world's payoff equals 6). Although there are scenarios promising higher payoffs for the world – preservation of status quo in state 10 (which gives international community a payoff of 10), payoffs for Russia and Denmark are too little to assume them recalling an attempt to improve to state 14, which that gives them, respectively, a payoff of 7 and 6. In other words, in terms of aggregate payoff, moving from state 10 (status quo) to state 14 (functional compromise-based coalition of Russia and Denmark) means -4 points for the world but +3 points, together, for Russia and Denmark. In order to get into this state from the state 13 (which is unfavorable to Russia as it recalls own submission, while Denmark

extends own EEZ in the Arctic), Russia needs to change own strategy in a way demonstrated with two arrows.

Table 4-4. Coalitions of the Arctic territorial dispute (strongly stable states marked in bold)

DMs	Options	Stable states (Equilibria)								
Russia	Add 0 km	Y	N	N	Y →	**N**	**N**	Y	**N**	**N**
	Add 718,4 thou. sq km	N	Y	N	N →	**Y**	**N**	N	**Y** →	**N**
	Add 1234,3 thou. sq km	N	N	Y	N	**N**	**Y**	N	**N** →	**Y**
Denmark	Add 0 km	Y	Y	Y	N	**N**	**N**	N	**N**	**N**
	Add 249,5 thou. sq km	N	N	N	Y	**Y**	**Y**	N	**N**	**N**
	Add 890,1 thou. sq km	N	N	N	N	**N**	**N**	Y	**Y**	**Y**
World	Accept	Y	Y	Y	Y	**Y**	**Y**	Y	**Y**	**Y**
Payoff for Russia		5	8	10	3	**7**	**9**	2	**4**	**6**
Payoff for Denmark		5	3	2	7	**6**	**4**	10	**9**	**8**
Payoff for the World		10	8	5	9	**6**	**4**	7	**3**	**2**
State number		10	11	12	13	**14**	**15**	16	**17**	**18**

Source: author.

Representing a scenario of Russia adding all claimed area in the Central Arctic Ocean, while Denmark adding 'only' area generated by drawing a new border at a distance of 350nm from the Greenland's baselines, state 15 (Option VI at Figure 1-5, which is Russia's BATNA) is not a potential coalition between the decision-makers. When moving to this state from status quo (state 10), Russia adds 4 payoffs points, but Denmark loses 1 payoff point, and the world loses as many as 6 payoff points – and it is rather unlikely that Denmark would form a coalition that is beneficial only for Russia, but not for Denmark. Another strongly stable state 17, with now Denmark annexing all claimed area in the Central Arctic Ocean and Russia adding 'only' area generated by drawing a new border at a distance of 350nm from the national baselines (Option VIII in Figure 1-5, which is Denmark's BATNA) is not a potential coalition, since the payoff for Russia, Denmark and international community is now 4, 9 and 3; which means Denmark adds 4 payoff points, Russia loses one payoff point, and the world losing 7 payoff points. Again, it is rather unlikely that Russia would enter a coalition that is beneficial only for its partner, Denmark, but not for itself.

Finally, the last strongly stable state 18, is the second potential functional coalition between Russia and Denmark. Representing Option IX at Figure 1-5, with both initiating decision-makers annex all claimed area in the Central Arctic Ocean, this scenario adds 1 payoff point to Russia and 3 payoff points to Denmark, if compared to status quo (state 10). However, in this scenario international community loses as many as 8 payoff points and it is the highest drop in payoff for this decision-maker among all strongly stable solutions, hence it is very unlikely that the world would accept it, despite the fact that the aggregate effect of this complete annexation on the balance of power in the world is not statistically significant (see Section 3.5). Nevertheless, if we loosen the requirement of the acceptance by the international community, this state does represent a potential coalition between the initiating decision-makers, since both of them get additional payoff points (although Russia gets 2 points less than Denmark). In order to get into this state from the state 17 (which is unfavorable to Russia since Denmark annexes all claimed area in the Central Arctic Ocean, while Russia adds 'only' area generated by drawing a new border at a distance of 350nm from the national baselines), Russia needs to change its strategy in a way demonstrated with two arrows.

In sum, two scenarios constitute potential coalitions between the initiating decision-makers, state 14 and state 18. In the first case, the difference between Denmark and Russia's increase in payoff equals one point (Denmark has +1 point, Russia has +2 points), while the World loses 4 points. In the second case, this difference constitutes 2 payoff points for the initiating decision-makers (Denmark has +3 points, Russia has +1 point) and -8 payoff points for the World. Given this comparison of payoff variation as implied by moving from status quo (state 10) to these strongly stable states in the Arctic game, coalition as shown in state 14 seems to be more probable than coalition as shown in state 18, if Russia and Denmark do take the reaction of international community into consideration. If this global reaction is not considered by the initiating decision-makers, state 14 and state 18 are interchangeable (although, in relative terms, state 14 brings a lower difference in payoff than state 18, and is therefore easier to agree with). Consequently, the null hypothesis (6_0) is falsified and the alternative hypothesis (6_1) is confirmed.

4.2.3 Sensitivity analysis

To reveal how sensitive is the model to the differentiated parameter settings, it was run 20 times with parametric modification to the initial logical configuration. Irreversibility

of moves proved to be a very powerful parameter defining the number of stable solutions in the Arctic dispute. Some of the most striking changes occur (a) when we change reversibility for all three decision-makers from Yes to No and vice versa, and (b) when we change reversibility between compromise-based strategies and full annexation-based strategies of the initiating decision-makers. The decision-makers' preferences have also proved to be less powerful, although still important, parameter defining the number of stable solutions in the Arctic dispute. Even though the model does not react to the reduction of Russia and Denmark's priorities that are less preferred than status quo, a significant reduction of prioritization rules for all decision-makers, and especially for the World, introduces the most significant variation in the results of equilibrium analysis.

In sum, the model proves to be sensitive to the modification of the initial parameters, and especially to reversibility of the decision-makers' moves – see Appendix K. Changes in option prioritization rules are also significant enough to imply different sets of solutions, but to a much smaller extent than (in)ability to recall once realized moves. However, all these changes are quite anticipated if the one considers the corresponding changes in the initial game configuration, hence such sensitivity of game model is logical.

4.3 Chapter summary

In this chapter we have demonstrated one straightforward way of using the results of the analysis of state power fluctuation as implied by the manipulation of the Arctic EEZ in case of Denmark and Russia in order to predict the potential solutions of the northernmost territorial dispute. Given the unique set of decision-makers, strategies (options) and prioritization rules in the Arctic dispute, *GMCR+* has found 9 feasible states are unstable under all conditions, 9 states that are partially stable under GMR and SMR, and only four states that are strongly stable under all solution concepts. Each of these four strongly-stable states represents a mixture of Russia and Denmark's non-status quo strategies accepted by international community. The decision support system also suggested two rational coalitions between the decision-makers. Finally, a sensitivity analysis revealed a significant dependence of these results on two parametric changes: reversibility of moves and decision-makers' rules of option prioritization.

Chapter 5
A Summing-Up

Where is Hans Island? Why is this uninhabited, 100-meter-long barren knoll of rocks located in Kennedy Channel of the Nares Strait claimed by both Denmark and Canada? Why did Russia launch the Arktika mission by sending a submarine to the bottom of the Arctic Ocean to plant a flag at the North Pole? Why did Canada respond with the construction of new military bases and the upgrading of its warships and coastal patrol vessels?

Until recently, most people not actually living within the Arctic Circle treated the polar region as a remote place about which they knew (and needed to know) little or nothing (Snowman, 1993, p. 14). Today, the Arctic is no longer a no-man's land of interest only to outdoor adventurers and military strategists. In fact, "in the not-too-distant future, the forces of climate change are going to transform this icy world into a new economic frontier" (Zellen, 2009, p. 184). This change will ultimately bring about a new chapter in polar history. Since "it is undeniable that many Arctic issues and the conflicts associated with them are international or transnational in scope", scholars and policy-makers should be aware of the changing geostrategic role of the Arctic in international politics.

This work has implied a two-stage analysis. First, we have explained the major puzzle behind the Arctic sovereignty problematic, defined the northernmost territorial dispute, and identified its major decision-makers, the situations these decision-makers were confronted with, and the rules for deriving the preferences of the decision-makers over these individual situations. Next, we derived the value of each decision-maker's preferences from variation in its socio-geographic power base due to specific territorial changes in the region, and evaluated the impact of geography on the aggregate socio-material global balance of power. In order to do so, we have answered the following four questions: *How can a systemic, positivist and quasi-experimental research design contribute to a geostrategic analysis of the northernmost sovereignty dispute? In order to determine which scenario will most probably prevail in future, what dynamic elements of the Arctic geopolitical system should be assessed? How does each decision-maker define*

his/her preferences in the game? and *How is the aggregate power base of each decision-maker influenced by geographic factors?*

Second, we modelled the northernmost territorial conflict by identifying the optimal solutions and suggesting the potential rational alliances among the decision-makers, in order to understand whether it is rational for the decision-makers to depart the dispute from the status quo and to assess the feasibility of all dispute solutions with which these decision-makers are confronted. In order to draw such conclusions, we have answered the next set of research questions: *Is it rational for the decision-makers to depart the game from status quo? How feasible are the situations with which the decision-makers are confronted?* and *In which cases a rational coalition between the Arctic claimant states and/or between the Arctic claimant states and the members of international community emerge?*

To answer all these research questions, we have tested five hypotheses. These hypotheses, together with the results of testing, are presented in Table 5-1. First, by calculating the Pearson product-moment correlation and performing the Wilcoxon matched pairs testing for (a) 187 nation states and (b) eight Arctic states, we proved that cross-temporal variation in absolute values of $SocR$ index for 187 states is not statistically significant. That means that the social part of our aggregate state power index is very stable over time.

Second, we again calculated the Pearson product-moment correlation and performed the Wilcoxon matched pairs testing for (a) 187 nation states and (b) eight Arctic states, and proved that cross-temporal variation in absolute values of $SocGeoR$ index for 187 states is statistically insignificant. That means that the entire aggregate state power index is also very stable over time. Third, by running a series of paired t-test to determine if the EEZ manipulation of the aggregate socio-geographic index of state power had effectively changed the $SocGeoR$ index of (a) 187 states, (b) eight Arctic states, and (c) five Arctic states directly facing the Arctic Ocean, we proved that this influence is not different from zero. In other words, in terms of the material balance of power in the world, the annexation of the entire area in the Central Arctic Ocean claimed by Denmark and Russia would not bring about any difference (however, it does not mean that there would be no difference in terms of political moralism and ethics in international relations). This result sharply contrasts with the mainstream idea to the contrary, so frequently circulated in mass media channels.

Fourth, running an equilibrium analysis in a selected multi-player game-theoretic software (*GMCR+*) based on the input of decision-makers' preferences as shown in Chapter Three, we prove that at least one equilibrium in the game that is strongly stable (i. e. stable under all solution concepts) is possible. In fact, there are four such solutions, and five more solutions which are partially stable (i. e. satisfying only two solution definitions). Finally, we used the same modeling interface to prove that there exists at least one rational coalition between the decision-makers in the Arctic territorial dispute. There are two such rational coalitions, but only one of them is the most probable if the variation in payoffs for all three decision-makers is taken into consideration – the scenario in which both Denmark and Russia move their northernmost maritime borders 150 nm seaward from the existing EEZ delimitation of 200 nm from their respective baselines in the Arctic Ocean.

Table 5-1. Five research hypotheses and results of testing

Hypothesis	Description	Result of hypothesis testing
H_1.	Cross-temporal variation in the absolute values of the $SocR$ index for 187 states is statistically significant.	No
H_2.	Cross-temporal variation in the absolute values of the $SocGeoR$ index for 187 states is statistically significant.	No
H_3.	The effect of changes to the Arctic EEZ over the $SocGeoR$ index is different from zero.	No
H_4.	There exists at least one equilibrium in the game that is stable under all solution concepts.	Yes (4)
H_5.	There exists at least one rational coalition between the decision-makers in the Arctic territorial dispute.	Yes (2), but only one coalition is the most probable for all three decision-makers – compromise (Option V in Figure 1.5)

Source: author.

5.1 Why such outcomes?

The outcomes are the product of the theoretical and methodological configurations of a given study. The selection of decision-makers is given by the current state of affairs in the dispute: only two countries have managed to submit their own sets of point

coordinates delimiting the new OLCS in the Central Arctic Ocean; Denmark and Russia. All other nation states, including other potential Arctic claimant states, constitute the third, cumulative decision-maker in the game. We do not consider the European Union as a separate player since, in the question of state sovereignty, it has no supra-national authority that would override the one belonging to its individual member states (that is probably why it is not mentioned in the official text of the claim submitted by Denmark and Greenland). Nine potential dispute options are also given by the current legal Framework, which assumes either a 'return-to-the-status-quo' strategy (with Denmark and/or Russia recalling their own submissions on the Arctic Ocean to the CLCS) or 'full annexation' strategy (as appears in the current reading of these two submissions). The third possible strategy, 'compromise' is also based in the realm of international public law, but has not yet appeared in Denmark's and Russia's submissions to the CLCS, or in any other legal document relating to them. Instead, it is a product of the author's alternative reading of Article 76 of the LOS Convention, which assumes a seaward extension of the OLCS to 350 nm from the national baselines.

The results of the state power analysis are given by the selected variables, and inter-variable linkages, in the state power model. Firstly, the social part of this model replicates, with a minor modification, the CINC index, with its unique understanding of state power in terms of three groups of variables – economic, military, and demographic – each consisting of two parameters and making six variables in total. This state power equation is based on simple (non-weighted) average of the Country:World ratio for each variable. The results are also due to the inclusion of a unique geographic component into the aggregate state power index, which consists of six variables and which is given exactly the same weighting value as the social component. This simple assignment of weighting was selected, as no other weighting (e.g., as appearing in state power equations [v, vi, ix, xiii, xvi xix, xxi, and xxii]) has proved to be more effective than this non-weighted variant. Also, the computation of the geographic component of the aggregate state power index proposed in this research is based on the same logic. Next, the prioritization of preferences of each decision-maker in the Arctic dispute results from the analysis of state power fluctuation as implied by the geographic manipulation of the Artic EEZ variable and a set of specific calculation procedures for obtaining the area claimed by both Denmark and Russia.

The results of the Arctic dispute modeling provide us with a set of stable solutions because the research follows a strategic, or *normal*, zero-sum game-theoretic form – a

very frequent form in the analysis of decision making (Davis, 1983, p. 3), which consists of three players, a set of strategies for each player (possible courses of action), a set of possible outcomes (scenarios), and a set of preference functions for each player that are quantified by means of utility scales (Bennett, 1995, p. 22). The two suggested coalitions result from the satisfaction of two (normative) modeling conditions: the rationality of the decision-makers, and their actions solely according to the prescribed payoffs (Colman, 1982, p. 170).

5.2 Practical (policy) implications

While suggesting policy implications on the basis of the available research results, the fact that the Arctic territorial dispute brings together a very heterogeneous set of nations should not be neglected. Having different (and even opposing) roles and goals, all four major model types of nation must meet and interact on the Arctic question: European, American, Asian, and African, as defined by Vladimir Baar (2002). Not only Denmark trying to extend its own OLCS in the Central Arctic Ocean, but other Arctic European states (Norway, Finland, Sweden, and Iceland) and other, non-Arctic European states constitute the first type, which holds together due to psychological togetherness defined by similar, Scandinavian-specific social characteristics such as language, culture, historical development leading to specific structural organization of government, and relation to national symbols (Baar, 2002, p. 58).

Canada and the United States (the potential Arctic claimant states) and the rest of the states of the Americas, represent the American type, whose uniqueness is defined mainly by culture and language which penetrated the region from Europe and adapted to local conditions, and whose togetherness is therefore a product of history, ethnicity and religion. Together with all Asian nations, which are grouped together due to common location, language and often history and religion, and African nations, which are tied together by the lowest level of socio-cultural development and the highest level of multi-ethnic dividing lines (caused by decolonization and the fragmentation of the continent into many small states), they constitute the rest of the aggregate Arctic dispute actor, 'the world' (ibid.). And the nation of Russia (another country trying to extend own OLCS in the Central Arctic Ocean) belongs to the Asian type although with certain characteristics of the European type as well.

At the same time, notwithstanding a specific supra-national integration (in the form of the European Union and other, more general globalization trends) or signs of internal political disintegration in some countries, it is very unlikely that the nation state would stop constituting a basic constitutive (and rather desirable) unit of the international community (Riegl, 2013, p. 189). This does not mean that sub- and supra-national actors are not present at all in international relations, however, in the matter of state maritime sovereignty, their legal role remains insignificant. That is why we suggest policy implications for three Arctic decision-makers at the national, and not sub-national or supra-national, level.

The Arctic territorial dispute does not exist in a vacuum. Its decision-makers are involved in a range of other single- and multi-issue inter-state interactions. These policy considerations relate not only to the scenario in which the Arctic dispute is resolved separately from other international issues, but also to cases in which this dispute is used as a trade-off for another international negotiation. In the latter case, it is very important to know the real 'cost' of all possible options in the Arctic dispute for each decision-maker involved.

Finally, by proving that even the most significant manipulation of the Arctic EEZ resulting from the annexation of all claimed area in the Central Arctic Ocean by both Denmark and Russia is not statistically significant in terms of material change, we highlight the issue of political moralism by distinguishing between "…material and moral benefits (namely, rights) available in the modern world" (Minogue, 2000, p. 105), with the emerging universalist moral order on the one side of the political spectrum (which may be threatened by the actions of the Arctic clamant states), and a nation state as the organization of collective, material selfishness on the other side (which has proved, statistically, not to be threatened by the actions of the Arctic clamant states). Although only (ultimately idealistic) political moralism is now at stake, each decision-maker makes use of it differently.

5.2.1 Denmark

In August 2011, the Government of Denmark, the Government of the Faroe Islands and the Government of Greenland adopted *The Kingdom of Denmark's Strategy for the Arctic 2011–2020*. Launched by the Kingdom's Ministry of Foreign Affairs, the document focused primarily on two issues: strengthening of Denmark's position in Arctic

politics and Copenhagen's new relations with the self-government of Greenland (Heininen, 2016, p. 1+).

As for the first strategic priority, the first chapter, "A Peaceful, Secure and Safe Arctic", deals with maritime dispute resolution, strengthening of maritime safety, enforcement of sovereignty, and surveillance undertaking. The document highlights the intention to solve sovereignty-related disputes in accordance with international law, specifically the LOS Convention. At the same time, the Strategy lists the priorities of enforcing sovereignty "…by the armed forces through a visible presence in the region where surveillance is central" (Kingdom of Denmark Strategy for the Arctic 2011–2020, 2011, p. 20). In addition, the document emphasizes the importance of the regional strategies of other Arctic coastal states (mainly those of the remaining 'Arctic 5') and the strategic role of NATO in regional politics. It also links security and the protection of the economic base of the country. Quite logically, the extension of the Kingdom's OLCS to the Central Arctic Ocean is beneficial as a source of additional potential commercial revenue. Although Denmark highlights international cooperation and peaceful dispute resolution with respect to the existing norms of international public law, it still considers a stronger position in the Central Arctic Ocean as a strategic national priority and is therefore resolute in extending its own EEZ there if the CLCS recommends that it does so, notwithstanding the fact that such an action would necessarily mean a loss of territory on the side of the international community.

As for the second strategic priority, the relationship with semi-sovereign Greenland, all four chapters of the regional strategy list a number of concrete tasks to emphasize and respect the roles of the Faroe Islands and Greenland's new status as the northernmost part of the Danish Realm. After years of negotiation, Greenland was granted limited sovereignty from Denmark when 70 percent of Greenlanders voted for home rule in 1979. Some 21 years later 76 percent of islanders voted for an extended self-government in the form of their own parliament (Landsting), government (Landsstyne), and full authority over taxation, fishing, gas, gold and diamond reserves, and education. Additionally, the decision to vote for full independence from Copenhagen is also in the hands of Greenlanders as well.

Because it is Greenland which serves as the only geographic justification for Denmark's claim in the Central Arctic Ocean, such independence may naturally seem to be a natural threat to Denmark's plans in the region. However, "[w]hilst full sovereign independence may appear the next logical move for Greenland, several factors do mitigate

against taking this final step" (Hough, 2013, p. 79). First, Greenland is subsidized by Copenhagen on an annual basis. Second, although Greenland had withdrawn from the European Community in 1985, in the legal sense, it is still one of the Union's 'overseas territories and dependencies' which is entitled to development aid. Third, Denmark provides Greenland with the security guarantee of the world's premier military alliance. Finally, by remaining a part of Denmark, Greenland enjoys very high standards of living and extensive trade, diplomatic and security links with a great number of other countries in the world. Consequently, it is very unlikely that in the near future Greenland would prefer to become fully independent of Denmark, so the submission to the CLCS is not in danger.

Denmark's BATNA, the second-most preferred outcome, after the annexation of the entire area claimed, relates to the scenario in which it annexes the entire section of international waters claimed in the Central Arctic Ocean following para. 6 of Article 76 of the LOS Convention, while Russia annexes an area detemined by the seaward extension of its EEZ to 350nm from the baselines according to para. 5 of Article 76 of the Convention. It is one of strongly stable solutions in the dispute according to equilibrium analysis in *GMCR+*, but it is not a state in which two initiating decision-makers form an issue-specific coalition, since it is rather unlikely that Russia would agree to enter an alliance which is beneficial only to its partner, Denmark, but not for Russia itself.

Given the current political climate around the Russia-EU and Russia-NATO relationships, a coalition between Denmark and Russia in the Arctic sovereignty question is not highly probable, though this option cannot be totally ignored, as such a coalition (in a limited, issue-specific sense) could be rational. In fact, coalition analysis in *GMCR+* identifies two potential coalitions between these two countries, and one in which both countries annex an area defined by the seaward extension of their respective EEZ to 350 nm from the northernmost baselines (as shown in Figure 3-10), is more acceptable to Denmark than the one in which Denmark and Russia annex all area claimed in the Central Arctic Ocean (as appearing in Figure 3-11), if Denmark insists on international recognition of this action (and it does, in fact, insist on this global acceptance). Due to this requirement, this solution is beneficial to Denmark although it is significantly worse than its BATNA in terms of absolute and relative gains and losses in state power, and it has no power over Russia to make it recall its own submission to the CLCS.

Keeping in mind that the members of the CLCS have certain 'flexibility' in their 'purely scientific' judgments,[209] and because the fluctuation in the material balance of power in the world resulting from Denmark's extension of its own continental shelf in the Central Arctic Ocean is not statistically significant, the Kingdom only risks damaging political moralism, i.e. idealistic, harmonic understanding of international relations, but not the material power of members of the international community. Moreover, even the position of Denmark itself would not change as a result of a positive recommendation by the CLCS regarding its Arctic submission. In this sense, it would be much easier for Denmark to obtain a compromise solution, as the real damage to the interests of the rest of the world is not far from zero.

5.2.2 Russia

In March 2009, Russia published its official Arctic strategy, *The fundamentals of state policy of the Russian Federation in the Arctic in the period up to 2020 and beyond*, which was designed under the auspices of the country's Security Council. Divided into four chapters (Russia's national interests in the region; major goals and strategic priorities; strategic tasks and means of regional policy realization; and fundamental mechanisms of this realization),[210] the document highlighted two primary policy priorities of Russia in the Arctic: strengthening of sovereignty rights, and resource security (Security Council of the Russian Federation, 2009, p. 1+). First, aimed at preserving the country's role as a 'leading Arctic power', the document set up the timeline for the delimitation of the outer limits of the continental shelf in the Central Arctic Ocean region, which was to be accomplished by 2015 (and Russia's official claim was submitted to the CLCS in August 2015). Second, because the Arctic and sub-Arctic regions were considered to be crucially important for Russia's wealth, social and economic development and competitiveness in global markets, and serve as a major source of revenue for the country, the Strategy highlighted the need to "…expand the resource base of the Arctic zone of the Russian Federation, which is capable in large part of fulfilling Russia's needs for hydrocarbon resources, aqueous biological resources, and other forms of strategic raw material" (Berman, 2009, p. 1+).

[209] See Subsection 1.1.3.
[210] The text does differentiate between the terms 'interests', 'goals', 'priorities', 'tasks', 'means' and 'mechanisms'.

Two months after the publication of the Arctic strategy, President Medvedev approved the *National Security Strategy of the Russian Federation until 2020* – the new national security doctrine which was modified slightly in December 2014.[211] Its para. 11 identified the future battlegrounds where it was assumed energy conflicts would occur: "[t]he attention of international politics in the long term will be concentrated on controlling the sources of energy resources in the Middle East, on the shelf of the Barents Sea and other parts of the Arctic, in the Caspian Basin and in Central Asia" and "in case of a competitive struggle for resources it is not impossible to discount that it might be resolved by a decision to use military might" (Kupchinsky, 2009, 1+). In order to realize these goals, another objective was set up in the Arctic strategy – the provision of adequate security support:

> In the sphere of national security, the protection of the national border of the Russian Federation…it is necessary to create general purpose military formations drawn from the Armed Forces of the Russian Federation, [as well as] other troops and military formations (mainly border units) in the Arctic zone of the Arctic Federation, capable of ensuring security under various military and political circumstances (Berman, 2009, p. 1+).

To accomplish these goals, since 2015 Russia has started steadily intensifying its military presence in the Arctic, sending troops, deploying advanced anti-aircraft missiles to the region, and completing six new military bases there. Despite these developments, Russian authorities clearly emphasized the need to preserve the Arctic as a zone of peace and cooperation, and underlined the role of regional bilateral and multilateral cooperation (Zysk, 2009, p. 1+). In fact, part of Russia's Arctic strategy was devoted to the pursuit of common interests in the region by means of international law. Russia's willingness to accept a compromise to settle the maritime boundary dispute with Norway in the Barents Sea in 2010, which constituted a concession on the Russia's side (Gvosdev and Marsh, 2014, p. 277), supports the claim that, in the Arctic, Russia is far more interested in cooperation than in confrontation with other regional actors. Keeping in mind the 'problematic' international political environment Russia has faced since the beginning of the 2014 Ukrainian crisis, such Arctic sovereignty-related cooperation could serve as a starting point in the improvement of Russia's relationship with those Western countries which are actively participating in the northernmost political discourse.

Russia's BATNA, the second most preferred outcome after annexing the entire area claimed, is a scenario in which it annexes the entire section of international waters

[211] The original 2009 version in Russian can be found at: http://kremlin.ru/supplement/461>, and its 2014 modification is available at: <http://rg.ru/2014/12/30/doktrina-dok.html.

claimed in the Central Arctic Ocean following para. 6 of Article 76 of the LOS Convention, while Denmark annexes an area defined by the seaward extension of its EEZ to 350nm from the baselines according to para. 5 of Article 76 of the Convention – the exact opposite scenario to the Danish case. It is one of strongly stable solutions in the dispute according to equilibrium analysis in *GMCR+*, but it is not a state in which the two initiating decision-makers form an issue-specific coalition, since it is rather unlikely that Denmark would agree to enter an alliance that is beneficial only for its partner, Russia, but not for Denmark itself.

The current Russia-EU and Russia-NATO relationships act against a coalition between Russia and Denmark, but, again, it is not wise to ignore this possibility, as it could be rational (in an issue-specific sense). Because the coalition analysis in *GMCR+* identifies two potential coalitions between Russia and Denmark, and the one in which both countries annex an area defined by the seaward extension of their respective EEZ to 350 nm from the northernmost baselines (as shown in Figure 3-10), is more acceptable to Russia than the one in which both countries annex the entire area claimed in the Central Arctic Ocean (as appearing in Figure 3-11), if Russia insists on international recognition of this action (and Moscow would benefit from this global acceptance much more than before the beginning of 2014 Ukrainian affair). That is why it is rational for Russia to prefer this compromise solution although it is less desirable than its BATNA in terms of absolute and relative state power (given that, similarly to Danish case, it has no power over its potential partner, to make it recall its own submission to the CLCS).

Keeping in mind that the members of the CLCS have certain 'flexibility' in their 'purely scientific' judgments,[212] and because the fluctuation in the material balance of power in the world resulting from Russia's extension of its own continental shelf in the Central Arctic Ocean is not statistically significant, Moscow only risks damaging the idealistic, moralist dimension of international relations, and not the material power of members of the international community. And, similarly to the Danish case, the absolute and relative power position of Russia itself does not change as a result of the manipulation of the Arctic EEZ through Moscow's Arctic OLCS submission. Consequently, it would be much easier for Russia to obtain a compromise solution, as the real damage to the interests of the rest of the world is not far from zero.

[212] See Subsection 1.1.3.

5.2.3 The rest of the international community

Policy implications for the remaining representatives of 'mankind' can be systematized according to two categories of nation states: the non-Arctic nation states and the Arctic non-claimant states. In both cases, countries which are not members of the United Nations – non-members with permanent observer status (the Holy See and the State of Palestine), former member (Taiwan), the Republic of Kosovo, Antarctica, Northern Cyprus, and a number of non-sovereign dependencies[213] – are not able to benefit from the actions of the United Nations specialized bodies established by the LOS Convention, ISA and ITLS. In a judicial sense, as stated in Article 140 of Part XI of the Convention, all individual elements of 'mankind' are not defined, but it is logical to assume that the specific provisions and rules of this legal framework apply only to the members of the United Nations. In other words, although international waters in the Arctic Ocean belong to all nations in the world, and it is not explicitly stated that this right relates only to the sovereign nation states, the practical realization of these gains in case of the United Nations non-members remains questionable. Consequently, because neither the status quo, nor its removal, have any effect on these non-members, to change this situation, the only recommendation to them is to become regular members of the United Nations.

For the regular members of the United Nations the situation is quite different. Constituting 'mankind', these countries would lose territory if Denmark and/or Russia were to annex even the smallest part of Arctic international waters, since the nature of the Arctic dispute between the world on the one hand, and these two Arctic states on the other hand is zero-sum. The larger the area of international waters taken by these two nation states, the greater the territorial loss on the side of the remaining representatives of the international community, consisting of a number of rather distant countries which desire

[213] American Samoa (US), Anguilla (GB), Aruba (NL), Bermuda (GB), Bouvet Island (NO), British Indian Ocean Territory (GB), British Virgin Islands (GB), Cayman Islands (GB), Christmas Island (AU), Cocos Islands (AU), Cook Islands (NZ), Coral Sea Islands Territory (AU), Falkland Islands (GB), Faroe Islands (DK), French Guiana (FR), French Polynesia (FR), French Southern Lands (FR), Gibraltar (GB), Greenland (DK), Guadeloupe (FR), Guam (US), Guernsey (GB), Heard and McDonald Islands (AU), Hong Kong (CN), Isle of Man (GB), Jan Mayen (NO), Jersey (GB), Macau (CN), Martinique (FR), Mayotte (FR), Montserrat (GB), Navassa (US), Netherlands Antilles (NL), New Caledonia (FR), Niue (NZ), Norfolk Island (AU), Northern Mariana Islands (US), Pitcairn Island (GB), Puerto Rico (US), Reunion (FR), Saint Helena (GB), Saint-Pierre and Miquelon (FR), South Georgia (GB), Svalbard (NO), Tokelau (NZ), Turks and Caicos Islands (GB), U. S. Minor Pacific Islands (US), U. S. Virgin Islands (US), and Wallis and Futuna (FR) – detailed information on United Nations membership can be found at: http://www.un.org/en/sections/member-states/about-un-membership/index.html.

to be part of future Arctic governance, such as China, India and Japan (Chaturvedi, 2012, p. 240). In fact, it is on no consequence if Denmark and Russia act simultaneously; what matters is the absolute number of sq km at stake.

Keeping in mind that both Denmark and Russia prefer that the international community accept the final resolution of the dispute, members of the CLCS have certain 'political flexibility' in their 'purely scientific' judgments,[214] and since the material balance of power in the world would not be damaged by any annexation of the Central Arctic Ocean waters by Denmark and Russia, the world has only one explanation of why these two countries should recall their submissions to the CLCS and leave the status quo unchanged – political moralism and the ethics of the peaceful coexistence of states in the international system, because only this dimension of the northernmost conflict may be indisputably damaged by the actions of the dispute's initiating decision-makers. It would be an idealist, ethical dimension, and not an egoistic realist dimension, which would justify the world's choice to respond to Denmark and Russia's actions with economic and political sanctions, and even an open military conflict. The international community may also benefit from different political and economic conditions these two countries now exist in, which does not make an alliance between them very probable. Denmark is part of the EU and NATO – organizations whose members now stand in sharp political opposition to Russia since the beginning of the Ukrainian crisis in 2014.

The international community's BATNA, the second most preferred outcome after maintaining the status quo, relates to the scenario in which Russia adds zero area of its EEZ by recalling own submission in the Arctic, but Denmark annexes 249,546 thou. sq. km determined by the seaward extension of its EEZ to 350 nm from the baselines of Greenland. However, the results of equilibrium and coalition analyses falsify this option as the most probable solution to the dispute. Out of two stable states, both of which result from a coalition of Denmark and Russia, the one in which both countries only annex an area determined by the seaward extension of their respective EEZ to 350 nm from the northernmost baselines (as shown in Figure 3-10), is definitely more acceptable to the world than the one in which Denmark and Russia annex all claimed area in the Central Arctic Ocean (as appearing in Figure 3-11). This compromise solution would be more beneficial to the world despite the fact that it is slightly worse than the world's BATNA,

[214] See Subsection 1.1.3.

if absolute and relative gains and losses in aggregate and individual state power are considered.

As of 2016, Denmark is united with 27 other European nation states through the EU. In some policy areas, such as the Common Agriculture Policy, the EU constitutes a supra-national institution with a qualified majority voting system which means that the majority of member states may force those not agreeing with a proposed norm or procedure to comply with this majority decision. At the same time, despite the existence of a Common Foreign and Security Policy,[215] in issues related to state sovereignty, the decision making still reflects intergovementalism and the unanimity voting system is preserved. In other words, most foreign and security policy decisions, including that concerning Denmark's desire to move its OLCS northward of the existing EEZ in the Arctic, require the agreement of all EU countries. Naturally, Denmark would not vote against own interests in the Arctic. Although other EU member states (the ones belonging to the aggregate decision-maker in the Arctic territorial dispute) cannot force Denmark to recall its submission to the CLCS, the EU can be used as a closed negotiation platform to discuss this issue with Denmark, especially in light of the existence of the EU Arctic policy (although state sovereignty is not among its three primary policy objectives).[216]

Some of the United Nations member states are Arctic states and, therefore, permanent members of the Arctic Council (AC), which strives to address issues faced by all Arctic governments and the indigenous people.[217] One of six working groups of the AC allows experts to communicate on a daily basis, to prepare agenda for bi-annual meetings of ambassadors and senior foreign ministry officials of the Arctic states. However, although the AC has been successful in creating a dialog between the Arctic states' governments,

[215] The EU Common Foreign and Security Policy is intended to (a) safeguard the interests, independence values, and integrity of the EU; (b) strengthen its security; (c) strengthen international security and preserve peace; (d) promote international cooperation; (e) develop and consolidate the rule of law and democracy, and (f) respect for fundamental freedoms and human rights (EU in the US, "Common Foreign and Security Policy", 2016). However, the issue of state sovereignty of EU member states is not among these goals.

[216] The EU Arctic policy has three main policy objectives: (a) protecting and preserving the Arctic in cooperation with the people who live there; (b) promoting the sustainable use of resources; and (c) stressing the need for international cooperation. The European Commission and the High Representative propose three additional policy areas: (a)support for research and the exchange of knowledge to deal with environmental and climate change in the region; (b) act responsibly to ensure that regional economic development is based on the sustainable use of resources and environmental expertise; and (c)step up in constructive engagement and dialogue with Arctic states, indigenous peoples and other interested regional actors. More information can be found at: http://www.eeas.europa.eu/arctic_region.

[217] The Arctic states' indigenous communities are linked through six indigenous networks that have Permanent Participant status in the AC, but this status does not imply any legal recognition.

it is an intergovernmental forum; hence the conclusions of these meetings are not legally-binding under international law.

Notwithstanding this legal limitation, the grounds for cooperation provided by the Arctic Council can serve as an effective arena where Arctic non-claimant states can communicate with Denmark and Russia on the necessity to compromise in the Arctic sovereignty matter in order to prevent conflict escalation and remain in the diplomatic dimension of the northernmost dispute resolution. In this sense, Norway, Finland, Sweden, and Iceland have additional regional means of interaction with Denmark and Russia which are unavailable to other members of the international community. To a lesser extent, the Barents Euro-Arctic Council (BEAC) – an intergovernmental forum with several specialized working groups that promote harmonization among national economic legislatures, and which connect the European Union with Norway, Sweden, Finland, Russia, and Denmark, may serve the same purpose.

5.3 Analytical implications

In the analytical dimension, the suggested integration of geographic, legal and political analysis with quantitative methodology has conceptual strengths and weaknesses which are the product of both the selected research questions and techniques available to answer these questions. We first critically evaluate the effectiveness of the selected research design, and then present ways in which it may enrich both the neoclassical geopolitical and political geographic analysis and the contemporary social polar research.

5.3.1 Strengths and weaknesses of the suggested methodology

Strengths. There are several reasons for treating the conceptual and methodological configuration of this study as analytically effective. First, by combining physical geography, international law and political science on the one hand, and thinking systemically on the other hand, we are able to think across disciplines and be less influenced by any single ideology that could constitute an integral (and in majority of cases, a hidden) part of them. Second, the empirical part of this research dealing with the concrete values of decision-makers' preferences is not based on intuition or any sort of speculation coming from unscientific data sources, but from real cartographic analysis aimed to create data specifically for the purpose of dispute resolution in the given

location. This factual information can then be used in other research, even in that not directly related to our research questions.

Third, by basing the analysis on the processing of a large amount of hard data, this approach contributes, in its own way, to empirical geopolitical analysis which has been developed from the 1970s onwards (Venier, 2010, p. 1+). While the authors of previous empirical geopolitical approaches focused mainly on the combination of geography, history, and spatial knowledge (Lacoste 1986), we combine geography with international law, political science, and cartographic analysis, leaving symbolic factors (including history) as the secondary research priority, mainly because, in the Arctic case, historical development has not been very intensive in comparison with other world regions.

Fourth, although dealing with only three decision-makers – Denmark, Russia and the rest of the world – the cross-temporal analysis of state power is calculated for 187 nation states, in Chapter 3. By staying on this global level of analysis, this study is flexible enough to introduce other decision-makers, both individual countries and group(s) of countries, into the analysis without the need to perform any additional calculations. By incorporating this globalist strategy, the research is in line with spatial analysis suggested and actively promoted by Ives Lacoste (2012, p. 26).

Fifth, because, in evaluating the countries' material strength to be used in the analysis of a specific inter-state dispute, 'one size does not fit all' (Toksoz, 2014, p. 159), the suggested approach is not, and should not be, universal, as not all parameters studied are relevant in all cases. Instead, the model has to be flexible enough to accommodate the differing structure of each dispute studied. Because geographic proximity to the disputed location is a legal requirement for submitting a claim on adjustments on the OLCS in the Arctic, we consider the physical presence in the Arctic (in the form of differentiating land- and EEZ area into Arctic and non-Arctic) to be significant enough to be presented in the selection of the variables studied in the state socio-geographic power ($SocGeoR$ index). In practice, it means that in this research an Arctic state is positively discriminated in comparison with a non-Arctic state. In some other interstate dispute(s), other countries, which would be geographically proximate to the location studied, should be logically prioritized in the model.

Sixth, this research systematizes the most important material and symbolic empirical evidence on long-term socio-geographic development in the region (1993-2013). It also provides information on specific territorial gains and losses for all decision-makers in the Arctic dispute which are produced in different potential dispute resolution options, and

the value of payoff for each decision-maker and each option in the dispute based on variation in aggregate national resources – information not yet present in recent geopolitical research on the Arctic sovereignty problematic. It also looks forward by demonstrating concrete dispute solutions based on different combinations of decision-makers' strategies, evaluating whether these solutions are optimal (i.e. stable), and suggesting potential rational coalitions among the decision-makers. By doing so, we are able to produce policy recommendations based on these alternative scenarios of future strategic developments in the region.

Seventh, we suggest concrete values of decision-makers' preferences which are usually missing in game theoretical analysis, since the latter usually takes them as 'external' and given, i.e. supplied by the researcher. So far, no other study provides this information. Eighth, although the Arctic dispute may not necessarily be a priority between the involved decision-makers, i.e. its solution may be traded off for an another, 'more important' international issue (e.g., recall one's own claim in the Arctic in exchange for concessions elsewhere), it is still important to know the strategic circumstances surrounding the Arctic case, in order to know the true 'price' of such a trade-off. Finally, the approach contributes to classical geopolitical, political geographic and social polar research, at the theoretical level. These contributions are explained in detail in Subsections 5.3.2 and 5.3.3.

Weaknesses. The theoretical and methodological configurations of this research imply certain limitations. First, the selection of variables, the weighting of each variable, and the inter-variable links, in the state power analysis follows a certain logic which constitutes only one way of analyzing states cross-nationally. The authors do not follow any pre-existing state power equation due to the need to incorporate more geographic variables that can be found in the present models. The selection of these geographic variables are arbitrary and may constitute a source of analytical distortion. Second, the selected time period, which ends in 2013, is used to model current state power globally. The problem, which is common to all social scientific modeling, and which is not that common in natural research, is that there exists a time lag between the reality and the availability of data to reflect this reality. If we consider data on state social material development (gross product, population, military expenditures, etc.) this time lag usually equals not less than two years. In other words, we estimate the current state of affairs in the region based on at least two-years-old numbers. Third, the non-universality of the

suggested state power equation constitutes not only a major strength, but also a weakness, as it cannot be used without modification in the study of other world region(s) and/or interstate dispute(s). Fourth, because any system consists of both internal (endogenous) and external (exogenous) components, this study highlights the first, agent-based parameters of the Arctic system and leaves open the question of structural and external parameters (Minogue, 2000, p. 87). Fifth, the subjective factors of analysis – the symbolic power of the decision-makers – are not considered due to a problematic operationalization and lack of any existing (de)coding template that could be used at the global level of analysis.

Finally, any modeling is a certain simplification of reality. The absolute rationality of actors is questionable. Decisions are harder to make when chance plays a role (Davis, 1983, p. 3). The Arctic case can be just a part of a 'bigger picture' better described by multi-linked games than by a single game model. Although the latter allows one to see the core of the problem, some important circumstances can be omitted and this selective ignorance could have dramatic implications. And, in addition to potential built-in mathematical distortions at the level of algorithm operationalization, the ranking of decision-makers' preferences over options in *GMCR+* software does not assume a manual input of cardinal priorities, i. e. the absolute values of preferences, but their ordinal specification. Because this ordinal perspective does not allow for a differentiated 'prioritization distance' between the options, the resulting payoffs do not necessarily reflect reality in the most accurate way, since these payoffs are assigned by the program, and not by the researcher. Moreover, the sensitivity analysis at the end of Chapter Four has proved that the dispute resolution model is rather strongly dependent on internal parametric changes. That means that any change in the reversibility of decision-makers' moves and/or the rules of option prioritization may bring totally different stability analysis results (although some solutions, as when both Denmark and Russia simultaneously annex all of the area claimed in the Central Arctic Ocean – state 18 – is strongly stable even if these parametric manipulations are performed).

In order to make the study more shock-sustainable, the aforementioned limitations could, and should, be treated in several ways. A factor analysis and autocorrelation analysis could be additionally performed in order to modify the selection of variables, and weighting of these variables, which are included in the model of state power. Several sets of geographic variables could be tested for effectivity when added into the aggregate

model of state power, and the selection of these variables could be adjusted to data available in open access. Next, at the moment when Canada submits its own set of coordinate points delimiting the claimed area in the Central Arctic Ocean to the CLCS, the country should be included in the model as the third initiating decision-maker. The same is true for the United States, with the only difference that this country should either ratify the LOS Convention (1982) to follow the Canadian case of submission to the CLCS, or take other judicial steps to share its own set of coordinate points delimiting its own claimed area in the Arctic Ocean that would be fully compliant with customary international law (for example, by asking United Nations member states to vote in regard to this intention in order to confirm the validity of such a claim). In this case the United States would become the fourth official initiating decision-maker in the Arctic territorial dispute. And, the subjective factors of analysis – the symbolic power of the decision-makers – (geopolitical representations, 'mental maps') could be added to the objective research using some sort of aggregate symbolic indicator, since the former may have a significant influence upon the latter. However, this indicator should be straightforward in its sub-components which, at least to some extent, must be comparable with cross-national analysis.

The study could also yield different, and probably more detailed, results if the assessment of the role of other decision-makers, both sub-national and international (e.g. China, the European Union, and the specific commercial companies interested in fishing, mining and tourism activities in the region) is taken into consideration in the modeling phase of research. The modeling itself could bring different results if (a) a different power equation consisting of a different set of variables is used, (b) if ranking of decision-makers' preferences is introduced on a cardinal, rather than ordinal basis, and (c) a different game theoretical model is used. Considering the last point (c), it can be especially interesting to see the results of a bi-matrix analysis where Russia and Denmark, Russia and the world, and Denmark and the world simultaneously play a game of a finite number of possible actions against each other (e.g., through a series Prisoner's Dilemma games).

5.3.2 Enriching neo- and non-geopolitical analysis

This study contributes, at the level of methodology and research operationalization, to geopolitical analysis and, specifically, to its neo- and non-versions, as defined by Virginie

Mamadouh in 1998. On the one hand, neoclassical geopolitics[218] is about the relationship between geographical location (and other strategic physical features, as resources) and the foreign policy of a state, and also about the role of geography on the relations between sovereign states. On the other hand, pleading for a scientific, neutral, geography of international relations, non-geopolitical political geographers still consider geographical perspectives within relations among states[219] so that "important themes in non-geopolitics are the (territorial) features of states and the constitution of the state system" (Mamadouh, 1998, p. 243).

The distinction between neo- and non-geopolitics is, in fact, very narrow in terms of the object of study – the interrelation between geography on the one hand, and the socio-political world on the other, so that geography and geographic configurations present certain opportunities for politicians and policy makers (Sloan and Gray, 1999, p. 2). However, in terms of the distance to this object of study, there is a difference between these two approaches: neoclassical geopolitics is mainly about the practical advice to political actors, i. e. the term has a political connotation and the ultimate goal is in certain analytical normativism; while non-geopolitics is about academic reflections which are intentionally distanced from policy advice, i. e. the term has a purely scientific connotation and the approach strives for absolute positivism and neutrality (Mamadouh, 1998, p. 238). This research is in line with the non-geopolitical approach as it offers in Chapter Three valuable suggestions on state power and its fluctuation in time resulting from neutral statistical analysis of hard, judgement-free data on national geographic and social material development. At the same time, we work in the neoclassical geopolitical tradition by showing how these neutral results could be used to produce policy recommendations. These recommendations are based on the results of an analysis of stable solutions and potential coalitions between the nation states in the Arctic territorial dispute, in line with Henry Kissinger's definition of geopolitics as a study of the requirements of equilibrium and the world balance of power (Kissinger, 1979, p. 914), in Chapter Four. And, by focusing on the Arctic, we dilute the contemporary over-

[218] We are not concerned with classical geopolitics, but with its neoclassical version, because we do not view a state as a living organism with temporary borders, but still view a state in terms of 'national interest' and 'national security' and its decision making as it is realized by one person. Also, in the 21st century, the existence of states is no longer defined exclusively by geographical determinism but, instead, the physical environment provides a state with certain threats and opportunities, i.e. with a powerful contextual effect.

[219] In the first issue of *Political Geography Quarterly* (January 1982), the editors-in-chief, Peter J. Taylor and John O'Loughlin highlighted 21 themes deserving the attention of political geographers, and three of them were related to geopolitics.

localization and over-concentration of neoclassical geopolitics[220] (Megoran, 2010, p. 188).

As of these two versions of geopolitical analysis, this research provides one possible operationalization of material geographic and social variables, including the suggestion on the inter-variable links, into a single model of state power. Creating a model of this kind is a goal of many approaches that attempt a systemic and holistic approach, including those developed by Alastair Taylor (1999), Gerard Dussouy (2001, 2006/2007, 2010), Aymeric Chapraude (2007), Guyla Csurgai (2009), and Patrice Gourdin (2010). As these approaches tend to miss even a minimum level of research operationalization that would allow one to produce cross-national and cross-temporal analyses, this research does provide the straightforward rules of operationalization of material geopolitical factors (although the symbolic factors are not part of the model and have to be considered manually on a case-by-case basis).

By focusing on the problematic of the OLCS in the Arctic, this research contributes to the traditional issue of political-geographic research: a border, which is likely to remain a key component of the international scene (Anderson, 1999, p. 125) and is crucial for "…establishing and defending territory of the nation-state" that is always linked "…to processes of identity formation and identification" (Mountz, 2009, pp. 201-203). At the same time, insisting on the acceptance of any potential dispute solutions by the international community in the game modeling phase of research (Chapter Four), it is in line with Rodma Bundy's conclusion that, given that there exists no single method of maritime border delimitation which is obligatory in all occasions, states do retain certain legal and practical relevance (Bundy, 1994, p. 24). By considering acceptance by the world, we reinforce the idea that although state sovereignty rights are more or less universally accepted, they are not automatically absolute, nor can they be legitimized in any permanent way (Painter and Jeffrey, 2009, p. 30). In contrast, each territorial claim should be based on a nuanced evaluation of a combination of factors, since the settlement of boundary dispute requires not only geographical evidence, but also political will underpinned by international law (Anderson, 1999, p. 126). At the same time, the territorial configuration of our research is in line with the traditional political geographic study of regionalism – another traditional issue of political-geographic analysis – which directly affects the political processes in the given area (Dahlman, 2009, p. 214).

[220] Recently, neoclassical geopolitics has tended to proliferate amongst scholars in specific locations (the UK, the USA, and Autralia) and around specfic regions under study (Central Asia and the Anglosphere).

If we consider, separately, the geographic and political components of political geography and geopolitics, some other positive contributions are possible. First, by integrating geographic and social variables into a single model, this study also confirms what the British geographer Sarah Whatmore describes as hybrid geographies: that nature and culture are not antitheses but are closely interconnected (Matthews and Herbert, 2008, p. 142). This study may also provide a potential answer to the key question for the future of geography as a discipline: how should it focus and organize itself in order to maximize its strength, make the most of its opportunities, and fulfill its potential? We do not insist that our logic provides an ultimate answer to the intra-discipline dilemma of the problematic, mutually-exclusive co-existence of human geography and physical geography. What we are trying to demonstrate is that combination of social and physical variables in a meaningful model is possible, in line with the 'integrated-development' scenario which assumes the study of different aspects of geography to be interlinked, interdependent, and mutually supportive (Matthews and Herbert, 2008, pp. 152-156).

Second, opting for a systemic perspective is in line with probably the most popular method of conceiving of politics scientifically, and the perception of a politician as 'an engineer' – a metaphor underlying political science and the role of its manipulator, a mechanic outside of this system trying to make the machinery work in a specific way (Minogue, 2000, p. 87). Finally, because "war, maps, and geography form a powerful triumvirate with one another" (Dodds, 2007, p. 116), cartography continues to be an important component of political power, as maps continue to constitute the only material images of political space (although never neutral or transparent).[221]

By producing maps demonstrating the extension of EEZ borders in the Arctic Ocean to 350nm from the baseline for Denmark/Greenland and Russia (Figure 3-10), and the maximal extension of EEZ borders in the Arctic Ocean – Denmark/Greenland and Russia (Figure 3-11), and according to the sets of submitted delimitation point coordinates in specialized cartographic software, we visualize the potential solutions to the Arctic dispute keeping the mathematical distortion within certain limits (see Section 3.5). By producing Figure 3-11, we were able to calculate the actual disputed areas (in sq km) which were not stated in the Executive summaries submitted to the CLCS by Denmark and Russia, and which are not available in open access, for unknown reasons. By producing Figure 3-10, we were able not only to calculate the potential area (in sq km),

[221] In addition to mathematical distortion (unequal area/angle/distance projection) there exists human-implied, ideological distortion.

but also to present an alternative solution not stated either in the Executive summaries submitted to the CLCS by Denmark and Russia, or anywhere else in open access.

5.3.3 Enriching contemporary social polar research

In 2014, the Nordic Institute for Studies in Innovation, Research and Education (Oslo) and the Danish Agency for Science, Technology and Innovation (Copenhagen) published a unique study, whose main purpose was, among others things, to map the state of affairs in contemporary global publishing on Polar topics, between 2008 and 2013. The results are quite clear: the total number of articles in polar research has increased by 20,7 per cent, compared to a general increase in science of 14,2 per cent over the same period of time, meaning that the output of articles on polar-related themes has increased more than the world average (Aksnes et al., 2014, p. 30).

A country-by-country analysis is presented in Table 5-2. The total numbers are impressive. They count for thousands of published pieces of research for each period studied. The Unites States alone generates almost 30 percent of articles on polar topics, followed by Canada, the United Kingdom, Norway, Germany and Russia. The fifteen countries appearing in Table 5-2 comprise 8 members of the Arctic Council with a naturally high interest in Arctic affairs, and 7 other countries with the highest share of publications related to polar research.

Not being an Arctic nation and not being among these 15 nation states, the Czech Republic is part of the "Other countries" category which managed to generate approximately 13 percent of articles on polar topics. The scientific research on the Polar Regions has been gravitating mainly around Projekt CzechPolar[222] on the basis of Masaryk University (Brno) and the University of South Bohemia (Czech Budejovice), and its results are frequently published in the specialized interdisciplinary journal *Czech Polar Reports*.

In other words, scientists around the world are interested in the Polar Regions and, specifically, in Arctic developments. The major problem arises in the unequal distribution of this scientific interest among the scientific disciplines. Although many different research institutions contribute to social science polar research, a number of specialized

[222] Czech Ministry of Education, Youth and Sports, LM2010009 "CzechPolar – Czech polar stations: Construction and operational expenses" [České polární stanice: Stavba a operační náklady], 2010-2015. Between 2016 and 2019 the Government plans to continue financing the Project with more than 74 million Czech crowns (ČTK, 2016).

and impacted scientific journals dealing with the social reality of the Arctic and the Antarctic are published regularly,[223] many more prominent social scientific journals devote special issues to the polar problematic,[224] and international conferences are held on a regular basis,[225] the share in the total number of published articles and working papers on social polar research is still tiny in comparison with the number of natural sciences-, medicine-, and engineering-related polar studies (if data from Web of Science is considered). Czech polar research is not an exception: the ongoing research project is focused, exclusively, on the natural sciences. By contributing to social polar research this study attempts to make this social scientific research/natural scientific research ratio less uneven.

Table 5-2. Number of articles from 2008 – 2012 by country (Arctic)

Country	Whole count	Fractionalised	Share	Trend
USA	11,984	9,032	29.0%	
Canada	5,269	3,770	12.1%	
The United Kingdom*	4,286	2,479	8.0%	
Norway	2,885	1,704	5.5%	
Germany	3,038	1,669	5.4%	
Russia	1,937	1,380	4.4%	
China	1,784	1,351	4.3%	
The Kingdom of Denmark*	1,685	935	3.0%	
France	1,826	926	3.0%	
Japan	1,286	838	2.7%	
Iceland	1,282	790	2.5%	
Sweden	1,589	749	2.4%	
Australia	1,141	547	1.8%	
Netherlands	903	428	1.4%	
Finland	787	425	1.4%	
Other countries	8,285	4,122	13%	
Total		31,145	100%	

Data from Web of Science – Thompson Reuters.
* The United Kingdom (England, Scotland, Wales & Northern Ireland); the Kingdom of Denmark (Denmark & Greenland).
Trend = yearly number of articles (fractionalised).

Source: Aksnes et al., 2014, p. 32.

We now attempt to contrast the results of this study also against the individual research outcomes dealing with maritime sovereignty and appearing in three more recent and frequently-cited collective monographs dealing with the polar problematic: *The Law of the Sea and the Polar Regions* edited by Erik J. Molenaar, Alex G. Oude Elferink and

[223] Among others, Polar Record (Cambridge Journals), Polar Research (Norwegian Polar Institute) and the Polar Journal (Routledge).
[224] Among others, *Geopolitics*, *Strategic Analysis*, *Foreign Affairs*, and *Indigenous Affairs*.
[225] Among other, *Arctic Frontiers* (annual conference focused on sustainable development in the Arctic).

Donald R. Rothwell[226] (2013); *Polar Geopolitics? Knowledges, Resources and Legal Regimes* edited by Richard C. Powell and Klaus Dodds[227] (2014); and *Geopolitics and Security in the Arctic: Regional Dynamics in a Global World* edited by Rolf Tamnes and Kristine Offerdal[228] (2014).

In case of the first aforementioned monograph, our research operationalization demonstrates one way to overcome the problem of non-existent single definitions of the Arctic discussed in Chapter 1, "The Regional Implementation of the Law of the Sea and the Polar Regions", by Erik J. Molenaar, Alex G. Oude Elferink and Donald R. Rothwell (2013a, pp. 9-11). Although our definition considers parts of the sub-regions of the Artic states that lie south of the Arctic Circle (see Subsection 1.1.1), therefore allowing some distortions, it still allows us to obtain data from national statistical agencies and produce meaningful cross-country comparisons that have a wider scope than the one suggested by specialized, Arctic-specific agencies (e.g. AMAP) dealing with some socio-material issues but not with other strategically significant issues. In other words, a definition of the Arctic based on internal administrative divisions in the Arctic states rather than on the functional definitions used by experts on physical geography (e.g. the tree line and the Arctic Circle) widens the scope of social scientific research. Next, the theoretical configuration of our study fully respects the conclusions in Chapter 4, "The Outer Limits of the Continental Shelf in the Polar Regions" by Alex G. Oude Elferink: the legal regime for any modification of the OLCS is defined in Article 76 of the LOS Convention (1982), and the CLCS plays the central role in the implementation of Article 76 (2013, p. 82). Second, we extend the results of this research by providing more recent data on the individual submissions of Denmark and Russia to the CLCS as, in 2013, neither country had managed to submit their sets of point coordinates delimiting the claimed area in the Central Arctic Ocean. Finally, in Chapter 17, "Interactions between Global and Regional Regimes: Trends and Prospects", Erik J. Molenaar, Alex G. Oude Elferink and Donald R. Rothwell discuss the past and future game challengers for the Arctic regime. Among various physical and social developments in the northernmost region, the authors consider the attempts by Russia to demonstrate own intentions in the Central Arctic Ocean by

[226] Senior experts on international law of the sea and its relation to fisheries and shipping in the polar regions.
[227] Experts on polar regions and lecturers in Human Geography and Geopolitics at Oxford University and Royal Holloway, University of London, respectively.
[228] Senior experts on international relations in the Arctic, lecturers and "Geopolitics in the High North" program, University of Oslo.

planting a titanium flag on the geographic North Pole in 2007 as one such challenger (2013b, p. 404). Our study fully corresponds to this idea, as the core assumption behind our research is that any physical extension of one's own OLCS in the Arctic by Denmark and Russia moves the current state of affairs in the region away from the status quo.

In the second monograph mentioned above, this research extends Chapter 3, "Defining and recognizing the outer limits of the continental shelf in the polar regions" by Harald Brekke in the part dealing with submissions made by states by adding information on the most recent submissions by Russia and Denmark (quite similarly to the case of "The Outer Limits of the Continental Shelf in the Polar Regions" chapter by Alex G. Oude Elferink in the previous monograph). Also, our understanding of the recent non-military, geopolitical development in the Arctic region is in line with the Brekke's idea that "[s]ince 1990, after the end of the cold war, marine scientific research and mapping of the Arctic Ocean and its surroundings has increased substantially" (2014, pp. 45-46), and that "[t]he delimitation of [a]n area of continental shelf beyond 200 nm will be up to the states themselves" (2014, p. 47) – see Subsections 1.1.2 and 1.1.3. Also, this research confirms the claim by Lassi Heininen in Chapter 14, "Northern geopolitics: actors, interests and processes in the circumpolar Arctic", that the entire North has become *politicized* [original emphasis] by, among others, the importance of physical space and strategic natural resources on the one hand, and on the other hand, by the importance of social space, and *interrelations* [our emphasis] in between (2014, p. 254). This multi-dimensional understanding of Arctic geopolitics fully corresponds to the suggested set of twelve variables of state power suggested in the current research.

Finally, regarding the third of the aforementioned monographs, our research is based on the idea that the LOS Convention (1982) and the Recommendation by the CLCS are powerful institutions governing dispute resolution in the Central Arctic Ocean, which coincides with the logic presented in Chapter 3, "The legal-political regime in the Arctic", by Alf Hakon Hoel: "[t]he role of institutions in mitigating current and potential disputes in the Arctic and enhancing cooperation should not be underestimated", because the law of the sea provides clear answers to the "who gets to decide what" questions (2014, p. 66). However, we cannot fully agree with the claim that the Arctic is a peaceful region with most bilateral maritime boundaries settled, which removes the potential source of friction (ibid.). Having the bilateral boundaries settled does not mean international waters in the Central Arctic Ocean do not constitute a source of tension between the claimant states and the rest of international community. If that were the case, Canada would not

have reacted to the planting a titanium flag on the geographic North Pole by Russia in 2007, but it did react by voicing the intention to increase its own military presence in the region. How could anyone do not consider these two developments as interrelated? By differentiation the decision-makers in the Arctic territorial dispute into 'initiating' and 'reacting', we confirm the claim made by Kristine Offerdal in Chapter 4, "Interstate relations: the complexities of Arctic politics", that the Arctic states need to show their own, national audiences that Arctic policies are not only being developed, but also implemented (2014, p. 92). In fact, Denmark and Russia did manage to submit the distinct sets of geographic coordinate points delimiting the claimed portion of the Central Arctic Ocean that, in a judicial sense, are necessary for a 'functional' submission to the CLCS, in contrast to Canada, whose claim remains only a potential claim without these delimiting coordinates. The same is true for the United States, which is not even party to the LOS Convention (1982). In other words, Denmark and Russia are more straightforward in their Arctic intentions than are Canada and the United States.

In sum, as stated in the introduction to this study, social polar research focuses on several themes: descriptive statements on the diversity of polar geography (Dowdeswell and Hambrey 2002, Woodford 2003, Stein 2008), or detailed description of the historical evolution of Arctic regional cooperation (Chaturvedi 1996, Koivurova 2009, Exner-Pirot 2012, Hough 2013), or summaries of the expected regional and global geopolitical effects from the changing environment (Anderson 2009, Chapman 2011, Ostreng et al. 2013). The main logic of this work is in line with the majority of modern polar analyses: the region is about to face a dramatic change in its physical environment and human constructs. In this sense, the conclusions are similar to those of, among others, Osherenko and Young 1989, Chaturvedi 1996, Bird et al. 2004, Christopher and Fast 2008, and Crawford et al. 2008. At the same time, this work does not agree with authors who stress that only a military conflict between the Arctic states is the most probable future of the northernmost region (for example, Reid 2007). In contrast, we have shown that even in the conflictual environment of a zero-sum territorial dispute in the Central Arctic Ocean, a coordinated, compromise-driven action is possible.

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Appendices

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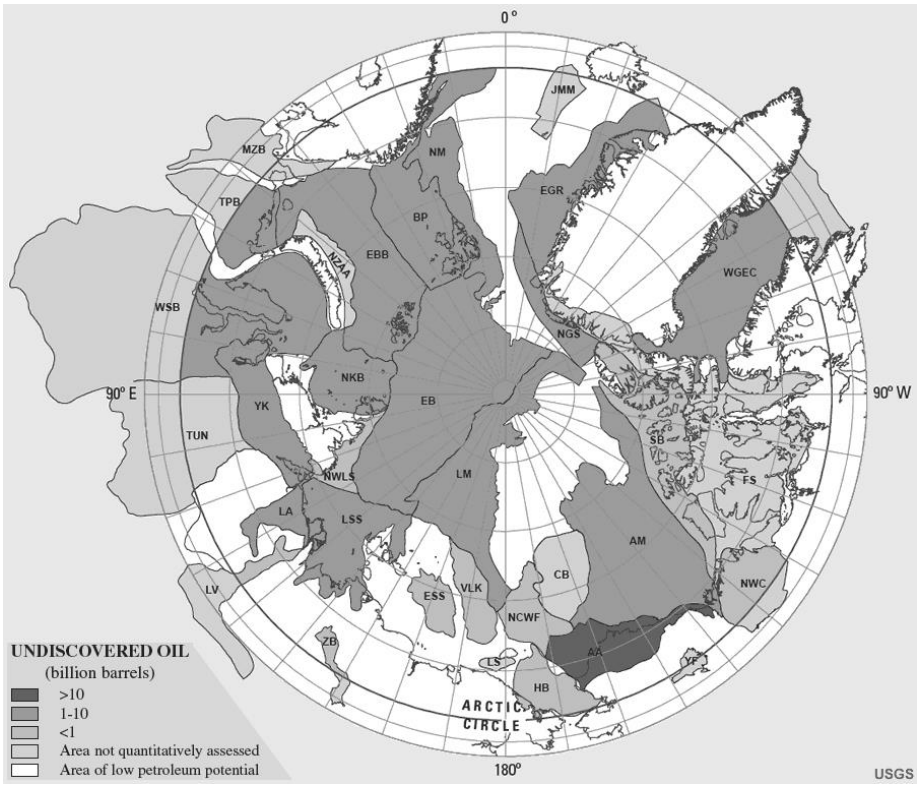
Appendix A. Non-living resources in the Arctic Ocean

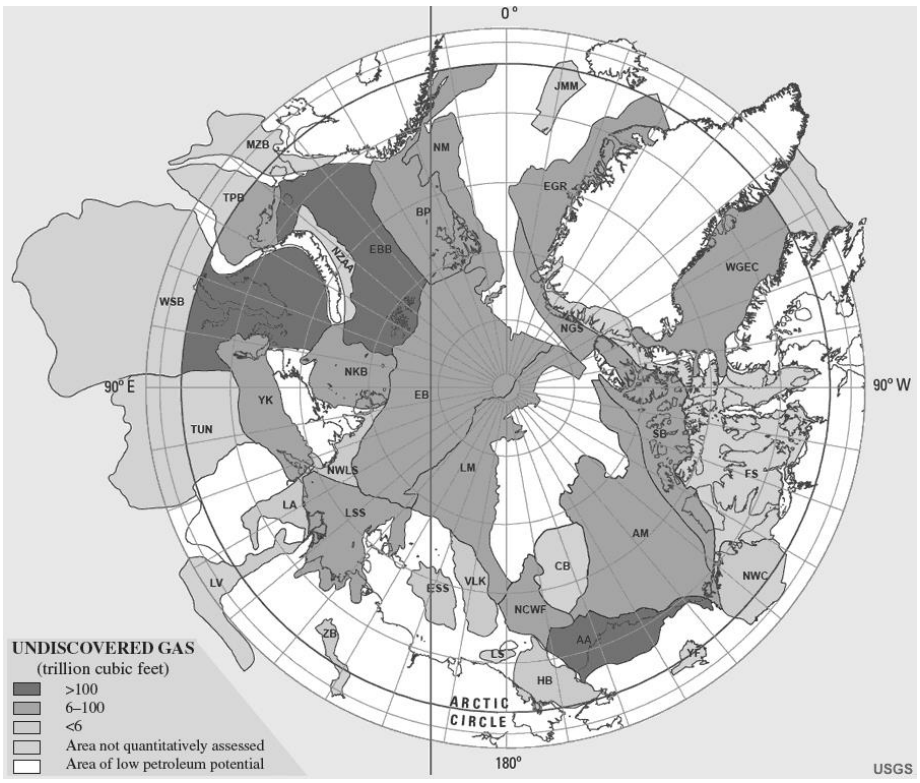
Circum-Arctic resources appraisal by United States Geological Survey (2008)

[MMBO, million barrels of oil; BCFG, billion cubic feet of natural gas; MMBNGL, million barrels of natural gas liquids; NQA, not quantitatively assessed. Results shown are fully risked mean estimates. For gas accumulations, all liquids are included as NGL (natural gas liquids). Provinces are listed in ranked order of total barrels of oil and oil-equivalent natural gas (BOE).]

Province Code	Province	Oil (MMBO)	Total Gas (BCFG)	NGL (MMBNGL)	BOE (MMBOE)
WSB	West Siberian Basin	3,659.88	651,498.56	20,328.69	132,571.66
AA	Arctic Alaska	29,960.94	221,397.60	5,904.97	72,765.52
EBB	East Barents Basin	7,406.49	317,557.97	1,422.28	61,755.10
EGR	East Greenland Rift Basins	8,902.13	86,180.06	8,121.57	31,387.04
YK	Yenisey-Khatanga Basin	5,583.74	99,964.26	2,675.15	24,919.61
AM	Amerasia Basin	9,723.58	56,891.21	541.69	19,747.14
WGEC	West Greenland-East Canada	7,274.40	51,818.16	1,152.59	17,063.35
LSS	Laptev Sea Shelf	3,115.57	32,562.84	867.16	9,409.87
NM	Norwegian Margin	1,437.29	32,281.01	504.73	7,322.19
BP	Barents Platform	2,055.51	26,218.67	278.71	6,704.00
EB	Eurasia Basin	1,342.15	19,475.43	520.26	5,108.31
NKB	North Kara Basins and Platforms	1,807.26	14,973.58	390.22	4,693.07
TPB	Timan-Pechora Basin	1,667.21	9,062.59	202.80	3,380.44
NGS	North Greenland Sheared Margin	1,349.80	10,207.24	273.09	3,324.09
LM	Lomonosov-Makarov	1,106.78	7,156.25	191.55	2,491.04
SB	Sverdrup Basin	851.11	8,596.36	191.20	2,475.04
LA	Lena-Anabar Basin	1,912.89	2,106.75	56.41	2,320.43
NCWF	North Chukchi-Wrangel Foreland Basin	85.99	6,065.76	106.57	1,203.52
VLK	Vilkitskii Basin	98.03	5,741.87	101.63	1,156.63
NWLS	Northwest Laptev Sea Shelf	172.24	4,488.12	119.63	1,039.90
LV	Lena-Vilyui Basin	376.86	1,335.20	35.66	635.06
ZB	Zyryanka Basin	47.82	1,505.99	40.14	338.95
ESS	East Siberian Sea Basin	19.73	618.83	10.91	133.78
HB	Hope Basin	2.47	648.17	11.37	121.87
NWC	Northwest Canada Interior Basins	23.34	305.34	15.24	89.47
MZB	Mezen' Basin	NQA	NQA	NQA	NQA
NZAA	Novaya Zemlya Basins and Admiralty Arch	NQA	NQA	NQA	NQA
TUN	Tunguska Basin	NQA	NQA	NQA	NQA
CB	Chuckhi Borderland	NQA	NQA	NQA	NQA
YF	Yukon Flats (part of Central Alaska Province)	NQA	NQA	NQA	NQA
LS	Long Strait	NQA	NQA	NQA	NQA
JMM	Jan Mayen Microcontinent	NQA	NQA	NQA	NQA
FS	Franklinian Shelf	NQA	NQA	NQA	NQA
Total		89,983.21	1,668,657.84	44,064.24	412,157.09

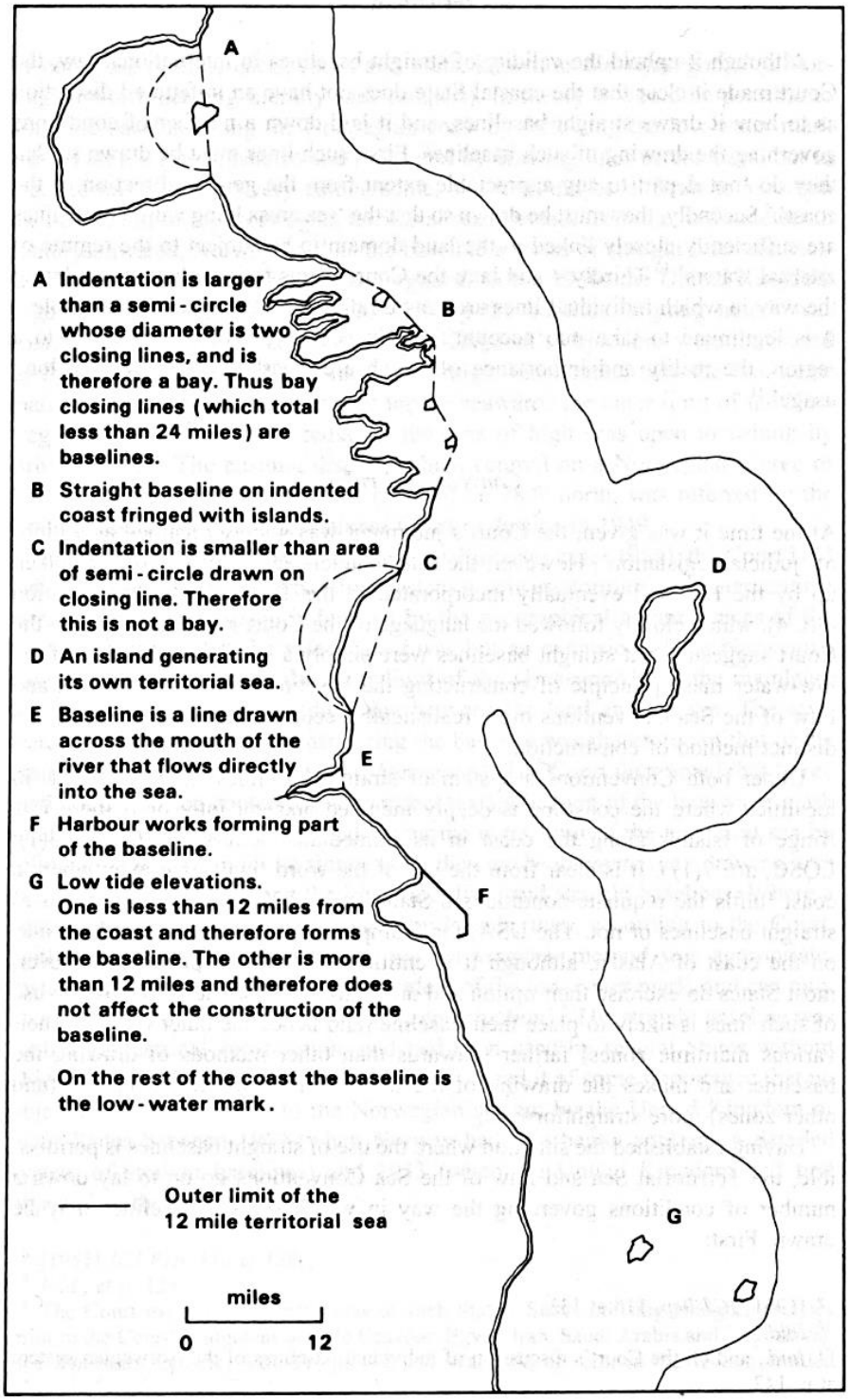
Source: Bird et al. 2008, p. 1





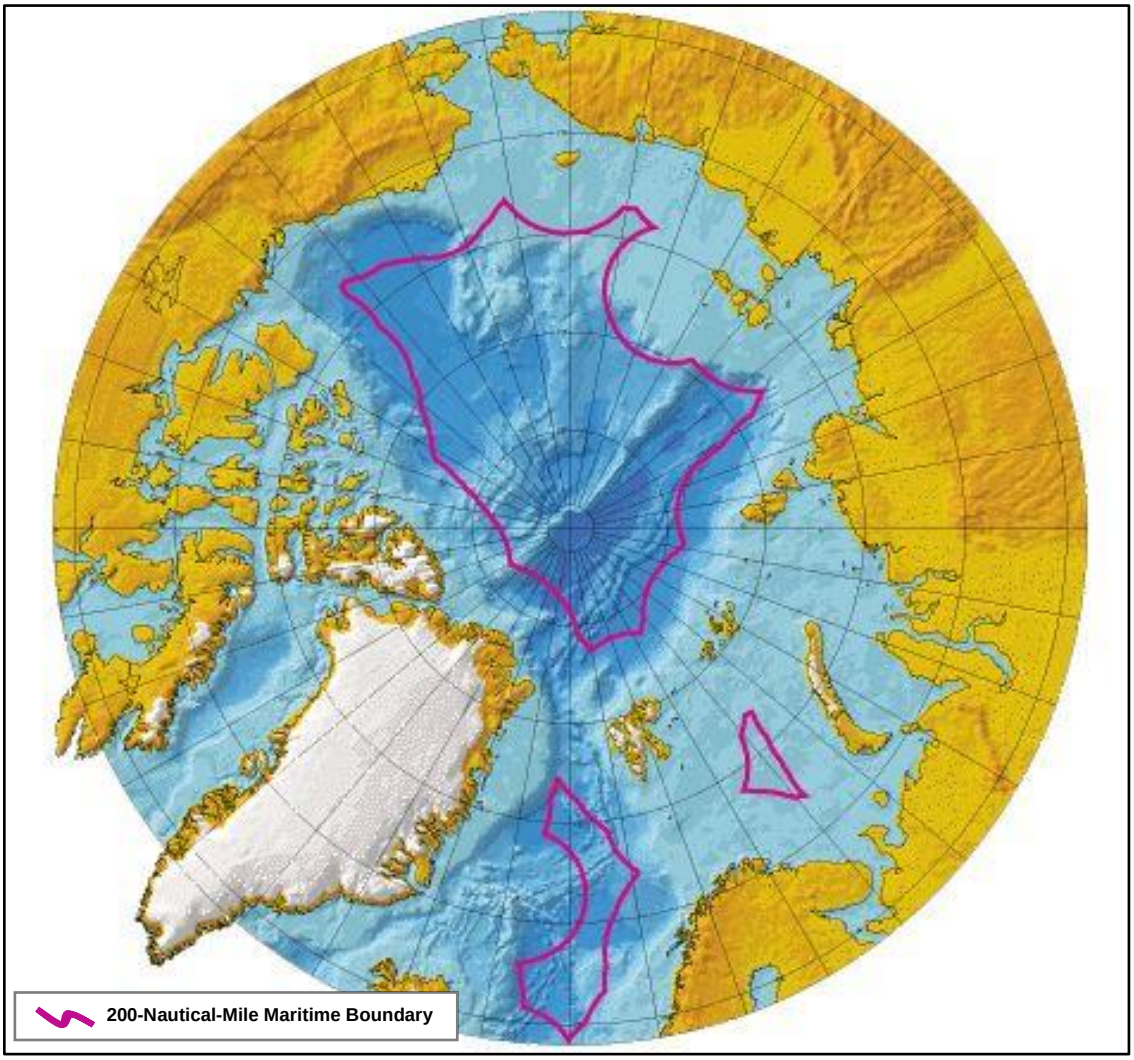
Source: Bird et al. 2008, pp. 3-4.

Appendix B. Rules of national baseline construction



Source: Churchill and Lowe, 1999, p. 36.

Appendix C. International waters in the wider Arctic maritime region



Source: International Bathymetric Chart of the Arctic Ocean, IOC/IASC/IHO Editorial Board, 1998.

Appendix D. Members of the Commission on the Limits of the Continental Shelf, 2012-2017

Name	Nationality
Arshad, Muhammad	Pakistan
Awosika, Lawrence Folajimi(CH)	Nigeria
Carrera Hurtado, Galo(V-CH)	Mexico
Charles, Francis L.	Trinidad and Tobago
Glumov, Ivan F. (V-CH)	Russian Federation
Haworth, Richard Thomas	Canada and United Kingdom of Great Britain and Northern Ireland
Heinesen, Martin Vang	Denmark
Jaoshvili, George	Georgia
Kalngui, Emmanuel	Cameroon
Lu, Wenzheng	China
Madon, Mazlan Bin	Malaysia
Mahanjane, Estevao Stefane	Mozambique
Marques, Jair Alberto Ribas	Brazil
Njuguna, Simon	Kenya
Oduro, Isaac Owusu	Ghana
Park, Yong Ahn(V-CH)	Republic of Korea
Paterlini, Carlos Marcelo	Argentina
Ravindra, Rasik*	India
Roest, Walter R. (V-CH)	Netherlands
Urabe, Tetsuro	Japan
Uścinowicz, Szymon	Poland

(CH) - Chairman

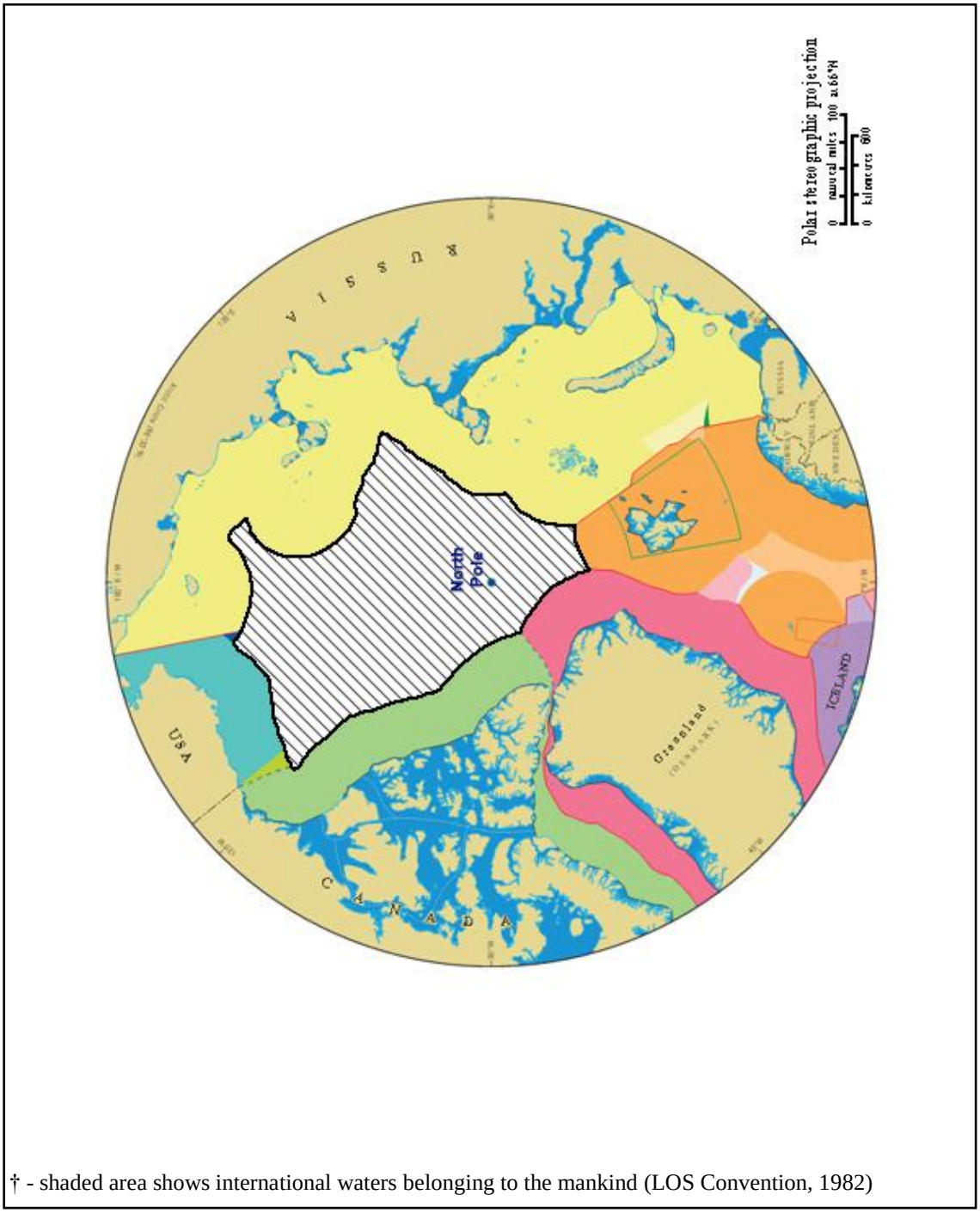
(V-CH) - Vice-Chairman

* - Mr. Ravindra was elected at the twenty-fourth Meeting of States Parties to the United Nations Convention on the Law of the Sea to fill the vacancy due to the resignation of Mr.Sivaramakrishnan Rajan.

Source: Members of the Commission on the Limits of the Continental Shelf, 2015. Available at: <http://www.un.org/depts/los/clcs_new/commission_members.htm#Members>

Appendix E. Options in the Arctic game and different territorial configurations

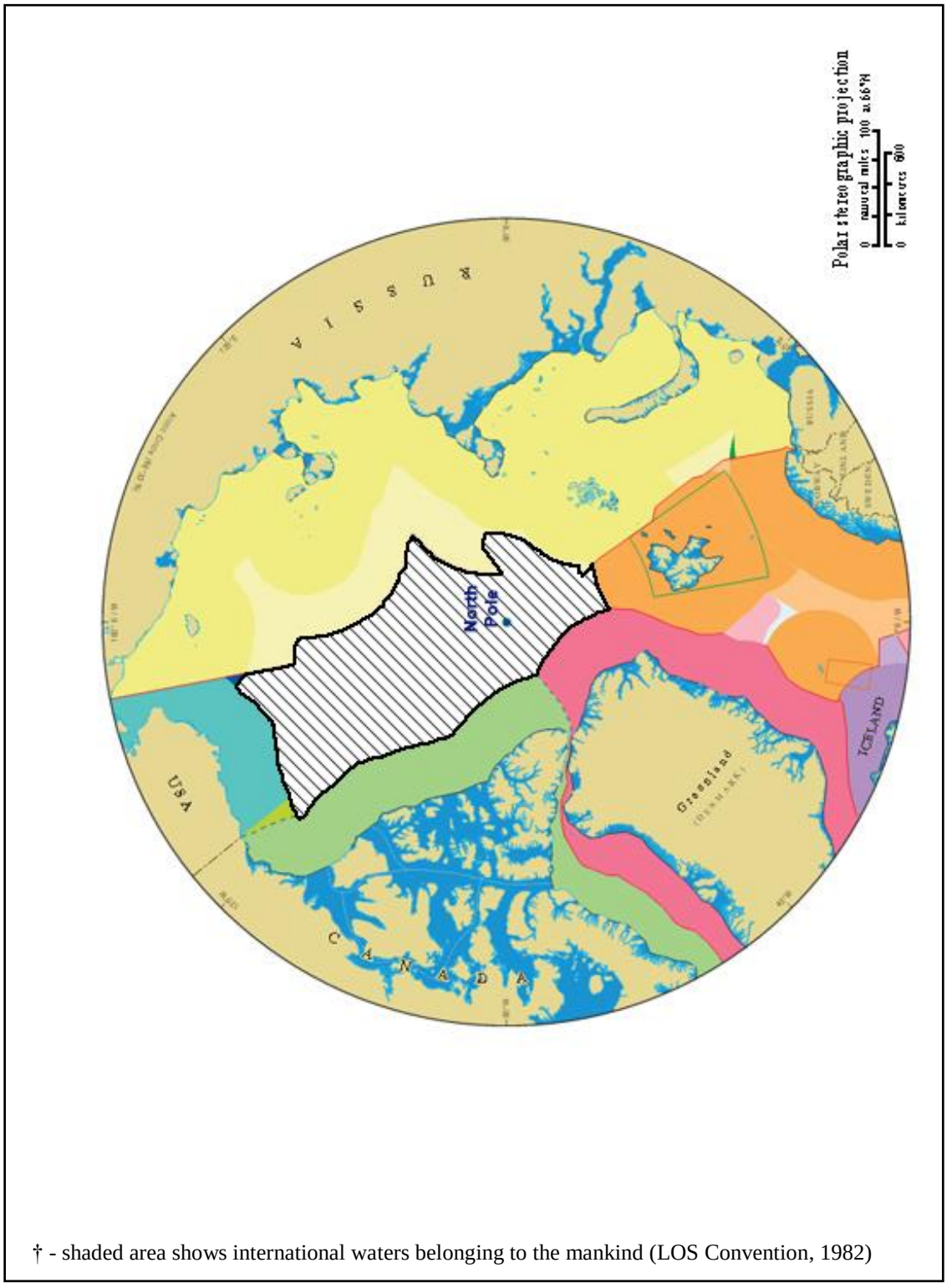
Option I – Status quo



† - shaded area shows international waters belonging to the mankind (LOS Convention, 1982)

Source: author, based on the LOS Convention (1982) and "Map of Arctic sovereignty claims" (IBRU, 2015).

Option II



† - shaded area shows international waters belonging to the mankind (LOS Convention, 1982)

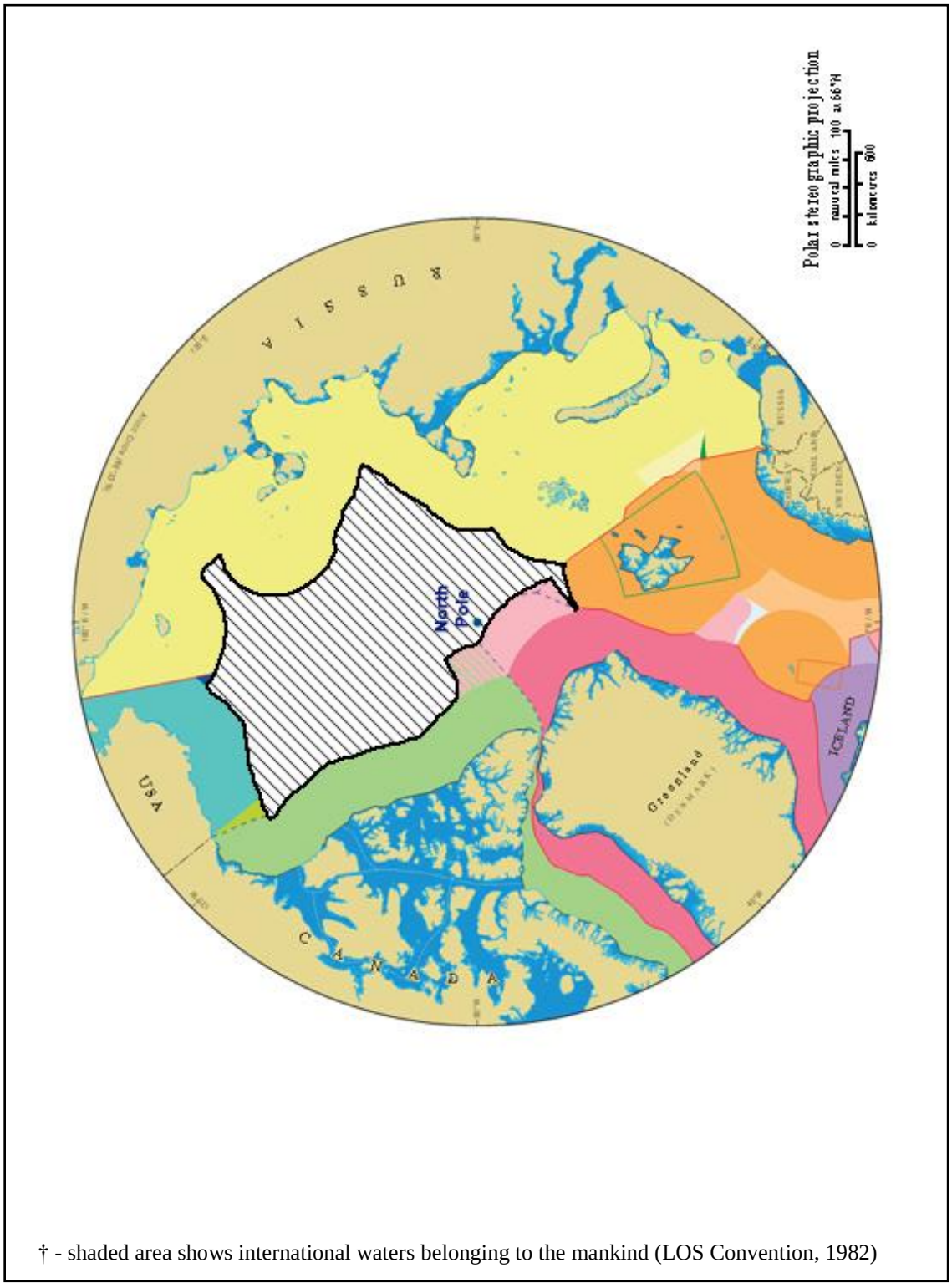
Source: author, based on the LOS Convention (1982) and "Map of Arctic sovereignty claims" (IBRU, 2015).

Option III

† - shaded area shows international waters belonging to the mankind (LOS Convention, 1982)

Source: author, based on the LOS Convention (1982) and "Map of Arctic sovereignty claims" (IBRU, 2015).

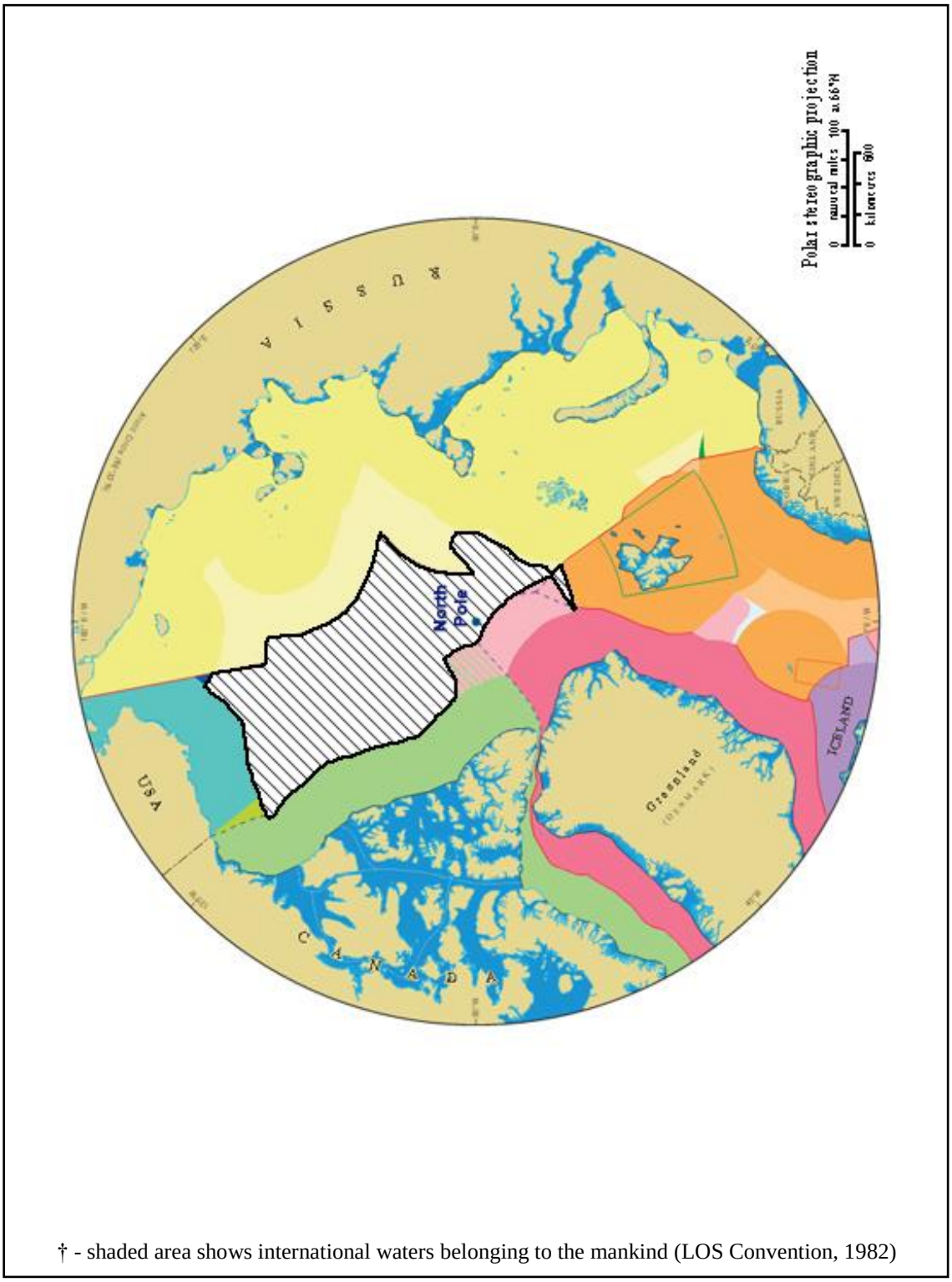
Option IV



† - shaded area shows international waters belonging to the mankind (LOS Convention, 1982)

Source: author, based on the LOS Convention (1982) and "Map of Arctic sovereignty claims" (IBRU, 2015).

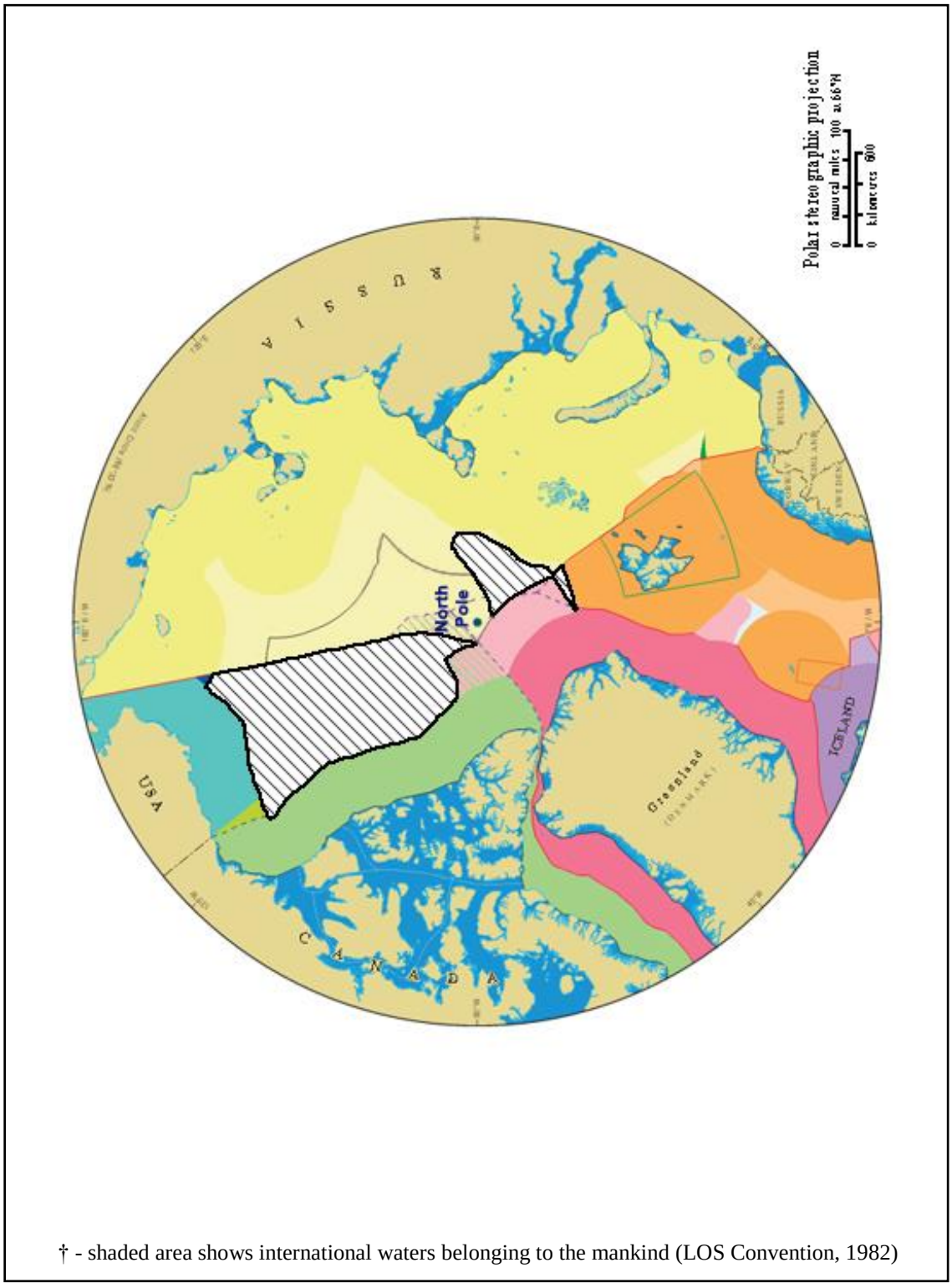
Option V – Compromise



† - shaded area shows international waters belonging to the mankind (LOS Convention, 1982)

Source: author, based on the LOS Convention (1982) and "Map of Arctic sovereignty claims" (IBRU, 2015).

Option VI



† - shaded area shows international waters belonging to the mankind (LOS Convention, 1982)

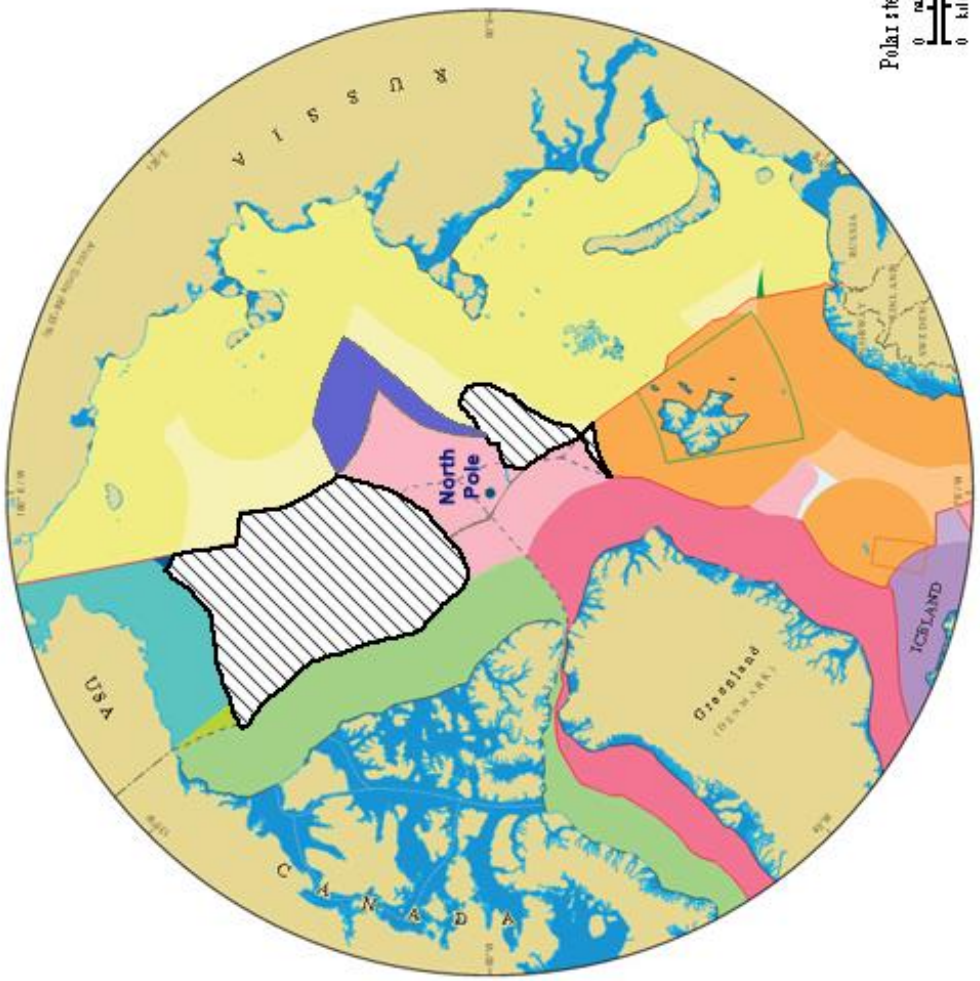
Source: author, based on the LOS Convention (1982) and "Map of Arctic sovereignty claims" (IBRU, 2015).

Option VII

† - shaded area shows international waters belonging to the mankind (LOS Convention, 1982)

Source: author, based on the LOS Convention (1982) and "Map of Arctic sovereignty claims" (IBRU, 2015).

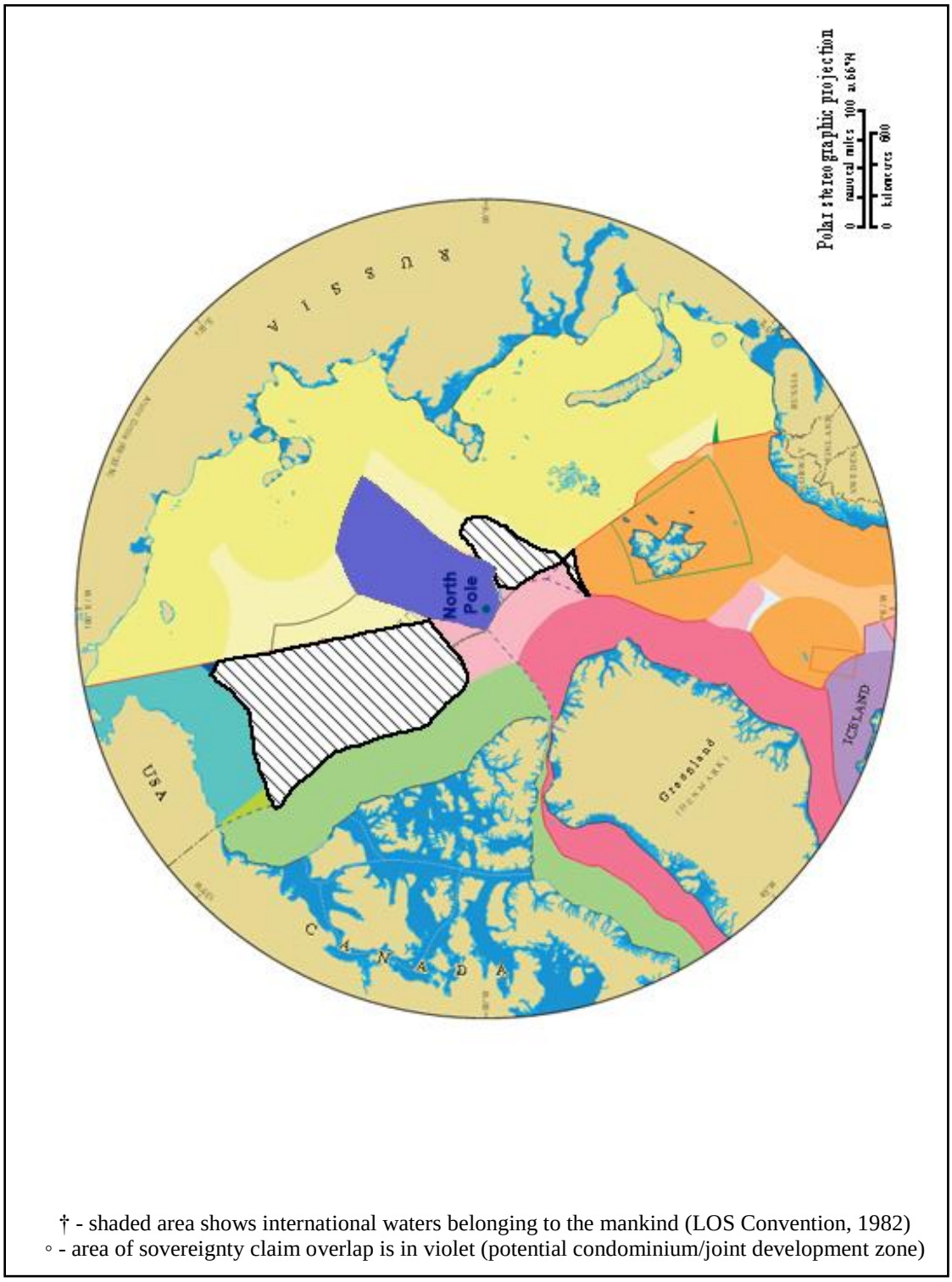
Option VIII



† - shaded area shows international waters belonging to the mankind (LOS Convention, 1982)
◦ - area of sovereignty claim overlap is in violet (potential condominium/joint development zone)

Source: author, based on the LOS Convention (1982) and "Map of Arctic sovereignty claims" (IBRU, 2015).

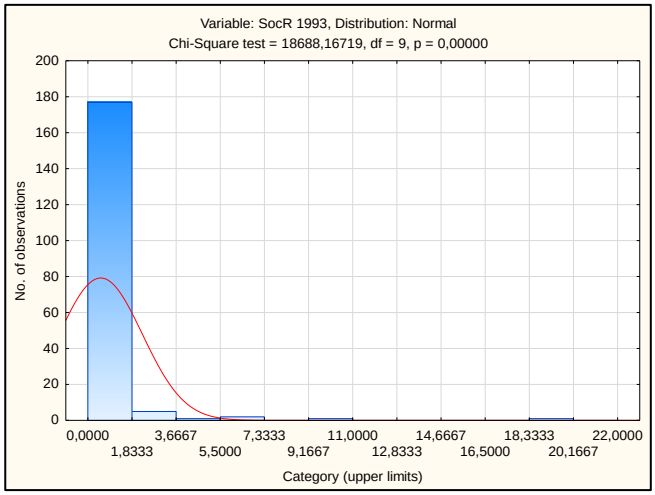
Option IX – Full annexation



† - shaded area shows international waters belonging to the mankind (LOS Convention, 1982)
◦ - area of sovereignty claim overlap is in violet (potential condominium/joint development zone)

Source: author, based on the LOS Convention (1982) and "Map of Arctic sovereignty claims" (IBRU, 2015).

Appendix G. Testing *SocR* and *GeoSocR* for normality (χ^2) [STATISTICA 10]



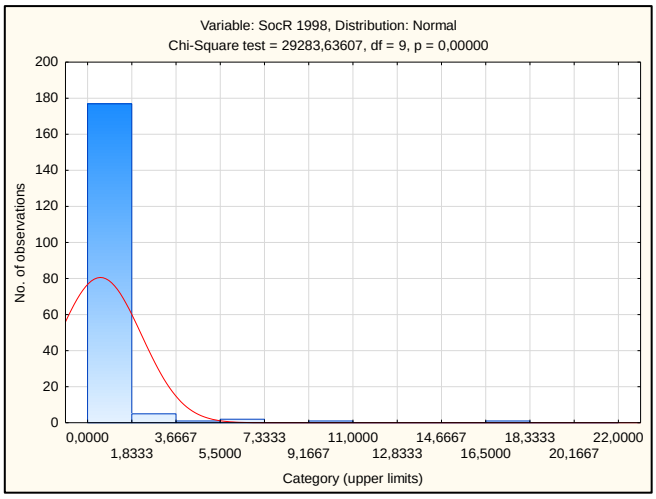
***SocR* - 1993**

H_0: tested random values have normal (Gaussian) distribution

H_1: tested random values do not have normal (Gaussian) distribution

Critical value of χ^2 with df=9 and α=0,01 is 21,66

Because 18688,16 > 21,66, H_0 is rejected



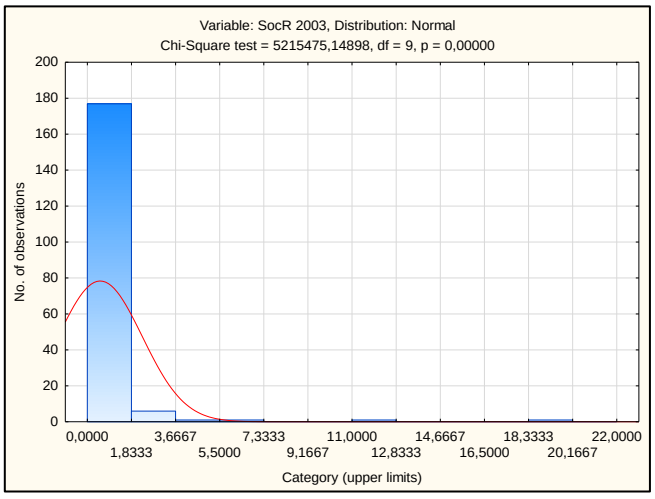
***SocR* - 1998**

H_0: tested random values have normal (Gaussian) distribution

H_1: tested random values do not have normal (Gaussian) distribution

Critical value of χ^2 with df=9 and α=0,01 is 21,66

Because 29283,63 > 21,66, H_0 is rejected



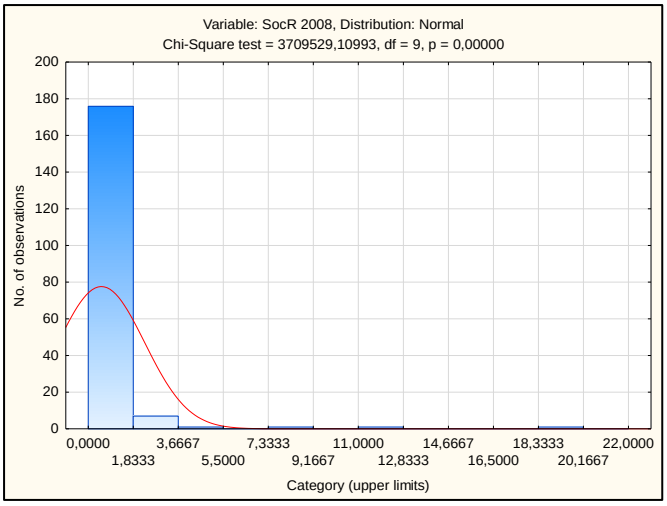
***SocR* - 2003**

H_0: tested random values have normal (Gaussian) distribution

H_1: tested random values do not have normal (Gaussian) distribution

Critical value of χ^2 with df=9 and α=0,01 is 21,66

Because 5215475,14 > 21,66, H_0 is rejected



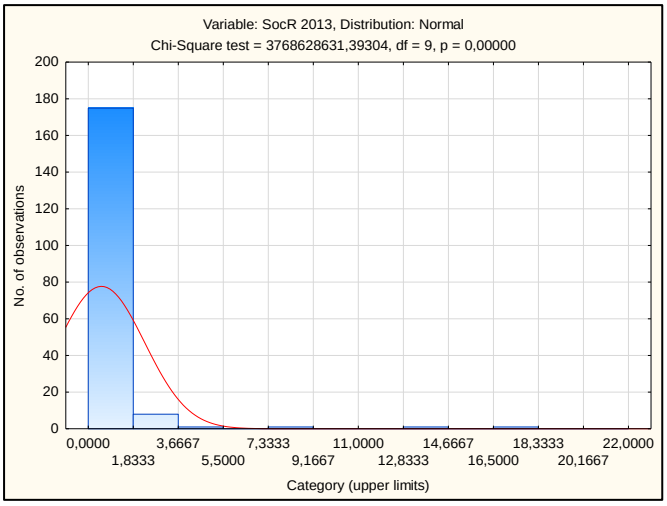
***SocR* - 2008**

H_0: tested random values have normal (Gaussian) distribution

H_1: tested random values do not have normal (Gaussian) distribution

Critical value of χ^2 with df=9 and α=0,01 is 21,66

Because 3709529,1 > 21,66, H_0 is rejected



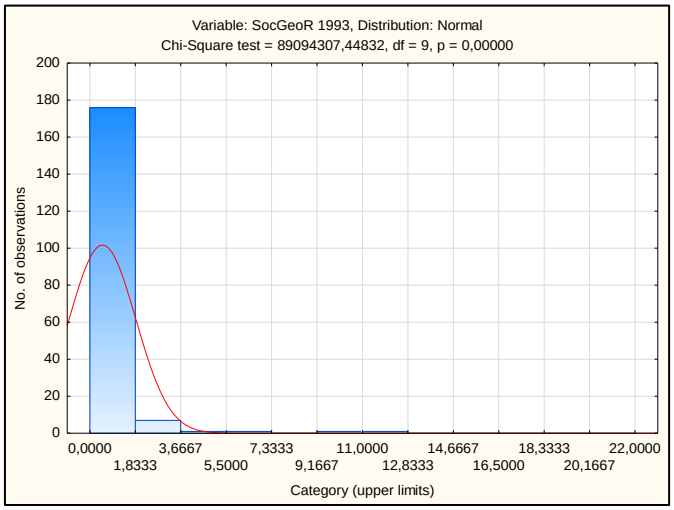
***SocR* - 2013**

H_0: tested random values have normal (Gaussian) distribution

H_1: tested random values do not have normal (Gaussian) distribution

Critical value of χ^2 with df=9 and α=0,01 is 21,66

Because 3768628631,3 > 21,66, H_0 is rejected



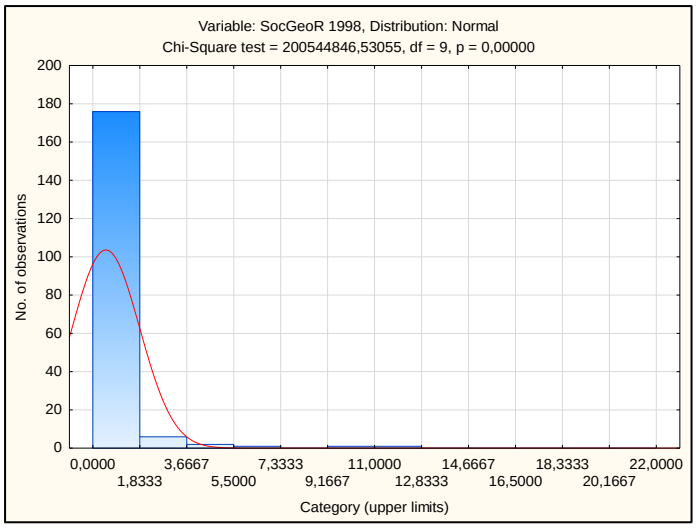
***SocGeoR* - 1993**

H_0: tested random values have normal (Gaussian) distribution

H_1: tested random values do not have normal (Gaussian) distribution

Critical value of χ^2 with df=9 and α=0,01 is 21,66

Because 89094307,44 > 21,66, H_0 is rejected



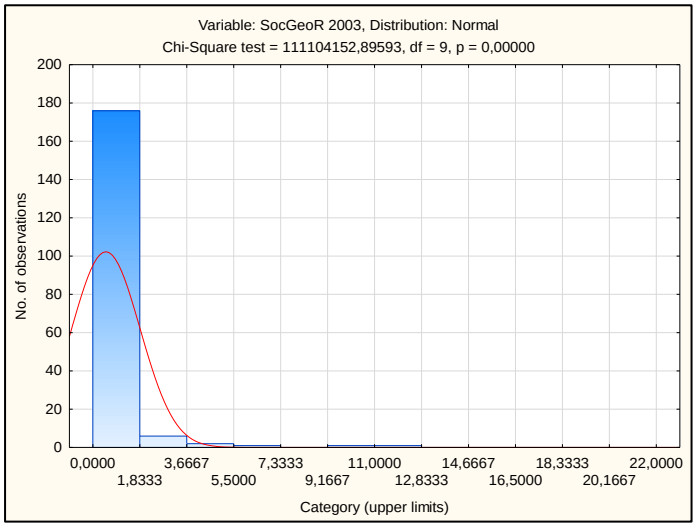
***SocGeoR* - 1998**

H_0: tested random values have normal (Gaussian) distribution

H_1: tested random values do not have normal (Gaussian) distribution

Critical value of χ^2 with df=9 and α=0,01 is 21,66

Because 200544846,5 > 21,66, H_0 is rejected



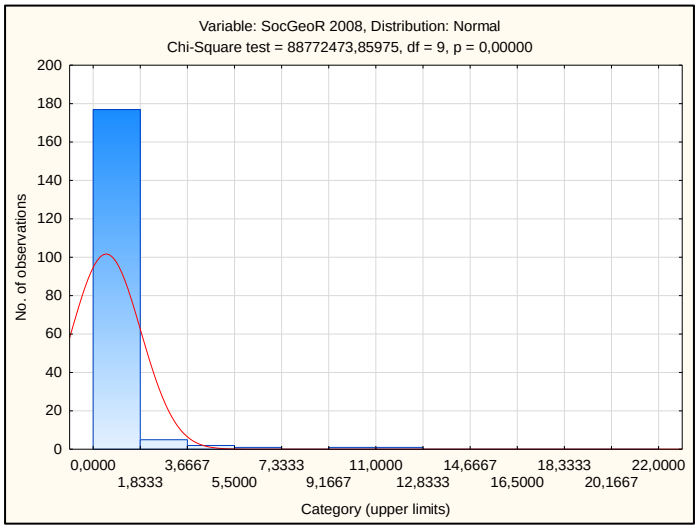
***SocGeoR* - 2003**

H_0: tested random values have normal (Gaussian) distribution

H_1: tested random values do not have normal (Gaussian) distribution

Critical value of χ^2 with df=9 and α=0,01 is 21,66

Because 200544846,5 > 21,66, H_0 is rejected



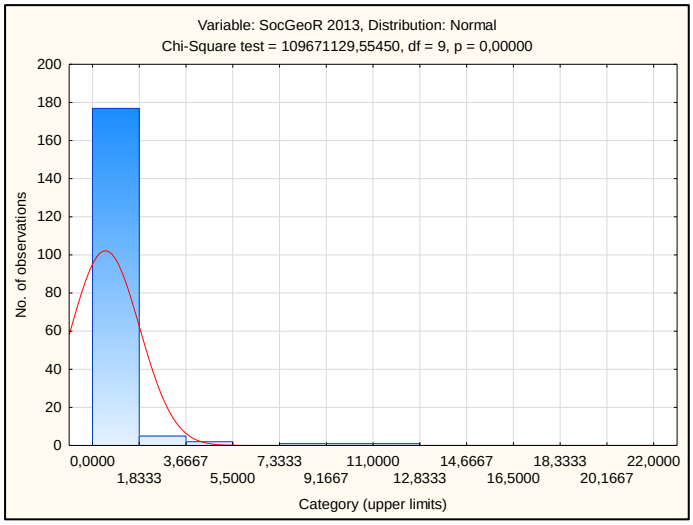
***SocGeoR* - 2008**

H_0: tested random values have normal (Gaussian) distribution

H_1: tested random values do not have normal (Gaussian) distribution

Critical value of χ^2 with df=9 and α=0,01 is 21,66

Because 88772473,85 > 21,66, H_0 is rejected



***SocGeoR* - 2008**

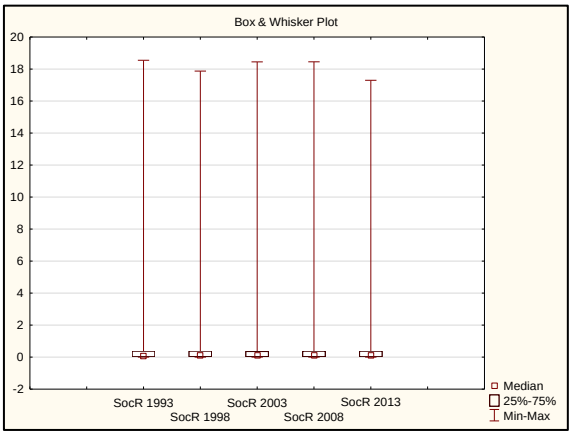
H_0: tested random values have normal (Gaussian) distribution

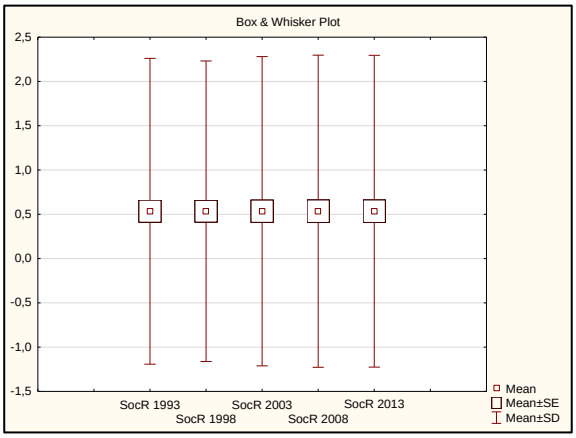
H_1: tested random values do not have normal (Gaussian) distribution

Critical value of χ^2 with df=9 and α=0,01 is 21,66

Because 109671129,55 > 21,66, H_0 is rejected

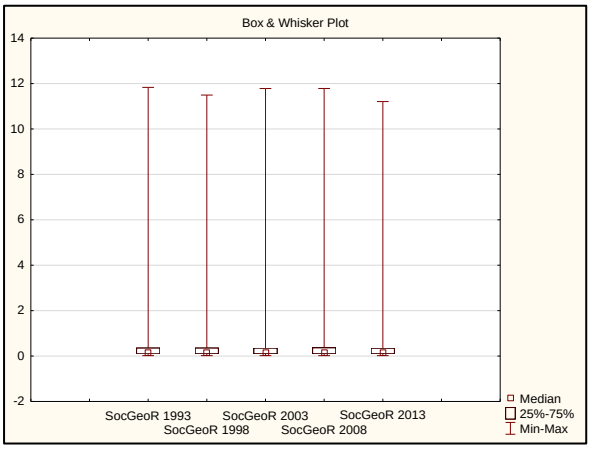
Median versus Mean - *SocR*





Median values reflect the sample better than mean values.

Median versus Mean - *SocGeoR*



Median values reflect the sample better than mean values.

Appendix H. Local resources of the Arctic states: data aggregation methodology

Area (thou. sq. km):
"Arctic provinces": sub-national administrative division as of 2010 applies. Variable is constant throughout the whole period under consideration.

Canada: Encyclopedia Britannica <http://www.britannica.com> : "Canada", "Northwest Territories", "Nunavut", "Yukon", "Quebec", "Newfoundland and Labrador".
Denmark: Encyclopedia Britannica <http://www.britannica.com> : "Greenland", "Faroe Islands".
Finland: ArcticStat <http://www.arcticstat.org> : Kainuu, Lapland, North Ostrobothnia. "Area, Population By Age, Language And Educational Level, Population Change, Industrial Structure And Household-Dwelling Units By Municipality."
Iceland: Encyclopedia Britannica <http://www.britannica.com> : "Iceland".
Norway: Statistics Norway <http://www.ssb.no> : Finnmark, Nordland, Svalbard, Tromso. "19 Total area, distribution of area and length of coastline, by county."
Russia: Rosstat <http://www.gks.ru> : Arkhangelsk and Nenets, Chukchi, Karelia, Khanty-Mansii, Komi, Krasnoyarsk, Murmansk, Sakha/Yakutia, Yamal-Nenets. "Main Socio-Economic Indicators Of The Regions Of The Russian Federation In 2010."
Sweden: Encyclopedia Britannica <http://www.britannica.com> : "Norrbotten", "Västerbotten".
United States: Encyclopedia Britannica <http://www.britannica.com> : "Alaska."

Rel-Loc (average, thou. km to the geographic North Pole, 90°N):
Distance Calculator calculates the air distance between any two locations on Earth. Air distance is the shortest, most direct distance between any two locations as measured by drawing a path along the surface of the Earth. This is different from tracing a path between two locations by going through the Earth's interior.
The variable reflects relative proximity on land as a distance between each Arctic province's regional capital(s) (administrative center(s) of polar provinces) and the Geographic North Pole (90°N).
Except the Alaska and Iceland cases, for each Arctic actor, the non-weighted average of results for all polar provinces is calculated for each Arctic state. The variable is configured at constant values throughout the entire period under consideration.

Arctic state	Polar province(s)	Province capital	Air distance to the North Pole (thou. km)
CAN	Newfoundland and Labrador	St. John's	4,7
	Northwest Territories	Yellowknife	0,4
	Quebec	Québec City	4,8
	Nunavut	Iqaluit	2,9
	Yukon	Whitehorse	3,2
	Average		*3,2*
DNK	West Greenland	Nuuk	2,8
	North Greenland	Thule	1,5
	East Greenland	Tasiilaq	2,7
	Average		*2,3*
FIN	Lapland	Rovaniemi	2,7
	North Ostrobothnia	Oulu	2,7
	Average		*2,7*
ISL		*Reykjavik*	*2,8*
NOR	Finnmark	Vadsø	2,2
	Nordland	Bodø	2,5
	Svalbard	Longyearbyen	1,3
	Troms	Tromsø	2,2
	Average		*2*
RUS	Arkhangelsk and Nenets	Arkhangelsk	0,9
	Chukchi	Anadyr	6,2
	Karelia	Petrozavodsk	3,1
	Komi	Syktyvkar	3,1
	Krasnoyarsk	Krasnoyarsk	3,7

	Murmansk	Murmansk	2,3
	Sakha (Yakutia)	Yakutsk	3,1
	Yamalo-Nenets	Salekhard	2,6
	Average		*3,1*
SWE	Norrbotten	Luleå	2,7
	Vasterbotten	Umeå	2,9
	Average		*2,8*
USA	*Alaska*	*Juneau*	*3,5*

Source: <timeanddate.com/worldclock/distance.html>

EEZ (thou. sq. km):

Total area of the Exclusive Economic Zone under the jurisdiction of an Arctic state generated by the coastline of each province facing the Arctic Ocean. The ocean's basin consists not only of the Arctic Sea, but of the Northern part of Atlantic, Barents Sea, Kara Sea, Laptev Sea, East Siberian Sea, Chukchi Sea and Beaufort Sea.

Depending on the availability of data, the variable is configured at constant values throughout the entire period under consideration. Three provinces are landlocked (Kainuu, Khanty-Mansii and Komi) and are therefore assigned a zero value. Data for Alaska (Arctic sea basin-only) and the Faroe Islands, Greenland, Iceland, Svalbard and Jan Mayen are imported without modification from the *Sea around Us Project*. In all other cases, the EEZ per province is not known. We therefore transform the available data with basic arithmetic algorithms. First, for each Arctic state, we find the length of coastline (<http://www.daftlogic.com/projects-advanced-google-maps-distance-calculator.htm>) and EEZ (<www.seaaroundus.org/eez/>). Next, in order to overcome the coastline paradox,[229] we "reconstruct" exactly the same length of coastline for each Arctic state in *DaftLogic: Advanced Google Maps Distance Calculator*. Screenshots for particular provinces are available on request. Using the same maps and markers, we calculate the percentile share of each province's coastline in the country's total coastline. Finally, we recalculate the country's total EEZ according to the provincial coastline percentile value.

Canada: <wediscovercanada.ca>, <www.seaaroundus.org/eez/> : only Arctic Sea and NW Atlantic EEZ
Denmark: <www.seaaroundus.org/eez/> : total country EEZ
Finland: <geography.about.com/Finland>, <www.seaaroundus.org/eez/> : total country EEZ
Iceland: <www.seaaroundus.org/eez/>, <www.seaaroundus.org/eez/> : total country EEZ
Norway: <geography.about.com/library/cia/blcnorway.htm>, <www.seaaroundus.org/eez/> : total country EEZ
Russia: <www.gks.ru>, <www.seaaroundus.org/eez/> : only Barents Sea, Kara Sea, Laptev Sea, East Siberian Sea, Chukchi Sea EEZ
Sweden: <www.scb.se/statistik/MI/MI0812/2012A01/MI0812_2012A01_SM_MI50SM1301.pdf>, <www.seaaroundus.org/eez/> : total country EEZ
United States: <www.seaaroundus.org/eez/> : only Beaufort Sea EEZ

Shelf (thou. sq. km):

Total shelf area under the jurisdiction of an Arctic state generated by the coastline of each Arctic province facing the Arctic Ocean. The ocean consists of the Arctic Sea, the Northern part of Atlantic, Barents Sea, Kara Sea, Laptev Sea, East Siberian Sea, Chukchi Sea and Beaufort Sea.

CAN	<www.seaaroundus.org/eez/> : only Arctic Sea and NW Atlantic shelf
DNK	<www.seaaroundus.org/eez/> : only Greenland shelf
FIN	No shelf in the Arctic Ocean
ISL	No shelf in the Arctic Ocean
NOR	<www.seaaroundus.org/eez/> : only Svalbard Isl. and Jan Mayen Isl. shelf
RUS	<www.seaaroundus.org/eez/> : only Barents Sea, Kara Sea, Laptev Sea, East Siberian Sea, Chukchi Sea Shelf
SWE	No shelf in the Arctic Ocean
USA	<www.seaaroundus.org/eez/> : only Beaufort Sea shelf

[229] Due to the fractal-like properties of coastlines, the length of the coastline depends on the method used to measure it.

Temperature (average, °C), Jan. and Jul.:
Average temperature in January and July as appears on Weather Dashboard <http://weatherspark.com> at weather stations located within the borders of Arctic provinces. If data from several weather stations is available, a simple average is calculated. The particular weather stations are listed below.

Canada: Yellowknife Airport (Northwest Territories); average: Iqaluit Airport, Hat Island (Nunavut); average: Komakuk Beach, Dawson City Airport (Yukon); average: La Grande-4 Airport and Inukjuak Airport (Quebec); average: Cape Kakkiviak and Cartwright (Newfoundland and Labrador)

Denmark: Average: Nerlerit Inaat Airport, Nuuk Airport (Greenland); Vagar Airport (Faroe Islands)

Finland: Kajaani Airport (Kainuu); average: Kemi-Tornio Airport, Ivalo Airport (Lapland); Oulu Airport (North Ostrobothnia)

Iceland: Average: Egilsstaðir Airport, Reykjavík Airport (Iceland)

Norway: Average: Berlevåg Airport, Kirkenes Airport (Finnmark); average: Brønnøysund Airport, Narvik Airport (Nordland); Svalbard Airport (Svalbard); Tromsø Airport (Tromso)

Russia: Average: Kotlas Airport, Amderma Airport (Arkhangelsk and Nenets); average: Pevek Airport, Ugolny Airport (Chukchi); Talagi Airport (Karelia); Khanty-Mansiysk Airport (Khanty-Mansii); Usinsk (Komi), average: Khatanga Airport, Igarka (Krasnoyarsk); Murmansk Airport (Murmansk); average: Tiksi Airport, Yakutsk Airport (Sakha/Yakutia); Salekhard Airport (Yamal-Nenets)

Sweden: Average: Luleå Airport, Kiruna Airport (Norrbotten); average: Lycksele Airport, Umeå Airport (Vasterbotten)

United States: Average: Bettles Airport, Wiley Post–Will Rogers Memorial Airport (Alaska)

Sea Temperature (average, °C), Jan. and Jul.:
Average sea temperature in January and July at selected Arctic sea monitor stations as appears at World Sea Temperature (<http://www.seatemperature.org/>). Because historical records on sea temperature are not available, we fix the values of the variable to the values as appearing at <http://www.seatemperature.org/>, that are assumed to be calculated from several years of recorded data.

Arctic state	Arctic sea monitor station(s)
CAN	Gjoa Haven, Kugluktuk, Pangnirtung, Rankin Inlet, Québec, Havre-Saint-Pierre, Torbay
DNK	Upernavik, Aasiaat, Maniitsoq, Qaqortoq, Tasiilaq
FIN	Keminmaa, Kuivaniemi, Haukipudas, Oulu
ISL	Siglufjörður, Höfn, Húsavík, Ísafjörður
NOR	Tromsø, Harstad, Mo i Rana
RUS	Anadyr', Tilichiki, Provideniya, Pevek, Tazovskiy, Mys-Kamennyy, Severodvinsk, Teriberka, Ostrovnoy, Polyarnyy
SWE	Täfteå, Ursviken, Piteå, Södra Sunderbyn, Rolfs, Haparanda, Husum
USA	Anchorage

Source: <http://www.seatemperature.org/>

Population (thou. persons):
Total residents (citizens and non-citizens) of Arctic provinces in 2000, 2005, and 2010.

Canada: Statistics Canada <http://www.statcan.gc.ca> : CANSIM Table 051-0001: "Estimates of population, by age group and sex for July 1, Canada, provinces and territories", ArcticStat <http://www.arcticstat.org> : "Population Statistics, Community Profiles, 1996."

Denmark: ArcticStat <http://www.arcticstat.org> : "Mean Population By Reporting Country, Age, Time And Sex, 1990, 1995, 2000, 2005, 2010-2011."

Finland: Statistics Finland <http://www.stat.fi> : "Population According to Age (1- year) and Sex by Area 1980-2011" (Kainuu, Lapland, North Ostrobothnia), <Population By Gender And Region At Year-End 1995-2011>

Iceland: ArcticStat <http://www.arcticstat.org> : "Mean Population By Reporting Country, Age, Time And Sex, 1990, 1995, 2000, 2005, 2010-2011."

Norway: Statistics Norway <http://www.ssb.no> : "Population by age. Absolute figures. County. 1 January." "Population in the Norwegian settlements at Svalbard, by age and sex.", "Population In Densely And Sparsely Populated Areas, By Sex. 1 January (M), 1990-

2013", <http://www.theodora.com/wfb/1995/svalbard/svalbard_people.html>, <http://www.theodora.com/wfb1990/svalbard/svalbard_people.html>

Russia: ArcticStat <http://www.arcticstat.org> : "Population Of Regions Of The Russian Federation As Of 1St January, 1995, 2000, 2005, 2007-2010" , "Population Of The Regions Of The Russian Federation (Thousand Persons), 1959, 1970, 1979, 1989, 1998, 1999, 2000 And 2001"

Sweden: ArcticStat <http://www.arcticstat.org> : "Population by sex, period, region, marital status and age" , "Population, By County 31 December According To Regional Division 1 January The Year After Reported Year, 1950, 1960, 1970, 1980, 1990, 1998, 1999 And 2000" , "Average Population By Region (NUTS 3), Thousand Persons, 1993-2011"

United States: U.S. Census Bureau <http://www.census.gov> : "Alaska. General Demographic Characteristics", ArcticStat <http://www.arcticstat.org>: "Population Of Counties By Decennial Census: 1900 To 1990", "Population Estimates For The U.S., Regions, Divisions, And States By 5-Year Age Groups And Sex:Time Series Estimates, July 1, 1990 To July 1, 1999 And April 1, 1990 Census Population Counts".

↑ Pop (1990-2010, in percent):

Absolute increase in number of residents (citizens and non-citizens) between 1990 and 2010. The following formula is used: Population Absolute Increase = (2010 Population - 1990 Population) / 1990 Population.

The numbers represent mean of the absolute increase in total number of residents in polar provinces of each Arctic state, in percent, between 1990 and 2010.

CAN Statistics Canada <http://www.statcan.gc.ca> : "Population by year, by province and territory."

DNK ArcticStat <http://www.arcticstat.org> : "Mean Population By Reporting Country, Age, Time And Sex, 1990, 1995, 2000, 2005, 2010-2011."

FIN Statistics Finland <http://www.stat.fi> : "Population According to Age (1- year) and Sex by Area 1980-2011."

ISL ArcticStat <http://www.arcticstat.org> : "Mean Population By Reporting Country, Age, Time And Sex, 1990, 1995, 2000, 2005, 2010-2011."

NOR Statistics Norway <http://www.ssb.no> : "Population by age. Absolute figures. County. 1 January." "Population in the Norwegian settlements at Svalbard, by age and sex."

RUS ArcticStat <http://www.arcticstat.org> : "Population Of Regions Of The Russian Federation As Of 1St January, 1995, 2000, 2005, 2007-2010."

SWE ArcticStat <http://www.arcticstat.org> : "Population by sex, period, region, marital status and age."

USA U.S. Census Bureau <http://www.census.gov> : "Alaska. General Demographic Characteristics."

Product (million USD):

Gross Domestic Product, by province, by year. Million current USD, constant prices.

Canada: ArcticStat <http://www.arcticstat.org> : "Gross Domestic Product (GDP), Expenditure-Based, Provincial Economic Accounts, Annual, Current Prices, (Dollars x 1,000,000), 2001-2010." Newfoundland and Labrador, Quebec – 2000 and 2010 values are not real but predicted. We first evaluate, via scatterplot in Statistica 10, whether the available time range data forms a trend. It does, so we use multiple regression analysis to predict the missing value. The esults are significant with 95 per cent probability (significance level = 0.05; p-value < 0.05).

Denmark: ArcticStat <http://www.arcticstat.org> : "Gross Factor Income, Gross Domestic Product, And Gross Domestic Income, 1998-2007."

Finland: ArcticStat <http://www.arcticstat.org> : "Gross Value Added, By Kind Of Activity (Mill. NOK) (C), 1997-2007". Table 2007-05-23-1. (data on North Ostrobothnia imported as "17 Pohjois-Pohjanmaa").

Iceland: ArcticStat <http://www.arcticstat.org> : "Gross Domestic Product And Gross National Income 2001-2012"

Norway: ArcticStat <http://www.arcticstat.org> : "Gross Value Added, By Kind Of Activity (Mill. NOK) (C), 1997-2007". Finnmark, Nordland, Tromso – 2010 values are not real but predicted. We first evaluate, via scatterplot in Statistica 10, whether the available time range data forms a trend. It does, so we use multiple regression analysis to predict the

missing value. The results are significant with 95 per cent probability (significance level = 0.05; p-value < 0.05). Data for Svalbard is fixed at 2007 values.

Russia: ArcticStat <http://www.arcticstat.org> : "Gross Regional Product, 1995, 2000-2005 (In Millions Of Rubles; In 1995 – In Billions Of Rubles)", "Main Socio-Economic Indicators Of The Regions Of The Russian Federation In 2010"

Sweden: ArcticStat <http://www.arcticstat.org> : "Regional Gross Domestic Product (NUTS 3), Current Prices, Million SEK, 1993-2008." Table 2007-07-23-3. 2010 values are not real but predicted. We first evaluate, via scatterplot in Statistica 10, whether the available time range data forms a trend. It does, so we use multiple regression analysis to predict missing value. Results are significant with 95 per cent probability (significance level = 0.05; p-value < 0.05).

United States: ArcticStat <http://www.arcticstat.org> : "Gross Domestic Product by State" (millions of current dollars). Bureau of Economic Analysis, U.S. Department of Commerce.

Yearly-average currency exchange rates exported from the *OANDA Historical Exchange Rates* database <www.oanda.com/currency/historical-rates>

Country	2000	2005	2010
CAD/USD (CANADIAN DOLLAR)	1.4842	1.2112	1.0302
RUR/USD (RUSSIAN ROUBLE)	28.1545	28.2794	30.3058
NOK/USD (NORWEGIAN KRONE)	8.7954	6.4382	6.0389
SEK/USD (SWEDISH KRONE)	9.1572	7.4660	7.2007
DKK/USD (DANISH KRONE)	8.0827	5.9912	5.6199
EUR/USD (EURO)	1.0841	0.8040	0.7545
ISK/USD (ISLANDIAN KRONE)	78.7884	62.7745	124.2935
NOK/USD (case of Svalbard)	2007: 5.85		

Source: <http://www.oanda.com/currency/historical-rates/>

↑ Product (1990-2010, in percent):

Absolute increase in gross product between 1990 and 2010. The following formula is used: Gross Product Absolute Increase = (2010 Gross Product - 1990 Gross Product) / 1990 Gross Product. Data for 2010 come from the previous indicator (Product, 2010). *Data for 1990 and 2000 is imported from the following sources:*

CAN Statistics Canada, CANSIM Table F.1.1 "Gross domestic product (GDP), Canada and jurisdictions, 1990, 1995, and 1999 to 2008" <http://www.statcan.gc.ca/pub/81-582-x/2009003/tbl/f.1.1-eng.htm>
Newfoundland and Labrador, Quebec – 2000 and 2010 values are not real but predicted. We first evaluate, via scatterplot in Statistica 10, whether the available time range data forms a trend. It does, so we use multiple regression analysis to predict the missing value. The results are significant with 95 per cent probability (significance level = 0.05; p-value < 0.05).

DNK CIA Factbook <www.cia.gov>: "Greenland".

FIN 1990 and 1995 values are not available. We generate these numbers by, first, finding the relative share of GRP in GDP in 2000 (5.48 percent) and, second, recalculating the values of GRP in 1990 and 1995 according to this percentile division. Finland's GDP in 1990 and 1995 is taken from WDI Database: <http://databank.worldbank.org/data/home.aspx>.

ISL ArcticStat <http://www.arcticstat.org> : "Gross Domestic Factor Income By Kind Of Activity 1991-2000 (NACE rev.1)" - Table 2011-03-31-10; "Gross Domestic Product And Gross National Income 2001-2012."

NOR 1990 values are not available. We generate the number for 1990 by, first, finding the relative share of GRP in GDP in 2010 (6.05 percent) and, second, recalculating the value of GRP in 1990 according to this percentile division. Norway's GDP in 1990 is taken from WDI Database: <http://databank.worldbank.org/data/home.aspx>.

RUS 1990 values are not available. We generate the number for 1990 by, first, finding the relative share of GRP in GDP in 2000 (17.86 percent) and, second, recalculating the value of GRP in 1990 according to this percentile division. Russia's GDP in 1990 is taken from WDI Database: <http://databank.worldbank.org/data/home.aspx>.

SWE ArcticStat <http://www.arcticstat.org> : "Regional Gross Domestic Product (NUTS 3), Current Prices, Million SEK, 1993-2008." Table 2007-07-23-3. 2010 values are not real but predicted. We first evaluate, via scatterplot in Statistica 10, whether the available time range data forms a trend.

It does, so we use multiple regression analysis to predict missing value. Results are significant with 95 per cent probability (significance level = 0.05; p-value < 0.05).

USA ArcticStat <http://www.arcticstat.org> : "Gross Domestic Product by State" (millions of current dollars). Bureau of Economic Analysis, U.S. Department of Commerce. Real Gross Domestic Product by State – EIA <www.eia.gov/state/seds/sep_use/.../use_gdp.pdf>

N_Res (2010, percent of Gross Product):

Share of extraction of crude oil and natural gas, production of energy and mining within the Gross Product, in 2010, in percent (GRP).

CAN ArcticStat <http://www.arcticstat.org> : "Gross domestic product (GDP) at basic prices, by North American Industry Classification System (NAICS), provinces and territories, annual (percentage share)". Table 379-0028 (1, 9).

DNK Statistics Denmark, ENE4HT, "Energy Account in monetary values. Supply of energy, detailed table (basic prices) by supply and type of energy": <http://www.statbank.dk/statbank5a/default.asp?w=1920>

FIN 0 <http://energyatlas.iea.org/?subject=-1920537974>

ISL 0 <http://energyatlas.iea.org/?subject=-1920537974>

NOR ArcticStat <http://www.arcticstat.org> : "Regional Accounts, By Industry, 2008-2011". Table 2012-06-17-04.

RUS ArcticStat <http://www.arcticstat.org>: "Main Socio-Economic Indicators Of The Regions Of The Russian Federation In 2010". Table 2011-11-09-01.

SWE 0 <http://energyatlas.iea.org/?subject=-1920537974>

USA ArcticStat <http://www.arcticstat.org>: Alaska, "Real GDP By State, By Industry (Millions Of Chained 2009 Dollars), 1997-2013", Table 2011-03-15-02. " Gross-Domestic-Product-(GDP)-by-Industry Data": <http://www.bea.gov/industry/gdpbyind_data.htm>

Mil_Bases (Number):

Number of active permanent [year-round] military installations (land bases incl. training centers, maintenance sites, surveillance bases, air bases and heliports, naval bases, Coast and Home Guard and sledge patrol bases) located within the borders of Arctic provinces.

We define a land base as a military installation with a personnel of at least 18 persons, a naval base a as military installation with at least one armed vessel, and an air base as military installation with a runway of at least 1600 m / 45 x 40 m (in case of heliport).

Canada: Newfoundland and Labrador: 5 Wing /CFB Goose Bay (air base, est. 1941), 9 Wing/CFB Gander (air base, est. 1936), CFS St. John's (naval base, est. 1941). Northwest Territories: CFNA Yellowknife (land base, est. 1970), Inuvik (air base, est. n/a), Yellowknife (air base, est. n/a). Quebec: 3 Wing /CFB Bagotville (air base, est. 1942), CFB/ASU Montreal (land base, est. 1968), CFB/ASU Valcartier (land base, est. 1914). Nunavut: CFS Alert (air base, est. 1968), Iqaluit (air base, est. n/a), Rankin Inlet (air base, est. n/a). Yukon: CFNA HQ Whitehorse (all services, est. 1970).
Source: <http://www.thecanadianencyclopedia.com/articles/canadian-forces-bases>, <http://thesimonsfoundation.ca/arctic-security>

Denmark: Greenland: Island Command Greenland (Coast Guard and surveillance, est. 1951), Station Nord (detachment in Northern Greenland, est. 1986), Luftgruppe Vest I Sondre Stromford/Kangerlussuaq (detachment in Western Greenland, est. n/a), Forsvarets Vagt I Mestersvig (detachment in Eastern Greeland, est. n/a), Slædepatruljen Sirius (Sledge Patrol, est. 1941), Thule Air Base (North -Western Greenland, est. 1943). Faroe Islands: Island Command Faroes – Torshavn (Coast Guard and surveillance, est. 1979).
Source:
<http://www.fmn.dk/eng/allabout/Pages/TasksintheArcticandtheNorthernAtlantic.aspx>, <http://thesimonsfoundation.ca/arctic-security>

Finland: Kainuu: Kainuu Brigade (land base, est. 1966). Lapland: Lapland Air Command – Rovaniemi (air base, est. 1973), Jaeger Brigade (land base, est. 1979), Lapland Air Defence Regiment (land base, est. 1989). North Ostrobothnia: n/a.
Source: <http://www.puolustusvoimat.fi/en/>

Iceland: Icelandic Coast Guard (est. 1920), United States Naval Air Station Keflavik (taken over by the Icelandic Defence Agency in 2006, and completely abolished in 2011).
Source: <www.princeton.edu/~achaney/tmve/wiki100k/docs/Military_of_Iceland.html>

Norway: Finnmark: Station Group Banak (air base, est. 1963), Garnisonen i Sor-Varanger/Kirkenes (land base, est. 1945), Garnisonen i Porsanger (land base-hunter squadron, est. n/a);

Nordland: Bodo (airbase, est. 1955), Drevjamoen/Mosjoen (land base, logistics, est. 1946), LORAN-C (surveillance base on Jan Mayen Island, est. n/a), ; Svalbard: no military installations (result of Svalbard Treaty 1920); Tromso: Andoya (air base, est. 1957), Sorreisa (surveillance base, est. n/a), Skjold (land base-part of Brigade Nord, est. n/a), Bardufoss (air- and helicopter base, part of Brigade Nord, est. 1938), Harstad incl. Evenes (land base, training center, est. n/a), Bjerkvik (maintenance site, est. n/a), Setermoen (land base-part of Brigade Nord, est. 1898), Sortland (Coast Guard Squadron, est. n/a).
Source: <http://mil.no/organisation/about/norwegianmilitarybases/Pages/default.aspx>, <http://thesimonsfoundation.ca/arctic-security>

Russia: Arkhangelsk and Nenets: Amderma – Novaya Zemlya (air base, est. 1960), Nagurskoye (air base, est. in 1950's), Naryan-Mar Airport – Nenets (air base, est. before 1990), Onega Andozero (air base, est. before 1980), Rogachevo – Novaya Zemlya (air base, est. before 1960), Savatiya (air base, est. before 1970), Severodvinsk (naval base, est. in 17th century). Chukchi: Dresba (air base, est. 1960), Mys Shmidta (military airport, est. 1954), Ugolny Airport (air base, est. 1950's). Karelia: Poduzhemye (air base, est. 1957), Loukhi-3 (air base, est. before 1945), Petrozavodsk Airport (air base, est. before 1960), Letneozersky (air base, est. before 1990). Khanty-Mansii: data is not available. Komi: Pechora Kamenka (air base, est. 1989). Krasnoyarsk: Alykel (air base, est. late 1950's), Greem Bell airfield (air base, est. 1978), Kansk (air base, est. before 1980), Khatanga Airport (air base, est. before 1970), Ostrov Bolshevik airfield (air base, est. 1960), Sredny Ostrov airfield (air base, est. 1950's), Brigade 120 (land base, est. n/a). Murmansk: Berezovka (air base, est. before 1980), Kilpyavr (air base, est. before 1985), Kirovsk-Apatity (air base, est. before 1990), Koshka Yavr (air base, est. before 1990), Luostari Pechenga (air base, est. in 1950's), Monchegorsk (air base, est. before 1990), Olenya (air base, est. before 1960), Umbozero (air base, est. n/a), Gadzhiyevo (naval base, est. 1957), Olenya Bay (naval base, est. before 1960), Polyarny (naval base, est. 1896), Severomorsk (naval base, est. 1933), Kola Bay (naval base, est. before 1990), Zapadnaya Litsa (naval base, est. 1958), Vidyayevo (naval base, est. 1958), Gremikha (naval base, est. 1915). Sakha/Yakutia: Chekurovka (air base, est. 1960), Chokurdakh Airport (air base, est. n/a), Suntar Airport (air base, est. n/a), Tiksi Aerodrome (air base, est. before 1999). , Yamal-Nenets: data is not available.
Source: <www.strategicstudiesinstitute.army.mil/pdffiles/PUB1073.pdf>

Sweden: Norrbotten: F 21 – Lulea (air base and heliport, est. 1941), Norrbotten Regiment – Boden (land base, est. 1841), Norrbottenbataljonen (Home Guard, est. n/a). Vasterbotten: CBRN Defence – SkyddC – Umea (land base, est. n/a), Västerbottenbataljonen (Home Guard, est. n/a).
Source: <http://www.forsvarsmakten.se/en/Organisation/The-Swedish-Army/>

United States: Alaska: Clear Air Force Station (air base, est. 1950), Eielson Air Force Base (air base, est. 1944), Elmendorf Air Force Base (air base, est. 1940), Fort Greely (land base, est. 1942), Fort Richardson (land base, est. 1940), Fort Wainwright (land base, est. 1939), ISC Kodiak (Coast Guard, est. 1941), Marine Safety Unit Valdez (Coast Guard, est. before 1989), USCG Juneau (Coast Guard, est. 1912).
Source: <http://thesimonsfoundation.ca/arctic-security>, Wezeman, S. "Military Capabilities in the Arctic." *Background Paper*. Stockholm: SIPRI, March 2012.

Mil_pers (as of 2010, thousands of persons):
Total number of active military personnel (Army, Navy, Air Force) in 2010 recalculated according to ratio local military installations / total military installations, in 2010. *Paramilitary and reservists are excluded.*

Arctic state	Local (Arctic) military installations	Total military installations	Ratio	In percent
CAN	13	37	0,351	35,1
DNK	6	25	0,24	24
FIN	3	16	0,187	18,7
ISL	2	2	1	100
NOR	14	35	0,4	40
RUS	41	180	0,291	29,1
SWE	7	24	0,227	22,7

USA	9	238	0,038	3,8

Source: IISS, The Military Balance 2010, recalculated by author.

Mil_Exp (Million constant 2011 USD)

Consistent provincial data on military expenditures is unavailable; thus national data is included. The latter is taken from the SIPRI Military Expenditure Dataset, Stockholm International Peace Research Institute. <http://milexdata.sipri.org/files/?file=SIPRI+military+expenditure+database+1988-2012.xlsx> [quoted 2013-06-20].

Worksheet: Military expenditure by country, in constant (2011) USD Million.

Countries: Canada, Denmark, Finland, Iceland, Norway, Russian Federation, Sweden, United States.

Years: 2000, 2005, 2010.

Russian Federation: figures are SIPRI estimates.

United States: all figures are for the fiscal year (1 Oct. of the previous year-30 Sep. of the stated year) rather than the calendar year.

Iceland: data for 2000 and 2005 is not available; thus the variable is fixed at 2010 value.

"Iceland does not have an army/military. The figures for Iceland relate to spending on maintaining the Icelandic Air Defence System, intelligence gathering and military exercises, for which Iceland has been responsible since 2008, NATO membership fees, and spending on the "Vikingasveitin" paramilitary special forces." Excerpt from SIPRI Yearbook 2013. *SIPRI Military Expenditure Dataset:* Footnotes, cell A75.

Arctic Sector (thou. sq. km) and Total claim (number):

Arctic state's area of national sector (pre-UNCLOS division of the Arctic Ocean) and total number of claimed areas (on land and at sea) by each Arctic state. The same values appear in ASGA and ASLA Datasets.

Arctic state	National sector area	International dispute	
	Million sq. km (percent of total Arctic)	Number of active claims	Non-Arctic claimed area
CAN	4,3 (21)	7	- Dixon Entrance - Beaufort Sea - Strait of Juan de Fuca - Gulf of Maine (Machias Seal Island and North Rock) - Northwest Passage - Hans Island
DNK	3 (14)	2	- Hans Island - Faroe Isl. CS
FIN	0 (0)	0	–
ISL	0 (0)	1	- Faroe Isl. CS
NOR	2,7 (13)	1	- Queen Maud Land and its CS (Antarctica)
RUS	9,3 (44)	6	- Malozhemchuzny Isl. - Sea of Azov - Tuzla Isl. - Strait of Kerch - Sarych - Aibga and surrounding area
SWE	0 (0)	0	–
USA	1,7 (8)	8	- Dixon Entrance - Beaufort Sea - Strait of Juan de Fuca - Machias Seal Island - North Rock - Northwest Passage - Bajo Nuevo Bank

			- Maritime boundary with Bahamas
TOTAL	**21 (100)**		

Sources: Bartsits, I. "O pravovom statuse rossijskogo arkticheskogo sektora." Pravo i politika 12 (2000) [quoted 2013-07-06]. Available at WWW: <http://geo.1september.ru/view_article.php?id=200700102>, <http://www.bbc.com/news/world-us-canada-10834006>, <cia.gov>.

Att_conflict (number):

This variable shows how many times each Arctic state participated in international militarized conflicts between 1990 and 2010, based on data on MIDs at the participant level (MIDB_4.01) containing one record per militarized dispute participant, from Correlates Of War dataset *MID v4.0.csv.*

CAN *<http://cow.dss.ucdavis.edu/data-sets/MIDs>*
DNK *<http://cow.dss.ucdavis.edu/data-sets/MIDs>*
FIN *<http://cow.dss.ucdavis.edu/data-sets/MIDs>*
ISL *<http://cow.dss.ucdavis.edu/data-sets/MIDs>*
NOR *<http://cow.dss.ucdavis.edu/data-sets/MIDs>*
RUS *<http://cow.dss.ucdavis.edu/data-sets/MIDs>*
SWE *<http://cow.dss.ucdavis.edu/data-sets/MIDs>*
USA *<http://cow.dss.ucdavis.edu/data-sets/MIDs>*

Autarky (percent of GDP):

We calculate a simple average of Imports (in percent of GDP) and Exports (in percent of GDP), as they appear in WDI Database for 2010, and extract their sum from 100 (GDP without any foreign trade), to demonstrate a strict opposite to trade openness, autarky.

Arctic state	Foreign trade			**Autarky**
	Import	Export	Average	
	(percent of GDP)	(percent of GDP)	(percent of GDP)	**(percent of GDP)**
CAN	31	29,1	30	**70**
DNK	43,6	49,7	46,6	**53,4**
FIN	37,4	38,7	38	**62**
ISL	43,1	53,5	48,3	**51,7**
NOR	28,5	40,5	34,5	**65,5**
RUS	21,1	29,2	25,1	**74,9**
SWE	40,7	46,2	43,4	**56,6**
USA	15,8	12,4	14,1	**85,9**

Source: Data from WDI Database, <http://databank.worldbank.org/data>, modified by the author.

Life_Q (HDI score):

Human Development Index (HDI) of each Arctic state as a summary measure of human development – a geometric mean of normalized indices measuring social achievement in three dimensions of human development: a long and healthy life, access to knowledge and a decent standard of living.

Algorithm of HDI calculation can be found in *UNDP, Human Development Report 2010,* pp. 216-217 (Technical note 1).

CAN UNDP. *Human Development Report 2010*, p. 143.
DNK UNDP. *Human Development Report 2010*, p. 143.
FIN UNDP. *Human Development Report 2010*, p. 143.
ISL UNDP. *Human Development Report 2010*, p. 143.
NOR UNDP. *Human Development Report 2010*, p. 143.
RUS UNDP. *Human Development Report 2010*, p. 144.
SWE UNDP. *Human Development Report 2010*, p. 143.
USA UNDP. *Human Development Report 2010*, p. 143.

UN-d (number):
Active international UN peacekeeping missions where each Arctic state deploys troops or has military observers in 2010.

CAN IISS. *The Military Balance 2010*, pp. 442-447.
DNK IISS. *The Military Balance 2010*, pp. 442-447.
FIN IISS. *The Military Balance 2010*, pp. 442-447.
ISL IISS. *The Military Balance 2010*, pp. 442-447.
NOR IISS. *The Military Balance 2010*, pp. 442-447.
RUS IISS. *The Military Balance 2010*, pp. 442-447.
SWE IISS. *The Military Balance 2010*, pp. 442-447.
USA IISS. *The Military Balance 2010*, pp. 442-447.

Non-UN-d (number):
Active international non-UN peacekeeping missions where each Arctic state deploys troops or has military observers in 2010.

CAN IISS. *The Military Balance 2010*, pp. 448-452.
DNK IISS. *The Military Balance 2010*, pp. 448-452.
FIN IISS. *The Military Balance 2010*, pp. 448-452.
ISL IISS. *The Military Balance 2010*, pp. 448-452.
NOR IISS. *The Military Balance 2010*, pp. 448-452.
RUS IISS. *The Military Balance 2010*, pp. 448-452.
SWE IISS. *The Military Balance 2010*, pp. 448-452.
USA IISS. *The Military Balance 2010*, pp. 448-452.

History (years):
The strength of historical affiliation of each Arctic actor to the polar landmass and waters.
The number of years since the official establishment of sovereignty in the Arctic region until 2010 is counted.

Arctic state	Arctic sovereignty established	Age of Arctic sovereignty in years	Description
CAN	1892	118	Canada Act (1982): acquisition of full sovereignty from the United Kingdom (British claim turned into the Canadian claim)
DNK	1814	196	Treaty of Kiel (1814) granted Denmark control over the Faroes, Iceland and Greenland.
FIN	1917	66	The Finnish declaration of independence was adopted by the Parliament of Finland on Dec. 6, 1917. It declared Finland an independent nation, and therefore broke the country free from being the Russian Grand Duchy of Finland.
ISL	1944	93	The Danish–Icelandic Act of Union expired on Dec. 31, 1943. In May 1944, Icelanders voted in a plebiscite on whether to terminate the personal union with Denmark and establish a republic. The vote was 95% in favour of the new republican constitution. Iceland formally became a republic on June 17, 1944.
NOR	1920	90	The latest Norwegian possession in the Arctic region is Svalbard. Svalbard Treaty between Norway, The United States of America, Denmark, France, Italy, Japan, the Netherlands, Great Britain and Ireland and

			the British overseas Dominions and Sweden concerning Spitsbergen, was signed on Feb. 9, 1920
RUS	1926	84	Decree of 1926: USSR annexed all lands lying between the eastern and western extremities of their mainland and the North Pole
SWE	1905	105	After some months of tension and fear of war between the two neighboring nations, inter-governmental negotiations led to Norway's recognition by Sweden as an independent constitutional monarchy on Oct. 26, 1905.
USA	1867	143	In 1867 the United States purchased Alaska from the Russian Empire by a treaty ratified by the U. S. Senate

Source: Hough (2013), modified by the author.

Appendix J. Calculation of the effect of Arctic EEZ manipulation of the $SocGeoR$ index [STATISTICA 10]

Effect of manipulated EEZ area of Denmark and Russia in Option IX over Arctic EEZ.

For the global sample of 187 nation states, the mean influence (M=-0,00000000000000005; SD= 0,388; N=187) is not statistically significant: t(186)= 0,000000000000002, and two-tail p= 1 (t critical for df=186 and alpha = 0,05 is 1,973), therefore the influence of changing area in the normalized Arctic EEZ is not statistically significant for 187 nation states. When we limit the studied sample to eight Arctic states, the situation is not different: the mean influence (M= -0,000000000000001; SD= 2,00165; N=8) is not significantly different from zero: t(7)= 0,0000000000000017, two-tail p=1 (t critical for df=7 and alpha = 0,05 equals 2,365); hence the influence of changing area in the normalized Arctic EEZ is not statistically significant for eight Arctic states. For five Arctic states directly facing the northernmost ocean, the mean effect from the EEZ manipulation is a bit higher than in the previous cases, but still not statistically significant: for M= -0,000000000000002, SD=2,647939283 and N=4, t(4)=0,0000000000000017 and two-tail p= 1 (and, in order to prove statistical significance, the critical value of t for df=4 and alpha = 0,05 should be higher than 2,776). In sum, the influence of changing area in the normalized Arctic EEZ is not statistically significant for five Arctic states.

Effect of manipulated EEZ area of Denmark and Russia in Option IX over global EEZ.

For the global sample of 187 nation states, the mean influence (M=11,36; SD=110,998; N=187) is not statistically significant: t(186)= -1,399574853, and two-tail p= 0,163306252 (t critical for df=186 and alpha=0,05 is 1,973), therefore the influence of changing area of Arctic EEZ over the Global EEZ value is not statistically significant. When we limit the studied sample to eight Arctic states, the situation is not different: the mean influence (M=265,5; SD=500,2; N=8) is not significantly different from zero: t(7)= -1,50146249, two-tail p=0,177 (t critical for df=7 and alpha = 0,05 equals 2,365); hence the influence of changing area of Arctic EEZ over the Global EEZ value is not statistically significant for eight Arctic states. Finally, for five Arctic states directly facing the northernmost ocean, the mean effect from the EEZ manipulation is a bit higher than in the previous cases, but still not statistically significant: for M=424,86, SD=594,3 and N=4, t(4)= -1,598385376 and two-tail p= 0,185201071 (and, in order to prove statistical significance, the critical value of t for df=4 and alpha = 0,05 should be higher than 2,776).

Effect of manipulated EEZ area of Denmark and Russia in Option IX over $GeoR$ index.

For the global sample of 187 nation states, the mean influence is not significantly different from zero: t(187)=0,000000000000002 and two-tail p=1 (and, to register statistical significance, the critical value of t for df=186 and alpha = 0,05 should be higher than 1,9728) for M=-0,00000000000000001; SD=0,064718776; and N=187. When we reduce the number of studied cases to eight Arctic states, the situation is not different: for M=-0,0000000000000022204, SD=0,333608992 and N=8, t(7)= 0,0000000000000019 and two-tail p=1 (t critical for df=7 and alpha = 0,05 equals 2,3646). And, for five Arctic

states, M=0,36462, SD=0,169, N=5; and t(4) is 0,0000000000000018 and two-tail p=1 (t critical for df=4 and alpha = 0,05 equals 2,776).

Effect of manipulated EEZ area of Denmark and Russia in Option IX over $SocGeoR$ index.

For 187 nation states, when considered against the status quo situation (Option I), the results Option IX are the following: M=0,000936669; SD=0,012; N=187; and t(186)= 0,00000000000000301 and a two-tail p=1 (and, to register statistical significance, the critical value of t for df=186 and alpha = 0,05 should be higher than 1,9728). For eight Artic states, the mean influence (M=0,021894628; SD=0,0619; N=8) is not statistically different from zero: t(7)=0,00000000000000282 and two-tail p=1 (t critical for df=7 and alpha= 0,05 is 2,3646). For five Arctic states, the mean influence (M=0,18; SD=0,08; N=5) is not significantly different from zero: t(4)=0,0000000000000027, two-tail p=1 (t critical for df=4 and alpha = 0,05 equals 2,776); hence the influence of changing area of Arctic EEZ over the $SocGeoR$ value is not statistically significant.

Appendix K. Sensitivity analysis: Irreversibility and Option Prioritization Rules [GMCR+]

Irreversibility

When all game strategies are allowed to be reversible, the game has one strongly-stable solution (state 18) and 9 additional partially-strong, *GMR* and *SMR*-only solutions (states 10 – 17). When only the strategy of the world is considered irreversible from No to Yes, the game has only one strongly-stable solution, state 18. When only the strategy of the world is considered irreversible from Yes to No, the game has 9 strongly-stable solutions (states 1-9 and 18) and 9 additional *GMR*- and *SMR*-only solutions (states 10 – 17). When all strategies are considered to be reversible apart from the one of the World (from No to Yes) and the ones reflecting Denmark and Russia's full annexation strategy (also from No to Yes), the game still has only one strongly-stable solution, state 18. When all strategies are considered to be reversible apart from the one of the World (from Yes to No) and the ones reflecting Denmark and Russia's full annexation strategy (also from Yes to No), the game has 13 strongly-stable solutions (states 1 – 9, 14, 15, 17 and 18) and five additional *GMR* and *SMR*-only solutions (states 10 – 13 and 16). When all strategies are considered to be reversible apart from the one of the World (from No to Yes) and the ones reflecting Denmark and Russia's compromise strategy (also from No to Yes), the game still has four strongly-stable solutions (states 14, 15, 17 and 18) and no partially-strong solutions. When all strategies are considered to be reversible apart from the one of the World (from Yes to No) and the ones reflecting Denmark and Russia's compromise strategy (also from Yes to No), the game has 10 strongly-stable solutions (states 1 – 9 and state 18) and 8 additional *GMR* and *SMR*-only solutions (states 10 – 17). When Russia and Denmark's non-status quo strategies are considered irreversible from No to Yes (but not the status quo strategy), and strategy of the World is considered irreversible from No to Yes, the game has only four strongly-stable solutions (states 14, 15, 17 and 18) but no semi-strong solutions. When all strategies are considered irreversible from No to Yes, the game has 9 strongly-stable solutions (states 10-18), while if all strategies are considered irreversible from Yes to No, the game has 18 strongly-stable solutions (states 1-18). When all When all strategies are considered reversible except status quo strategies of both Denmark and Russia (Yes to No) and the World (No to Yes), the game has 1 strongly-stable solutions (state 18).

Option prioritization rules

When we remove preferences over those scenarios which are less beneficial to the initiator decision-makers than the status quo (Option I at Figure 1-5), the number of strongly-stable and partially-stable solutions does not change. However, when, in addition to this preference removal, we delete all preferences of the World except the one over status quo, the game starts having 12 strongly-stable solutions (states 2 – 9, 14, 15, 17 and 18); 18 semi-stable, *GMR* and *SMR*-based solutions (states 1 – 18); and one *GMR*-, *SEQ*-, *SEQ* and *SIM*-, and *SMR*-based solutions (state 1 – status quo). When we consider only one most favorable strategy for both Denmark and Russia, but all prioritized strategies of the World, the game has 6 strongly-stable solutions (states 12, and 14 – 18) and three additional GMR and SMR-based solutions (states 10, 11 and 13). When we consider only one most favorable strategy for Denmark, Russia and the World, the game has 13 strongly-stable solutions (states 2 – 9, 12, 14 – 18), two additional *GMR* and *SMR*-based solutions (states 11 and 13), one *GMR*-, *SEQ*, *SEQ* and *SIM*-, and *SMR*-based

solution (state 1), and one *GMR*-, *SIM*-, *SEQ* and *SIM*-, and *SMR*-based solution (state 10). When we consider only three most favorable strategies for Denmark and Russia but leave all preferences of the World as they are in our primary modeling configuration, the game has 3 strongly-stable solutions (states 16 – 18) and 6 additional semi-stable, *GMR* and *SMR*-based solutions (states 10 – 18); but if we consider only three most favorable strategies for each decision-maker, the game has 9 strongly-stable solutions (states 3, 5 – 9, 16 – 18) and 18 semi-stable, *GMR* and *SMR*-based solutions. If we prioritize only three most favorable strategies for the World, but consider all original priorities of Denmark and Russia, the game has 7 strongly-stable solutions (states 3, 5 – 9 and 18) and 11 additional semi-stable, *GMR*-, *SEQ*-, *SEQ* and *SIM*-, and *SMR*-based solutions (states 1, 2, 4 and 10 – 17). But if we allow only one preference for the World, but consider all original priorities of Denmark and Russia, the game starts having 9 strongly-stable solutions (states 2 – 9 and 18) and 9 additional semi-stable, *GMR*-, *SEQ*-, *SEQ* and *SIM*-, and *SMR*-based solutions (states 1 and 10 – 17). If we consider only five most favorable strategies for each decision-maker, the game has five strongly-stable solutions (states 3, 6, 8, 9 and 18), 8 additional semi-stable, *GMR* and *SMR*-based solutions (states 10 – 17), and five *GMR*-, *SEQ*, *SEQ* and *SIM*-, and *SMR*-based solutions (states 1, 2, 4, 5 and 7). If we limit the number of prioritized strategies to two for all decision-makers, the are 12 strongly-stable solutions (states 2, 3, 5 – 9, 12 and 15 – 18) and 6 additional *GMR*-, *SEQ*-, *SEQ* and *SIM*-, and *SMR*-based solutions (states 1, 4, 10, 11, 13 and 14).

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