Differentiating Arctic Provinces

A Cluster Analysis of Geographic and Geopolitical Indicators

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Based on a geographical-administrative definition of the region, theoretical assumptions of contemporary structuralist geopolitics, cross-sectional data for 2000, 2005 and 2010 from the Arctic Regional Attributes Dataset, and the technical capabilities of cluster analysis, this article aims to produce a 3-stage geopolitical differentiation of 27 Arctic provinces according to 16 indicators reflecting their performance in the physical, economic, demographic, military and institutional areas over the first decade of the new millennia. First, geographic attributes of the Arctic provinces are clustered (area, average temperature in January and July, exclusive economic zone, sector area). Second, a set of geopolitical attributes is added into the analysis (total and indigenous population, gross regional product and its agriculture-industry-services segregation, advancement in economic and military regionalism, military bases and expenditures, and possession of nuclear weapons) to detect the consequent responses in the model. Finally, geopolitical variables are clustered separately in order to reveal the cause of unstable membership. Two geographic clusters, three geopolitical clusters, and four outlier cases are identified.

Keywords: systemic, differentiation, geopolitics, Arctic, conflict, regionalism, cluster analysis

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Introduction

A stable characteristic of the beginning of the 21st century is the unprecedented, increasing rate at which Arctic ice has been melting. By August 2012, the Arctic ice shelf had shrunk to the smallest size ever

observed. Today it covers just half of the area it covered in the 1980s, when measurements began, and it is estimated that the first iceless summer will occur over the next few years, instead of the 30-40 year period previously predicted. Such dramatic geophysical transformations have enormous human-related consequences. Scientists, politicians, lawyers, senior multinationals managers, army generals, and even media stars and athletes steadily reintroduce the problematic of polar ice melting into academic space and mass media discourse. Indeed, the positions are manifold. While some scholars point to the irreversibility of ice melting and call the Arctic the next geopolitical hot spot others question whether it is appropriate to treat it as a distinct region at all, as the idea is little more than 'an artificial construct that requires serious manipulation of the facts to seem credible' and attempt to falsify the economic rationale behind the majority of profit-related projects in the region. Before allying with any position, it is necessary to understand the basic configuration of the Arctic geopolitical space.

Apart from a series of issue-specific institutional reports, most scientific works operating on the systemic, regional level of approximation either highlight the diversity of polar geography – re: Dowdeswell and Hambrey 2002, Woodford 2003, Stein 2008 – or evaluate the evolution of Arctic regional cooperation – re: Chaturvedi 1996, Koivurova 2009, Exner-Pirot 2012, Hough 2013 – or summarise the expected geopolitical effects from the changing environment – re: Anderson 2009, Chapman 2011, Ostreng (et al) 2013. With the exception of a comprehensive empirical introduction to the functioning of the Arctic geopolitical system by Knell (2008), a rigorous attempt to combine these issues is lacking – as quantitative interdisciplinary geopolitical classification of Arctic provinces according to their geographic, economic and political attributes is still missing in literature.

Based on the geographical-administrative definition of the region, theoretical assumptions of contemporary structuralist geopolitics, empirical data from national and international statistical databases, and the technical capabilities of cluster analysis, this article aims to produce a 3-stage geopolitical differentiation of 27 Arctic provinces according to 16 indicators reflecting their performance in the physical, economic, demographic, military and institutional areas over the first decade of the new millennium. First, this work clusters a set of geo-

graphic attributes of the Arctic provinces (area, average temperature in January and July, exclusive economic zone, sector area). Second, a set of geopolitical attributes is added to the analysis (total and indigenous population, gross regional product and its agriculture–industry–services segregation, advancement in economic and military regionalism, military bases and expenditures, and possession of nuclear weapons) to detect the consequent responses in the model. Finally, the clustering of Arctic provinces is done according to a set of geopolitical attributes (omitting the geographic ones). The aim is to study the intersection of the geographic and geopolitical vectors of Arctic development. The significant divergence of these vectors might be interpreted as a potential source of conflict between the Arctic states. In order to discover the most probable areas of potential interstate conflict, this research verifies the significance of vector coincidence and evaluates the potential implications of the presence of two geographic factors leading to interstate conflict, proximity and temperature change, on the Arctic geopolitical system.

The null hypothesis is that: *Clusters are dynamic, i.e. they are not stable in time.*

The following questions are answered in this work:

1. How are Arctic provinces grouped according to their geographical attributes?
2. Is the geographical grouping stable in time?
3. How do geopolitical attributes adjust geographical grouping?
4. *Is the adjusted grouping stable in time*?

Answering these questions allows the discovery of geographic forces of clustering, detecting and evaluating geopolitically-driven deviation from geographical clustering, and assessing the emerging sources of conflict between geography and politics in the region. Fulfilling these goals provides a neutral, comparative and compact analytical addition to regression-based research on Arctic geopolitics and creating an objective ground for forecasting.

The analysis is described in five additional sections. First, the 27 Arctic provinces are defined. Next, discussion focuses on how Arctic regional attributes are related to each other. This part presents the methodological configuration of the time-series model. Third, a summary of the mechanics of the cluster analysis and a presentation of the data and measurements is done. The fourth section offers the results while the final part of the article summarises the findings, discusses the role of

cluster stability within the relationship between geography and interstate conflict, and provides directions for further research.

27 Arctic Provinces: Similar but Diverse

The Arctic region includes the vast, northernmost coastal parts of North America, Europe and Asia; a series of archipelagos between them; and the relatively enclosed waters of the world's smallest ocean. While the region's northern extremity is the North Pole, the delimitation of its southern border is not obvious, as geographical, ecological and historical borders do not coincide. Since delineating the Arctic is not the primary goal of the analysis, and because maintaining consistency in the aggregation of empirical data is of primary importance in any quantitative research design, two restrictions apply: (a) sub-national administrative units with at least one per cent of territory within the Arctic Circle (66°33′44″) and/or 10° July Isotherm and/or tree line are considered to be a part of the Arctic region; (b) the administrative division of 2010 applies throughout the period under consideration – see Figure 1. This work considers 27 sub-national administrative units or "Arctic provinces:" Newfoundland and Labrador, The Northwest Territories, Quebec, Nunavut, The Yukon (Canada); The Faroe Islands, Greenland (Denmark); Kainuu, Lapland, North Ostrobothnia (Finland); Iceland; Finnmark, Nordland, Svalbard and Jan Mayen, Tromsø (Norway); Arkhangelsk and Nenets, Chukchi, Karelia, Khanty-Mansii, Komi, Krasnoyarsk, Murmansk, Sakha/Yakutia, Yamal-Nenets (Russia); Norrbotten, Västerbotten (Sweden); and Alaska (US). Apart from imposing administrative borders on land, these provinces also generate delimitation of the Arctic according to the real and potential (imaginary) borders of, respectively, the Arctic states' exclusive economic zones and national sectors

The Arctic provinces are both similar and heterogeneous. On one hand, they all experience the lowest atmospheric temperatures and longest winters on Earth, 'polar days' and 'polar nights,' and have glaciers instead of trees, as well as certain visual and sound effects found only north of the Arctic Circle. The current Arctic states take these conditions into account when organising their military, economic, and demographic spaces.


Pacific Ocean
Japan
China
United States
Canada
Arctic Ocean
Russia
Norway
Greenland
Iceland
Finland
Kazakhstan
Sweden
Faeroe Is.
Norway
Latvia
Belarus
Lithuania
Ukraine
Georgia
United Kingdom
Poland
Turkey
Jordan
Atlantic Ocean
0 350 700 Km

The provinces also share the historical position within the structure of the nation state: '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 centres of gravity lie, for the most part, far to the south.' On the other hand, the Arctic provinces are heterogeneous in relief, climate, and distribution of natural resources, as well as in population and industrial composition, military configuration, and level of institutional integration and technological advancement. Despite the potential change in climate, it is highly unlikely that these characteristics will disappear in the near future.

Geopolitical Analysis: Theoretical and Methodological Configuration

In the 21st century, geography still matters 'because humans are physical beings who occupy space and have physical needs geography cannot be dethroned from its central position in the international sphere.' At the same time, the new thinking in geopolitics refers to geographical possibilism rather than determinism. Geography is now assumed to be one of many possible *conditional* factors in national and global politics, with a facilitating rather than a pure effect as O'Loughlin and Anselin argued (1993). It is, however, unclear whether this condition holds in the Arctic.

This work belongs to the domain of systemic (structural) geopolitics. It implies that 'the study of the structural processes and tendencies that condition how all states practice [domestic and] foreign policy.' Systemic analysis is a powerful methodological tool for contrasting Arctic provinces as, firstly, many scholars believe that it is relatively "neutral" and, secondly, it is probably the best approach ever imagined when comparing heterogeneous political systems such as those of the eight Arctic states, according to Berg-Schlosser and Stammen (2000). Methodologically, a systemic approach 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. In diagram form, this version of elementary modeling might be presented as:

Whole → System of elements → Whole

Among the rare analytical attempts to operationalise systemic geopolitical analysis four works deserve special attention since their theoretical and methodological elements form the basis of the current analysis. The first is Dussouy's 'Global Interpretation Method of the World' (2010). 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 interaction of all these things in different places and under varying circumstances.

Accordingly, a strictly axiomatic approach is not adoptable as 'it is impossible, in all social sciences, to practice any sort of a priori verification.' The global system is partitioned into five distinct geopolitical action spaces: physical, natural space; demo-political space; diplomatic-military space; socio-economic space dealing with globalisation; and symbolic, idealistic and cultural space representing the system's subjective attributes. Each space should then be subjected to a spatial analysis to uncover the internal structural logic and the obstacles it has to face. Dussouy offers a methodology for gathering data that can serve as the basis for an empiric-inductive theory. While displaying clear signs of systemic geopolitics, Dussouy's analysis leaves the question of model operationalisation and, specifically, the determination of concrete indicators of performance within individual action spaces, open.

Second, in 'Constant and Variable Factors of Geopolitical Analysis' (2009), Csurgai proposes that the geopolitical system consists of both objective and subjective 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. 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. In doing so, 'geopolitical analysis can respond to the need of using a multidimensional method to interpret the complexity of contemporary international relations.' However, no definite specification of individual indicators is offered.

The third work offers a solid empirical configuration of Arctic geopolitics. In 'Reemergence of the Arctic as a Strategic Location' (2008),

Knell highlights the multi-dimensional character of modern geopolitics in the Arctic and proposes a multi-vector analytical response to it. He analyses the northernmost region as a system of its political, military, economic, social, infrastructural, and information sub-systems, as 'any purely linear approach to the Arctic would be doomed, because it would not recognise the complexity of any one action.' Knell suggests to start with analysing the developments within each sub-system and then focusing on the system's dynamic interaction of parts. However, the intra-regional geopolitical differentiation of Arctic provinces is absent, as the study remains on a national, rather than sub-national, level.

A final, indirect, contribution to the operationalisation of systemic geopolitical analysis belongs to Wolfson, Madjd-Sadjadi and James (2004). Advocating the appropriateness of cluster analysis in understanding the full range of interactions among political, economic, and conflict-related variables, the authors suggest that 'it is appropriate to begin without imposing too many restrictions on the analysis.' The variables are assumed to form part of a yet-to-be-understood, non-linear, time-dependent interactive system. Again, the analysis operates on the national level.

Integrating the interdisciplinary logic of the four above-mentioned approaches and focusing on the sub-national level of regional analysis, this study assumes the geopolitical performance of each Arctic province to be defined as a complex process of simultaneous interaction between geographic, economic, demographic, military and institutional factors. If the Arctic civilizational evolution is divided into 'pre-Cold war,' 'Cold war' and 'post-Cold war' periods, the 'Cold war' period might be represented as the region's traditional geopolitical configuration. Because there are two primary conditions for a state's sovereignty – territory and population – the importance of geographic and demographic factors is traditionally significant. Assessment of military presence in the region is another traditional factor to be considered while studying Arctic geopolitics. Becoming much stronger in the post-Cold war period, economic and institutional factors are relevant because recent geopolitical analysis indicates the tendency of socio-economic factors to get ahead of the traditional military-oriented vision of the region as noted by Sale and Potapov (2010), Zellen (2009), Keskitalo (2004) and Knell (2008). As 'the lines between

international economics and regional economics are becoming blurred,' it also seems appropriate to position the Arctic provinces within an international context, showing the extent of their participation in intra- and inter-regional institutional integration. The reason is obvious – cooperation, rather than conflict, is in everyone's interest.

These factors are operationalised through the following geographical and geopolitical indicators: total land area (sq. km); temperature in January and July (average, oC); exclusive economic zone (thou. sq. km); national sector area (thou. sq. km); total and indigenous population (thou. persons); gross regional product (million USD) and its division into agriculture (million USD), industry (million USD), and services (million USD); active links of economic and military regionalism (number); military bases (number), annual national military expenditure (million 2011 USD), and possession of nuclear weapons (binary).

The analysis is strictly objective: with no attempt to repudiate the presence of certain factors of subjective geopolitics in the Arctic, this work omits them due to the unbearably low availability of empirical data and problematic operationalisation. The only (partial) exception to this strategy is the decision to differentiate between the provinces based on their share of the national sector area. Indeed, the latter is a semi-subjective indicator. Even though the sector doctrine by itself does not constitute a valid basis for claims of title to territory, and is generally rejected by Denmark, Norway and the US, 'it appears that, since there are no outstanding disputes over land and island territories in the Arctic, the substance of the sectors claims there has been recognised either by treaty or simply by acquiescence.' The sector approach, if contrasted to EEZ, says much more about the role of provinces in the Arctic states' symbolic treatment of the Arctic Ocean (on geopolitical representations/'mental maps'). A mapping of modern territorial claims in the Arctic confirms that the sector approach is not completely out-dated.

The classification of Arctic provinces according to both geographic and geopolitical attributes allows (a) the identification of attributes that generate group membership instability and (b) reveal which specific areas in the region are more prone to potential interstate conflict in the region. The latter is defined as a disagreement of at least two Arctic states over some type of contentious issue(s). A substantial amount of empirical evidence exists on the causal relationship between geography and interstate conflict.

Two geographic facilitating conditions for causing of interstate conflict are relevant to the Arctic case: the threat of proximity and temperature change.

According to Bremer (1992), Huth (1992) and Hensel (2000), the majority of interstate conflicts occur between neighbouring states because 'contiguity produces the strongest effect, increasing the probability of war by over 35 times – more than such common explanations as alliances, major power status, and relative capabilities.' It is appropriate to demonstrate the ways in which the resulting geopolitical grouping of Arctic provinces contributes to the strength of this factor.

The proximity argument then implies the need to identify areas where groups border each other, as these are assumed to be the most probable candidates for potential conflict within the Arctic geopolitical system. At the same time, studying 10-year variation in Arctic temperatures allows the verification of the significance of temperature change in the region as, according to Hsiang, Burke and Miguel

> when climate variations occur, they can have substantial effects on the incidence of conflict across a variety of contexts. The median effect of a 1σ change in climate variables generates a 14% change in the risk of intergroup conflict…If future populations respond similarly to past populations, then anthropogenic climate change has the potential to substantially increase conflict around the world, relative to a world without climate change.

Research Mechanics: Cluster Analysis, Data, Measurement

A general question raised by researchers across many disciplines, including political geography and geopolitics, is how to organise the observable phenomena in vivid structures, i.e. to draw taxonomy. Cluster analysis (the term first used by Tryon 1939) is not one specific algorithm but a task encompassing a series of descriptive, multivariate and exploratory statistical procedures to classify entities into groups according to (a) how close the attributes are to one another and (b) how far they are from others. Despite the existence of intrinsic paradoxes, the method is both useful and meaningful and therefore popular in contemporary science. Besides, in contrast to factor analysis, clustering works well even with

a limited number of cases and attributes – a situation that is currently observable in the Arctic region.

Because the 'selection of variables dictates the scope and validity of research, preliminary knowledge about theoretical linkages between variables procures the factual analysis. Searching for coherent groups of Arctic provinces, this clustering of geographical, economic, military, demographic and institutional variables emphasises the interdisciplinary nature of modern geopolitics. The analysis is run in the Statistica 10 package using menus.

Three basic decisions need to be made when performing cluster analysis. The first decision is what type of clustering method to deploy since Statistica offers a range of approaches. Without presupposing a particular number of groups to be found and without expecting the clustering of both cases and variables to yield useful results (when k-means clustering and two-way joining are, respectively, the most appropriate methods), this work applies the joining (tree) clustering method on cases resulting in a series of vertical dendrograms. Because, in this case, 'similarities are a set of rules that serve as criteria for grouping or separating items,' the choice of distance measurement is the second compulsory decision. Euclidean distance is the basic, and most frequently used, geometric distance in the multidimensional space. Its squared version allows greater weight to be placed on objects that are further apart. Both techniques are preferable when the data is raw. City-block (Manhattan) distance operates on the logic of the average difference across dimensions, but has the danger of a dampened effect on single large differences (outliers) as the latter are not squared. Chebychev distance is appropriate if two objects are defined as "different" if their difference occurs on any one of the dimensions. Power distance measurement allows assigning (and manipulating) the weight on dimensions on which the respective objects are very different. Finally, per cent disagreement measurement is preferable for analysing data whose parts are categorical in nature.

The last decision is on the choice of linkage rule (amalgamation). Single linkage determines the distance between two clusters based on the distance of the two closest objects in the different clusters (nearest neighbour). Complete linkage determines the distance between two clusters based on the greatest distance between any two objects in the different clusters (furthest neighbour). Pair-group average calculates the distance between clusters as the average distance between all pairs

of objects in the two different clusters, and its weighted version uses the size of the respective clusters as weight. Pair-group centroid determines the target distance as the difference between centroids; the average points in the multidimensional space defined by the dimensions. Its weighted version allows weights to be assigned in case there is an expected variation (considerable) in cluster size. Finally, based on a sum-of-squares technique, Ward's method uses variance approach to calculate the distance between clusters. It is closer to regression analysis than the other methods.

The Arctic Regional Attributes Dataset (ARA Dataset) is presented in Appendix A in Excel 2010 format. It is a cross-national dataset of 27 cases (provinces) covering 16 variables (geographical and geopolitical indicators). Balancing between the inevitable costs of data compilation and the need to provide credible results, the dataset does not strive to include all data for a 10-year period but instead takes information from databases once every five years, starting in 2000 and ending in 2010. Two indicators (Econ_Reg and Mil_Reg) are the analytical invention of the author, and the rest has been culled from the eight Arctic states' national statistical databases, circumpolar statistical database ArcticStat, Encyclopedia Britannica, CIA – World Factbook, Weatherspark: Weather Dashboard, Sea Around Us Project, DaftLogic: Advanced Google Maps Distance Calculator, OANDA Historical Exchange Rates Database, Барциц (2000) and the SIPRI Military Expenditure Dataset. Some variables have been standardised in order to eliminate nation-specific scaling differences.

Appendix B provides detailed description of data aggregation in Word 2010 format. What follows is a brief description of the configuration of variables. In most cases, the variables are defined 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. Each Arctic province is characterised by the following mix of variables:

Area (thou. sq. km) – sum of all land area (including inland water and glaciers) delimited by provincial boundaries and/or coastlines, as defined in the respective sub-national administrative division of the Arctic states. The variable is configured at constant 2010 values throughout the entire period under consideration.

EEZ and *Nat_Sector (thou. sq. km)* – two variables reflecting the existing and potential (imaginary) maritime delimitation of the region; recal-

culated for each Arctic province according to the length of its coastline facing the northernmost ocean.

EEZ denotes existing borders. It reflects the area under the jurisdiction of the Arctic state generated by the coastline of each province facing the Arctic Ocean. 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, EEZ per province is unknown. This work transforms the available data using basic arithmetic algorithms; for each Arctic state, the length of the coastline (km) and EEZ (sq. km). Next, to overcome the coastline paradox, this work reconstructs the same length of coastline for each Arctic state in *DaftLogic: Advanced Google Maps Distance Calculator*. Using the same maps and markers, the calculated percentile share of each province's coastline in relation to the country's total coastline is undertaken. Finally, this work recalculates the country's total EEZ according to the provincial coastline's percentile value.

Nat_Sector denotes the potential (imaginary) partition of the Arctic Ocean. It demonstrates each province's area of national sector generated by its own coastline. This variable has two functions: to differentiate the eight Arctic states according to their relative location vis-à-vis the ocean (littoral – non-littoral) and according to their sovereign ambitions regarding waters beyond their EEZ (extended continental shelf claims – no extended continental shelf claims). Finland and Sweden are non-littoral states – their coastlines do not directly face the Arctic Ocean. At the same time, Iceland does not seek to extend its jurisdiction over the High North, even though part of its EEZ is located north of the Arctic Circle. Zero values are assigned in all three cases. For other Arctic provinces, the share of national sector – generated by their own coastline – is recalculated according to the percentile share of its coastline within the country's total coastline.

t_Jan. and *t_Jul. (average, °C)* – two variables reflecting the average temperature registered at thirty-seven weather stations located within the borders of Arctic provinces. The simple average is calculated if data at several stations in the Arctic province is available.

Population and *Indig_pop* (*thou. persons)* – two demographic variables denoting the total number of residents (both citizens and non-citizens), and total number of indigenous residents, of Arctic provinces as of January 1 of the respective year. All data are standardised. With the exception of Greenland, the Faroe Islands, Iceland and Alaska, no raw data are available on the ethnic composition of Arctic provinces. This work imports data on the percentile share of the indigenous population within the total population in the Arctic states' northernmost territories. Percentile values remain constant throughout period under consideration. The value for the indigenous population is calculated by augmenting the total population of the Arctic province with its percentile value for indigenous population. Data for Sweden, Norway, Finland, Canada and Russia are averaged.

GRP (mln. USD) – Gross Regional Product, by province, by year, in current prices. Data has been standardised. National currencies have been converted into current USD using OANDA yearly-average historical currency exchange rates. There is a lack of year-specific data on the following provinces: Newfoundland and Labrador, Quebec (2000, 2010); Finnmark, Nordland, Tromso, Norrbotten, Vasterbotten (2010). These values are not real but predicted. First an evaluation, via scatterplot in Statistica 10, was undertaken to see whether the available time range data form a trend. They do and thus this work uses multiple regression analysis to predict the missing value. Results are significant with 95% probability (significance level = 0.05; p-value < 0.05).

Agriculture (mln. USD) – the share of agriculture, forestry, fishing, and hunting within the Gross Regional Product, by province, by year, recalculated according to percentile value for every respective year. To reconstruct missing data on Nunavut, Northwest Territories and Yukon in 2010 an evaluation, via scatterplot in Statistica 10, is conducted to see whether the available time range data form a trend. They do and a multiple regression analysis is used to predict the missing value. Results are significant with 95% probability (significance level = 0.05; p-value < 0.05).

Industry (mln. USD) – the share of mining, manufacturing (metal products, electronics, machinery and scientific instruments, shipbuilding, pulp and paper, foodstuffs, chemicals, textiles, and clothing) and energy and water supplies, within the Gross Regional Product, by province, by year, recalculated according to percentile value for every respective year. To reconstruct the missing data for Nunavut, the Northwest Territories

and the Yukon in 2010 an evaluation, via scatterplot in Statistica 10, is conducted to see whether the available time range data form a trend. They do. A multiple regression analysis is deployed to predict the missing value. The results are significant with 95% probability (significance level = 0.05; p-value < 0.05).

Services (mln. USD) – the share of construction, wholesale and retail trade, transportation, information, finance, real estate, tourism, education, healthcare and social services within the Gross Regional Product, by province, by year, recalculated according to the percentile value for every respective year. To reconstruct the missing data for Nunavut, the Northwest Territories and the Yukon in 2010 an evaluation, via scatterplot in Statistica 10, to see whether the available time range data form a trend. They do and a multiple regression analysis is used to predict missing value. Results are significant with 95% probability (significance level = 0.05; p-value < 0.05).

Econ_Reg and Mil_Reg (number of active links) – two variables of international institutional regionalism denote the number of active membership in any of the following economic and military integration frameworks: World Trade Organisation, European Free Trade Association, North American Free Trade Agreement, Partnership and Cooperation Agreement, European Union – Common Market (economic regionalism) as well as North Atlantic Treaty Organisation, Memorandum of understanding between the Ministry of Defence of the Kingdom of Denmark, the Ministry of Defence of the Republic of Finland, the Ministry of Defence of the Kingdom of Norway, and the government of the Kingdom of Sweden concerning Nordic coordinated arrangement for military peace support and the North American Aerospace Defence Command (military regionalism). The codification of provincial advancement in institutionalised integration is conducted according to the following scale: 0 = no active link, 1 = one active link, 2 = two active links; with no intention of reflecting the intensity ('depth') of integration. Each province is assumed to be 100% open towards the respective nation state. In terms of intra-state regionalism, the Arctic provinces are assumed to share all national-level opportunities and responsibilities granted by given integration frameworks.

Mil_Bases (number) – active permanent military installations (land bases including 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 the Arctic provinces. A land base is defined for this work as being a military installation with a personnel of at least 18 persons, a naval base as a military installation with at least one armed vessel, and an air base as a military installation with a runway of at least 1600 m (45 x 40 m in case of heliport). Appendix B contains a full list of military bases. Data on the Khanty-Mansii and Yamal-Nenets provinces is not available.

Nat_Mil_Exp (mln. 2011 USD) – consistent provincial data on military expenditures is unavailable, thus national data is incorporated. The latter is taken from the SIPRI Military Expenditure Dataset. The military expenditure of Canada, Denmark, Finland, Iceland, Norway, Russian Federation, Sweden, and the US in 2000, 2005 and 2010, is considered in million constant 2011 USD.

Nucl_W (binary: 1=Y/0=N) – this variable differentiates between nuclear and non-nuclear Arctic states. This differentiation is based on the premises of Non-Proliferation Treaty (in force since 1970). According to the Treaty, the US and Russia are nuclear states and Canada, Denmark, Finland, Iceland, Norway and Sweden are non-nuclear states.

Cluster Analysis Using the ARA Dataset: Results

Because 'it is up to the researcher to select the right method for his/her specific application,' this work tried all methods of visual representation of clusters in Statistica 10 on the 2000 data. Since this work aims to contrast two perspectives of Arctic regional development in time, geographic and geopolitical, the method of amalgamation and distance metrics must be the same in both cases throughout the entire period under consideration. Only Ward's method and percentage disagreement offered apparent groups with relatively large membership within each group. The issue of membership is important because cluster analysis loses meaningfulness if there are many small and low-membership groups. Other methods did not offer plausible results; while single and complete linkage, pair-group average and centroid techniques produced too many groups with low membership (maximum three participants); Euclidean, City-block (Manhattan), Chebychev, Pearson and power distances did not allow clear distinguishability of groups (clusters themselves, and lines of association, were not discernible from zero). These techniques were therefore abandoned, and Ward's method combined with per cent disagreement was applied also to the 2005 and 2010 data.

Figures 2-7 demonstrate the clustering of Arctic provinces for 2000, 2005 and 2010. Even though the grouping method is the same in all cases, the reference values might be different for geographical and geopolitical clustering. In contrast to other research techniques, cluster analysis not presupposes any standard rules of cluster occurrence determination (e.g. 95% significance test in regression analysis). Clusters are found by drawing a reference line across the tree diagram and identifying groups below that line. The position of the reference line is arbitrary in nature and hence this work provides both the data (in both Excel 2010 and Statistica 10) and the clustering procedures in order to encourage other researchers to review the validity of the current results. Based on the author's preliminary knowledge of Arctic geopolitical affairs, the reference line is set up at the 1,35 value for geographic and geopolitical clustering. Such a configuration results in two geographical and three geopolitical clusters. Apart from several abnormalities, all clusters are stable in time, meaning that the null hypothesis is disproved. Abnormalities signal that 16 variables are enough to discover patterns in the data but are still not sufficient to produce mutually exclusive categories, as 'cluster analysis is diagnostic rather than definitive in nature.'

Geographically, the Arctic provinces are divided into two groups, the former being more internally homogeneous than the latter (see figures 2, 4, and 6). The first group might be called the 'Inner Ring' and it includes 15 provinces (16 in 2005). Members of this cluster share greater locational proximity to the North Pole (demonstrated though the existence of area of National sector generated by the province's coastline) and lowest January and July temperatures. Sample members are Nordland, Yukon and Krasnoyarsk. The second group might be called the 'Outer Ring,' it includes 12 provinces (11 in 2005). Members of this cluster are located further from the North Pole and/or have no direct access to the basin of the Arctic Ocean. They also experience moderate January and July temperatures, compared to provinces belonging to the first group. Sample members are Khanty-Mansii, Faroe Islands and Kainuu.

Geopolitically, the Arctic provinces are grouped into three internally homogeneous clusters (see figures 3, 5, and 7). The first cluster is termed 'Russia,' as it includes all Arctic provinces of the Russian Federation. Members of this group share a unique combination of geographical, economic, military, demographic and institutional integration attributes not found elsewhere in the region. And, these provinces account for almost

half the region's territory, population, and military installations, share nuclear state status, and generate approximately one fourth of gross regional product. They are also the least regionally integrated provinces, in both economic and military terms. This cluster therefore confirms the 'isolated' status of Russia mentioned by a number of analysts such as Arkhangelsk and Nenets, Murmansk and Chukchi.

The second group might be labelled 'Northern Europe' as it includes 5 provinces (7 in 2000 and 6 in 2005) of Finland, Sweden, and, until 2005, Iceland and the Faroe Islands. It is important to note that two Danish territories appeared in different clusters in 2000, indicating their heterogeneity. This heterogeneity, however, did not last long: by 2010, Iceland and the Faroe Islands have moved into the third cluster. Apart from common geographical attributes, members of this cluster also have the highest share of services in their gross regional product and a moderate level of regional economic and military integration. Sample members are North Ostrobothnia and Vasterbotten.

The third cluster is 'North America to Norway' since it includes 13 provinces (11 in 2000 and 12 in 2005) of Canada, the US, Greenland and Norway. In our analysis, contrary to the wide-spread conception of Scandinavian uniqueness, Norway is more similar to Canada and the US than to other Northern European countries. The same is true for Greenland; despite its political ties to the European sub-continent, it is part of the third cluster. Accounting for the greatest share of the region's indigenous population and generating more than half of gross agricultural and industrial product, these provinces are the most advanced in regional economic and military integration. Alaska, Nunavut and Svalbard are sample members.

The clustering of geopolitical variables, without geographic variables, is also done in order to determine the cause of unstable group membership of four Arctic provinces: Yamal-Nenets, Sakha/Yakutia, Iceland and the Faroe Islands. All geopolitical groups were found to be totally stable throughout the period studied.[1] Consequently, the preliminary impulse of instability arises from the geographic vector of regional development. Because three of five geographic variables in the dataset are fixed at constant values (total area, area of EEZ, area of National sector) the remaining two variables, average temperature in January and in July; appear to be the sole cause of unstable membership.

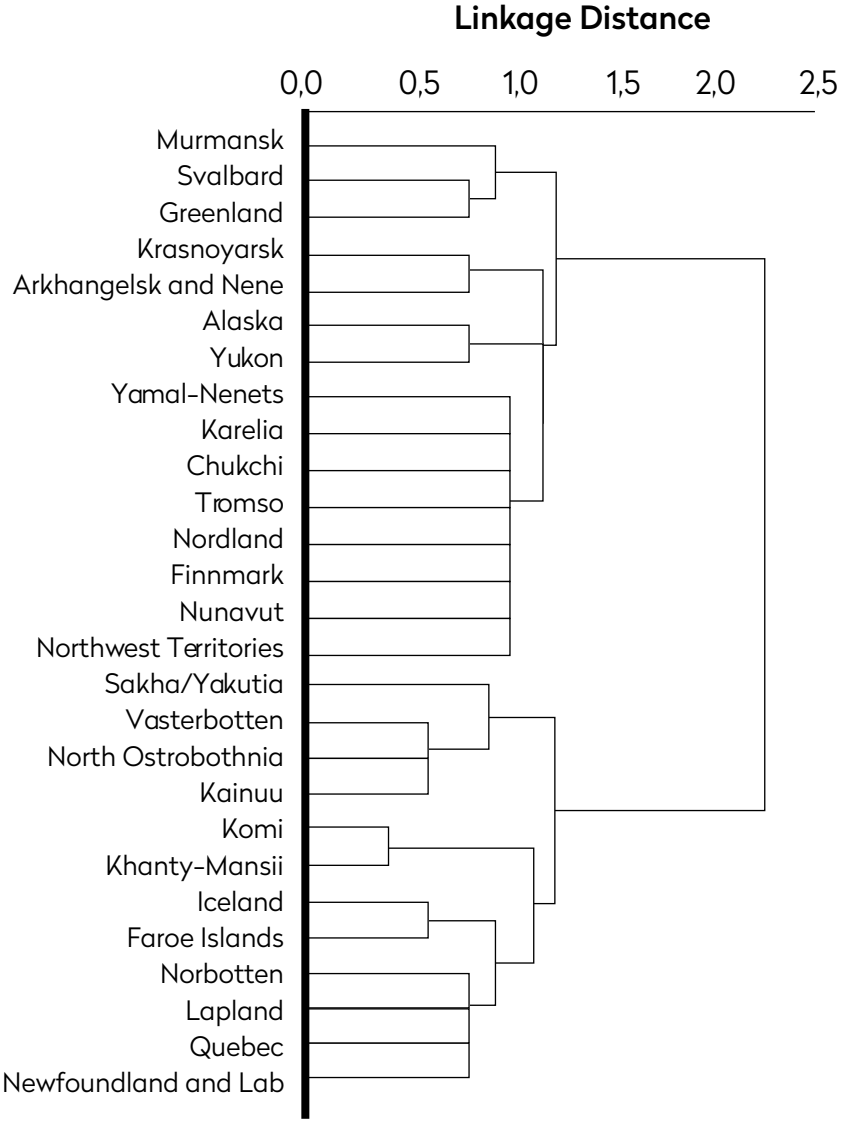

Figure 2: 2000 Tree Diagram for 27 Cases, Ward's Method, Percent Disagreement (Geographic Variables)

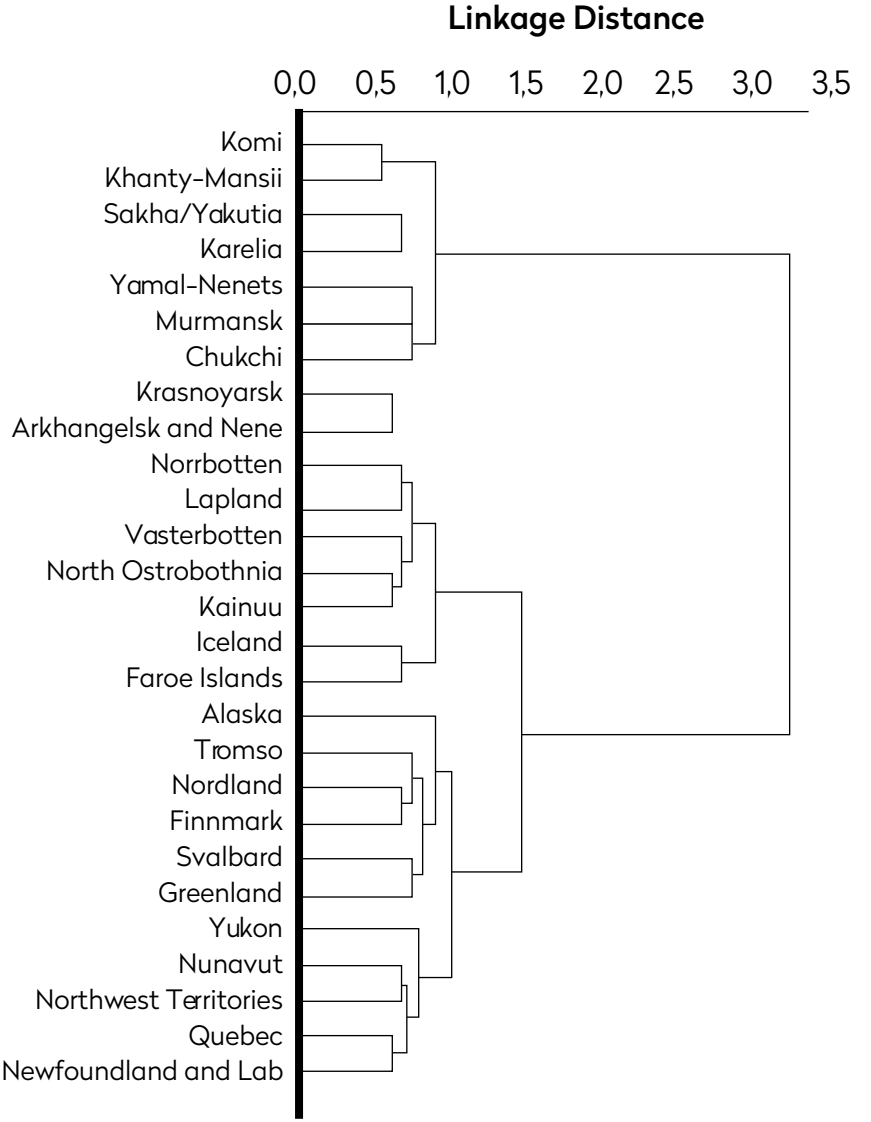

Figure 3: 2000 Tree Diagram for 27 Cases, Ward's Method, Percent Disagreement (All Variables)

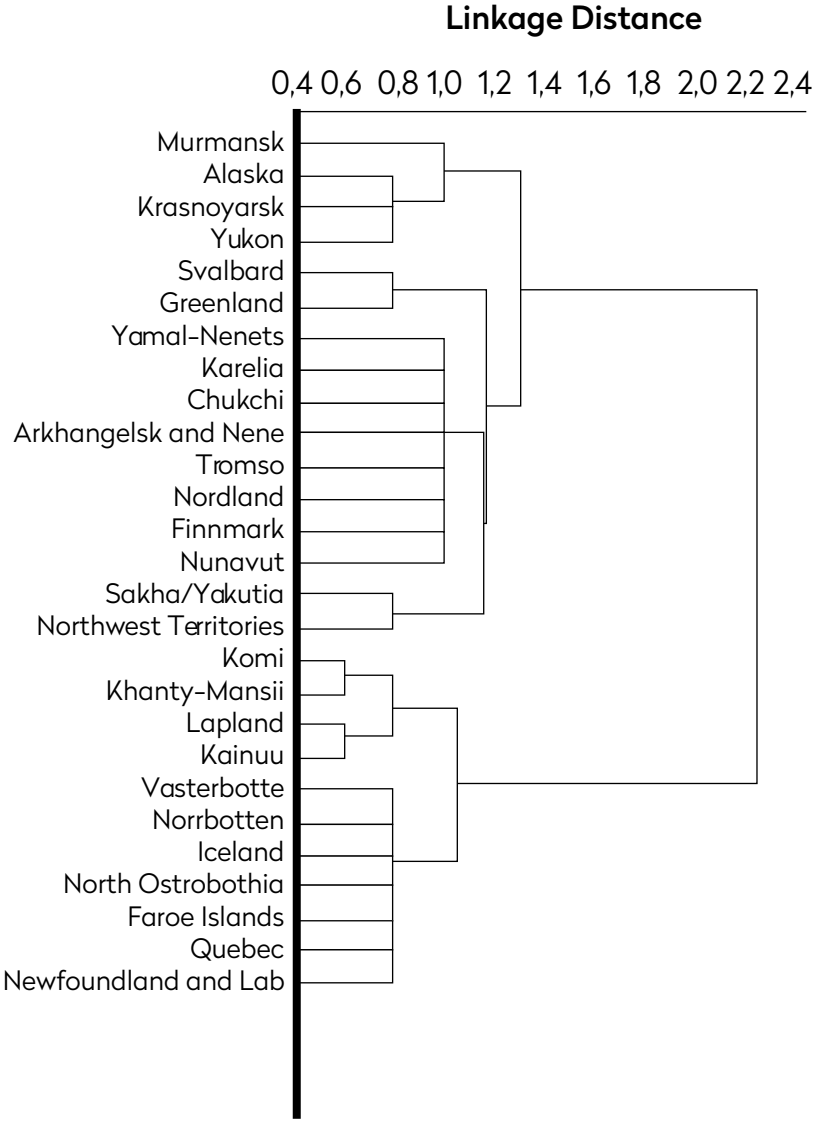

Figure 4: 2005 Tree Diagram for 27 Cases, Ward's Method, Percent Disagreement (Geographic Variables)

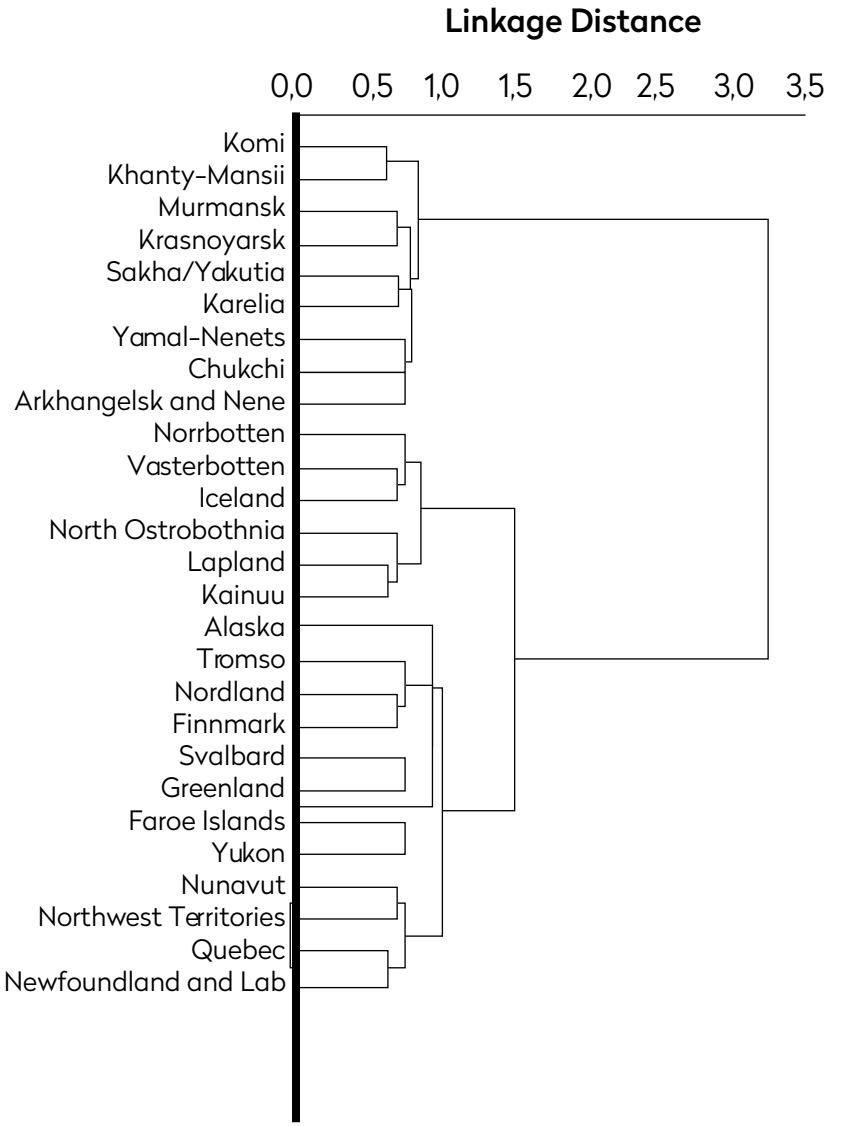

Figure 5: 2005 Tree Diagram for 27 Cases, Ward's Method, Percent Disagreement (All Variables)

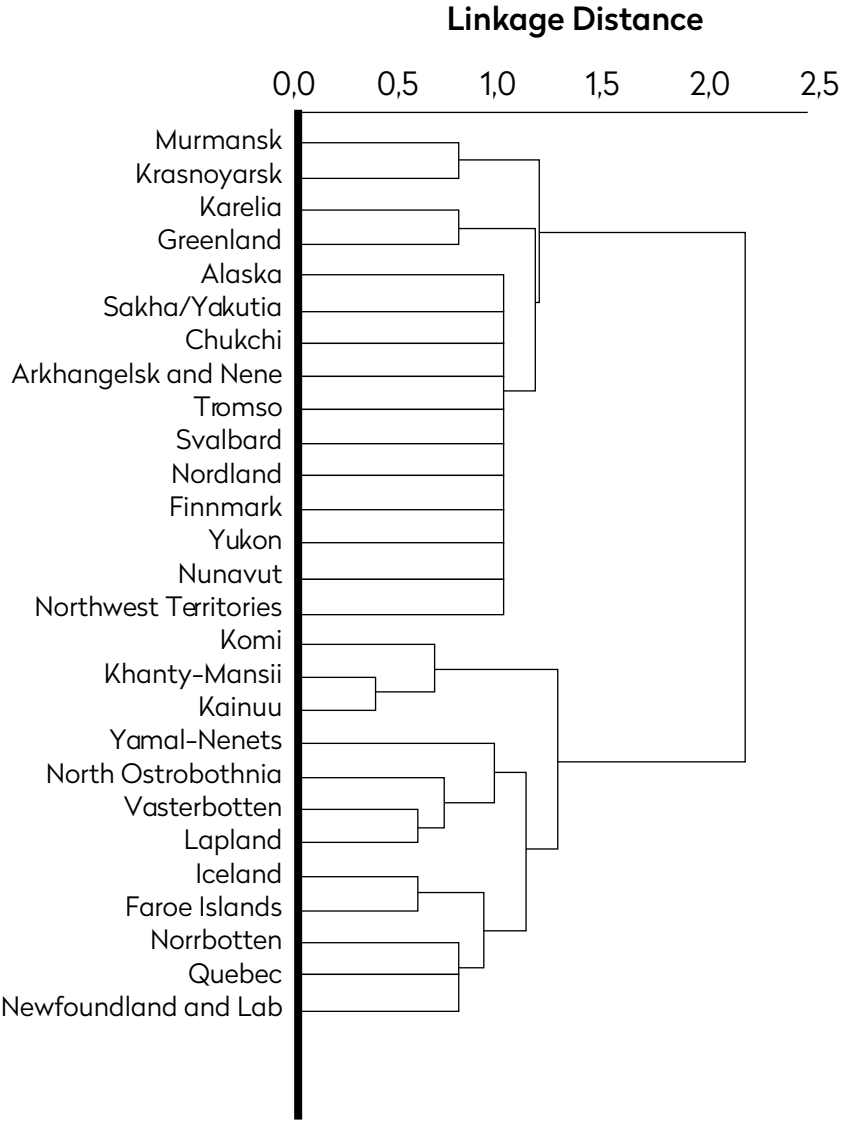

Figure 6: 2010 Tree Diagram for 27 Cases, Ward's Method, Percent Disagreement (Geographic Variables)

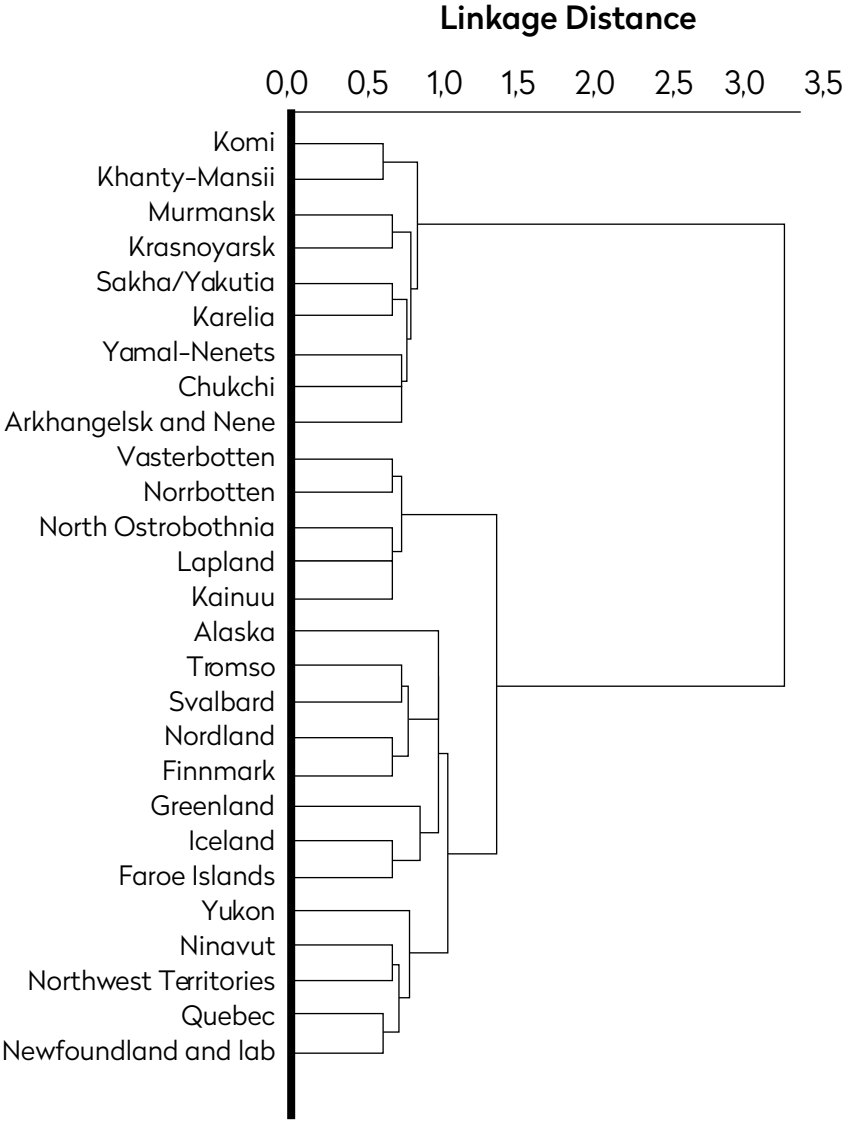

Figure 7: 2010 Tree Diagram for 27 Cases, Ward's Method, Percent Disagreement (All Variables)

Summary, Discussion and Directions for Further Research

This analysis differentiates Arctic provinces according to 16 specific attributes, in order to determine whether geographic and geopolitical groupings coincide and whether these groupings are stable throughout the first ten years of the new millennium. The analysis has revealed two groups based on the clustering of geographic attributes and three groups based on clustering of geographic and geopolitical attributes (the 'Inner Ring,' the 'Outer Ring,' 'North America to Norway,' 'Northern Europe' and 'Russia,' respectively). Membership stability in all groupings is not lower than 93%. The null hypothesis is therefore falsified. In practice it means that, despite popular rhetoric, neither geographic nor geopolitical configuration of the region has not changed dramatically. Besides, the widespread belief that Norway, Iceland and Denmark are part of Scandinavia is false: their position in Arctic geopolitical system consisting of 16 attributes has been shown to be more similar to the ones of Canada and the US than to the other Northern European countries, Finland and Sweden.

Geographical clustering divides the Arctic provinces according to their relative location and temperature; geopolitical clustering does not respect this grouping and provokes a deviation in the model. Such deviation causes modern Arctic geopolitics to have a conflict nature. On the one hand, given the current extent of the Arctic ice cover the first geographic condition for interstate conflict, the threat of proximity, is present in areas where one group faces (an)other group(s) in the conventional (i.e. not transpolar) manner. There are 11 such areas: Murmansk, Karelia and Chukchi belonging to the 'Russia' group; all areas except North Ostrobothnia belonging to the 'Northern Europe' group; and Finnmark, Tromso, Nordland and Alaska from 'North America to Norway' group. However, Murmansk, Karelia and Chukchi cases are different from all other cases due to Russia's isolated status within the regional economic and military integration framework.

On the other hand, four cases of membership instability (Yamal-Nenets, Sakha/Yakutia, Iceland, and Faroe Islands) are due to fluctuations in two temperature-related variables. The melting of the Arctic ice as a driving force of regional geopolitical transitions is empirically confirmed so the second geographic condition for interstate conflict, temperature change, is present within the Arctic geopolitical system. This presence is, however, unequal; while seven provinces demonstrate zero change in average temperatures in January or July (Murmansk, North Ostroboth-

nia, Iceland, Nordland, Svalbard, Tromso,[2] Khanty-Mansii), 19 provinces experience 1°C variation (Quebec, Greenland, Kainuu, Lapland, North Ostrobothnia, Iceland, Finnmark, Svalbard, Arkhangelsk and Nenets, Chukchi, Karelia, Khanty-Mansii, Komi, Krasnoyarsk, Murmansk, Sakha/Yakutia, Yamal-Nenets, Norrbotten, Vasterbotten), and this number drops to 6 if we search for provinces with a variation of at least 2°C (Quebec, Khanty-Mansii, Komi, Krasnoyarsk, Murmansk, Norrbotten). Because they experience the greatest variation of temperature, the latter 6 provinces should be more prone to involvement in interstate conflict than the other Arctic provinces. When this effect is controlled for the internal configuration of Arctic geopolitical classification, it is clear that the central positions of three Russian provinces and one Canadian province (within the 'Russia' and the 'North America to Norway' groups, respectively) make them less prone to conflict than the Murmansk province, as the latter is located on the border with provinces belonging to two different geopolitical groups, the 'Northern Europe' and the 'North America to Norway.' At the same time, Norrbotten belongs to the 'North America to Norway' group but borders the 'Northern Europe' group.

Again, the distinction should be made between the Norrbotten and Murmansk cases. It seems reasonable to believe that the Murmansk area is more prone to conflict. While the Murmansk province is area where "isolated" Russia borders the EU, with the Partnership and Cooperation Agreement as the deepest form of integration, the Norrbotten area is involved in an advanced stage of regional integration with the northernmost members of the EU. Keeping in mind the lack of variables reflecting the internal political organisation of the Arctic provinces in the dataset, and the horizontal approach to the quantification of intraregional integration, it is so far impossible to identify most 'conflict' cases. Additional analysis of the relationship between Arctic geography and interstate conflict is necessary.

The results of this study provide a preliminary, diagnostic geopolitical map of the Arctic region. It is important to understand whether the four exceptions challenging the stability of the clusters (Sakha/Yakutia, Yamal-Nenets, Iceland, and the Faroe Islands) are due to the inconsistency of raw inputs into the ARA Dataset, or because there exists a hidden geopolitical development which is not evident at the current stage of analysis. It is also crucial to ascertain whether the inclusion of Norway and Denmark in the 'North America to Norway' cluster is altered by the

introduction of additional indicators of regional development. Moreover, both cluster analysis and the ARA Dataset have certain limitations, so the next step would be to obtain data on other aspects of geopolitical development in the region (among others, the level of technological advancement, intrastate political configuration, the ecological situation, density of transportation, and labour force specifics) and support current findings by other analytical approaches (regression-based techniques, qualitative analysis).

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Notes

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about/norwegianmilitarybases/Pages/default.aspx>; OANDA Historical Exchange Rates Database <www.oanda.com/currency/historical-rates>; Rosstat <www.gks.ru>; Sea Around Us Project <www.seaaroundus.org/eez/>; SIPRI Military Expenditure Dataset <milexdata.sipri.org/files/?file=SIPRI+military+expenditure+database+1988-2012.xlsx>; Statistics Canada <www.statcan.gc.ca>; Statistics Finland <www.stat.fi>; Statistics Greenland <www.stat.gl>; Statistics Iceland <www.statice.is>; Statistics Norway <www.ssb.no>; Statistics Sweden <www.scb.se>; Statistiska centralbyrån. 'Kust och stränder i Sverige,' MI 50 SM 1301. Sveriges officiella statistik / Statistiska meddelanden, 2013. <www.scb.se/statistik/MI/MI0812/2012A01/MI0812_2012A01_SM_MI50SM1301.pdf>; Swedish Armed Forces <www.forsvarsmakten.se/ en/Organisation/The-Swedish-Army/>; United States Census Bureau <www.census.gov>; Weather Dashboard <weatherspark.com>; 'Russia in the Arctic,' Carlisle: Strategic Studies Institute, July 2011, (accessed 13 July 2013), <www.strategicstudiesinstitute.army.mil/pdffiles/PUB1073.pdf>; 'Canada: First Nations' World Directory of Minorities and Indigenous Peoples, 2013, (accessed 17 July 2013), <www.refworld.org/docid/49749d4137.html>; 'Canadian Forces Bases' The Canadian Encyclopaedia, 2012, (accessed 12 July 2013), <www.thecanadianencyclopedia.com/articles/canadian-forces-bases>; 'Military of Iceland,' Princeton University, 2013, (accessed 10 July 2013), <http://www.princeton.edu/~achaney/tmve/wiki100k/docs/ Military_of_Iceland.html>; 'Circumpolar Military Facilities of the Arctic Five,' Vancouver: The Simons Foundation, 2013, (accessed 15 July 2013), <http://thesimonsfoundation.ca/arctic-security>; 'Tasks in the Arctic and the Northern Atlantic,' Copenhagen: Ministry of Defence, 2012, (accessed 13 July 2013), <www.fmn.dk/eng/allabout/Pages/TasksintheArcticandtheNorthernAtlantic.aspx>.

6 The Arctic Ocean spans over 14 million square kilometres.

7 Arkhangelsk, Nenets, Novaya Zemlya and Franz Josef Land are aggregated; Nordland and Jan Mayen are aggregated; Labrador is incorporated into Newfoundland and Labrador; Nunavik is incorporated into Quebec; Chukchi includes Koryak; and Krasnoyarsk includes Evenk and Dolgan-Nenets provinces and Severnaya Zemlya. Distorted results are possible in case of Alaska, Quebec, Krasnoyarsk, and Sakha/Yakutia provinces – the share of non-Arctic area exceeds 50% of the total area.

8 As defined under the United Nations Convention on the Law of the Sea (1994), EEZ denotes exclusive economic zone adjacent to the territorial sea extending to 200 nautical miles (370 km) from the coast, within which the littoral state has sovereign rights over economic exploitation and exploration of natural resources (both living and non-living), production of energy, establishment and use of artificial islands, installations, and structures having economic and scientific purposes; and preservation of the marine environment.

9 Traditional, sector-based delimitation of the High North assumes five Arctic states (Canada, Denmark, Norway, Russia and the US) to have territorial sovereignty over all land and islands enclosed within a triangular sector defined by a baseline or the contiguous land mass of the claiming state

and two lines of longitude traced to the point at which they converge at the Pole – И. Барциц, "О правовом статусе российского арктического сектора," Право и политика 12 (2000), p. 1+. [I. Bartsits, 'On Legal Status of Russian Arctic Sector,' Law and Politics 12 (2000), p. 1+], (accessed 06 July 2013, <http://geo.1september.ru/view_article.php?id=200700102>.

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30 Neighbouring states are expected to be more likely than more distant states to engage in conflict due to their overlapping interests and perceived security threats, and the ease in projecting sufficient military capabilities.

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41 Appendix A might be found at:

42 Appendix B might be found at:

43 For EEZ see: <www.seaaroundus.org/eez/>, <geography.about.com/Finland>, <www.scb.se/statistik/MI/MI0812/2012A01/MI0812_2012A01_SM_MI50SMI301.pdf>, <geography.about.com/library/cia/blcnorway.htm>, <www.gks.ru>, <wediscovercanada.ca>, <www.seaaroundus.org/eez/>, <www.daftlogic.com/projects-advanced-google-maps-distance-calculator.htm#loginbox>. Nat_Sector: Барциц (2000).

44 Due to fractal-like properties of coastlines, the length of the coastline depends on the method used to measure it.

45 See <weatherspark.com>.

46 Due to significant heterogeneity in the extent of seasonal temperature scattering across Arctic provinces, annual average temperature is not as informative as biannual average temperature.
See: <www.arcticstat.org>; <www.statcan.gc.ca>; <www.stat.fi>; <www.ssb.no>; <www.census.gov>. See also: Hugo Ahlenius (ed) (2010), Vital Arctic Graphics: People and Global Heritage on our Last Wild Shores, Arendal: UNEP/GRID, at: <http://www.grida.no/publications/vg/arctic/, p. 15> (accessed 01 December 2010),

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49 See: <www.arcticstat.org>.

50 Ibid.

51 Ibid.
52 Irina Valko (2013), 'The Arctic Regional System under External Influence: The Case of China,' in Riegl and Landovský (2013), pp. 104, 109.
53 Coding the intensity ('depth') of institutionalised integration is a challenging task: in contrast to economic regionalism, wherein a range of approaches to typifying regional economic integration frameworks exist (e.g. Telo 2008) nevertheless without operationalisation algorithms, no template for evaluation of military regionalism is available.
54 See: <thesimonsfoundation.ca/arctic-security>; <www.thecanadianencyclopedia.com/articles/canadian-forces-bases>;<www.fmn.dk/eng/allabout/Pages/TasksintheArcticandtheNorthernAtlantic.aspx>;<http://www.puolustusvoimat.fi/en/>;<http://mil.no/organisation/about/norwegianmilitarybases/Pages/default.aspx>;<www.strategicstudiesinstitute.army.mil/pdffiles/PUB1073.pdf>;<http://www.forsvarsmakten.se/en/Organisation/The-Swedish-Army/>; <http://www.princeton.edu/~achaney/tmve/wiki100k/docs/Military_of_Iceland.html>. And see: Siemon T. Wezeman (2012), 'Military Capabilities in the Arctic,' Background Paper, Stockholm: SIPRI. See: <milexdata.sipri.org/files/?file=SIPRI+military+expenditure+database+1988-2012.xlsx>
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57 Wolfson, Madjd-Sadjadi and James (2004), p. 613.
58 Geographical Clustering: Sakha/Yakutia, Yamal-Nenets; Geopolitical clustering: Iceland, Faroe Islands.
59 Wolfson, Madjd-Sadjadi and James, p. 614.
60 See Knell (2008).
61 Screenshots of results are available on request.
62. Tromso is the only province indicating zero change in both January and July temperatures.