

2. The economy of the circumpolar Arctic

G rard Duhaime and Andr e Caron

The first comprehensive study on the Arctic economy using the main macroeconomic indicators was published in 2004 in the Arctic Human Development Report (AHDR).¹ According to this study, the circumpolar economy, as measured in 2001, has three distinguishing characteristics. First, the Arctic is exploited as a vast reservoir of natural resources serving the world market, and this massive extraction largely structures the rest of economic activity. Second, public services are often supported by major transfer payments from central to regional governments. Third, the customary use of living resources in activities such as family-based fishing, hunting and animal breeding continues to be important in economic terms and is now inextricably linked with the market economy.

The AHDR analysis also revealed some major characteristics of the geographic distribution of economic activity. First, while the Arctic exports to southern regions enormous amounts of raw materials for processing, it also imports a massive amount of finished goods and services for final consumption. Second, economic activity is unequally distributed among the different Arctic regions; the economic prosperity of the wealthiest regions being based on large-scale exploitation of natural resources.

The objective of this chapter is to present a new and updated analysis of the circumpolar Arctic considered as a whole. This analysis is based on an update of most of the data published in the 2004 AHDR.² It examines whether the conclusions reached then are still valid and, in some cases, it proceeds further in the investigation.

In the context of this chapter, the circumpolar area comprises the following 29 regions: Alaska, Northern Canada (Yukon, Northwest and Nunavut Territories and Nunavik), Greenland, Iceland, Faroe Islands, and the northern portions of Norway (Finnmark, Nordland, Troms, Svalbard), Sweden (Norrbotten, Vasterbotten), Finland (Lapland, Oulu) and the northern part of the Russian Federation (Karelia, Komi, Arkhanglesk, Murmansk, Khanty-Mansi, Yamalo-Nenets, Nenets, Taymir, Evenkia, Sakha, Chukotka, Magadan, Koryakia).³

The data obtained were from the most recent year available from the national statistical agencies of the different countries. They measure the total population and the gross domestic product by region and by industry of Arctic regional economic activity. To allow

comparisons between Arctic regions in different national contexts, the economic indicators in local currencies have been converted into US dollars at purchasing power parity (USD-PPP), and made to refer to a single reference year, namely 2003.⁴

The Arctic and the global economy

In 2003, the economic activity of the Arctic totalled some USD-PPP 225 billion. Globally, this economy is comparable in size to that of Malaysia (USD-PPP 222 billion), which has a population of 25 million and Switzerland (USD-PPP 237 billion), which has a population of 7.4 million (see Table 2.1).

The population of the circumpolar Arctic was estimated at approximately 9.9 million in 2002. This represents 0.16 per cent of the world population and two per cent of the total population of the countries covered by the study (see Table 2.2, Table 2.3). Consequently, the Arctic GDP accounts for 0.44 per cent of the global economy, which is greater than its demographic weight of 0.16 per cent. This gap suggests that income generation is more concentrated in the Arctic than in the rest of the world. On the other hand, Arctic GDP includes resource rents from extraction of non-renewable resources, parts of which should rather be viewed as replacement of wealth from one asset into another asset than income generation.

The economic activity of the circumpolar Arctic as indicated by GDP also represents 1.6 per cent of the economy of all countries with Arctic regions, which is

Table 2.1. GDP and population for selected countries with a GDP between 200 and 300 billion USD-PPP. 2003. Million USD-PPP and N

	GDP Million USD-PPP	Population Million
Greece	220 000	11.0
Malaysia	222 000	24.8
Arctic regions	224 766	9.9
Switzerland	237 000	7.4
Austria	241 000	8.1
Bangladesh	258 000	138.1
Ukraine	262 000	48.4
Egypt, Arab. Rep.	266 000	67.6
Columbia	286 000	44.6
Saudi Arabia	298 000	22.5

Source: 2005 World Development Indicators, Table 1.1 Size of Economy and Table 2.1 Population Dynamics.

The results for the Arctic regions were calculated by the authors from the national statistical agencies GDP and population data.

Table 2.2. GDP and population, World and Arctic Regions. 2003. Million USD-PPP and N

	GDP Million USD-PPP	Population N
Arctic regions	224 766	9 915 271
World	51 401 000	6 272 500 000
Percentage	0.44	0.16

Source for the world data: 2005 World Development Indicators, Table 1.1 Size of Economy and Table 2.1 Population Dynamics.
Other results were calculated by the authors from the national statistical agencies GDP and population data.

Table 2.3. Arctic Countries and Arctic Regions population. 2003. N

	Countries N	Regions N	Per cent of total N
Canada	31 600 000	111 546	0.4
Faroe Islands	47 000	47 000	100.0
Finland	5 200 000	645 272	12.4
Greenland	56 000	56 000	100.0
Iceland	289 000	289 000	100.0
Norway	4 600 000	465 200	10.1
Russian Federation	143 400 000	7 144 000	5.0
Sweden	9 000 000	508 973	5.7
United States	290 800 000	648 280	0.2
Total	484 992 000	9 915 271	2.0

Source for the countries data: 2005 World Development Indicators, Table 2.1 Population Dynamics except for Faroe Islands, Greenland and Iceland: Table 1.6 Key Indicators for Other Economy.
Other results were calculated by the authors from the national statistical agencies population data.

slightly less than its demographic weight (2.0 per cent). That gap, the opposite of the preceding one, could be explained by the fact that the Arctic includes relatively poor regions with high demographic weights that tends to drag the average Arctic GDP per capita figure downwards. On the other hand, many arctic regions, for instance Alaska, Yamalo-Nenets and Yukon have higher GDP per capita figures than the countries to which they belong (Table 2.4). In short, with some exceptions, economic activity seems to be more intense in the Arctic than in the rest of the world, but on average less intense in the Arctic than in the countries that encompass it. (Table 2.4.)

Table 2.4. Arctic Countries GDP and Arctic Regions GDP. 2003. Millions USD-PPP and USD-PPP per capita

	Countries		Arctic Regions		
	Millions USD-PPP	USD-PPP per capita	Millions USD-PPP	USD-PPP per capita	Per capitaGDP as per cent of country average
Canada	950 000	30 040	5 194	46 567	155
Faroe Islands	1 069	22 738	1 069	22 738	100
Finland	143 000	27 460	13 742	21 296	78
Greenland	1 108	19 552	1 108	19 552	100
Iceland	8 835	30 570	8 835	30 570	100
Norway	173 000	37 910	9 882	21 243	56
Russian Federation	1 284 000	8 950	139 815	19 571	219
Sweden	239 000	26 710	13 417	26 361	99
United States	10 978 000	37 750	31 704	48 905	130
Total	13 778 012	28 409	224 766	22 669	80

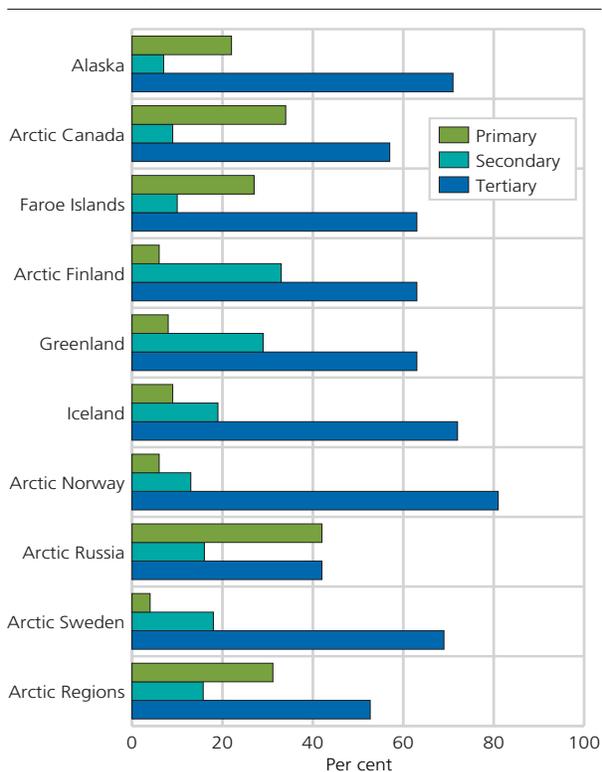
Source for the countries data: 2005 World Development Indicators, Table 1.1 Size of Economy except for Iceland Table 1.6 Key Indicators for Other Economy.
The results for the Arctic regions (including Faroe Islands and Greenland) were calculated by the authors from the national statistical agencies GDP data.

Primary sector plays major role⁵

The primary sector is the second largest sector in the circumpolar Arctic as a whole. Based essentially on the exploitation of natural resources, the primary sector represents roughly USD-PPP 70 billion and contributes 31 per cent to Arctic GDP (Figure 2.1).

The primary sector in the Arctic consists primarily of two types of activities. The first type is the large-scale extraction of non-renewable resources, the value and volume of which is immense. These include hydrocarbons from Alaska's North Slope and the Khanty-Mansi Autonomous Okrug in Russia, nickel from Norilsk and the Kola Peninsula, diamonds from Canada's Northwest Territories and gold from Bilibinsky in Chukotka. Hydrocarbon production alone accounts for roughly USD PPP 53 billion, while the rest of mining production totals approximately USD PPP 9 billion. These activities characterize the Arctic and confirm its role as a reservoir of natural resources for world markets. The vast Arctic regions, most of which were opened to large-scale industrial exploitation in the 20th century, attract large national and transnational firms that have the necessary means to support massive operations and retain profit. Most often, this large-scale exploitation is carried out with capital, equipment and labour from outside the Arctic regions themselves. The real impacts on local and regional economic agents vary greatly. In some cases, these operations are, so to speak, parachuted into resource areas in the style of a «boom town», and are of little benefit to local businesses and manpower. This was the case with the Colomac and Tundra mines in Northern Canada.⁶ In other cases, especially when the territorial rights of aboriginal residents are involved, these operations produce greater economic benefits for local and regional agents, as in the case of the Red Dog Mine in Alaska.⁷ These projects also generate sizeable negative impacts. For example, they sometimes interfere with customary activities carried on by residents, in particular aboriginal residents, when they harm the environment or compete for land use.⁸

Figure 2.1. GDP by main industry. Arctic Regions. 2003.
Per cent



These results were calculated by the authors from the national statistical agencies' GDP data. 2002 for Iceland, Norway and the Russian Federation; 1992 for Greenland. Totals for Finland and Sweden do not equal 100, some data been classified as «non-specified». Data for the Russian Federation are estimated.

The second type of primary sector activity concerns renewable resources. In Karelia and the Faroe Islands, for example, commercial fisheries and forestry increase the value of primary activities. Compared with the first type of activity, these activities have an entirely different importance to the economic accounts and social reality. They are generally based on local investment rather than investment from outside; they are also heavily labour-intensive and the workers employed are mainly residents. These activities are carried on almost everywhere in the Arctic on a small scale. They are widespread and visible. They have broad impacts in the regions concerned, and for some of these regions, they are the backbone of the economy, even though their economic value is much smaller than that of hydrocarbons and minerals.

Uneven development in the secondary sector

The secondary sector (manufacturing and construction) is third in importance in the circumpolar Arctic, as a whole. It does not have the same importance in the Arctic regions as it has in the countries to which these regions belong, where manufacturing is generally more developed.

However, the secondary sector is not absent from the Arctic. It plays a substantial role in Iceland, Northern Scandinavia and Greenland.⁹ In Iceland, for example, secondary activity exceeds primary activity in value creation. Manufacturing in the Arctic is especially robust in industries such as sea products, basic metals and metal products, machinery and various equipment, including precision instruments and transportation equipment. Overall, manufacturing is little developed in the Arctic, and therefore everyday consumer goods are generally imported from industrial centres further south.

Tertiary sector with public predominance

Lastly, in the circumpolar region as a whole, the tertiary sector (service industries) is by far the most dominant (Figure 2.1). It accounts for more than 50 per cent of all economic activity, and the figure even rises to more than 80 per cent in some regions such as Yukon or Troms and Finnmark. This situation may be explained by two major factors. The first is the weight of public administration. In general, public administration is the dominant service industry. In most regions, the total public sector, including health and education services, generally accounts for 20 to 30 per cent of all economic activity. In some regions, especially those where the primary and secondary sectors are little developed, public services may account for more than 30 per cent of all economic activity, as is the case in the Nunavut Territory where it reaches 45 per cent. The second factor that explains the preponderance of tertiary activity is the development of other industries such as trade, transportation and real estate. These industries stand out from the others because of their specific importance in the Arctic. Trade increases as basic industries expand and thus extend their economic benefits in the form of employment and consumption. Similarly, trade increases with the scale of government operations, such as investment in social housing and transportation infrastructures, and increase in public services. In the Arctic, this activity greatly benefits the transportation industry, since demand is largely for imported consumer goods, which must be brought into the Arctic.

Two development models

The Arctic displays two fairly distinct development models. In the first model, Arctic regions characterized by ancient settlements have structured their economy around the exploitation of renewable natural resources, such as fisheries or forestry. Some of these regions have managed to support this type of development, in particular through intensive industrialization, as in the case of the fishing industry in Greenland. In that region, the government has oriented development toward the harvesting and processing of groundfish and shrimp.¹⁰ But other regions have seen this traditional foundation of economic activity approach stagnation. In these regions, such activities are still performed, but the economic context is such

that profitability is difficult to achieve or maintain. For example, reindeer herding is still practised in the north of the Russian Federation, but the reorganization of the industry in the post-Soviet period has led to a sizeable decrease in herds.¹¹ Also, reindeer herding is vulnerable to the degradation of pasturelands as a result of oil exploration.¹²

In the second development model, the economy is largely based on large-scale exploitation of non-renewable resources, mainly basic metals and hydrocarbons. Those regions, which have experienced major prosperity, some of it quite recently, have literally been opened to massive exploitation in support of national policies for industrial development or, more recently yet, energy security. This is the case with the gas-producing regions of the Yamalo-Nenets Autonomous Okrug to the east of the river Ob, where the Zapoliarnoie deposit was exploited from 2001.¹³

In both models, the growth of the State has accompanied these types of development or even induced them. In regions of ancient settlement, the introduction of universal services and national standards has seemingly increased the size of public administration. In regions where massive industrial projects were more recent, the presence of the State appeared to have laid the foundations for exploitation by supporting the creation of public infrastructure (health services, municipal services, housing, education, etc.). In any event, the relative weight of public administration in overall economic activity is a major characteristic of the situation in the Arctic. In all cases, industries such as trade and transportation develop in support of the basic industries.



Alaska. Photo: Photos.com

Import and export

Much of the resources extracted in the Arctic are transported outside the northern regions for processing. In particular, this is the case with hydrocarbons and minerals. Massive amounts of food products are also exported, as in the case of Greenland shrimp sold in Asia. However, not all food production is exported,

as domestic markets exist in some regions. Conversely, the Arctic regions are supplied from outside with goods and services for consumption. While precise data are lacking on the circumpolar scale, there is every indication that globally the Arctic acts as an exporter of raw materials and energy and an importer of final goods and services.

The Arctic regions within the Arctic countries

An analysis of data gathered from the Arctic regions, as distinct from the country to which they belong, reveals some striking characteristics. The situation in the Russian Federation is unique. Only 5 per cent of the Federation's total population lives in its Arctic regions, but the domestic product of those regions accounts for 11 per cent of the country's overall economic activity. Nowhere else is the gap between these indicators so large. An analysis of relative results, that is, as measured per capita, yields similar findings. The per capita gross domestic product of Russia's Arctic regions is approximately twice as large as that of the Russian Federation as a whole. Again, in none of the other Arctic countries is this gap so pronounced. These differences seem to reflect the economic benefits of exploiting natural resources, especially the non-renewable resources, for which the volume and prices are high.

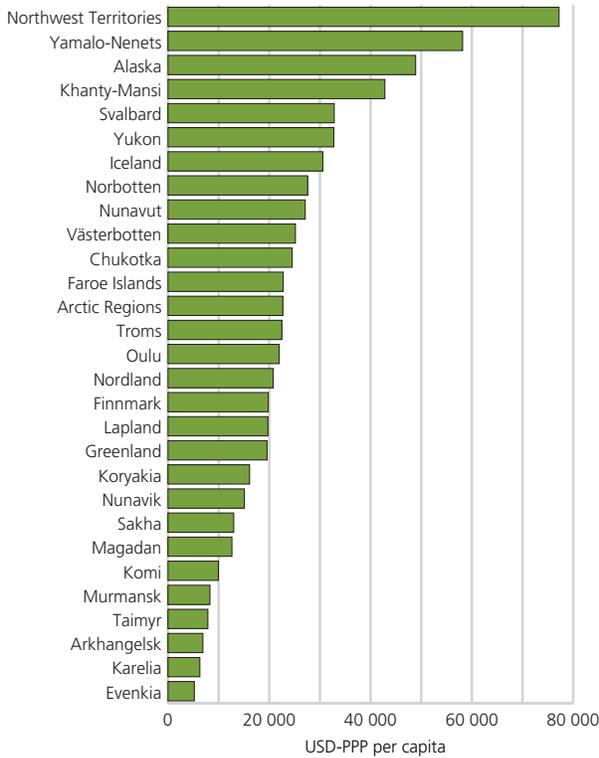
Other regions have gaps of this nature, but not of this magnitude. In Alaska and Northern Canada, the domestic product of the Arctic regions is also greater than their demographic weight. This is also true for per capita gross domestic product, which is higher in these regions than in the United States or Canada as a whole.

In Arctic regions, where the main extractive activity is in renewable resources, such as forestry in the Arctic areas of Sweden, per capita gross domestic product is closer to the average and may at times even be lower than that of the country as a whole.

Weight of the Russian North

The Arctic is made up of 28 separate regions in 8 different countries. Alaska alone accounts for 14 per cent of all circumpolar output, whereas its population represents only 6 per cent of the Arctic population. This may be explained by the fact that, in Northern Alaska, there is major oil production on the North Slope and Alaska has the largest zinc mine in the world, as well as a large commercial fishing industry that has shaped its history for decades. Four regions generate more than 60 per cent of Arctic economic activity, that is, Khanty-Mansi, Alaska, Yamalo-Nenets and Sakha. Note that 3 of the 4 regions behind the 60 per cent of circumpolar GDP belong to the Russian Federation. As with Alaska, large-scale extraction activities are a major feature of the economy of these regions. Northern Russia is a major producer of oil

Figure 2.2. GDP, Arctic Regions. 2003. USD-PPP per capita



The results were calculated by the authors from the national statistical agencies GDP data except for Iceland 2005 World Development Indicators Table 1.6 Key Indicators for Other Economy

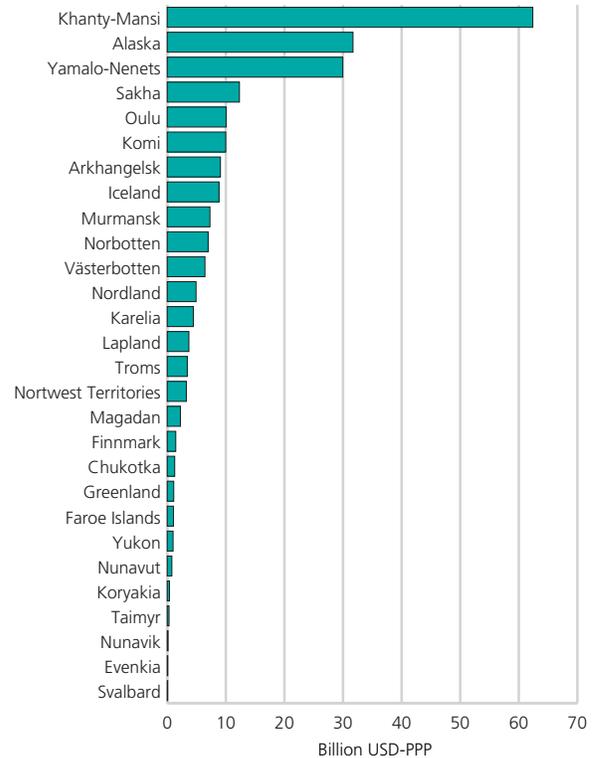
and natural gas, supplying both the Russian Federation and the global market.

Northern Russia alone represents two-thirds of all circumpolar economic activity. When combined with the economy of Alaska, this proportion reaches three-quarters. In other words, the economic activity of the Arctic regions of the Russian Federation and Alaska far outweighs that of the rest of the circumpolar world (Table 2.4 – Figure 2.3).

The geographic distribution of Arctic Russia’s production is very unequal across the Russian Federation’s Arctic territory. Apart from the regions that are particularly rich in natural resources (oil, minerals) like for instance Yamalo-Nenets, the value of the economic activity of most other Russian regions accounts for less than 1 per cent of the total circumpolar Arctic. In fact, apart from the Yamalo-Nenets, Khanty-Mansi and Chukotka regions, all the other Russian regions have a per capita GDP below the circumpolar average (see Figure 2.2).

The regional differences in the distribution of economic activity among its Arctic regions make Russia the country with the most contrasting regional differences. Some regions benefiting from the presence of strategic resources have undergone substantial development. Other regions, some of which were previous-

Figure 2.3. GDP, Arctic Regions. 2003. Billion USD-PPP



The results were calculated by the authors from the national statistical agencies GDP data except for Iceland 2005 World Development Indicators Table 1.6 Key Indicators for Other Economy

ly prosperous, have experienced an absolute decline, for instance, the Murmansk region, where the years following the dismantling of the Soviet Union, marked by high emigration and a decline in economic support from Moscow, were very harsh. Such regions were developed under the Soviet regime to exploit the presence of resources that were strategic at the time, such as base metals needed to industrialize the country. But the industrial infrastructure has aged considerably, while the resources themselves have been largely depleted, making the continuation of these activities much less attractive. In other cases, the support provided by the Soviet regime made it possible to maintain enterprises such as reindeer breeding in the Far East. This support ended with the dismantling of the Soviet Union, causing a major decline in this type of activity and deterioration in the living conditions of the populations affected.

Disparities among Arctic regions

When the circumpolar Arctic regions are analysed according to their per capita economic output, some noteworthy differences are revealed. The Canadian Northwest Territories have the highest per capita gross domestic product in all the Arctic (Figure 2.2). This situation is due to a low population density combined with significant diamond production. Launched at the start of the 2000s, diamond production in that region is now equal to the value of all mineral pro-



Canada. Photo: Photos.com

duction in Alaska, excluding oil. This is an important industry, not only because the mining is intensive, but also because the stones mined are of great value on global markets. Indeed, this production has boosted Canada into second place, worldwide, in diamond production. Alaska, the Khanty-Mansi and the Yamalo-Nenets Autonomous Okrugs are the other regions having a per capita GDP more than twice the average for the Arctic as a whole. Like the Northwest Territories, those regions benefit from large-scale resource exploitation while their population, except for Alaska, is rather small. One should be aware, though, that high GDP per capita levels do not automatically transform to high levels of disposable income and/or consumption, in particular not in the regions with substantial extractive industries. On the one hand, resource rents and return to capital may be transferred out of the region to capital owners. Although, these figures will still add to regional GDP, they will not be available for consumption or saving in the region. On the other hand, direct state transfers will contribute to per capita levels of disposable income and/or consumption, but will not show up in regional GDP figures. Hence, a ranking of regional disposable income levels or consumption levels in the Arctic may follow a different order from GDP per capita.

Practically all the Arctic regions of Scandinavia, along with Iceland, Greenland and the Faroe Islands, have a GDP per capita around the average for the circumpolar Arctic. These regions all have relatively diversified economies, a relatively high standard of living and, at least in the Scandinavian regions, denser economic development than elsewhere in the Arctic countries. Iceland, whose fishing industry continues to be important, also has a developed tourism industry, as do the Arctic portions of the Scandinavian countries due to a road infrastructure that links the northern fringes with the rest of the European continent. Greenland, a major exporter of shrimp on world markets, as earlier mentioned, also has a relatively large tertiary sector. In Finland, the manufacturing sector, which is relatively undeveloped everywhere else, has undergone a remarkable boom in the Oulu region due to the pres-



Iceland. Photo: Photos.com

ence of its wireless communications manufacturing industry.

Finally, the regions with the lowest production value belong to the Russian Federation, as already mentioned. These results would appear to be attributable to a combination of several factors, including the disorganization of the economy during the 1990s and emigration.¹⁴

Concluding remarks

This analysis confirms the earlier findings of the 2004 AHDR. The circumpolar Arctic is exploited as a vast reservoir of natural resources that are destined for the southern, non-Arctic, parts of the countries that also include Arctic regions, and more broadly to global markets. The Arctic is a major producer of hydrocarbons, minerals and marine resources, whose importance is confirmed by the very value of the resources produced. The economy of the Arctic is also characterized by large service industries, particularly through the role of the State. Finally, it is characterized by a limited secondary sector, at least in most of the regions covered.

This analysis also confirms that circumpolar economic activity is unequally distributed among the different Arctic regions. Those with plentiful natural resources, particularly non-renewable resources, have a level of economic activity well above the Arctic average. Those regions where economies are not based on large-scale exploitation of resources, or with a very limited secondary sector, generally experienced a below-average level of economic activity. Regions with GDP per capita around the average generally appear to have a more diversified economy. Not only are there sizeable divergences across the circumpolar area as a whole, but such divergences also exist within the most geographical vast countries, such as the Russian Federation and Canada.

The data presented above confirm Russia's considerable economic weight in the circumpolar world. Russian regions exhibit the main characteristics observed at the circumpolar level: large-scale exploitation of

natural resources and very unequal distribution of economic activity as indicated by GDP

Finally, an analysis of geographically disaggregated data suggests that the Arctic regions have developed according to two distinct models, based on the type of resources exploited and the size of operations. This indicates that the economic reality of the Arctic is not homogenous. More detailed analyses, involving inter-regional comparisons, for example, could advance the study of this topic.

Notes

- ¹ Duhaime, Gérard et al. 2004. Economic Systems. In Einarsson, Niels et al. Arctic Human Development Report. Akureyri, Stefansson Arctic Institute, pp. 69–84.
- ² The basic data used to describe the situation of Nunavik (in Canada) are the same as those used in 2001 because they have not been updated since then. Labrador (in Canada) is still not included in this analysis, as there is no available data on its gross domestic product.
- ³ In addition, the AHDR study covered an area that included some portions in the Northern Russian Federation that stretch well below the Arctic Circle. The vast oblasts of Tyumen and Kamchatka and the krai of Krasnoyarsk were included in AHDR because the economic statistics available at the time were not disaggregated enough to depict the Arctic region. Further compilation by Goskomstat Russia (now Rosstat) now provides data of the administrative territories in the Russian Federation that correspond more closely to the polar circle.
- ⁴ The data used to describe and analyse the economy are reported in different currencies and must be converted to a common currency. However, price levels differ between countries and the transformation of GDP to a common currency by exchange rates does not properly reflect the purchasing power in the various countries. The Purchasing Power Parity (PPP) makes it possible to obtain conversion rates between currencies that eliminate differences in price levels between countries (see Box 1).
- ⁵ This type of analysis is difficult in the circumpolar context. The Russian Federation uses an industrial classification system that is hard to compare with the systems used elsewhere. In other regions, it is easy to distinguish activities belonging to the primary sector, e.g., mining, from those belonging to the secondary sector, e.g., metal processing. The Russian data do not make these distinctions: for example, it aggregates into a single category the measures of natural resources extraction, refining and processing. Currently, the only way to get around this problem is to produce estimates using the methods employed in the 2004 AHDR. These estimates provide an order of magnitude of the primary and secondary sectors, but they overestimate the importance of the primary sector, to an extent that cannot be determined. Consequently, the findings that follow must be treated with caution.
- ⁶ For these examples and similar ones, see: http://nwt-tno.inac-ainc.gc.ca/cd-s_e.htm#3.
- ⁷ The legal and policy framework for resource exploitation practices seem to vary greatly from one place to another in several respects in relation to the local economic spin-offs or protection of the environment, and therefore there are equally varied impacts on the regions or communities involved. Public and private policies, corporate practices and economic and social spin-offs associated with these large projects merit further study. For examples and a discussion of the topic, see Duhaime, G. et al. 2003. *The Mining Industry and the Social Stakes of Development in the Arctic*. Québec, Université Laval, 20 p. www.chaireconditionautochtone.fss.ulaval.ca/extranet/doc/116.pdf.

- ⁸ Environmental degradation was amply documented in the AMAP reports. Also, see Crawford, R.M.M., 1997. *Disturbance and Recovery in Arctic Lands. An Ecological Perspective*. Dordrecht, Kluwer Academic Publishers, 621 p; Nuttal, M., 1998. *Protecting the Arctic. Indigenous Peoples and Cultural Survival*. Amsterdam, Harwood Academic Publishers, 195 p. For traditional activities, such as reindeer herding, examples of competition include forestry companies in the north of the Scandinavian countries. These companies disturb grazing areas. In Northern Russia, competition comes from gas companies, which disturb transhumance routes. See Kankaanpaa, S. et al. (eds), 2002. *Northern Timberline Forests: Environmental and Socio-Economic Issues and Concerns*. Kolaari, The Finnish Forest Research Institute, 289 p.; Association of World Reindeer Herders, 2002. *The 2nd World Reindeer Herders' Congress*. Anar 2001. n.l. University of Lapland (Arctic Center Reports 36), 182 p.; Golovnev, A.V. & G. Osherenko, 1999. *Siberian Survival. The Nenets and Their Story*. Ithaca, Cornell University Press, 176 p.
- ⁹ The analysis of Greenland data is deliberately limited here, since the data on the distribution of GDP by sector and industry date back more than ten years. However, the distribution of the labour force by sector and industry, for which the data date from 2003, tend to confirm the importance of the secondary sector. According to this source, nearly 15 per cent of the labour force are employed in the secondary sector and are distributed fairly equally between manufacturing (essentially the processing of products from the sea and other food products) and construction. See Statistics Greenland, 2005. *Greenland in Figures 2005*. «Employment distributed by trades and industries,» p. 12.
- ¹⁰ See Rasmussen, R.O. (2001). *Local, Regional and International Markets for Fish in Greenland*. In Caulfield, R.A. & M. Kojima (eds). *Northern Communities and the Global Economy. Proceedings of the Fifth Circumpolar Arctic Social Sciences Ph.D. Network (CASS) Field Course, Alaska 2000*. Fairbanks, University of Alaska, pp. 75–87.
- ¹¹ The Chukotka reindeer herd declined from 464 000 to 148 000 between 1985 and 1998. See Newell, J., 2004. *The Russian Far East*. Mckingleyville, Daniel & Daniel, p. 286.
- ¹² For example, see Tuisku, T., 2003. *Surviving in the Oil Age*. In Rasmussen, R.O. & N.E. Koroleva (eds). *Social and Environmental Impacts in the North*. Dordrecht, Kluwer Academic Publishers, pp. 449–462; Forbes, B.C., 1997. *Anthropogenic Tundra Disturbance in Canada and in Russia*. In Crawford, R.M.M. *Disturbance and Recovery in Arctic Lands. An Ecological Perspective*. Dordrecht, Kluwer Academic Publishers, pp. 365–380.
- ¹³ See Cabanne, C. and E. Tchistiakova, 2002. *La Russie. Perspectives économiques et sociales*. Paris, Armand Colin, pp. 123 ff.
- ¹⁴ The exodus is substantial in the northern regions of Siberia, at the mouth of the Ob in the Bering Strait, but also further west in the European north, in the Komi Republic, the Nenets Autonomous Okrug of the Arkhangelsk Oblast, the Republic of Karelia and the Kola Peninsula. The exodus has been brought on by the closure of establishments that were opened to develop natural resources, the elimination of the benefits granted at that time to workers who agreed to live in the north (higher wages, travel vouchers), the hardships of daily life (such as power outages and difficulty and cost of obtaining supplies), etc. «Deputatsky, in northern Yakutia, had a population of 17,000 in 1990. In 2001, there remained only 3,900 inhabitants, supplied with power, as is often the case in the Far North, by a diesel-operated mini electric power plant. In February 2001, 1,400 inhabitants had to be air-evacuated because of a fire at the station in temperatures of –46°.» See Cabanne, C. and E. Tchistiakova, 2002. *La Russie. Perspectives économiques et sociales*. Paris, Armand Colin, pp. 39–40.