Exploitation of Natural Resources and the Public Sector in Greenland

Background Paper for the Committee for Greenlandic Mineral Resources to the Benefit of Society

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Abstract:
This paper considers the role of the public sector in future exploitation of non-renewable resources, especially minerals, in Greenland. The focus is on fiscal sustainability, principles for public sector involvement and the form of government take from mining activities.
At present, the public budget in Greenland is nearly in balance, but at unchanged policies and standards public expenditures relative to GDP are bound to increase dramatically over the next decades due to population ageing. At the same time, the freezing of the block grant from Denmark implies a decrease in revenues relative to GDP. Hence, fiscal policy is quite far from being sustainable. Apart from a need for reforms, these facts also constrain the possible role of the public sector in future resource exploitation. In any case, the government should preferably adhere to strict principles when developing the mineral sector in Greenland. Furthermore, serious attention should be given to how to secure an appropriate government take from mineral activities. The paper discusses several types of taxes as well as financing models.

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1. Introduction

This paper investigates the possible role of the public sector in Greenland in connection with prospective exploitation of the (non-renewable) natural resources there. To determine that role we take a look at current and future fiscal policy and the associated indebtedness of the public sector. We also examine the ways in which future mining activity presupposes investments from the public sector in education, infrastructure, health institutions, etc., and we go through several possible financing models for resource extraction, in which the role of the public sector varies. Finally, we discuss appropriate ways of securing returns to Greenland's society from exploitation of its natural resources; among several types of taxation we aim to derive the most useful, given the specific circumstances. After all, the natural resources belong to the people of Greenland, so it should benefit from the use of the exhaustible resources.

The paper is structured as follows. We begin in section 2 by providing a broad introduction to Greenland, its society, and its economy. Special attention is paid to development of the mining sector in Greenland.

Section 3 then takes a close look at the public budget and fiscal policy in Greenland. Greenland faces strong challenges in its fiscal policy in the future. While the current budget is not far from balance, fiscal policy as presently laid out is nevertheless far from sustainable. The major reason is a pronounced population aging in Greenland; in addition, the sizeable block grant from Denmark will be close to constant in real terms in the future and thus cannot keep up with a potentially growing economy in Greenland.

In the light of the insights from section 3 we in section 4 first inquire into the possible role of the public sector in the process of exploitation of Greenland's non-renewable resources. Mining activity causes a host of needs, some of which the public sector may in principle cover. But what is a sensible division of labor between the public sector and private mining companies?

Section 4 goes through several financing models for resource exploitation in Greenland. Here, the discussion in section 3 will be applied. It also considers various ways in which the population of Greenland may secure an adequate benefit from exploitation of its natural resources. Various tax instruments (including royalties) are discussed, and with support from the literature we attempt to circle in those instruments which under the conditions in Greenland may be the more helpful ones. Section 5 concludes the article.

2. Greenland and its economy

Greenland is the world's largest island with an incredible surface of 2.130.800 km^2, of which only a minor part, 375.000 km^2 (however, corresponding to more than the total area of Germany) is not covered by ice year-round. It has a population of 56.370 inhabitants (early 2013) which lives in four major towns and 71 small towns and settlements, spread all along its very long coast line. The capital is Nuuk with around 16.500 inhabitants.

Greenland's economy is dominated by three important features. One is the extreme dependence on natural resources – especially a few renewable ones. Exports of fish and fish products, mainly prawns and halibut, account for no less than 90 per cent of total exports of goods. At present, exploitation of exhaustible resources is at a very low level, but extraction of different types of minerals may potentially contribute more to the economy in the future, depending on several factors. Also, the construction of an aluminum smelter is being deliberated at the moment and this and perhaps production of oil could become major contributors to the economy. But for now, these are birds on the roof, and Greenland's economy remains highly dependent on fishery.

Greenland receives a huge block grant from Denmark. In 2012 it amounted to 486 million Euros per year, corresponding to 28 per cent of Greenland's GDP. Together with services paid for by the Danish government (108 million Euros per year) and with a transfer from the EU as part of a so-called partnership agreement conceding fishing rights in Greenlandic waters, the block grant constitutes almost half of the income of the public sector in Greenland.

By international standards Greenland has a very large public sector. GDP in Greenland amounts to about 1.75 billion Euros, while disposable gross national income (including net factor payments and net transfers from abroad) reaches ca. 2.2 billion Euros. As total public expenditures constitute more than 1.3 billion Euro, the public sector measures some 3/4 of GDP, or almost 60 per cent of disposable gross national income. Either way these are high ratios by international standards; for instance, the public sector in Denmark corresponds to 48 per cent of GDP, in Sweden a bit less, and in all other EU countries the public sector is considerably smaller.

There are in fact sound economic reasons for having a relatively large public sector in Greenland. In such a small society it will be difficult to make sure that private markets work appropriately for a range of goods and services; hence a way out is public goods provision. Further, given the immense distances between towns and settlements in Greenland, public transportation becomes especially demanding. Add to this that differences in income and living conditions as well as social problems in the population are large by western standards, implying an enhanced role for social security and policy. All the same, the large public sector must be seen in connection with the fact that the block grant from Denmark exclusively accrues to the public sector and thus enters the revenue side of the public budget.[1]

A Greenland-Danish Self-Government Commission was set down in 2004, and it handed in an extensive report in 2008. The recommendations of the commission led to legislation in 2009. Thereby, Greenland switched from Home Rule to become a self-governmental part of the Kingdom of Denmark.

Among the issues dealt with by the Self-Government Commission were the future development of the block grant from Denmark, and the control over natural resources in

[1] As a thought experiment, the block grant could be paid to the population in Greenland in the form of equal per capita transfers. In order to run and finance a large public sector, taxes would have to be significantly higher than in other countries. This would almost forbid itself, and the end result would therefore be a marked reduction in the role of the public sector compared to the current situation.

Greenland. While the commission along the way discussed various schemes for reduction of the block grant, the final political decision entailed a constant block grant, in real terms, throughout the future. In addition, Greenland was given the right to full control over its mineral resources. The revenue from exploitation of the resources will thus accrue to the self-government authorities. However, if this revenue exceeds a certain minimum (ca. 10 million Euros per year in 2010) half of that revenue should be deducted in the annual block grant.
A key word in the debates in Greenland has been economic self-reliance. Greenland wishes to become less reliant on external transfers. But with a constant block grant this can only materialize in a situation of economic growth. Only if GDP grows (markedly) over time will the block grant and other external transfers fall appreciably relative to GDP. Can a society which ultimately is based on natural resources of a given size at all grow over time? Looking back, there have been clear productivity gains in fishery, implying that today fewer persons are involved in fishery and associated production on land than, say, 20 years ago. The labor thus freed has so far to a high extent been able to find employment elsewhere, and as a result GDP in Greenland has in fact grown by about 1.1 percent per year in the last 20 years. This does not reflect increased transfers from Denmark – the block grant has actually been fairly constant in real terms for quite many years. As a result, the block grant has gone from 38 per cent of GDP in Greenland in 1994 to 28 percent in 2008 (and a similar ratio in 2013).

Greenland's natural resources, in particular the non-renewable ones, are by many seen as a stepping stone towards economic self-reliance. Indeed, at the moment resource extraction appears to be the potentially most important supplement to existing economic activity in Greenland.

For a number of years there has been considerable oil exploration activity on Greenland's mainland and in particular in its waters. For instance, this activity was estimated to cost some 0.7 billion Euros in 2010 and 2011 combined. In the two subsequent years, though, there has been no activity, and it is unclear when the activity will resume. Oil resources have been located, but at current oil prices and given the necessarily high costs of extraction due to difficult arctic conditions, production is not profitable.

The large international aluminum company, ALCOA, has contemplated locating an aluminum smelter in Greenland, close to the town of Manitsoq. The plant would use hydro power from a couple of nearby lakes. However, other than reserving these lakes for the purpose, ALCOA has not yet taken steps toward establishing the smelter.

More promising is the minerals area. Right now the only active mine (after reconstruction of the company in charge) is a gold mine in Southern Greenland, but a series of smaller and somewhat bigger projects may be started up in the future. Most important among these is an iron mine in Isua way into the Nuuk fjord. The conditions under which such iron extraction may happen were agreed upon in October 2013 by the mining company (London Mining), the government and the two municipalities involved. Further, a small ruby mine is about to open shortly, and in the Narsaq area in Southern Greenland two mining fields offering rare earth minerals (REEs) may be opened in the future. For one of these, the removal of the previous

'zero-tolerance rule'[2] concerning uranium was necessary, and this removal was passed in the Greenlandic parliament also in October 2013 (after intense public debate).

Exploration activity in the mining area has been low in 2013, and this may be the case next year, too. A number of other potential mining areas and activities may emerge in the future, among these a zinc mine in the northernmost part of Greenland (Citronen Fjord). Almost one hundred exploration licenses have all in all been conceded to international companies.
For all these activities, foreign capital and, to a high degree, foreign labor will be required. To varying extent Greenlandic labor may find employment in the projects, both in investment and production phases, and the purchase of local goods and services in the relevant Greenlandic areas will further promote employment of Greenlandic workers. In general, the higher the educational and competence level of local Greenlandic labor, the greater the chance of benefitting work-wise from mineral activities.

3. Fiscal policy sustainability

We next turn to the public sector in Greenland, its budget, and the outlook for sustainability in the longer term.[3]

3.1 The current budget

The main items in the public budget in Greenland appear in Table 1.
We note that, as in other countries, education, social transfers and health care are main drivers of expenditure in Greenland. However, a comparatively large part of expenditures is directed to the private sector and to publicly owned enterprises in the form of business subsidies or flat-out income support to small-scale fishermen and hunters.

[2] The 'zero tolerance rule' for uranium stressed that harvested resources may not contain more uranium than 60 ppm (gram per ton). So not actually zero, but close. Some contemplated mines can live up to the current rule, some cannot. For instance, the proposed mine at Kvanefjeld has a uranium content about six times as high as the threshold.

[3] The material in this section builds on annual reports from the Economic Council of Greenland (2010-13), material from the Ministry of Finance and data from Statistics Greenland.

Table 1. Public finances 2012 (million Euros)

Income:		Expenditure:	
Block grant	594.7	Social protection	354.4
Income and wealth taxes	491.7	Education	254.4
Production and import taxes	106.6	Health	188.8
Other	174.7	Economic affairs (administration etc.)	147.2
		General public services	152.9
		Other	213.3
Total	1367.8	Total	1311.3

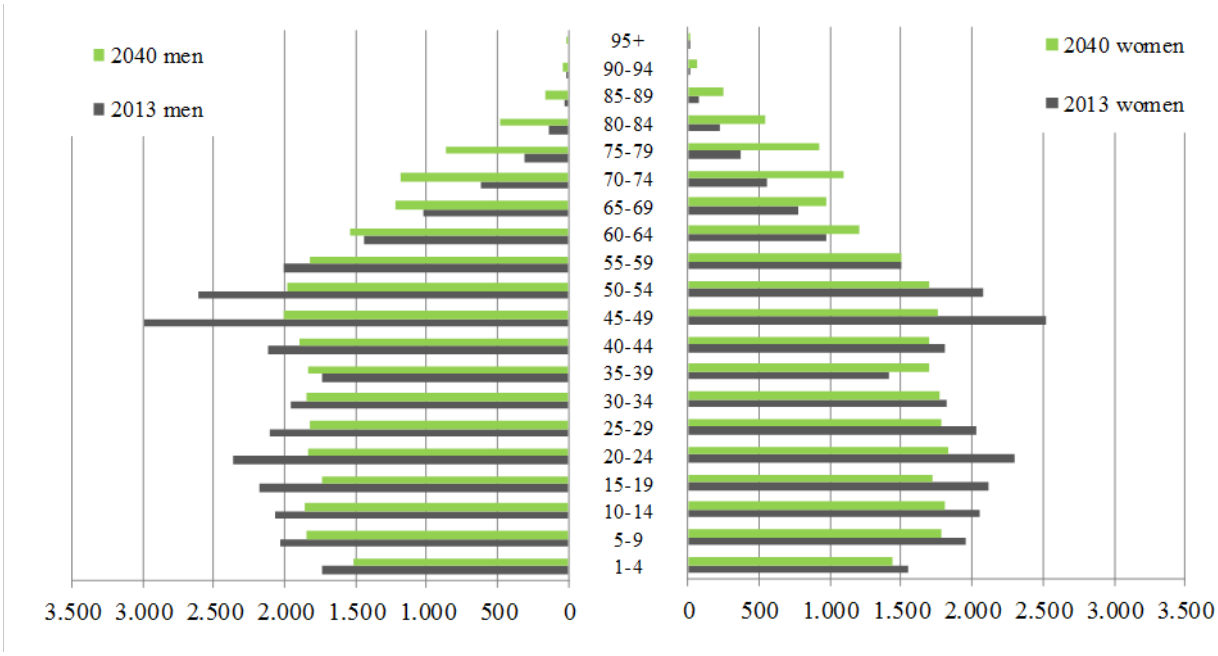
Source: Statistics Greenland. Note that 'Block grant' includes reimbursements from the Danish state of 108.8 million Euros, while in the same column 'Other' covers, among other items, the payment from EU of 42.1 million Euros.

On the income side, the significance of the block grant and other transfers clearly emerges from the table. While income taxes are important, too, it is notable that Greenland has no value-added tax, but does have a series of (stiff) excise taxes.

3.2 The expenditure side: Population aging

Recently, Statistics Greenland (2010) issued a new population forecast, detailing the expected number of persons living in Greenland in the period till 2040 across different ages, cf. the population pyramid in Figure 1.

Figure 1. Population pyramid

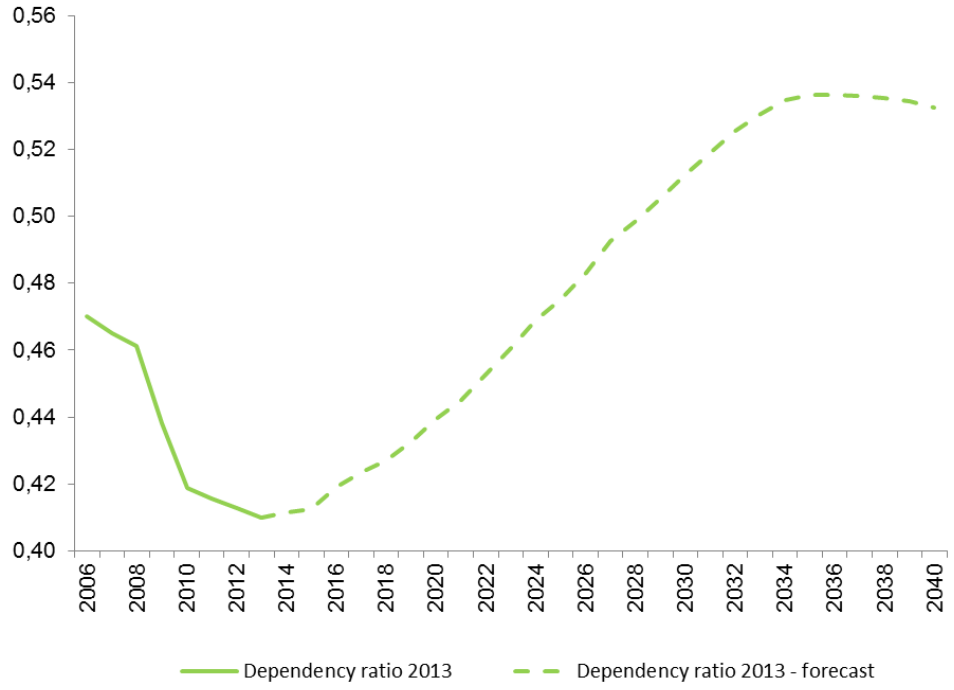


Source: Statistics Greenland

Part of this forecast builds on fairly certain information, including the size of previous birth cohorts and a well-documented development towards greater life expectancy. Other underlying assumptions are more uncertain, in particular those pertaining to birth rates in the distant future and patterns of migration over time. However, the general trend in the population forecast of many more elderly people from around 2020 onwards is uncontested – previous birth rates and longer expected lifetimes will inevitably produce this population aging.

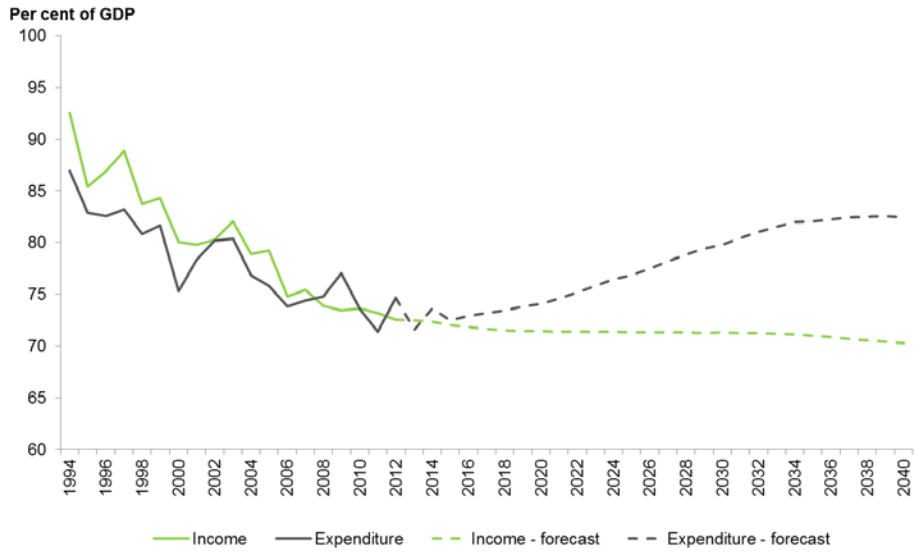
At the same time, the number of people at working age (17-65) is going to fall over time. Hence, dependency ratios as normally computed will undoubtedly rise, especially from around 2020 until 2035. Figure 2 shows the dependency ratio computed by Economic Council of Greenland in its 2013 report:

Figure 2 Dependency ratio



Indeed, the dependency ratio is set to rise rather dramatically, beginning around 2015-16. Taking the standards of public transfers (pensions etc.) and public services provision (day care institutions, schools, health care, care for the elderly, etc.) as given, the consequence will be an intensifying pressure on public transfers and services in the future. The upper part of Figure 3 illustrates the forecasted development of public expenditures in Greenland relative to its GDP:

Figure 3 Public expenditures and income



Note: Excl. interest payments. GDP estimated in 2012. Forecast from sustainability model with 1 per cent productivity growth. Source: Statistics Greenland, Economic Council of Greenland.

The graph is based on available statistics on public expenditure in Greenland, and an assumed 1.0 percent productivity growth rate (in the private sector). Further, an inflation rate of 1.75 percent is assumed, and the anchor in the calculations is provided by the presumed return of the Greenlandic economy to a 'business cycle neutral' year in 2015.[4]

Data on age-specific public expenditure in Greenland do not exist; instead the Danish equivalents, scaled up to match relevant expenditure totals in Greenland, have been employed. This probably provides us with the best possible forecast of the development of public expenditures. All this information has been fed into a simple macroeconomic model, primarily based on a national accounting system. (Full national accounts exist for 2004; for subsequent years existing official statistical information on income-based GDP, public sector accounts, international trade, external transfers, etc. has been applied.)

We note that while public expenditure may lie flat (as a ratio of GDP) for a few years, mainly reflecting a smaller number of pupils in primary schools, it thereafter will increase strongly. In fact, between 2020 and 2035 the increase in public expenditure relative to GDP will not be far from ten percentage-points. Over the entire period 2008-2040 both public transfers and public services are bound to rise by 3-4 percentage-points.

[4] See the discussion in the Economic Council of Greenland's technical background paper 2013-04 on fiscal policy sustainability.

3.3 The income side: Block grant and tax revenue

Next, let us turn to the financing of the welfare state in Greenland. Total income of the public sector consists of revenue from taxes and excises, and external transfers. In 2012, tax revenue amounted to around 44 percent of income, while transfers from abroad together stood for about 47 percent.

Income of the public sector has for a period been falling as a share of GDP. This trend is obvious in Figure 3. The main reason for this is that over a series of years, the block grant from Denmark has in fact been fairly constant in real terms, while the economy has grown in the meantime. So, Greenland has in this sense already become more self-reliant and less dependent on transfers from Denmark.[5]

This process is due to continue. Taking tax policy as given, income tax revenue is likely to follow GDP quite closely, while excise tax revenue may track private consumption more closely. And in a situation of economic growth (driven by the assumed private sector productivity increase of 1.0 percent as mentioned above), GDP and consumption will over time diverge somewhat, since the sizeable external transfers remain (approximately) constant. Altogether, the sum of tax and excise tax revenues and transfers from abroad will decrease by 2-3 percentage-points from 2013 to 2040, as also indicated in Figure 3 (the lower curve).

It should be mentioned here that possible future public income (and expenditures) associated with exploitation of natural resources are not taken into account in the projections of income and expenditures. This is in line with the 'principle of prudence' endorsed by Greenland's authorities (see section 4). To the extent that Greenland succeeds in developing a healthy resource sector this could contribute to closing the gap between projected expenditures and income in the future. But only partially – the development of the resource sector will at best progress slowly, whereas the expenditure-income gap starts to widen rather quickly. On top of that, the involvement of the public sector in exploitation of resources generally implies expenditure obligations preceding any tax and other income stemming from the resource projects. (More on this in section 4 below.)[6]

3.4 Fiscal policy is not sustainable

Figure 2 contains a clear message. A major gap between (forecasted) public expenditures and public sector income will emerge and widen over time. Indeed, the difference between the two will grow dramatically towards 2035 and seemingly stay at a high level thereafter. This development is clearly not sustainable. While it may be possible to secure external borrowing to finance public deficits for a few years, before long that can no longer be accomplished, and a need will arise for major adjustments in fiscal policy.

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[5] Note also that public expenditures have in fact likewise been falling relative to GDP over the last decade.

[6] Of course, once resource projects become reality, the associated obligations and income for the public sector can and should be included in sustainability computations.

The extent of lack of sustainability in fiscal policy can be measured by computing a 'sustainability indicator' along the lines of Blanchard et al. (1990) and Broda and Weinstein (2004). The method is explained in the appendix to the present article. The output from the method is an indicator, denoted by s* in the appendix, which expresses the permanent adjustment of public expenditure needed to ensure that the level of debt relative to GDP converges back to its initial level, guaranteeing that the intertemporal budget constraint for the public sector is fulfilled.

In other words, the sustainability indicator expresses the necessary once-and-for-all adjustment of the primary budget balance to ensure that over the time horizon public expenditures can be financed out of incoming tax revenue and foreign transfers without eroding public net wealth.

Calculating the sustainability indicator for the period until 2040 using the previously stated assumptions – given standards on the public expenditure side, given tax policy, given the evolution of the block grant, a 1.0 per cent private productivity growth rate, and a nominal interest rate of 4.75 percent – results in a sustainability indicator of -5.8 per cent in the base case.

That is, to render the forecasted development of public expenditures and public sector income sustainable, public finances have to be improved in every year by an amount corresponding to 5.8 percent of GDP.

Measured in Euros, a decline in public expenditure of around 100 million Euros in this 56.000 person economy is needed, or some 1.800 Euros per person per year. This represents a daunting task, as total public expenditure, including that of municipalities, is of the order of 1300 million Euros per year. In fact, several factors suggest that this adjustment to make fiscal policy sustainable is actually underestimated. First, Greenland's economy has run into stagnation and will stay there for the next couple of years, effectively preventing any steps to be taken towards sustainability. Second, the computation presumed 2015 to be a neutral year, business cycle-wise. This may be a bit of a stretch. Third, beyond the end year 2040 used in the computations, there remains a large gap between estimated expenditures and revenues, also pointing towards the adjustment being more pronounced than expressed in the 5.8 percent figure.

The adjustment required to bring fiscal policy on a sustainable path can, of course, take place on the revenue side as well as the expenditure side of public finances – or on both simultaneously.

Compared to many other countries, Greenland has an advantageous starting point. The state there has financial assets, including liquid bank assets and bond holdings, which together more than offset its gross debt.

It must be noted that a time horizon of 30 years is short when calculating fiscal sustainability. Here, there is a practical reason for this, since the official population projection for Greenland has 2040 as end year, and a forecast of the small population of Greenland into a distant future is considered extremely sensitive to future changes to migration patterns.

As mentioned above, the calculation of public expenditures and relative public sector income was based on all available statistical information in Greenland. Where such statistical information was missing, such as age-specific public health care expenditure per person, the Danish equivalents scaled up to match expenditure totals in Greenland, were used. Even though the availability and quality of statistical information in Greenland does not provide an ideal framework for assessing fiscal sustainability (e.g., the assessment of public sector net wealth is fraught with uncertainty), the calculations are rather robust to changes in assumptions, and somewhat different inputs will not affect the conclusion. Fiscal policy in Greenland is obviously not on a sustainable path.

3.5 How to make policy sustainable?

In principle, there are three ways to solve the sustainability problem of fiscal policy in Greenland and thereby bring the sustainability indicator towards zero.

First, in line with the definition of the sustainability indicator, public expenditures can be cut. This implies going through all items of public expenditure, prioritizing and determining where reductions will hurt the least. As stated previously, public expenditures in Greenland are very high by international standards, so comparison to the structure of public budgets elsewhere should yield ideas as to where cuts could be carried out. In addition, expenditure growth ceilings over a number of years can be applied.

Of course, specific features of the Greenlandic society must be factored into the process. For instance, the public sector plays a large role in production activity, in the housing market, and in securing a reasonable safety net for a large part of the population with pronounced social and unemployment-related problems.

Second, public sector income can be raised. Jensen and Nielsen (2003) have demonstrated that the tax burden in Greenland is actually quite low as compared to other European economies. There are virtually no social security contributions and payroll taxes; 'green' and energy taxes are very low; taxation of capital income from especially housing, land and pensions is inefficient; and there is no value-added tax.[7] There are, however, stiff and high excise taxes on alcohol, tobacco and selected other goods. But it is not impossible to secure higher tax revenue in the future by introducing new types of taxes or tightening existing tax levers.

In a bigger perspective, a sensible aim would definitely be to steer towards a situation of i) a consistent set of green/energy taxes; ii) a consistent set of fees for all types of natural resource exploitation, be it living or dead resources (this includes land and property taxes as well).

[7] Moreover, tax and other arrears are at a very high level in Greenland, some 8 percent of total public income. See Politisk-Økonomisk Beretning (Political-economic report) 2013 from Departementet for Finanser (Ministry of Finances); p. 23.

Third, structural economic reforms must be considered, too. Reforms which bring more people into the labor market and into a situation in which they can support themselves economically. And reforms which increase the quality and profitability of employment of a significant number of people. In this context it is noteworthy that a large number of persons in Greenland are on disability benefits. Whether it would be possible to bring some of these back to the labor market is worth investigating. Even more important, Greenland is seriously lagging behind when it comes to education. Only around one half of individuals aged 18 to 65 and thus potentially in the labor market have completed an education. This number is way lower than those in other Western economies.[8] A significant drive to secure that more individuals enter into and conclude education successfully, and another drive to provide older cohorts in the labor market with additional competencies are bound to pay back handsomely. Greenland's Economic Council (2010) has already demonstrated that education is associated with a sizeable return (both privately and for society at large).

The Tax and Welfare Commission set down in the autumn of 2009 handed in its final report in the spring of 2011. On the basis of analysis of major policy areas it contains a series of recommendations, many of which have potential impact on the sustainability of fiscal policy. These recommendations encompass education at all levels, social and welfare policy, the safety net, housing, pensions and taxation. While the Commission has inspired policy since, there are still ample opportunities for turning the recommendations into practical policy in order to solve the sustainability problem.

Not much adjustment appears to happen in the immediate future. The government has with only one exception incurred a small deficit on its finances (including net lending to state enterprises) in the last seven years, and in the new budget proposal covering 2014-17, a deficit is likewise proposed for each of the years. Excluding lending (primarily to the construction of new hydro power plants) the four years on average have a balanced budget.

4. Public sector involvement in resource extraction

4.1 Constraints and pressure

The preceding section has made abundantly clear that fiscal policy in Greenland and the public coffers themselves are under considerable pressure now and especially in the medium term. Even if politicians succeed in containing public expenditures; raising existing tax levers or introducing new taxes; and carrying out considerable reforms of the public sector, it will be difficult to bring fiscal policy anywhere near sustainability. And in the short run, maintaining the warranted flexibility in terms of liquidity and ability to assist publicly owned enterprises will necessitate public borrowing abroad time and again.

The conditions for such borrowing activity can quickly become strained, and potential creditors will likely put the suggested use of funds under some scrutiny. On the other hand,

[8] One may note that the level of education is markedly higher also among Greenlandic people living outside of Greenland (chiefly in Denmark).

Greenland is part of the Danish kingdom which probably means that the attitude of creditors will be more relaxed than had Greenland been completely on its own.

The strained public fiscs are not the best starting point for further exploring the prospects for exploitation of natural resources in Greenland and their possible role in enhancing economic growth and accelerating economic self-reliance. Mining activity on a medium to large scale will be associated with all kinds of needs and investment, and inevitably the public sector will be drawn into contemplations about how to help in getting mining activity started.

The first phases of mining activity – geological investigations and exploration – demand few public resources.[9] But once real investment and production activity starts, the public sector will inevitably be drawn into the process.

Upstarting mining activity requires:

- Adequately trained white and blue collar workers as well as management
- Transportation of equipment and raw materials to the site
- Delivery of electricity, water etc.
- Transportation of finished and intermediate products from the site
- Ordinary public services, including transportation, to be enjoyed by personnel involved, and
- Housing for said personnel.

Going through the list it becomes obvious, that even though the public sector takes no direct part in mining activity, public policy in the areas of education, infrastructure, health, social welfare, housing and so on will be put to a major test. If these possible obligations are not met with cautious and thought-through principles for public involvement, they can potentially cut a major hole in the public budget.

One and a half year ago, the then government in Greenland issued a so-called 'Debt and investment strategy' (Gælds- og investeringsstrategi, April 2012).[10] The aims behind that strategy were first, to set up a framework for the development in public debt, and second, to render the process of prioritization of public investments transparent. The policy laid out in the strategy document rests on a 'principle of prudence' in order to ensure that there will be funds to pay back public debt even in bad times.

Indeed, the coming years in Greenland are characterized by increasing desires as to public investments to enhance development of the Greenlandic economy and society. The public fiscs cannot finance all wanted investments, so politicians are led to divide investments into a

[9] Geological analysis, exploration etc. is provided by, among others, Nuna Minerals which is 33.4 pct. owned by the public sector in Greenland. The rest of the shares belong to a few bigger and some 2000 smaller individual investors. Nuna Minerals has an annual budget of around 4 million Euro.

[10] The present government in Greenland has endorsed the strategy, too.

group to be financed by taxes (and, initially, loans) and another group which must be carried out by private sector actors and financed by user fees.

The following principles are contained in the debt and investment strategy:

1. In a normal year, there must be a surplus in the public budget (current and investment expenditures included), and interest and payback of loans should not limit opportunities for providing public services in a bust period.

2. The public sector will only incur debt which finances an improvement in sustainability of fiscal policy.

3. The public sector should only incur debt for housing construction and for business and infrastructure projects, if increased user fees can finance at least interest and payback on the debt.

In addition, the strategy requires continuous updating of public sector indebtedness, so that total debt can be read off at any time.

If we undertake a strict translation of these principles to the area of exhaustible resource extraction, it has relatively dramatic consequences. Following the list above, we note

(a) Education and training policy in Greenland could (in part) be attuned to the needs of mining companies and associated service providers in such a way that Greenlandic workers (and managers) have a possibility to become employed in those companies. Since, however, most mining activities are short-lived, education should not be too specialized; the competencies acquired by Greenlandic workers should be of value after mining activity has ceased.

(b) Infrastructure policy: The public sector can involve itself in infrastructure investment to the extent that the infrastructure in question has value to the Greenlandic society sans or subsequent to mining activity. This principle holds for the construction of roads, harbor facilities, air strips, electricity lines, water supply, etc. In other words, the public sector should stay away from financing investments in infrastructure which have no or limited value to businesses or consumers outside of the mining sector.

(c) Social welfare and health policy: Employees of mining companies (and associated service providers) working in Greenland are supposed to be at least limited taxable[11] and thus pay income tax to Greenland. In return they can expect to enjoy health and social services from the public sector just like others in a similar position. How this is implemented in practice will depend on the specific circumstances of the extraction activity in question, not least its geographic location.

[11] In Danish 'begrænset skattepligtige'.

(d) Housing policy: Workers employed in construction and production phases need accommodation. The precise solution to these needs will depend very much on the location of the mine. As a rule, the mining company or its suppliers ought to cover the costs associated with housing the workers, and the public sector should stay away from associated housing construction, unless the houses being built have a clear alternative use after mining activity has ceased and so can be rented out or sold to other customers. Even then, there is a catch, though. The housing sector in Greenland is so heavily subsidized and has always been so, that any new construction, whether by the public sector itself or by anyone else, automatically will draw on public funds. Indeed, there is an independent need to examine housing policy on the part of the government in Greenland.[12]

4.2. Financing models

The discussion in the previous subsection established that the public sector in Greenland will have to seriously decide how and where to get involved, when mining activity calls for expenditures and investment outlays in the areas of education, training, infrastructure, health and social policy. This is the case, even if the government is not in any way involved in the mining activity proper. There are, though, several models for financing mining activity, and it has some value to go through possible models one by one.

At one extreme, government may itself single-handedly undertake exploration, investment and production directly or, more practically, via a 100 pct. publicly owned company. The clear advantage of such a strategy is that net income resulting from resource extraction will accrue directly to the public fiscs.

However, there are several drawbacks as well. First, a major investment outlay is involved which requires considerable financial strength on the part of the public sector. Second, resource extraction is inherently very risky business, where just about every aspect of the activity is subject to major uncertainty. That goes from investment and extraction costs to the quantity extracted, its fineness and the price it eventually brings in. Third, it would be a straight miracle if the public sector possessed the best available knowledge required to ensure maximum net value from the extraction activity, in other words, maximum resource rents.[13] Private sector firms specializing in such type of activity would be expected to have acquired the knowledge, not the public sector.

Another option is to co-own the enterprise which undertakes the extraction or perform the operation in a joint venture with a private operator. The advantage here is the opportunity to split the uncertainty with a private sector actor while at the same time relying on the actor's special competencies in the field. The drawback is that the co-ownership or the joint venture may develop into a rather unbalanced affair, simply because the private actor possesses much

[12] The current government also plans to set down a commission to investigate the housing sector in Greenland.

[13] The so-called 'resource rent' can be thought of as the return accruing to the exploiting party over and above the normal return to the invested equity capital (and after the use of labor, materials and debt capital has been paid for).

better knowledge about the operation and its profitability. And part of the heavy risk burden would still lie with the public sector.

At the other end of the spectrum the government may stay away completely from the extraction activity in the sense that it financially is not involved at all (except for investments and service provision in accordance with the debt and investment strategy described in the preceding subsection). The main advantage here, of course, is that the public budget on the expenditure side will be as little exposed to the ongoing activity as possible, and the amount of risk conferred on the public sector will thus be minimized. On the other hand, this option raises the difficult challenge of securing that the extraction of society's common resource by an outside party generates an income stream which can enhance the income side of the public budget. This is dealt with in the next subsection.

Until recently, there was some talk about establishing a so-called 'GONG' in Greenland. The inspiration for this construct derives from Denmark, where the company DONG[14] (now DONG Energy) for decades has been a major publicly owned player in the energy area in Denmark – and, for that matter, in neighboring countries as well.

DONG is set up in the following way. The state of Denmark is majority owner (having 76.49 percent of the shares), and a couple of municipality-owned regional electricity companies own the remainder of shares. DONG started out as a state-owned natural gas company in 1972; later on, its activities were expanded, and in 2006 it was merged with a series of regional electricity companies. Over time, it has acquired extensive knowledge about all aspects of energy extraction, transmission and supply, and the construction of DONG as a limited liability corporation allows the government to remove itself from the (probably modest) business risks facing a company like DONG.

Would a similar model be an option in Greenland, i.e. could a 'GONG' be established as a governmentally (at least majority) owned company in the oil and minerals area there? At present, and for the reasons given in section 4.1, it is difficult to imagine such an entity in the Greenlandic case. Bringing in the necessary funds for the initial and subsequent capital injections would represent a major challenge to the government. Furthermore, the activities such a GONG would be involved in would be highly risky, implying that it would be an unstable source of income for the public sector. And the government might be called upon, perhaps in bad times, to finance deficits or extensions of operations in the company.

Instead of establishing a GONG, the government of Greenland realistically has to rely on private sector players in resource extraction.[15] Accordingly, attention shifts from operational concerns to regulatory ones.

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[14] DONG stands for Danish Oil and Natural Gas.

[15] In the oil area, Greenland's national oil company NUNAOIL A/S is completely owned by the government. It participates as a non-paying partner (with a so-called carried interest) in all exploration projects with a share between 8 and 12.5 percent. In case, a find is sufficiently promising for production, NUNAOIL faces corresponding opportunities and obligations.

During the last couple of years, several Danish pension funds have expressed an interest in financing resource exploration and extraction activities in Greenland. This was motivated by a desire to diversify their income base and, of course, the possible perspectives in regard to return to investments. Lately it seems, though, that the interest on the part of the pension funds has cooled off.

4.3 Taxation of natural resource exploitation

This section takes a brief view at tax and other instruments which may ensure that resource exploitation yields an appropriate 'government take'.

The point of departure is and must be that the exhaustible resources in Greenland belong to ts people (see also the discussion of the Self-reliance Act in section 2). The value which the resources represent thus belongs to the population there and represents a part of Greenland's overall national wealth.

The unique characteristic of Greenland's non-renewable oil and mineral resources is their scarcity. When some party is given the permission to exploit a resource, such exploitation is barred to everyone else. If the resource were not scarce, no problem would occur, but all economically interesting natural resources are by nature scarce (no pun intended). Hence, to the extent that one party exploits a resource, value is removed from everyone in that society.

The value of a resource is in principle measured by the 'resource rent'. This resource rent is effectively handed over from the population at large to the party which has obtained permission to extract the resource, and of course it is in the legitimate interest of Greenland to receive remuneration from that party which as far as possible approximates the size of the resource rent.

Various taxes and other instruments are on hand for this remuneration.

First, and perhaps most obvious,[16] is a resource rent tax. A rent tax is in principle imposed on the resource rent, which is the return accruing to the company undertaking the resource extraction over and above the normal return to its equity capital (cfr. fn. 13 above). A calculation of the tax base for the rent tax entails deducting, from the company's revenue, not only materials costs, labor costs, depreciation of the capital base and interest on debt, but also an imputed return to injected equity capital (book value).[17] What is left is interpreted as the rent and subject to the rent tax.

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[16] See, though, the discussion of auctions below.

[17] This particular version of the rent tax is called ACE – Allowance for Corporate Equity. Boadway and Keen (2009) present several alternative rent taxes, including also the Cash Flow Tax and the Resource Rent Tax. While all these types of rent taxes are equivalent under certain assumptions (among other things, losses must produce tax rebates), the *timing* of tax payments will differ between them.

In theory – and this is then a clear advantage of the rent tax – the rent tax does not affect economic behavior. A company harvesting a resource should not alter its behavior, if instead of being able to keep the entire resource rent it only receives, say, 50 percent of it on account of a 50 percent resource rent tax. This presumes, though, that the tax is correctly set up, and that the base of the tax is precisely the resource rent.

The rent tax is implemented in practice here and there. As an example, Norway has a 50 percent rent tax (the so-called Special Petroleum Tax, SPT) on the production of oil in the North Sea. There are many practical problems associated with levying rent taxes, some of which are common to the rent tax and the corporate income tax (see the following discussion).[18]

The standard corporate income tax is meant to tax the economic income accruing to the equity capital of firms operating within the jurisdiction in question. A mining company active in Greenland is accordingly supposed to delimit the income it has earned in a given year there and subsequently pay corporation tax to the tax authority of Greenland on this tax base at the going corporate income tax rate.

The corporate income tax is a more crude tax instrument compared to the resource rent tax. It is bound to distort behavior, as it cuts into the marginal return on equity capital and thus lowers the amount of capital used in resource extraction, so slowing the speed of extraction[19]. At the same time, it does promise to deliver more revenue than a rent tax, simply because it in addition taxes the ordinary return to equity capital.

Assume for a moment that the annual incomes of the company under consideration were adequately measured over the years in which it was active in Greenland. Then the total income over these years would measure the sum of a normal return to the equity capital injected into the company plus the resource rent of the resource extracted. And then the total corporate income tax revenue would contain a fraction of the resource rent equal to the applicable corporate income tax rate. With a Greenlandic corporate income tax rate of 30 percent, 30 percent of the resource rent will be captured by the Greenlandic society.

The assumption of adequate measurement of income rests on a fragile basis, however.

First, the corporate income tax law may itself prevent the adequate measurement to the extent that, e.g., tax depreciation of investment in buildings, machinery, intangible assets etc. does not match the economic depreciation. Second, declared taxable income may differ from

[18] An important issue, downplayed here, is the tax treatment of losses. For a rent tax to be fully neutral, losses must give rise to tax rebates. The associated threat of having to cover parts of losses of operators requires public finances to be in a strong position.

[19] Or causing the less accessible part of the resource to be left behind.

true income to the extent that output and input quantities are flawed and, more importantly, prices of outputs and inputs used to compute taxable income differ from true price levels.[20]

The latter situation is characteristic of the effort of taxing entities of multinational enterprises (MNEs). For the typical MNE, also in the resource extraction industry, a major part of output in entities of the MNE is delivered to other entities of same MNE. These internal shipments can be priced by the MNE with great flexibility. In practice, as long as prices belong to certain intervals, an outsider such as a national tax authority will have a hard time rejecting the price in question as a reasonable valuation of the internal delivery in the MNE. The MNE thus is relatively free to position the transfer price in the interval in such a way that its worldwide tax payments are minimized.

Such distortion of transfer prices of MNEs is well-documented in numerous empirical studies in public finance.[21] A mining MNE engaged in resource extraction in Greenland will face a relatively high corporate income tax rate there, so will be induced to limit corporate income declared there and shift profits out, using distorted transfer prices. It also has incentives to undertake so-called debt shifting and to distort interest rates in internal loans within the MNE. As a result, one may fear that overall, over the period of mining activity, the total corporate income tax revenue of such a mining MNE could become rather slight compared to the potential rent of the resource being extracted.[22]

This observation, together with the stated desire to ensure that the local society does receive as much as possible of the resource rent, leads one to look for other fiscal instruments to supplement the corporate income tax and the rent tax. An oft-used instrument is the royalty or output tax.[23] Precisely what a royalty or an output tax is may depend on circumstances, but most often it is a gross revenue tax, that is a tax on the value of output sold from the company.

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[20] The discussion presumes that true prices of outputs and inputs exist. In most realistic contexts, this is at least a bit of a stretch. Fixed production factors and joint production of several types of output are just two sources which render the definition of a true output/input price quite meaningless.

[21] See, for instance, the overview provided in Devereux (2007). Schjelderup (2013) takes a particular strong position in the debate. Gresik (2001) gives a general introduction to the taxing task of taxing multinationals, a process which, by the way, implies considerable compliance costs for the multinationals themselves under the current international tax regime. An introduction to the workings of the current 'separate accounting' regime and an alternative deliberated by the EU Commission is given in Nielsen (2009). Nielsen et al. (2010) also compares different international company tax regimes with an emphasis on the mechanics of distorted transfer pricing.

[22] While resource rent and corporate income taxes seem to work well in the oil sector in Norway, the story is rather different in countries south of Sahara (Mozambique, Zambia, Ghana, Sierra Leone and Tanzania), where most of tax revenue derives from production taxes (royalties).

[23] Lund (2002) demonstrates that when cost transfers (meant to be at 'true transfer prices') can only be imperfectly monitored, it is optimal under some conditions to combine a tax on gross revenue with a rent tax.

The chief advantage of a gross revenue tax is that it guarantees tax revenue, and it will deliver revenue as soon as output begins to flow out of the company. Hence, it is not sensitive to distortionary transfer pricing on inputs or inflated cost reporting or the like. But it will be sensitive to proper recording of the gross revenue. If for instance output from the company is in the form of a composite which is sent to another entity of the multinational mining company, the fineness of the composite (content of the desired material) may be unknown to tax authorities, leading to some scope for underpricing.

Public finance has a general response to situations where all available types of taxes are fraught with various, but at least to some degree different, problems: Use all of them in a balanced way.[24] Along these lines, a recommendation to Greenland's tax authorities would be to seriously consider implementing rent taxes and gross revenue taxes on top of the existing corporate income tax.

Public finance also has another recommendation which should be given some attention. If circumstances permit, the access to harvesting natural resources could be determined by an auction. In the auction, licenses to produce the resource in question would be auctioned off. Under very ideal conditions, including symmetric information (in regard to market conditions etc.) and many parties interested in extracting the resource, an auction can produce very attractive results. On one hand, the company able to generate most value from the extraction (maximize the resource rent) will win the auction. On the other, the revenue from the auction could approach the associated resource rent.

Under less ideal conditions, where information is imperfect, and there are only few interested companies, an auction can still be helpful in conceding extraction permission to the company in the best position. The auction revenue will be more modest, and taxes (tax policy being taken into account in the bidding process) might well be the preferred instruments for recouping (part of) the resource rent for the local people. With one or very few interested mining companies, auctions may be irrelevant and extraction licenses handed out instead, preferably against a license fee. To determine the appropriate size of the fee, substantial knowledge is required. Nevertheless, a license fee may still be helpful, in combination with subsequent taxes.

To finish off the discussion of taxation it should, of course, be mentioned that apart from the tax and fee instruments already discussed which capture part of the resource rent, other taxes and excises will also generate additional public revenue, when mining companies invest and subsequently produce. Suffice here to mention personal (labor) income taxes, import tariffs, consumption taxes, etc.[25]

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[24] Although Boadway and Keen (2009) in their theoretical review find it difficult to put forth general conclusions, they lean towards balanced use of several instruments, including also license fees and, when circumstances so allow, auctions.

[25] Note here that while Greenland applies a series of excises and import tariffs, there is no value added tax there.

4.4 Pace and timing issues

It is easy to lose sight of important issues having to do with timing of resource exploitation. When a particular exhaustible resource should be exploited in principle and in practice will depend on a number of considerations.

From a purely economic standpoint, and from the perspective of the operator, the timing of exploitation would be determined by the expected development of the price of the resource (as well as the development of the cost of exploitation). If the price is expected to rise dramatically, this will be an argument for postponing the development.[26] The same conclusion holds, if costs of exploitation are expected to drop significantly. On the other hand, the optimal point of time to extract the resource could be the immediate future, if a dramatic increase in the price of the resource and a significant fall in the costs are not anticipated.

From society's point of view it furthermore plays a role to which extent domestic capital and labor can be expected to take part in extraction and related activities. If the current level and composition of competencies on the part of domestic labor do not allow much participation, this is an argument for postponing resource extraction until such competencies are brought in place.

Furthermore, several of the prospective (and imaginable) mining projects are so large that one should avoid lumping them together. Too many projects at the same time causes a risk of overheating of domestic labor markets with adverse consequences on other sectors of the economy and higher involvement of foreign capital and labor than in the case where projects were better sequenced over time. Another advantage of sequencing is that a slow start allows gaining experience from the first projects for the benefit of securing returns to society from subsequent projects.

5. Conclusion

We have investigated the outlook for fiscal policy in Greenland and the possible role of the public sector in the process towards exploitation of the mineral resources in Greenland. Greenland became a self-governing part of the Danish kingdom in 2009, and the Greenlandic population has for some time strived towards economic self-reliance. Denmark offers a block grant and other transfers, but is not involved in fiscal policy in Greenland.

We have inquired whether, against future population aging and the political agreement to keep the block grant from Denmark constant in real terms in the future, Greenland's public finances will be on a sustainable path. The conclusion was that a major gap between estimated expenditures and income in the public sector is due to develop, and that as a result fiscal policy is not sustainable. The required adjustment, if undertaken on the expenditure side, is a cut in expenditure in the order of at least 6 percent of GDP, indeed a very large number. In principle, stronger or broader taxation can also assist in the adjustment, as can select structural economic reforms, some of which were hinted at in the article.

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[26] The bare-bones argument, when suppressing cost considerations, is as follows: If the expected rate of increase of the price of the resource exceeds the real rate of interest, it pays to postpone extraction, and vice versa.

The exploitation of Greenland's mineral resources can put the public fiscs under pressure in many ways. The active participation of Greenlandic workers presupposes an adequate level of competence and thus successful schooling, training and education. Furthermore, an adequate extent and quality of public infrastructure in many dimensions is warranted. For the public sector in Greenland this necessitates outlays before any increase in income via various types of taxes and fees, even with no direct participation in the extraction process.

The process of resource exploitation raises the difficult question of how to ensure that gains from the process accrue to a reasonable extent to the people of Greenland. These gains come in two forms. First, an appropriate government take in the form of well-chosen taxes and fees. Second, the remuneration of Greenlandic companies and their employees cooperating with or enjoying spill-overs from resource extraction companies. We took a look at what the literature has to say about resource taxation; resource taxation contains difficult and unresolved issues, but a cautious conclusion points to application of, on top of corporate income taxation, resource rent taxation and, possibly, royalties and license fees.

An important thing to keep in focus is the fact that mineral resources are exhaustible resources. Hence, exploitation can occur only once. This introduces the difficult question of when to conduct the extraction. In theory, the right time to do so is when the (discounted) net revenue (as seen from society's perspective) is at its highest. Stated in another way, it should not pay to do it sooner, and it should also not pay to wait until later. This sounds simple enough, but implementing the principle requires much knowledge about market conditions, cost conditions, and the opportunity for involving a greater part of Greenland's society.

Will resource exploitation solve Greenland's fiscal policy sustainability problem? No, and for two reasons. First, one cannot imagine resource extraction to produce such an increase in public sector revenue as to close the gap between estimated expenditures and income in the future. Second, even if the level of activity in the mining sector becomes large, one should remember that extracting resources means decreasing Greenland's overall stock of national wealth, unless the majority of the resulting revenue is kept in place for future generations in some form, for example a stock of foreign financial assets. Accordingly, generations present during the exploitation phase strictly speaking should only consume the ordinary return to national wealth, not decrease it.

Given that the extraction of mineral resources cannot be the solution to the lack of sustainability of fiscal policy, there is no way around reforming the public sector and economic structures in Greenland. The government has announced its willingness to scrutinize the labor market, the housing market, tax policy and other dimensions of structural policy. Such intentions are welcome, but further applause must wait until words are translated into appropriate political action.

Appendix: The sustainability indicator

To compute a sustainability indicator for fiscal policy in Greenland we used a discrete time variant of the methodology developed in Blanchard et al (1990). The same methodology is used in e.g. Broda and Weinstein (2004) in assessing fiscal policy and sustainability in Japan.

To define the sustainability indicator, denote by b_t the primary deficit (expenditures less revenues) measured relative to GDP so that

$$b_t = g_t - \tau_t - v_t \qquad (1)$$

where g_t is public expenditure, consumption as well as transfers, τ_t is taxes and other public revenues except the block grant (and other foreign transfers) which is denoted by v_t.

Having i denote the constant nominal interest rate and η the nominal growth rate of the economy (assumed constant for notational simplicity), the level of public debt measured relative to GDP at the end of period t, d_t, is then given by

$$d_t = \left(\frac{1+i}{1+\eta}\right) d_{t-1} + b_t \qquad (2)$$

Hence, the level of debt-to-GDP n years into the future is given by

$$d_n = \sum_{t=1}^{n} \left(\frac{1+i}{1+\eta}\right)^{n-t} b_t + \left(\frac{1+i}{1+\eta}\right)^{n} d_0 \qquad (3)$$

where the initial level of debt-to-GDP is denoted by d_0 .

This equation states that the level of debt relative to GDP n periods into the future is the sum of accumulated primary deficits that grow at the rate (1+i)/(1+ η), and the value of the initial level of debt which grows at the same rate.

Following Blanchard et al (1990) we now define a fiscal policy as sustainable if the path of expenditures and revenues is such that the level of debt relative to GDP converges back to its initial level under the time horizon under consideration.

Hence, given this definition of fiscal sustainability, $d_n = d_0$, and by expanding our primary budget balance with a fictitious expenditure called s_t, so that our primary deficit is given by $b_t + s_t$,, we can obtain our sustainability indicator, s^*, by rearranging equation (3)

$$s^* = \frac{\eta - i}{1+\eta}\left[d_0 + \left(1 - \left(\frac{1+\eta}{1+i}\right)^n\right)^{-1} \sum_{t=1}^{n} \left(\frac{1+\eta}{1+i}\right)^t b_t \right] \qquad (4)$$

Having defined s_t as a (fictitious) expenditure, the interpretation of s* is the permanent adjustment of public expenditure needed to ensure that the level of debt relative to GDP converges back to its initial level, i.e. ensure that the intertemporal budget constraint for the public sector is fulfilled.

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