Labor Market and Current Account Equilibria in Greenland

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Abstract: Greenland's population and employment have historically been stable, but its growth performance is not impressive. Greenland enjoys rather stable fishing exports, and it receives two-thirds of its import capacity as a grant from Denmark. Non-fishing labor contributes to either private consumption or government consumption. The first is import-intensive and the second is labor-intensive. Greenland's imports cannot exceed the sum of the grant and net fishing exports. A large public sector guarantees stable employment. A larger private-government consumption ratio is hypothesized as a way to increase welfare, and a lower real wage is the means by which this can be achieved.

Keywords: Greenland; Labor market; Current account; Denmark
JEL codes: E19 & E31

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1. Introduction

Greenland is caught between its realities and its ambitions. The nation's realities are its notorious difficulties in achieving economic growth, some causes of which are easily identified: a population of approximately 56,000, an ice-free area the size of Sweden, a widely distributed population of 0.12 persons per square kilometer, the existence of only small towns and villages (*bygder*) that are not connected by roads, and a harsh climate. Moreover, distances to larger markets (Europe, the populated parts of Canada) are long (approximately four hours by air), and the task of upholding territorial sovereignty for the total area, which includes an ice cap of over two million km^2, is challenging. Turning to Greenland's ambitions, the wish is more economic independence. Although it manages its own internal affairs, has a parliament, passes its own laws, and stands on equal footing with Denmark and the Faroe Islands in the Kingdom of Denmark, the massive amount of financial help that Greenland receives from Denmark –covering two-thirds of Greenland's capacity to import – hurts the nation's natural desire for self-reliance.

Not surprisingly, there is a long history of discussion about Greenland's prospects. Mogens Boserup, who later became a professor at the University of Copenhagen, presented both a positive and a pessimistic view in his classic text, Boserup (1963). At that time, the population of Greenland was increasing at a yearly rate of 4 percent. This growth could not continue indefinitely, but Boserup maintained that with financial help from Denmark, the population could be larger, while the economy could still function. He added the caveat "possibly", as he was not certain. In a characteristic and more aggressive style, Jørgen Pedersen, renowned economics professor at the University of Aarhus, Pedersen (1965), argued that the possibilities for establishing branches of trade and industry in Greenland were non-existent, with the exception of fisheries and some tourism. The basic analyses of these two economists do not differ much, and with the benefit of 50 years of hindsight, we find that both were correct. Taking a view that is somewhat in between these two economists, Paldam (1997) leaves open the possibility of new or increased export-oriented trades if costs that depend on wages and skills were lower.

It is difficult for Greenland to realize the three Marshallian advantages of economic centers. (1) The small size of the labor market reduces the probability of finding a new job in another sector or firm after a job loss. In addition, a firm looking for more labor may have difficulty attracting persons who have lost their jobs elsewhere. (2) The range of services available in the local market is limited. Finally, (3) low labor mobility between branches and firms means fewer positive externalities from learning on the job and gaining experience. In short, Greenland's urban agglomerations and labor market lack size and depth, see Lund (2011), chapters 3 and 6, and Lund (2015). At first glance, a nation with a relative-

ly small GDP per capita is expected to have growth potential. However, for the many reasons mentioned above, this hardly applies to Greenland.

This paper presents a model that highlights some important features of Greenland's economy, discusses the effects of exogenous forces, and analyzes the meaning and strength of the nation's preference for economic independence. The emigration of Greenlandic nationals is an important issue. To simplify, the labor supply is taken as given, and emigration is treated as an exogenous change.

The fishing sector, which is considered a resource-based sector with exogenously determined employment, is kept separate from the rest of the labor market. For the rest of the employment, we have a labor market constraint, which relates to private consumption (in short, consumption) and government consumption expenditure (in short, government expenditure or government spending). Government expenditure is more labor intensive than consumption, and it can therefore be a means of absorbing an excess supply of labor. There is no investment in the model, and we exclude export-oriented production, with the exception of that from the fishing sector.

An external constraint says that imports cannot exceed the sum of net exports from the fishing sector and outside financial help. The majority of outside financial help is in the form of the *bloktilskud* from Denmark, a lump-sum grant that is at Greenland's free disposal. Furthermore, Denmark pays for certain activities (mainly police, judiciary, and military) directly. At the unit level, these outlays and the grant have the same impact with respect to income determination, but from a policy perspective, they are different. From the European Union, Greenland receives a smaller, although not negligible, transfer. All transfers from abroad are lumped together in one amount. We assume a current account balance or surplus equivalent to a postulate that Greenland cannot be a net borrower; that status would soon cause lenders to fear a lack of solvency, as Greenland's tarnished government finances and public independence debate tend to undermine the nation's credit worthiness. Another possibility is a surplus, and the public sector in particular could run a surplus. This possibility is closely related to Greenland's achieving economic independence, as discussed below.

To illustrate the working of the model, assume a situation with unemployment and a balance on the current account of the balance of payments. Higher government expenditure reduces unemployment, but imports cannot increase any further. An increase in labor-intensive government spending must happen in combination with a decrease in import-intensive household consumption so as not to violate the balance of payments restriction. After the necessary substitution, both the labor market and the outside restrictions are satisfied and binding. Then, let there be a wage increase. Unchanged employment would mean excess imports. It will thus be necessary to tax away the increase in the disposable income of workers, and the consequence is that higher wages and prices lead to unemployment. To overcome this, we revert to the increase in government expenditure and a fur-

ther decrease in consumption. This establishes two main points of this article. An oversized public sector guarantees employment of the labor force, and wage increases aggravate this awkward balance. Going in the other direction, a lower wage increases the purchasing power of the *bloktilskud* in terms of Greenlandic value added and makes it possible to have higher consumption.

A desire for more economic independence or, stated differently, a desire to rely less on the *bloktilskud,* is at the forefront of policy debates in Greenland. A necessary step in this direction would be a public savings policy, namely allocating some of the *bloktilskud* to a savings fund. Any preference in this direction has not yet been revealed. Nevertheless, it is an essential topic, and it is discussed in this article.

The rest of this paper is structured as follows: Section 2 presents the model. The effects of shifts in the exogenous variables on the solution of the model are described in section 3. In section 4, we set up goals for the economy and analyze optimization. Section 5 considers some of the model's simplifications and argues that they are justified by the special characteristics of Greenland. Section 6 presents a brief empirical analysis. Concluding remarks are provided in section 7.

2. The model

Table 1 illustrates the flows of expenditures, income, and transfers in the model. Income sources are included on the right-hand side and expenditures on the left-hand side. We begin with the private sector. The non-fisheries segment earns income from the production of consumption *C* and from government expenditure *G*. We have q_C and q_G as import propensities. *C* is thus divided into $q_C C$ as payment for imports and $(1 - q_C)C$ as purchase of Greenlandic value added. *G* is divided correspondingly. Net exports or factor income for the fisheries sector, including both fishing proper and the local fishing industry in plants on the coast, is *F*. Total private sector income is used to buy consumption goods and to pay net taxes *T*, which are tax payments minus transfers from the government to households and firms. These net taxes, along with the lump-sum *bloktilskud B,* are the public sector's income sources, and, without government saving, they equal government spending *G*. Finally, the foreign sector buys fisheries products *F* and transfers *B* to the government of Greenland.

All the flows are in real terms; the precise meaning of this is explained shortly. As for the two parameters, it is important and realistic that $q_C > q_G$.

Table 1. Income and transfer flows

Private sector		Government		Foreign sector	
Uses	Sources	Uses	Sources	Uses	Sources
C	$(1-q_C)C$				$q_C C$
	$(1-q_G)G$	G			$q_G G$
	F			F	
T			T		
			B	B	

When two accounts in *Table 1* balance, so does the third. We assume throughout that the private sector account balances. Therefore, both the budget and the current account balance, or neither does. There is no private saving and no domestic investment in the model.

Underlying the above are employment numbers. Let N be total employment, N_F fisheries employment, and the residual $N - N_F$ structural employment in the non-fishing economy. N and N_F are exogenous. Finally, the real wage in non-fishing is w, which is used as a shift variable. C and G are endogenous.

With no distinction between wage income and profits, total factor income is $w(N - N_F) + F$, which is equal to the right-hand side of the private sector account. Domestic demand for domestic goods equals factor income in the non-fishing economy, so we have:

$$(1)\ (1-q_G)G + (1-q_C)C = w(N - N_F)$$

In general, the propensities to import depend on relative prices via the real exchange rate. In the case of Greenland, an initial approach may be to use fixed quasi-technical coefficients on consumption and government expenditure.

In a diagram, with C along the horizontal axis and G along the vertical, the absolute slope and the intersections of (1), shown in *Figure 1*, are as follows:

$$\frac{1-q_C}{1-q_G} < 1;\ \frac{w(N-N_F)}{1-q_C};\ \frac{w(N-N_F)}{1-q_G}$$

A unit reduction in household consumption reduces domestic demand, $1 - q_C$, and sets free $\frac{1-q_C}{w}$ units of labor. It takes $\frac{1-q_G}{w}$ units of labor to produce one unit of G. Therefore, $\frac{1-q_C}{w} / \frac{1-q_G}{w}$ is the absolute slope.

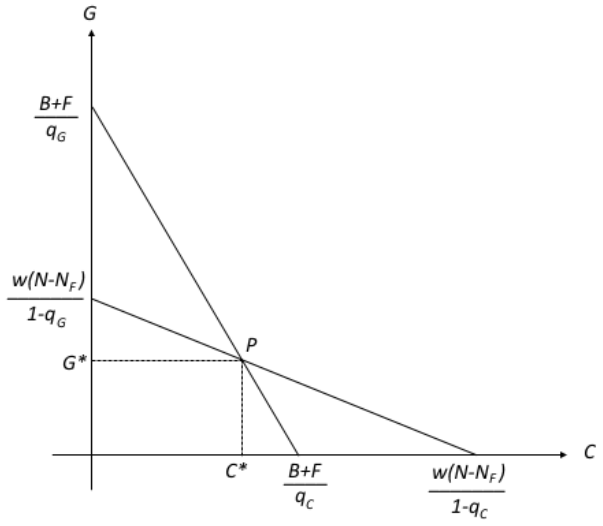

Figure 1. Labor market constraint with the smaller absolute slope and external constraint

The external constraint follows from the foreign sector account in *Table 1*:

$$(2)\, q_G \cdot G + q_C \cdot C = B + F$$

The sum of B and the fishing sector's real net exports F (i.e., revenue minus imported raw materials) finance the imported part of consumption and government spending.

The absolute slope and intersection with the axes of (2) in *Figure 1* are:

$$\frac{q_C}{q_G} > 1;\ \frac{B+F}{q_C};\ \frac{B+F}{q_G}$$

It is important to be clear about nominal and real values. B is indexed to maintain a constant real value in Danish Kroners (DKK), and w is measured as a fraction of B. Thus B/w is the number of labor units B can buy. All nominal values are deflated by the index used to determine the nominal value of B. The real wage definition is special because it does not take into account the price of real Greenlandic value added. This is discussed at the end of section 4.

In *Figure 1*, the labor market restriction depends on factor income in the non-fishing sector and on the import propensities. With $N - N_F$ as structural employment in non-fisheries, there is unemployment under the line and excess demand above. The external restriction depends on the capacity to import and the import propensities. Below the line, import capacity $B + F$ is underutilized. Above the line, Greenland must borrow from abroad. Both restrictions are binding at point P. Point P corresponds to balance on all three accounts in *Table 1*. On the stretch from $w(N - N_F)/(1 - q_G)$ to P, the public sector is in surplus, as is the current ac-

count. The steep part of the limit to the feasible area is a little trickier. If the private sector account always balances and the capacity to import is used up, then all sectors balance. This implies that $w(N - N_F)$ can no longer be exogenous. There will be unemployment.

It can be shown that $0 < q_G < q_C < 1$ implies intersection of the loci in the first quadrant as shown in the *Figure*. Solving equations (1) and (2) gives:

$$(3) C^* = \frac{(1-q_G)(B+F)-q_G w(N-N_F)}{q_C-q_G}$$

$$(4) G^* = \frac{q_C w(N-N_F)-(1-q_C)(B+F)}{q_C-q_G}$$

The solution is structurally dependent on two quantities: $w(N - N_F)$ and $B + F$. First, an increase in $w(N - N_F)$ should allow both *C* and *G* to rise. This violates the external restriction, so demand must shift from *C* to *G*. The second is the capacity to import. Again, because of the other restriction, if that capacity rises, *G* must decrease, and the increased imports come from an increase in less labor-intensive consumption.

Assume that the values in (3) and (4) materialize. There is no investment, so $C + G$ is domestic demand. With *F* exogenous and imports equal to $F + B$, income or production is $C + G - B$. However, there is no specified behavior leading to this solution, and a traditional consumption function is not part of the story. My interpretation is that a planner steers some aspects of the economy. In fact, population, labor force and employment have been quite constant for a long period of time. Thus, it looks *as if* an equilibrium exists, where a combination of household consumption and government spending sustains employment, given the capacity to import.

The planner chooses *G* and taxes, the latter of which are mentioned in *Table 1* but not otherwise included in the model, and he tells consumers to use all their disposable income for consumption. He cannot change *B* or *F*. (Fisheries policy is not explored in this paper.) Employment is exogenous, and N_F is technically determined, and as such, it is beyond the reach of the planner.

In principle, the planner could fix the wage level *w*. In reality, real wage formation lies in a grey zone, where the planner and the labor market share decision power. Normally, real wage changes influence exports and imports through the real exchange rate. This is not the case in the model. Rather, changes in *w* determine the change in the ratio of consumption to government expenditure. We return to the important role of *w* in section 4.

Neither fixed nor human capital are elements of the model, which characterizes it as short run. However, we think that the model captures some slowly changing traits of the Greenlandic reality. Accordingly, we discuss adjustments that take place only over the longer run.

3. Shifts in exogenous variables

Contingent on moving to a new intersection of the restrictions, *Table 2* identifies decreases (−), increases (+), and no effects (n. e.) from positive shifts in the variables in the first column. The middle column refers to quantitative changes. The effect is shown as a change in the *C/G*-ratio. The last column is, at the outset, more speculative, but if we let factor income divided by the *bloktilskud* be an indicator of economic independence, we immediately obtain the first two results. The last three lines indicating no effect are not entirely correct. A larger $w(N - N_F)$ increases real income and draws employment away from the supply of consumption value added. It would imply independence bought by an even larger public sector.

Table 2. Effect of positive shifts in exogenous variables

Larger	$\frac{C}{G}$	Economic independence
B	+	−
F	+	+
N	−	n. e.
w	−	n. e.
N_F	+	n. e.

The shift from public spending to consumption following a larger *B* might be a welcome development in Greenland, given its large public sector. At the same time, however, Greenland comes to rely more on help from outside. Increases in *w* or *N* lead to vertical shifts in the labor constraint. In both cases, the *C/G*-ratio decreases. An increase in N_F decreases F/N_F, the average income in the fisheries sector, but otherwise, the effect is like that of a smaller *N*. Note that the expectation is a falling trend in employment in the fishing sector due to productivity increases in fisheries, as in other primary trades.

To advance the analysis, we examine a change in the relative prices of imports and Greenlandic value added. Consumption is divided into the proportion $(1 - q_C)/q_C$ between Greenlandic value added and imports, which implies homothetic preferences for these two components. Keeping the price on imports constant, for a given total *C*, the imported quantity is fixed. The domestic component $(1 - q_C)C$ is also fixed, and we have a rectangular hyperbola with consumption-producing labor and the wage rate along the two axes. The utility from a unit of *C* is higher when *w* is lower. In the same way, a smaller *w* means substitution towards labor in government expenditure and a utility gain per unit.

Figure 2 illustrates the effect of a lower wage. The labor market constraint shifts from *AA'* to *DD'*. The intersection shifts from *P* to *P'*. Real consumption in-

creases from C_1 to C_2, and G decreases from G_1 to G_2. Households increase imports, and domestic factor payments from consumption increase. There is a shift in labor from the public to the private sector. This effect is dampened by a more labor-intensive production of government consumption. The precise forms of substitution are no doubt unrealistic. Nevertheless, we find it satisfactory that this very simple model allows the composition of consumption to react to changes in relative prices. Without substitution, that is, if domestic labor hours and real imports enter in fixed proportions in both *C* and *G*, we would have a Leontief case and only one possible wage rate. An additional restriction, $aG + bC = N - N_F$, with positive *a* and *b*, in addition to (1) and (2), would require one more endogenous variable.

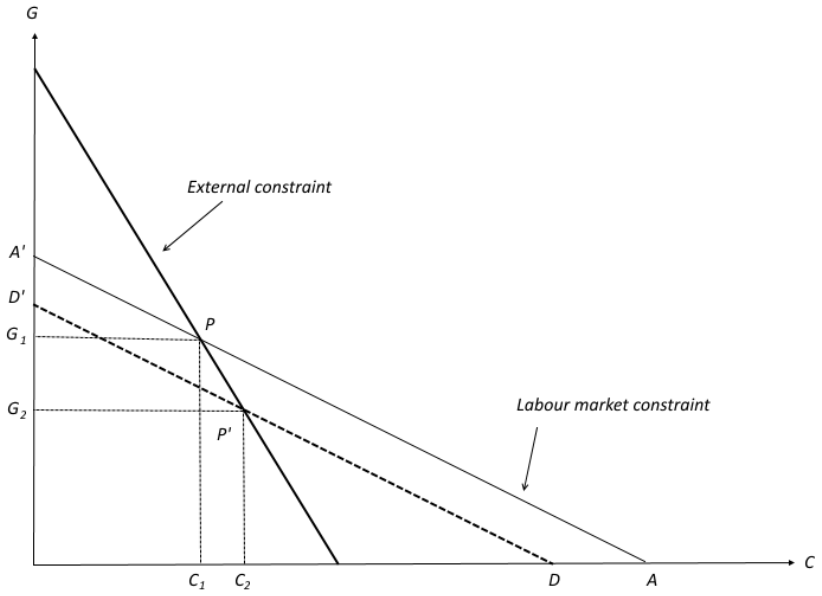

Figure 2. Decrease in the wage rate and shift towards private consumption

4. Optimization

4.1. No public saving: Policy recommendation

The planner's problem is to find the optimal solution. This must satisfy the external constraint. For a given *w,* it is known how units of *C* and *G* are composed in terms of imports and internal value. For *C,* the parts are q_C and $(1 - q_C)/w$. An indifference map is drawn based on this information. Having found the point of tangency, we must ask whether this also lies on the labor constraint. If so, then

the problem is solved. The external constraint and an indifference map are shown in *Figure 3*.

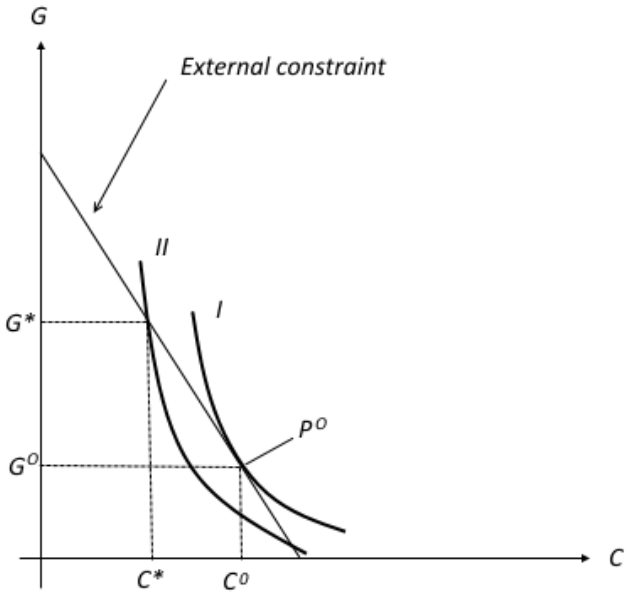

Figure 3. Optimization: the external constraint and indifference curves

Suppose that point P^O is the overall solution, and let the corresponding wage be w^O. At P^O, indifference curve *I* has tangency with the constraint, and $G < C$, which can be regarded as the normal and preferred case, valid, we assume, also for Greenland. In fact, the opposite pattern is observed: government spending is greater than consumption. As Greenland's economic counsel, Økonomisk Råd (2015), p. 13, notes, $G > C$ may not be found for any other market economy.

Let the actual wage be w^*, corresponding to the point (C^*, G^*) in *Figure 3*, and assume the labor market to be in equilibrium, then $w^* > w^O$. A change in the wage, such that the intersection with the labor constraint shifts from the actual to the optimal combination, is precisely the change illustrated in *Figure 2*. However, we must think about what the indifference map – conditional first on w^* and then on subsequently lower wages – would look like. Or, to be more precise, will the indifference curve through (C^*, G^*) dependent on w^* be steeper than the constraint? We see no reason why this should not be true. The ratio of the domestic labor contents in units of *C* and *G* must be independent of *w*, so there seems to be no technical reason for *G* to be more preferred because of larger values of *w* and *G* for points on the constraint. We hypothesize the indifference curve through (C^*, G^*) to cut the constraint as shown with curve *II* in *Figure 3,* whether the wage is w^*or w^O.

Suppose that w^* has been changed to w^O and that labor has been re-allocated accordingly. As the accounts in *Table 1* balance, *T* falls by as much as *G* does. Only balanced budget changes are allowed. Thus, for the private sector as a whole, real disposable income has risen. Suppose that real taxes levied on the fishing sector are unchanged. The real disposable income of that sector is unchanged. Then, taxes from the non-fishing economy must decrease by the full amount of the tax decrease, so the real disposable income of the non-fishing part of the economy increases. The relative price of Greenlandic value added in consumption has fallen. Therefore, the utility of disposable income has risen in both of the private sectors. Allowing taxes to fall only in the non-fishing economy is a limit case. However, the fisheries sector tends to benefit the most from a wage decrease, simply because such a change does not affect its income.[2]

A numerical example with reasonable values of the parameters is provided in Appendix 2, which hints at large effects of a moderate wage rate change. Using magnitudes from the 2014 national accounts as reference, *C*+*gross investment* divided by *G* is 1.3. (*C* alone is 85% of *G*). For Denmark and Germany, the values of (*C*+*gross investment*)/*G* are 2.6 and 3.9. In the example, the C/G ratio increases by 15% from 1.30 to 1.49 upon a 5% decrease in *w*. The example also illustrates the asymmetry of the distributional effect. If the relative increase in real disposable income must be the same in fisheries and non-fisheries, and if there was an initial common tax rate of 24%, then the rate in the fisheries part of the economy should decrease to 21.6%, and that in the non-fishing part of the economy should decrease to 17.5%.

The example highlights another feature of an economy in which the government receives outside financial aid. Consider a decrease in *G*. We have $\Delta T = \Delta G$, and the simple equation

$$\frac{\Delta T}{T} = \frac{\Delta G}{G} \cdot \frac{G}{T} \text{ follows;}$$

that is, the elasticity of *T* with respect to *G* is G/T.

Using the numbers in the example, the elasticity is 2.5. It increases as *G* falls. After the 5% decrease in *w*, it becomes 3.0. In Greenland, there is potential for much larger percentage decreases in taxes (gross taxes minus transfers) than in government consumption expenditure. This, no doubt, would have to be an important piece of information about a policy that aims to move downward along the constraint from (C^*, G^*) in *figure 3*.

2. From an application perspective, we touch upon the need for special taxation of the resource-dependent sector.

4.2. Public saving for more economic independence

Reducing Greenland's reliance on the grant from abroad and increasing its economic independence are equivalent. The 2009 self-government law does not restrain Greenland's use of *B*. Part of *B* could therefore be placed in a fund, and this buffer would serve as precautionary savings. Over the longer run, returns on the fund could make it possible to negotiate a new economic relationship with Denmark. A full-fledged plan for the building of such a fund is beyond the scope of this paper; see chapter 2 of Lund (2011) for an example.

Introduce economic independence as a goal in the planner's utility function. We measure the increment toward independence by public savings. Define Z from the set-up in *Table 1* as $Z = B + T - G$. With balance in the private sector, it follows that $Z = F + B - q_C C - q_G G$; government saving is equivalent to a current account surplus. If, for a moment, we forget about a goal for the *C/G*-ratio, *Figure 4* provides an illustration. A movement from *P* to *P'* increases welfare. A shift in the external constraint to the broken line is a self-imposed burden, which secures a current account surplus equal to the parallel horizontal shift multiplied by q_C. At the margin, the burden of the shift equals the gain in economic independence. The indifference curve is drawn for a given surplus $\bar{Z}$, and it must also depend on the expected real yield $\bar{r}$ on the fund.

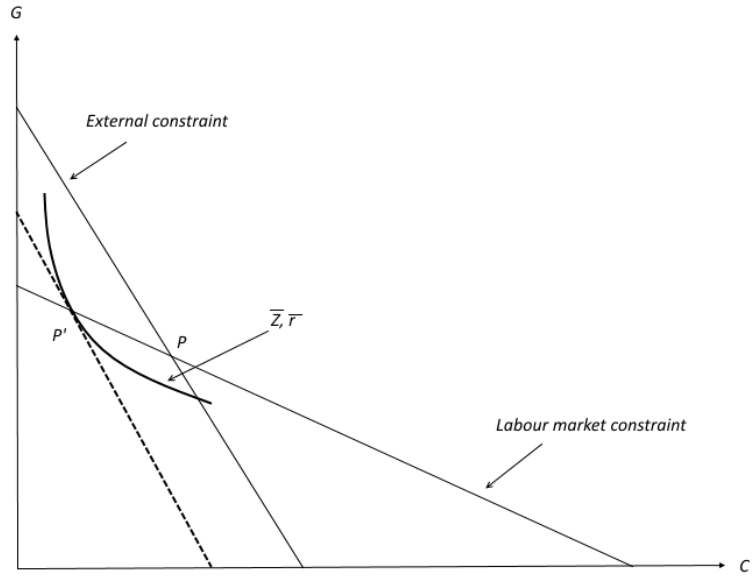

Figure 4. Optimal saving for economic independence with fixed w

A policy that simultaneously aims at greater economic independence and a higher C/G-ratio calls for a policy mix of lower w and G combined with public savings.

5. The model's simplifications

To let labor supply be exogenous is a heroic assumption. Both the population and labor force have been remarkably stable for approximately 30 years, but this does not turn stability into a reliable prediction. Migrations will have a huge influence on the future size and composition of the population. Recent calculations from Statistics Greenland, Grønlands Statistik (2017), show continuous net-emigration at all ages up to 65. At today's rates, at the age of 25, only 70 percent of those born in 2016 still live in Greenland, and at age 65, this figure is one half. With fertility edging below two, it seems that immigration of non-Greenlanders will be crucial if the actual size of 50 to 60 thousand inhabitants is to remain stable. Given this fluid background, and disregarding that the policies discussed here would influence migration rates, we choose to let employment be a shift variable. The limitations of the model, including its lack of consideration of real and human capital, which could influence labor demand, should be borne in mind.

Could Greenland increase its exports if the cost level were lower? This question is crucial to the discussion of growth potential. The model uses the Jørgen Pedersen postulate that there is no possibility of starting new export trades; see section 1. The above question is relevant to other smaller communities with peripheral status. One example is Puerto Rico, which is an unincorporated territory of the United States (i.e., controlled by but not part of); it is located in the Caribbean and receives large subsidies from the US. With a population of over three million inhabitants, it should have far better chances of initiating a growth trajectory than Greenland. This has not occurred. Consider some of Paul Krugman's comments on the economy of Puerto Rico, Krugman (2015): "It doesn't have a special skill complex", and "it's fairly slow and expensive to ship things in and out". If Puerto Rico had a large amount of human capital, the story would be different; this just underlines Greenland's difficult situation.

One may object that we have paid too little attention to tourism. There is no clear rebuttal, but it is suspected that net exports would, at best, increase slowly. The bottleneck may be the lack of competence to supply these services rather than the costs of supplying them.

New raw material projects can and will create job opportunities. The importance of the domestic wage level in such cases is unclear; it may have only a small effect. The model could be adapted to large projects by introducing a new exogenous net export R (factor income), which increases the import capacity. Correspondingly, N_R could be added to N_F. The report from a university committee, Udvalget (2014), underlines the uncertainty of and limited economic net gains from raw material projects.

The time perspective of the model without investment is unclear. However, the main point is that this is a no-growth model. The activities and earnings of the resource-based fisheries sector are exogenous. In reality, this sector invests, but

this investment is more focused on maintenance and modernization than on a necessary capacity-driven increase in the capital stock.

Housing investment is closely related to the concentration of the population in a few growing cities. We consider this a sort of technical adjustment rather than growth in the number of homes. Those who move into new or modernized dwellings must save in accordance with financial schemes. It may not be that far-fetched to assume that these savings and public subsidies offset investment, such that negligible additional savings result at the macro level, which is in line with the assumption that consumption equals private disposable income.

6. Empirical considerations

Table 2 summarizes the directions of the effects of shifts in the exogenous variables. We now examine the consequences of a lower wage rate. From (3) and (4) we obtain

$$\frac{C}{G} = \frac{(1-q_G)(B+F) - q_G w(N-N_F)}{q_C w(N-N_F) - (1-q_C)(B+F)} = \frac{n}{d}$$

where numerator *n* and denominator *d* are introduced for convenience. We calculate the elasticities of *C/G* with respect to $w(N-N_F)$ and $(B+F)$. As seen in the following expressions, they have identical absolute values. If the focus is on *F,* the elasticity is smaller.

$$e_{\frac{C}{G},w(N-N_F)} = -\frac{(q_C-q_G)w(N-N_F)(B+F)}{nd} = e_{\frac{C}{G},w}\ given\ (N-N_F)$$

$$e_{\frac{C}{G},B+F} = \frac{(q_C-q_G)w(N-N_F)(B+F)}{nd}\ or$$

$$e_{\frac{C}{G},F} = \frac{(q_C-q_G)w(N-N_F)F}{nd}$$

To obtain values of the elasticities, we must choose the import propensities and use national accounting figures. Appendix 1 provides a short account of the choices and selected data. We use $q_C = 0.5$ and $q_G = 0.15$ as the two import rates. *Table 3* lists the national account figures used, which are drawn from Statistics Greenland (StatBank). There are exports other than those from fisheries, so an estimated half a billion DKK in "tourism" is added.

Table 3 National account figures for factor incomes and import capacity

2013	Item	Millions DKK
National account figures	1. Total factor income	13,499
	2. Fisheries sector, *F*	1,850
	3. "Tourism"- net exports	500
	4. Foreign financial aid, *B*	4,866
	1-2-3: $w(N-N_F)$	11,149
	2+3+4: *B+F+"tourism"*	7,216

We obtain:

$$-e_{\frac{C}{G},w} = e_{\frac{C}{G},B+F} = 3.2 \; and \; e_{\frac{C}{G},F} = 1.0$$

The elasticity of *C/G* with respect to *w* is rather large. Imagine, for example, a decrease in the real wage of 5 percent. The ratio $(C + investment)/G$, which is approximately 1.3, would increase by 16.0 percent to 1.5. The numerical example in Appendix 2 gives an elasticity just below 3.

The rest of this section considers changes over time in the dependent and independent variables of the model. The data are available only for the period 2003-2015. Appendix 1 explains the construction of the following time series: *C, G, w, N,* N_F, and *F.*

N and N_F work through the difference $(N - N_F)$. This leads to a hypothesis of the form

$$\frac{C}{G} = f(w, (N - N_F), F).$$

The ratio of consumption to government expenditure is a function of the real wage, (trend) employment in the non-fishing economy, and factor income in the fishing sector.

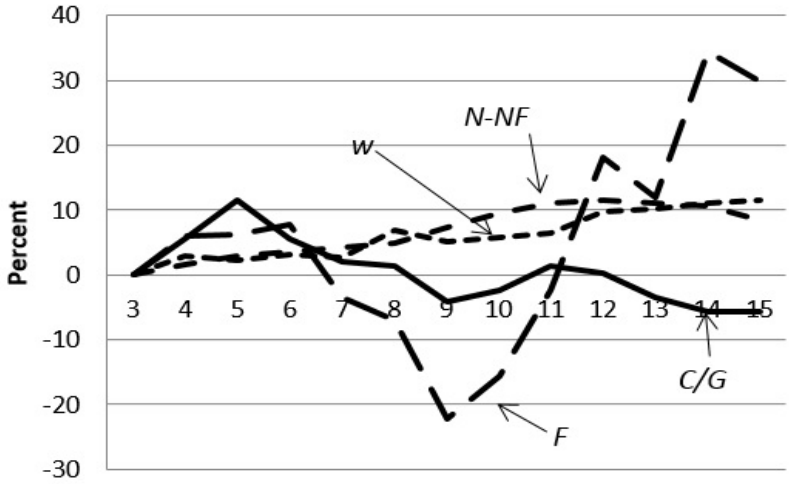

Figure 5. Percentage changes in C/G (dependent) and $w, N - N_F, and\ F$. 2003 to 2015.

Figure 5 shows the accumulated percentage change in the dependent variable *C/G* and the three explanatory variables *w,* $(N - N_F)$, and *F*. The model predicts that *C/G* falls when *w* and $(N - N_F)$ increase as the labor market constraints of the figures shift upwards. The opposite is true for the impact of *F*, where an increase shifts the external constraint to the right. Overall, the curves in *Figure 5* do not contradict these expectations. The declining trend in *C/G* from 2005 to 2015 corresponds to increasing trends in *w* and $(N - N_F)$ over the whole period. As for *F,* the graph shows a large business cycle–like swing. The decrease in the first half of the period correlates with the declining *C/G*-ratio. Thereafter, a steep rise in *F* helps to stabilize *C/G*. The effect, however, seems weak. This is unsurprising because *F* represents only the smaller part of the import capacity. Let us emphasize that the development in *Figure 5,* and especially the steady increase in the real wage, runs against the policy recommendation in section *4.1* and thus, in our view, decreases welfare.

7. Conclusions

The model owes its simplicity to many heroic assumptions. Several factors are taken as exogenous, notably, structural employment. In fact, emigration from Greenland is not difficult because of the option to move to Denmark with full citizenship. The restriction that import capacity is exogenous seems realistic over both the shorter and longer run. Many factors contribute to the seeming impossibility of establishing export-oriented trades beyond fisheries and to the limited net income earned from tourism.

In practice, Greenland has not used discretionary policies to attain a higher *C/G*-ratio or more economic independence. Nevertheless, it is important to discuss such policies. We concentrate on the impact of a lower wage on the ratio of household consumption to government consumption expenditure, assuming an increase to be welfare gain. Using available data, the elasticity has been calculated: a one-percent decrease in the real wage can, in the longer run, be expected to increase the C/G-ratio by approximately 3 percent. Short time series do not contradict the assertion that the *C/G*-ratio should decrease when the real wage and employment increase.

Is it reasonable to concentrate so much on the effect of a lower real wage? With a lower wage, taxes could be reduced, disposable real incomes could increase, and consumption demand could lead to greater use of domestic services and trades because of income and substitution effects. In a more ordinary country, the government income would decrease with a decrease in wages and incomes. In Greenland, however, because of the *bloktilskud*, a large portion of government income increases its purchasing power for labor and other domestic value added.

Moreover, a lower wage should increase international competitiveness. Even if we do not expect too much from this effect, the opposite pattern, unchanged or higher wages, will increase the need for a large public sector in Greenland and maintain Greenland's indefinite dependence on financial aid from Denmark.

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Appendix

Appendix 1: Data

Based on inspection of input-output tables, Grønlands Statistik (2015), round values of the import propensities are chosen: $q_C = 0.50\ and\ q_G = 0.15$.

For the remaining variables, data are from Statistics Greenland's online data platform, StatBank. *C, G* and 'nominal *F*' are from national accounts. *B* is from public finances. *N* is from population, ages 17-64. The overall structural employment rate is set as 75%. N_F is from labour market (only from 2008): main employment, fishing plus manufacturing (mainly fish and shellfish factories). For the first years, the 2008-number is increased backwards by 3% a year to match productivity increases. The C/G- ratio is homogeneous of degree 0 in *w, F* and *B*. 'Nominal *F*' is deflated with the implicit regulation index for *B*. The real wage increase is determined as the difference between the increase in consumer prices and the implicit regulation index for *B*. This is problematic, as it neglects a difference between developments in prices and wages due to changes in productivity. However, we have no wage index. For the period 2008-2015, a comparison of the development in nominal incomes in the non-fisheries economy and prices shows essentially the same growth in the two series, which tends to make our procedure acceptable.

Appendix 2: Wage decrease: A numerical example

To calculate values for *C* and *G* from (3) and (4), the following parameter values are chosen:

$$w = 1.5, q_C = 0.5, q_G = 0.15, N - N_F = 100, N_F = 11.5, B = 60, F = 20$$

They give natural proportions when compared to the national income accounts. The number for N_F is not necessary, but it states that factor income per person is highest in the fishing sector, and it illustrates a distributional effect in the following computations. We fill in these values in *Table 1:*

	Private sector		Public sector		Foreign sector	
	Uses	Sources	Uses	Sources	Uses	Sources
C	130	65				65
G		85	100			15
F		20			20	
T	40			40		
B				60	60	
Balance	170	170	100	100	80	80

Here, *C* is larger than *G*, but it must be remembered that referring to national account data, *C* includes investment; see comments on *Table 3*. The implied average tax rate is $40/170 = 0.24$. Reducing the wage by 5%, we obtain the following completed table:

	Private sector		Public sector		Foreign sector	
	Uses	Sources	Uses	Sources	Uses	Sources
C	133.2	66.6				66.6
G		75.9	89.3			13.4
F		20.0			20.0	
T	29.3			29.3		
B				60.0	60.0	
Balance	162.5	162.5	89.3	89.3	80.0	80.0

As shown in the diagrams, *G* decreases by more than *C* increases. The average tax rate becomes $\frac{29.3}{162.5} = 0.18$.

Consumption increases by 3.2. If incomes in both fisheries and non-fisheries are initially taxed at 24%, and if the relative increase in disposable incomes is the same for the two groups, then the tax rate should decline most in non-fisheries. Computation shows that the tax rate in non-fisheries should decrease to 17.5% and in fisheries to 21.6% to produce the same relative growth in consumption for all income earners.

The elasticity of C/G with respect to w is as follows:

$$e_{\frac{C}{G},w} = -\frac{\left(\frac{133.2/89.3}{130/100} - 1\right)}{0.05} = -2.95$$