Economic Development In Greenland: A Time Series Analysis Of Dependency, Growth, And Instability

By

Joan Nymand Larsen

A Thesis
Submitted to the Faculty of Graduate Studies in Partial Fulfillment of the Requirements of the Degree of

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Department of Economics
University of Manitoba
Winnipeg, Manitoba

0-612-76737-X

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Abstract

The main objective of this thesis is an empirical investigation into obstacles to economic development in Greenland. A central theme is the degree of trade, financial, and technological dependency, and its consequences for economic growth and instability in Greenland's post-colonial history. Econometric models are specified to test hypotheses about the association between economic dependency and growth and instability.

The econometric results suggest first, that primary exports have been able to produce trickle-down effects that have been a contributing factor in the economic growth process in Greenland.

Second, the results of an empirical investigation into the relationship between economic growth in Greenland and indicators of trade, financial, and technological dependency do not find support for the theoretical proposition that a negative association exists between economic growth and dependency. Rather, the evidence points to a positive association between growth and some indicators of dependency.

Third, an analysis of structural change and instability suggest that structural change has occurred in Greenland. In general, the analysis points to the sensitivity of the Greenland economy to shocks to its natural resource supply, and it highlights the lack of a real change in policy regime with the implementation of Home Rule.

Fourth, an empirical investigation into the degree of export and income instability in Greenland, and its causes and consequences, suggests first, that export and income instability is associated with some indicators of economic dependency, and second, that export and income instability both act as deterrents to economic growth in Greenland.

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Chapter 1

Introduction

1.0 Scope and Objective of Thesis

In 1953 Greenland ceased to be a colony of Denmark and became fully integrated into the Kingdom of Denmark. Greenland acquired Home Rule in 1979, but remained within the Danish realm. With the introduction of Home Rule the Greenland Inuit became the first Inuit to achieve some level of self-government, and to many observers the case of Greenland represents an example of successful self-government.

While Greenland is becoming an increasingly modern economy, it is also a country, which continues to be highly dependent on Denmark both in terms of financial support, technology, and markets for its products. The situation today is one of continued reliance on the political and economic expertise of Danish advisors, and a high level of dependence on Danish transfers to fund Greenland's public sector. Although financial dependence has declined, both in terms of its size relative to Greenland's GDP and as a share of public sector revenues, it remains high. In 1998, dependence on Danish State expenditures as a percentage of GDP was equal to 41 percent (down from 65 percent in 1979), and similarly, it accounted for about 48 percent of total public sector revenue in 1998.

Since achieving Home Rule the key development goals have included the achievement of a higher degree of independence from annual Danish block grants, an increase in export earnings and employment, and a reduction in Greenland's dependence on imported Danish personnel (Danielsen et al., 1998). Taken together these four goals represent an overall goal of achieving a standard of living comparable to that of Denmark but independent of Danish financing.

The general theme of this thesis is an investigation into the level of dependency in Greenland in the period 1955-1998, and its impact on economic growth and instability. The analysis is carried out at the macro level using data available for the period 1955-1998. The focus of the study is specifically on the overall macro economy with no specific attention being given to regional differences or differences between modern and traditional living.

The scope is primarily confined to a study of selected indicators of trade, financial, and technological dependency, and the relation of such dependency to the economic growth process and variations in economic instability over time. Specifically, the study analyses empirically, first, the primary-export-led growth hypothesis applied to the case of Greenland; second, the relationship between indicators of trade, financial and technological dependency and the rate of economic growth; third, the presence of structural change; and fourth, the causes and consequences of economic instability in the Greenland economy.

The theoretical context adapted for this thesis is one that recognizes that a process of modern day economic development cannot take place in isolation of external markets. It is further acknowledged that even developed economies may exhibit some level of dependency when measured in terms of various indicators of dependency, and that dependent countries may exhibit periods of reduced dependency as measured by such indicators. The difference between advanced and developing economies lies in their ability to respond to instability in the presence of dependency. More advanced countries tend to have higher degrees of flexibility and economic diversification which permit them to minimize the adverse effects of external shocks and disturbances through the utilization of domestic or foreign substitutes. Open and overspecialized developing countries, in contrast, tend to lack resource mobility, the ability to develop substitutes and the ability to cope with external shocks to the economy.

The study is cast within a time series context. The Greenland economy is very small and based in large part on its supply of natural resources, and therefore even small shocks and disturbances are likely to have a large impact on the national economy. Hence, attempts to draw conclusions from analyses based on a narrow time frame run the risk of failing to capture the real dynamics of dependency and instability, since the degree of dependency and economic instability will depend on the year chosen.

By analysing the development process within a time series setting, this study allows for the possibility of a country experiencing periods of decreased dependency. In other words, dependency is not viewed as a permanent circumstance from which there is no escape. When high levels of dependency persist, as in the case of Greenland, this does not pose an absolute barrier to economic development but rather presents an impediment to the economic development process that may be overcome through the application of appropriate strategies of economic development.

Much has been written on Greenland and its economy. However, the main body of the literature has tended to be non-econometric and often non-theoretical. Also, much of the literature has been focused on the domestic side of the economy and the traditional aspects of the country, and the time horizons are often short or not defined.

Also, while much of the debate on Greenland has been focused on the dependency aspect of the economy, few, if any, attempts have been made to define, measure, and analyse empirically this dependency over time. The general approach has been to assume a level of dependency and then make assertions about its consequences, generally with limited empirical backing. Similarly, the literature frequently makes reference to the degree of economic instability and vulnerability resulting from Greenland's narrowly based economy, yet the degree of instability has not been measured and its impact not tested.

This study represents an attempt to employ econometric techniques to draw conclusions about some basic relationships surrounding the Greenland economy and its high level of dependency in the period since the end to colonial rule.

1.1 Field Research And Methodology

At the outset of this study it became apparent that availability of statistical data and literature on Greenland and its economy was limited. Although the literature is increasingly being translated, much of what has been written on Greenland's economy continues to be written in Danish and as a result is most often available in Danish journals and publications. Therefore, it was necessary to undertake research trips to both Greenland and Denmark in pursuit of data and literature for this study.

In the summer months of 1998 and 1999, two research trips were undertaken to Greenland and Denmark respectively. The objective of these trips was first, to gather statistical data of macroeconomic aggregates and social indicators covering the time period 1955-1998; second, to collect academic literature, government reports and policy papers and other relevant information, and third, to interview officials in various Home Rule departments and to gain information and insight through conversations with the local Greenlandic population. Conversations with the local population were particularly important, and proved very insightful, since the majority of the literature on Greenland on this topic has been written by Danish academics and government officials, who often live in Denmark, and therefore, the literature does not necessarily reflect the experiences as seen through the eyes of the native population.

During the summers of 1998 and 1999, the author gathered literature, statistics, and government reports in Denmark, while visiting the University of Copenhagen, the Danish Polar Center, and Statistics Denmark. The trips to Denmark were followed by trips to Greenland, where the author completed the collection of statistics, academic literature, government reports and policy papers. In the capital of Greenland, Nuuk, the author was provided with an office at Statistics Greenland, which greatly facilitated the gathering of data and other information. While in Nuuk the author also spent time in conversations with officials and directors from various Home Rule departments, and the fishing industry, as represented by Royal Greenland Inc., which allowed the author to gather useful and first-hand information regarding the goals, objectives, and strategies of economic development in Greenland. During the 1999 trip, the author spent time in Maniitsoq as well. Maniitsoq is a relatively large town located north of Nuuk, about half an hour by helicopter. A visit was also made to a very small and isolated settlement, Kapisillit, about four hours by boat from Nuuk. The trips to Maniitsoq and Kapisillit provided invaluable insight into life outside the main administrative centre of Nuuk.

The methodological approach adopted for this study includes literature reviews and descriptive statistics as well as econometric analyses. The data used in the analysis are published data, the main sources being publications by the bureaux of Statistics Greenland and Statistics Denmark. In general, the literature available on the subject of this study includes studies on the Greenland economy, governmental reports, published statistics and special statistical investigations, and a large volume of theoretical literature and empirical studies relating to obstacles to economic development in developing economies in general.

The main methodology entails empirical testing of various hypotheses regarding economic development and the level of dependency in Greenland. Econometric models are specified to test relationships between indicators of dependency and rate of economic growth, and the level of economic instability. Additionally, this study employs the Granger-causality testing procedure to test the direction of causality in specific relationships. Evidence on the direction of causality is important in an analysis of economic development and dependency. It provides additional insight into questions such as whether the Greenland economy is a case of primary export-led growth, whether dependency is growth stagnating or growth generating, and whether economic instability is a deterrent to economic growth.

1.2 Data Quality And Limitations

It became clear early on in this study that data quality and lack of recorded and published data on some macroeconomic aggregates was going to present some limitations in terms of the scope of the econometric analyses.

During the era of the Danish administration only limited data was published on Greenland, and it included primarily data of interest to the Danish administration. Published records included data on the allocation and distribution of Danish State expenditures on Greenland, export and import statistics, social indicators and demographic characteristics of the resident population, production of Greenlandic products, and statistics on the trade between the Inuit population and the Danish trade company, (The Royal Greenland Trade Department). The macroeconomic data was largely confined to international trade statistics, and the consumer price index.

While data availability and accessibility has improved greatly since Home Rule, obtaining consistent data series that extend back to 1955 has proven more problematic. For instance, a national income account system was first introduced after the implementation of Greenlandic Home Rule, and although this system does provide data on key macroeconomic aggregates it remains a very limited system that continues to undergo further developments and revisions.

Because the system of national income accounting did not get introduced until after the implementation of Home Rule, the GDP data for the period prior to Home Rule was obtained from Paldam et al. (1994) who have developed the series from 1955 and onward. Paldam et al. computed a consistent GDP series based on Hansen's (1976) compilation of national accounts, and on detailed public records of the Greenland economy.

A further limitation is related to the macroeconomic price deflator. Statistics Greenland does not compute a GDP deflator. The accepted and current convention in Greenland is to use the CPI series for Greenland as a deflator for macroeconomic time series. Statistics Greenland publishes annual CPI dating back to 1979, and all macro data are deflated using this series. An annual CPI series dating back to 1955 was compiled by the author by using a method of averaging quarterly consumer price indices for the years 1955-1978. Quarterly CPI figures are available dating back to 1955. Annual statistics published by Statistics Greenland, which are similarly based on quarterly CPI figures, were used for the remainder of the study period, 1979-1998.

Due to problems relating to data limitations and availability, this study was not able to define a large number of variables for the empirical sections of this study. Additionally, in a couple of cases it was necessary to make some broad assumptions when defining and measuring variables. However, in the case of trade dependency, availability of data made it possible to define and measure a broad set of variables.

1.3 Organization Of The Thesis

This thesis is divided into nine chapters. Following this introductory chapter, in chapter two the study presents an introduction to Greenland and its economy. This includes a brief overview of the main structural characteristics of the economy, an introduction to the government, the labour market, and the geographical realities confronting this small arctic economy. Chapter three discusses the main goals and objectives of economic development policy and strategies in Greenland since the end of colonial rule. It outlines and discusses the economic development approach of the former colonial administration in Denmark, and the broad trends in economic development strategies undertaken by the Home Rule government. Chapter four provides an empirical analysis of the primary-export-led growth hypothesis applied to the case of Greenland. It tests for unidirectional causality between the rate of growth of real GDP and the growth rate of real exports in Greenland using the Granger causality test. In light of the key focus placed on fisheries and their exports in the economic development process, the chapter attempts to answer the question of the extent to which primary exports have been a factor in fueling economic growth in Greenland. In chapter five, the study presents an analysis and discussion of economic dependency in Greenland. Specifically, it defines and measures the degree of trade, financial, and technological dependency in the period under study, and discusses briefly the trends over time. Chapter six provides an empirical investigation into the question of the extent to which external dependency in Greenland has been growth stagnating or growth generating. Specifically, it tests the significance of selected indicators of trade, financial, and technological dependency in explaining variations in economic growth in Greenland. In chapter seven the study presents an analysis of structural change in Greenland in the period, 1955-1998. It tests for the presence of permanent level breaks and one-time pulse changes in the real export and real GDP macroeconomic time series. Specifically, it tests for structural change in years surrounding key events, i.e. a positive supply shock in 1973, the implementation of Home Rule in 1979, and a negative supply shock in 1990. Chapter eight first reviews the theoretical developments and issues in the literature on the causes and consequences of economic instability. Next, it measures export and income instability, followed by an empirical analysis of the relationship between indicators of dependency and instability. This is followed by an empirical analysis of the consequences of export and income instability for the rate of economic growth. Hence, the chapter seeks to answer the question of whether instability has been a deterrent to economic growth in Greenland. Finally, chapter nine provides a summary, discussion, and some concluding comments.

Chapter 2

An Introduction To The Greenland Economy

2.0 Introduction

This chapter presents an introduction to Greenland and its economy. It provides a brief overview of the main structural characteristics of the economy; the geography, the financing of the Home Rule government, the economic growth record, the labour market, and the country's main renewable and non-renewable resources.

The chapter is not intended as a detailed introduction to Greenland and its economy. Rather, the intent is to provide some brief introductory highlights, which will be followed by more in-depth discussion and analysis in subsequent chapters.

2.1 Characteristics of Greenland and its Economy

The Greenland economy is small, open and highly dependent upon fisheries and net transfers from Denmark. The financial dependence on Denmark affords Greenland a standard of living that would otherwise not be attainable, at least not in the foreseeable future, and it places the country in the category of middle income economies.

At the same time, Greenland is confronted by many problems also seen in less developed countries, such as inadequate infrastructure, an acute housing problem, shortages of skilled labour, high dependence upon transitory foreign workers, and a poorly developed manufacturing sector (Poole et al., 1992).[1] Additionally, there are several geographical factors that are believed to further complicate advances on the economic and labour market front.

Geography

Greenland, the world's largest and oldest island, lies within the arctic climatic zone (Figure 2.1.1). The total area of Greenland is about 2,166,086 sq. km., but only about 15 percent of Greenland is free of permanent ice, (410,449 km^2), restricting significantly the size of the habitable area of Greenland. The ice cap rises to a height of 3,200 meters in its central part, with a maximum of 3,500 meters in its thickest parts. The climate in Greenland is cold and arctic. In the warmest month of the year the average temperature does not rise above 10 degrees celcius (Statistics Greenland, 2000).

The population, which counts just over 56,000 people, lives in 130 towns, scattered along a more or less accessible coastline in isolated settlements and stations unconnected by road. On Jan. 1, 2000, the population of Greenland stood at 56,124, which represents an increase of 37 persons compared to Jan. 1, 1999.

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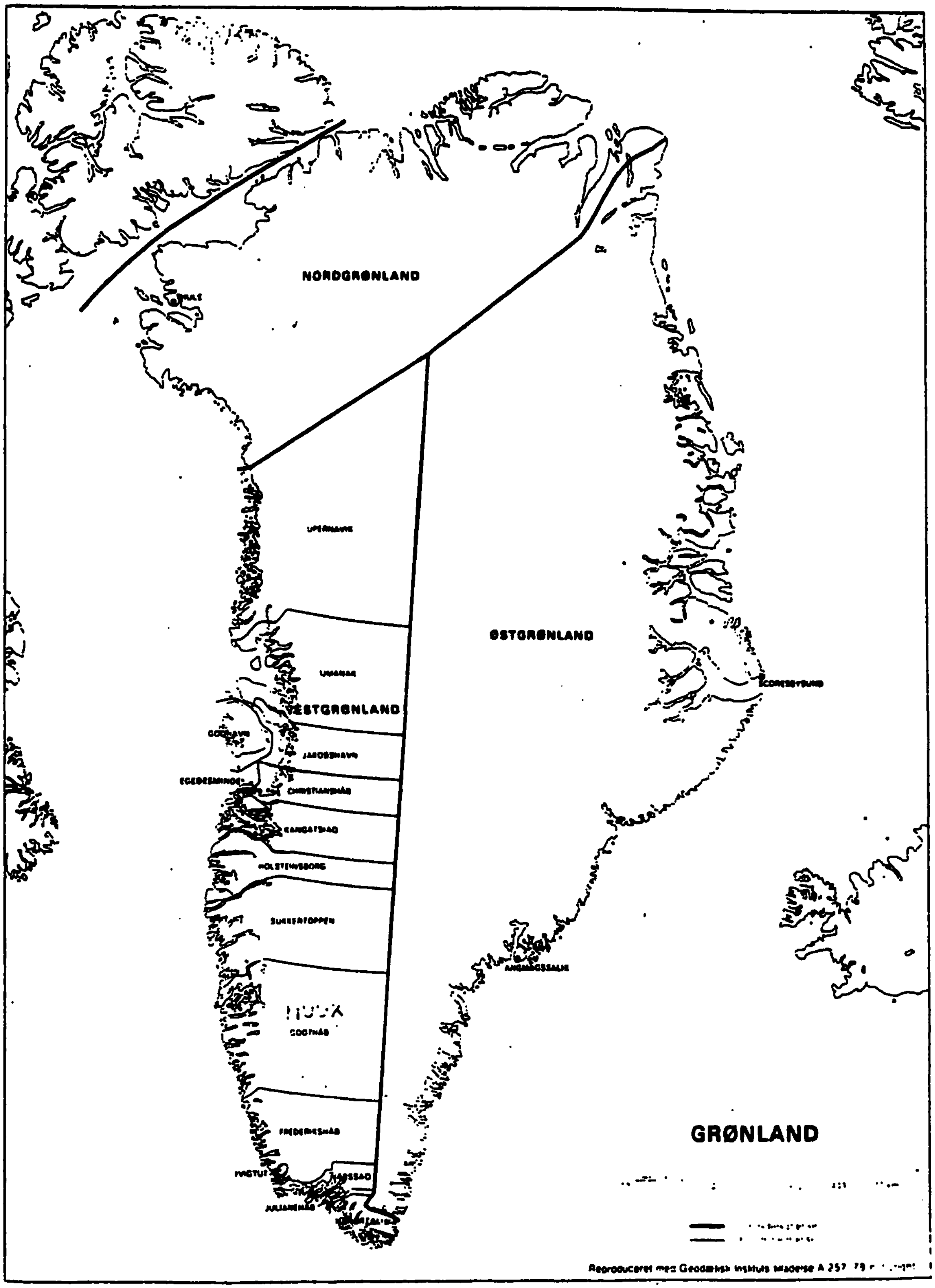
[1]The life expectancy at birth of a Greenlander is 64.1 years. Greenland has a high infant mortality rate and a high frequency of death caused by accidents, murder and suicide (Statistics Greenland Yearbook, 1997).

Figure 2.1.1

MAP OF GREENLAND



According to population projections for 2000-2010, the population of Greenland will increase to 57,149 by year 2010, with 89 percent of the population born in Greenland. As of 1998, approximately 88 percent of the total population were born in Greenland, i.e. mainly Inuit, while about 12 percent were born outside of Greenland, i.e. mainly of Danish origin.

There are 18 municipalities (15 in West Greenland, 2 in East Greenland and 1 in North Greenland). By far the greatest proportion of the population lives in West Greenland (92.3 percent), 6.2 percent resides in Eastern Greenland, and only 1.5 percent lives in Northern Greenland. About 24 percent of the population reside in the capital of Nuuk, 57 percent in the other 17 towns, 17 percent in 108 settlements and 2 percent in 8 stations and areas outside the municipalities. The average size of settlements is therefore quite small.

For the majority of the population, remoteness and accessibility is a major concern. Remoteness is even more severe when coupled with the small size of community populations and their scattered pattern. Many towns and settlements are not only isolated from external economies but also from each other. This complicates efforts on the economic development front. Remoteness affects the access of communities to a range of markets for goods and services, just as it affects markets for business ventures and for products produced locally, and for employment opportunities in general.

The scattered population pattern and the general remoteness of many communities and, in turn, the difference in access to markets and economic opportunities, means that inhabited localities are at different stages of economic development. As noted by Lyck

(1987), life in some places is little changed from the traditional past, whereas in others it is much like living in a Danish town.

Government and Public Finance

Greenland ceased to be a colony of Denmark in 1953 and became fully integrated into the Kingdom of Denmark. In 1979 it acquired Home Rule, but remained within the Danish Realm. Despite more than 20 years of Home Rule Greenland remains heavily dependent on economic support and annual block grants from the former colonial government in Denmark.

Home Rule in Greenland is of a qualified form. Sovereignty continues to rest with Danish authorities, and Denmark reserves absolute jurisdiction in the fields of the constitution, foreign affairs, national finances, and defence. The Home Rule government administers all its own internal affairs in cooperation with the municipalities. The phased transfer of administrative fields to the Home Rule government began in 1979 and finished in 1992. The annual block grants are calculated as the costs of administering the fields transferred to the Home Rule government. Thus, the financing of the Home Rule government is tied directly to the size of the annual block grant. The amount of the block grant in 1998 (DKK 2,575 million) represented about 39 percent of total public revenue. Since 1998 the block grant has been regulated by the same percentage used in the Danish State budget based on the development in prices and wages in Denmark.

Aside from the block grant the Greenland Treasury derives income from income taxes, imports, licences, and exports of fish and fish products (Statistics Greenland, 2000).

Public sector expenditures in Greenland are large. In 1998, these expenditures made up 82 percent of GDP. This figure is quite significant when seen relative to the corresponding figure for Denmark, which is at 56 percent.

The total government revenue in 1998 amounted to DKK 6,657 million. The block grant from Denmark constitutes the largest revenue item, and it stood at DKK 2,575 million, or what is equivalent to 39 percent of total revenue. Transfers from abroad, i.e. block grants, fishing licences from the EU, a share of profits of the Danish National Bank, and financing from the Danish state sector, totaled DKK 3,505 million (52.7% of total revenue). The revenue from income tax was DKK 1,886 million (28% of revenue), while indirect taxes made up DKK 628 million, or 9.4 percent of revenue. Greenland also levies a tax on shrimp that are not processed in onshore processing plants. This tax is currently at 3 percent. The total tax burden in Greenland stood at 33 percent of GDP in 1998, of which 26 percent were income and capital taxes, and 7 percent were production and import taxes. This can be compared to Denmark where the tax burden was approximately 50 percent. Thus, when compared to Denmark, the tax burden in Greenland is relatively small.

The economy

While economic growth in Greenland has fluctuated significantly over time, the data reveal a significant expansion of the national economy since 1955, the year that roughly coincides with the onset of major economic development initiatives in Greenland. As shown in Table 2.1.1, real GDP increased from DKK 377 million in 1955 to 3,723 million in 1998, an increase of 888 percent. While nominal GDP stood at DKK 7,706 million in 1998, the disposable gross national income was equal to DKK 10,695 million. The great difference between Greenland's GDP and the disposable gross national income is the result of large annual Danish State transfers (i.e. block grant and other transfers). In 1998, these were equal to 41 percent of GDP and, over the period 1955-1998 they rose from DKK 639.6 million to 1,541.6 million, or in real terms, an increase of 141 percent.

With respect to GDP per capita, nominal GDP per capita rose from DKK 2,140 to DKK 137,406 over the period under study. A comparison of Greenland's per capita GDP in 1998 to that of other countries shows that it was greater than that of countries such as Spain, Portugal, and Russia, but significantly less than that of Denmark's which stood at DKK 212,658 per capita. Hence, the per capita GDP in Greenland was 59.4 percent of that in Denmark. (Statistics Greenland, 2000).

As noted above, Greenland has experienced significant fluctuations in economic growth throughout the Home Rule era. Following a period of uneven growth from 1980-1984, the economy experienced five years of healthy growth from 1985-1989. This was followed by a significant downturn spanning from 1990 to 1993, with a rate of growth of minus 11.7 percent in 1990 and minus 5.0 percent in 1993. The economic downturn of the early 1990s was attributed primarily to the closing of a zinc and lead mine (the Maarmorilik mine) in 1990, a significant decline in construction and also, but not least, the disappearance of the cod from Greenlandic waters (Statistics Greenland Yearbook, 1997).

Table 2.1.1

The Greenland Economy, 1955-1998

YEAR	1955	1960	1970	1980	1998
Nominal GDP (Mill DKK)	58.0	109.0	561.0	2,683.0	7,706.0
GDP per Capita	2,140.0	3,289.0	12,056.0	53,438.0	137,406.0
Deflator (1981=100)	15.4	18.4	35.5	87.0	207.0
Real GDP (Mill DKK)	377.0	592.0	1,581.0	2,730.0	3,723.0
Real GDP per Capita	13,911.0	17,864.0	33,977.0	54,849.0	66,385.0
Total Danish Exp. on Greenland (Mill DKK)	98.5	167.3	656.3	1,950.0	3,189.0
of which Block Grant (Mill DKK)	n/a	n/a	n/a	456.0	2,574.0
Total Danish Exp. on Greenland (MILL DKK) (1981=100)	639.6	909.2	1,848.7	2,241.4	1,541.6
of which Block Grant (MILL DKK) (1981=100)	n/a	n/a	n/a	524.1	1,243.5

Sources: Statistics Greenland Annual Publications.
Notes: Greenland did not start a system of national income accounting until 1979. Figures on GDP for the period preceding the official national income accounting system were obtained from Paldam et al. (1994) who computed a consistent GDP series based on Hansen's (1976) compilation of national accounts and on detailed public records on the Greenland economy.

The time from 1994 to 1998 was a period of recovery. Growth rates stood at 5.9%, 3.7%, 1.5%, 1.4%, and 7.8% for the five years 1994-1998, respectively. The high growth rate seen in 1998 (7.8%) has been mainly attributed to significant increases in wages and salaries in the public sector (Statistics Greenland, 2000).

The 1990s, which were characterized by periods of negative and slow economic growth, have emphasized the extreme vulnerability of the Greenland economy. Economic vulnerability has been attributed in part to a lack of economic diversification and a heavy reliance on natural resources as a primary source of income.[2] In more recent years, a declining world price of shrimp has contributed to a significant decline in export revenues.

Due to the very small size of internal markets, Greenland relies heavily on international trade. International trade in Greenland has three main characteristics; the majority of trade is with Denmark; trade is heavily concentrated in a few primary products; and imports are predominantly used for consumption and intermediate inputs.

As highlighted in Table 2.1.2, Greenland has witnessed a significant increase in the volume of international trade over the past couple of decades when measured in nominal terms. Viewed in constant prices, however, the value of trade declined significantly between 1980 and 1998; real exports and imports in 1998 were about 40% less than in 1980.

Later chapters will present an in-depth analysis of the trends in international trade and the instability in export earnings over time. A preliminary insight into the degree of dependence on international trade can be gained from the export and import ratios. While

[2]See chapter eight for an analysis of economic instability; its causes and consequences.

these ratios have been falling over time, they remain high. As of 1998, the export and import ratios stood at 22.3 percent and 34.4 percent, respectively. The export sector and the public sector together make up the bulk of Greenland's GDP.

Table 2.1.2

Summary Statistics Of Greenland's International Trade

Year	1960	1980	1998
Nominal Imports (1,000 DKK)	107,548	1,847,877	2,648,825
Nominal Exports (1,000 DKK)	58,340	1,199,301	1,701,930
Real Imports (1981=100) (1,000 DKK)	584,500	2,123,997	1,279,626
Real Exports (1981=100) (1,000 DKK)	317,065	1,378,507	822,188
Export Ratio (%)	53.6%	50.5%	22.3%
Import Ratio (%)	98.8%	77.8%	34.4%
Share of Fish in Total Exports (%)	38.8%	64.1%	92.9%
Share of Raw Minerals in Total exports (%)	53.5%	31.1%	0.0%
Consumption Imports (%)	N/A	36.9%	28.1%
Intermediate Imports (%)	N/A	31.4%	31.8%
Denmark's Share in Greenland's Exports (%)	46.5%	49.4%	85.0%
Denmark's Share in Greenland's Imports (%)	89.7%	75.0%	70.5%

Sources: Statistics Greenland and Statistics Denmark Annual Publications.

Greenland's export trade is also highly concentrated, both commodity wise and geographically. The share of fish in total export has risen significantly over the past couple of decades, and stood at almost 93 percent in 1998. As the share of fish in total exports has grown in importance, raw minerals have disappeared from the export statistics. Raw minerals dominated Greenland's export sector (53.5% of exports in 1960) in the earlier period, but with the closure of the zinc and lead mine in 1990, the export of raw minerals has ceased.

The majority of trade is with Denmark. In 1998, Denmark's share in Greenland's exports and imports stood at 85 percent and 70.5 percent, respectively.

Of the total value of imports in 1998, 28.1 percent was consumption goods and services, while 31.8 percent was for intermediate input usage.

In seeking to address the problems associated with the narrowly based economy renewed efforts have been placed on finding and developing alternative sources of income, as well as designing economic and industrial policies to help further private initiative in land-based trades. The Home Rule Government has introduced reforms to de-regulate and privatize trade and industry with the objective of making the economy more market driven. These reforms represent a clear departure from Home Rule policies of many years, namely efforts to decentralize, to maintain employment levels and to ensure supply through subsidization schemes and industrial policies to protect public enterprises. The new departures are also believed to be in conflict with the political goals of furthering income equality and maintaining outlying settlements (e.g. see Danielsen et al., 1998).

Renewable resources in Greenland

The fishing industry is the most important sector in the Greenland economy. Fishing is conducted from small trawlers and large sea-going factory vessels capable of packing and processing on board. The most important catch is shrimp followed by halibut and cod.

As shown in Table 2.1.3, in 1998 the total tonnage of fish catches by Greenlandic vessels stood at 1,026,000 , of which shrimp accounted for 68 percent, halibut made up 22 percent, and cod's share in total tonnage was 5.3 percent.

Table 2.1.3

Catches Of Fish By Greenlandic Vessels.
1987 To 1998 (1,000 Tonnes).

Year	1987	1989	1991	1993	1995	1998
Total	95.3	173.7	114.8	115.3	127.9	102.6
Shrimp	64.4	67.3	73.1	76.5	82.7	69.5
Cod	17.6	96.4	26.6	7.6	9.2	5.4
Halibut	6.7	7.5	10.2	13.5	18.6	22.7

Source: Statistics Greenland, Yearbooks.

Table 2.1.3 highlights cod's declining share in total tonnage, the increasing share of halibut, and the declining share of shrimp in the 1990s.

The majority of Greenland's land-based facilities are owned by Royal Greenland Inc., a Home Rule owned enterprise. It is the largest employer in Greenland, and it is increasingly becoming a firm operating globally, having established processing plants and sales offices in Japan, Denmark, Sweden, Germany, the UK, France, Italy, the USA, Iceland and the Faeroe Islands (Greenland Statistics Yearbook, 1997).

To keep fish stocks at sustainable levels the Home Rule government sets a quota on fish which complements those set by international fisheries agreements. Greenland has bilateral fishing agreements with Norway, Iceland, the Faeroe Islands and the Russian Federation.

Besides fishing, subsistence hunting and animal husbandry are important to the economies of the small villages and settlements in Greenland. Sheep farming, reindeer raising, caribou and muskoxen hunting are amongst other renewable resources, which have been explored as forms of subsistence and to some extent, as industries. The most numerous renewable resource is the seal staple which continues to be part of the traditional Greenland subsistence economy. Sometimes seal skins provide the only cash income for families living by subsistence.

Greenland's hunting industry is dominated by a Home Rule owned net-managed enterprise, Great Greenland, which handles the purchase from the hunters, the tanning and sale of skins, as well as the production and sale of fur articles. The enterprise has purchased about 70,000 sealskins annually in recent years. Great Greenland is a subsidized enterprise. It receives subsidies for operating the tannery and for performing the societal obligation of purchasing skins, and maintaining purchasing prices at higher levels than would otherwise be possible (Statistics Greenland, 2000).

In 1998 Nuka Inc. was formed. Nuka Inc. is a Home Rule owned company, which used to be part of Royal Greenland. This company purchases primary products from local hunters and fishers, and manages the production and sales of seal, whale, fish and birds to the domestic markets.

Non-renewable resources

As Greenland seeks alternative sources of income and a greater degree of economic diversification the focus is increasingly being placed on the non-renewable resource sector. Sub-surface resources in Greenland are owned jointly by Greenland and Denmark which means that any future revenue derived from Greenland's sub-surface will benefit all members of the Danish Realm. Currently there are no active mines in Greenland. Greenland does have valuable minerals such as uranium, gold, silver, platinum, molybdenum, chromium, lead, zinc and niobium. However, because of the high costs associated with extraction in Greenland, commercially viable mining would require deposits of rare or precious minerals, and they would have to be not only large but also of a high quality (Taagholt, 1994, p. 229). There are also potential sources of oil and natural gas off the Continental Shelf in West and East Greenland. Seismic surveys were carried out in the 1990s (Ibid., p. 224). In addition, pilot studies have indicated the potential for building a number of hydropower plants.

The labour market

The Greenland economy is characterized by a general lack of employment and economic opportunities. This is linked in part to the very restricted market, a lack of infrastructure, a limited resource base, and the general remote and scattered pattern of towns and settlements.

The labour market in Greenland is faced with a structural problem that is characterized by an employment paradox in which a large number of jobs are filled by imported Danish personnel while, at the same time, Greenland is faced with unemployment consisting almost exclusively of local labour. This employment paradox is closely linked to the lack of educational attainment in Greenland. The labour market problem could worsen as the country is confronted with the demographic reality of a relatively young population moving into its working age years while, at the same time, educational attainment and skill levels keep falling behind requirements. Additionally, economic and employment opportunities have failed to develop at a rate to match the growth of the labour force.

Table 2.1.4 highlights the distribution of the population between those born in Greenland and those born outside Greenland (primarily Danes). While the proportion of the Danish population and the proportion of the Danish working aged population, defined here as the population aged 15-64, have been falling since the introduction of Home Rule, they remain high. The proportion of the working aged population born outside of Denmark can be used as a proxy for the size of imported Danish personnel and, as such, indicates a continued high dependence on "foreign" labour.

It has been argued by some that the transitory nature of much non-local labour and the associated problems caused by the language barrier and lack of local knowledge affects productivity adversely in Greenland (Westerlund (1988); Paldam (1994)).

Table 2.1.4

Greenland's Working Age Population

YEAR	1960	1980	1998
Total Population	33,140	49,773	56,076
Born in Greenland (%)	91.6%	82.3%	87.6%
Born outside of Greenland (%)	8.4%	17.7%	12.4%
Total Working Age Population[1]	17,781	33,162	38,058
Born in Greenland (%)	87.4%	78.6%	84.1%
Born outside of Greenland (%)	12.6%	21.4%	15.9%

Source: Statistics Greenland, Yearbooks.
Notes: (1) Working age population is defined in this study as the years 15-64.

The population of Greenland rose from 33,140 in 1960 to 56,076 in 1998, an increase of almost 70 percent. As of 1998, the share of the population born outside of Greenland was 12.4 percent; an increase from 8.4 percent in 1960. Similarly, the total working aged population grew from 17,781 to 38,058 over that same period, an increase of 114 percent. The share of the working aged population born outside of Greenland is significant, and stood at almost 16 percent in 1998. While this represents a decrease from 21.4 percent in 1980, it remains large.

In 1997, 52.2 percent of those born in Greenland, in the age category 20-59 years, did not have any form of secondary or post secondary education (Statistics Greenland, 1997). Some have argued that shortages of educated Greenlanders is one of the most serious problems facing Greenland (E.g. Boserup (1963); Lyck (1989)).

The labour force was estimated at 34,160 in 1996, of which 28,140 (83 percent) persons were born in Greenland and 6,029 (17 percent) persons were born in Denmark. In 1996 the overall unemployment rate in the high season was approximately 9 percent (10 percent for those born in Greenland, and 4 percent for those born outside Greenland) while in the low season it stood a 18 percent (21 percent for those born in Greenland, and 6 percent for those born outside Greenland), (Statistics Greenland Yearbook, 1997). Hence, there exists significant disparities in unemployment rates depending on place of birth.

The labour force participation rate is approximately 84 percent for those born in Greenland, and 90 percent for those born outside of Greenland. Of the estimated labour force, 42 percent of those born in Greenland had an educational background in 1996, while 91 percent of those born outside of Greenland had some form of educational attainment (Ibid.). The large difference in educational attainment between the two groups reflects the fact that the larger share of those born outside of Greenland are imported personnel who have been brought to Greenland to fill a specific job vacancy that requires an educational background.

Just as there is a clear link between rate of unemployment, level of education, and place of birth, there is a clear association between occupational category and place of birth. Persons born in Greenland make up 63.4 percent of the fishers, hunters and unskilled labour categories compared to only 9.4 percent of the labour force born outside of Greenland. As highlighted in Table 2.1.5, persons born outside of Greenland are over-represented in the public sector and in the entrepreneurial category, while they have limited representation in traditional Greenlandic occupations. This pattern presumably reflects the fact that imported personnel are brought to Greenland to fill occupations for which there is a shortage of qualified local labour. In 1996, approximately 96 percent of those born in Greenland were employed in the fishing industry and the fisheries. Of those employed in public administration and services 29.1 percent were born outside of Greenland, and likewise, 25.4 percent of those employed in public infrastructure were born outside of Greenland. In the raw minerals sector, 75 percent were born outside of Greenland.

Second, the size of public administration and services has grown in terms of employment since 1974, both relatively and absolutely, while the size of the primary industry has fallen, in both relative and absolute terms. Total employment in public administration and services increased by almost 50 percent over the period 1974-1996, from 5,320 to 7,950. Similarly, employment in land-based trades rose by 30.5 percent over this period. In contrast, employment in fisheries declined by 8.5 percent. These trends reflect the progress that has taken place on the economic development front.

Table 2.1.5

Distribution Of Employment Between The Population Born In Greenland And The Population Born Outside Greenland. 1974 And 1996 Census.

	BORN IN GREENLAND		BORN OUTSIDE GREENLAND		TOTAL EMPLOYMENT	
YEAR	1974	1996	1974	1996	1974	1996
Fishery and the Fishing Industry	6,430 (93.3%)	6,120 (95.9%)	540 (7.7%)	260 (4.1%)	6,970 (100%)	6,380 (100%)
Raw Minerals	50 (18.5%)	10 (25.0%)	220 (81.5%)	30 (75.0%)	270 (100%)	40 (100%)
Tourism	30 (75.0%)	140 (66.6%)	10 (25.0%)	70 (33.3%)	40 (100%)	210 (100%)
Other Land-based Trades	4,580 (72.7%)	6,670 (81.1%)	1,720 (27.3%)	1,550 (18.9%)	6,300 (100%)	8,220 (100%)
Public Infrastructure	1,190 (57.5%)	1,590 (74.6%)	880 (42.5%)	540 (25.4%)	2,070 (100%)	2,130 (100%)
Public Admin. & Services	3,800 (71.4%)	5,640 (70.9%)	1,520 (28.6%)	2,310 (29.1%)	5,320 (100%)	7,950 (100%)
Military Bases	40 (2.7%)	50 (20.8%)	1,420 (97.3%)	190 (79.2%)	1,460 (100%)	240 (100%)
Total	16,120 (71.9%)	20,220 (80.3%)	6,310 (28.1%)	4,950 (19.7%)	22,430 (100%)	25,170 (100%)

Source: Danielsen et al., 1998.

The size of Greenland

Earlier in this chapter various characteristics of Greenland and its economy were highlighted, including the size of its habitable area, the size of its GDP, the foreign sector, and its population and labour force. All of those statistics have one thing in common; they all describe a country constrained by its small size.

In the literature, smallness has been defined both in terms of population size and land area. Kuznets (1960) defined a small country as one with less than 10 million inhabitants. Demas (1965), on the other hand, defined a small country as one with less than 5 million inhabitants and 10,000 to 20,000 square miles of usable land (p. 22). Others have defined size in terms of GDP. Yet others have defined size as a variable that extends beyond a simple measure of population or GDP; e.g. Thomas (1974), interpreted smallness as one aspect of the context of relations between classes and groups in society, and their own relationships to the material environment of their political unit. He argued that smallness is the spatial, demographic, and resource context in which social relations are formed and developed and the mode of production is organized. Thomas proposed that smallness be measured as a composite and weighted index of population, national output, including its distribution between persons and its spatial concentration, and geographic area. Measured this way size is not simply a constraint imposed by nature on development, nor is it a constant factor (p. 30).

More recently, Blundell, et al. (1981) suggested that, as an alternative, size could be judged in terms of the absolute value of a country's export earnings and that this dimension of size could be expected to be negatively related to instability of such earnings.[3]

Any of these measures of size will show that Greenland is a very small country with a very small economy. When measured simply in terms of population size, Greenland must be considered a very small country. The population of Greenland does not begin to approach the cut-off numbers proposed by Kuznets (1960) and Demas (1965). Additionally, when population size is coupled with the geographic realities facing a small arctic country, and the scattered population pattern, the size of the Greenland economy must be considered even more constrained. As emphasized earlier, while Greenland is the world's largest island, most of the country is covered by a permanent icecap. Hence, the habitable area of Greenland is quite restricted. This fact, combined with a general problem of remoteness, lack of accessibility, and a scattered population pattern explains the problem of size in the broader context of the arctic reality.

Additionally, when measured in terms of GDP, the size of Greenland can only be described as small. Greenland does have a relatively high standard of living as reflected in its net domestic income, which includes a large annual transfer from Denmark. When measured in terms of the value of the country's own-production, however, Greenland must be considered a very small country.

A composite and weighted index of size, such as proposed by Thomas (1974), would contribute to the understanding of the complexity of smallness in Greenland, just as it would help capture the changes in economic size over time resulting from public

[3] Blundell, et al. offered the explanation that countries with large exports, given their degree of commodity concentration, tend to experience less stochastic supply instability in the aggregate, as the number of independent producers and exporters within each sector increases with larger exports (p. 303).

policy, development programs, and the implementation of Home Rule. While it is beyond the scope of this study to present such an index for Greenland, it is an index that could potentially prove useful in an analysis of the relationship between size, economic growth and instability of earnings over time.

Demas (1965) argued that the smallness of a domestic market means that a country must specialize in the production of a small number of commodities for export to world markets to ensure economies of scale. Moreover, a high proportion of capital and intermediate goods must be imported as a result of a small country's skewed resource base in order to fill the gaps in production structure. Thus, it is often the case that as a result of smallness, small economies tend to be more reliant on international trade in furthering their economic development as compared to the case of larger economies. This means that smaller economies are significantly dependent on external decisions and taste preferences as well as external technology and technical change, and consequently their economic development may be limited by their size. It has been argued that dependence on trade is directly related to economic instability, which in turn will tend to adversely impact on economic development.

In subsequent chapters this thesis measures and analyses trade dependency and concentration in trade, and tests the impact of trade dependency on economic instability and growth.

2.2 Conclusion

As the foregoing overview has indicated, the Greenland economy is characterized by a significant level of economic dependency; a high degree of concentration in trade; and a heavy reliance on imported personnel. Also, the harsh arctic climate combined with geographical realities and constraints imposed by smallness, means that progress on the economic development front is slow, in particular in communities outside the capital region.

In the following chapters this study presents an empirical analysis of the degree of economic dependency in Greenland and its impact on economic growth. This is followed in later chapters by an analysis of economic instability and its causes and consequences. To begin with, this study presents an overview and discussion of the goals and objectives of economic development policy in Greenland. This will form the contextual background for subsequent chapters.

Chapter 3

Goals and Objectives of Economic Development Policy in Greenland

3.0 Introduction

While strategies of economic development in Greenland have undergone changes since the first major development initiatives of the 1950s, current approaches are in many ways similar to those that have characterized the entire period. The main focus is on economic diversification and development of production and services within the private sector; a break with the centrally controlled economy including a restructuring that involves a move away from public monopolies toward more private initiative; and development of the necessary requirements for an economically viable private sector (Danielsen et al., 1998). The key development goals flowing from these policy objectives have, since Home Rule, centred around the achievement of a higher degree of independence from annual Danish block-grants, an increase in export earnings and employment, and a reduction in Greenland's dependence on imported Danish personnel (Ibid., p. 31). The purpose of these goals is to achieve a standard of living comparable to that of Denmark but independent of Danish financing. Hence, the long term goal is to close the gap between the level of absorption in Greenland and the level of domestic production, and to close this gap at a level comparable to that of Denmark (Paldam, 1994). The key development problem facing the Home Rule government, therefore, is to identify obstacles to economic development in Greenland and to design and implement a strategy of economic development that can raise domestic production and close the gap. The task of closing the gap continues to be met with significant challenges on several fronts including major resource constraints and obstacles related to geographical and climatic realities.

The following two sections outline and discuss the economic development approach of the former colonial administration in Denmark and the broad trends in economic development strategies undertaken by the Home Rule government.

3.1 Overview of the Danish government approach to economic development in Greenland

This section outlines the main trends in the approach to economic development taken by the government of Denmark in respect of Greenland since the time of colonization.

Colonial period

Danish colonial rule in Greenland began more than 230 years ago, and throughout the eighteenth century colonies were established along the coast of Greenland. With the modern colonization of Greenland the term "colony" was used as synonymous with mission or trade station, and this term continued in use until 1953 when Greenland was formally made an integral part of Denmark.

While there was a colonial relationship between Greenland and Denmark from 1721-1945, many historians refer to it as having been an unusually soft one in comparison with other European colonial powers.[1]

A key feature of the colonial period was the establishment in 1776 of the Danish government trade company, the Royal Greenland Trade Department (Kongelige Gronlandske Handel, KGH) which marked the beginning of a Danish trade monopoly in Greenland that lasted until the end of the second world war. Other nations were barred from direct communication with Greenland. Denmark did not see its presence in Greenland as exploitative: rather the general perception was that trade had to benefit the indigenous population, and the Danish motives in the involvement with Greenland were considered primarily social, not economic. With the presence of the KGH in Greenland the Inuit population soon became dependent on the trading economy. They sold their furs and other products to the KGH which, in turn, provided them with trade goods to supplement diet and technology, and some even sought wage employment with the KGH.

By the middle of the nineteenth century the Danish administration began raising questions about choices and policies for the development of Greenland. At that time

[1]In studying colonialism with reference to the Caribbean, Thomas (1974) has argued that

> "Colonialism ...did not rely exclusively on ...violence to maintain its rule. The development of social forces and the whole institutional superstructure which grew around the productive base of colonialism survived because they functioned so as to ensure that the momentum of colonial rule was *internalized* within these social systems. In this situation, the formal abandonment of colonialism does not stop- although it does impede- the internal dynamics of dependency." (p. 52).

the Danish government decided to institute what has been called a northern model of development without modernization, which meant that the population should maintain a separate identity as far as possible to preserve the culture of Greenland (Ørvik, 1977). Hence, prior to the end of colonial rule, Danish economic development initiatives by and large came in the form of a government services type strategy (See Loxley, 1986). Such a strategy, while meeting certain basic needs in Greenland, did little in terms of creating a viable economic base upon which Greenland could seek its financial independence. While Denmark in the 1960s, as will be discussed below, implemented more substantial development initiatives, the government services approach continued throughout the era of the Danish administration.

Much of Danish mainstream literature has interpreted the Danish colonial attitude as having been isolationist and paternal with an objective to protect the Inuit hunting culture. As far as the Danish government was concerned, Greenland was regarded as an inherited dependency and not, at least at the official level, as a centre for Danish capitalist expansion. Others, however, have argued that while the Danish colonization of Greenland was peaceful, this was due in part to the fact that Greenland had no organization above the household level, and thus lacked anyone who might be interested in defending his power (Petersen, 1995, p. 3). It has also been argued by some critics of Denmark-Greenland relations that the relationship between Denmark and Greenland was that of an imperial one (e.g. Viemose, 1977;1975; Hansen et al., 1982). For instance, Viemose (1975) argued that the objective behind Danish activities in Greenland has

Similarly, many critics of Danish colonial history in Greenland would argue that a colonial rule has been internalized in Greenland and that, even today, this represent a key cause of continuing external dependence.

always been economic gain, not for the benefit of all of Danish society, but for the benefit of the Danish bourgeoisie (p. 7). Viemose (1980) has further argued that the Danish colonial power organized, systemized and made effective the trade-based exploitation of the Greenlanders in what became a very complex State apparatus.[2] Such interpretations of history, however, have often been disputed by the more mainstream literature. For instance, Bornemann (1980), and Lidegaard (1973) have maintained that an imperial relationship could not have existed since Danish State budgets on Greenland did, in general, not show surpluses. The radical literature has responded to this assertion by arguing that deficits in State budgets cannot be used in arguments against an imperialistic interpretation of the relationship between Denmark and Greenland. This is because, they argue, the State did not exploit Greenland for its own advantage, but rather its function was to create an environment that would help attract Danish private capital and enable its expansion. Several authors have suggested that the growth of private Danish business in Greenland was made a clear economic-political goal in itself (e.g. Buch-Hansen et al. (1972); Nielsen (1980); Hansen et al. (1982)).[3]

While the relationship between Greenland and Denmark has been referred to as paternal at one extreme and as imperial and exploitative at the other, these opposing

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[2] According to Viemose (1975), the Danish colonial policy was an overwhelming success: to be able to exploit a country's natural resources and its population for 250 years without the population making an attempt at rebellion or uproar was something not many colonial powers achieved.

[3] The key instruments for achieving the main objective as expressed by the Commission were first to introduce the Danish constitution in Greenland to establish a legal framework; secondly, to make extensive investments in infrastructure, with a particular focus on developing the transport and communications network, as well as housing and institutions; thirdly, to provide business support in the form of cheap loans; and finally, to concentrate the population in major open-water coastal centres. This was done by concentrating investments in these areas (Hansen et al., p. 12, 1982).

views simply reflect different ways of interpreting the same historical events. Whether intentional or not, Danish policy initiatives were often flawed. In combination with other internal and external factors Danish policy initiatives led ultimately to the level of dependency seen in post-colonial history and present day Greenland.

Although history has been interpreted in a number of ways, it would appear that, at least up until the end of colonial status, the official Danish government approach to Greenland was to protect the population from so-called undesirable influences from other parts of the world. The objective was to preserve the culture of Greenland and secure a harmonious development. This isolationist strategy, however, ran into problems during the Second World War when Greenland became separated from Denmark and, for the duration of the war, the United States became its centre of influence. After the war had ended, a commission on Greenland was struck to make recommendations regarding Greenland's development. A key feature of the recommendations was the abolition of the KGH trade monopoly to the extent of Greenland being opened to Danish private enterprise. All major aspects of development, however, continued to be centrally controlled from Denmark. When Denmark ended its isolationist policy and Greenland ceased to be a Danish colony an emphasis was placed on social welfare and infra-structural change as part of a process of 'modernization'.

The end to official colonial status in Greenland

With the abolition of colonial status in 1953, Greenland became an integral part of the Kingdom of Denmark, which meant that for the first time in history the Greenland

Inuit were to be given equal status to Danes. No real changes in terms of administrative ties between Greenland and Denmark took place with the end of the colonial period, as Denmark continued to administer the common civil rights in Greenland and govern Greenland with the same civil servants and the same administrative body as before. The modernization of Greenland was planned in Denmark, it was paid for by the Danish State and was realized by imported Danish personnel. This overwhelming control of the development process by the Danish State has, throughout the post-colonial period, acted as a key impediment to political and economic autonomy in Greenland. 1953, did however, mark the beginning of another era characterized by extensive changes in economic development. These changes were felt on two major fronts: first, Denmark began an extensive construction program with an objective to meet the needs of a growing population in the areas of health, education and housing; and second, efforts were made to modernize the fishing industry.

The first phase of economic development policy in Greenland, G-50

The new wave of economic development efforts which characterized the post-colonial period were the result of recommendations made by the Commission on Greenland in the final years of colonial rule. This commission had been appointed in 1948 to make recommendations regarding the development of Greenland. The recommendations resulted in a series of laws in 1950, referred to as G-50, which became the key turning point in policy concerning relations between Denmark and Greenland.

Prior to Greenland becoming an integral part of the Kingdom of Denmark, the colonization had been guided by the principle that Greenland should neither be a financial liability, nor a source of profit for the Danish State (Boserup (1963); Barfod (1958)). This meant that the standard of living in Greenland was dependent upon revenue obtained from the sale of Greenlandic products. Prices paid to primary producers and prices paid for consumer goods in the State owned KGH shops were fixed at levels such that the Danish government's economic activities, together with the government's profit from the mining of cryolite, would generate a surplus that would be sufficiently large to cover expenditures on education, health, church and general administration (Boserup, 1963, p. 478). In 1950, following recommendations by the Greenland Commission, this all changed such that public expenditures were to be financed by the Danish State independent of export revenues. While the principle "no profit, no loss" was to be applied to the Danish government's trade activities in Greenland, this principle was no longer applied to the administration of Greenland as a whole. A key objective with this change in policy was the implementation of a process of equality with modernization, which meant that Greenlanders were to be given equal status to Danes. A main feature of the new policy was the abolition of the State run trade monopoly, KGH.[4] Prior to the end of colonization, KGH had a monopoly not only on the import and sale of goods and services in Greenland but also on the purchase, handling, processing, and export of Greenlandic

[4]In 1987 KGH was transferred to the Home Rule government as part of the phased transfer of Greenland's domestic affairs. It has subsequently been restructured and is now divided into Royal Greenland Inc., KNI Inc., and Royal Arctic Line Inc.

products. For years there had been talks of removing this State monopoly which was viewed by both Denmark and Greenland as an obstacle to economic development.

The privatization that followed the abolition of the Danish State trade monopoly had four main characteristics, namely: it was very small in relation to the State's enterprise; it took place exclusively in the area of small retail trade; it was overwhelmingly dominated by Danes who had moved to Greenland, and almost none of the activities of KGH were transferred to private hands. For instance, the KGH monopoly on supply was maintained in order to ensure a continued supply of goods and services to outlying settlements, and to ensure business opportunities where private initiative was lacking (Barfod, 1958). Furthermore, to ensure minimal fluctuations in both prices and quality the KGH retained some control over the export of Greenlandic products.

The general perception of the 1950s was that the KGH supply service had both a humanitarian and welfare function. This, according to the KGH, was reflected in the spread of its operations to unprofitable and high-cost outlying settlements, its selection of communities, and its pricing policy. The pricing policy was one of uniform prices in the KGH State shops across Greenland regardless of differences in costs between regions and between communities of different size (Boserup, 1963). While the G-50 policy had sought to create favourable conditions for private investors, Danish private initiative remained disappointing throughout the 1950s. This was blamed in part on Greenland's unusually harsh climatic and geographical conditions. As a result, the KGH was able to maintain a considerable status in Greenland.

Following the recommendations by the Greenland Commission, the goal of the new Greenland policy were expressed in G-50 as follows:

> "The time has come when we should be working toward the goal of ensuring equal status for Greenlanders as members of Danish society and when we should be working toward creating opportunities for open and free engagement between Greenlanders and other people, and thereby contribute to a strengthening of the Greenlandic initiative. Ultimately, they (the Greenlanders) will be responsible for developing Greenland socially, economically and culturally." (Vol. 1, p. 18. Translation by J. Larsen).

The Commission acknowledged that Greenland would need a growing and continued assistance from Denmark in order to realize improvements on the economic development front. A key feature of the strategies that followed was the development of an economically viable fishing industry, which was to be realized through an extensive investment program and the establishment of new and modernized processing plants. The Commission also argued for a shift toward the development of a business sector, owned and operated by Greenlanders. While the abolition of the trade monopoly was a key feature of this policy recommendation, an emphasis was placed on continued and intensified technical and economic assistance from Denmark (Barfod, 1958, pp. 281-84).

The goals of G-50 were further expressed as follows:

> "The main goal we are striving toward in opening up Greenland to Danish private capital is not to create new business opportunities for Danish capital, but to develop a business sector operated by Greenlanders and for the benefit of Greenlandic society. Hence, the goal is not to provide Danish capital for the Greenland economy, since this task could be carried out by the State, but rather the goal is to establish private and independent Danish and Faeroe businesses in Greenland, such that they will be able to teach Greenlanders modern ways of conducting business, and thereby contribute to the advancement of business development in Greenland." (Greenland Commission, 1950, p. 30. Translation by J. Larsen).

This was also formalized by the Commission in the following statement:

> "The economic policy must allow for Danish private capital and private initiative to do business ...in Greenland...Opening up Greenland to Danish private capital and private initiative can in the long run contribute to developing the conditions necessary for the realization of an increase in production by the Greenlandic population. This, in turn, could create the conditions necessary for a higher standard of living, which is the main goal." (The Greenland Commission, Vol. 5, p. 28. Translation by J. Larsen).

The overall objective of G-50, as expressed by the Commission, was to create greater equality between Greenland and Denmark; to improve the standard of living and to work toward a higher degree of economic independence. The Danish administration sought to achieve this through population concentration and centralization, imported Danish capital and expertise, privatization, and investments in infrastructure and a modernized fishing industry.

Centralization and population concentration

While the new Greenland policy focused on investments in infrastructure and fisheries, centralization of the population became a key objective in itself. The main policy objectives were to reduce the cost of supplying goods and services, to reduce the cost of administration and development, to create a population base sufficiently large to support private business development and to create a source of labour for the growing fishing industry (e.g. Nielsen, 1980, p. 11). Maintaining a decentralized society in Greenland, which would meet the demands for modernization within an acceptable time frame, and at acceptable costs, was not considered to be possible. Therefore, centralization was resorted to as a short-cut to modernization-with-equality (Ørvik, 1977).

It has been argued that a decision to work simultaneously towards modernization and full equality between two ethnic groups, such as in the case of Greenland and Denmark, really leaves no choice: the society which is more developed and modernized in material terms will set the standards towards which the less developed will strive. The result in practical terms is likely to be full adoption of the southern model (Ørvik, 1977). When Denmark first adopted the economic development strategy of equality-with-modernization, it became clear that modernization could not be achieved in the outposts within the limits of available resources, and as a result Denmark 'encouraged' the migration of the population away from the scattered villages and settlements along the coast of Greenland into larger centres. To speed up out-migration from the settlements, targeted localities were often denied housing and business support, and KGH discontinued its investment program, just as it discontinued the upkeep and upgrading of production and processing plants in those settlements (Jensen, 1957). Public investments were being concentrated in the most suitable towns, which meant towns where boats would have access all year round, and where fish could easily be exported. The result of the centralization policy was felt in the time that followed: Danish public investment expenditures in the settlements fell from 14 percent of investments in towns in the mid 1950s to a low of 2.5 percent in the late 1960s.

After rising from 11,982 in 1955 to 12,658 in 1965 the number of people living in settlements declined to 10,112 at the time of Home Rule, and stood at 9,752 in 1998. Hence, over the period of time under study, the population living in settlements declined by about 2,230 people or about 23 percent. In terms of its share of the overall population, the settlement population fell from 44.2 percent of the total population of Greenland in 1955 to 41 percent by 1960, to 32 percent by 1965, to a low of 21 percent by the end of the Danish administration. Over the same period of time the number of settlements fell from a total of 171 in the early 1950s to 160 by 1960, to 149 by 1965 to a low of approximately 138 by the end of the Danish administration in Greenland (Statistics Greenland, Yearbooks, various years).

Imported Danish personnel

Another key feature of the new development policy was the very extensive reliance on imported Danish personnel. In its recommendations the Greenland Commission argued:

> "In order to complete a construction and infrastructure development of the size outlined in the recommendations, it will be necessary to import manpower from Denmark... as there is not enough educated manpower available in Greenland. Furthermore, it would seem irresponsible to employ Greenlandic manpower in construction that is of a temporary nature. This would only limit the opportunities for Greenlanders to engage in, and improve upon the traditional Greenlandic occupations, which are going to provide the economic foundation of the society." (Commission on Greenland, Vol. 1, p. 52. (Translation by J. Larsen)).

The Danish share of the population of Greenland rose from 4.5 percent in 1950 to 11.3 percent by 1965. By the end of the Danish administration this share had risen to a high of **19.2 percent**. Similarly, the Danish share of the total working-age population in Greenland rose from 5.8 percent in 1950 to 17.4 percent by 1965, to a high of more than **26 percent** by the end of the Danish administration.[5]

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[5] This study defines the working age population as the age range 15-64 years.

While the era of the Danish administration saw several different and often changing strategies to economic development in Greenland, including export-promotion, a government services type strategy appears to have remained a central component throughout the period. Such a strategy has several shortcomings. Denmark provided investments for infrastructure and made expenditures in the areas of health, education and housing to meet basic needs. This increased the ability of Greenland to meet the basic needs of its population, but Greenland was to a large extent left out of the development process, and the majority of the personnel employed in construction and administration was imported from Denmark.

Economic development in Greenland around the mid 1960s was disappointing not only because Greenland lacked educational facilities but also because value added generated in connection with development projects often leaked out of Greenland and made its way back to Denmark. This resulted in a lack of local capital and a subsequent lack of local initiative (Marshall, 1966). The economy became highly dependent upon the use of labour from Denmark and some of the most intractable problems for economic policy in Greenland that followed were a result of that fact (Boserup, p. 479, 1963).

The high proportion of imported Danish personnel in Greenland continued throughout the 1950s and 60s and well into the period before Home Rule.[6]

[6]The means of attracting Danish staff to Greenland were economic, housing, and social privileges. In the mid 1960s a wage differential policy was legalized by passing the "birthplace-criterion" in the Greenland

Second phase of economic development policy in Greenland, G-60

In the early 1960s the Greenland Commission presented a study on the main problems of economic policy. This resulted in the second phase of economic development policy, the G-60 policy, which was implemented in 1964. The G-60 policy dominated Danish economic development policy in Greenland up until the time of Home Rule.

Many of the key features of G-50 were continued in the G-60 development policy, but in intensified form.[7] The Commission recommended that more effort be placed on cooperation between the population of Greenland and the Danish State, with increased emphasis on shared responsibility and the participation of Greenlanders in decision making. At the same time provisions were made for increased State activities. This included State support for the acquisition of larger trawlers and the construction of fish processing plants. This was largely in response to disappointing private initiative. The role of the Danish State was first and foremost to establish the technical and financial requirements for a centralized and industrialized fishery. It has been argued by Viemose (1980), that this policy, along with the population's increased dependency on money, caused a fall in the number of small fishermen, and an increase in the number of wage-dependent and un-educated workers. This, and the highly technical method of production, resulted in Greenlandic manpower being left with low-skilled, low paid, undesirable work. At worst, and for the most part, it meant that the population was left

Civil Servant Act, according to which civil servants born in Greenland would be in receipt of only 85% of the Danish basic salary.

obsolete in the central towns where the possibilities for fishing or hunting for own consumption were very poor.

Danish public investments in Greenland's fisheries

As noted above, the expansion and modernization of the fishing industry was a key component of the central strategy of economic development. When Danish planners in the 1950s sought a foundation upon which to build a modern economy in Greenland, the only option that appeared to hold some promise was the modernization of the country's fisheries. Since marine resources appeared abundant and could create job opportunities in existing settlements, development of the fishing sector was favoured over other activities such as mining. Through the 1960s large Danish investment expenditures were made on an industrial fishery, a modernized fishing fleet and the construction of fish processing plants. The resettlement of the population into major centres, as discussed earlier, was a fundamental part of this strategy. Danish expenditures on the export sector rose from 5.4 percent of total investment expenditures in the middle of the 1960s to 8.5 percent in 1970.

The modernization of the fishing industry, which took place throughout the 1950s and 1960s and the subsequent expansion of the export base, signaled the beginning of what may be referred to as an export-promotion strategy. Greenland's fish exports rose from 17.3 percent of total exports in 1950 to 39.3 percent by 1955, to 68.7 percent by

[7] The key changes in G-60 came about as a result of a lack of private Danish investments and the subsequent disappointing development in Greenland's business sector.

1965, to 79 percent by 1970. Since Home Rule, export of fish has risen significantly, and stood at a high of 93 percent of total exports in 1998.

The strengths and weaknesses of export-promotion strategies have been the subject of much debate.[8] Proponents of such strategies see primary exports as an engine of growth. Improved utilization of a country's factors of production, expanded factor endowments, and the creation of linkage effects are some of the key benefits that may follow an export-promotion strategy. Profitable opportunities may attract foreign investment both for the export sector and other sectors of the economy. Thus, an export promotion strategy can lead to more foreign investment, higher skill levels and more domestic savings. With respect to linkage effects, export-promotion can provide stimulus to other sectors of the economy. A consumption linkage may develop if labour receives higher earnings, thereby creating a demand for consumer goods. Moreover, investments in infrastructure to support the export industry can provide an incentive for other business ventures. In addition, export-promotion may create fiscal linkages when revenue obtained from taxing exports is allocated toward the finance of development in other sectors. A key advantage of such a strategy is that it may enable an economy to access a much broader market and hence enable the country to broaden its income base. Income generated from export promotion may permit a country to import goods and services from the world market, and this at a lower cost than the cost of producing such goods domestically (Gillis et al., 1987).

While a strategy of export-promotion may hold many promises, it has also frequently been alleged that a strategy of primary export may be ineffective. This is

[8] Chapter 4 of this thesis analyses the case of primary-export-led growth in Greenland.

because markets for primary products often grow slowly, earnings tend to be unstable due to price fluctuations, expected diversification around the export industry often is nonexistent or limited and linkages are often weak or non-existent. Significant instability and fluctuations in earnings may result if production is concentrated in one or a few products and if exports are geared only to a few external markets. A country may remain heavily dependent on imports of both final and intermediate products, as well as imported personnel in many cases. The end result is that export promotion may contribute little to the development of an economy as income may be leaving the country both in the form of earnings to imported personnel and expenditures on imported intermediate and final products.[9]

The population of Greenland has by and large been content with the results of modernization, but there has been broad discontent related to the way modernization was planned and carried out. While the Danish approach of centralization was instrumental in bringing about rapid social and economic advances in Greenland, the population was largely left out of the development process, which has meant that the influence of Greenlanders themselves was either absent or weak in the design, implementation and execution of the process. In addition to the lack of inclusion in the development process, the Danish strategy created only limited jobs and hence income for Greenlanders, and the

[9]Data on imports by end-use is only available since 1983. In 1983 intermediate goods import made up 31.4% of total imports and goods for household consumption made up about 37% of imports. By 1995 intermediate goods import constituted about 31.8% of total imports while imports for household consumption made up about 28.1%.

strategy did little in the way of establishing economic linkages in Greenland as most of the materials for development were imported from Denmark. [10]

Critics of Danish policy regarding Greenland have argued that although Greenland is becoming an increasingly modern economy it is also a country which continues to be not only dependent upon Denmark, but in many ways controlled both politically and economically by that country (eg. Nielsen (1980); Petersen (1995)).[11]

After Home Rule

In the 1970s general discontent with the Danish administration was growing in Greenland which was fueled by a number of things, including the failed Danish promises of the development programs that followed 1953, but also by the result of persistent ethnic stratification, the almost total control of trade and commerce by the KGH, Greenland's objection to membership in the EEC, and the overwhelming influence of

[10]The rationale behind the very large State expenditures on Greenland have often been debated. On the basis of an analysis of expenditures for the fiscal year 1970/71, Buch-Hansen et al. (1972), argue that expenditures on Greenland have first and foremost benefited Danish private enterprise. And only in light of this fact would it be possible to understand the motive behind the very large annual expenditures in Greenland, which according to Buch-Hansen et al. are considerably out of proportion to the very small Greenlandic population base (p. 12). They argue further, that by making the expenditures of the size seen in connection with Greenland , the Danish State has in effect supported both directly and indirectly Danish private enterprise: directly by purchasing goods and services from Greenland-based Danish businesses, and indirectly by financing the infrastructure necessary to attract, and make possible, Danish private investments in Greenland. According to the study done by Buch-Hansen et al., it was found that approximately 84% of the Danish expenditures on Greenland accrued to Danes, and only about 16% to Greenlanders (Buch-Hansen et al., 1972).

[11]Dryzek and Young (1985) have argued that Home Rule becomes a sham when it is not met with serious attempts to provide a reasonable basis for economic self-sufficiency and when Home Rule is coupled with arrangements that ensure a continuation of economic dependence. They further argue that when control over the principal resources of the locality are subject to continued control from the outside, then the result of such policies become even worse. In Greenland continued control is seen in the case of minerals, as Denmark has a right of veto.

Danish authorities in the design of the school system in Greenland. The result was that in 1979 Denmark granted Greenland Home Rule[12], and with that, the Greenland Inuit became the first population of Inuit to achieve a degree of self government. With territorial self-government aboriginal governments are empowered to levy taxes and they may have some form of sovereignty recognized by the former colonial government. Also, it is the only type of self-government model where legislative, administrative and judicial functions necessary to govern are brought together under aboriginal control (Ponting, 1986, p. 390).

Home Rule in Greenland is, however, of a qualified form. Sovereignty continues to rest with Danish authorities, and Denmark reserves absolute jurisdiction in the fields of the constitution, foreign affairs, national finances, and defence. Home Rule authorities have assumed control over and responsibility for policies that aim to develop the country in terms of its own social and economic conditions and available resources. The ownership of mineral resources continues to be the most controversial aspect of the Home Rule agreement. Management of minerals is regulated by agreement between the Danish government and the Home Rule government, with both having the right of veto. According to the Mineral Resources Act, which was passed at the time of Home Rule, the resident population of Greenland has fundamental rights to the *natural resources* of Greenland. It further states that the access to *mineral resources*, defined as non-living natural resources in the Greenland subsoil, is the property of the Realm (Statistics Greenland, Yearbook, 2000). When Greenland obtained Home Rule a plan was

[12]The Greenland Home Rule case is an example of what may be called a territorial self-government model, and is used by governments as an instrument of de-colonization. The Danish Home Rule model grants specific rights and powers to the population living in a specific territory (Lyck, 1986, p. 124).

formulated for the phased transfer of responsibility of Greenland's domestic affairs to the Home Rule government throughout the 1980s. The financing of a transfer of a given field has followed the principle that the Danish State compensates the Home Rule government by block grants in such a way that Denmark neither gains nor loses money compared to the expenses up to the date of the transfer.

While Greenland has obtained Home Rule, economic support in the form of annual block grants from Denmark continues to be a significant share of the annual budget. In the years following Home Rule a block grant reduction scheme was implemented which reduced the block grant by the amount of the income accruing from the levy on mineral concessions. In 1988 income from mineral resources was, however, separated from the block grant system and hence the block grant was no longer reduced by income from this source.[13]

The total Danish expenditures on Greenland (inclusive of block grant) stood at DKK 3,189 million in 1998, up from DKK 1,950 million in 1980, in current prices. Expenditures by the Danish State accounted for 48 percent of total public sector revenues in Greenland in 1998. This represents a significant drop since 1980, when total Danish expenditures were approximately 300 percent of Greenland's public sector revenues. This drop is explained by the phased transfer of administrative fields, and hence block grants, to the government of Greenland, as well as an increase in other revenue sources. Since Home Rule the block grants, which make up the major share of Danish

[13]The reason behind this was a new mineral resources act in 1988 according to which the income from exploitation of mineral resources in Greenland would be allocated to Greenland and Denmark by 50 per cent to each country up to a total of DKK 500 million, after which the allocation would be a matter of negotiation (Statistics Greenland, 2000).

expenditures on Greenland, have been recorded as revenue for the public sector in Greenland.

Public sector revenues have also been increasing as a percent of GDP. Again, this reflects in part the phased transfer of block grants to the Home Rule government since the end of the Danish administration, but also the increase in revenue sources in the years since introduction of Home Rule. In 1980, the block grant accounted for a significant share of public sector revenue while other revenue sources made only minor contributions, i.e. import duties, duties on motor vehicles and restaurants, and taxes and royalties for the Greenland exchequer. Since then, the tax base in Greenland has increased, and so have the tax rates and the number of different taxes collected. The total tax burden (i.e. the total of all taxes and duties measured as a percentage of GDP) increased from approximately 17 per cent in 1980 to approximately 34 per cent in 1997 (Statistics Greenland, 2000). In 1998, aside from the block grant, the main revenue sources included income taxes (DKK 1,886 million), indirect taxes (DKK 628 million), fishing licences from the EU (DKK 286 million), and net yield of interest etc. from quasi-corporations (DKK 255 million).

The annual block grant as a separate item, which stood at DKK 2,574 million in 1998, accounted for 39 percent of Greenland's public sector revenues. This was a significant drop since 1980 when the block grant (DKK 456 million) accounted for 71 percent of public sector revenues in Greenland.

The size of the block grant has risen relative to Greenland's GDP. The block grant was 33 percent of GDP in 1998, up from 17 percent in 1980. As in the case of total

Danish expenditures on Greenland, this increase reflects the phased transfer of administrative fields to Greenland.

3.2 Greenland's Home Rule Approach to Economic Development

This section outlines the key features of the Home Rule government's economic development strategy since 1979.

Since obtaining Home Rule in 1979 Greenland has achieved a significant level of political autonomy. While full political autonomy is closely linked to economic independence from Denmark, a discontinuation of Danish expenditures on Greenland would significantly impair the Greenland economy and reverse many gains made in its standard of living. Achieving economic and political autonomy, while maintaining the current standard of living, will therefore require significant efforts in the development of existing sources of income as well as development of new ones. Lyck (1987), has argued that while Greenland formally is in an autonomous phase, from a real point of view, and with emphasis on economic and administrative matters, the country is still in a phase that may be described as assimilation (p. 89).

Since Home Rule, efforts have been placed on developing a diversified and economically sound economy. While the fishing industry has taken centre stage in development plans, efforts in recent years have also been geared toward developing alternative sources of income within the mineral resources and tourism industries as well as in other land-based trades. Increased attention to economic diversification has come in response, not only to increased demand for employment, but in response to growing concerns about economic instability associated with this very narrowly based economy.

In broad terms, development initiatives of the Home Rule government have been geared toward achieving full political and economic autonomy while, at the same time, overcoming shortcomings of the past Danish administration. This is reflected in efforts to raise educational attainment and reduce dependence on imported personnel. Also, after obtaining Home Rule, Greenland's discontent with the European Common Market's control over the country's fishery policy did, in 1985, lead to its withdrawal from the Common Market, and for the first time since Home Rule Greenland achieved full control over the management of marine resources in Greenlandic waters.

The Home Rule government influences the development of trade and industry through industrial policies and public ownership. The main components of its industrial policy have included: the development of existing industrial sectors and the creation of new ones; infrastructure planning and technological renewal; sustainable utilization of living resources; market liberalization and competition; and the amelioration of adverse regional consequences of market liberalization.

While policy objectives in the 1980s were centred around overcoming shortcomings of development initiatives prior to Home Rule, the reforms that have been introduced in the 1990s represent a clear departure from Home Rule policies of many years, namely efforts to both decentralize and maintain employment levels, as well as ensuring supply through subsidized and protected public enterprises. The general trend has been toward a free market ideology, entailing a reduction in the role of the public, industry restructuring, rationalizations, contracting out of services, and talk of removal of the uniform price system and privatizations (Grønlands Hjemmestyre, Politisk-Økonomisk Redegørelse, 1999). To strengthen the Greenland economy over the long term, the Home Rule government has initiated a comprehensive process aimed towards increasing the efficiency and competitiveness of trade and industry. The conversion in 1990 of the Home Rule government's fishing, production and export business into the Home Rule owned company, Royal Greenland Inc., was the first initiative implemented in an effort to develop a business community operating under market conditions. Another important initiative was the restructuring of the Home Rule owned enterprise, Greenland Trade, KNI.[14] Commercialization of Home Rule owned enterprises has been undertaken in an effort to separate out the political agenda from the economic agenda. The goal is to make social assignments, such as maintaining production, supply, and employment, in outlying districts the responsibility of separate, non-commercial enterprises. Additionally, current policy statements argue for cutbacks in subsidies to public enterprises, and curtailment of other financial contributions to industry. Similarly, a removal of the uniform price system is increasingly being viewed as a precondition for a more competitive market structure. A removal of the uniform price system would, however, have consequences for the policy so far of maintaining a decentralized society. Nonetheless, in recent years the government has argued that maintaining uniform prices impedes competition and impairs progress on the economic development front.

[14]The restructuring was implemented in January, 1993 and divided the KNI into two enterprises: KNI Pilersuisoq Inc. (internal passenger transport by ships, postal services and supplying of goods to settlements and outlying districts) and KNI Pisiffik Inc. (wholesale and retail). KNI Holding Inc. controls and co-ordinates the restructuring process.

It has further been argued, that development, in order to succeed, must take place where the conditions necessary for its success exist, and that this will entail a removal of uniform pricing (Ibid.).[15] Thus, as in the years of the Danish administration, strategies in more recent years appear to have the effect of creating a more centralized society, with development taking place in major centres. In fact, as mentioned earlier, four major towns have been chosen as "development towns".

A recent report by the OECD in 1999, recommends that a long-term reform strategy be initiated based on the reform of the uniform price system, a reduction in the role played by the public sector, a programme for privatization, and an improved structure of competition. (OECD, 1999). The recommendations made by the OECD by and large coincide with those of the Home Rule government. In its annual political-economic report in 1999, the Home Rule government made recommendations to enhance competitiveness; to separate commercial and non-commercial activities in Home Rule owned enterprises; to contract out some services; to cut back on financial contributions and subsidy schemes; to reduce the gap between the wage level and productivity. The wage level is considered artificially high in Greenland. It is kept high to be competitive with that in Denmark, and also to allow Greenland to attract Danish labour. However, the high wage level is viewed by some as an impediment to competition domestically; and to make prices reflect true costs more closely, i.e. a reform or removal of the uniform price system. Overall, the Home Rule government has, since the late 1980s, undertaken various strategies to make the Greenland economy more market oriented, all in an effort to reduce the high level of dependence that still remains.

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[15] The uniform price system is discussed further in the section entitled "Other Land Based Trades".

The fishing industry and export-promotion

A five year development strategy was formulated and passed in 1984. A key objective of this strategy was the modernization of Greenland's fishing industry. This was going to entail a modernization of the fishing fleet to enable the exploitation of an increased amount of the total resource base, just as it was going to involve a modernization of fish processing plants in the towns and the restoration of worn-out facilities in the settlements. The plan involved the construction of publicly owned processing plants to ensure the processing of catches by publicly owned trawlers. Also, an emphasis was placed on improved access to government loans and financial contributions for the construction of both production and processing plants in the fishing industry. In addition, low interest loans were made available for the purchase of trawlers and fishing boats. Moreover, prices paid to fishers were fixed and guaranteed by the Home Rule government to ensure a steady supply of resources and to ensure incomes.[16] The development plan called for a broad geographical distribution of investments in the capacity of the fishing industry and the upgrading of worn out facilities. A clear policy goal was to maintain a decentralized population distribution and to achieve regional and distributional objectives of greater income equality (Poole (1990); Danielsen et al. (1998)).

[16]As a result of increased capacity with the initiatives in the 5 year plan, concerns of a possible depletion of some marine resources were growing, and by 1989 a 25% over-fishing of shrimp was recorded. To achieve a more sustainable fishery and to stabilize reduce over-fishing, tradable quotas in ocean fisheries were introduced in 1991. However, a restructuring was still deemed necessary to reduce excess capacity. This led in 1993 the Home Rule government to spend DKK. 104.5 mill on reducing the number of ocean going vessels. The number of shrimp vessels fell from 42 to 22 by 1994 (Statistics Greenland Yearbook, 1997). This has renewed hopes for a sustainable shrimp supply.

In 1985 Greenland left the EEC. At the same time Greenland obtained OLT status, i.e. overseas territory in relation to the Community. Greenland had become a member of the EEC in 1972 when Denmark joined the Community. However, dissatisfaction with the EEC membership soon mounted. On joining the EEC, Greenlandic waters changed status to EEC waters, and fishing quotas were administered from Brussels. Greenland no longer had exclusive fishing rights in its own waters. In 1982 Greenland voted to withdraw from the EEC. The process of withdrawing from the Community was prepared by Greenlandic politicians in close co-operation with the Danish Foreign Ministry. Throughout the negotiations with the EEC, officials attempted to achieve an agreement that would address the interests of all parties involved. The end result was a compromise that satisfied both Greenland and the EEC. The process of finalizing a deal with the EEC had its starting point in viewing the case of Greenland as that of a number of other developing countries who, in earlier years, had been members of the EEC because of their colonial status. The Home Rule government entered into an agreement that included a protocol of the OLT status of Greenland and a fishing protocol. Greenland achieved duty free access to EEC markets in exchange for EEC fishing rights. The fishing protocol allocates fishing quotas to the EU and, as compensation, the Home Rule government receives a fixed amount of financial compensation every year, currently (1996 till year 2000) approximately DKK 283 million a year (Statistics Greenland, 2000). The most important aspect of the agreement with the EU has been the almost complete end to foreign shrimp fishery in Greenlandic waters. The EU fish quotas consist almost entirely of species that either have all but disappeared from Greenlandic waters or species that Greenland does not have the "know-how" to exploit anyway (Danielsen, et.al, 1998, p. 55).

The fishing and hunting sector by far make up the largest portion of the country's export sector. Approximately 95 percent of export revenue in 1996 accrued from the sale of fishing and hunting products, and their processing. Together with the annual block grant from Denmark this sector constitutes Greenland's primary source of income, and with employment accounting for 25 percent of the labour force this sector must be regarded as the most important sector in the Greenland economy.[17] A large portion of the fishing fleet is financed by subsidized loans from the Home Rule government.[18] In addition, the government finances the building and maintenance of processing plants.

Restructuring has been taking place in the fishing industry since the late 1980s. This has resulted in a fall in employment on the large trawlers and in the processing plants.[19] While restructuring has been deemed necessary in order to allow the industry to compete on a global scale, it is in conflict with the political objective of maintaining a decentralized population distribution and high levels of employment. To ensure the viability and profitability of the fishing industry, production and processing have been

[17]In 1996 the fishing industry received government subsidies totaling DKK 235 million. When seen in relation to total employment in this industry of about 6,400 people this amounts to a government support of approximately DKK 37,000 per employed person. The subsidy amounts to approximately 12% of export revenues.

[18]Although historically there have been attempts to privatize the fishing industry its importance to society continues to be reflected in the very large involvement by the public sector in all aspects of production and processing. Royal Greenland Inc., a Home Rule owned corporation, controls most of the fishing industry. The fishing industry relies heavily on government subsidies.

[19]The Greenlandic fishing fleet may be divided into a sea-going fishing fleet with vessels of up to 80 GRT (gross register tonnes) and a coastal fleet consisting of vessels of a tonnage of between 5 and 80 GRT as well as a fleet of fishing boats of less than 5 GRT (Statistics Greenland Yearbook, 1997). In 1993, the fishing fleet totaled 289 vessels of more than 5 GRT. In order to reduce the capacity of the fishing fleet the Home Rule government introduced a program granting financial support to owners laying up vessels.

centralized and methods of catching fish have become increasingly capital intensive with large investments in modern high capacity fishing vessels.

In the 1990s restructuring entailed the commercialization of the Home Rule owned enterprise Royal Greenland, and the introduction of a system of tradable quotas and a point system to reduce the number of trawlers and phase out smaller and less efficient fishing vessels. These measures were put in place to make the industry more effective and efficient, while ensuring sustainable supplies of the fish resource.

Towards the end of the 1980s concerns were raised about the sustainability of Greenland's marine resource supply. In 1989, marine biologists had concluded that the Greenlandic fisheries suffered from over-capacity in the number of large trawlers. A system of tradable quotas was put in place in 1991, which resulted in a reduction of ocean-going trawlers from 42 in 1989 to 22 in 1994. Similarly, a point system was introduced, with the objective of phasing out the smaller and less effective boats. Also, to support the phasing-out of the surplus capacity in the trawler fleet, the government granted loans and condemnation subsidies in the early 1990s to shipping companies taking part in the capacity adjustment. The tradable quotas and the point system led to a highly rationalized fishing fleet and by the accounts, also a significantly more effective and efficient industry (e.g. Skydsbjerg (1999); Statistics Greenland (2000)).

Current strategies of economic development relating to the fishing industry are planned within a sustainable development framework. This has meant a strategy emphasizing that total size of catches comply with sustainable guidelines as advised by marine biologists, and that financial resources be allocated to the development of new species to avert negative consequences of downturns in trout and shrimp stocks.

In 1998, Nuka Inc. was established. Nuka Inc., is a Home Rule owned corporation, which has taken over the responsibilities relating to maintaining settlement installations and ensuring that possibilities for the local fishermen to sell their catches are available. Thus, Nuka Inc. oversees some of the social obligations that earlier had presented conflicts within the commercial operations of Royal Greenland Inc.

While the fishing industry continues to take centre stage in Greenland's process of economic development, no clear and measurable goals with respect to the development of this industry have been formulated.

Mineral Resource Industry

So far fisheries provide the only basis for major industrial development in Greenland which in and of itself places significant constraints on strategies of economic development. In response to a possible future downturn in the fishing industry, and with a policy goal of achieving financial independence from Denmark, Greenland is currently focusing on developing alternative sources of income (Grønlands Hjemmestyre, Landsplanredegørelse, 1994). The mineral resources industry is viewed as a potential source of income in the future. Initiatives have so far focused on furthering the exploration and extraction of mineral resources with the objective of creating an economically viable industry (Råstofkontoret, 1996).

In 1990, a new industrial strategy, which focused on mineral resources was presented by the Joint Council of Mineral Resources. It included a proposal for the amendments to the mineral resources legislation and a new set of strategies based on:

changed licence terms; competitive tax regulations; and increased fieldwork in the area of mining and oil drillings (Statistics Greenland, 2000). The amendments established guarantees for exploration companies that they would be granted licences for exploitation in the event that commercially exploitable deposits were found, and firm conditions for exploitation independent of the deposit found and without special negotiations. Also, the Greenlandic taxation legislation was amended, creating special regulations for companies carrying out mineral resources activities in Greenland. In 1996 new and simpler application procedures for prospecting and exploration for minerals were introduced (Statistics Greenland, Yearbook 1998, pp. 62-63). Currently, the overall goals include the financing of searches for major mineral deposits, and the opening of 2-4 large active mines and several smaller ones to ensure the viability of the hard mineral industry; financing of 2-4 major oil drillings per year over the next 10 years to search for oil deposits; and the employment of Greenlandic factors of production as far as possible.

However, making a mineral resource discovery that would be large enough for commercial utilization would require a large and potentially very costly undertaking. Also, one potential drawback to a mineral resources strategy is that the effect of mineral extraction on employment creation would likely be small. Nonetheless, a discovery of a large mineral deposit would be a first step toward establishing new and active mines in Greenland (Grønlands Hjemmestyre, Politisk-Økonomisk Redegørelse 1997). Currently there are a number of licences in force in Greenland. The Mineral Resources Act distinguishes between three types of licences: Prospecting, exploration and exploitation licences. A licence for prospecting is, in contrast to the other two types of licences, not associated with exclusive rights. One exploitation licence, 57 exploration licences and 19 prospecting licences had been granted by the end of 1997 for various areas throughout Greenland.

Tourism Industry

Efforts have also been geared toward developing a culturally and environmentally sound tourism industry. In 1996, the Home Rule government passed a strategy for the development of the tourism industry, covering the period 1996-2005. The main goals were: to achieve total annual foreign exchange earnings of DKK 500 million by year 2005; to develop the tourism industry in an environmentally and culturally sound way, which would entail a goal of an estimated 61,000 tourists annually. To meet the target of 61,000 tourists annually, plans were made for new investments in overnight accommodation, product development and marketing, as well as in the education and training of qualified personnel for this industry (Greenland Tourism Inc., 1996).

No statistics exist on the total number of tourists in Greenland. The only statistic available is the total number of hotel room bookings. The total number of tourists has been estimated to have been between 16 - 18,000 in 1998 (Skydsbjerg, 1999). For the near future, this sector is not expected, however, to have any significant impact on income and employment creation. The industry continues to be confronted with several constraints, including a very short tourist season of only 2-3 months in places without dogsledding, but a couple of extra months in places that offer dogsled tours; a short tourist season which makes it difficult to attract students who might otherwise be interested in educational opportunities in the field of tourism; the large cost of air travel to and from Greenland, as well as within Greenland; and a high price level and high cost of hotel accommodation in Greenland all of which have placed limitations on efforts to further tourism.[20]

Other Land-based Industries

As touched upon earlier, the fishing, mineral resources, and tourism industries are all characterized by significant resource constraints. Even if exploited to their maximum capacity these industries would not be able to close the gap between absorption and domestic income in Greenland. Rather, the Greenland economy will be relying on the future development of other land-based industries. The land-based industries currently contribute about 60 percent of total economic growth, about 33 percent of employment, but less than 1 percent of export revenue (Statistics Greenland Yearbook, 1997). The domestic market for land-based industries consists primarily of isolated micro markets, which complicates efforts of business and employment development (Danielsen et al., 1998).

As noted earlier, the price system in Greenland is one of uniform prices regardless of differences in costs between regions and between communities of different size. The uniform price system was introduced together with the establishment of the Danish State trade monopoly, KGH, in 1781. It has often been suggested that this policy should be discontinued because it is tantamount to a subsidy to State retail trade in the small and remote communities, which makes it almost impossible for private retail shops in the

[20]The price level in Greenland is estimated to be approximately 22% higher than that in Denmark.

same place to compete. However, against this view, it has been pointed out that a policy of raising retail prices in the small and remote communities would have undesirable social effects and yet serve no useful purpose since these places are so small that it would be wasteful to have competition between several local businesses (Ibid.). Today the uniform pricing system continues to be the subject of much criticism. It has been argued that this system contributes to artificially high cost levels in areas where there otherwise would be the possibility for lower prices for water, electricity, transportation etc. and, in turn, impedes private sector development. Similarly, it has been argued that uniform pricing complicates the task of identifying economic consequences of development strategies. An OECD report in 1999 also argued for the reform of the uniform price system (OECD, 1999). Despite the continuing criticism of this system, and notwithstanding a report which recommended its removal, the system remains in place. However, in 1999, the Home Rule government argued in its annual political-economic report that the uniform price system is an obstacle to economic development. According to the report, the system places a financial burden on economically viable regions, while reducing the cost of living and cost of doing business in places that are not economically sustainable. The report further points out that this reduces the level of competitiveness in those regions that help finance the system. The report goes on to argue that development has to take place where conditions exist that can bring about success development (Grønlands Hjemmestyre, Politisk-Økonomisk Redegørelse, 1999).

Greenland has witnessed a significant increase in the number of private retailers since the 1960s, when efforts were first put in place to achieve market liberalization and privatization. In 1996, the number of private shops numbered 169. Despite market liberalization, however, the Greenland economy continues to be dominated by public owned enterprises. In 1996, Greenland had approximately 100 publicly owned KNI shops (SULISA Inc., 1996). The KNI shops accounted for approximately 64 percent of employment in the retail sector (2,255 employed people), while 36 percent, or 1,295 people, were employed in private retail. In the category of land-based trades, the retail sector stands out as the sector with the highest share of public employment, which is attributed entirely to the high share of employment found in the KNI shops.

In 1996, 56 percent of the labour force were employed in publicly owned enterprises, while 44 percent were employed in privately owned enterprises. Of the privately owned enterprises 22 percent were independent or private entrepreneurs (Danielsen, et al., 1998, p. 24). In tourism, 33 percent of employment was found in publicly owned enterprises; in fishing, hunting and the fishing industry, 39 percent of those employed were employed in public enterprises; and 50 percent of those employed in the raw mineral sector were employed in enterprises owned by the public (Ibid., p. 26).

While efforts have been placed on providing incentives for the Greenland population to become private business entrepreneurs, today about 62 percent of the private retail shops are owned by Danes.

No clear goals or strategies have been formulated with respect to the development of land-based trades.

Public Sector

As seen above, the public sector accounts for about 60 percent of employment in Greenland. The size of this sector is the result of Greenland's history, the size of its markets, and its ideology. Historically, the reason behind the large size of the public sector can be found in the lack of private initiative in Greenland and the subsequent need to establish public enterprises to ensure production and supply. With Home Rule, Greenland adopted a system characterized by a wide range of public sector involvement at various levels of production and distribution and in all aspects of economic life. The influence of the public sector is reflected in the large publicly owned and operated corporations. The very small and scattered markets in Greenland and the subsequent lack of private sector investments and initiative, has also been a factor explaining the growth of the public sector. Moreover, market liberalization and privatization in Greenland would most certainly lead to a further increase in Danish ownership, and in turn Danish control over decision-making. This would counteract visions of developing a business sector owned and controlled by Greenlanders. Nonetheless, as noted earlier, recent policy statements call for a reduction in the role of the public sector, and a move toward increased market orientation which would involve privatizations. Also, an OECD report has recommended that Home Rule enterprises should be privatized and that potential investors should include foreign nationals (OECD, 1999). The Home Rule government endorsed these recommendations in its annual political-economic statement in 1999, however, no clear initiatives have been forthcoming on this front so far.

Public involvement in Greenland's business sector is reflected in the number of publicly owned corporations. The Home Rule government participates directly in the business sector through its total and partial ownership of a number of corporations.[21] The public involvement is also reflected in the very extensive subsidy schemes. The objective of these schemes are to maintain and create job opportunities just as they have a role to play in maintaining the scattered community pattern.[22] However, as noted earlier, these subsidy schemes are currently under review. The publicly owned corporations are also subject to an extensive cross-subsidization scheme designed to further distributional goals. Redistribution through cross-subsidization is often geographical but redistribution also takes place between industries (e.g. the supply service subsidizes the fishing industry through its rate structure on water and electricity).

3.3 Conclusion

Throughout the 1990s Greenland's narrowly based economy began to feel the stresses of growing constraints on the renewable resource base combined with increased global

[21]The total stock value of the Home Rule share in corporations was equal to DKK 1.8 billion in 1997. The largest of these corporations have their historical beginning in the then Danish State monopoly KGH; which has since Home Rule been broken up into three divisions: KNI Inc. which is responsible for supply; Royal Greenland Inc. which make up the larger share of the fishing industry; and Royal Arctic Line Inc. which controls transportation. These corporations are 100% owned by the Home Rule government.

[22]Of the total direct subsidies in 1996 of DKK 286 million, 54% went to the fishery and hunting sector and industry; 13% to raw minerals; 15% to tourism; and 17% to other land-based trades, primarily sheep farming (Danielsen et al., 1998, p. 27). The year 2000 budget shows total subsidies of DKK 301 million distributed on the fishing and hunting sector and industry (57%); raw minerals (9%); Tourism (21%); and other land-based trades (13%). In 1996 subsidies went to support business projects (32%), development (26%), price subsidies (19%), employment creation (17%), and financial subsidizing (6%).

competition. This continues to pose a threat to the sustainability of the Greenland economy and prospects for economic independence. The lack of alternative sources of income appears to be a key factor undermining any immediate prospects of achieving full economic autonomy.

In general, policies in more recent years have been geared towards market liberalization, privatization, restructuring, and contracting out. The move toward a strengthening of the free market ideology continues to include the commercialization of Home Rule owned enterprises and deregulation, just as it increasingly entails talk of privatizations and a removal of the current uniform price system. With the commercialization of Home Rule owned enterprises, the goal has been to separate out the political agenda from the economic agenda, with social assignments being delegated to separate enterprises. It has been argued by the Home Rule government that public monopoly is an ineffective organizational structure, not least because of the conflicts between political and economic interests (Grønlands Hjemmestyre, Politisk-Økonomisk Redegørelse, 1999).

While Greenland has obtained Home Rule and for more than two decades now has worked towards greater political and economic autonomy, the challenge of the future will be that of finding a strategy that creates a sound economic base, while at the same time permitting a workable balance between modernization and protection of the culture of Greenland.

Despite advances on the economic development front many of the fundamental obstacles to economic development in Greenland are still unchanged: communities are isolated from both internal and external markets which significantly complicates progress in economic development; internal markets tend to be very small, scattered and isolated, and communities are confronted with the problem of lack of accessibility to markets and populations large enough to support regional-scale manufacturing and service activities; and the economic base is very narrow, which continues to pose a key challenge to achieving a higher degree of self-sufficiency.

This chapter presented an overview and analysis of the Danish and Greenlandic government goals and objectives in respect of economic development before and after Home Rule. The focus of the next chapter is on the contribution of the export sector to economic growth in Greenland.

Chapter 4

Testing for Primary-Export-Led Growth in Greenland

4.0 Introduction

This chapter investigates empirically the relationship between real export growth and the growth rate of real GDP using annual published data from 1955-1998, the period for which macro data were available. It tests for unidirectional causality between the rate of growth of real GDP and the growth rate of real exports in Greenland using the Granger causality test.

A study of the primary-led-growth hypothesis applied to the case of Greenland is of importance to this study. Danish and Greenlandic policy initiatives have, since the end of colonial rule, placed fisheries and the promotion of their exports at the centre of economic development efforts. An empirical test of the primary-export-led growth hypothesis will provide insight into the question of the extent of the dynamic gains from trade in Greenland, and hence, the ability of the fishery-based export sector to fuel economic growth.

This chapter first presents a brief introduction to the main theories related to the development of primary exporting countries. This is followed by an overview and discussion of Greenland's export sector. Next, this chapter analyses the strength of economic linkages in the Greenland economy. After that, the study presents a review of the main empirical literature on the link between the rate of growth of exports and economic growth. This is then followed by the Granger causality test and an analysis and discussion of the results.[1]

4.1 The Theory of Primary-Export-Led Growth

Greenland has pursued various economic development initiatives since the 1950s, almost all of which have placed fisheries and the promotion of their exports at the centre of strategies of economic growth and development. Economists have long debated the importance of pursuing export promotion policies for stimulating economic growth. The basic argument in support of such policies has been that exports contribute positively to economic growth both directly, as a component of aggregate output, as well as indirectly through efficient allocation of resources, greater capacity utilization, exploitation of economies of scale, generation of technological improvement in response to greater competition from abroad, capital formation, and employment creation. The successful growth record of the outward-oriented economies of East Asia in the last decade has renewed interest in export promotion policies and revived the debate on optimal growth strategies for developing countries (Burney, 1996).

Theories related to the development of primary exporting countries fall into several categories. Amongst the more well-known theories are the "vent for surplus" approach, the "staple theory", the dual economy models and dependency theory.

Myint (1959) used Adam Smith's term "vent for surplus" to explain how countries with pre-trade idle land and labour have reached a point of higher factor

[1] Zellner (1975) and Pierce et al. (1977) give an in-depth discussion of the concept of causality.

utilization through international trade. However, as argued by Myint, when land or labour was "vented" as a result of colonization, the gains from trade often imposed a high cost on the indigenous population.[2] Whether primary exports that arise initially as a vent for surplus will lead an economy to further growth and development will depend in part on the ability of the export sector to create linkage effects.

Along a different line of thinking, the dual economy models (Arthur Lewis (1954, 1958); Fei and Ranis (1964)) describe development as a shift of labour from low-productivity subsistence activities to high-productivity modern sector activities. The successful transformation of an economy from a low-income dual economic structure to a higher-income, diversified, and less dualistic one depends to a large extent on the growth of productivity in the agricultural sectors. The gains from trade in tropical products will shift in favour of exporting countries only when they have improved the productivity of resources engaged in growing food (Lewis, 1978).

In contrast to the vent for surplus theory and dual economy models, the literature of underdevelopment and dependency theories (e.g. Baran (1957); Frank (1967); Griffin (1969)) argues that the characteristics of capitalist development are more strongly felt in peripheral capitalist states than in the centre. An extreme specialization in international trade and an enclave type nature of investment result from the tendency of international trade and investment to seek to extract surplus in the periphery and return it to the centre. A common feature of the dependency paradigm is that economic and political development requires a severance of links with the international capitalist system of

[2] In Adam Smith's terminology, trade provides a "vent for surplus" (Gillis et al. 1987, p. 415).

investment and trade, and a focus on self-reliance, including the reduction of the extent of dependence on international trade.

Finally, amongst the theories related to the development of primary exporting countries can be found the staple theory (H.A. Innis (1915); R.E. Baldwin (1956); D.C. North (1959); Watkins (1963)) which examines the development of primary exporting countries in terms of various characteristics of a country's staple. A staple is a primary product that faces a large and growing demand in world markets, does not require elaborate processing, and has a high enough value-weight ratio to bear transportation costs (Roemer, 1970, p. 6). A central feature of the staple theory is the spread effects and the process of diversification around the export base, which in turn is a process of economic development.

The fundamental assumption underlying the staple theory is that staple exports are the leading sector of the economy and, in turn, are a key determinant of the rate of economic growth.[3] There are three kinds of benefits to primary-export-led growth: improved utilization of existing factors, expanded factor endowments, and linkage effects.[4] The focus of analysis is not so much on the export industry itself as on the effects of staple production on the rest of the economy (e.g. Watkins (1963); C.P.

[3]Roemer (1970, pp. 9-19) presents several cases of development led by a primary export sector: "Canada at the turn of the century, the United States before the Civil War, Denmark in the last 20 years of the nineteenth century, Zambia (Northern Rhodesia) since WW II, and South Africa after its mineral discoveries in the last nineteenth century" (p. 9).

[4] In Peru the rapid expansion of the fishmeal industry during the 1950s and the 1960s led directly to the production of fishing boats and processing equipment. The shipbuilding industry became efficient enough to export fish craft to neighbouring countries, while the processing-equipment industry gave Peru a start on one kind of capital-goods production that can supply a wide range of food-processing industries (Roemer, 1970, "Fishing for Growth: Export-Led Development in Peru, 1950-1967").

Kindleberger (1962)). Secondary and tertiary industry is likely to develop around the export base through the external effects of inputs demanded, outputs supplied, consumer markets created, and education provided or stimulated by the export industry (Roemer,1970). The staple spread effects lead to demand for factors of production, demand for intermediate inputs, processing of the staple, and help determine the distribution of income. The spread effects determine the degree of diversification and hence the existence of investment opportunities. An expansion of the export sector means an increase in income in this sector which, in turn, leads to more investment opportunities in other sectors. The resulting linkage effects are referred to as backward, forward and final demand linkages. Hirschman (1958), argued that investment decisions should be valued not only for their immediate contribution to output but because of their linkages. Backward linkages are a measure of the inducement to invest in the home-production of inputs, including capital goods, for the expanding export sector. Diversification around an export base will be greater, the greater the opportunity for producing the input-requirements in domestic markets. Capital-intensive staples tend to require high import content, in part due to barriers to entry into machinery production which, in turn, weakens the backward linkage.

Forward linkages are a measure of the inducement to invest in industries using the output of the export industry as an input. The magnitude of forward linkages is primarily determined by economic possibilities for further processing and the nature of foreign tariffs.

Final demand linkages are a measure of the inducement to invest in domestic industries producing consumer goods for workers in the export sector. The size of the domestic market, and in turn, the level and the distribution of income, are key determinants of the size of the final demand linkages. The strength of such linkages is determined in part by the distribution of income, where a more equal distribution of income will tend to create stronger forward linkages.

While a number of empirical studies find evidence to support export-led growth, it has also frequently been alleged that primary exports cannot effectively lead the way to economic development. This is because markets for primary products often grow too slowly to fuel growth, earnings tend to be unstable due to price fluctuations, just as the expected diversification around the export industry and the creation of linkages tend to be weak or non-existent.[5] Green (1970) argued in his critique of the Staple thesis that "The Staple thesis is not wrong in the sense that export expansion cannot be used to initiate or accelerate national development, but only in appearing to consider it a sufficient condition." (p. 293).

This study tests the export-led growth hypothesis and draws conclusions about Greenland's ability to reap the dynamic gains from trade in primary exports. It analyses the extent to which the strength of economic linkage effects has been significantly large to be a contributing factor in fueling economic development in Greenland.

[5] For instance, it has been argued that the raw mineral and mining industries generally remain enclaves, remote from other centers of production and ill-adapted to link with them economically.

4.2 Greenland And Its Export Sector

Fisheries are a primary source of income in Greenland and they have since the 1950s been viewed as a potential engine of economic growth and development (e.g. Greenland Commission Reports (1950 and 1964); Boserup (1963); The Danish Perspective Planning for Greenland, (1970-85)). The general consensus has been that in order to find solutions that would allow Greenland to realize a higher level of economic development and self-reliance a key focus must be placed on the possible spread effects of the fishery-based export sector.

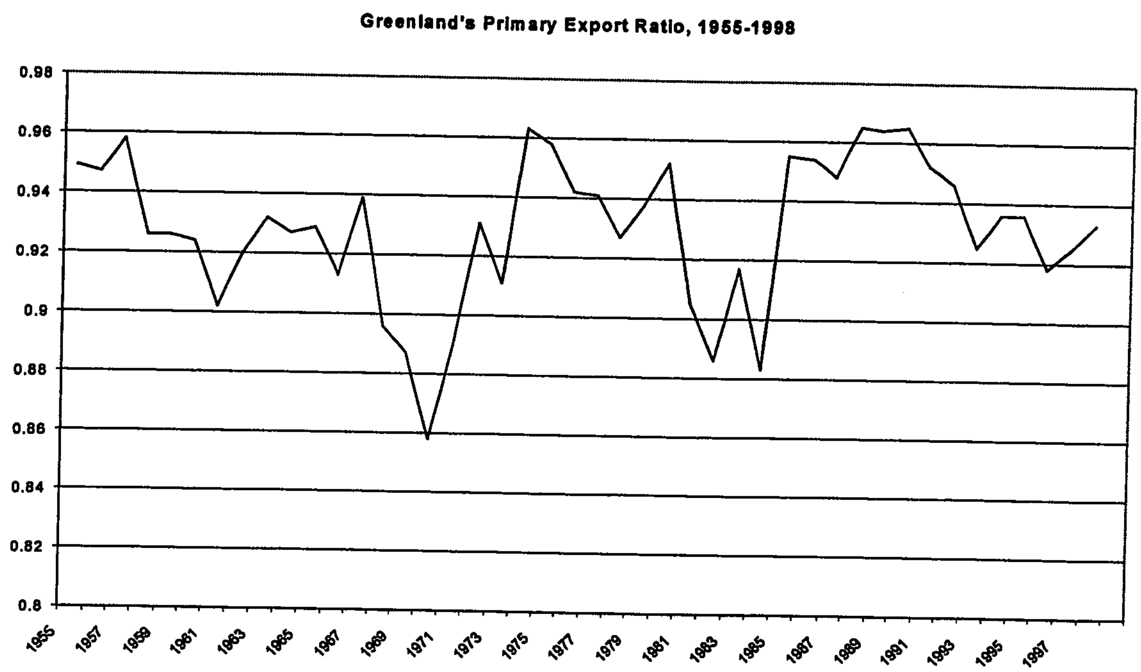
The Greenland economy is highly dependent upon fisheries and their contribution to foreign trade. Primary exports, which by 1998 consisted entirely of processed, semi-processed and un-processed fish, account for about 93 percent of total export earnings, and the total value of exports makes up a significant share of GDP. Exports comprised just over 64 percent of GDP in 1955. This figure fell to a low of 16.5 percent in 1970, and jumped to another high of just over 50 percent the year after the introduction of Home Rule.[6] Exports' share of GDP has been declining through the 1980s and the 1990s to a low of approximately 22 percent in 1998. Although renewed efforts have been placed on finding and developing alternative sources of income, fisheries continue to be a

[6] Greenland's export ratio has been fluctuating significantly reflecting that the export ratio is highly sensitive to fluctuations in the price of primary commodities and to fluctuations in the supply of Greenland's primary resources. Also, exports include items sent to Denmark for servicing or repair, and thus in years where major capital equipment is being serviced the impact on the export ratio will be significant. Part of the reason for the vulnerability of the export ratio has to do with the very small size of the Greenland economy, which means that even small changes in the economy have large impacts.

key source of revenue, and so far they remain a central component of options for the future of the Greenland economy.

Figure 4.2.1 shows the primary export ratio for the period 1955-1998.

Figure 4.2.1



Source: Statistics Greenland. Ratio was calculated based on annual published export data.

The primary export ratio is calculated as the ratio of fish and raw mineral exports to total exports. The range of this ratio was 0.86-0.96 for the period 1955-1998, with a value of 0 denoting no primary exports and a maximum value of 1, indicating primary exports of 100 percent of total exports.

As indicated in Table 4.2.1, the share of fish exports in total exports has been on an upward trend for the period under study except for a fall in the early 1970s.

Table 4.2.1

Greenland's Primary Exports

Selected Years	1955	1960	1970	1980	1990	1998
Value of Exports.[1] (DKK 1,000)	37,232	58,340	104,960	1,199,301	2,794,691	1,701,930
Primary Exports Percent of total.	95.0	92.0	86.0	95.0	96.0	93.0
of which fish	41.0	42.0	92.0	67.0	86.0	100.0
of which minerals	59.0	58.0	8.0	33.0	14.0	0.0
Key fish exports.[2] Percentage of total Primary exports:						
Shrimp	--	18.0	49.0	52.0	78.0	72.2
Cod	--	63.0	8.0	7.0	17.0	1.2
Greenland Halibut	--	0.0	0.0	3.0	0.6	12.0
Mineral exports. Percentage of total Mineral exports:						
Cryolite[3]	100.0	59.0	100.0	8.0	0.0	0.0
Zinc[4]	0.0	19.0	0.0	59.0	82.0	0.0
Lead[5]	0.0	22.0	0.0	33.0	18.0	0.0

Sources: J. Larsen's calculations, based on Statistics Greenland and Statistics Denmark, various years.
Notes:
1: Exports of other Greenlandic products: Leather, furs, raw furskin, sheep and lamb skins, furskins of seal and whale, meat products, ivory, whole bones, horns, hooves.
2: Other fish exports: Redfish, trout, salmon, scallops, crabs, Atlantic halibut.
3. Mine closed in 1984.
4. Mine closed in 1990.
5. Mine closed in 1990.

As noted earlier, in 1998, 93 percent of total export revenue accrued from primary exports, and fish exports accounted for 100 percent of total primary export revenue. This can be compared to 1955 when earnings from the export of fish accounted for only 41 percent of primary export revenue, while 59 percent of revenue originated in the export of minerals. Currently, the key fish exports are shrimp and Greenland halibut. While cod made up a significant share of total fish exports in 1960 it had all but disappeared from Greenlandic waters by the 1990s.

Over the same period of time the share of shrimp in total exports of fish rose significantly and made up in excess of 72 percent of total fish exports by 1998.

In 1998, Greenland halibut accounted for 12 percent of fish exports; an increase from three percent in 1980. Shrimp and halibut collectively accounted for just over 84 percent of all fish exports in 1998.

The share of cryolite in total exports fell from just over 75 percent in 1950 to just under one percent by the time of Home Rule. The mine closed in 1984. The last shipment of zinc and lead left the Maarmorilik and Black Angel mine in 1990. This marked the first time in more than 100 years that Greenland was without mineral exports, and there have been no active mines in Greenland since then. At its peak in 1975, zinc's share of total exports stood at just over 46 percent. Lead mining never contributed any significant amount to total exports except in 1980 when its share was about 12 percent.

Thus, primary exports contribute significantly to the economy of Greenland. This raises the question posed by the Staple theory of economic growth of whether Greenland's form of primary-export-led growth has led to improved utilization of existing factors, expanded factor endowments, and strong linkage effects, or whether as some empirical studies elsewhere have found, the strategy is ineffective because the creation of linkages tends to be weak or non-existent. The following section presents an overview of the strength of linkages in the Greenland economy.

4.3 Linkages in the Greenland Economy

As outlined earlier, the Staple theory of economic growth suggests that economic development results from spread effects and a process of diversification around an export base. Staple exports can be a leading sector of the economy, and the resulting spread effects are referred to as backward, forward and final demand linkages.

The direct backward linkages are measured for each sector, j, as

$$L_{bj} = \sum_i \frac{X_{ij}}{Z_j} \tag{4.3.1}$$

where L_{bj} is the index of the backward linkage, and X_{ij}/Z_j is the Leontief input-output coefficient. The total backward linkage index incorporates indirect linkage effects by summing the direct plus indirect coefficients of the Leontief inverse matrix, r_{ij} to get the following expression;

$$L_{tj} = \sum r_{ij} \tag{4.3.2}$$

The direct forward linkage index is measured as

$$L_{fi} = \sum_{j} X_{ij} / Z_i \qquad \textbf{(4.3.3)}$$

where L_{fi} is the forward linkage index for the ith industry, X_{ij} is the output of the ith industry that is purchased by each jth user industry, and Z_i is the production of good i for both intermediate and final use (Gillis et. al., 1987, p. 548). A high index indicates that expansion of the industry will stimulate production in other sectors of the economy.

Yotopoulos and Nugent (1973), measured the sectoral linkage indices for five less-developed countries (Chile, Greece, South Korea, Mexico, and Spain), and found that basic metals, minerals and chemicals ranked high in terms of direct forward linkages. Leather, clothing, textiles, and food and beverages, ranked highly in terms of total backward linkages, whereas primary industries, utilities, and services ranked low. They found that in terms of direct forward linkages basic metals and minerals ranked at the top with indexes of 0.980 and 0.870 respectively, whereas clothing (0.025) and construction (0.093) ranked in the bottom. Out of the 18 sectors, agriculture ranked 11th (0.502), utilities 6th (0.614), and services 14th (0.378). With respect to total backward linkage effects the study found leather ranked 1st (2.39), basic metals 2nd (2.36), clothing 3rd (2.32), whereas, at the low end of the scale, agriculture ranked 15th (1.59), utilities 16th (1.49), mining 17th (1.47), and services 18th (1.41).

Some insight into the strength of economic linkages in the Greenland economy can be gained from a preliminary input-output model produced by Statistics Greenland in 1992 (Statistics Greenland (2000); Danielsen et al. (1998)). This model points to the weak and often non-existent forward, backward, and final demand linkages in Greenland.

Table 4.3.2 highlights some of the evidence on the strength of linkage effects as suggested by the Greenland input-output model. The sectoral linkage indices suggest that the Greenland economy is very weak on direct forward and backward linkage effects, as well as total backward linkage effects. The sector categorized as "other land based trades", while very small, has the largest forward linkage effect (0.862) in the Greenland economy followed by fisheries (0.285). The model suggests that the raw-mineral and tourism sectors have no forward linkages.

Table 4.3.1

Sectoral Linkage Indices for Greenland, 1992

Sector	Direct forward linkage effect	Direct backward linkage effect	Total backward linkage effect
Fisheries	0.285	0.492	1.762
Tourism	0.002	0.304	1.418
Raw Minerals	0.000	0.228	1.304
Other Trades	0.862	0.239	1.320
Other	0.371	0.257	1.346

Source: J. Larsen's calculations based on input-output model for Greenland, 1992 (Danielsen et al., 1998).

With respect to the direct backward linkage effects, fisheries and tourism have the largest linkages with indices of 0.492 and 0.304, respectively. The direct backward linkages are stronger than the forward linkages, but are still very low.

In terms of total backward linkage effects, fisheries rank number one at an index of 1.762, followed by tourism (1.418) and other land based trades (1.320). These indices are very small, and considerably smaller than those found in the study by Yotopoulos and Nugent (1973).

The matrix of coefficients of the input-output model, similarly, reflects the weak backward linkages.[7] This is shown in Table 4.3.2.

The matrix suggests that of the total value of production in the fishing sector in 1992, 25.3 percent was made up of inputs from fisheries, 19 percent from other land-based trades, 4.9 percent from other non-specified sectors, 14.1 percent from imports, and 36.8 percent from value added.

The model indicates even weaker backward linkages for the tourism and raw mineral sectors, with most of the total value originating from value added. Backward linkages will more than likely remain weak or non-existent well into the future as

[7] The model analyses the economy as consisting of only five sectors; fishery, tourism, raw minerals, other land based trades, and others. The year 1992 is used to develop the input-output coefficients. This represents a problem in using the model for analysis of subsequent years in that Greenland is a very small economy, and therefore even a small change in any sector of the economy may affect the whole economy.

Greenland battles with the weaknesses of private business, high cost of production, and a market size too small to achieve economies of scale.

Table 4.3.2

MATRIX OF COEFFICIENTS FOR GREENLAND, 1992

Sectors	Fishing industry	Tourism	Raw-minerals	Other land-based trades	Other
Fishing industry	0.253	0.026	0.000	0.006	0.000
Tourism	0.000	0.002	0.000	0.000	0.000
Raw-minerals	0.000	0.000	0.000	0.000	0.000
Other Trades	0.190	0.221	0.119	0.187	0.145
Other	0.049	0.055	0.109	0.046	0.112
Import	0.141	0.185	0.135	0.242	0.105
Value added	0.368	0.511	0.637	0.519	0.635
Total output	1.000	1.000	1.000	1.000	1.000

Source: Danielsen et al., 1998, p. 192.

Intermediate goods production in Greenland has also been hampered by firms' preference for imported inputs for price and quality reasons. Greenland relies heavily on imports of its equipment, machinery and material inputs, and it is highly unlikely, at least in the foreseeable future, that Greenland will be in a position to manufacture its own inputs let alone start up a capital goods industry.[8]

Similarly, the relative weakness of the forward linkages is reflected in the size of the input coefficients. Of the total value of production in fisheries 25.3 percent was used as input into the same sector for processing, while 0.26 percent went into tourism, and less than 0.01 per cent was used in other land-based trades. The weak forward linkages flowing from fisheries can be explained in part by the level of processing of fish exports. Much of Greenland's fish staple is exported in raw or semi-processed form.

Table 4.3.3

Degree of Processing of Fish Exports

SELECTED YEARS	1955	1965	1975	1980	1990	1995
Total Fish Exports (DKK Mill)	14.5	61.8	204.4	623.2	2323.4	1933.8
Of which						
Unprocessed Fish (%)	16.0	53.0	48.0	50.0	66.0	64.0
Semi-Processed Fish (%)	73.0	15.0	12.0	39.0	2.0	2.0
Processed Fish (%)	11.0	32.0	40.0	11.0	32.0	34.0

J. Larsen's calculations using annual Statistics Denmark publications of trade figures.
Definitions:
Unprocessed fish: fresh, chilled or frozen fish, and frozen shrimp and crustaceans.
Semi-processed fish: salted, dried or smoked fish, shrimp shelled, and dried or salted molluscs.
Processed fish: Canned or otherwise processed fishery products, and preserved crustaceans.

This causes the economy to lose value-added which is contributing to weaknesses

[8]Greenland's trade accounts show evidence of a very high volume of import as a percent of GDP; the import ratio has fallen from 99% in 1960 to 78% in 1980 to 37% currently. Greenland imports almost all of its consumer goods. Goods for household consumption account for approximately 28% of total imports. This is down from 37% in 1983.

in forward linkages in the Greenland economy. As indicated in Table 4.3.3 the degree of fish processing in Greenland is very limited.

The high share of un-processed and semi-processed fish exports means that Greenland is not maximizing potential multiplier effects.[9]

Final demand linkages tend to be weak as well. With a population size of only about 56,000, the size of the domestic market in Greenland is very small. It is possible that final demand linkages in Greenland have been slow to develop partly as a result of the income received by Danish labour not being taxed in Greenland prior to Home Rule, and partly as a result of their remittances to Denmark. In fact, Buch-Hansen et al. (1972) found that approximately 84 percent of Danish expenditures on Greenland leaked out of the Greenland economy to end up back in Denmark. This coupled with the very scattered and often inaccessible nature of the market, and thus the very high cost of production and distribution, means that final demand linkages in Greenland do not form easily.[10]

Aside from the income leakages in Greenland, income remains very unequally distributed (Lyck, 1986). In theory, the more equal the income distribution the greater the likelihood of a broadly based market for mass-produced goods.[11] Lyck found that when ranking the population according to income levels, 37.1 percent of total income went to the 10th decile of the population. This can be compared to a country such as India where the 10th decile received 30.2 percent of income. Amongst the Scandinavian countries the percentage of income accruing to the 10th decile fell in the range between 21.7 percent to

[9] See Graham Poole (1992) for a discussion of this issue.
[10] Only 15% of Greenland is free of permanent ice.
[11] Because of the geographical and size factors in Greenland, mass production of consumer goods would never be likely. Geographical and size factors coupled with the high price and cost levels make private initiative on a broad scale unlikely.

27.2 percent. Comparators such as these help shed light on the high level of income inequality in Greenland. Although the distribution has improved slightly in recent years, this continuing pattern of inequality tends to reduce local demand just as it places additional pressure on imports of luxury consumer goods from Denmark and elsewhere.

As discussed above, the evidence on the strength of linkage effects in Greenland points to a case of very weak or non-existent linkages. Such evidence would in theory question the ability of the Greenland economy to reap the gains from trade in primary products. In the following section this study tests the export promotion hypothesis using real GDP and real export data from the Greenland economy for the period, 1955-1998.

4.4 Testing for primary-export-led growth in Greenland

The 1970's witnessed an emerging consensus in favour of export promotion. Analysis of individual country experiences provided extensive support for export promotion as an effective development strategy (Jung et al.,1985). Most of the studies however relied on cross-sectional evidence, and almost all of them regressed a growth variable on an export variable. But none considered the direction of causality between exports and growth. The Granger causality test goes beyond mere correlation and addresses the issue of the direction of causality.

Using a range of methodologies, the literature supports an association between exports and growth. However, this association tends only to hold in cross-section analyses, there being nothing like the same degree of agreement in time-series work (Greenaway et al., 1994). Some authors have employed rank correlation (e.g Michaely, 1977); others have employed rank correlation and OLS regression analysis (e.g. Balassa (1978) and Kavoussi (1984)); and some have used production function methodology (e.g. Michalopoulos et al. (1973); Balassa (1984); Tyler (1981); Kavoussi (1984); Moschos (1989); and Salvatore et al. (1991)).[12]

While there is significant controversy over the causality between export growth and growth of GDP, much literature has concluded that export growth has made substantial contributions to export oriented economies (e.g. Roemer (1970); Michaely (1977); Balassa (1978); Williamson (1978); Fajana (1979); Tyler (1981); Feder (1983); Kavoussi (1984); Salvatore & Hatcher (1991); Serletis (1992)).[13] While a significant amount of literature, using a range of methodologies, supports an association between exports and growth, this association tends only to hold in cross-sectional analysis, whereas time-series analysis is characterized by considerable disagreement.

Using time-series data for the period 1870-1985 Serletis (1992) found evidence to suggest that the growth of GNP and export growth are interdependent and supports the export-led growth strategy in that expansion in exports promotes the growth of national income (p. 144).

Using a cross-section of 41 countries, Michaely (1977) tested the hypothesis that a rapid growth of exports accelerates the economy's growth. The hypothesis was tested by examining the correlation between growth and exports (p. 48). Michaely found a positive association of growth with export expansion. Emery (1967), Maizels (1968) and Kravis (1970) used a similar approach and found the two variables to be significantly correlated.

[12] For a review of the different methodologies used and results see Greenaway and Sapsford (1994).

Feder (1983) analyzed the sources of growth in the period 1964-1973 for a group of semi-industrialized less developed countries, and found support for the export growth hypothesis. The results indicated that social marginal productivities are higher in the export-sector, and economies which shift resources into exports will gain more than inward-oriented economies (pp. 59-73).

Chow (1987) investigated the causal relationship between export growth and industrial development in eight Newly Industrializing Countries (NICs). The causality test was conducted by applying the Sims (1972) technique to annual data on exports and manufacturing production from eight NICs for the decades of the 1960's and 1970's. According to Sims, one can regress Y on past and future values of X, and 'if causality runs from X to Y only, future values of X in the regression should have coefficients insignificantly different from zero, as a group' (Sims, 1972, p. 545). The results of the Sims' causality test showed that for most NICs, there is a strong bi-directional causality between the growth of exports and industrial development. These findings supported the export-led growth strategy in that expansion in exports not only promotes the growth of national income but also leads to structural transformation of the developing countries (pp. 55-63).

Jung and Marshall (1985) performed causality tests between exports and growth for 37 developing countries, employing annual time-series data for the period early 1950s to 1980. Using the Granger causality test the evidence in favour of export promotion was weaker than earlier statistical studies have indicated (p. 1-12).

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[13]See Jung and Marshall (1985) and Greenaway and Sapsford (1994).

Dodaros (1991) employed a cross-section analysis for a wide range of less-developed countries and found a strong correlation between economic growth and the proportion of manufactures and stage three processed primary products. In general the analysis suggested that evidence in support of export promotion and export-led growth is not as strong as is sometimes suggested and that the effectiveness of such policies depends on the level of development and the structure of exports.

Dodaro (1993) applied the Granger causality test to 87 developing countries over the period 1967-1986. Dodaro's results did not support the neoclassical theory. The results were in favour of the export-led growth hypothesis only in seven primarily poor and low income countries.

Bahmani-Oskooee et al. (1991) studied 20 developing countries and found inconclusive results about the causal relations between exports and economic growth. Five countries (Dominican Republic, Indonesia, Korea, Taiwan, and Thailand) exhibited positive causality, while three countries (El Salvador, Paraguay, and Peru) indicated negative causality from exports to economic growth. Positive causality was found from output to export growth in the case of four countries (Korea, Nigeria, South Africa, and Thailand). Indonesia exhibited negative causality running from output growth to exports.

Using a similar procedure, Love (1994), found evidence in support of the export-led growth hypothesis. Love's results exhibited positive and statistically significant unidirectional causality from exports to output growth in the case of seven countries and negative causality in the case of four. Statistically significant and positive bi-directional causality was found for three countries. This result was interpreted by Love as a sign of "substantial support for the hypothesis that export growth causes growth of output" (p. 209).

Yaghmaian (1995) studied the merits of export-promotion policy in Africa by testing the causal relations between export growth and economic growth using a sample of 44 countries covering the period 1960-1992. Yaghmaian used the Granger causality test and the results suggested that the case for export-led growth in Africa is very weak and unsubstantiated by empirical evidence. For 87 per cent of the countries in the sample, the causality test did not support the contention that better export performance causes economic growth. The results also failed to support the opposite contention that economic growth causes the growth of exports (p. 81).

Greenaway and Sapsford (1994) employed a time-series study of a sample of 19 countries. Using a production function approach, they found little support for the export - growth relationship (p. 170).

Burney (1996) analyzed the relationship between export and growth by estimating an augmented GDP-growth equation on the basis of cross-country data, and using OLS and random coefficient (RC) methods. The relationship was estimated for two separate periods, i.e. 1965-80 and 1980-90. The estimates obtained using the RC method indicated that while there exist a positive link between exports and economic growth, the relationship is significant only for the period 1980-90.

The results of empirical studies on the causal relations between export growth and economic growth in developing countries are, therefore, inconclusive, leading some to conclude that the lack of adequate empirical support for the direction of causality from exports to economic growth must cause concern about the rationality and desirability of development policies that are based on the engine-of-growth thesis (Yaghmaian, 1995, p. 81).

The Granger Causality Test

The current study will test the export-led growth hypothesis in Greenland using the Granger causality test.

According to Granger (1969), a variable X is said to cause another variable Y, with respect to a given information set that includes X and Y, if current Y can be predicted better by using past values of X than by not doing so, given that all other past information in the information set is used.[14]

Testing to see if exports cause economic growth in the Granger sense, the following set of equations can be employed, where X and Y are presumed to be a pair of linear covariance-stationary time-series: [15]

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[14] Formally, let U_t, t=...-1, 0,1,2,..., be the given information set. U_t includes at least (X_t , Y_t). Let $\overline{U}_t = \{U_s, s < t\}$. $\overline{X}_t$ and $\overline{Y}_t$ are defined similarly. Then according to Granger X causes Y if $\sigma^2(Y_t \mid \overline{U}_t) < \sigma^2(Y_t \mid \overline{U}_t - \overline{X}_t)$, where σ^2 (Y | Z) denotes the variance of the minimum variance unbiased predictor of Y given information set Z

[15] In the Granger sense a variable X causes another variable Y, with respect to a given information set that includes X and Y, if current Y can be better predicted by using past values of X than by not doing so (Serletis, 1992).

$$Y_t = \alpha_0 + \sum_{j=1}^{m} a_j X_{t-j} + \sum_{j=1}^{p} b_j Y_{t-j} + U_t \tag{4.4.1}$$

$$X_t = \beta_0 + \sum_{j=1}^{r} c_j X_{t-j} + \sum_{j=1}^{s} d_j Y_{t-j} + V_t \tag{4.4.2}$$

where U_t and V_t are serially independent.

Unidirectional causality from X to Y is indicated if the estimated coefficients on the lagged X in (4.4.1) are statistically not jointly zero and the set of the estimated coefficients on the lagged Y in (4.4.2) is not statistically different from zero (i.e. $d_1 = d_2 = \ldots = d_j = 0$). Unidirectional causality from Y to X exists if the set of lagged X coefficients in (4.4.1) is not statistically jointly equal to zero and the set of the lagged Y coefficients in (4.4.2) is statistically different from zero. Feedback, or bilateral causality, is suggested when the sets of X and Y coefficients are statistically significantly different from zero in both regressions. Independence is suggested when the sets of X and Y coefficients are not statistically significant in both the regressions.

The procedure involved in the Granger causality test is to first; obtain the restricted residual sum of squares by regressing X on all lagged X terms; second, to obtain the unrestricted residual sum of squares by including the lagged Y terms in the regression; third, to formulate the null hypothesis as $H_o : \sum a_j = 0$, that is, lagged Y terms do not belong in the regression; and fourth, to test the hypothesis an F-test is performed where

$$F = \frac{(RSS_R - RSS_{UR})/m}{RSS_{UR}/(n-k)}$$

which follows the F distribution with m and $(n\text{-}k)$ degrees of freedom. Here m is the number of lagged Y terms and k is the number of parameters estimated in the unrestricted regression; fifth, if the F value is greater than the critical F value at the chosen level of significance, the null hypothesis is rejected, and we conclude that the lagged Y terms belong in the regression, in other words Y causes X. Steps one to five are repeated to test whether X causes Y, i.e. equation (4.4.2).

Empirical Analysis and Results

Several methodological problems have been found in many of the empirical investigations outlined above. Often causality tests have been performed without due consideration of stationarity of the macro economic series involved; the lag length employed in the selection criteria was not optimal; and tests for error structure were not carried out. In the present study, prior to performing the causality test, tests will be undertaken for stationarity, optimal lag length and error structure.

The empirical analysis employs annual time series data for the period 1955-1998.

Testing for Stationarity

Empirical work based on time series data of GDP and export earnings assumes that the underlying time series are stationary, as they must be before the Granger causality test can be applied. But this assumption needs further testing, since in the presence of non-stationary variables, there might be a spurious regression (Granger and Newbold, 1974). A spurious regression has a high R^2, t-statistics that appear to be significant, but the results are without any economic meaning.

The unit root test can be used to test for stationarity. There are important differences between stationary and non-stationary time series. Shocks to a stationary series are temporary; over time the effects of the shocks will dissipate and the series will revert to its long-run mean level. On the other hand, a shock to a non-stationary series is permanent. The assumptions of the classical regression model necessitate that the sequences of the dependent and independent variables be stationary and that the errors have a zero mean and finite variance. The stationarity properties of the variables, growth rate of real exports and growth rate of real GDP, were examined using the Phillips-Perron (1988) test with a specification which includes a constant and a trend variable.[16] The results of the Phillips-Perron unit root tests for stationarity are presented in Table 4.4.1.

The results show that the test statistics are greater than the 10% asymptotic critical values. Therefore, the Phillip-Perron test rejects the unit root hypothesis, and it can be concluded that both the growth rate of real GDP and the rate of growth of real exports are stationary in growth rates.

Table 4.4.1

Phillips-Perron Unit Root Test Results

VARIABLE	ι-STATISTIC	Z-STATISTIC	CONCLUSION
Growth rate of real GDP			
Constant, no trend	-6.7529	-46.996	No unit root
Constant, plus trend	-7.1478	-49.656	No unit root
Growth rate of real exports			
Constant, no trend	-7.2586	-44.642	No unit root
Constant, plus trend	-7.1992	-45.432	No unit root

Equation with constant and no time trend:
Asymptotic critical value at 10% of ι-test is -2.57. Asymptotic critical value at 10% of z-test is -11.2
Equation with constant and time trend:
Asymptotic critical value at 10% of ι-test is -3.13. Asymptotic critical value at 10% of z-test is -18.2

[16] The Phillips-Perron test is more powerful than the Dickey-Fuller (1984) test for unit root.

Model Specification

Based on a specification test and the Schwarz (1978) test for lag length the following specification of the causality model was chosen:

$$RGDP_t = \alpha_0 + \sum_{i=0}^{5} a_i RX_{t-i} + \sum_{i=1}^{2} b_i RGDP_{t-i} + U_t \qquad \textbf{(4.4.3)}$$

$$RX_t = \beta_0 + \sum_{i=1}^{1} c_i RX_{t-i} + \sum_{i=0}^{1} d_i RGDP_{t-i} + V_t \qquad \textbf{(4.4.4)}$$

where RGDP is the real rate of growth of GDP, and RX is the real rate of growth of total exports. Equation (4.4.3) postulates that current RGDP is related to past values of RGDP as well as to current and past values of RX, and equation (4.4.4) postulates a similar behaviour for RX. The chosen specification of the causality model is an autoregressive model, specified as a simultaneous-equation system. This is a structural model that allows for the effect of the current values of the explanatory variables, and it includes one or more lagged values of the dependent variable among its explanatory variables. It is a dynamic model since it portrays the time path of the dependent variable in relation to its past values. Lag lengths *m, p, r, s* were determined so as to minimize both the Akaike (1974) information criterion (AIC) and the Schwartz (1978) criterion (SC), where

$$\text{AIC} = \ln \tilde{\sigma}^2 + \frac{2k}{N}, \qquad \text{and} \qquad \text{SC} = \ln \tilde{\sigma}^2 + \frac{k \ln N}{N},$$

where $\tilde{\sigma}^2 = \frac{e'e}{N}$, e is a residual vector, N is the number of observations, and k is the number of parameters to be estimated.

The model was tested for simultaneity bias using the Hausman (1978) specification test. The presence of simultaneity bias would cause the OLS estimators to be inconsistent. The real rate of growth of GDP (RGDP) was regressed on the pre-determined variables excluding the current rate of growth of real exports (RX). The predicted RGDP and the estimated residuals of equation (4.4.3) were then substituted for RGDP in equation (4.4.4). The t-statistic of the estimated residuals is 0.6533, and the critical value is 2.020 at the 5% level of significance. It can be concluded that the estimated residuals are statistically insignificant at the 5% level, and hence simultaneity bias is not present in the model.

Testing for Normality

The OLS assumptions require that the error terms follow a normal distribution. Otherwise, the testing procedure will not be valid in small, or finite, samples. The Jarque-Bera test is used here to test the null hypothesis that the residuals are normally distributed. If the p-value of the computed chi-square statistic is sufficiently low, one can reject the hypothesis that the residuals are normally distributed. But if the p-value is reasonably large one does not reject the normality assumption. The results of the normality tests are results summarized in Table 4.4.2.

In the case of equation (4.4.3) the Jarque Bera χ^2 value is 0.2048. The p-value of obtaining such a χ^2 value at 2 degrees of freedom is about 0.90. Therefore, asymptotically we do not reject the normality assumption.

Table 4.4.2

Jarque-Bera Test for Normality

Equation	Test-Statistic	Degrees of Freedom	P-value
Equation (4.4.3)	0.2048	2	0.90
Equation (4.4.4)	5.4500	2	0.09

In the case of equation (4.4.4) however, the χ^2 value is 5.45 with a small p-value of about 0.09 at 2 degrees of freedom. Although these results suggest that the residuals in the equation (4.4.4) are not approximately normally distributed, this is not a serious problem given the large size of the sample. Furthermore, equation 4.4.3 is the key equation in this test.

Testing for Equation Specification Error

Ramsey (1969) proposed a general test of specification error called the RESET test (regression specification error test). The RESET test is performed to test one of the assumptions of the classical model, that the model is correctly specified such that there is no specification bias or specification error. The test results are summarized in Table 4.4.3. The test results show that for both equations (4.4.3) and (4.4.4) the critical values are greater than the test-statistics at the 5% level of confidence.

Table 4.4.3

Ramsey RESET Test for Equation Mis-Specification

Equation	Test-Statistic	DF	Critical Value 5%
Equation (4.4.3)			
RESET (2)	0.2493	F(1,28)	4.20
RESET (3)	2.4882	F(2,27)	3.36
RESET (4)	2.0957	F(3,26)	2.98
Equation (4.4.4)			
RESET (2)	3.5878	F(1,37)	4.05
RESET (3)	2.2745	F(2,36)	3.28
RESET (4)	2.2607	F(3,35)	2.88

This suggests that both equations pass the RESET test, and it can be concluded that there is no model mis-specification.

Testing for the degree of Multicollinearity

When near or high multicollinearity is present, the OLS estimators have large variances and covariances, making precise estimation difficult. Since multicollinearity refers to the condition of the explanatory variables that are assumed to be nonstochastic, it is a feature of the sample. Therefore, a test cannot be performed for the presence or absence of multicollinearity, but rather it is possible to measure the degree of multicollinearity. In the following the variance-inflating factor (VIF_j) and the tolerance (TOL_j) are used to detect the degree of multicollinearity. The VIF_j is defined as $VIF_j = 1/(1-R^2_j)$, where R^2_j is the R^2 in the (auxiliary) regression of X_j on the remaining (k-2) regressors. The larger is VIF_j the more collinear is the variable X_j. If the VIF of a variable exceeds 10 then it is said to be highly collinear. The $TOL_j = (1 - R^2_j) = 1/VIF_j$. $TOL_j = 1$ if X_j is not correlated with the other regressors, whereas it is zero if it is perfectly related to the other regressors. Measures of VIF_j and TOL_j for equations (4.4.3) and (4.4.4) are shown in Table 4.4.4 below. In the case of equation (4.4.3) the VIF_j values are less than ten (falling between 1.051 – 1.407) and TOL_j values are approximating a value of one (falling between 0.711 – 0.952). Similarly, in the case of equation (4.4.4) the VIF_j values are less than ten (falling between 1.008 – 1.353) and TOL_j values are approximating a value of one (falling between 0.739 - 0.992).

Table 4.4.4

Measuring the Degree of Multicollinearity

EQUATION (4.4.3)			EQUATION (4.4.4)		
R-Square	VIF_j	TOL_j	R-Square	VIF_j	TOL_j
0.2892	1.407	0.711	0.2608	1.353	0.739
0.2885	1.405	0.712	0.0083	1.008	0.992
0.0781	1.085	0.922	0.2555	1.343	0.745
0.2699	1.370	0.730			
0.2671	1.364	0.733			
0.0482	1.051	0.952			
0.0492	1.052	0.951			
0.0816	1.089	0.918			

Thus, the test results indicate that there is no problem of multicollinearity in either of the two equations.

Testing for Autoregressive Conditional Heteroscedasticity

It has been found by researchers that the ability to forecast variables in a financial time series varies considerably from one time period to another. This would suggest that there is some kind of autocorrelation in the variance of forecast errors. Engle (1982) developed the autoregressive conditional heteroscedasticity (ARCH) model. This model assumes that forecast errors depend on the behaviour of the disturbances u_t, and in turn, that there is autocorrelation in the variance of u_t. The ARCH(p) model has the test statistic $nR^2 \sim \chi^2_p$ where n = number of observations and R^2 = coefficient of determination from the auxiliary regression. nR^2 follows the chi-square distribution with df equal to the number of autoregressive terms in the auxiliary regression. The ARCH(p) test is performed on equations (4.4.3) and (4.4.4) to test for autoregressive conditional heteroscedasticity. The results are summarized in Table 4.4.5 below. The results of the ARCH(p) tests indicate that the error variance of equations (4.4.3) and (4.4.4) is not affected by autoregressive conditional heteroscedasticity. Table 4.4.5 shows that the probabilities (p-values) of obtaining the chi-square test statistics are sufficiently large in both equations. This suggests that the error variances of equations (4.4.3) and (4.4.4) are not serially correlated.

Table 4.4.5

ARCH(p) Test for Autoregressive Conditional Heteroscedasticity

EQUATION	**Test-Statistic**	**P-value**
Equation (4.4.3)		
ARCH(1)	0.423	0.55
ARCH(2)	0.417	0.80
ARCH(3)	1.470	0.73
Equation (4.4.4)		
ARCH(1)	0.003	0.94
ARCH(2)	0.070	0.96
ARCH(3)	0.101	0.99

Granger Causality Test Results and Discussion

The causality test suggests bilateral causality between real growth of exports and the growth rate of real GDP in Greenland over the period 1955-1998. The results of the Granger causality test are summarized in Table 4.4.6. The results show that the rate of growth of real exports (RX) Granger-causes the rate of growth of real GDP (RGDP) since the estimated F value at 14.55 is statistically significant at the 5% level; the critical F value is 2.16 (at 10,30 degrees of freedom). Similarly, RGDP Granger-causes RX since the estimated F value at 13.18 is statistically significant at the 5% level; the critical F value is 4.08 (at 1,40 degrees of freedom). These results would suggest that the Greenland economy has been able to spread the dynamic gains from trade to other sectors of the economy.

Table 4.4.6

Results of Granger Causality Test (Equations 4.4.3 and 4.4.4).

Direction of Causality	**F-Statistic**	**Critical Value (α=5%)**
RX $\Rightarrow$ RGDP	14.55	$F(10,30) = 2.16$
RGDP $\Rightarrow$ RX	13.18	$F(1,40) = 4.08$

The fundamental assumption underlying the staple theory is that staple exports are the leading sector of the economy. In 1998, exports accounted for 22 per cent of Greenland's GDP, and primary exports made up 93 per cent of total exports.

According to the input-output model presented earlier in this chapter, while economic linkages are very weak or non-existent in Greenland, the strength of direct backward linkages in Greenlandic fisheries are larger than those of other sectors. The direct forward linkages in fisheries, on the other hand, are weaker than those calculated for other sectors in the economy. Part of the explanation behind the generally weak linkages, as discussed previously, is that Greenland imports most of its consumer and intermediate imports, and also, it exports most of its marine resources either non-processed or semi-processed thereby loosing value added. The prevalence of weak linkages would, in theory, question Greenland's ability to reap the gains from trade in primary products. Nonetheless, despite the weak linkages, the empirical results point to a case of primary-export-led growth.

The empirical results suggest that the growth of real exports in Greenland represents a significant source of domestic income, which in turn allows for an increase in productive intermediate imports. Also, an expansion of the export sector may have led to increased efficiency caused by technical change, improved training and educational attainment and the exploitation of scale economies.

Throughout the 1980s and 1990s Greenland witnessed major restructuring and rationalization of its fishing industry which led to improvements in effectiveness and efficiency.

As outlined in chapter 3, the Home Rule government undertook a five-year development plan for the period 1985-1989, which included the modernization of the fisheries sector. Specifically, expenditures were made to increase the fishing fleet, and to modernize the fish processing plants in the towns and restore facilities in the settlements. In addition, efforts were placed on developing the coastal fisheries and diversifying the offshore fisheries. Expenditures were also made to help secure employment opportunities within fisheries and the processing sector (Poole, 1990).

The changes that took place in the 1990s entailed a restructuring of the Home Rule owned enterprise Royal Greenland to make it commercially operated, and the introduction of a system of tradable quotas and a point system to reduce the number of trawlers and phase out smaller and less efficient fishing vessels. These measures were put in place to make the industry more effective and efficient, while ensuring sustainable supplies of the fish resource.

Royal Greenland was established in 1988. Within the first few years of operation, Royal Greenland Inc. was reporting significant financial problems. The corporation maintained that a key reason behind its financial strains was the conflicting interests of being, on the one hand, a commercial enterprise and, on the other hand, being responsible for ensuring employment and production in the smaller and outlying settlements (Royal Greenland Inc., 1997). In 1990, and in response to the dilemma caused by its social obligations, Royal Greenland was restructured and established as a commercially operating stock company (Royal Greenland Inc.), with the Home Rule Government having 100 per cent ownership. In the 1990s, and with the establishment of Royal Greenland Inc., Greenland saw a significant reduction in the number and importance of privately owned processing plants. New and costly technology was needed in order to compete on an international scale, and this required large investments, which the smaller enterprises did not have. As a result, Royal Greenland Inc. was able to gain a monopoly position in the fishing industry.

However, despite the restructuring that had taken place, the 100 per cent ownership of the Home Rule Government made it difficult to avoid non-commercial interests entirely. There continued to be expectations that the corporation would fulfill certain social obligations, such as maintaining jobs and production in smaller towns and outlying settlements. In 1998, and in response to growing concerns over reconciling commercial operations and social obligations, Royal Greenland Inc. established a new corporation, Nuka Inc., which is also 100 per cent government owned. Nuka Inc. operates 26 settlement installations and two processing plants. The basis for the settlement installations is to ensure that possibilities for the local fishermen to sell their catches are available. Thus, Nuka Inc. oversees some of the social obligations that earlier had presented conflicts within the commercial operations of Royal Greenland Inc.

Along side the restructuring of Royal Greenland, the fishing industry underwent major rationalizations in the 1990s. Towards the end of the 1980s concerns were raised about the sustainability of Greenland's marine resource supply. In 1989, marine biologists had concluded that the Greenlandic fisheries suffered from overcapacity in the number of large trawlers. A system of tradable quotas was put in place in 1991, which resulted in a reduction of ocean-going trawlers from 42 in 1989 to 22 in 1994. Similarly, a point system was introduced, with the objective of phasing out the smaller and less effective boats. Also, to support the phasing-out of the surplus capacity in the trawler fleet, the government granted loans and condemnation subsidies in the early 1990s to shipping companies taking part in the capacity adjustment. The tradable quotas and the point system led to a highly rationalized fishing fleet and by the accounts, also a significantly more effective and efficient industry (e.g. Skydsbjerg (1999); Statistics Greenland (2000)). The restructuring and rationalization efforts in the 1990s may be a factor in explaining the empirical results pointing to export-led growth.

Additionally, it is possible that the centralization and concentration of both investment and population in Greenland since the 1960s, in response to economic development efforts and a need to create a pool of workers for the expanding fishing and export industry, may also have been a significant factor in explaining the primary-export-led growth. This is because the concentration of the population in major centres would have led to an expansion of the modern monetary economy. Also, it is possible that the centralization efforts combined with the high ratio of imported Danish personnel in major centres gave rise to a demonstration effect, which similarly could be linked to Greenland's economic growth record.

Turning now to the second set of empirical results, as shown in Table 4.4.6, the results indicate that RGDP Granger-causes RX. Hence, there is evidence of a feedback effect running from RGDP to RX, that is, the results show bi-directional causality. This feedback effect points to the close link between the export sector, the fishing industry, and the Home Rule government in Greenland. The export sector is to a large extent synonymous with the fishing industry, which by and large is synonymous with the Home Rule owned corporation, Royal Greenland Inc.. As the sole owner of Royal Greenland Inc., the Home Rule government finances capital expenditures and investments for the expansion of the export sector, just as it provides financial support for the operations of processing plants. In addition, Royal Greenland Inc. relies heavily on subsidies from the Home Rule government. Also, prices paid for catches sold to Royal Greenland Inc. are in principle the result of negotiations between Royal Greenland Inc. and the organizations representing cutter and trawler owners. At the same time, however, the Home Rule government may subsidize these prices, and the size of the subsidy is laid out in the government budget (the Parliamentary Finance Act).

In general, the amount of transfers received by the fishing industry, the size of investment expenditures in infrastructure to support this industry, and the size of investments in new processing facilities and the upgrading and expansion of existing ones, is determined, among other things, by the Home Rule government budget, the size of which would be linked, in part, to the growth of real GDP. Hence, the feedback effect running from real GDP to real exports can be explained by the heavy involvement of the public sector in Greenland's fishery based export industry.

4.5 Conclusion

The results of the Granger causality test suggest bi-directional causality between the real growth rate of exports and the real growth rate of GDP for the Greenland economy for the period, 1955-1998.

While a number of empirical studies find evidence in support of export-led growth, it has also frequently been alleged that a strategy of primary exports is ineffective. Using the Staple theory as a theoretical framework, this chapter tested the hypothesis of primary-export-led growth by applying the Granger causality test. The results suggested that primary exports, which currently consist exclusively of fish exports, and which make up in excess of 90 percent of total exports in Greenland, have been able to produce trickle-down effects that have been a contributing factor in the economic growth process in Greenland's post-colonial history.

Although these results point to a case of primary-export-led growth, they should, however, be viewed with some caution. More conclusive evidence on the ability of Greenland's primary export sector to fuel economic growth is contingent upon improvements in data reliability, the availability of a larger data base in the future, and further development of a more complete and accurate system of national income accounting for Greenland.

While this chapter has presented evidence in support of primary exports as a growth generating factor over the period 1955-98, a key problem for Greenland would be that of realizing long-run sustained growth. This would most likely require both resource flexibility and resource mobility as well as innovation sufficient to permit shifts into new export lines and possibly shifts into production for the domestic market, just as it would require the capacity to enter into new foreign markets. Greenland would be confronted with a number of challenges including the existing limits on resource flexibility, the ever present constraints on finding, as well as entering into new foreign markets, and the difficulties associated with a very small, and scattered population base, which presents barriers to achieving economies of scale in domestic markets.

In the following chapter, this study presents a macroeconomic time series analysis of economic dependency in Greenland. While the current chapter found evidence to suggest that, in the case of Greenland, primary exports are an engine of economic growth, in the next chapter this study tests, among other things, the relationship between economic growth and various measures of concentration in trade.

Chapter 5

Economic Dependency in Greenland, 1955 - 1998

5.0 Introduction

The purpose of this chapter is to analyse and discuss economic dependency in the Greenland economy. Specifically, this chapter defines and measures the degree of trade, financial, and technological dependency in the period 1955-1998, using annual published data.

The chapter first outlines a theoretical framework for analysing external dependence and obstacles to economic development in Greenland. Next, it presents a brief overview of the literature on the measurement of dependency. This is followed by an analysis and discussion of the degree of external dependence in Greenland. The focus is placed on the measurement of trade, financial and technological dependency, and the trends in dependency in the period under study.

5.1 Analytical Framework

This section presents an analytical perspective that will set the general framework for subsequent econometric analyses of hypotheses of selected determinants of economic growth, development, and economic instability in Greenland. The analytical framework provides the context necessary for formulating hypotheses regarding obstacles to economic development just as it provides a background for analysing the environment within which the process of economic development is taking place.

An investigation of annual social and economic indicators over the period 1955 to the present reveals the strengths and weaknesses of the development strategies employed by Denmark in relation to Greenland. Although there have been significant advances on the economic development front, strategies have failed in terms of finding permanent solutions to the problems of underdevelopment. While the standard of living in Greenland has risen since the beginning of the first comprehensive development programs of the 1950s, it is a standard of living that has been financed largely by Danish expenditures on Greenland and one that to this day is maintained largely through annual Danish transfers to Greenland.

In the literature, several theories have been advanced to explain the phenomenon of underdevelopment. Orthodox theories purporting to explain underdevelopment have tended to emphasize overpopulation, geographical and cultural factors, and various limiting factors as key causes. Development policies which flow from orthodox explanations generally emphasize measures to raise domestic savings, increase capital inflows, raise educational attainment and improve the efficiency of the market mechanism. Referring to such orthodox policy initiatives, C.Y. Thomas (1969) argued that;

> "...despite the apparent diversity of these theoretical formulations, there is indeed a common methodological unity in that they all purport to explain underdevelopment as a phenomenon *independent* of the historical process. They are therefore fundamentally anti-historical theories, explaining underdevelopment in terms of innate characteristics of peoples and their environments, or in terms of self-

perpetuating cycles of poverty. Given this line of reasoning, it follows that the economic policies and plans that have been derived and practiced on this basis are also not informed by any serious understanding of the underdevelopment process." (p. 48).

Thomas (1969) further argued that the degree of trade concentration may not be the result of size, but rather it may be historically created in countries that have been under colonial rule. He argued that "typically the features of underdevelopment have been combined in such a way that export coefficients are high, indicating that structural integration and dependence on capitalism have resulted in a very high degree of specialization of output marketed as export sales (p. 52)." He further argued that empirical analysis has given no statistical significance to the effect of size in determining trade patterns, and "the trade structures of these countries cannot be explained outside of the specific historical processes of colonialism. Size is the context, not the cause, of economic specialization. Trade ties, when measured in terms of market concentration, are above all else a reflection of which nation happened to be the dominant colonizing power vis-a-vis the country in question" (p. 54).

Amongst orthodox development theories can be found the modernization paradigm which locates the causes of underdevelopment in the deficiencies of the traditional sectors of an economy and the unsuitability of the workers it produces. At a general level, and in focusing on the problems of less-industrialized countries, modernization theory argues that the characteristics of traditional sectors represent major obstacles to be overcome if development is to proceed (Rostow, 1960, 1970). From the perspective of modernization theorists, capitalism is an engine for world development; the solution to economic "backwardness" lies in the diffusion of "superior" western technological, cultural, and social values to the "backward" areas to allow them to catch up to developed regions. In broad terms, the modernization theories divide the economy into two sectors: modern and non-modern. The basic idea is that the non-modern sector lacks certain attributes important to achieving development, among which are common impediments such as low ambitions, risk aversion strategies, family ties, and lack of entrepreneurial and industrial skills. Solutions to the underdeveloped state of the non-modern sector are sought through strategies of modernization which may focus on: industrialization; factors important to industrialization such as entrepreneurship, industrial skills and capital; and the diffusion of elements of the modern sector, such as economic, social and political institutions.

The modernization approach to development has been a key feature of Danish economic development efforts directed at Greenland in the period before Home Rule. Ørvik (1977) argued that one would assume that modernization is a widely accepted goal for a large majority of people living in the north. He argued that "any southern model would need a great deal of modification to apply to the north; but it is hard to conceive of any model for northern development that is not a modification of the southern model."

The process of modernization in Greenland, which began after the enactment of the new constitution, was planned and overseen by Denmark without much input from the population of Greenland. Not only was it paid for by the Danish state and realized by imported Danish personnel, but the Danish staff and administration introduced Danish ideas concerning economic activities and organization (e.g. Lyck (1986), Petersen (1996), Boserup (1963), Paldam (1994)).

Orthodox development strategies in general have laid the framework for much of Danish government strategies directed at achieving economic development in Greenland.

This is reflected in the overwhelming emphasis placed on achieving a higher educational attainment and the creation of business entrepreneurs.

The dominance of orthodox policy in much of early Danish economic development planning is reflected in the recommendations by the Commission on Greenland, which argued for more Danish private capital as a means of stimulating Greenlandic business development.

The modernization paradigm has not gone unchallenged. At a general level, the dependency theorists have sought to provide historical evidence to refute the modernization paradigm's main thesis of the "backward" areas being limited by a "lag" in terms of technology and modern cultural traits. According to dependency theorists, core areas (the modern sector) have only been able to develop through the direct exploitation and subjugation of peripheral areas (the traditional sector). In its more extreme version dependency theory argues that the development of the modern sector of society leads to the underdevelopment and stagnation of the traditional sector. Dependence is viewed as a conditioning situation in which the economy of the traditional sector is conditioned by the development of the modern sector. A dependent relationship exists when the traditional sector can only expand as a reflection of the growth of the dominant sector. The traditional and the modern sector do not exist independently of one another, and it is exactly the exploitative relationship between the two sectors that inevitably results in the development of the modern sector and underdevelopment of the traditional sector. The traditional sector becomes dependent upon the modern sector for economic assistance, since the modern sector drains the traditional sector of the means to its survival. Thus, in effect, while capitalism can be an engine of growth in the modern sector it tends to produce underdevelopment and poverty in the traditional sector.

Gunder Frank (1969) advanced the hypothesis that the development of subordinate countries is constrained or limited by their "satellite" status. Satellites (peripheral areas) experience their greatest economic development if and when their ties to their metropolis (core area) are weakest, and today's most underdeveloped regions are the ones which had the closest ties to the metropolis in the past.[1] Hoselitz (1960) characterized a 'satellite economy' in the following way:

> "a society which draws all its capital for development from abroad and develops only those branches of production whose output is entirely exported. If we further stipulate that all or the bulk of capital imports come from one source and that all or the bulk of exports go to one destination, we have the ideal type case of a country with a 'satellite' pattern of growth (p. 93)".

Scholars, such as Dos Santos (1970), have outlined the dependency process as follows: Less Developed Countries (LDCs) wishing to industrialize are dependent on capital imports which in turn depend on exports. Traditional export sectors therefore have to be preserved and since they have few linkage effects, this limits the growth of the internal market and conserves backward technology. The trade relations that do occur take place in international markets that tend to lower prices of raw materials and raise the prices of industrial products, particularly inputs. Because of their financial power, the dominant countries gain control over the productive resources of the dependents and extract from them in interest, profits and other payments, sums that exceed their remittances to them.

[1]The thesis of the New International Division of Labour (NIDL) suggests that NIDL creates growth without development, and dependency of the periphery increases (Froebel, Heinrich & Kreye, 1980, 1986). This theory has been criticized on the grounds that it overestimates the extent of employment relocation from developed to developing countries just as it tends to underestimate the role played by the state in mobilizing capital.

Furthermore, since modern technology emanates from the dominant centres, capital intensive production techniques are inappropriately introduced, limiting job opportunities and reinforcing unequal income distributions which in turn limit internal industrial markets. According to orthodox dependency theory, what all of this means is that developing countries are unable to solve their problems of development.[2]

The dependency perspective has been applied to the concept of internal colonialism. Internal colonialism is said to inevitably lead to distortions in local economies. The main distortions centre around external control and priorities and the emergence of a class structure within the local population.[3] Blauner (1969) identified some distortions related to external control and priorities. In his view internal colonialism takes the form of indigenous groups being subject to forced integration, excessive control by the dominant society, and subject to a policy that serves to constrain, control and destroy the culture and economy of the internal colony (Blauner in Ponting, 1986, p. 85).

Authors such as Pretes (1988) have argued that dependency theory could help shed light on the problems of northern development. In applying the Gunder Frank model of underdevelopment to the Canadian North as a satellite of Southern Canada, Pretes concluded that the entry and collapse of capitalist investment in the Canadian Arctic has led to a similar form of underdevelopment and dependency as in the Brazilian Amazon.[4] Underdevelopment and dependency in both regions are seen as the result of the collapse of economic, primarily resource extraction, booms. Similarly, Dacks (1983) noted that

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[2]Dependency theory has been subject to much criticism. Stein (1979) argued that, while the dependency concept lacks general applicability, it is a paradigm that could provide a broad framework in which to view obstacles facing certain countries in certain times and situations.

[3]Petersen (1996) has argued that within Greenland a situation of internal colonialism is also developing, where settlement communities feel they are in a situation reminiscent of internal colonialism.

northern development in Canada only takes place "when the South needs something the North possesses". Resources are extracted, with little of the revenue remaining within the North. According to Dacks, the trend towards foreign control of resource industries has further removed potential rents from the North. While resource revenues are lost to the South, much of the food and other necessities of life must be imported from outside the region at great cost. It is further argued that the forms of underdevelopment seen today would not have taken place had the metropolis-satellite ties not strengthened, leading to the dominance of the capitalist economy over the traditional. In a similar vein, in applying the dependency model to the case of Aboriginal communities in Canada, Frideres (1988) argued that dependency theory helps to overcome the long-accepted proposition that Canadian aboriginals are in the condition they are in because of some inherent fault in their cultural ideals and institutional arrangements.[5]

The literature has tended to present the modernization and dependency paradigms as two opposing theoretical approaches to development theory. In the more recent literature, however, different scholars have suggested a new approach, which incorporates both paradigms. In this approach the two paradigms complement rather than oppose each other. The new comparative political economy[6] has examined economic development within a framework, which recognizes that political and economic issues should not be separated in analytical work. Also, it recognizes that international factors play a role in economic

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[4]The dependency relationship between the Arctic and southern Canada as explained here would fall within the framework of internal colonialism as outlined by Blauner (1969).
[5]Similarly, Haddad et al. (1992), analyzed dependency and modernization on a reserve in Canada where a community encouraged investment by a multinational corporation in an attempt to eliminate poverty and underdevelopment. It is argued that development has followed modernization principles similar to those undertaken in many less developed countries. Haddad et al. argued that while such investment creates jobs it also leads to economic exploitation and dependency.
[6]Evans and Stephen (1988).

development but that they are not necessarily determinative of the dynamics of domestic development. And it argues that attention to historical sequences is fundamental to the understanding of developmental paths, social dynamics and the transformation of cultures and sociopolitical structures (Schmidt, 1998).[7] Schmidt (1998) proposes a new theory to test "whether development strategies in the Arctic have been largely state-led and are comparable with the development experiences of their originating Master countries...or whether these states remain vulnerable dependent on factors largely beyond their control - for instance capital, technology transfer, original equipment manufacture and in general decisions taken outside the sphere of influence of domestic policy makers" (pp. 3-4). Schmidt takes the new comparative political economy as his point of departure and argues for the importance of the inter-linkages between internal and external factors in explaining why some states succeed in the long run and others fail in their development paths (Ibid.).[8]

Similarly, the present study recognizes the importance of internal as well as external factors in explaining the economic development paths of Greenland. It also recognizes that economic dependency in Greenland has undergone changes throughout history, and that international factors are not a priori determinative of economic development. In so doing

[7]Similarly, C.Y. Thomas (1969) recognized the importance of the historical process. In studying the case of Carribean economies C.Y. Thomas has argued that, the divergence between domestic demand and the needs of society has been historically created, and "tendencies toward this initially developed also in the larger colonial areas, but by and large this process has not developed to the same extreme...There were no internal imperatives in terms of market size (in smaller economies) to justify the capitalist development of indigenous production for the local market. Integration into capitalism was therefore so complete that the perspective for profitable opportunities in production, which precluded all other opportunities, was that of the capitalist of the center countries.... flag independence has not been sufficient to alter decisively these basic features of the economic situation."

[8]Schmidt (1998) quotes the words of Smelser (1968): "Social change is best analysed as a complicated sequence of different kinds of equilibrium processes; whether one type or another predominates depends on the phase in the social-change sequence under consideration and on the interaction of variables in each phase."

this study leans towards an application of the general framework employed by the new comparative political economy approach to economic development.

The primary focus of this study is on those domestic consequences of dependency that originates in dependence on external markets, finance and technology. In the following section the degree of external dependence will be examined with attention to specific indicators.

5.2 Measuring Dependency

In general terms economic dependency reflects a situation where economic growth is dependent upon external factors. More specifically, it refers to a situation where the growth of income of a country is substantially, if not entirely, dependent on external factors, essentially exports, imports and external finance and technology.[9] Thomas (1969) and Brewster (1971), argued that economic dependency reflects a situation where a wide and growing disparity exists between the structure of domestic demand and the structure of domestic resource-use, and

> "the crucial elements of the functioning of an economic system....are of such a character and are organized in such a way that these communities have internalized through their social relations of production and the use of their productive forces, a pattern of

[9]According to Thomas (1969), the dynamics of the process of underdevelopment is centered on the "productive relations which give rise to the divergence of the pattern of domestic resource use, domestic demand, and the needs of the broad mass of the community, ...material development can be interpreted, in the most basic and fundamental way, as the initiation of economic processes which overcome this divergent pattern of needs, domestic production, and domestic consumption" (p. 123).

> consumption that does not represent the needs of the community and a pattern of production not oriented to either domestic consumption or domestic needs (Brewster (1971) p. 59)."

A situation of economic dependency may be categorized as either structural or functional in nature. As defined by McIntyre (1970), structural dependence arises because of the size and structure of an economy and cannot be helped, while functional dependence arises because of particular policies chosen, and therefore can be avoided if alternative policies are pursued. Both types of dependence may exist simultaneously.

At the same time, and as argued by Dos Santos (1970), a distinction should be made between vulnerability and dependence. In more advanced countries a high degree of flexibility and economic diversification permits an economy to minimize the adverse effects of external shocks and disturbances through the utilization of domestic or foreign substitutes. In contrast to advanced countries, open and overspecialized developing countries can be categorized as dependent whenever they lack resource mobility, the ability to develop substitutes and the ability to cope with external shocks to the economy.

The literature on dependency theories includes several attempts at identifying and testing criteria for economic dependency. For instance, Green (1970) outlined ten different criteria for identifying dependency: (1) A high ratio of exports to GDP and a high ratio of a limited number of unprocessed primary products to total exports; (2) A high ratio of imports to GDP and a high ratio of imported manufactures to total supply; (3) Capital imports representing a high proportion of gross fixed capital formation; (4) Concentration of foreign trade; (5) Concentration of foreign investment by source and concentration of foreign investment in the export sector and secondary activities relating to it rather than in development of a more integrated national economic structure; (6) Small internal markets which render a shift in the patterns of production, designed to reduce dependence, both costly and difficult; (7) Inadequate public sector revenues and domestic savings which hamper financing any investment not of interest to foreign capital sources; (8) Limited technical and managerial capacity, necessitating importation of foreign personnel; (9) A low ratio of official reserves to imports; (10) And a high share of foreign ownership of key sectors.

Stallings (1972), like Green (1970), analysed economic dependence and suggested three measures to define aspects of such dependence, namely: the percentage of total official bilateral aid coming from the major donor country; the percentage of exports going to the most important trading partner; and the three leading commodity exports as a percentage of total exports.

McGowan (1976) took Stallings' measures of dependence and applied them to the case of Africa to analyse their correlation with selected indicators of economic performance. Theory predicts that dependence is negatively associated with indicators of economic growth and development. McGowan, however, found no statistical support for the dependency theory. His overall conclusion was that the dependency theory as applied to the case of Africa in the middle 1960s has failed. Given the general statistical insignificance of selected explanatory variables, and the poor performance of the modeling in general, McGowan concluded that one fundamental problem with the testing procedure was that it employed a static approach to test a dynamic theory.

The dependency theory has also been tested by Cheng-Chung Lai (1991), who looked at the applicability of the theory to the case of Taiwan. Cheng-Chung Lai defined a dependent economy as an open developing country that depends largely on the market, technology and capital of industrialized countries (p. 39). In his study, economic dependence was measured by the ratio of foreign investment to gross domestic capital formation, technological dependence was measured by the share of imported capital goods in total imports, and trade dependence was measured by the export and import coefficients. The study suggested that Taiwan has experienced increased economic growth fostered by increased dependence. Hence, he concluded that the 'dependence-stagnation pessimism' does not hold in the case of Asian LDCs. Rather, and as emphasized by Arthur Lewis (1980), foreign trade may be an engine of growth in many LDCs.

Similarly, Kaufman et al. (1975), presented a preliminary test of dependency theory based on a statistical comparison of seventeen Latin American countries. While their findings indicated some support for dependency theory they were not able to arrive at definitive conclusions. They concluded that "...perhaps as a complement, rather than an alternative to more "conventional" theories of development - the concept of dependency may indeed be useful in diagnosis and understanding of these problems (i.e. problems of development)" (p. 330). They also argued, as authors before them, that;

> "...theoretically, the condition of dependency and the alleged results of that condition should both be considered as aspects of an unfolding, historical process, the full dimensions of which should be measured longitudinally as well as synchronically."(Ibid.).

Thus, while much of the literature has tended to view modernization and dependency as opposing theoretical approaches to development theory, many attempts, especially in more recent times, have been focused on finding ways of reconciling these paradigms within frameworks in which they complement rather than oppose each other.

Much of the critique surrounding the empirical analysis of dependency has been related to the methodology used. The majority of studies on external dependency have employed cross-sectional analysis applied to either a specific year, or a period of a few years. Hence, the degree of dependence will depend upon the year chosen for analysis, and therefore, using indicators, such as those proposed by Green (1970) could lead to questionable results. For instance, according to Stein (1979), criteria such as these are inadequate and unsatisfactory. Stein argued that; first, a concentration of foreign investment by source and a concentration of foreign investment in the export sector can also be found in some advanced countries; second, inadequate public sector revenues and low domestic savings are simply characteristics of less developed economies; third, a prolonged export boom could alter a situation of inadequate public sector revenues and low domestic savings, and hence alter the situation of dependence as measured by these indicators; and fourth, even without an export boom government policies could raise domestic ownership through nationalization of key industries, and raise public sector revenues through royalty taxation (p. 78). The shortcomings outlined by Stein (1979) can, to a large extent, be overcome by distinguishing between dependence and vulnerability. In contrast to dependent countries, advanced countries should be categorized as vulnerable since they have the flexibility to minimize the effects of external shocks to their domestic economies (Dos Santos, 1970). In addition, many of the concerns raised by critics of dependency criteria such as these outlined above can be dealt with by analysing dependency within a time-series framework.

Shortcomings were recognized by Green (1970) himself, who argued that short-term increases in certain indices of concentrated dependence may not be adequate evidence either of an unsound economic strategy or of the absence of longer-term planning toward reducing economic dependence. Rather, the study of a particular economy requires careful examination of causal relationships and implications for future trends (p. 292).

The following section presents an analysis of the degree of economic dependence in Greenland followed by an analysis of the association between indicators of dependency and economic growth. The focus of the analysis is confined to selected indicators of trade, financial, and technological dependence. The analysis is placed within a time-series context, extending from the end of colonial rule to the present, which permits the analysis to capture the condition of dependency as it has unfolded within the historical process. This helps avoid the shortcomings that arise when dependency is analysed in cross-sectional frameworks. Second, the framework for analysis is the relationship between a territorial self-government and a former colonial government.

Some of the dependency indicators used in this study bear resemblance to those advanced by Green (1970). However, since the present study places the analysis within a time series context, the study captures dependency as it unfolds through time, and in so doing, it avoids the main shortcomings of the dependency criteria advanced by authors such as Green. Green analysed dependency in a cross-sectional framework for a specific year, which is problematic because it ignores changes in dependency from year to year, and hence the degree of dependency would depend on the year chosen. Additionally, economic instability in Greenland and the inability to respond effectively to external shocks and disturbances are among some of the factors that sets Greenland apart from more advanced economies. In advanced economies "dependency" may be described more appropriately as "vulnerability". Chapters 7 and 8 analyse structural change and economic instability in Greenland.

5.3 A Case of External Dependency in Greenland

External dependency in Greenland is characterized by significant trade, financial and technological ties to Denmark. Economic structures of dependent economies do tend to be characterized by a number of distinct features, which are also present to varying degrees in Greenland. First, the relationships between different sectors of the economy tend to be few and limited. Only a very small fraction of production serves as inputs into other sectors of the domestic economy. The economy of Greenland is characterized by very weak linkage effects. The input-output model of this economy highlights these weaknesses (See chapter 4). Second, resource use in dependent economies tends to be less flexible than in the case of more developed economies. There are significant constraints on the ability of product-mix to adapt to the effects of external shocks.[10] And as noted earlier, Dos Santos (1970) emphasized that the distinction between vulnerability of advanced countries and dependency of developing countries lies in the ability to respond effectively to shocks and disturbances. Greenland continues to be constrained not only by a lack of resources but also by a lack of flexibility in existing resources. The significant resource constraints witnessed in Greenland are reflected, among other things, in the level of dependence on imported personnel, the degree of financial dependence, and the high trade concentration. Third, economic growth is highly dependent upon external factors. External demand changes in dependent economies are central to making full use of productive capacity and to justifying and financing large-scale investment to expand capacity. In the case of Greenland, investment expenditures on domestic productive activity continue to be domestically unsustainable in the sense that Greenland is heavily dependent upon the import of intermediate products and capital equipment, just as it continues to rely on imported Danish personnel. Fourth, in dependent economies there exists a significant disparity between the structure of domestic demand and domestic resource-use. This is reflected in very high export and import coefficients, a high concentration in commodity exports, and a low concentration in commodity imports. As will be shown in the following, Greenland is characterized by high export and import coefficients, and a high concentration in export trade. Additionally, Greenland continues to import the majority of its consumer goods, which explains the low commodity concentration of imports. And fifth, domestic institutions tend to be directed and controlled to a significant degree by the external environment. The Greenland economy is based on a set of institutions that to a significant degree have been not only designed by Denmark, but up until recently also directed and controlled by Denmark. As discussed in chapter two, the current situation is one of significant political autonomy but incomplete economic autonomy. While Greenland has to a large extent gained control over its institutions with the introduction of Home Rule, the block grant arrangement limits economic autonomy. In addition, a significant share of administrative positions continue to be staffed by Danish imported personnel which subsequently has the effect of limiting Greenlandic decision-making and control despite Home Rule (Larsen, 1993).

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[10]Chapter 8 analyses the existence of economic instability in Greenland, its causes and consequences.

Thus, according to this preliminary overview of some key features, Greenland shares some traits that in the literature have been associated with dependent economies.

In the following, this study measures and analyses the degree of external dependence in Greenland and the trends of that dependence in the period 1955-1998. The focus of the analysis is specifically on trade, financial, and technological dependency. Data availability limited the range of variables that could be defined and measured for this exercise. Fortunately, however, it was possible to obtain data series on some of the most distinct features of the dependency ties to Denmark. While the analysis draws on conventional measures of dependence, the indicators are defined and adjusted to reflect the unique framework within which dependence in Greenland has been unfolding.

Greenland's Trade Dependency

The Greenland economy is small, open and highly dependent on external trade. The level of trade dependence is reflected in a high ratio of international trade to gross domestic product, and in high commodity and geographic concentrations in export trade with a parallel low concentration in import trade. Dependence on trade in small countries has been analysed extensively in the literature. Among common explanations have been that if small countries are to realize the advantages of specialization and economies of scale, both indispensable prerequisites to a higher per-capita economic performance, they must rely more heavily on foreign trade than larger countries. Also, resources in a small country are likely to be highly skewed, while the composition of domestic demand for goods and services is more diversified. Hence, most small countries must of necessity exchange the products of their few specialized resources against a great variety of imported goods (Demas, 1965). While such explanations are useful as a first step in beginning to understand the causes of trade dependence in small economies, in the case of Greenland trade dependence must also, for a more comprehensive analysis, be explained within the context of colonial and post-colonial history. This, however, is beyond the scope of this study.

As shown in Table 5.3.1, the Greenland economy has experienced a noticeable increase in the values of real exports and imports in the period between 1955 and 1998. Real exports grew by 242 percent, from DKK 241.8 mill in 1955 to DKK 825.7 mill in 1998. Similarly, the value of real imports increased by 153 percent, from DKK 508.2 mill in 1955 to DKK 1,285.9 mill in 1998. The trade balance has experienced significant fluctuations since the 1950s, and extensive trade deficits have been recorded throughout most of the period. In 1998, the real trade deficit stood at minus DKK 460.2 mill.

Table 5.3.1 also depicts Greenland's large but declining trade coefficients. The country has a high ratio of exports to GDP, but it has been declining over the period under study. In addition, the ratio has fluctuated in the period since 1950, reflecting, in part, swings in the total volume of fish catches and fluctuations in the world price of fish. The export coefficient fell from 64.1 percent in 1955 to a low of 16.5 percent in 1970. This was followed by an increase to 50.5 percent by 1980, and a subsequent decline since Home Rule. It stood at 22 percent in 1998.

Table 5.3.1

Greenland's International Trade, 1955-1998

	1955	1960	1970	1980	1990	1998
Real Exports (1981=100)	241,766	317,065	295,662	1,378,507	1,502,522	825,728
Real Imports (1981=100)	508,156	584,500	1,116,335	2,123,997	1,481,548	1,285,922
Trade Balance (1981=100)	-266,390	-267,435	-820,673	-745,490	20,974	-460,194
Export to GDP ratio	64.1	53.6	16.5	50.5	44.3	22.1
Import to GDP ratio	134.8	98.8	62.2	77.8	43.7	34.4
Ratio of exports plus imports to GDP	198.9	152.4	78.7	128.3	88	56.4

Source: Statistics Greenland publications, various years.

This can be compared to Iceland and the Faroe Islands, which provide useful comparisons because, like Greenland, they are highly export oriented with a heavy concentration in the export of fish. The ratio of exports to GDP in the Faroe Islands stood at 42.0 percent in 1998. Similarly, this ratio was 34.9 percent in 1998 in Iceland. Thus, after falling steadily Greenland's export coefficient is currently below that of Iceland and the Faroe Islands. The decline in trade dependence, as reflected in the export coefficient, is the result of progress on the economic development front and the associated change in the relative size of the contributions of sectors to GDP. While the share of exports in GDP has declined the share of public sector has increased significantly.

The Greenland economy is also characterized by a very high ratio of imports to GDP. In the early period, imports made up about 135 percent of GDP (1955). They have fallen in the period in question, but remain high. Since Home Rule the ratio has fallen from 78 percent to a low of just under 35 percent by 1998. The high import coefficient reflects a lack of manufacturing in the Greenland economy. In comparison the Faroe Islands and

Iceland also have high ratios of imports to GDP, at 37.3 percent and 39.2 percent respectively in 1998. For Denmark this ratio was lower at rates of 29.7 percent in 1980 and 26.3 percent in 1998. The relatively high export coefficients and import coefficients seen in Greenland are, as mentioned earlier, indicators of the high level of trade dependence of that country.

Greenland is also characterized by high commodity and geographic export concentrations; a low commodity import concentration and high geographic import concentration; a large Danish share in the country's imports and exports; and a very significant share of fish exports in total exports.

In the present study the degree of commodity and geographic concentration in trade is measured using the Hirschman-Gini coefficient of concentration. This coefficient of concentration is calculated as follows: If there are *n* export goods, the annual value of exports of any good *i* is x_i , and the annual value of total exports is X, the coefficient of concentration of exports will be

$$\sqrt{\sum_{1}^{n}\left(\frac{x_i}{X}\right)^2} \qquad (5.3.1)$$

The range of this coefficient is from 0 to 100, with a maximum value of 100 denoting that all export revenue originates from the export of just one commodity, and a value of zero denoting an infinite number of export commodities.

For the purpose of this study the three-digit SITC classification code was chosen for the calculation of export concentration over the period 1950 -1998.[11] A code with more digits would record commodities that are very close in consumption or production as separate items, and exports that are similar would appear as heterogeneous, and in turn trade would appear less concentrated than it actually is. Export concentration was adjusted for re-export by subtracting SITC classification 7 from export figures. In addition, the export commodity classified as "other" was not included in the calculation; including this category would put an upward bias on the index.

As shown in Table 5.3.2, Greenland's commodity concentration of exports is currently at an index value of 50.0 as measured by the 3-digit SITC categories. This can be compared to 1980 when the index was at a low of 41.4.

Michaely (1958) calculated the commodity concentration of exports, using the 3-digit SITC code, for 44 countries. He suggested the following possible explanations for variations in export concentration (from 16.9 to 98.8) across countries: First, it is possible that the more developed an economy is, the more diversified are its exports since a higher degree of economic development may be associated with a more varied production. Second, and related to point one, the more industrialized an economy is (i.e. the lower the share of primary production in GDP) the more diversified are its exports. Third, the greater is the geographical proximity of a country to centres of world trade, the more diversified are its exports, since the less important the transportation costs the larger is the number of goods which a country can export.

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[11]The SITC classification changed from three digit to four digit in the 1970s which necessitated a careful

Table 5.3.2

Greenland's Trade Concentration, 1955-1998

SELECTED YEARS	1950	1955	1960	1970	1975	1980	1990	1995	1998
Export Commodity Concentration Index	N/A	63.0	44.1	50.9	53.2	41.4	52.6	58.0	50.0
Import Commodity Concentration Index	N/A	24.1	22.0	21.8	26.2	24.5	22.9	25.1	22.9
Geographic Export Concentration Index	N/A	69.3	51.7	82.3	47.4	60.2	80.0	88.3	85.0
Geographic Import Concentration Index	N/A	83.1	89.6	94.0	89.2	75.5	66.6	76.1	71.4
Fish Share in Total Exports (%)	17.3	39.3	38.8	79.0	40.1	64.1	83.4	92.9	92.9
Cryolite Share in Total Exports (%)	75.2	55.6	31.6	6.9	1.71	0.9	0.0	0.0	0.0
Lead Share in Total Exports (%)	0.0	0.003	12.0	0.0	7.3	12.0	2.4	0.0	0.0
Zinc Share in Total Exports (%)	0.0	0.0	9.9	0.0	46.7	18.2	10.6	0.0	0.0
Danish Share in Total Exports (%)	N/A	67.4	46.5	81.2	38.1	49.4	79.2	88.0	83.1
Danish Share in Total Imports (%)	N/A	82.6	89.7	93.9	88.9	75.0	65.2	75.4	70.5

Source: Statistics Greenland publications on international trade, various years.
Trade concentration was calculated by using the Hirschman-Gini coefficient of concentration. Commodity export concentration was measured using a 3-digit SITC code. Commodity import concentration was measured using a two-digit SITC code.

And fourth, a more varied production is possible the larger a country is. The argument here is that the larger a country the more varied presumably are its natural and human resources as well as its climatic regions and, as argued by Michaely, one may speculate that the more varied will be production and the more diversified will be exports (pp. 728-29). Kuznets (1958) had, similarly, emphasized the positive relationship between country size and export diversification. Michaely found that among the 44 countries under study the average coefficient of commodity concentration of exports is greater for smaller

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conversion of trade figures into the three digit classification.

countries (41.5) than for larger ones (40.7), and greater for underdeveloped countries (53.7) than developed ones (31.2) (p. 729).[12]

Greenland's commodity concentration of exports was 44.1 in 1960, around the time of Michaely's study. The concentration index has fluctuated over time and is currently at a value of 50. As in the case of Greenland, the concentration of exports in the Faroe Islands is likewise very high, and reached 45.7 in 1980 and 42.9 in 1995.

Possible explanations of the high export concentration in Greenland may be found in conventional theory (e.g. see Michaely, 1958): First, Greenland has a relatively low variation in production which is associated in part with the relatively low level of economic development; second, and related to the first point, the country has a low level of industrialization; third, there is a lack geographical proximity to centres of world trade, and this imposes high transportation costs which tends to limit the number of goods which can be exported; and fourth, due to its very small size, Greenland is confronted with constraints related to a limited variation in the supply of human and natural resources. All of these factors may have played a role in limiting the degree of export diversification in Greenland.

The high export concentration in trade is the result of the high share of fish products in Greenland's total exports. This share has risen from about 17.3 percent in 1950 to an all

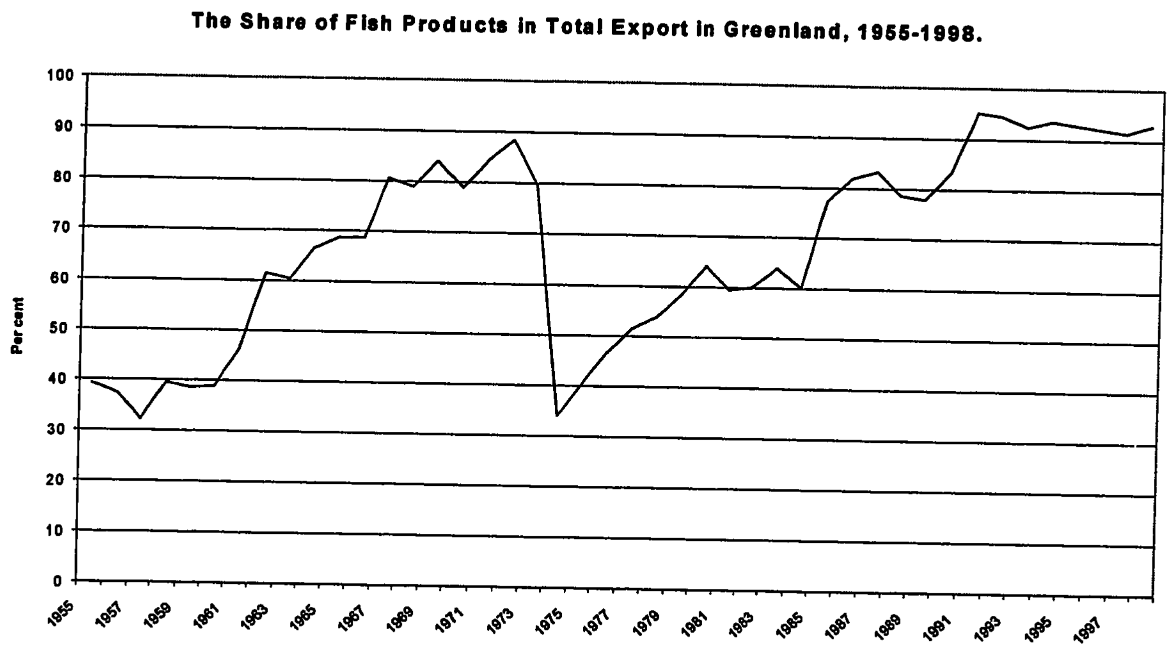
[12]According to Keesing et al. (1971) densely populated countries are expected to demonstrate a systematic comparative advantage in manufactures as against primary products. The chief reason is that land area per head should be positively (and its inverse, population density, negatively) highly correlated with the combined availability of mineral wealth, arable land, and other economically useful endowments from nature. Hence, densely populated countries could be expected to specialize in manufactures, and lightly populated countries in primary products. A second reason is that countries with dense populations might be expected, as a matter of statistical likelihood, to enjoy advantages in manufacturing compared to lightly settled countries in terms of costs (and access to) transportation, communications, distribution systems, and the like.

time high of almost 93 percent in 1998.[13] A key factor explaining this very significant increase has been the end to mineral exports in Greenland with the closure of two key mines in the early 1990s. The Faroe Islands likewise have a very high share of fish in total exports, which stood at 95.9 per cent in 1998. In the case of Iceland, the share of fish in total exports was at 72.6 per cent in 1998. This share has been relatively constant since the 1980s.

Greenland's commodity export concentration is at 50.0 despite the 93 percent share of fish exports in total exports. This significant discrepancy in the size of the two measures is the result of the concentration index being based on the 3-digit SITC classification. As touched upon earlier, a 3-digit classification code allows different types of fish and fish products to enter separately in the calculation of the concentration index. The more digits an index is based on the lower the concentration ratio will be. In the case of Greenland, if the concentration ratio was measured using a one-digit SITC classification code the size of this coefficient would approximate the value of the share of fish exports in total export proceeds. Figure 5.3.1 shows the trend in the share of fish exports in total exports since 1950.

[13]The ratio of fish exports to total exports is very high and has been increasing since Home Rule. The larger share of Greenland's key export trade takes place in unprocessed or semi-processed form. Only about a third of Greenland's marine exports is processed before being exported, i.e. canned or preserved in some form. About two-thirds of the fish exports is unprocessed, and presently about only 2% of marine exports is semi-processed, i.e. salted, dried, or smoked. Because of the high share of unprocessed and semi-processed fish exports, Greenland is not maximizing potential multiplier and linkage effects, and therefore is foregoing an opportunity to generate additional income and employment domestically. While the share of semi-processed fish exports has fallen over the period under study, the share of unprocessed fish exports has risen from 16% in 1955 to 64% in 1995.

Figure 5.3.1



Source: Statistics Greenland Publications, annual.

It depicts the general increase in this ratio over time, except for the significant one-time drop in the early 1970s. The major upswings and downswings shown in Figure 5.3.1 are explained by changes to the share of mineral exports in total exports (See chapter 4, Table 4.2.1).

The primary export ratio has fluctuated significantly over time. In this study the primary export ratio has been measured as the ratio of fish, cryolite, lead and zinc exports to total exports. The primary export ratio has fluctuated in the range between 97 to 86 per cent in the period 1955 – 1998 (See Figure 4.2.1 of chapter 4).

In later years, and with the closure of one large mine in 1984 and two key mines in the early 1990s, the primary export ratio has increasingly become synonymous with the share of fish exports in total exports. The primary export ratio and the fish export ratio both stood at approximately 93 percent as of 1998.[14]

Commodity concentration of imports, in contrast to export concentration, has remained low and stood at approximately 24.5 and 23 in 1980 and 1998 respectively. A three-digit SITC classification code was not available from Statistics Greenland and therefore a two-digit SITC classification code was used for measuring this Hirschman-Gini coefficient of concentration. A three-digit code would have produced a significantly lower concentration ratio. The commodity concentration of imports in 1980 in the Faroe Islands was approximately 25.5 (2-digit classification code), which is similar to that of Greenland for that year.

Michaely's study (1958) suggested, contrary to expectation, that a positive correlation exists between concentration of exports and imports, although as he noted, there are many exceptions to this rule (p. 730). One of the key explanations given by Michaely is that less developed countries tend to have higher concentrations of exports, and at the same time, a low level of development (i.e. per capita income) which implies not only a lower level of consumption per capita, but also a less varied consumption. In the case of Greenland, however, the SITC classification for annual import statistics shows that Greenland's imports have remained relatively steady with respect to the degree of

[14] The non-primary exports fall in the category of "other" in the export statistics. Additional, they include commodities such as clothing articles, postal stationary, postage stamp, printed books, brochures etc., electronics, and ornaments.

variation.[15] This may be explained in part by the following: first, the high ratio of Danes to Greenlanders, in particular during the period of G-50 and G-60, may have caused a demonstration effect which may have been reflected in the composition of imports; second, the gap between absorption and domestic production in Greenland is financed by annual transfers from Denmark, which allows the country to maintain a relatively high standard of living despite the relatively underdeveloped state of the domestic economy; and third, the relatively low concentration of imports reflects the lack of economic diversification in the Greenland economy.

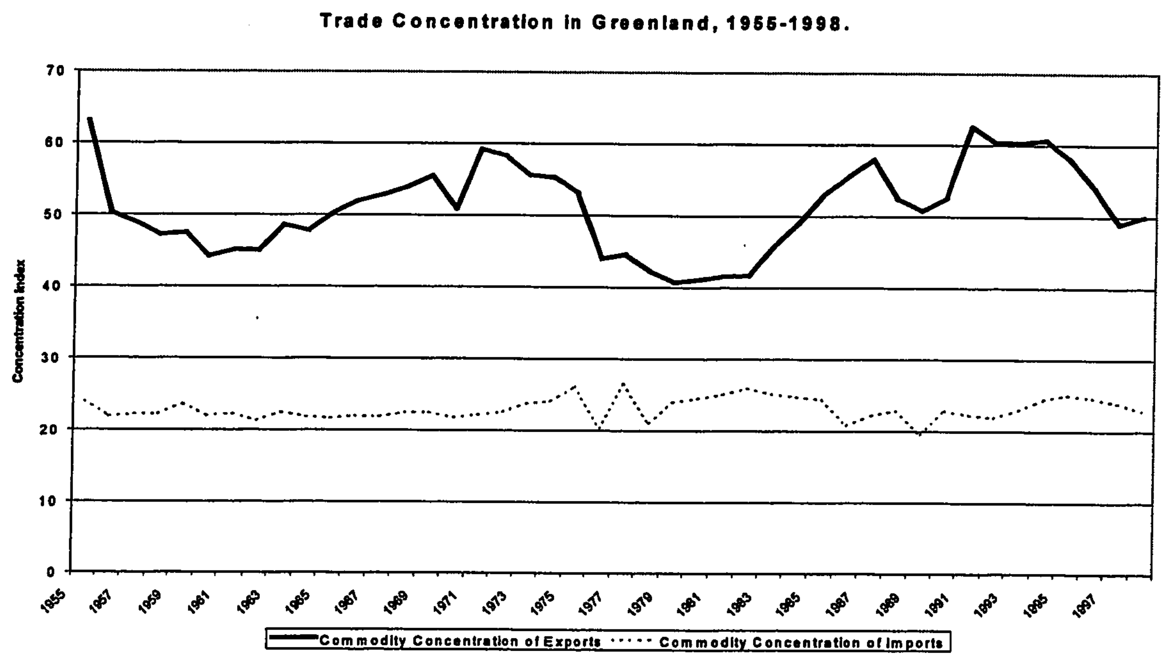
Figure 5.3.2 depicts the trend of commodity concentrations of exports and imports in the period 1955-1998. While the indices of commodity export and import concentrations are not directly comparable, since two different SITC categories have been used for computation, one may still conclude from the two indices that imports are less concentrated. A 3-digit SITC classification would yield an even lower commodity concentration of imports.

Contrary to Michaely's (1958) findings, in the case of Greenland a positive correlation does not exist between the concentrations of exports and imports in the period 1950-1998. The correlation coefficient between commodity concentration of exports and commodity concentration of imports has a value of –0.0757. Trade is characterized by a high commodity concentration of exports coupled with a low and relatively stable coefficient of import concentration. This pattern of trade concentration describes a key

[15]It is beyond the scope of the present study to test hypotheses regarding the causes of concentration and the possible correlation between different indices.

development problem in Greenland: a limited variation in domestic production with production geared primarily to external markets, paralleled with a significant import trade consisting of a wide range of imports which makes up the majority of consumer and intermediate goods.

Figure 5.3.2

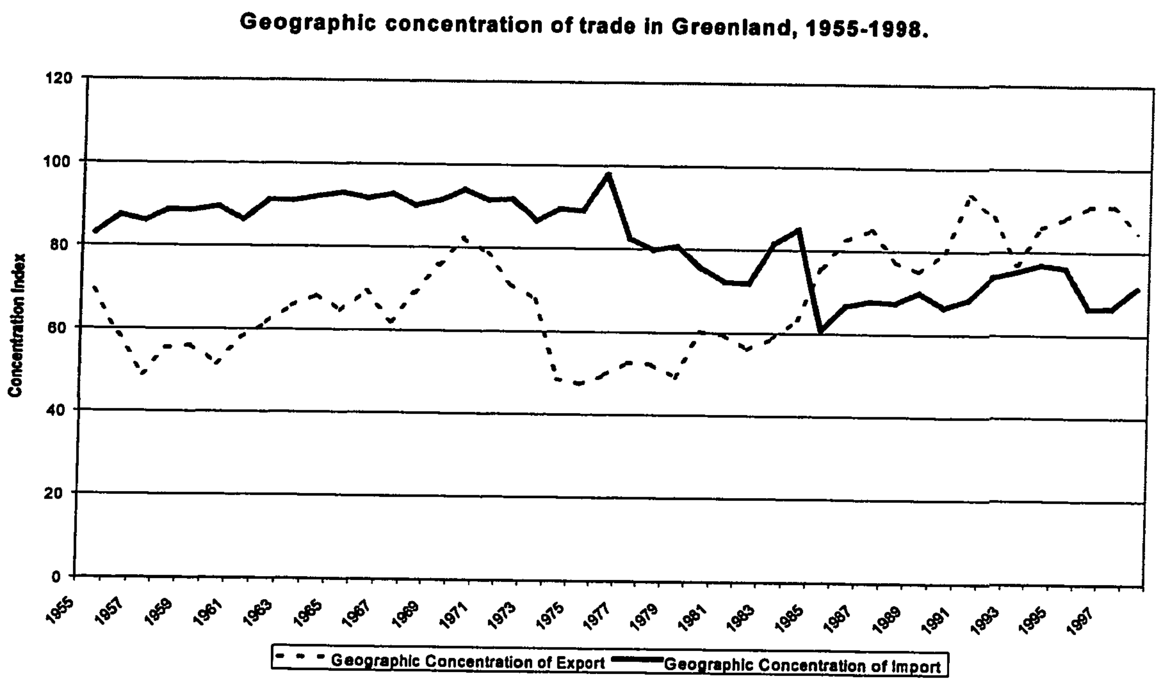


Source: Statistics Greenland Publications, annual.

Greenland's trade is also characterized by a very high geographic concentration in trade. Figure 5.3.3 shows the geographic concentrations in import and export trade over the period 1955 to 1998. In 1998, geographic concentration of exports and imports, as measured by the Hirschman-Gini coefficient, stood at 85 and 71.4 respectively. Greenland trades predominantly with Denmark, which accounts for this high level of concentration.

Hirschman (1945) calculated the coefficients of geographic concentration of trade of 45 countries, for the period 1913-38, and made two key conclusions: First, exports tend to be more geographically concentrated than imports; and second, the geographic concentration of exports is stronger, the stronger the commodity concentration of exports.

Figure 5.3.3



Source: Statistics Greenland Publications, annual.

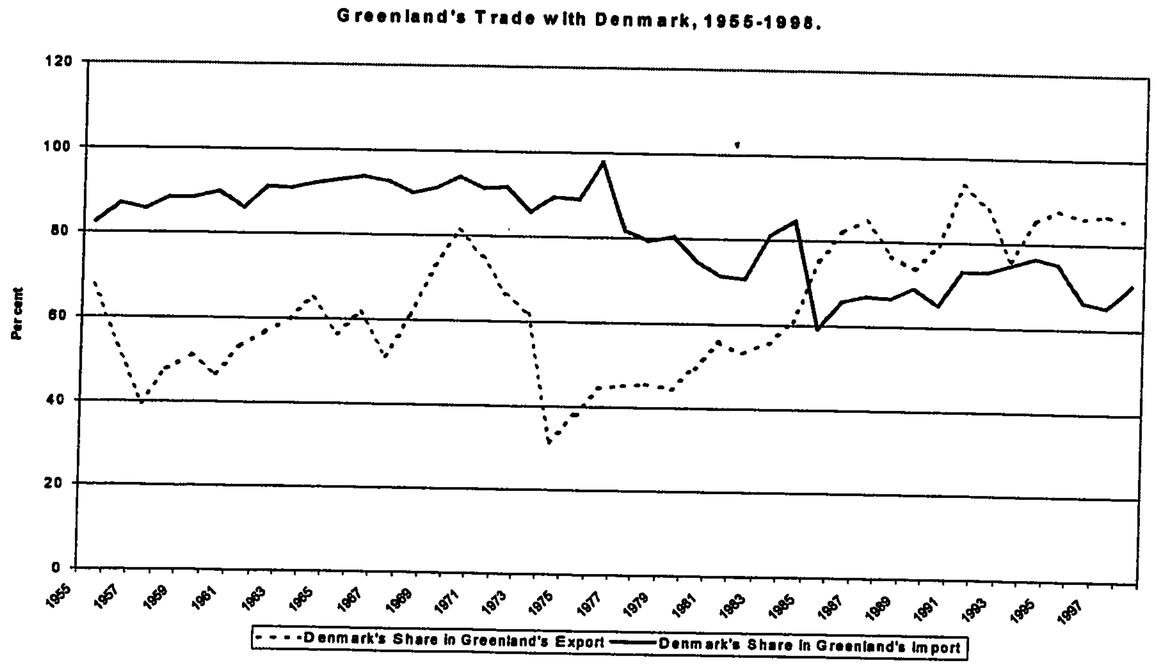
Michaely (1958), on the other hand, in his study of 44 countries, concluded that although exports tend to be somewhat more geographically concentrated than imports, the difference is relatively insignificant. Michaely's study did however support Hirschman's findings that the higher the commodity concentration of exports, the stronger is their geographic concentration (pp. 733-34). He calculated the coefficient of geographic concentration in trade for 44 countries for the year 1954 and found that it ranged from 18.7 (United Kingdom) to 95.5 (Panama).

The geographic import concentration of trade ranged from 19.4 (United Kingdom) to 81.2 (Mexico). For the same year he found the Danish geographic concentration in exports and imports to be 41.8 and 37 respectively (p. 732).

The present study has calculated Greenland's geographic concentration in exports and imports for 1955 to be 69.3 and 83.1 respectively. Thus geographic concentration of trade, as could be expected, was considerably higher in Greenland than in the former colonial power around the time of G-50. Greenland's geographic concentration in trade in 1955 lies at the extremes of Michaely's tabulations.

Moreover, the geographic export concentration has intensified over the period under study and was at a high of 85 in 1998. The geographic import concentration peaked in the years leading up to Home Rule reflecting the very intense development program of G-60. Around 1970, Greenland imported almost exclusively from Denmark. Since Home Rule geographic import concentration has fallen, but it is once again on the rise, and stood at 71.4 in 1998.

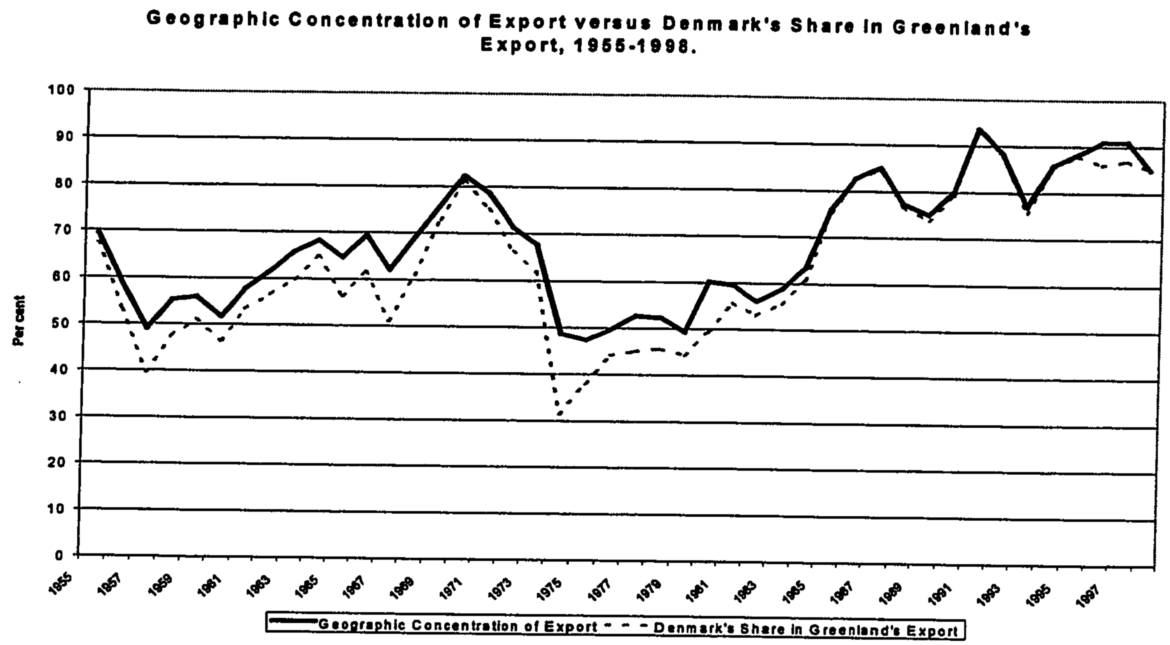
Figure 5.3.4



Source: Statistics Greenland Publications, annual.

As noted above, Denmark's share in Greenland's exports and its share in imports accounts for the high geographic concentrations witnessed in both export and import trade. Figure 5.3.4 depicts the general downward trend in Denmark's share in Greenland's imports since the 1970s, and the almost parallel increase in Denmark's share in Greenland's exports over the same period.

Figure 5.3.5

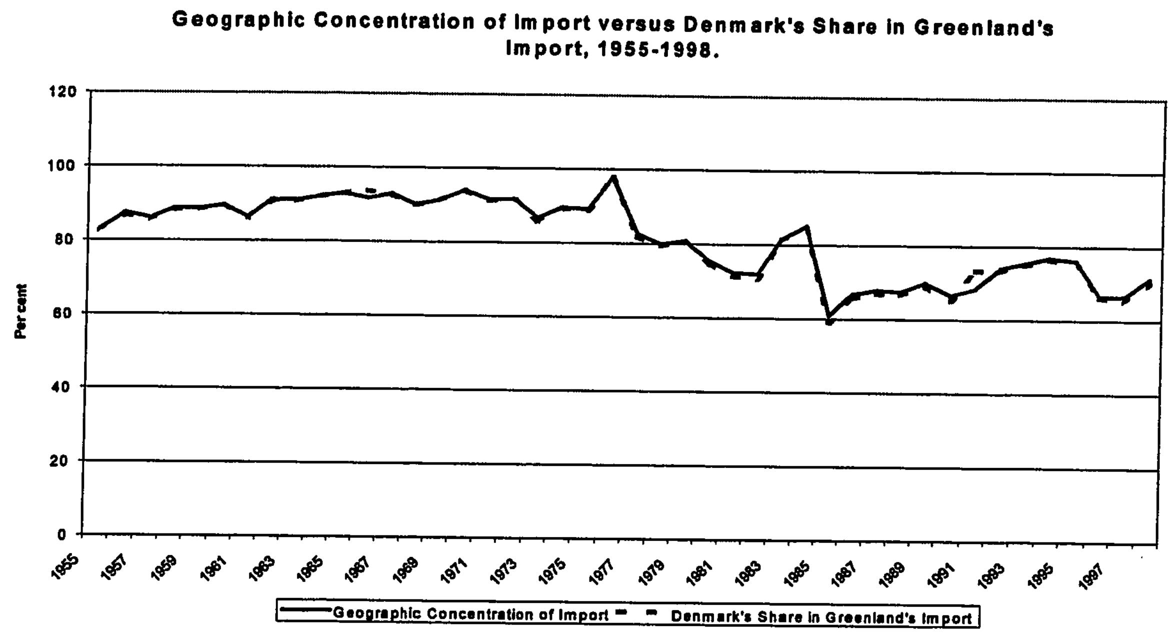


Source: Statistics Greenland Publications, annual.

In 1955, 67.4 per cent of Greenland's exports went to Denmark. At the time of Home Rule this share had fallen to 49.4 per cent but rose to an all time high of 83 percent by 1998.[16] As shown in Figure 5.3.5 above, Denmark's share in Greenland's exports follows very closely Greenland's geographic concentration of exports.

Similarly, and as shown in Figure 5.3.6, Denmark's share in Greenland's imports follows very closely the index of geographic concentration of imports.

Figure 5.3.6



Source: Statistics Greenland Publications, annual.

In comparison, Denmark's share in the value of imports in the Faroe Islands was 30.7 per cent in 1998.

As shown in the above overview and analysis of key indicators of trade dependence, the Greenland economy continues to be characterized by a high dependency on external trade. While trade dependence has been subject to fluctuations in the period under study, the level of dependency has remained high. The upswings and downswings in external

[16]Kleiman (1976) tested and rejected the hypothesis that trade patterns that were imposed under colonialism continue long after the termination of direct colonial rule.

dependence witnessed by this country emphasize the importance of placing the analysis of dependency within a time-series context.

Greenland's Financial Dependency

Greenland's financial dependence on the Danish State is reflected in the financing of Greenland's public sector by the Danish State, and in the ratio of total Danish expenditures on Greenland to GDP. In 1998, 48 percent of public sector revenue in Greenland was made up of expenditures (including block grant) by the Danish State. That same year, the ratio of Danish expenditures on Greenland to GDP stood at 42 percent.

In the literature, financial dependence has been measured by the degree and concentration of foreign investment, and the size of official aid and the source of that aid. For instance, Green's (1970) indices of the financial dimensions of external dependence included: first, concentration of foreign investment by source, and a parallel concentration of foreign investment (including public sector funds) in the export sector and secondary activities relating to it; and second, inadequate public sector revenues and low domestic savings, which may hamper the financing of any investment not of interest to foreign capital sources, and consequently may deter even those changes in productive structures consistent with small markets; and third, a high share of foreign ownership in key sectors (p. 289). Financial dependence has also been analysed by Stallings (1972), who measured it in terms of the percentage of total official bilateral aid coming from the major donor country.

Measurements of financial dependence, such as official aid, concentration of foreign investment, and share of foreign ownership in key sectors are less useful when applied to the case of Greenland. Indicators such as these must be modified when applied to the study of external dependence in this country. First, the Greenland economy is characterized by public ownership. The Home Rule government owns most of the key corporations in Greenland. The fishing industry, by far the key industry, is dominated by Royal Greenland Inc.; a Home Rule owned corporation. Similarly, retailing in Greenland is dominated by the Home Rule owned enterprise, KNI (Kalaallit Niuerfiat Inc.). Other key Home Rule enterprises include: Great Greenland (production and sale of fur articles); Greenland Shipyards; INI Inc. (Housing Company); Royal Arctic Line Inc.; Greenland Air Inc.; Tele Greenland Inc.; Greenland Field Investigations (Asiaq); Greenland Energy Supply (Nukissiorfiit); Greenland Airport Services (Mittarfeqarfiit); Nuka Inc., (purchases primary produce etc. from hunters and fishermen, and manages production to home market; and NunaOil Inc. As discussed in chapter 3, Greenland's private sector is small. And while attempts have been made to develop a private business sector, these attempts have largely failed. For instance, initiatives to attract Danish private business to Greenland in the 1950s and 1960s were unsuccessful in part because of the high cost of doing business in Greenland and the harsh arctic climate. As a result of the lack of success in developing a private business sector, the public sector has had a key role to play in solving problems of supply and distribution. Notwithstanding these facts, a recent OECD report argued for a reduction in the role of the public, and the privatization of Home Rule owned enterprises. The report recommended that potential investors not be restricted to Greenlanders, but that they also include foreign nationals, who would be able to bring not only capital but also new skills and expertise (OECD, 1999).

Second, as explained in chapter two, while Greenland has obtained Home Rule, it does not have sovereignty. When Greenland ceased to be a Danish colony in 1953 it remained part of the Danish realm. Because of the special ties to Denmark a key measure of financial dependence is the size of annual Danish State expenditures on Greenland. These expenditures can be substituted for conventional measures of foreign aid and foreign investment. Danish expenditures have in the period under investigation included in broad terms: (1) Before Home Rule; expenditures on the Ministry for Greenland, the Greenland Technical Organization, the Royal Greenland Trade Department (KGH), and other ministries; and (2) After Home Rule; annual block grants.

Danish public investments rose in the years following the end to Danish colonial rule and the onset of the G-50 and G-60 policies, as discussed in chapter two. Investment expenditures were made in industry, fisheries, education, health, public institutions, residential construction, infrastructure, and social institutions.[1] While extensive investment expenditures were made in the export sector, it was a relatively small share when compared to investments made in construction and infrastructure and other secondary activities. In general, at least at the official level, investment expenditures were made with the objective of modernizing the Greenland economy and developing a more integrated economic structure.

While domestic revenue sources, which include direct and indirect taxes, fishing licences from the EU, and net yield of interest from quasi-corporations, have expanded over time, they fall far short of the requirements of Greenland's public sector. In general, inadequate public sector revenues and low domestic savings have characterized the Greenland economy in the period under study. The result continues to be a high dependence on annual Danish government expenditures on Greenland. Greenland's national income account data, which is published by Statistics Greenland, does not

[1]Private Danish investments were limited. This was primarily the result of the harsh polar climate, the risks involved, and the high costs of doing business in Greenland.

include a time-series on domestic savings. However, data do exist for a few select years. For instance, in 1992, the last year for which data are available on savings, Greenland recorded GDP equal to DKK 6,265 million, while net domestic income stood at 8,850 million (GDP plus Danish transfers). Of the 8,850 million in net domestic income 3,260 mill was public consumption, 3,700 mill was private consumption, and 1,890 mill was gross savings (i.e. 21.4% of net domestic income). Of the gross savings, 58 percent was public savings, while private savings made up 42 percent.

Financial dependence in Greenland can be measured as the ratio of total Danish State expenditures on Greenland to GDP, and similarly, by the size of annual block grants to GDP. As indicated in Table 5.3.3, when viewed in terms of the size of total Danish expenditures on Greenland and the size of the annual block grant, Greenland continues to be highly dependent on external financing. In 1998, the gross domestic product stood at DKK 7,706 million, and accounted for 72 percent of gross net domestic income. Transfers from the Danish State in the amount of DKK 3,189 million made up the difference between GDP and gross net domestic income. Of the total transfers from Denmark, the block grant of DKK 2,574 million made up about 81 per cent.

Since Home Rule the size of the block grant measured as a percentage of GDP has risen from 2 percent in 1979 to about 33 percent in 1998. This increase, however, reflects the phased transfer of programs and responsibilities to the Home Rule government, and hence, it does not reflect increased financial dependence.

Total Danish transfers to Greenland as a percentage of GDP have remained relatively constant in the period since Home Rule, but at a very high level; just over 42 percent in 1998.

Table 5.3.3

Greenland's National Accounts

	1979	1990	1998
National Accounts (DKK Million)			
Compensation of Employees	1,643	5,406	6,266
Gross Operating Surplus	614	1,050	1,453
GDP at Factor Cost	2,257	6,399	7,719
Indirect Taxes	156	509	628
Subsidies	200	602	641
GDP at Market Prices	2,213	6,306	7,706
Compensation of Employees to the rest of the world	218	450	200
Gross National Income	1,995	5,856	7,506
Transfers from Danish State Of which block grant	1,442 42	2,941 1,531	3,189 2,574
Gross Net Domestic Income	3,437	8,797	10,695
Danish Expenditures/GDP (%)	65.2	46.6	41.4
Block Grant/GDP (%)	1.9	24.3	33.4

Sources: Statistics Greenland and Statistics Denmark, annul publications.
Note: A system of national income accounting began in 1979 in Greenland.

The public sector has expanded at a considerable rate since the beginning of the modernization phase and the economic development policies of the 1950s and 1960s. Greenland is highly dependent on Danish transfers to help finance its large and growing public sector. As noted earlier, while Greenland has own source revenue that includes direct and indirect taxes, fishing licences from the EU, etc., Danish transfers continue to account for a significant share of public sector revenues. As shown in Table 5.3.4, out of the public sector's total revenue of DKK. 6,657 million in 1998, approximately 48 percent were made up of transfers from the Danish State, while only about 38 percent were financed by direct and indirect taxes in Greenland. The annual transfer from the EU to pay for fishing rights in Greenlandic waters accounted for only about 4 percent of the budget. As touched upon in chapter three, while the public sector remains highly dependent on Danish financing, the tax base in Greenland has expanded in the period under study and so have the number of taxes collected.

Table 5.3.4

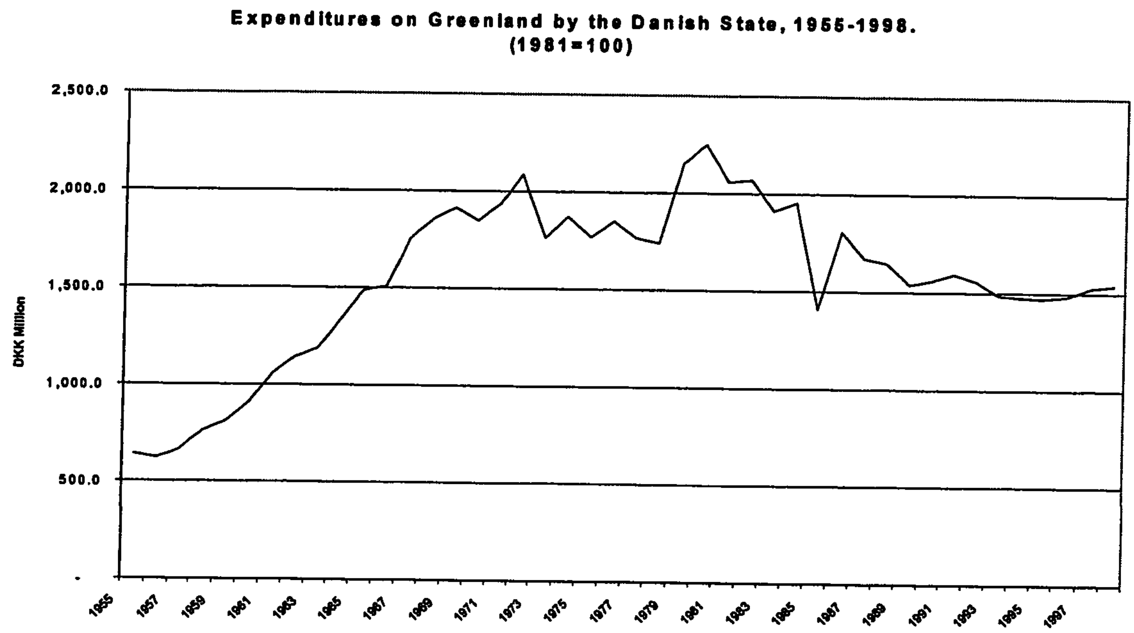
FINANCING OF THE GREENLANDIC PUBLIC SECTOR, 1994-1998 (DKK MILLION)

DKK MILLION	1994	1996	1998
Total Revenue	6,155	6,318	6,657
Gross Operating Surplus	311	317	321
Extract of Income from Public	97	57	62
Quasi-corporations. Net Yield of Interest etc.	373	317	255
Taxes from Concessions	-	5	-
Income Tax	1,529	1,696	1,886
Indirect Taxes	610	598	628
Fishing Licenses from the EU	274	274	286
The National Bank of Denmark	52	35	34
Other Income	1	5	11
Block Grant from Denmark	2,375	2,441	2,575
Additional Income from the Danish State	533	574	599
Block Grant as % of Total Revenue	38.6	38.6	38.7
Total Danish Expenditures as % of Total Revenue	47.2	47.7	47.7
Total Taxes plus EU Licenses as % of Total Revenue	39.2	40.6	42.1

Sources: Statistics Greenland and Statistics Denmark, annual publications.

Figure 5.3.7 shows the total annual Danish expenditures on Greenland over the period, 1955-1998. Greenland saw an increase in expenditures by the Danish State during the modernization phase of G-50 and G-60, followed by a leveling off in expenditures, and a decline in expenditures in the post Home Rule period.

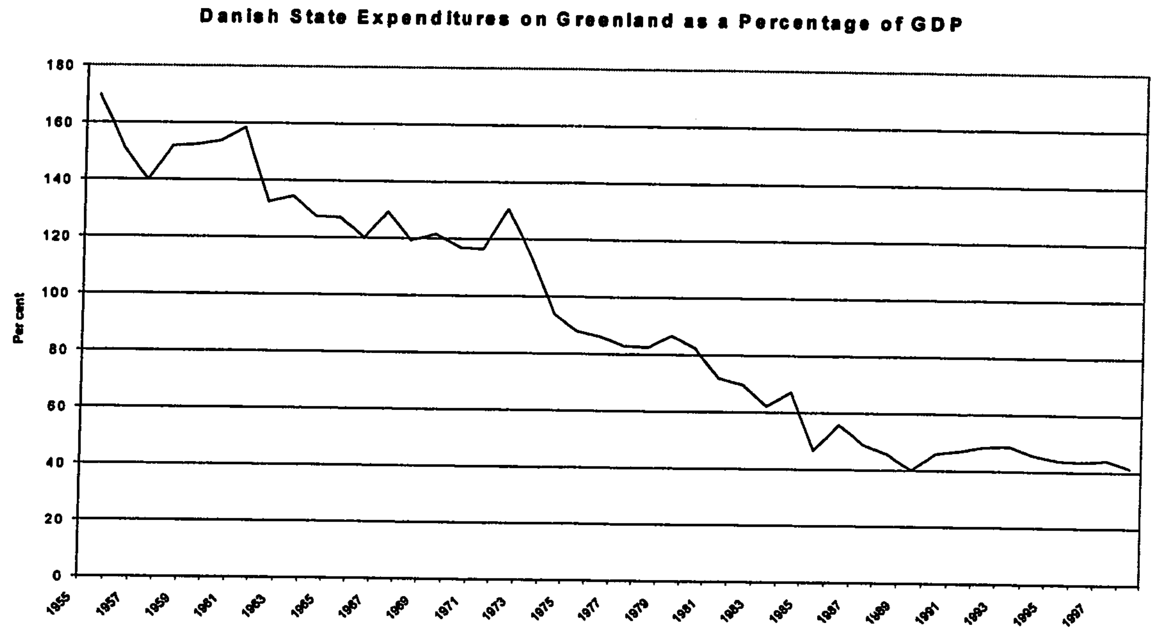
Figure 5.3.7



Source: Statistics Greenland Yearbook, Various Years.

The ratio of total Danish State expenditures on Greenland to GDP is shown in Figure 5.3.8. This ratio has been declining steadily since 1955, from a high of about 170 percent to approximately 40 percent by 1998. The decline in this ratio over time is the result, in part, of the increase in real GDP.

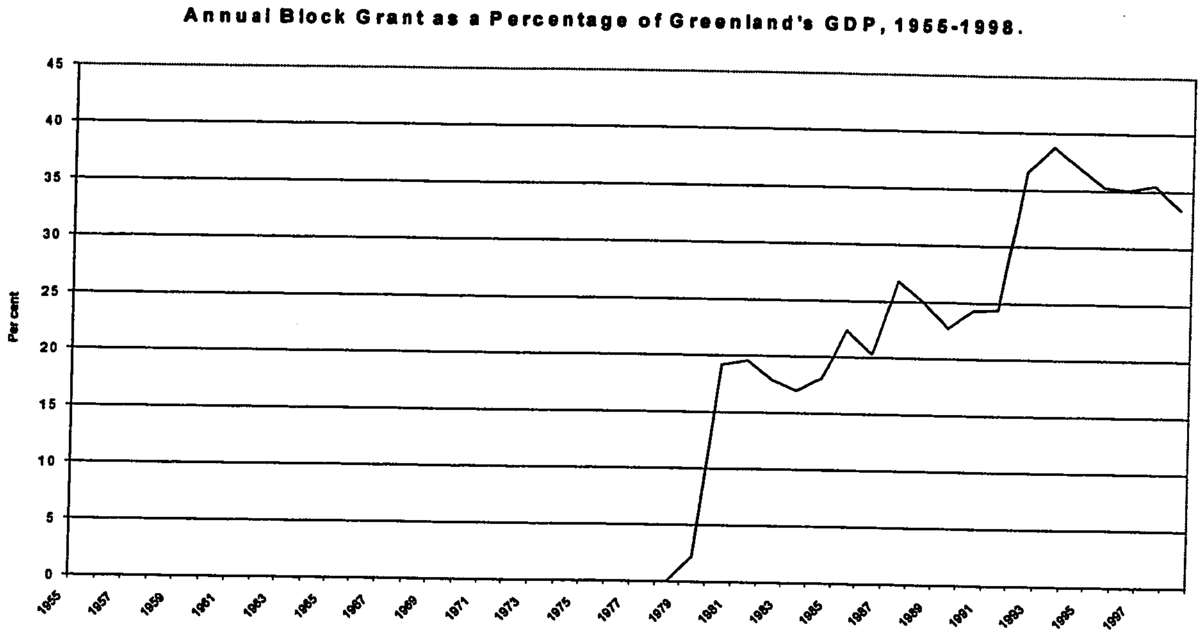
Figure 5.3.8



Source: Statistics Greenland, annual publications.

Figure 5.3.9 shows the ratio of the annual block grant to GDP since the implementation of Home Rule. The upward trend in this ratio, as mentioned above, reflects the phased transfer of responsibilities to the Greenlandic Home Rule government.

Figure 5.3.9



Source: Statistics Greenland, annual publications.

In order to gain additional insight into the explanation behind changes in the level of dependency in Greenland over time, it may be useful to briefly consider changes in the structure of its GDP. Unfortunately Statistics Greenland does not publish data on the structure of GDP, i.e. the distribution of GDP by sector. However, Paldam et al. (1994), has produced an income based data series of GDP distributed by sector for the period 1955-1991. The data, according to calculations by Paldam et al., show that the contribution of the share of primary occupations in real GDP rose from 8.57 percent in 1955 to 16 percent in 1991. In these occupations, the largest contribution to real GDP was made by fisheries, which rose from 4.88 percent in 1955 to 15.6 percent in 1991.

Hunting, agriculture, and mining made only minor contributions. The contribution of secondary occupations to real GDP was 37.58 percent in 1955 and 30.64 percent in 1991. The decline in the share of these occupations is attributed, first to construction, which saw its share decline from 23.43 percent to 18.49 percent in this period, and the food and beverage industry (primarily the fishing industry as represented by Royal Greenland Inc.), which declined from 12.24 percent in 1955 to 7.11 percent in 1991. Other industry made only a very minor contribution to real GDP. The share of tertiary (1) occupations rose from 15.21 percent in 1955 to 27.54 percent in 1991. All occupational groups in this category (communications/transportation, trade and commerce, housing, and hotel and restaurant) experienced an increase in their share of real GDP. The main contributions to real GDP were made by communications and transportation, which rose from 7.52 percent in 1955 to 10.07 percent in 1991, and by trade and commerce which rose from 6.21 percent in 1955 to 9.52 percent in 1991. The share of tertiary (2) occupations in real GDP declined over the period 1955-1991, from 38.64 percent in 1955 to 25.82 percent in 1991. This decline is explained by the decline in defence, from 21.66 percent in 1955 to only 2.48 percent by 1991. Public services and "other services" both experienced growth in their shares of real GDP, albeit minor: the share of public services increased from 15.91 percent in 1955 to 16.87 percent in 1991, while the share of "other services" rose from 1.01 percent to 6.47 percent over this period of time (Paldam et al., 1994).

Overall, the calculations by Paldam et al., suggest that there has been a redistribution of individual contributions to real GDP over this period of time. The main trends have been a significant decline in the share of defence in real GDP, and a subsequent increase in the share of fisheries, tertiary (1) occupations, and "other services" in the tertiary (2) category. These changes highlight the progress that has taken place in the area of economic development.

Aside from the occupational shares in GDP, it is useful to consider also changes in the key factors influencing GDP. This provides further insight into the trends in dependency as outlined earlier. The economy of Greenland is primarily influenced by two factors: exports and public consumption. Public consumption includes wages and salaries of public employees and government purchases, but excludes subsidies, transfers, and public investments. Public consumption in Greenland accounts for a large share of aggregate demand. While real GDP and real exports in Greenland have both been trending upward in the period 1955-1998, there are two periods in which real exports deviated significantly from the growth path of real GDP: early 1960s-1973, and again in the late 1980s till the end of the period. This suggests that something else, other than exports, has been a key factor in explaining real GDP (Statistics Greenland, 2000:1). Data on public consumption in the period since the introduction of Greenland's national income account system show that this series has followed real GDP closely throughout the period. Hence, as noted by Statistics Greenland, in the period since the late 1980s public consumption has been a key factor explaining growth in real GDP, while the importance of exports has been on a decline, especially in the latter part of the period (Ibid.). This explains the observed decline in the export coefficient in the period under study.

The Greenland economy grew by 7.8 percent in real terms between 1997-1998. This represents the highest rate of growth since Home Rule. This rate of growth was mainly the result of increases in wages and salaries (about 57 percent of growth was accounted for by wages and salaries). About half of the increase in GDP attributed to wages and salaries was the result of increases in public sector compensation. Additionally, publicly and privately owned companies saw an increase in revenue this year.

The ratio of exports to GDP stood at 39 percent in 1980. It rose to just over 4 percent by 1990, but dropped to approximately 22 percent in 1998. Public consumption as a percentage of GDP on the other hand has been on a steady increase since 1980: it stood at just over 45 percent in 1980, but had risen to almost 54 percent by 1998.

The foregoing overview shows evidence of an economy that continues to be significantly constrained by financial dependence. Although this dependence, as measured by the ratio of Danish expenditures on Greenland to GDP, has been on a decline in more recent history, the level remains critically high.

Greenland's Technological Dependency

The literature has measured technological dependence in terms of criteria such as the degree of reliance on imported foreign personnel and imported capital goods. For example, Green (1970) defined technological dependence by a situation of limited technical and managerial capacity, which necessitates importation of foreign personnel. Cheng-Chung Lai (1991) measured technological dependence by the share of imported capital goods to total imports. The economy of Greenland is highly dependent upon both imported personnel and imported capital goods. When judged in terms of indicators such as these, Greenland can be defined as a country with a high degree of technological dependence. This section will define and measure these indicators, and provide an overview of their trends since 1955.

In the present study technological dependence is measured by two proxy variables. Statistics Greenland does not report the number of imported Danish personnel, nor does it report the value of capital import in the period under consideration. Hence, in this study these variables are estimated as follows:

(1) Dependence on Danish imported personnel. This dependency is measured by the share of the working age population born outside of Greenland. Statistics Greenland records population statistics based on whether a person is born in Greenland or outside Greenland. The population born outside of Greenland is primarily Danish and can therefore be used as a proxy for the number of people born in Denmark, i.e. the number of Danes living in Greenland. The population statistics is also broken down into five year age cohorts. The number of imported Danish personnel can be approximated by the number of people aged 15 - 64, born outside of Greenland. Dependence on imported Danish personnel for each of the years over the period 1955-1998 can be measured as the ratio of people aged 15-64 born outside of Greenland to the number of people aged 15-64 born in Greenland. This measure of dependence is based on three assumptions: first, that the population born outside of Greenland is primarily Danish; second, that the age group 15-64 is employed; and third, that the age group 15-64, born outside of Greenland, is transitory in nature, that is, it does not take up permanent residence in Greenland. These assumptions closely reflect reality and current practice.

(2) Dependence on imported capital equipment. Dependence on imported capital equipment is measured as the capital-import ratio. Technological dependence could also have been measured by the ratio of foreign investment (or capital import) to gross fixed capital formation. However, Statistics Greenland does not publish statistics on gross fixed capital formation, and hence it was not possible to define this variable.

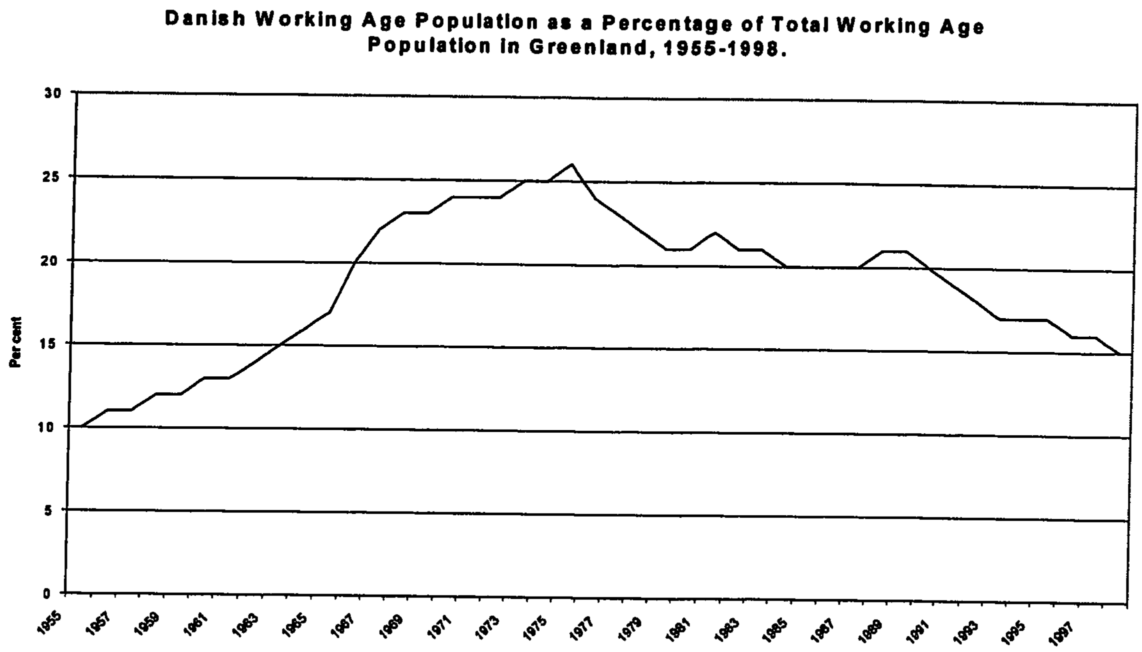
The capital-import ratio is calculated by dividing the annual value of imports reported in category 7.0 of the SITC classification (Machinery and Equipment) by the annual value of total imports in Greenland for each year over the period 1955-1998. Hence, this measure of technological dependence is based on two assumptions: first, that capital import can be approximated by category 7.0 in the SITC classification; and second, that category 7.0 of the import statistics describes new capital equipment and not re-import. The trade statistics of Greenland include, however, a certain amount of re-export and re-import, in part because a significant share of capital equipment is sent to Denmark for repairs. In addition, this variable will be sensitive to the composition of capital import: The import of a major piece of capital equipment such as a motor, ship or aircraft, will have a significant effect on this ratio, since the total expenditures on imported goods is small in absolute terms. Since the capital-import measure is only as good as the assumptions on which it is based, it would be valid to infer that this proxy variable has some margin of error.

Availability of local labour with the required skills, and the appropriate technical and managerial expertise was a significant problem for many years after the onset of development initiatives in Greenland, and to a certain extent local skill shortages continue to present significant problems in this country. Since the onset of modernization in Greenland, as well as in the post Home Rule era, Danish labour has been imported and employed to fill the gap created by skill shortages. As a result of this, the labour market in Greenland is faced with a severe structural problem where a large number of jobs are filled by imported Danish personnel, while at the same time, Greenland is faced with high unemployment consisting almost exclusively of local labour. Approximately 20 percent of the total number of employed people in 1996 were born outside Greenland (i.e predominantly Danish). Of the total number of employed people in the Home Rule government in 1996, approximately 30 percent were born outside Greenland. Within the fishing industry, where most jobs are of low-skilled requirements, the majority of employed people in 1996 were born in Greenland. However, within other land-based trades, approximately 19 percent of employed people were born outside Greenland (Danielsen et al., 1998; Statistics Greenland Yearbook, 1997).

As discussed in Chapter 2, the Danish share (i.e. population born outside of Greenland) of the total population of Greenland rose from 4.5 percent in 1950 to 19.2 percent in the years leading up to Home Rule, followed by a steady decline in the post Home Rule era. This ratio currently stands at about 12.4 percent. The Danish share of the working age population rose from 5.8 percent in 1950 to 25.7 percent in 1975, and then declined to 18.9 percent in 1998. Thus, while the ratio has been declining, it remains high.

Figure 5.3.10 shows the increase in the ratio of the Danish working age population in Greenland since 1955.

Figure 5.3.10



Source: Statistics Greenland, annual publications.

The ratio rose throughout the period between the end to colonial rule and the time of Home Rule. The increase in imported personnel is reflecting the growing demand for technical and managerial expertise with the introduction of Danish development initiatives, particularly G-50 and G-60. In the post Home Rule era the share of Danes has been declining, which reflects, in part, the phased transfer of responsibilities to Greenland's Home Rule government, but also the heightened emphasis on furthering Greenlandic educational attainment, as well as Home Rule policies of giving employment priority to people born in Greenland.

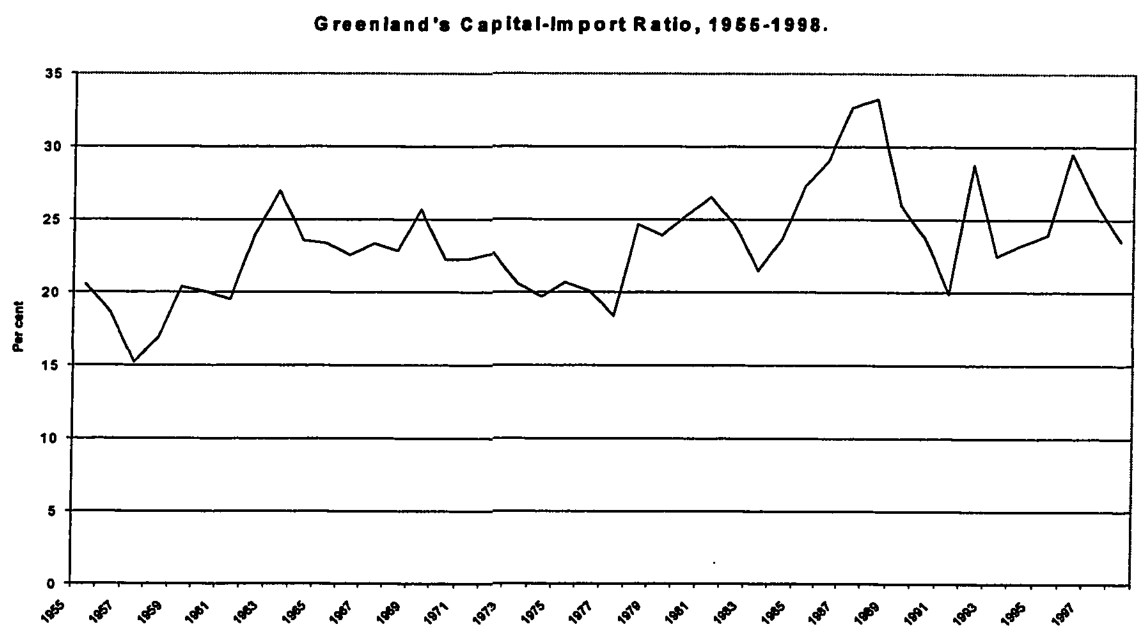
While the educational attainment of Greenlanders has improved in the period under consideration it remains low compared to that of the Danish. A report published by Statistic Greenland on schooling and educational attainment in Greenland highlighted the following facts for year 1994: first, 33.1 percent of the Danish born population residing in Greenland finished high-school or equivalent compared to 2.6 percent of those born in Greenland. Second, 83.8 percent of those born in Greenland have less than seven years of schooling compared to 29.3 percent of those born in Denmark. As noted in the report, these differences reflect in part the fact that the Danes living in Greenland on average have a higher educational attainment than the average seen in Denmark. Third, 53.3 percent of the total population in Greenland have no qualifying education, while 34.2 percent have some vocational training and 8.2 percent hold an academic degree. Fourth, of those in the labour force, 52.3 percent have no educational qualifications, while 37.6 percent have some vocational training, and 10.1 percent have an academic degree. Fifth, of those born in Greenland, 60 percent have no educational background beyond primary school, compared to only 12.7 percent of those born in Denmark. Moreover, 38.9 percent of those born in Denmark who are in the labour force have an academic background, compared to only 4.3 percent of those born in Greenland (Statistics Greenland, Nov. 1997).

In a report presented by the Home Rule government in 1999, the problems of the low level of educational attainment in Greenland were discussed. On a positive note, the report highlighted the fact that since the introduction of Home Rule the number of post-secondary educations offered has increased (Grønlands Hjemmestyre, Landsstyrets Politisk-Økonomisk Redegørelse, 1999). This has led to a significant increase in the number of post-secondary students in Greenland. As a result already by the mid 1980s two-thirds of students were able to obtain their educational credentials in Greenland, while only a few years earlier most had to go to Denmark to complete their studies (Skydsbjerg, 1999). In general, the objective in Greenland has been to raise the educational attainment of the resident population, and thereby enable them to obtain the qualifications necessary to start up businesses etc. Policies of furthering educational attainment in Greenland are expected to reduce the dependence on imported personnel.

The Home Rule government's annual political-economic report also noted the large drop-out rate in vocational training in Greenland. The high drop-out rate has long been viewed as unacceptable because of the large cost it imposes on society, but also because of the inability to meet the requirements of the labour market for skilled labour. The report argued that an emphasis needs to be placed on raising the quality of primary schooling to enable the school system to educate students who will be better equipped to tackle vocational and post-secondary education, and thereby also reduce the unacceptably high drop-out rate (Grønlands Hjemmestyre, Landsstyrets Politisk-Økonomisk Redegørelse, 1999). Public schooling in Greenland has long been under intense scrutiny for its purported less than adequate quality of education.

Turning now to the capital-import ratio, this ratio has remained relatively stable throughout the period under study, despite its potential sensitivity to import of even moderately sized capital equipment. The ratio has fluctuated in the range of approximately 15 to 27 percent. It stood at 20.5 percent in 1955, and at 27 percent in 1985. It is currently at approximately 23 percent. While the capital-import ratio has been fluctuating within a relatively narrow range, Figure 5.3.11 does suggest that the capital-import ratio started an upward trend in the mid 50s that lasted till the early 60s.

Figure 5.3.11



Source: Statistics Greenland, annual publications.

The ratio started another, but minor, increase around the middle of the 1960s.

These upward trends overlap with the periods surrounding the Danish development initiatives coined as G-50 and G-60. The early to late 80s also saw a significant upward trend coinciding with the implementation of Home Rule, followed by a decline back to pre-Home Rule levels.

While the objective of this section has not been to draw conclusions about the causes of technological dependence, the above graphical overview indicates that dependence on external technology has passed through various stages in the post colonial era, and that major development initiatives and Home Rule policies, have been important factors impacting on those levels.

In summary, two proxy variables were introduced to capture the reliance on imported personnel and capital-import. The time-series indicate that the impact of key development initiatives and the introduction of Home Rule have been felt on the level of technological dependence.

Table 5.3.5 below summarizes the indicators of dependence in Greenland for selected years.

Overall, while dependence has been on a decline, it remains high. Several factors have contributed to the change in the level of dependence over time. With respect to trade dependence, as discussed earlier, the key explanation behind the decline in the

Table 5.3.5

SUMMARY OF EXTERNAL DEPENDENCY IN THE GREENLAND ECONOMY

TRADE DEPENDENCY	1955	1965	1975	1985	1998
Geographic Export Concentration	69.3	64.6	47.4	76.0	85.0
Commodity Export Concentration	63.0	50.3	53.2	53.0	50.0
Danish Share in Greenland's Export (%)	67.4	56.4	38.1	75.4	85.0
Danish Share in Greenland's Import (%)	82.6	92.9	88.9	59.1	70.5
Commodity Import Concentration	24.1	21.7	26.2	24.4	22.9
Geographic Import Concentration	83.1	93.0	89.2	60.9	71.4
Primary Export Ratio (%)	94.9	92.9	95.8	95.5	93.3
Fish Share in Total Exports (%)	39.3	68.7	40.1	77.3	92.9
Import Coefficient (%)	134.8	85.1	62.6	71.8	34.4
Export Coefficient (%)	64.1	32.6	43.0	42.1	22.1
TECHNOLOGICAL DEPENDENCY					
Capital-Import Ratio	20.5	23.4	20.7	27.3	23.5
Danish Share of Working Age Population (%)	10.0	17.0	26.0	20.0	15.0
FINANCIAL DEPENDENCY					
Ratio of Danish Expenditures on Greenland to GDP	169.7	127.2	87.9	46.8	41.8

Source: Statistics Greenland, annual publications. Calculations by Author.

export coefficient lies in the redistribution of the sectoral contributions to GDP, with the public sector having grown significantly in importance relative to other sectors.

The primary-export ratio has remained high, in the 90 percent range. However, the share of fish in total exports has increased, which by and large reflects the end to mineral exports. Commodity import concentration has remained relatively stable, while export commodity concentration has fluctuated appreciably more, with a trend toward a decline in concentration in the late 1990s compared to the early period. The reduction in export concentration between 1955 and 1998 reflects in part the emphasis placed on diversification in fish species harvested, and the modernization of fish processing plants to enable further processing. For instance, as discussed earlier, the 5-year development plan, from 1985 to 1989, entailed expenditures on the modernization of the fishing fleet and fish processing plants, and diversification of off-shore fisheries.

Technological dependency, as reflected in the import of Danish personnel, has declined in the post-Home Rule era. This trend, as discussed above, is the result, in part, of advancement in the level of educational attainment, as well as priority in hiring given to Greenlanders. The Home Rule government continues to place education high on its list of priorities. While current policy statements argue for improvements to primary education, they also highlight the need for bi-lingualism to allow students access to a broader range of educational opportunities, as well as the option to study in Denmark (Grønlands Hjemmestyre, Politisk-Økonomisk Redegørelse, 1998).

Financial dependency, measured as the ratio of Danish expenditures to GDP, has likewise been on a downward trend, as outlined earlier (See Fig. 5.3.8). This decline reflects the increase in GDP resulting from more than four decades of economic development initiatives in Greenland (For a discussion of economic development initiatives in Greenland please see chapter 3).

5.4 Conclusion

Some authors, notably Stein (1979), have argued in their critiques of indicators of dependence, that a level of dependency as measured by some of these indicators may also be present in advanced countries. Thus, some might argue that since it is possible that some advanced countries could score high on selected measures of dependency, caution should be used in relying on dependency criteria in classifying countries, including Greenland, as dependent. However, it must also be pointed out that in the case of advanced countries "dependency" does not necessarily impose major constraints on development. This is because they have the necessary resource flexibility as well as resource mobility that will allow them to avert or limit negative impacts of external shocks and disturbances. Thus, as noted earlier, while advanced countries may be vulnerable, developing countries are dependent.

While a dependent economy may be characterized by various indicators of external dependence, an economy that is independent may, on the other hand, be described by a basic orientation of production towards meeting domestic demand; a large capacity for the satisfaction of that demand; the employment of domestic factors of production in the production process; and an ability to obtain a position of relative equality in international economic relations (e.g. Green, 1970, p. 288). When judged according to criteria such as these, and in light of the foregoing, one must conclude that Greenland continues to be in a state of significant external dependence.

At the same time, countries designated as dependent are not all trapped in a permanent situation of foreign control and regulation in which they are destined to endure low growth rates and low levels of income (e.g. Stein, 1979). The level of dependence as measured by various indicators may change through time. As the above indicators of dependence suggest, the economy of Greenland has experienced fluctuations in the level of dependence over time, as well as some lessening of some key indicators since Home Rule, but the general picture remains largely unchanged: dependency ties to Denmark continue, and at a high level.

From the foregoing analysis it can be concluded that Greenland can be classified as a dependent economy. Greenland scores high on selected indicators of dependence in all three categories of trade, finance, and technology. Advances on the economic development front, including modernization of the fishing industry and development within the public and private sectors, have not resulted in any significant lessening of external dependence in Greenland.

While theory predicts that dependency is growth stagnating there exists no empirical evidence from Greenland or the rest of the Arctic to support or disprove this claim. Further analysis is needed in order to rule out the possibility that dependency could be growth generating. As discussed earlier, authors such as Lewis (1980), Cheng-Chung Lai (1991), McGowan (1976), and Kaufman et al. (1975) found evidence to suggest that dependency fuels economic growth.

The following chapter tests the relationship between selected indicators of dependence and economic growth in Greenland, and draws conclusions about the extent to which dependency is a factor in explaining economic growth in Greenland.

Chapter 6

An Analysis Of The Relationship Between External Dependency And Economic Growth

6.0 Introduction

This chapter presents a model for testing various hypotheses regarding the relationship between indicators of dependence and economic growth. Specifically, it tests the significance of selected indicators of trade, financial, and technological dependence in explaining variations in economic growth in Greenland in the period 1955-1998. Additionally, it tests for unidirectional causality between selected indicators of dependency and economic growth. The empirical analysis provides insight into the question of the extent to which external dependence in Greenland has been growth stagnating or growth generating.

6.1 Testing the Relationship between Dependency and Economic Growth

This section tests the relationship between indicators of economic dependency in Greenland and the rate of economic growth. Indicators of dependency were identified, measured and analysed in the previous chapter.

The Model and Empirical Analysis

The relationship between rate of growth of real gross domestic product in Greenland and selected indicators of external dependence is tested in multiple regression equations using the method of Ordinary Least Squares (OLS). The dependent variable and indicators of trade, financial, and technological dependence are presented below.

Dependent Variable:

$RGDP_t$ = the rate of growth of real GDP in Greenland at time t.

Explanatory Variables:

$DKEXP_t$ = the ratio of total real Danish State expenditures (including annual block grant) on Greenland to real GDP in Greenland at time t.

KM_t = the capital-import ratio. This ratio is measured as the value of imports reported in category 7.0 of the SITC classification of imports divided by the value of Greenland's total imports at time t.

XMG_t = a proxy for the total volume of trade, and a measure of trade dependence. XMG_t is defined as the total value of real exports plus imports divided by real GDP at time t.

$DKPOP_t$ = the ratio of the working aged population born outside of Greenland to the working aged population born in Greenland at time t. The working aged population born outside of Greenland is used as a proxy for the number of imported Danish personnel. The working aged population is defined as ages 15-64.

$XGDP_t$ = the export coefficient. It is calculated as the total value of real exports divided by real GDP at time t.

$MGDP_t$ = the import coefficient. It is calculated as the total value of real imports divided by real GDP at time t.

PX_t = the primary export ratio. This ratio is measured as the total value of fish, zinc, lead, and cryolite exports divided by total export earnings at time t.

XC_t = the commodity export concentration at time t. It is measured by the Hirschman-Gini coefficient using the 3-digit SITC classification of exports.

DSX_t = the Danish share in Greenland's exports at time t. It is measured as the value of Greenland's exports going to Denmark divided by total export earnings. No correction is made for exports that are re-exported from Denmark, with a different country as final destination.

MC_t = the commodity import concentration at time t. It is measured by the Hirschman-Gini coefficient using the 2-digit SITC classification code.

DSM_t = Denmark's share in Greenland's imports at time t. It is measured as the value of Greenland's imports coming from Denmark divided by total value of imports.

Unit Root Tests

The stationarity properties of the variables were examined using the Phillips-Perron (1988) test with a specification that includes a constant and a trend variable.

Table 6.1.1 shows the results of the unit roots test. If a computed absolute value of a t-statistic exceeds the absolute critical value, then we do not reject the hypothesis that a given time-series is stationary. If, on the other hand, it is less than the critical value, the time-series is non-stationary. From the results it can be concluded that only four variables, i.e. KM, XGDP, PX, and MC, are stationary since the test-statistics are greater than the 10% asymptotic critical values, and hence for those variables the unit root hypothesis is rejected. For the rest of the variables, i.e. RGDP, DKEXP, DKPOP, MGDP, DSX, DSM, XC, and XMG, the test statistics do not exceed the 10% asymptotic critical values, and it can be concluded that the time-series of these variables are non-stationary.

Table 6.1.1

	Phillips-Perron unit root tests on levels		Phillips-Perron unit root tests on first difference	
Variable	**t-statistic**	**Conclusion**	**t-statistic**	**Conclusion**
RGDP	-1.9021	Unit root	-6.8651	No unit root
DKEXP	-2.8939	Unit root	-4.9858	No unit root
DKPOP	-1.2231	Unit root	-3.1748	No unit root
KM	-3.7796	No unit root	-3.4607	No unit root
XGDP	-3.5002	No unit root	-3.2815	No unit root
MGDP	-2.9649	Unit root	-3.6190	No unit root
PX	-3.7812	No unit root	-3.2203	No unit root
DSX	-2.3028	Unit root	-4.6703	No unit root
DSM	-2.6306	Unit root	-3.8256	No unit root
MC	-5.4916	No Unit root	-3.5636	No unit root
XC	-2.0126	Unit root	-3.7890	No unit root
XMG	-3.1200	Unit root	-6.4452	No unit root

The asymptotic critical value at 10% of the t-test is –3.13.

Unit root tests were then performed on the first difference of all variables. As shown in Table 6.1.1, after first differencing the variables, all test-statistics exceeded the critical values, i.e. the variables are trend stationary in the first difference.

The differencing of the variables in the model is determined by the unit root tests results. The time series of four variables, KM, XGDP, PX, and MC were stationary in levels, that is they are I(0). The time series of DKEXP, DKPOP, MGDP, DSX, DSM, XC, and XMG, on the other hand, were difference stationary, that is they are I(1), and therefore enter the model as I(1). The dependent variable, RGDP, is specified as a growth rate, and this time-series is stationary in growth rates, as determined earlier in Chapter 4.

Model Specification and Tests

After experimenting with different models using standard criteria to assess goodness of fit, a linear model specification was chosen for the analysis. As noted above, the results of the unit root tests determined whether the explanatory variables were entered in levels or first differences. The Schwarz (1978) Criterion for lag length was used in determining the appropriate lag length of the independent variables.

Five different equations were estimated. The first equation to be estimated is shown below.

Equation (6.1.1):

$$RGDP_t = \alpha_0 + \beta_1\Delta\ DKEXP_t + \beta_2\Delta\ DKPOP_{t-1} + \beta_3\sum_{j=1}^{2}KM_{t-j} + \beta_4 XGDP_t + \beta_5\Delta\ MGDP_{t-1} + \varepsilon_t$$

where the symbol Δ denotes the first difference of a variable, e.g.

$\Delta DKEXP_t = (DKEXP_t - DKEXP_{t-1})$.

The model shown as Equation (6.1.1) is specified as a linear regression equation with rate of growth of real GDP ($RGDP_t$) as the dependent variable. There are five explanatory variables: $\Delta DKEXP_t$, $\Delta DKPOP_{t-1}$, KM_{t-j}, j=1,2 , $XGDP_t$, $\Delta MGDP_{t-1}$.

Dependency theory would expect economic growth to be a negative function of these variables, which represent financial, technological, and trade dependency. In this study, however, it is expected that some indicators of dependency have been positively related to economic growth in Greenland in the period under study. This hypothesis is based on the earlier review of the historical relationship between Greenland and Denmark, and the debate in the literature which has linked the process of economic development and growth with development initiatives carried out by Denmark, as discussed in chapter 3.

The change in the ratio of real Danish expenditures on Greenland to real GDP at time t ($\Delta DKEXP_t$) is expected to be positively related to the rate of growth of real GDP. A positive sign is expected under the hypothesis that an increase in the ratio of real Danish State expenditures on Greenland to real GDP will raise public sector revenues and increase real GDP through the multiplier effect. Second, the change in the lagged ratio of the working age population born outside of Greenland to that born in Greenland ($\Delta DKPOP_{t-1}$) is hypothesized to be positively related to the dependent variable. A positive sign is expected under the hypothesis that an increase in the Danish share of the working age population in Greenland raises the level of average income, and also that it gives rise to a demonstration effect. Third, the capital-import ratio at time t-1 and t-2 (KM_{t-j}, j=1,2) is hypothesized to be positively related to the growth rate of real GDP under the assumption that capital import is employed in productive investments which expands the economy through the multiplier effect. Fourth, the export coefficient at time t ($XGDP_t$) is expected to be positively related to the dependent variable under the assumption that the Greenland economy reaps the dynamic gains from trade in primary exports. And fifth, the lag of the differenced import coefficient ($\Delta MGDP_{t-1}$) is expected to be directly related to real economic growth under the hypothesis that imports are used in productive investments.

Tests were performed for normality, equation specification error, autocorrelation, autoregressive conditional heteroscedasticity, and multicollinearity.

First, normality was checked using the Jarque Bera test for normality. With a test statistic of 1.06 and a p-value of about 0.59 it can be concluded that the residuals are approximately normally distributed. Second, the Ramsey RESET tests were done to test for specification error. The tests were statistically insignificant at the 5% level of significance, which suggests that equation (6.1.1) has no specification error. Third, the Durbin-Watson test for autocorrelation was undertaken. With a D.W. test statistic of 2.2045 and 33 degrees of freedom it can be concluded that the model does not have a problem of autocorrelation. Fourth, multicollinearity was checked using the Tolerance (TOL_j) and the Variance Inflation Factor (VIF_j) tests from the auxiliary regressions. The TOL_j values fall in the range between 0.8049 - 0.9744, and thus are approximating values of one. The VIF_j values fall in the range of 1.026 - 1.242, and hence are all less than 10. Since the VIF_j values are less than ten and TOL_j values are approximating a value of one it can be concluded that there is no problem with multicollinearity.

The results of the estimated equation (6.1.1) are as follows:

$$\hat{RGDP}_t = -0.0173 - 0.0048\,\Delta DKEXP_t + 3.2529\,\Delta DKPOP_{t-1} +$$
$$\quad\quad (-0.442) \quad (-3.531) \quad\quad\quad (3.026)$$

$$0.0042\,KM_{t-1} + 0.0071\,KM_{t-2} + 0.0014\,XGDP_t + 0.0008\,\Delta MGDP_{t-1}$$
$$(1.208) \quad\quad (2.144) \quad\quad (1.380) \quad\quad (0.489)$$

$R^2 = 0.49$ Degrees of Freedom = 33

On the whole, the results of the OLS estimation of equation (6.1.1) indicate that the goodness of fit along with the results of the residual tests is satisfactory. The R-square is 0.49 and the adjusted R-square is 0.40. The F-test is used to test for overall significance of the regression. The F-statistic is significant at the 5 percent level, indicating that the dependent variables together are significant in explaining the variation in the rate of growth of real GDP.

The results of the estimation of regression equation (6.1.1) indicate that here is an inverse relationship between the first difference of the ratio of Danish State expenditures on Greenland to GDP and the rate of economic growth. The explanatory variable $\Delta DKEXP_t$ is significant at the 5 per cent level with a t-ratio of –3.531, and it bears the hypothesized sign. The estimation result suggests, contrary to the hypothesis, that an increase in the first difference of financial dependence is inversely related to the rate of growth of the Greenland economy. While this result does not establish the direction of causation, this inverse relationship could be explained in part by the possible impact of Danish expenditures on Greenland's domestic savings. Greenland does have a very low savings rate. An increase in Danish expenditures on Greenland may deter domestic savings in Greenland, and in turn limit the pool of funds available for productive investments. In addition, an increase in Danish expenditures on Greenland may have a negative impact on economic growth through its effect on domestic inflation and, in turn, on the crowding out of private investment and initiative (See Paldam, 1994). However, since the estimation result does not establish a direction of causation, it is also possible that the negative sign reflects that an increase in Greenland's GDP reduces the expenditures on Greenland made by the Danish State. It should be noted briefly, that to shed some additional light on the association between financial dependency and economic growth, this equation was also estimated with an alternative measure of financial dependency: the first difference of real Danish expenditures. The results of this estimation are not shown here, but very briefly, the estimation suggested that the first difference of real Danish expenditures on Greenland is positively related to economic growth, with a t-ratio of 3.102. The overall conclusions drawn from the sign and significance tests of the other variables in the model remained unchanged when the financial variable was specified simply as the change in real Danish expenditures, and not as a ratio of real GDP.

The proxy variable representing dependence on imported Danish personnel, ($\Delta DKPOP_{t-1}$), is statistically significant at the 5 per cent level with a t-ratio of 3.026, and it bears the hypothesized sign. This result suggests that an increase in dependence on imported Danish personnel is positively associated with economic growth. First, the positive association between an increase in the lag of the differenced ratio of Danish personnel in the workforce and the rate of growth of real GDP may be explained in part by the human capital characteristics of the imported personnel and the subsequent effect on the skill level of the labour force. The Danish personnel that was sent to Greenland by the Danish government in the era before Home Rule, and the personnel that has been imported by the government of Greenland since Home Rule, has in most cases been selected because they are assumed to possess the skill set, the educational requirements, or the managerial expertise that are needed to perform a specific job. Second, an increase in imported personnel may have a direct impact on GDP through the change in spending associated with the higher average income of this group, as well as an indirect impact through the change in spending of the Greenlandic born population, which may occur as a result of a demonstration effect. This variable is significant in its lagged specification suggesting that it takes a time-period of one year to realize the impacts of changes to the composition of the labour force and the impact of the demonstration effect. As in the case of the ΔDKEXP variable, it should be noted here, that the result does not establish the direction of causation. Hence, the positive association between economic growth and the ΔDKPOP variable could, alternatively, be explained by an increase in Danes seeking employment in Greenland as a result of an expansion of the economy and a subsequent increase in the availability of employment and economic opportunities.

The estimation results further suggest that the lagged capital-import ratio, (KM_{t-j}, j=1,2) is a positively associated with the rate of growth of real GDP, as hypothesized.

While the first lagged term of the capital-import ratio (KM_{t-1}) is not statistically significant with a t-ratio equal to 1.208, the second term (KM_{t-2}) is significant with a t-statistic of 2.144. This result might suggest that capital import raises economic growth and that the effect of capital import takes a couple of years to make its mark on the domestic economy, which can be explained by the time lag between import of capital equipment and its employment in the domestic economy. As in the foregoing, however, direction of causation cannot be determined in this estimation. This analysis does not allow one to exclude the possibility that economic growth causes KM, e.g. that economic growth generates the revenue necessary to realize an increase in capital import.

The two remaining variables representing the degree of trade dependence in Greenland, i.e. the export coefficient and the lag of the differenced import coefficient ($XGDP_t$, and $\Delta MGDP_{t-1}$), both bear the hypothesized signs, but neither of the two variables are statistically significant at the 5 per cent level. These results could suggest, contrary to 'a priori' reasoning, that an increase in the ratio of exports in GDP is not statistically significant in explaining variations in the rate of growth of real GDP. Similarly, an increase in the first difference of the lagged ratio of imports to GDP is statistically insignificant when estimated together with other key proxy variables of external dependence in Greenland.

A number of equation modifications were undertaken, and the estimation results are presented in Table 6.1.2.

Table 6.1.2

Estimation Results (Equations 6.1.1 – 6.1.5)

Explanatory Variables	Equation (6.1.1)	Equation (6.1.2)	Equation (6.1.3)	Equation (6.1.4)	Equation (6.1.5)
Constant	-0.0173 (-0.442)	0.0328 (2.869)	-0.8835 (-1.614)	-1.0012 (-2.319)	-0.1343 (-1.482)
$\Delta DKEXP_t$	-0.0048 (-3.531)	-0.0051 (-3.756)	-0.005 (-3.986)	-0.005 (-4.111)	-0.0051 (-3.985)
$\Delta DKPOP_{t-1}$	3.2529 (3.026)	2.9554 (2.684)	1.8806 (1.508)	2.0372 (1.797)	1.8483 (1.543)
KM_{t-1}	0.0042 (1.208)	0.0053 (1.573)	0.0063 (1.951)	0.0066 (2.117)	0.0067 (1.933)
KM_{t-2}	0.0071 (2.144)	0.0072 (2.136)	0.0083 (2.550)	0.0084 (2.713)	0.0086 (2.578)
$XGDP_t$	0.0014 (1.380)				
$\Delta MGDP_{t-1}$	0.0008 (0.489)				
ΔXMG_t		-0.0153 (-0.128)			
PX_t			0.7953 (1.698)	0.8717 (2.067)	
ΔDSX_t			-0.0005 (-0.404)		
ΔDSM_t			0.0027 (2.253)	0.0028 (2.491)	0.0021 (1.856)
MC_t			-0.0016 (-0.229)		
ΔXC_t					0.0021 (0.679)
	R^2 = 0.4869 d.w.=2.2045 d.f. = 33	R^2 = 0.4565 d.w.=2.1857 d.f. = 34	R^2 = 0.5633 d.w.=2.1246 d.f. = 31	R^2 = 0.5605 d.w.=2.1933 d.f. = 33	R^2 = 0.5105 d.w.=2.2748 d.f. = 33

T-ratios are in brackets.

In equation (6.1.2), the two statistically insignificant variables from the first equation, i.e. the export and import coefficients ($XGDP_t$, and $\Delta MGDP_{t-1}$), are deleted and substituted by a proxy for the total volume of trade in Greenland, that is the ratio of exports plus imports to GDP (ΔXMG_t). This variable, as indicated earlier, is stationary in the first difference. By applying the Schwartz Criterion for lag length it was determined that errors were minimized by not lagging this variable. The overall goodness of fit remains satisfactory with the modifications: the R-square is equal to 0.46 and the F-statistic is significant at the 5 per cent level.

The modified equation passes conventional residual tests for normality, autocorrelation and specification error. Also, there is no evidence of a multicollinearity problem. The added variable, ΔXMG_t, is, however, not statistically significant at the 5 per cent level, suggesting that the annual change in the total volume of trade has not been significant in explaining variations in the rate of growth of real GDP over the period under consideration. Thus, none of the three trade variables ($XGDP_t$, $\Delta MGDP_{t-1}$, and ΔXMG_t) is statistically significant when estimated together with other variables of financial and technological dependence.

In equation (6.1.3), the proxy variable (ΔXMG_t) is deleted and substituted with four new variables representing trade dependency: PX_t, ΔDSX_t, ΔDSM_t, and MC_t. The primary export ratio (PX_t) is hypothesized to bear a negative sign. It is hypothesized that the PX variable is negatively associated with economic growth under the hypothesis that dependence on primary exports impacts negatively on economic growth through instability of earnings. The first difference of the Danish share in Greenland's exports (ΔDSX_t) is hypothesized to bear a negative sign under the assumption that geographic concentration of trade leads to earnings instability. The first difference of the Danish share in Greenland's imports (ΔDSM_t) is hypothesized to have a positive sign. A positive association is hypothesized here under the assumption that Greenland is able to take advantage of special trade arrangements with the former colonial government. And lastly, the commodity import concentration (MC_t) is hypothesized to bear a negative sign. A negative sign is hypothesized under the assumption that the higher the degree of commodity concentration the more limited the range of imports for intermediate input use. Also, a higher degree of concentration may reflect a more unequal distribution of income and also a lower level of income.

As in the previous equations, the unit root test results determined the degree of differencing of the variables, and the Schwartz's Criterion was used in deciding the appropriate lag lengths. The test for lag length indicated that added variables, except for ΔDSX, should enter the model specified in time t.

The various residual tests and a test for multicollinearity were performed. The Jarque-Bera test indicated that the residuals are approximately normally distributed (p-value = 0.51), and the Ramsey RESET tests suggested that the model is correctly specified. The D.W. test showed no sign of autocorrelation (D.W. = 2.1246), and the Tolerance (TOL_j) and the Variance Inflation Factor (VIF_j) tests showed that there is no problem of multicollinearity. The TOL_j values fall in the range between 0.603 - 0.9697, and thus are approximating values of one. The VIF_j values fall in the range of 1.031 - 1.658, and hence are all less than 10. The goodness of fit is quite satisfactory. The R-square is 0.563, and the estimation passes the F-test at the 5% level.

Although equations (6.1.1) and (6.1.2) did not show evidence of a statistically significant relationship between the trade coefficients and the rate of growth of the Greenland economy, it is plausible that the effect of trade in Greenland on economic growth is through the level of trade concentration. The estimation results of equation

(6.1.3) suggest that with the addition of the four new variables representing trade dependence, the ΔDKPOP variable is no longer statistically significant. The KM variable, on the other hand, is now statistically significant in both lags, although the first lag is significant only at the 10% level, with a t-ratio of 1.951. The variable representing financial dependency, ΔDKEXP, remains highly significant with a t-ratio of –3.986. With respect to the added variables, the results suggest that the primary export ratio, PX_t, is not statistically significant at the 5% level, with a t-ratio equal to 1.698. It does, however, pass the significance test at the 10% level, which has a critical value of 1.687. The sign is positive which is contrary to the hypothesis. This suggests that an increase in the ratio of primary exports fuels economic growth in Greenland. This result would also lend support to the findings of the previous chapter where it was found that export trade in Greenland has been an engine of growth by way of the trickle down effects that it gives rise to. Furthermore, the results suggest that any potential negative impacts on growth originating in instability of primary export earnings have been outweighed by the country's advantage in the export of fish and other marine products.

Next, the estimation results suggest that with a t-ratio of –0.404 the change in the Danish share in Greenland's export, (ΔDSX_t), is not statistically significant at either the 5 or 10% level. A possible explanation may be that this variable does not solely reflect the value of export with Denmark as country of destination, but rather, it includes commodities that either pass through Denmark or that are re-exported from Denmark after undergoing further processing.

The estimation results suggest a positive relationship between the Danish share in Greenland's imports (ΔDSM_t) and economic growth. The estimated coefficient is statistically significant at the 5% level with a t-ratio equal to 2.253, and it bears the hypothesized sign. This positive association may be explained by potential advantages related to trade ties with Denmark, such as special trade and pricing arrangements; just as it may be related to a potentially more stable and predictable supply; and also, the almost exclusive import of technology, capital-equipment and other intermediate inputs from Denmark may have a positive effect on economic growth because Danish technology and capital import will be appropriate to the institutions formed by Denmark and to the physical and social infrastructure based on Danish design and Danish methods. Because the development of Greenland has been largely controlled, directed and implemented by Denmark the Danish design, method, and technique is used in almost every aspect of economic development, design and implementation. Therefore, Danish imported goods, services, and capital may prove more appropriate to that system than imports from other countries.

The estimation results further show that the commodity concentration of imports (MC_t) is statistically insignificant at the 5 and 10% levels with a t-ratio of –0.229. This suggests that an increase in the MC_t does not help explain the variations in the growth rate of real GDP in Greenland. This result is not that surprising. As was shown earlier in this chapter, this variable has remained relatively constant over the period under study. Greenland has not experienced any pronounced changes in the level of this variable over time. Rather, the import concentration has remained relatively low, which, as touched upon in the previous chapter, may be related to the size of Danish expenditures on Greenland which permits Greenland a higher standard of living and hence also a more varied commodity import than would otherwise be possible.

In equation (6.1.4) the two statistically insignificant variables, ΔDSX_t and MC_t, are deleted from the equation. The overall goodness of fit remains satisfactory with an R-square of 0.5633 and an adjusted R-square 0.4806. Similarly, the F-test remains statistically significant at the 5% level. The residual tests are all quite favourable: the residuals are approximately normally distributed (Jarque-Bera test-statistic is 1.133 at 2 DF), there is no evidence of autocorrelation (D.W. = 2.1933 with 33 DF), the Ramsey RESET test indicates that there is no model misspecification error, and the TOL and VIJ values are all favourable suggesting no problem with multicollinearity. The TOL_j values fall in the range between 0.6391 - 0.9923, and thus are approximating values of one. The VIF_j values fall in the range of 1.008 - 1.565, and hence are all less than 10. The model modifications in equation (6.1.4) do, however, change a few of the previously reported results. ΔDKEXP remains highly significant with a t-ratio of –4.111. ΔDKPOP is statistically insignificant with a t-ratio of 1.797. This result is similar to that reported in equation (6.1.3). The capital-import ratio is now statistically significant at the 5% level in both lags with t-ratios of 2.117 and 2.713 for each of the two lags. Similarly, the primary export ratio is now statistically significant with a t-ratio of 2.067, and it bears a positive sign. The variable representing the Danish share in Greenland's import remains significant at the 5% level.

In equation (6.1.5) a variable measuring the commodity concentration of exports (ΔXC_t) is substituted for the primary export ratio (PX_t). This variable is substituted for PX to test whether the composition of primary exports is significant in explaining the rate of growth of real GDP. The variable is entered in first difference, and based on the test for lag length, the variable is specified in time t. It is hypothesized that ΔXC_t bears a negative sign under the assumption that "putting all ones eggs in one basket" has negative consequences for economic growth, as discussed earlier in this chapter.

The model continues to perform satisfactorily: it passes all the standard residual tests and there is no problem of multicollinearity. The R-square, however, falls to 0.5105. The regression estimation results show that, as in the previous estimations, the variables of ΔDKEXP and the two period lagged KM remain statistically significant at the 5% level. However, the variable ΔDKPOP remains insignificant as in the two previous estimations, and the one period lagged KM is now only statistically significant at the 10% level with a t-ratio of 1.933. The variable ΔDSM is now statistically insignificant, which is a change from the other estimations that included this variable. And with respect to the added variable, the differenced commodity concentration of exports has a t-ratio of 0.679, and hence this variable is not statistically significant at the 5 or 10% levels. This would suggest that the combination of fish and other marine products in exports and their relative shares in primary exports do not help explain variations in economic growth in Greenland. This result can be compared with the result obtained in equation (6.1.4) that suggested that the primary export ratio is statistically significant at the 5% level. These findings suggest that it is the total share of primary exports that is important in explaining economic growth and not the combination and size of individual contributions of different marine resources. If on the other hand the XC variable had been measured using the 1-digit SITC classification code the estimation results would most certainly have mirrored those of PX, since a 1-digit classification does not distinguish between different species of fish.

Overall, the above analysis suggested that the rate of growth of real GDP in Greenland over the period 1955-1998 has been negatively associated with the first difference of the ratio of Danish expenditures on Greenland to GDP. The results further suggested that the two time-period lagged capital-import ratio was positively associated with economic growth. Similarly, the one time-period lagged capital-import ratio was statistically significant at the 10% level when other trade ratios were deleted from the model. The results also indicated that the primary export ratio and the Danish share in Greenland's imports were positively related to the rate of growth of real GDP, although these variables did fail the significance tests in a couple of estimations. On the other hand, a number of other variables that represented key dependency indicators did not pass the significance tests. The commodity concentration of exports, the commodity concentration of imports, the Danish share in Greenland's exports, the export and import coefficients, and the variable representing total trade volume, were all statistically insignificant at both the 5 and 10% levels of significance.

On the whole, the results do not lend convincing support to the claim of a negative relationship between rate of economic growth and indicators of dependence. Only the variable representing financial dependency, ΔDKEXP, was negatively associated with economic growth. But as noted earlier, when financial dependency was measured simply as the rate of growth of Danish expenditures, and not as a ratio of GDP, this variable was found to be positively related to economic growth. Overall, the results indicate that there is evidence to suggest that in the case of Greenland some indicators of dependence have been growth generating over the period under study.

Section 6.2 takes a closer look at the direction of causality between the rate of growth of real GDP and the rate of growth of financial dependence (DKEXP), and between rate of growth of real GDP and the growth rate of technological dependence (DKPOP).

6.2 Causality Analysis of Dependency and Economic Growth

The purpose of this section is to test for unidirectional causality between the rate of growth of real GDP and the real growth rate of indicators of technological and financial dependence in Greenland, using the Granger causality test.

The analysis of the previous section suggested some important and statistically significant relationships between indicators of dependency and rate of economic growth. Specifically, the results pointed toward a negative relationship between the dependence on Danish State financing (DKEXP) and the rate of growth of real GDP, and a positive association between dependence on imported personnel (DKPOP) and the growth rate of real GDP. However, the econometric analysis did not provide evidence on the direction of causality in those relationships. Establishing the direction of causation is, however, of importance to this study. Financial dependency, as represented by ΔDKEXP, and technological dependency, as represented by ΔDKPOP, have been key features of the relations between Greenland and Denmark throughout the period under study. In particular, Danish State financing and imported Danish personnel were key features of the development policies referred to as G-50 and G-60 in the pre Home Rule era. In the post

Home Rule era dependency on Danish financing and imported personnel has continued, albeit at a lower level. These points were discussed in some detail in chapter 3. A causality analysis will provide insight into the question of the success of these policies in terms of their impact on economic growth and development.

Rate of Growth of the Greenland Economy versus growth rate of Financial Dependence

Using the method of Ordinary Least Squares regression, a Granger causality test is performed to test for unidirectional causality between the rate of growth of real GDP and the rate of growth of the ratio of financial dependence in Greenland. The analysis of the previous section suggested that the variable representing financial dependence (DKEXP) is negatively related to the rate of growth of real GDP (RGDP). The estimation results of section 6.1, however, did not provide evidence to draw conclusions regarding the direction of causality.

The time-series were tested for stationarity. The Phillips-Perron unit root tests results suggested that the RGDP and DKEXP time-series are stationary in growth rates, i.e. they are I(0).

Based on a specification test and the Schwarz (1978) test for lag length the following specification of the causality model was chosen:

$$RGDP_t = \alpha_0 + \sum_{i=0}^{2} a_i DKEXP_{t-i} + \sum_{i=1}^{2} b_i RGDP_{t-i} + U_t \qquad (6.2.1)$$

$$DKEXP_t = \beta_0 + \sum_{i=1}^{1} c_i DKEXP_{t-i} + \sum_{i=0}^{1} d_i RGDP_{t-i} + V_t \qquad (6.2.2)$$

where RGDP is the rate of growth of real GDP, and DKEXP is the rate of growth of the ratio of Danish State expenditures to GDP. Tests for lag length determined that in equation (6.2.1) the appropriate lag length is 2 years for DKEXP, and 2 years for RGDP. In equation (6.2.2) lag length is 1 year for each of DKEXP and RGDP.

Tests were performed for simultaneity bias, normality, equation specification error, multicollinearity, and autoregressive conditional heteroscedasticity.

The Hausman (1978) test for specification bias suggested that the model is not affected by simultaneity bias. The t-statistic of the estimated residuals is –1.321, which is less than the t-critical value of 2.021 at the 5% level of significance.

Both equations passed the Jarque Bera test for normality, indicating that the residuals are approximately normally distributed.

The Ramsey RESET tests for equation mis-specification were performed for both equations. The tests were statistically insignificant at the 5% level of significance, which suggests that neither of the two equations have problems with specification errors.[1]

Next, both equations were tested for multicollinearity using the Tolerance (TOL_j) and the Variance Inflation Factor (VIF_j) tests. In the case of equation (6.2.1) the VIF_j values are less than ten (1.190 – 1.593) and TOL_j values are approximating a value of one (falling between 0.628 – 0.840). Similarly, in the case of equation (6.2.2) the VIF_j values are less than ten (1.016 – 1.188) and TOL_j values are approximating a value of one (falling between 0.842 – 0.985). Thus, the test results indicate that there is no problem of multicollinearity in either of the two equations.

Both equations were then tested for autoregressive conditional heteroscedasticity using the Arch(p) test. The results of the ARCH(p) tests indicate that the error variances of equations (6.2.1) and (6.2.2) are not affected by autoregressive conditional heteroscedasticity. The probabilities (p-values) of obtaining the chi-square test statistics are sufficiently large in both equations. In equation (6.2.1) the test results of ARCH(1) to (3) produced t-statistics of 0.0780, 0.1804, and 2.7324, with corresponding p-values of 0.80, 0.91, and 0.60 respectively. Similarly, in equation (6.2.2), the test results of ARCH(1) to (3) produced t-statistics of 0.1260, 0.1408, and 0.1980, with corresponding

[1] RESET results of equation (6.2.1) : RESET (2): t-statistic = 0.2173; critical value = 4.12. RESET(3): t-statistic = 0.258; critical value = 3.29. RESET (4): t-statistic = 0.1460; critical value = 2.89.

RESET results of equation (6.2.2): RESET(2): t-statistic = 1.2218; critical value = 4.10. RESET (3): t-statistic = 1.6542; critical value = 3.27; RESET (4): t-statistic = 1.0766; critical value = 2.88.

p-values of 0.75, 0.94, and 0.97 respectively. These results suggest that the error variances of the two equations are not serially correlated.

The Granger causality test was performed on both equations.[2] The results are summarized in Table 6.2.1 below.

Table 6.2.1

Results of Granger Causality Test (Equations 6.2.1 and 6.2.2)

Direction of Causality	F-Statistic	Critical Value (α=0.05)
DKEXP $\Rightarrow$ RGDP	4.255	$F(2,38) = 3.20$
RGDP $\Rightarrow$ DKEXP	7.772	$F(1,40) = 4.08$

The results of the Granger-causality test show evidence of bi-directional causality between the growth rate of real GDP (RGDP) and the rate of growth of financial dependence (DKEXP) in the period 1955-1998. In the case of equation 6.2.1, the calculated F-statistic is 4.255 with a critical value of 3.20 at the 5% level of significance. Hence, the estimation passes the F-test which indicates that DKEXP Granger-causes RGDP. Similarly, in the case of equation 6.2.2, the calculated F-statistic is 7.772, which

[2]For more detail on the Granger causality test, please see chapter 4.

exceeds the critical value of 4.08 at the 5% level of significance. This suggests that there is a feedback effect running from RGDP to DKEXP.

While the two F-tests point to a case of bi-directional causality, it should be noted that this result does not hold at the 1% level of significance, since at the 1% level, equation 6.2.1 fails the F-test. At the 1% level of significance the critical value in equation 6.2.1 is 5.20 which exceeds the F-statistic.

The causation running from DKEXP to RGDP at the 5% level (eq. 6.2.1) may be explained by the a crowding out effect related to the large Danish block grant and other annual Danish State expenditures on Greenland. These expenditures make it possible to finance a very large public sector. Throughout the period since the end to colonial rule the size of the public sector and its extensive involvement in all aspects of production and distribution, as discussed in chapter three, has been a topic for much debate. Much criticism has surrounded the alleged negative impact of the public sector on private initiative, the degree of competition, and the price level in Greenland. It should be noted here, that while the Granger-causality is an F-test, and hence does not consider the statistical significance of individual explanatory variables, the t-test does show in the case of equation 6.2.1 that DKEXP at t=0 is statistically significant with a t-ratio of –2.470. The two lagged terms of DKEXP also bear negative signs, but they do not pass the significance test at the 5% level. The F-test together with the result of a t-test, lends support to the argument that not only does DKEXP cause RGDP, but the association is a negative one. This lends support to the argument of a crowding out effect caused by Greenland's financial dependence on Denmark. As a side note, the causality test was also performed using the rate of growth of real Danish expenditures as an alternative measure of dependency. Briefly, when financial dependency is measured simply as the rate of growth of Danish expenditures the results continue to show bi-directional causality, but the findings indicate that the rate of growth of Danish expenditures fuels economic growth (i.e. in the case of equation 6.2.1, the F-statistic is 8.80, which exceeds the critical value for the F-test, and the t-test of the coefficient of the financial dependency variable indicates a positive association. In the case of equation 6.2.2, the F-statistic is 29.7).

In the case of equation 6.2.2, i.e. the causation running from RGDP to DKEXP, the F-test is statistically significant at both the 5% and 1% levels. Additionally, as in the case of equation 6.2.1, the association is a negative one. The result of a t-test shows that RGDP is statistically significant (t-ratio = -2.522), and it bears a negative sign. Hence, the feedback effect running from RGDP to DKEXP could suggest that an increase in economic growth, and hence an expansion of the Greenland economy, reduces the rate of growth of financial dependence, where financial dependence is measured as the ratio of Danish State expenditures on Greenland to GDP.

Rate of Growth of the Greenland Economy versus growth rate of Technological Dependency

A Granger causality test was then performed to test for unidirectional causality between the rate of growth of the Greenland economy and the rate of growth of the ratio of technological dependence as represented by the DKPOP variable.

The time-series were tested for stationarity. The Phillips-Perron unit root tests results suggested that the RGDP and DKPOP time-series are stationary in growth rates, i.e. they are I(0).

Based on a specification test and the Schwarz (1978) test for lag length the following specification of the causality model was chosen:

$$RGDP_t = \alpha_0 + \sum_{i=0}^{4} a_i DKPOP_{t-i} + \sum_{i=1}^{1} b_i RGDP_{t-i} + U_t \quad (6.2.3)$$

$$DKPOP_t = \beta_0 + \sum_{i=1}^{1} c_i DKPOP_{t-i} + \sum_{i=0}^{6} d_i RGDP_{t-i} + V_t \quad (6.2.4)$$

where RGDP is the rate of growth of GDP, and DKPOP is the rate of growth of the ratio of the population of Greenland born outside of Greenland (used as a proxy for Danish imported personnel) to the population born in Greenland. The tests for lag length suggest that the appropriate lag lengths are 4 years for DKPOP and 1 year for RGDP in equation (6.2.3). In equation (6.2.4) the lag lengths were determined to be 1 year for DKPOP and 6 years for RGDP.

The standard residual tests were performed for normality, equation specification error, and autoregressive conditional heteroscedasticity, and tests were performed for multicollinearity.

But first, the model was tested for simultaneity bias. The t-statistic of the estimated residuals is 1.264, which is less than the critical value of 2.021. Since the estimated residuals are statistically insignificant, it can be concluded that there is no simultaneity bias.

Both equations passed the Jarque Bera test for normality, indicating that the residuals are approximately normally distributed.

The Ramsey RESET test for equation mis-specification was performed for both equations. The tests were statistically insignificant at the 5% level of significance, which suggests that neither equation have problems with specification errors.[3]

Next, both equations were tested for multicollinearity using the Tolerance (TOL_j) and the Variance Inflation Factor (VIF_j) tests. In the case of equation (6.2.3) the VIF_j values are less than ten $(1.587 - 1.998)$ and TOL_j values are approximating a value of one (falling between 0.501 – 0.630). Similarly, in the case of equation (6.2.4) the VIF_j values are less than ten $(1.117 - 1.886)$ and TOL_j values are approximating a value of one (falling between 0.530 – 0.896). Thus, the test results indicate that there is no problem of multicollinearity in either of the two equations.

[3] RESET results of equation (6.2.3) : RESET (2): t-statistic = 0.0005; critical value = 4.17. RESET(3): t-statistic = 1.4047; critical value = 3.32. RESET (4): t-statistic = 1.7688; critical value = 2.92.

RESET results of equation (6.2.4): RESET(2): t-statistic = 1.5760; critical value = 4.17. RESET (3): t-statistic = 0.7634; critical value = 3.32; RESET (4): t-statistic = 0.5534; critical value = 2.92.

Both equations were then tested for autoregressive conditional heteroscedasticity using the Arch(p) test. The results of the ARCH(p) tests indicate that the error variances of equations (6.2.3) and (6.2.4) are not affected by autoregressive conditional heteroscedasticity. The probabilities (p-values) of obtaining the chi-square test statistics are sufficiently large in both equations. In equation (6.2.3) the test results of ARCH(1) to (3) produced t-statistics of 0.0320, 0.0132, and 0.8888, with corresponding p-values of 0.85, 0.96, and 0.80 respectively. Similarly, in equation (6.2.4), the test results of ARCH(1) to (3) produced t-statistics of 1.2190, 1.0960, and 1.8128, with corresponding p-values of 0.30, 0.70, and 0.70 respectively. These results suggest that the error variances of the two equations are not serially correlated.

The Granger causality test results are presented in the Table 6.2.2 below.

Table 6.2.2

Results of Granger Causality Test (Equations 6.2.3 and 6.2.4)

Direction of Causality	F-Statistic	Critical Value (α=0.05)
DKPOP $\Rightarrow$ RGDP	4.19	$F(4,37) = 2.65$
RGDP $\Rightarrow$ DKPOP	7.91	$F(6,35) = 2.39$

The results of the Granger causality test suggest feedback, or bilateral causality between the rate of growth of technological dependence, as represented by DKPOP, and the growth rate of real GDP (RGDP), in the period 1955-1998.

First, the results indicate that the DKPOP Granger-causes RGDP. The F-test is statistically significant at the 5% level with an F-statistic of 4.19 and a critical value of 2.65 (The F-test is not significant at the 1% level). At the same time, the opposite direction of causality also holds, that is, RGDP Granger-causes DKPOP.

The F-test is statistically significant at the 5% level with an F-statistic of 7.91 and a critical value of 2.39 (The F-statistic also exceeds the critical value at the 1% level). It should also be noted here, that aside from the results of the F-tests, which point to bi-directional causality, a t-test revealed that, similarly to the results of the analysis in section 6.1, the association between RGDP and DKPOP is a positive one.

The causality running from DKPOP to RGDP is likely associated with the human capital characteristics of the imported personnel and the subsequent effect on the skill level of the labour force. Additionally, an increase in imported personnel may have a direct impact on GDP through the change in spending associated with the higher average income of this group, as well as an indirect impact through the change in spending of the Greenlandic born population A change in the level and pattern of spending may occur as a result of the demonstration effect. These points were discussed in section 6.1. The feedback effect, represented by the causality running from RGDP to DKPOP, may be explained by the increase in demand for skilled labour associated with an increase in economic growth. Skill development and educational attainment has not kept pace with the growth of real GDP in Greenland, and hence Greenland has not been able to meet the increased requirements of the labour market, and therefore Danish personnel has been imported to fill the gap.

These results suggest that Greenland's technological dependency, as represented by the share of imported personnel in the work force, has been a factor in Greenland's economic growth process. Additionally, the results indicate that strategies involving the employment of imported personnel (e.g. G-50 and G-60) have been successful in terms of their impact on Greenland's economic growth record.

6.3 Conclusion

This chapter tested various relationships between real economic growth and indicators of dependence. The results of this analysis did not lend overwhelming support to arguments of a negative association between external dependency and economic growth. Only one variable, DKEXP, was negatively associated with economic growth. However, to gain further insight into the association between Danish financing and economic growth in Greenland, an estimation was undertaken using the first-difference of real Danish expenditures on Greenland as the measure of financial dependency. The results of this estimation indicated that when financial dependency is measured simply as the first-difference of Danish expenditures, and not as a ratio of GDP, then financial dependency is positively associated with economic growth.

The test results indicated that some dependency measures fuel economic growth. These results are in keeping with the general inconclusive results regarding dependency theory in the empirical literature.

While keeping in mind that the causality results are at best suggestive, the results provide some preliminary insight into the question of the effectiveness of economic development strategies in the post-colonial era in terms of the impact on economic growth in Greenland. Danish State financing and the reliance on Danish personnel have been key features throughout the era under study. The Granger-causality results indicate that technological dependency has been a contributing factor in Greenland's economic growth process, and furthermore, that the rate of economic growth has fuelled further dependency on technology. In the case of financial dependency, however, the analysis points to a case of growth retardation caused by external financing, while economic growth itself leads to a reduction in the rate of growth of financial dependency. As a side note, the results of the causality test, using the rate of growth of real Danish expenditures as an alternative measure of dependency, were briefly reported on. When financial dependency is measured as the rate of growth of Danish expenditures the results continue to show bi-directional causality, but the findings indicate that the rate of growth of Danish expenditures fuels economic growth.

In chapter seven this study analyses the relationship between economic instability and indicators of dependency. While the present chapter did not suggest a negative association between all indicators of dependency and economic growth, any negative consequences of external dependency may be felt on economic instability. But first, in the next chapter the analysis turns to an empirical investigation into the presence of structural change in the Greenland economy and its impact on economic stability.

Chapter 7

Structural Change In Greenland, 1955-1998

7.0 Introduction

This chapter presents a macroeconomic time series analysis of structural change in Greenland in the period, 1955-1998. Specifically, it tests for the presence of permanent level breaks and one-time pulse changes in the real export and real GDP macroeconomic time series for the period 1955-1998, using a test procedure developed by Perron (1989).

An analysis of the presence of structural change is of key interest to this study. This is because it helps reveal information about the sensitivity to shocks of Greenland's very small, highly dependent, and very narrowly based economy, just as it provides information to help identify some of the key sources of economic instability of that country.

The following first briefly presents some introductory comments about the debate over the dynamic properties of macroeconomic time series and the unit root hypothesis. Next, and as part of the analysis of structural change, it tests the unit root hypothesis and draws conclusions about the stationarity of the real exports and real GDP time series for the Greenland economy. This is followed by a discussion and graphical illustration of three possible breakpoints over the period 1955-1998. The graphical analysis provides preliminary insights into the presence of structural change. Finally, this chapter presents a formal test and analysis of structural change in the Greenland economy. The study formulates hypotheses about the presence of structural change surrounding three key events in the history of Greenland. These events include a positive supply shock in 1973, the introduction of Home Rule in 1979, and a negative supply shock in 1990.

7.1 Testing for structural change

The dynamic properties of macroeconomic and financial time series have been debated extensively in the literature. The main issue in the debate has been the long run response of a trending data series to a current shock to the series. Using statistical techniques developed by Dickey and Fuller (1979; 1981), Nelson and Plosser (1982) argued that random shocks have permanent effects on the long-run levels of most macroeconomic and financial aggregates (Zivot et al.; 1992). In fact, much of the empirical evidence has found that fluctuations are not transitory and hence that most macroeconomic time series have a unit root. Against this view, Perron (1988; 1989) has concluded that most macroeconomic time series are not characterized by the presence of a unit root and that fluctuations are indeed transitory. Perron found that most macroeconomic variables are not characterized by unit root processes as widely believed. Instead, he found evidence to suggest that the variables are trend stationary processes coupled with structural breaks. He found that when a macroeconomic time series has a structural break, the various Dickey-Fuller and Phillips-Perron test statistics are biased toward the non-rejection of a unit root, even when the series is stationary within each sub-period occurring before and after the breakpoint. Perron argued that if the Great Depression of 1929 and the oil price shock of 1973 are treated as points of structural change then one can reject the unit root hypothesis, and most macroeconomic time series are in fact trend stationary. He found evidence to suggest that the Great Depression created a dramatic drop in the mean of most aggregate variables, and that the oil price shock of 1973 was followed by a change in the slope of the trend for most aggregates. He went on to suggest that most macroeconomic variables are trend-stationary if one allows a single change in the intercept of the trend function after 1929 and a single change in the slope of the trend function after 1973 (Perron, 1989, pp. 1362-3).

This section uses the methodology advanced by Perron (1989) to test for structural breakpoints in the Greenland economy. First, it presents the conventional unit root test to draw conclusions about the stationarity of the real exports and real GDP macroeconomic time series for the Greenland economy. If the time series show evidence of non-stationarity, then this may be the result of structural breaks in the series. A formal test is then presented to ascertain hypotheses about such breakpoints.

7.1.1 Unit root test

In order to draw conclusions about the time series properties of the real export and real GDP series, the series are tested for the presence of a unit root. The Phillips-Perron tests were performed on both series using the relevant unit root test commands available in the SHAZAM program. Table 7.1 below presents the test results for the Greenland economy, 1955-1998.

Table 7.1 Phillips-Perron Unit Root Test Results, 1955-1998.

Variable	τ-statistic	Critical value 5%	Conclusion
Real Exports			
Constant, no trend	-1.5166	-2.93	Unit root
Constant, plus trend	-1.5015	-3.50	Unit root
Real GDP			
Constant, no trend	-1.0383	-2.93	Unit root
Constant, plus trend	-1.8284	-3.50	Unit root

In the case of real exports, it is not possible to reject the null hypothesis of a unit root at conventional significance levels. The test statistic for the estimation with a constant but no trend is -1.51, which is greater than the critical values for n=50, with values of -2.60, -2.93, and -3.22 at the 10%, 5%, and 1% significance levels, respectively. Similarly, the test statistic for the estimation with a constant and trend is -1.50, which is greater than the critical values of -4.15, -3.50, and -3.18 at the 10%, 5%, and 1% levels of significance, respectively. Thus, the results of the Phillips-Perron test for stationarity suggest that a unit root problem exists in the levels of the real export series.

Similarly, in the case of real GDP, the null hypothesis of a unit root cannot be rejected at conventional significance levels. The test statistics of -1.03 and -1.82 exceed the Phillips-Perron critical values at conventional significance levels in the estimations with and without a time trend. Hence, the results of the unit root tests suggest that the macroeconomic time series are described by non-stationary processes. The economic interpretation of these results is that exogenous shocks to the system will have permanent effects on the real exports and real GDP series. However, as outlined briefly in the previous section, Perron (1989) presented a test and empirical evidence to suggest that most macroeconomic series may be trend stationary with structural breaks, and not unit root processes as suggested by much empirical research in the literature. Thus, while these test results point to a case of non-stationarity in the macroeconomic time series for the Greenland economy, the results could be biased toward the non-rejection of a unit root. That is, the presence of possible breakpoints in the Greenland macroeconomic time series may bias the processes toward the non-rejection of a unit root.

In the following this study presents an application of the Perron (1989) test for structural change to the case of the Greenland economy. The Perron test for structural change assumes that the breakpoints are known. Three possible breakpoints are identified.

7.1.2 Breakpoints in the Greenland economy

There are three big events in the post-colonial history of Greenland that could reasonably be viewed as possible exogenous structural breakpoints. These events are: first, a positive supply shock with the opening of a zinc and lead mine in 1973. Following the opening of this mine the export of zinc and lead concentrates increased dramatically between 1973 and 1974. The combined increase in exports represented an increase of 1,455 percent in export revenue that year.

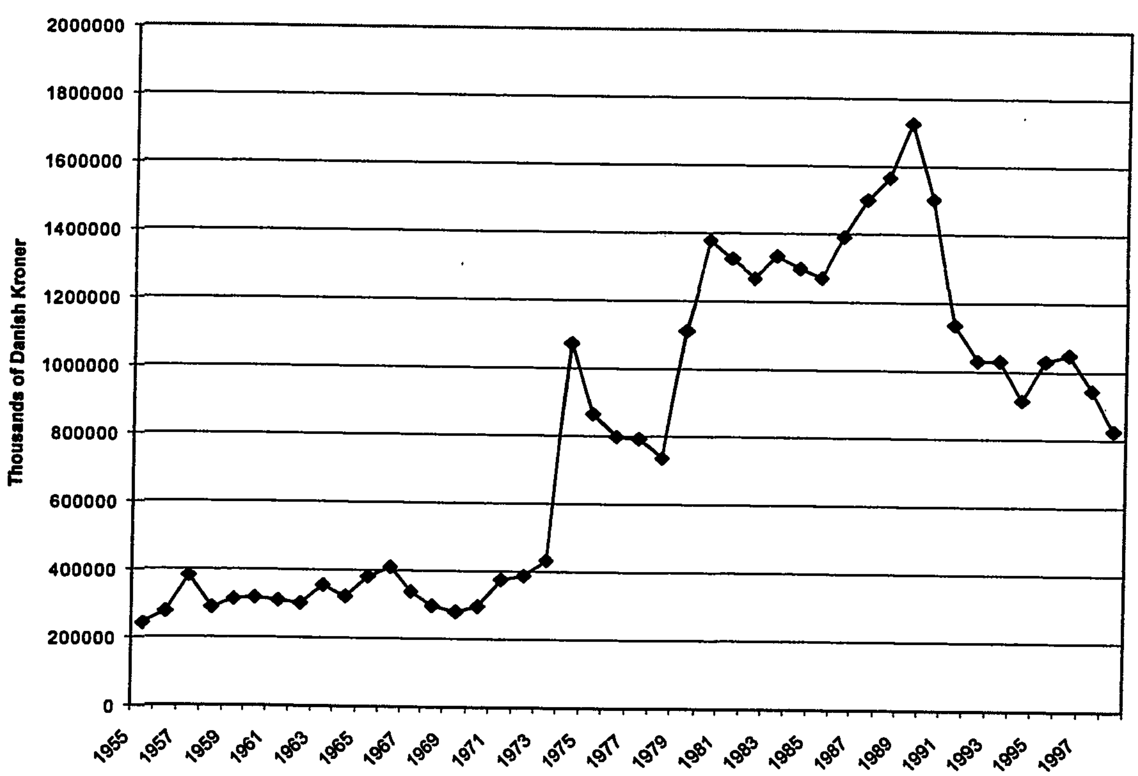
Second, the introduction of Home Rule in 1979 may represent a possible breakpoint. As discussed in chapter three, the phased transfer of administrative fields from the Danish administration began following the introduction of Home Rule. The phased transfer started in 1980 and finished in 1992.

Third, in 1990 Greenland experienced a major shock to its natural resource supply, which also meant a major decrease in the country's export base. This negative supply shock occurred with the closure in 1990 of the Maarmorilik and Black Angel mines, both zinc and lead mines. There have been no active mines in Greenland since then. In addition, the impact on the export base was aggravated by the disappearance of cod from Greenlandic waters. At the start of the 1970s cod fishing dropped dramatically, in part due to over-fishing and in part due to a fall in the temperature of the ocean waters. The Greenlandic cod fisheries were at their highest levels in the 1950s and 1960s. Since the 1970s, except for a brief period in the mid 1980s, the cod fisheries have remained relatively low. By 1991 cod fisheries had lost their importance to Greenland fisheries, and in 1992 the cod had completely disappeared from Greenlandic waters (Statistics Greenland, 2000).

As emphasized earlier, an empirical test is required to draw conclusions about the presence of structural breaks and their statistical significance. A graphical illustration of the real exports and real GDP series and their detrended series, however, can provide a crude and preliminary insight into the presence of possible structural breakpoints surrounding the key events in the years outlined above.

Figure 7.1 below shows the real export series for the Greenland economy, 1955-1998.

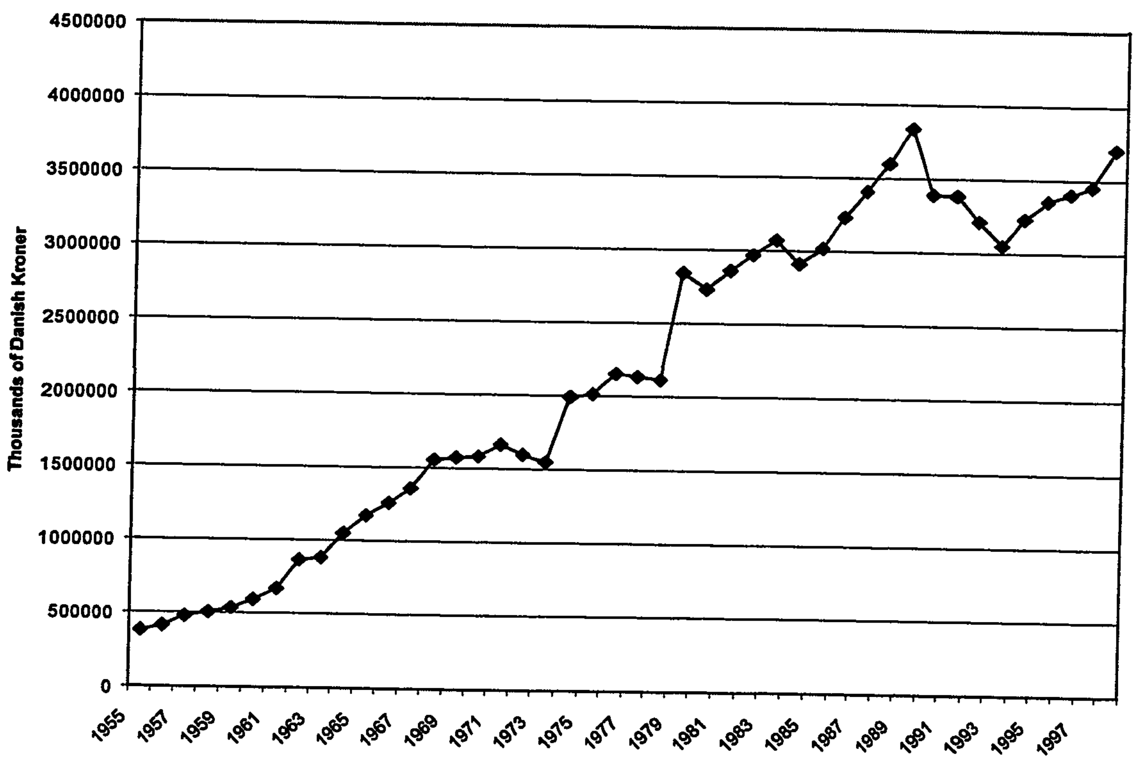
Figure 7.1 **Real Export in Greenland, 1955-1998.**



The series displays evidence of positive breakpoints in both 1973 and 1979, and a negative breakpoint in 1990.

Similarly, in the case of the real GDP time series, and as shown in Figure 7.2 below, there is preliminary evidence of possible breakpoints over the period, 1955-1998. The graphical illustration presents some evidence of breakpoints in the years discussed above; i.e. evidence of positive breaks around 1973 and 1979, and a negative breakpoint in 1990.

Figure 7.2 **Real Gross Domestic Product in Greenland, 1955-1998.**



Additional graphical support can be gained by detrending the two time series. The detrended real exports and real GDP series provide graphical illustrations in support of possible breakpoints in Greenland's post-colonial history. The macroeconomic time series are detrended by estimating each of the following two linear equations:

$$RX_t = \alpha_0 + \beta_1 T + \varepsilon_t \quad (7.1)$$

$$RGDP_t = \alpha_0 + \beta_1 T + \varepsilon_t \quad (7.2)$$

where RX_t = real exports at time t, $RGDP_t$ is real exports at time t, and T is a time trend.

The results from estimation of equation (7.1) are as follows:

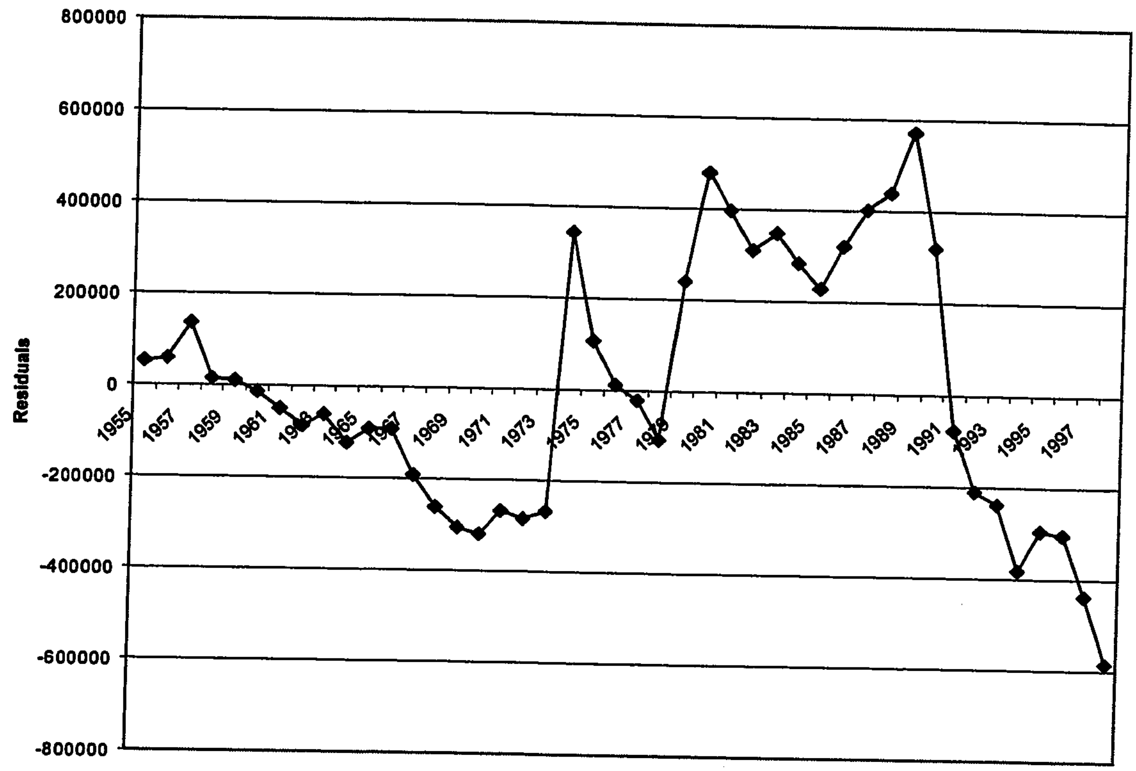
$$RX_t = \underset{(0.3039)}{\underset{29385}{\alpha_0}} + \underset{(8.707)}{\underset{28102}{\beta_1 T}}$$

$\overline{R}^2 = 0.6297$

The estimation results of the linear trend equation (7.1) are quite satisfactory. The adjusted R-square is 0.6297. The deterministic time trend, T, is highly significant at the 1% level of significance with a t-ratio of 8.707.

The estimated residuals from equation (7.1) are graphed in Figure 7.3 below. The graphical illustration points to possible breakpoints in 1973, 1979 and 1990. Additionally, the plot suggests a negative trend for the period 1980-85, the years that coincide with a period of unstable and uneven growth for the Greenland economy. This is followed by an upward trend for the period 1985-1989, which marked the years of a five year development strategy that involved the modernization of the Greenlandic fisheries sector (See chapter three). This period was characterized by healthy growth. However, a formal test is required to draw definitive conclusions about breakpoints in the time series.

Figure 7.3 Estimated residuals from equation (7.1).



Similarly, the results from estimation of equation (7.2) are as follows:

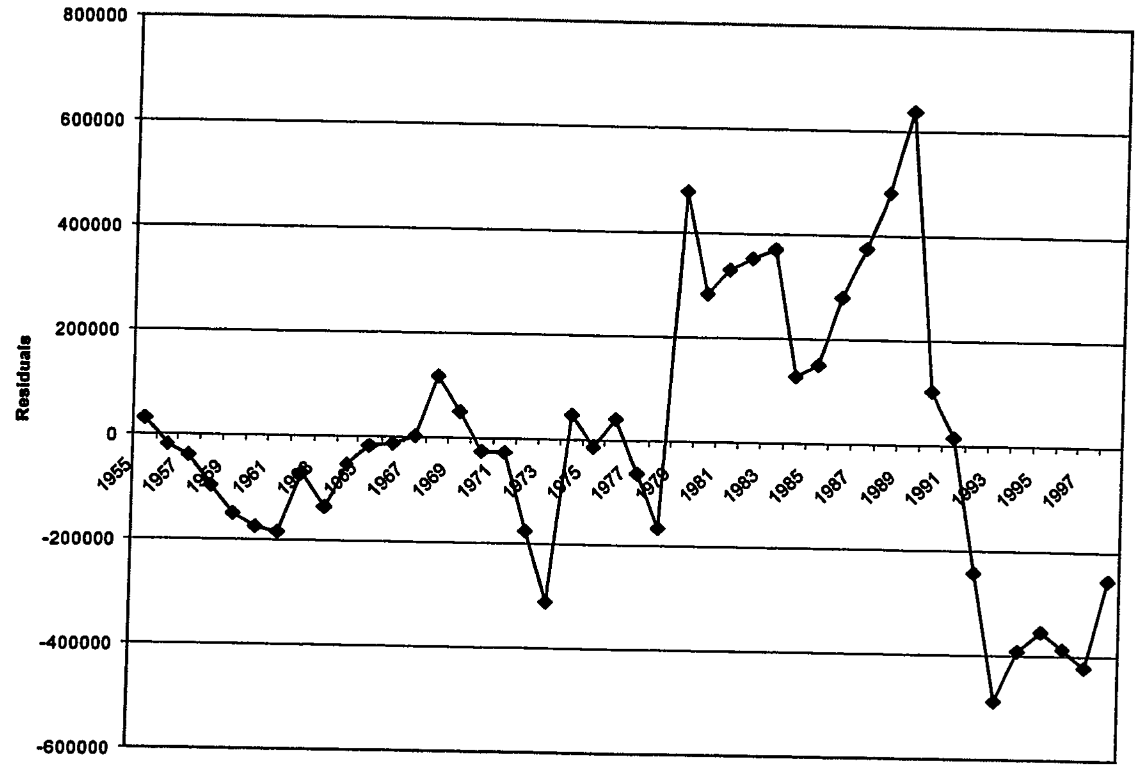
$$RGDP_t = \underset{\substack{-158080 \\ (-1.685)}}{\alpha_0} + \underset{\substack{84025 \\ (27.12)}}{\beta_1 T} \tag{7.2}$$

$\overline{R}^2 = 0.94$

The estimated linear trend equation (7.2) has a very good fit with an adjusted R-square of 0.94. The deterministic time trend, T, is highly significant with a t-ratio of 27.12.

The estimated residuals of equation (7.2) are graphed in Figure 7.4. The detrended real GDP series shows evidence of wide fluctuations from the early 1970s and onward. As in the case of the real export series the graphical illustration points to a possible positive breakpoint in 1973 and again in 1979, and a negative breakpoint in 1990. Additionally, mirroring the trends of the exports series, the plot suggests a downturn in the trend of the estimated residuals in the early 1980s, the years of uneven growth that coincide with the period of the phased transfer of administrative fields from the Danish administration to the Home Rule government. This is followed by an upswing in the years of healthy growth (coinciding with the years of the 5 year development plan), which lasted till the end of the 1980s.

Figure 7.4 **Estimated residuals from equation (7.2).**



The graphical illustrations above have provided preliminary insight into possible breakpoints in the Greenland economy in the period 1955-1998. The following section presents a formal test and analysis to draw conclusions about the presence of structural change in Greenland.

7.1.3 The model

To test the macroeconomic time series for the presence of structural breaks the following autoregressive equations are estimated, using the approach suggested by Perron (1989)[1]:

$$RX_t = a_0 + \mu_1 D_P + \mu_2 D_L + a_2 t + a_1 RX_{t-1} + \varepsilon_t \qquad (7.3)$$

$$RGDP_t = a_0 + \mu_1 D_P + \mu_2 D_L + a_2 t + a_1 RGDP_{t-1} + \varepsilon_t \qquad (7.4)$$

where RX_t represents the real exports series and $RGDP_t$ represents the real GDP series, and t is a deterministic time trend. a_1 is the coefficient of the one-period lagged real export series and real GDP series in equations (7.3) and (7.4), respectively. Under the null hypothesis of a unit root, the theoretical value of a_1 is unity. D_P and D_L represent two dummy variables that take on the values of the hypothesized breakpoint years. D_P represents a pulse dummy variable such that $D_P = 1$ if $t = \tau + 1$ and zero

[1]Perron (1989) also presented an alternative technique: first, estimate the linear time trend equation with the dummies, and obtain the residuals. Next estimate an equation with the residuals as the dependent variable and the lagged residuals as the independent variable. The results of this method and the method presented above is the same. Both methods were attempted in this study, and the conclusion reached were the same for the two approaches. Perron also suggested using an augmented form of the model if serial correlation is present. Since serial correlation was not a problem in the present study the augmented form was not employed in the estimation.

otherwise, and D_L represents a level dummy variable such that $D_L = 1$ if $t > \tau$ and zero otherwise, where τ is the year of the breakpoint. The subscript P in the dummy variable D_P refers to the fact that there is a single pulse in the dummy variable. In the case of a unit root process, a single pulse in the dummy will have a permanent effect on the sequence of a macroeconomic series, and hence a one-time shock will have a permanent effect on the mean value of the sequence. This would mean that a macroeconomic process takes a discrete jump, without ever exhibiting any tendency to return to the pre-break level. In the case of a stationary process, on the other hand, a single pulse in the dummy would mean a permanent change in the intercept followed by a continuation of a trend stationary process.

In contrast to the subscript P, the subscript L in the dummy variable D_L is designed to indicate that the level of the dummy changes. In the case of a stationary process, a one-time change in the level of the process will be followed by a continuation of a stationary process. A level shift, also referred to as structural change, would mean a change in the rate of change of the series. If, on the other hand, a level change occurs in a unit root process, then following this change the series continues on its non-stationary process, never exhibiting a tendency to return to the pre-break level.

To test for a structural break point the following null hypothesis is tested:

Null hypothesis: $a_1 = 1$, $a_2 = 0$ and $\mu_2 = 0$. Hence, the null hypothesis is that there is a one-time change in the mean of a unit root process.

Against the null hypothesis is the following alternative hypothesis:

Alternative hypothesis: $a_1 < 1$ and $\mu_1 = 0$. Hence, there is a permanent one-time break in a trend stationary model.

Perron (1989) shows that when the estimated residuals, in this case from equations (7.3) and (7.4), are identically and independently distributed, the distribution of the coefficient a_1 depends on the proportion of observations occurring prior to the breakpoint. This proportion is denoted by $\lambda = \tau/T$ where T = total number of observations, and τ is the number of observations before the break. There is no structural change unless $0 < \lambda < 1$. Perron calculated critical values that depend on the sample size and the value of λ. Under the null hypothesis of a unit root, classical test procedures which assume stationarity are inappropriate, and therefore conventional critical values of the t-test cannot be used. Perron's critical values are printed in his journal article of 1989.

7.1.4 Estimation results and discussion[2]

i) Testing for structural change in 1973. The opening of zinc and lead mine:

The Black Angel mine in the Uummannaq area of central West Greenland opened in 1973 and closed in 1990. While this mine produced significant volumes of zinc and

[2] The Perron (1989) test for structural change was also performed for 1985 to test the impact of the onset of the 5 year development program. The results, however, were statistically insignificant and are not reported here.

lead concentrates, the total tonnage was on a much smaller scale than the larger mines of Mestervig, Ivittuut, and Maarmorilik, all of which are now closed. In the first year of the operation of this mine total tonnage of zinc export rose from 17,920 to 161,777 tonnes, 803 per cent, and the export revenue rose by approximately 1,150 per cent. That same year lead export rose from zero to 37,687 tonnes. The total increase in zinc and lead export revenue was 1,455 per cent. This dramatic increase in export volume and revenue can be explained largely by the significant increase in mineral exports that year resulting from the opening of the Black Angel mine.

Thus, while research, such as that presented by Perron (1989), points to a negative pulse break following the oil crisis in 1973 in most macroeconomic series, in the case of Greenland there may be evidence of a positive breakpoint. Similarly, empirical evidence may provide evidence to suggest a positive rather than negative breakpoint in the GDP series because of possible trickle down effects produced by the export sector.

Equation (7.3) above was estimated using OLS. The dummy variables are defined as $D_P = 1$ in year 1974 and zero otherwise; and $D_L = 1$ for all t beginning in 1974 and zero otherwise. The results of the estimated equation, equation 7.1.3, are presented in Table 7.2 below.

Tests were performed for goodness of fit, normality, equation specification error, autoregressive conditional heteroscedasticity, and multicollinearity.

On the whole, the results of the OLS estimation of equation 7.1.3 indicate that the goodness of fit along with the results of the residual tests is satisfactory. The adjusted R-square is 0.93. The Jarque Bera test for normality indicated that the residuals are approximately normally distributed. The ARCH(p) test suggested that there is no problem of autoregressive conditional heteroscedasticity. Also, multicollinearlity was checked using the Tolerance and Variance Inflation Factor tests. The test results indicated that there is no serious problem of multicollinearity. Finally, the Ramsey RESET tests were performed to test for specification error. The tests were statistically insignificant at the 5% level of significance, which suggests that the regression equation has no specification error.

Under the presumption of a one-time change in the mean of a unit root process, $a_1 = 1$, $a_2 = 0$, and $\mu_2 = 0$. Under the alternative hypothesis of no unit root, $a_1 < 1$, and $\mu_1 = 0$, and there is a permanent one-time break in a trend stationary model. As noted earlier, Perron (1989) showed that the distribution of a_1 depends on the proportion of observations occurring prior to the time of the breakpoint, and that this proportion is denoted by $\lambda = \iota/T$, where T = total number of observations, and ι is the number of observations occurring before the break. In the present estimation, T=45, $\iota = 19$, and hence $\lambda =$ 0.42. For $\lambda =$ 0.42 and with 50 observations (n = 50), the critical values calculated by Perron are -3.72 and -3.44 for conventional levels of significance at the 5% and 10% levels, respectively.

The estimation results show that the point estimate μ_1 of the dummy variable D_P is significantly different from zero at conventional levels. The t-statistic of 3.608 exceeds the critical value calculated by Perron. The point estimate μ_2 of the level dummy, D_L, on the other hand, is not statistically significant with a t-ratio of 1.411. Similarly, the time trend, t, does not pass the significance test at conventional levels with a test statistic of -

0.652. With respect to the coefficient a_1 , the estimated value of $a_1 = 0.858$. It is significantly different from unity at the 5% and 10% levels of significance with a t-ratio of 8.957, and hence, there is little support for the unit root hypothesis. Acceptance of the null hypothesis would require a value of a_1 that approximates unity.

The statistically insignificant level dummy, D_L , was dropped from the equation. After dropping the level dummy the estimation results, as shown in equation 7.1.3, suggest that the pulse dummy D_P is statistically significant with a t-ratio of 4.935. Also, $a_1 = 0.949$ with a t-statistic of 13.23 is statistically significant and is approximating a value of unity. It should be noted here, however, that, as discussed by Adgar (1994), a dilemma occurs when analysing series with roots close to unity in absolute value. Unit root tests do not have much power in discriminating between characteristic roots close to unity and actual unit roots. This dilemma aside, the results point to a unit root process in the real export series with a breakpoint in 1973. Overall, the estimation results suggest that Greenland experienced a permanent one-time increase in the intercept of the real export series following the dramatic increase in export volume in 1973, which resulted from the increase in exports of zinc and lead concentrates. Given the failure to reject the unit root hypothesis it can be concluded that this breakpoint had a permanent effect on the Greenland economy. As briefly noted above the year 1973 was also the year of the world oil price shock, which according to findings by Perron (1989) caused a negative level break, or in other words, a single change in the slope of the trend function of most macroeconomic time series. In the case of Greenland, however, any potential negative consequences of the 1973 oil price shock has, according to the estimation results, been outweighed by the dramatic increase in Greenland's natural resource supply, and in turn the expansion of the primary export base following the opening of the Black Angel mine.

Next, the test for structural change in 1973 was performed on the real GDP series. Hence, equation 7.4 above was estimated with real GDP as the dependent variable. Again, and as in the previous estimation, $D_P = 1$ in year 1974 and zero otherwise; $D_L = 1$ for all t beginning in 1974 and zero otherwise. As in the case of the real export equation, tests were performed for goodness of fit, autoregressive conditional heteroscedasticity, multicollinearity, normality, and specification error. The results suggested a very good fit with an adjusted R-square of 0.97. Also, all residual tests were favourable.

The estimation results of equation 7.4 are presented in Table 7.2 below. Equation 7.4.1 suggests that neither the pulse dummy nor the level dummy are significant at conventional levels with test statistics of 1.051 and 1.661 respectively. Thus, there is no empirical evidence to suggest either a pulse or a level break in the real GDP series in 1973. The time trend also fails the significance test with a t-statistic of 1.728. The estimated coefficient of $a_1 = 0.743$ is highly significant with a t-ratio of 6.985 and a Perron critical value of -3.72. Since a_1 is statistically different from unity, there is evidence to suggest that the real GDP series, when estimated together with the pulse and level dummies, does not have a unit root.

In equation 7.4.2 the pulse dummy is dropped, and the significance of the level dummy increases. At a t-statistic of 2.275, and using the Perron critical value of -3.72, the level dummy D_L fails the significance test. It should be noted, however, under classical testing procedures (which assumes stationary variables) the critical value would be 2.00 and the point estimate would have passed the significance test at the 5% level. Similarly, the time trend, t, fails the significance test with a t-ratio of 1.916, but it would have passed the t-test at the 10% level under classical stationary assumptions.

Overall, the estimation results of the real GDP equation suggest that the opening of the Uummannaq mine in 1973, and the subsequent increase in export volume, did not give rise to either a pulse or a level shock in the real GDP series. Thus, while the real exports series experienced a pulse shock in 1973, the real GDP series did not feel the effects of the increase in Greenland's natural resource supply. This result may shed light on the lack of strength of economic linkages in the period prior to the introduction of Home Rule. The statistically insignificant pulse and level dummies in the real GDP series may be explained in part by the size of the supply shock, but also by the weak and underdeveloped economic linkages and the subsequent inability of the Greenland economy to fully reap the advantages of the growth of the export sector in the pre-Home Rule era. As a further explanation, it is possible that the 1973 oil shock caused the price of imports to rise, and that the resulting negative effect on GDP could have outweighed any potential effects of the positive resource supply shock.

Table: 7.2
Breakpoint: 1973

Dependent Variable: Real Exports	a_0	μ_1	μ_2	a_2	a_1
7.3.1	83434 (1.464)	521400 (3.608)	144800 (1.411)	-1946.5 (-0.652)	0.8584 (8.957)
7.3.2	32373 (0.726)	624020 (4.935)		212.45 (0.082)	0.9494 (13.23)
Dependent Variable: Real GDP					
7.4.1	92893 (1.268)	191400 (1.051)	184280 (1.661)	14826 (1.728)	0.7438 (6.895)
7.4.2	107600 (1.494)		231200 (2.275)	16256 (1.916)	0.7071 (6.918)

Test statistics are in brackets.

However, the evidence on the value of imports does not lend much support for such an explanation, as the increase in the value of nominal imports remained approximately constant at around 12 percent in each of the years from 1972 to 1974.

ii) Testing for structural change in 1979. The introduction of Home Rule:

The real exports and real GDP series are now each tested for structural change with the introduction of Home Rule in 1979. Equations 7.3 and 7.4 are estimated with the pulse and level dummies defined as follows: $D_P = 1$ in year 1980 and zero otherwise; $D_L = 1$ for all t beginning in 1980 and zero otherwise.

The estimation results of the real export equation are presented in equation 7.3.3, Table 7.3. Tests were performed for goodness of fit, autoregressive conditional heteroscedasticity, multicollinearity, normality, and specification error. The results suggested a very good fit with an adjusted R-square of 0.89. Also, all residual tests were favourable, and tests indicated that multicollinearity is not a serious problem.

Here T=45, $\iota = 24$, and hence $\lambda = 0.53$. For $\lambda = 0.53$ and n = 50, the critical values calculated by Perron are -3.76 and -3.46 for the 5% and 10% levels of significance, respectively.

Neither the level nor the pulse dummy are significant at conventional levels. D_P is statistically insignificant with a t-ratio of 1.945 and a critical value of -3.76 at the 5% level of significance. Similarly, with a t-ratio of -0.364 the level dummy D_L is statistically insignificant at the 5% level. Thus, there is evidence to suggest that Greenland did not experience a structural change in the real export series as a result of the introduction of Home Rule in 1979. The results further suggest that $a_1 = 0.893$, and with a t-ratio of 8.297, is statistically different from unity at conventional levels of significance leaving little support for the unit root hypothesis. The time trend, t, with a t-ratio of 0.785 does not pass the significance test at the 5% and 10% levels, thereby suggesting that the export series is not trend stationary.

In equation 7.3.4, the statistically insignificant level dummy, D_L, is dropped from the estimation. However, the significance tests remain largely unchanged, as there is no evidence of a pulse break at the time of Home Rule. As a point of interest, under classical testing procedure, with an assumption of stationarity of the series, the pulse dummy, with a t-ratio of 1.935, would have passed the significance test at the 10% level.

Next, the test for structural change is performed for the real GDP series, and the estimation results are reported in equations 7.4.3 and 7.4.4. As in the previous estimations, residual tests were performed, and the results were checked for multicollinearity. The results of these tests are quite satisfactory. Similarly, the goodness of fit is very good with an adjusted R-square of 0.97.

The results of equation 7.4.3 show that neither the level nor the pulse dummy are statistically significant. The point estimate μ_1 of the dummy variable D_P is not statistically significant at conventional levels. With a t-statistic of -0.428, the pulse dummy does not exceed the critical value calculated by Perron. Similarly, the point estimate μ_2 of the level dummy, D_L, is not statistically significant with a t-ratio of -0.456. With respect to the unit root hypothesis, the coefficient $a_1 = 0.823$ is significantly different from unity at conventional levels with a t-ratio of 6.746, thus suggesting that the series is stationary in levels when estimated together with the breakpoint dummies. The time trend, t, does not pass the significance test with a t-statistic of 1.724, which fall below the critical value calculated by Perron, thus indicating that the series is not trend stationary.

In equation 7.4.4, the pulse dummy is dropped from the equation. However, the results of the significance tests of the remaining variables do not change. The level dummy remains highly insignificant with a t-ratio of -0.538. The coefficient $a_1 = 0.813$ is significantly different from unity at conventional levels with a t-ratio of 7.439, thus suggesting that the series is stationary in levels when estimated together with the breakpoint dummy. The time trend, t, does not pass the significance test. The t-statistic of 1.917 falls below the critical value of -3.72 calculated by Perron. It should be noted here, however, that classical testing procedures would have found the time trend significant at the 10% level.

Overall, the results of the estimation of the real GDP equation suggest that the introduction of Home Rule did not result in structural change in the Greenland economy. At a general level, it can be argued that the introduction of Home Rule did not provide a significant change in the country's policy regime, but rather, that the country for many years, despite Home Rule, continued to operate under limited political autonomy and very limited economic autonomy. Additionally, an explanation for the lack of structural change may be sought in the way in which administrative fields were transferred to the Home Rule government. The first fields to be transferred were relatively small and easy to administer. These fields were transferred in January 1980, and they were: Organization of the Home Rule in Greenland; organization of local government; direct and indirect taxes; and the established church and dissenting religious communities (Skydsbjerg, 1999; Lyck, 1996). The following year, in 1981, other fields such as; fisheries, hunting and agriculture; legislation governing trade and competition; social welfare; labour market affairs; and education and cultural affairs, were transferred. In 1984 'other matters' relating to trade were transferred, and then in later years the remaining fields, such as health services, supply of goods, and internal transport were transferred. Thus, the fields that were transferred initially were relatively minor in scope and probably of limited consequence for the Greenland economy. The phased transfer meant that there was no real shock to the economic system since fields were transferred over time with the smaller and lighter fields transferred first. Moreover, when the various fields were transferred, the Home Rule government adopted the Danish system that was already in place in Greenland. Furthermore, since there was not enough qualified Greenlanders to fill the administrative positions, Danish personnel were imported to fill many of those positions. While the Greenlandic politicians made the final decisions, the large number of imported Danish personnel undoubtedly allowed the Danish influence to continue, at least at some level, and this may have contributed to the weak or insignificant difference in economic structure seen in the period before and after Home Rule. In addition, while the Home Rule government has the legislative and executive power over the transferred fields, the juridical power rests with the Supreme Court in Denmark. Similarly, the Home Rule government controls Greenland's domestic affairs and fiscal policy, but it has no control over monetary policy, exchange rate policy, or defence and security. Furthermore, the implementation of Home Rule did not result in a change in the size of available public funds, nor did it entail the onset of an economic development program.

Table: 7.3
Breakpoint: 1979

Dependent Variable: Real Exports	a_0	μ_1	μ_2	a_2	a_1
7.3.3	27351 (0.356)	309580 (1.945)	-41702 (-0.364	2919.8 (0.786)	0.8932 (8.297)
7.3.4	47037 (0.873)	295430 (1.935)		2214.2 (0.706)	0.8704 (10.05)
Dependent Variable: Real GDP					
7.4.3	23776 (0.274)	-79507 (-0.429	-55909 (-0.457)	16254 (1.724)	0.8229 (6.746)
7.4.4	16122 (0.192)		-64409 (-0.539)	17286 (1.917)	0:8137 (6.847)

Test statistics are in brackets.

Rather, and as explained above, the transfer of fields was gradual, and it involved the immediate start of an annual block grant arrangement. The size of the block grant transferred was reached by considering the actual costs incurred by the Danish administration for the administrative field in question. This amount was then transferred to the Home Rule government. Essentially the block grant arrangement insured that the fields that were in place could continue without any change to the size of service delivery. All of this helps explain why Greenland did not experience a pulse or level break in its exports and GDP series at the time of implementation of Home Rule.

iii) Testing for structural change in 1990. Shocks to Greenland's natural resource supply.

In the following the real exports and real GDP series are now tested for structural change with the shocks to Greenland's natural resource supply in 1990.

Two mines, the Maarmorilik and Black Angel mines, closed in 1990 which meant a significant decline in the natural resource supply and a subsequent decline in export volume and proceeds. In addition, Greenland experienced a significant decline in export earnings due to a decline in the harvesting of fish resources with cod's disappearance from Greenlandic waters, as well as a decline in the world price of shrimp.

At the same time that Greenland was experiencing significant changes to its resource supply, the fishing industry was undergoing restructuring which entailed converting Royal Greenland to a commercially operated crown corporation in 1990.

Royal Greenland experienced significant financial strains in the years surrounding the restructuring which may likewise have added to the observed downturn in the Greenland economy in the early 1990s.

The economic downturn that started in 1990 was the result of a combination of things, including; export earnings that fell dramatically due to the disappearance of cod from Greenlandic waters, the decline in the world price of shrimp, the closure of two zinc and lead mines, and financial crisis in Greenland's key industry, Royal Greenland, in the midst of major restructuring. At the same time Greenland experienced a crisis in the building and construction industry. This downturn resulted in an increasing number of bankruptcies, first in construction, and then followed by other trades. This gave rise to increased unemployment, decreased incomes in fisheries, and for the Greenland government it meant increased expenditures but decreasing revenues (e.g. Grønlands Hjemmestyre, Landsplanredegørelse, 1994).

To test for the presence of a structural change in 1990, equations 7.3 and 7.4 are estimated with the pulse and level dummies defined as follows: $D_P = 1$ in year 1991 and zero otherwise; $D_L = 1$ for all t beginning in 1991 and zero otherwise. The estimation results are presented in Table 7.4 below.

The estimation results of the real export equation are presented in equation 7.3.5. Tests were performed for goodness of fit, autoregressive conditional heteroscedasticity, multicollinearity, normality, and specification error, and the results suggested a very good fit with an adjusted R-square of 0.91. Also, all residual tests were favourable, and tests suggested that there is not a problem with multicollinearity.

In the present estimation T=45, $\iota = 36$, and hence $\lambda = 0.80$. For $\lambda = 0.80$ and n = 50, the critical values calculated by Perron are -3.75 and -3.46 for conventional levels of significance at the 5% and 10% levels, respectively.

The results of the estimation of equation 7.3.5 show evidence to suggest that neither the level nor the pulse dummy are significant at conventional levels. The pulse dummy, D_P , is statistically insignificant with a t-ratio of -0.829 and a critical value of -3.76 at the 5% level of significance. Similarly, with a t-ratio of -2.879 the level dummy, D_L , is statistically insignificant at the 5% level. However, the level dummy would pass the classical significance test at the 5% level under an assumption of stationarity in the series. With respect to the unit root hypothesis, the results further suggest that the point estimate $a_1 = 0.715$, with a t-ratio of 6.678, is statistically different from unity at the 5% level of significance, thus leaving little support for the unit root hypothesis. The time trend, t, with a t-ratio of 2.660 does not pass the significance test at the 5% and 10% levels, thereby suggesting that the export series is not trend stationary. However, as a point of interest, as in the case of the level dummy, the time trend would pass a standard classical t-test at the 5% level of significance.

In equation 7.3.6, the insignificant pulse dummy is dropped from the estimation. With the deletion of the pulse dummy, the results now show evidence of a negative level shift in the real export series. The t-statistic of the estimated coefficient of the level dummy has increased to -3.856 which exceeds the Perron critical values of -3.75 and -3.46 at the 5% and 10% levels, respectively. Similarly, the time trend, t, now exceeds the Perron critical value at the 5% level with a t-statistic of 3.511. The estimated coefficient $a_1 = 0.676$, with a t-ratio of 7.039, is statistically different from unity at conventional levels of significance, thus leaving little support for the unit root hypothesis. Thus, the results of equation 7.3.6 suggest that the real exports series is described by a trend stationary process with a structural change occurring in 1990. This result lends support to the empirical findings of Perron (1989) that structural change biases the estimation towards a non-rejection of the unit root hypothesis. In other words, once the level break is accounted for, the series is trend stationary, and not a unit root process.

Turning now to the case of the real GDP series. The estimation results of the real GDP equation are presented in equation 7.4.5. As in the previous estimations, tests were performed for goodness of fit, autoregressive conditional heteroscedasticity, multicollinearity, normality, and specification error, and the results suggested a very good fit with an adjusted R-square of 0.98. Also, all residual tests were favourable.

The results of the estimation of equation 7.4.5 suggest that, as in the case of the real exports series, a negative level shift occurred in 1990. While the pulse dummy, D_P, is statistically insignificant with a t-ratio of 1.706 and a critical value of -3.76, the estimated coefficient of the level dummy is statistically significant at the 5% level with a t-statistic of -4.249. With respect to the unit root hypothesis, the results further suggest that the point estimate $a_1 = 0.314$, with a t-ratio of 4.251, is statistically different from unity at conventional levels of significance, thus leaving little support for the unit root hypothesis. The time trend, t, is also statistically significant at conventional levels with a t-statistic of 4.859.

In equation 7.4.6 the insignificant pulse dummy is dropped from the estimation. The results remain largely unchanged. The level dummy, the time trend, and the coefficient of the lagged real GDP, all remain statistically significant at the 5% level with t-statistics that exceed the Perron critical values. The results of the real GDP estimation provide strong evidence to suggest that the real GDP series is in fact a trend stationary process with a negative structural change occurring with the resource supply shock in 1990. This result, as in the case of the real export estimation, lends support to the Perron thesis that macroeconomic time series that are non-stationary unit root processes may in fact be trend stationary processes coupled with structural breakpoints. When the series are tested for the unit root hypothesis, and excluding the structural breakpoint, as shown in section 7.1.1, it is not possible to reject the unit root hypothesis for either of the two series.

The structural change that occurred in 1990 emphasizes the sensitivity of the Greenland economy to changes in the natural resource sector. The Greenland economy, as discussed earlier, is characterized by a narrowly based economy with limited economic diversification. This has left the economy vulnerable to even minor shocks or disturbances to its natural resource supply. As suggested by the results, when the macroeconomic series are controlled for the structural change in 1990, the evidence indicates that the series are trend stationary. Thus, the structural change that occurred as a result of the events outlined above was a source of instability in the Greenland economy, that is, without the inclusion of the structural change in the estimation, both of the series mimic a unit root process.

These results also point to the close link between Greenland's narrowly based economy, its small size, and its vulnerability to external shocks and disturbances. Destabilising forces originating outside a country can be more easily transmitted into a small country heavily dependent on foreign trade than they would be in a larger country not as heavily dependent on trade. Any shift in demand for the exports of small countries can mean a relatively large proportionate change in demand for the country's total product. It is also possible that a small country may not be in as strong a position to effectively retaliate against outside policy measures threatening to influence its economic stability (Khalaf, 1976, p. 423). In the case of Greenland, shocks and disturbances are likely to impact on both export and income instability, since even a small shock would represent a large share of total export volume because of the small size of this sector.

In the next chapter, this thesis takes a closer look at the extent of economic instability, and the causes and consequences of both exports and income instability in Greenland.

Table: 7.4
Breakpoint: 1990

Dependent Variable: Real Exports	a_0	μ_1	μ_2	a_2	a_1
7.3.5	-69456 (-1.123)	-133100 (-0.829)	-290000 (-2.879)	13162 (2.660)	0.7153 (6.678)
7.3.6	-81537 (-1.362)		-330000 (-3.756)	14861 (3.511)	0.6768 (7.039)
Dependent Variable: Real GDP					
7.4.5	-292060 (-2.992)	286800 (1.706)	-548050 (-4.249)	68397 (4.859)	0.3147 (4.251)
7.4.6	-234400 (-2.499)		-442600 (-3.817)	58552 (4.452)	0.4116 (5.145)

Test statistics are in brackets.

7.2 Conclusion

Various hypotheses were tested with respect to the presence of pulse shocks and level shifts in the real exports and real GDP macroeconomic time series for the Greenland economy, 1955-1998.

The results of the above analysis suggested that Greenland experienced a positive one-time pulse shock to the real exports series in 1973 at the time of the opening of the Black Angel, zinc and lead mine. This pulse shock occurred in a unit root process, which would suggest that the shock had permanent effects on the time series without any tendency of the series to return to its pre-break level. The real GDP series, however, did not experience a breakpoint in 1973. The statistically insignificant pulse break in the GDP series would lend support to the argument that economic linkages, especially in the early development years in the pre Home Rule era, were weak or non-existent. And hence, spill-over effects from the export sector to the rest of the economy would have been limited. Also, it should be mentioned that the supply shock of 1973 was minor relative to that of 1990, and this may also be a factor in explaining why the GDP series did not have a pulse break.

In the case of the test for structural change in 1979, with the introduction of Home Rule, the results provided evidence to suggest that the real exports and real GDP series were not impacted statistically by the implementation of Home Rule. This result can be explained by the phased transfer of administrative fields along with the block grant arrangement, the lack of change in monetary policy, and also the use of Danish advisors. In other words, it can be argued that Greenland is a country that despite Home Rule in many ways continues to be controlled both politically and economically by Denmark, and therefore that the introduction of Home Rule has not provided a significant change in the country's policy regime.

Lastly, the test for structural change in 1990 showed clear evidence of a statistically significant negative level shift in the Greenland economy in the year of the shock to the country's natural resource supply and the subsequent decline in the export base. The test results pointed to a case of structural change in both of the two macroeconomic series analysed. The unit root problem disappeared when the negative level shock was accounted for, and hence, economic instability, as represented by the presence of a unit root process, disappeared when the events of 1990 are accounted for, and the processes became trend stationary. This suggests that the 1990 shocks were a cause of economic instability in Greenland.

The following chapter presents an in-depth analysis of the causes and consequences of export and income instability in Greenland.

Chapter 8

Economic Instability in Greenland, 1955-1998

8.0 Introduction

This chapter presents a macroeconomic time series analysis of economic instability in Greenland in the period, 1955-1998. Specifically, it measures export and income instability, and it analyses the causes and consequences of both types of instability in Greenland.

The previous chapter presented an analysis of the presence of break points and structural change in the Greenland economy. This analysis tested the significance of specific events as potential causes of macroeconomic instability. The objective of the present chapter is to present models to test the impact of selected indicators of financial, trade and technological dependency. Econometric models are specified to test hypotheses regarding the significance of dependency indicators in explaining variation in economic instability.

This chapter first presents a brief overview of the main literature on the definition and measurement of economic instability. Next, it measures export instability for the Greenland economy for the period, 1955-1998, using two different measures of instability. This is followed by an analysis of the causes of export instability, with a specific focus placed on indicators of dependency in explaining such instability. Next, this study presents an analysis of the economic consequences of instability in export earnings, where the focus is placed on the relationship between instability and economic growth. Following this analysis, the remainder of the chapter is devoted to first measuring income instability, followed by an analysis and discussion of the causes and consequences of instability of income in Greenland.

8.1 Definition and Measurement of Export Instability in the Literature

The literature has employed various measures of instability, the basic problem being the fluctuations of export earnings around their trend values. The most widely used approach has focused on separating out trend earnings from deviations around the trend. This approach tackles directly the problem of identifying what is meant by "normal" earnings, with trend values being taken to represent the "normal" path of earnings. Instability is then equated with deviations from trend. Different authors have used different trend corrections and various measures of dispersion. The most popular measures of instability in the cross section export instability literature are defined in terms of absolute deviations from trend, and squared deviations from trend. When averaged over a given time period these measure overall period instability, with the squared version assigning a greater weight to larger deviations. Amongst the more common methods of calculating export instability indices are: the standard error of the estimate divided by the mean of observations; the standard deviation from a logarithmic trend; the average proportionate deviation from a logarithmic trend; and the standard deviation from a linear trend. As noted by Love (1976, p. 62) while these instability indices will produce different numerical values from the same data series, various authors have observed a high degree of correlation among results obtained using different indices.

Most empirical analysis involving measures of instability has been conducted within a cross-country framework. The approach has been to calculate one measure of instability for a given time period for each country in the sample. Measures of instability have tended to fall into two categories: those based on first-order deviations from trend and those based on squared deviations. Measures of instability based on first-order deviations from trend estimates can be represented by:

$$I_t = \left(\frac{1}{n}\right)\sum_{t=1}^{n}\frac{X_t - \hat{X}_t}{X_{st}} \qquad (8.1.a)$$

where n = the number of observations in the export earnings time series, X_t = actual export earnings, $\hat{X}_t$ = the predicted value of export earnings and X_{st} = the scaling factor applied at time t (Love; 1987). The scaling factor, X_{st} is introduced to produce normalised measures which are independent of the currency units in which the export series is measured and which, therefore, permit cross-country comparisons of instability.[1]

The second type of indices are those based on squared deviations. Such a measure may typically be represented by:

$$I_t = (\tfrac{1}{n})\sum_{t=1}^{n}\left[(X_t - \hat{X}_t)/X_{st}\right]^2 \qquad (8.1.b)$$

The index provides a normalised summary in the form of an average of the squared deviations from trend.

While the measures of instability, as represented by equations 8.1.a and 8.1.b, have been used extensively in the literature, much debate has centred around the issue of whether all deviations from trend should be considered undesirable. Coppock (1962) argued that "not all changes...should be considered undesirable...the purpose of economic activity is assumed to be the most efficient use of changing resources to meet changing wants, not the rigid stabilization of certain flows of relations" (p. 22). Also, as argued by Wilson (1994), not all deviations are problematic in as much as they reflect long term shifts in consumer tastes, technology, or factor supplies. Fluctuations must be viewed as undesirable when they serve no useful purpose but only serve to trigger fluctuations in other variables such as government revenue and investment which might in turn impact on short term macroeconomic stability and longer run economic development. Coppock argued that the key difficulty lies in being able to distinguish the wasteful or inequitable

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[1]Commonly used scaling factors include the mean value of the actual export series, $\bar{X}$, the estimated trend value for the year t, $\hat{X}_t$, and the actual value of earnings in year t, X_t.

kind of instability from the changes which are unavoidable or desirable.[2] As argued by Love (1987) these statements from Coppock made it clear that achievement of definitional precision requires making explicit judgements about the meaning of terms such as "excessive", "wasteful" and "normal".

On the same issue, Michaely (1962) argued that sporadic elements of deviations from some "normal" level of earnings are likely to be the greater cause of concern as opposed to regularly reversing deviations (p. 93). Similarly, Massell (1970) argued that "it is possible for income to fluctuate over time and yet be known in advance with certainty" and hence emphasized the need to distinguish between the stability and certainty of income (p. 404). The debate over what constitutes excessive deviations and whether deviations are necessarily undesirable seems to have centered around the view that events which are predictable or certain do not necessarily have adverse consequences.[1] Karak (1973) argued that regularly reversing fluctuations "make it easier to predict the level of exports each year and also to judge the correct timing for implementing...stabilising policies"(p.558). He further pointed out that the usefulness of the distinctions presented by Michaely and Massell depends "on a country's ability to predict and react correctly...and on its capacity for raising reserves to implement stabilisation policies".

Love (1979) argued that given that the scope for corrective action in developing countries tends to be limited by the effectiveness of monetary and fiscal policies and

[2]Coppock (1977) argued that "there seems to be a residuum of instability which serves no useful purpose and which can be considered wasteful or unjust in its effects." Also, Coppock argued that instability means some excessive departure from a fixed level (p.4).

inadequate foreign exchange reserves, it is unlikely that governments in developing countries can undertake effective offsetting policies, even given the optimistic assumption that they can predict the future accurately (p. 234).

The following section measures export instability in Greenland over the period, 1955-1998.

8.1.1 Measuring Export Instability in Greenland

The purpose of this section is to measure the degree of export instability in the Greenland economy in the period 1955-1998 by building on approaches to measuring instability of earnings as outlined above. Two measures of export instability are presented, and they are: first, an index of the level of instability at time t; and second, a measure of the average instability of export earnings for the whole period under study, 1955-1998. In defining and measuring instability, the approach taken here is to view instability as squared deviations from trend values.

Measurement and Analysis

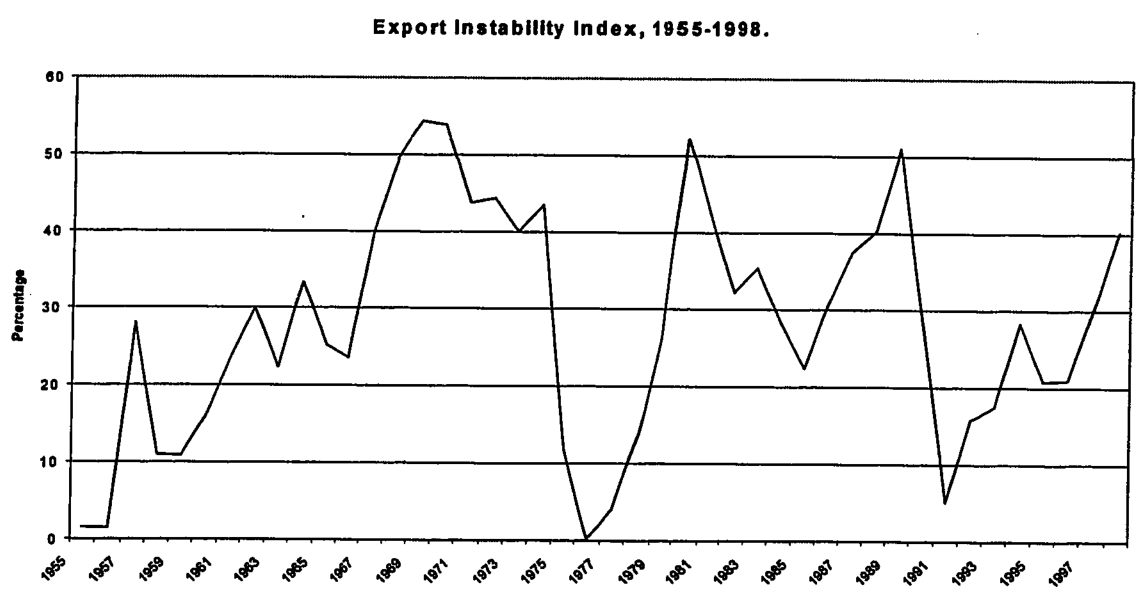
The first index of export instability is calculated using the following formula:

$$IX_t = \sqrt{\left(\frac{RES_t}{\hat{X}_t}\right)^2} * 100 \qquad (8.1.1)$$

where IX_t is an index of export instability at time t; RES_t is the residual at time t that is obtained by regressing real export earnings on a time trend. Please refer to chapter 7, equation 7.1, for the results of the detrended real export series. $\hat{X}_t$ is the predicted value of real exports at time t, which was obtained from estimation of equation 7.1.[3]

The export instability index, IX_t, is graphed in Figure 8.1.1 below.

Figure 8.1.1



[3] Chapter 7, Figure 7.3, shows the fluctuations of the estimated residuals.

Figure 8.1.1 shows evidence of considerable fluctuations in instability over time as measured by the squared deviations from trend values. The index assigns a greater weight to larger deviations, and alternatively, a smaller weight to smaller deviations. It takes on values ranging from 0 to 100%, with higher percentage values indicating a higher degree of instability. The IX_t index for the Greenland economy falls in the range between 0.2% to 54.4%. As shown in Figure 8.1.1, the index reached values in the high end of the range in the period that coincides with the years surrounding the development phased referred to as G-60, i.e. the late 1960s to mid 1970s; in the period following the introduction of Home Rule (1979-1981); and again in the latter part of the 1980s with the disappearance of cod from Greenlandic waters. In the following, this study will present an econometric analysis of the causes of instability.

Next, after measuring instability at time t, a measure of the overall instability for the entire period was calculated. Such an index is useful because it gives an overall measure of instability for the entire period under study, 1955-1998. Additionally, it can be compared to a similar measure of income instability. This will provide insight into the difference in instability between the two series.

The index of average overall instability for the period 1955-1998 is calculated as follows:

$$IIX_t = 100\left[\tfrac{1}{n}\cdot\sum_{t=1}^{n}\left(RES_t/\hat{X}_t\right)^2\right]^{1/2} \qquad (8.1.2)$$

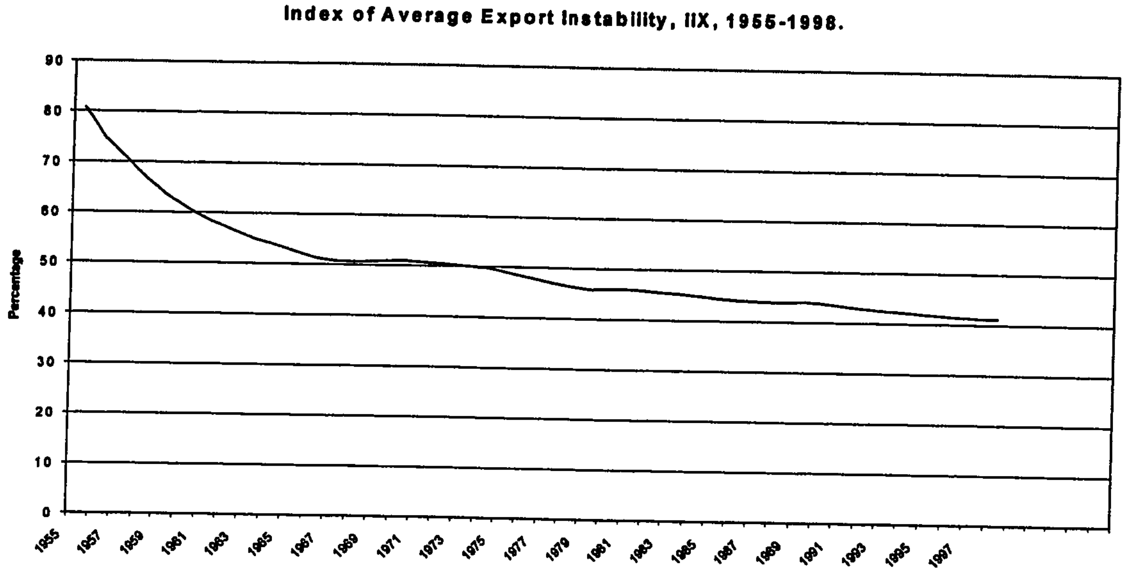
where IIX_t is the index of average export instability for the period 1955-1998, RES_t are the residuals from the estimation of equation 7.1 in chapter 7; and $\hat{X}_t$ is the predicted value of real exports which is employed as a scaling factor. Wilson (1994) used a similar approach.

The value of IIX is calculated to be equal to 41.2%. As in the previous estimation the value of IIX takes on values ranging from 0 – 100%.

It should be noted here that the export instability index was also calculated by using the residuals from a regression of logarithms of nominal exports on a time trend. This produced an index of 9.65 for the period under study. The instability index was also calculated for two sub-periods; 1955 - 1973 and 1974 - 1998. The index of the log specification was calculated to be 10.15 and 7.84 respectively, suggesting that instability was higher in the pre Home Rule era. A similar analysis was not undertaken of the real specification since the regression model for the first sub-period produced a less satisfactory fit. Wilson (1994) employed the same measure of average instability for the case of Singapore, and used a log specification for trend correction. He found the average instability to be 7 percent for the period 1955-1971, and 13 percent for the period 1972-1988. Hence, if one compares Wilson's measures with those obtained in the case of Greenland, it is clear that instability was at a higher level for Greenland in the early period, while it was less than that seen in Singapore in the second period.

By calculating IIX at each time t it is possible to get a picture of the change in average instability over time. IIX_t is graphed in Figure 8.1.2.[4]

Figure 8.1.2



As indicated in Figure 8.1.2 the index of average export instability shows a declining trend over time. It suggests that the instability measure has a large fixed component and a smaller variable component.

A useful indicator of the trend in instability is gained by calculating the annual change in IIX_t. The annual change in the index is graphed in Figure 8.1.3.

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[4] IIX_t was calculated for each year, 1955-1998. E.g. $IIX_{1970} = 100 * \left[\frac{1}{15}\sum_{t=1}^{15}\left(\frac{RES_t}{\hat{X}_t}\right)\right]^{1/2}$

Figure 8.1.3

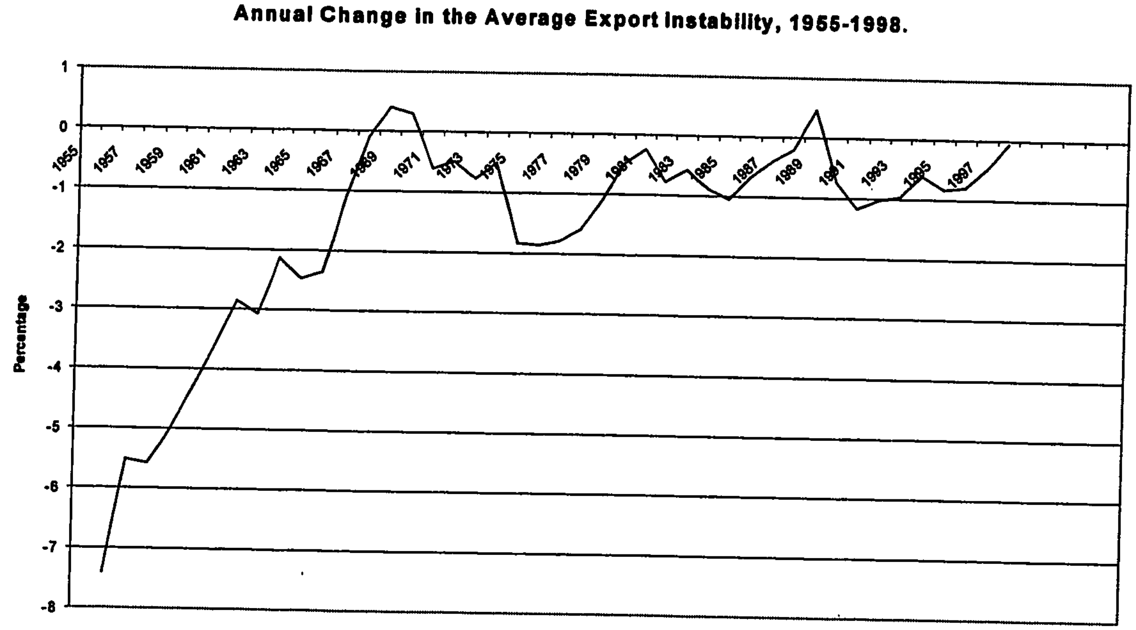

Figure 8.1.3 depicts the upward trend in the rate of growth of average instability in the period leading up to Home Rule, followed by a downward trend in the 1970s. This is then followed by upward trends in the mid to late 80s and again in the 1990s, the period coinciding with the time of significant resource supply shocks and restructuring of the fishing industry.

The indices of export instability provide some insight into the degree of instability in the Greenland economy. In the following section this study presents a detailed econometric analysis of the causes of export instability in the period under study.

8.2 Causes of Export Instability

The debate on the causes of export instability has focused on both demand and supply conditions. On the demand side, the causes of export instability have centred around; first, cyclical variations in income in the markets of developing countries; and second, the low price elasticities of demand in world markets for developing countries' exports. On the supply side, the focus has been on natural factors affecting the level of output, and the short-run price elasticity of supply (Love, 1987).

Structural causes of developing countries' instability have in the literature been focused on the dependence on primary products, the degree of commodity concentration and the degree of geographic concentration (e.g. Michaely (1962), Massell (1964) and MacBean(1966)). Also, it has been argued in the literature that in so far as the economic structure of a small country is characterized by a more limited diversity, its degree of economic instability is likely to be higher than that of a larger country where economic structure is more diversified. The unavailability of abundant and diversified resources, and a limited domestic market, reduces the capacity of a small country to accommodate sudden changes in demand for its products. One would expect, therefore, exports of small countries and hence their national income to show a higher degree of instability than the exports and total products of large countries (e.g. Khalaf (1976), Michaely (1962)).

According to conventional literature on foreign trade and economic development, specialization in only a few products tends to be a leading cause of fluctuations in export earnings.[5] LDCs are characterized by dependence on a narrow range of commodities for export which are often exported to a limited number of foreign markets, and this is believed to be a key cause of export fluctuations.[6] Numerous studies have recorded higher average levels of instability for groups of developing countries than for groups of developed countries (including those of MacBean, 1966; Massell, 1964, 1970; Leith, 1970; Erb and Schiavo-campo, 1971; Glezakos, 1973; Naya, 1973; Lawson, 1974; Knudsen and Parnes, 1975; Sheehey, 1977; Murray, 1978; Lancieri, 1978). MacBean (1966) has pointed out that "concentration on a few products reduces a country's chance of having fluctuations in one direction in some of its exports offset or ameliorated by counter-fluctuations or stability in others" (p. 41). According to MacBean (1966) the "typical" developing country specializes in exporting primary products, and receipts from primary product exports are inherently subject to greater short-run instability than receipts from manufactured goods (pp. 36-7).[7]

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[5]And in turn policies of export diversification have been proposed to reduce export earnings instability.

[6]MacBean's (1966) individual country case studies provided some evidence consistent with the view that dependence on one or a few primary products exerts considerable influence. Instability in total export earnings was found to be associated with instability in earnings from jute and cotton in Pakistan (pp. 196-200), from sisal in Tanzania (pp. 163-4) and from coffee and cotton in Uganda (pp. 142-3).

[7]Love (1983) looked more closely at the questions of whether diversification into non-traditional exports was likely to lead to greater stability in total export earnings. After establishing that export diversification had taken place in each of the twenty-four countries in his sample between the period 1959-68 and the period 1969-78, he examined the increases in instability recorded for traditional and non-traditional (manufactured) exports and also the covariance between these groups' instabilities. It was found that increased shares of non-traditional exports were accompanied by relatively greater increases in their instability. Moreover, the results suggested that the conventional assertion of lower covariances between manufactures and primary products than between sets of primary products is misplaced. This throws some doubt on the efficacy of the view that increasing exports of manufactured goods will tend to result in greater earnings stability.

In a similar vein, Massell (1970), has argued that fluctuations in supply are more severe for some goods than for others.[8]

With respect to geographic concentration of exports the a priori argument is that the greater is the degree of geographic concentration, the more likely are a country's exports to be susceptible to economic conditions in one or a few countries. As in the case of commodity concentration, this argument is based on two assumptions; first, that the country's exports are concentrated on one or a few markets; and, secondly, that trading partner markets are unstable, and subsequently, instability is being transmitted to the country's total export earnings.[9]

Empirical investigations have, however, provided little support for the proposition that commodity and geographic concentration, as measured by the Hirschman-Gini coefficient of concentration, are important factors contributing to the instability in export earnings in developing countries.[10]

[8]Some foods and agricultural raw materials experience especially great short-run supply instability, and Massell (1970) accounted for this in terms of the cobweb effect, pest, plant disease and weather variability. With respect to demand, Massell differentiated among different types of primary products in terms of the impact of shifts in demand arising from changes in purchasing power, arguing that foods, with lower income elasticities, will tend to be less affected by foreign demand shifts than other goods such as raw materials (p. 621).
[9]E.g., according to Massell (1970), "high geographic concentration is likely to imply greater dependence on economic conditions in one or in a few countries. Fluctuations in demand in any recipient country will then have a more pronounced effect on receipts of the exporting country than if exports were more diversified among recipients" (p. 622).
[10]The literature on export fluctuations have primarily made use of cross-sectional studies to investigate the relationship between inter-country differences in export fluctuations and the degree of commodity concentration of countries' exports (e.g. Coppock (1962), Massell (1964), and MacBean (1966)). Different authors have employed different trend corrections just as different versions of the Gini coefficient have been used for measuring commodity concentration. Such differences in measurement may of course lead to differences in conclusions across studies.

Massell (1964) used a sample of 36 countries to estimate for each country an index of export earnings instability for the time period 1948-59 by fitting a regression line to export earnings expressed as a function of time, and then computing the standard error of the estimate and dividing it by the mean of the observations. Using the Gini-coefficient of concentration for 1959, Massell estimated a regression equation with export instability as the dependent variable and commodity and geographic concentration and primary-product ratio as independent variables. The findings did not suggest a statistically significant relationship between export instability and concentration, nor between primary-product ratio and instability. Thus, according to Massell, the study did not lend support for diversification and industrialization as a method of reducing export instability. Massell explained this by suggesting that

> "it is quite possible that countries whose exports are highly concentrated geographically tend to have more effective methods of smoothing out the fluctuations in export receipts, perhaps because bilateral commodity arrangements may be prevalent in such cases. In many cases, it is likely that some form of commodity agreement between the exporting and importing countries tends to reduce fluctuations in export receipts. Perhaps the dominant trading partner in these cases either pegs the price of the staple exports or else imports a guaranteed amount, in either case insulating the exporter from the full impact of market forces" (pp. 56-57).

In his 1970 study, Massell went on to examine the relationship between instability in the value of exports and a set of variables that help characterize a country's economic structure. Massell (1970) computed an instability index for each of 55 countries (36 LDCs and 19 DCs) employing data for the period 1950-66. The instability index employed was defined as the standard deviation of the residuals from an exponential time trend. And the Hirschman-Gini coefficient was computed for 1960 for each country using 3-digit SITC. With respect to trade concentration Massell's regression results suggested that LDCs tend to experience greater instability because of their greater product concentration but less instability as a result of their heavier dependence upon foods. The findings indicated that countries that derive a large percentage of their export earnings from food tend to experience less export instability than countries that are more heavily dependent on raw materials or manufactures. According to Massell, an explanation may be that export instability is caused by shifts in demand, and food tends to be relatively income inelastic. And hence, if a country is small and exports only a few items it does well to concentrate on foods (pp. 628-29).

Looking at seventeen Asian developing countries, Naya (1974) found that, as in the case of Massell (1970), the larger is the value of exports, the less is the degree of instability but also that the greater are a country's exports to its neighbouring countries, the greater is export instability. Naya concluded that the sources more traditionally said to give rise to instability, for example, limited number of exportable products and high specialization in primary commodities, were found to be statistically not significant (p. 639).

In a similar vein, Blundell, et al. (1981), in analysing 139 developed and developing countries, for the period 1965-77, found three variables to be statistically significant: the value of exports; the degree of openness; and the share of manufactures. They concluded that countries with a large volume of exports, pursuing open-trade policies, and that have promoted manufactured exports, have experienced less instability in export earnings than have other countries (p. 308).

Similarly, Khalaf (1976), using a cross-section method tested the relationship between export instability and concentration in trade (commodity import and export concentration, and geographic concentration in trade) for a group of 83 countries using an export instability index based on the logarithmic variance method and the concentration index based on the Gini coefficient of concentration using 1-digit SITC code. In contrast to the findings of Massell, Khalaf's analysis suggested that there is no statistically significant relationship between export instability and commodity and geographic concentration in trade (p. 427). Askari and Weil (1974) reached a similar conclusion. They examined export earnings instability for 70 LDCs over a time period from 1954 to 1968. They divided total exports into major/minor and manufactured/non-manufactured exports. They analysed the variance-covariance and tested the traditional hypothesis that LDCs exporting a large percentage of primary products must on this account suffer from a large degree of export instability. Their results rejected this hypothesis. Rather they found that instability is a larger problem for exporters of manufactured goods than non-manufactured goods.

Jerry L. Kingston (1976), analysed the relationship between export concentration and various aspects of the export performance of 31 developing countries during the period of 1954-67. Kingston found little support for the conventional views of a direct relationship between export concentration and the instability or growth rate of export earnings (p.311). Employing an index of export instability, the results did not suggest any statistically significant correlation coefficient between geographic concentration and export instability, nor between geographic export concentration and the growth rate of export earnings. According to Kingston the results indicated that those countries that experienced the greatest average annual changes in the geographic structure of their export earnings experienced, on average, no greater or lesser amounts of export instability than did those countries that maintained a rather constant level of geographic export concentration, and that those developing countries that directed a high proportion of their annual exports to only a few countries experienced rates of export growth similar to those nations with a more geographically diversified structure of export receipts. Kingston concluded that policies designed to provide for a more geographically diverse structure of export receipts are not likely to result in reduced fluctuations of export proceeds, nor, would policies designed to reduce the amount of geographic concentration of export earnings likely be effective in raising the growth rate of export earnings (p.316).[11]

But as pointed out by authors such as Love (1976) and Kingston (1976) there is an inherent problem with the empirical tests of the relationship between export instability and concentration in trade. The conventional cross section studies have employed a method of calculating an index of export instability based on a certain time period by measuring deviations from trend values. At the same time, however, the concentration index has been measured for a particular year using the Hirschman-Gini coefficient of concentration. Hence, the concentration index will depend on the year chosen. This conventional approach to the problem has ignored the differential amounts of change in the geographic concentration that may have occurred in the individual countries during the time period over which the measure of export instability was computed (e.g. Kingston (1976), p. 313; Love (1976) p. 64).

[11]However, MacBean (1966) noted that regional concentration of exports may be risky. Fluctuations in demand in one region could be offset by contrary changes in demand in another consuming country if exports were regionally diversified (p.44). Similarly, Knudsen and Parnes (1975) found that countries with higher concentration levels tend to experience greater instability (p. 129).

As pointed out by Love (1976), the insignificant results of the empirical studies may reflect these problems rather than the absence of a causal relationship. Suggesting a different method of measurement, Love (1976) departed from the customary cross-country methods of measurement, and examined the relationship between the forms of concentration and export instability for each country in a sample of 52 developing countries. The results obtained suggested that there are causal relationships for a wide range of countries.[12]

Although much research has been done on the characteristics of export instability on a cross section basis, almost no work has been carried out at the individual country level on the magnitude of instability and its pattern over time. As alluded to above, the problem with the cross section approach is that it is attempting to summarize all the information in a given export time series into a single summary index of instability for each country in the sample. This runs the danger of missing the true pattern of instability if the indices are sensitive to the choice of time period and trend correction model, especially when a single time period and trend model are used for all countries in the sample.

Stern (1969) presented a time-series analysis of export instability in Pakistan. Values of the Hirschman-Gini coefficient were estimated for each year of the period 1957/58 - 1967/68 and these were related to the percentage deviations of actual earnings

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[12]For each of 52 countries earnings are divided into earnings from the major source and into the sum of earnings from all other sources. Instability is determined by a weighted average of the variance and covariance of earnings from the two sources. Love (1976) then goes on to measure for each country the contribution of the major source to instability in earnings plus a 'proportionate contribution statistic' for the major source, as well as a ratio of the 'proportionate contribution statistic' to the export share of the major source (p. 65). Using this approach Love concludes that the contributions of the major products and markets differ considerably among countries, but for all of the countries in the sample the major product and/or the major market contributed disproportionately to earnings instability (p. 68).

from trend values over the same period. The results obtained indicated a positive association between measures of commodity concentration and the series of deviations. Stern argued that these results provided at least some justification for the belief that, in the case of Pakistan, a decrease in commodity concentration of exports has reduced the instability of export receipts (p. 218).

Similarly, Leith (1975) undertook a time-series analysis of export instability in Ghana over the period 1957-65. Leith found no significant correlation between geographic concentration and instability except possibly a negative correlation for minor commodities. His results did, however, suggest a significant correlation between commodity concentration and export instability (p. 52).[13]

Wilson (1994) has presented a more recent time-series study. He investigated the magnitude of export revenue instability for Singapore between 1957 and 1988 and how the pattern of instability has changed over time. The findings indicated that export fluctuations may have made short-term macro management and longer run development planning more difficult for Singapore. But as argued by Wilson, in an absolute sense these problems do not appear to have been serious given Singapore's record of rapid economic growth since the mid 1960s and heavily dampened foreign trade multiplier (p. 409). In his study, Wilson measured export instability for two separate periods; 1957-1971 and 1972-1988. He used a Chow test to compare the two sub-periods, and found

[13]Leith (1975) disaggregated Ghanaian exports by commodity and geographic market, and then estimated correlation coefficients and simple linear equations between the mean commodity concentration indices and the corresponding instability indices for the eight major export destinations, and between the mean geographic concentration indices and the corresponding instability indices for the twelve principal export products. Commodity concentration and geographic concentration were measured using the Hirschman-Gini coefficient (pp. 49-50).

that instability in the two periods were not statistically different. The study did not include hypotheses testing of causes of instability.

The literature has been largely divided on the causes of export instability. As indicated above, the lack of consensus has been due in part to methodological differences.

The following subsection presents a time series analysis of the causes of export instability in Greenland.

8.2.1 Causes of Export Instability in Greenland

This section presents an analysis of the causes of export instability in the Greenland economy. Two model specifications are presented; the first one uses the instability of exports at time t (IX_t) as the dependent variable, and the other uses the rate of change in average export instability at time t (ΔIIX_t). The empirical analysis tests the statistical significance of various indicators of trade dependency and concentration of trade in explaining variations in instability of export earnings.

Model Specification and Empirical Analysis

Various model specifications were tested with a view to testing the overall hypothesis that trade dependency and concentration of trade is positively related to instability of export earnings in the Greenland economy. The relationship between export instability and indicators of trade dependency and concentration is tested in multiple regression equations using the method of Ordinary Least Squares regression. The dependent and independent variables are as follows:

Dependent Variables:

IX_t = export instability at time t.

ΔIIX_t = rate of growth of average export instability at time t.

Explanatory Variables:

The explanatory variables are indicators of dependency, which were first presented and defined in chapter 6. Four additional variables are tested here, and they are:

$FISH_t$ = the share of export earnings accruing from the sale of fish and fish products to total export revenue at time t.

MX_t = the share of mineral export revenue to total export revenue at time t.

IX_{t-1} = the one period lagged export instability index.

IIX_{t-1} = the one-period lagged index of growth of export instability.

The first regression analysis uses IX_t as the dependent variable. After experimenting with different models using standard criteria to assess goodness of fit, a linear autoregressive model specification was chosen for the analysis. The results of a unit root test determined whether the explanatory variables were entered in levels or in first differences. The Schwarz (1978) criterion for lag length was employed in determining the appropriate lag length.

The unit root test results, as presented in chapter 6, showed that most of the variables are non-stationary and hence must enter the variable in first-difference, and they are: XG, XC, DSX, FISH, and MX. Only PX and the lagged IX are stationary and therefore enter the model in levels.

Six different specifications were estimated. The first equation to be estimated is shown below in equation (8.2.1). The estimation results are presented in Table 8.2.1.

$$IX_t = \alpha_0 + \beta_1 \Delta XG_t + \beta_2 \Delta XC_t + \beta_3 \sum_{j=1}^{2} IX_{t-j} + \varepsilon_t \qquad (8.2.1)$$

where the symbol Δ denotes the first-difference of a variable. The hypothesized signs on the basis of theory are: $\beta_1 > 0$; $\beta_2 > 0$; $\beta_3 > 0$

The model shown in equation 8.2.1 has export instability at time t as the dependent variable (IX_t). There are three independent variables: the first difference of geographic concentration of exports at time t (XG_t), which is hypothesized to be positively related to export instability; the first difference of commodity concentration of exports at time t (XC_t), which is likewise hypothesized to bear a positive sign; and lastly, the one and two period lagged export instability index which are hypothesized to be positively related to instability in export earnings in the current period.

Tests were performed for normality, equation specification error, autoregressive conditional heteroscedasticity, and multicollinearity. First, the classical OLS assumption of normality of the residuals was checked using the Jarque-Bera test procedure. With a Jarque-Bera chi-square test statistic of 1.74 and 2 degrees of freedom (df), the corresponding p-value is 0.45 and it can be concluded that the residuals are approximately normally distributed. Second, the Ramsey RESET tests were performed to test for the presence of model specification error. The tests were statistically insignificant at the 5% level indicating no specification error, with test statistics of 1.1133 (1,35 df), 0.5905 (2,34 df), and 0.4165 (3,33 df), and critical values of 4.12, 3.27, and 2.88 respectively. The estimation results were then tested for autoregressive conditional heteroscedasticity using the ARCH(p) test. With p-values in excess of 0.90, it could be concluded that the error variance is not affected by autoregressive conditional heteroscedasticity. Lastly, checking the estimation for multicollinearity using the Tolerance and Variance Inflation Factor tests, it could be concluded that there is no problem of multicollinearity. The TOL_j values fall in the range 0.565 to 0.897 and hence are approximating a value of 1. The VIF_j values fall in the range 1.115 to 1.769, and hence are less than 10.

These standard tests were performed for all subsequent modifications of the model, and they were all producing favourable results as in the case of estimation 8.2.1 above.

The OLS estimation results of the regression equation 8.2.1 are shown immediately below with t-ratios in parentheses. The results are also summarized in Table 8.2.1 together with the estimation results of equations 8.2.2 through 8.2.6.

Estimated Equation 8.2.1:

$$\hat{IX}_t = \underset{(2.755)}{11.6330} - \underset{(-0.825)}{0.2249}\,\Delta XG_t - \underset{(-0.225)}{0.1196}\,\Delta XC_t + \underset{(5.185)}{0.8244}\,IX_{t-1} - \underset{(-1.413)}{0.2136}\,IX_{t-2}$$

On the whole, the results of the OLS estimation of equation 8.2.1 indicate that the goodness of fit along with the results of the residual tests is quite satisfactory. The R-square is equal to 0.49, and the F-test is statistically significant at the 5% level.

The estimation results suggest that neither of the two export concentration indices, ΔXG_t and ΔXC_t, are statistically significant at the 5% level with a critical value of 2.031 at 36 df. Only the one-period lagged value of the export instability index is statistically significant, and bearing the hypothesized sign, with a t-ratio of 5.185. These results could lend support to the large body of empirical research that finds no association between export concentration and instability of export earnings.

A number of equation modifications were undertaken, and they are listed in Table 8.2.1. In equation 8.2.2 the two statistically insignificant variables from equation 8.2.1, ΔXG_t and ΔXC_t, are deleted and substituted by two alternative measures of geographic and commodity concentration, the one of which is a measure of the Danish share in Greenland's exports, ΔDSX_t, which is hypothesized to have a positive sign, and the other which measures the share of fish export earnings in total export revenue, $\Delta FISH_t$. This variable is also hypothesized to bear a positive sign. Both of these variables, as indicated earlier, are stationary in the first difference. In addition, when applying the Schwarz criterion for lag length it was determined that the errors were minimized by entering these variables at time t, and hence, export instability is modeled as a function of indicators of export concentration in the current period.

The overall goodness of fit remains satisfactory with the model modifications: the R-square is equal to 0.56; the F-test remains significant at the 5% level; and the estimation passes standard residual tests.

The first difference of the Danish share in Greenland's exports, ΔDSX_t, is significant at the 10% level with a t-ratio equal to –1.769. This variable, however, does not bear the hypothesized sign. Rather, the estimation suggests that an increase in ΔDSX_t reduces instability in export earnings. This finding may be explained by potential stabilizing effects of close trade ties with Denmark. It should be noted here that in estimation 8.2.1 the geographic export concentration variable, ΔXG_t, was not statistically significant. This variable, although it is a close proxy for ΔDSX_t given the high share of exports going to Denmark, has some limitations in that a consistent series of export destinations was not available for the whole period, and hence this could help explain why it was insignificant.

The first difference of the variable measuring fish's share in total export earnings, $\Delta FISH_t$, is statistically significant, and it bears the hypothesized sign, but only at the 10% level with a t-ratio of 2.004 and a critical value of 2.031 at 36 df. This could lend support to the argument that "putting all ones eggs in one basket" causes export instability. In addition, this result suggests that it is not the share of various export commodities (primarily fish and fish products in later years) in total exports, as represented by XC_t, that explains instability, but rather, it is the overall reliance on marine natural resources, and in turn the lack of diversification into other types of export commodities that is of significance to the Greenland economy. It should be noted, that if the XC_t variable had been measured using a 1-digit classification code instead of a 3-digit code, it would have approximated the measure of the ratio $FISH_t$, since this classification does not distinguish between different species and products of fish.

As in the previous estimation the one-period lagged index of export instability is positively related to instability of export earnings, and hence, an increase in the lagged instability raises instability in the current period.

In equation 8.2.3, two alternative measures of natural resource dependency are substituted for ΔDSX_t and $\Delta FISH_t$, and these measures are: first, the share of mineral export revenue in total export earnings (MX_t), and second, the primary export ratio (PX_t). The variable, MX_t, is entered in the first difference. Both variables are hypothesized to bear a positive sign. ΔMX_t is expected to bear a positive sign under the hypothesis that "putting all ones eggs in one basket" will leave the economy vulnerable to external shocks and domestic changes in resource supply. Likewise, PX_t is expected to be positively related to IX_t under the hypothesis that concentrating exports in a few products fuels instability.

The overall goodness of fit remains satisfactory with an R-square of 0.53, and a statistically significant F-test. The estimation results, however, suggest that neither of the two alternative variables are statistically significant in explaining variations in Greenland's export instability. Similarly, the sign test is statistically insignificant, however, the variables do bear the hypothesized signs. These results suggest that the mineral export sector has had no significant impact on instability in Greenland, and in turn, it lends support to the generally accepted proposition in Greenland, that fisheries are a main cause of economic instability.

In equation 8.2.4, the least significant variable from the previous estimation, ΔMX_t, is deleted from the estimation and substituted with $\Delta FISH_t$. The R-square increases to 0.56, and the model continues to pass all standard residual tests as in all previous estimations.

The estimation results suggest that the first difference of the fish share in total exports remains statistically significant, but only at the 10% level with a t-ratio of 1.779 and a critical value of 1.690 at 36 df. The primary export ratio remains statistically insignificant, but it should be noted that it just barely fails the significance test at the 10% level with a t-ratio of 1.660 and a critical value of 1.690.

In equation 8.2.5, $\Delta FISH_t$ is estimated together with the lagged instability variable only, and it remains statistically significant, but as in the previous estimation, only at the 10% level of significance.

In the estimation of the last model modification, equation 8.2.6, the PX_t variable is estimated without the other resource variable ($\Delta FISH_t$). The primary export ratio is now statistically significant at the 10% level, and it bears the hypothesized sign with a t-ratio of 1.699.Overall, the results of the OLS estimation of equations 8.2.1 – 8.2.6 support the argument that relying on a few primary resources is a source of instability in the Greenland economy.

Table 8.2.1

Estimation Results (Equations 8.2.1 – 8.2.6). Dependent Variable : IX_t

	Equations: 8.2.1 - 8.2.6					
	8.2.1	8.2.2	8.2.3	8.2.4	8.2.5	8.2.6
Explanatory Variables						
Constant	11.6330 (2.755)	1.0452 (0.158)	13.1040 (3.202)	2.3324 (0.349)	1.3174 (0.194)	12.079 (3.077)
ΔXG_t	-0.2249 (-0.825)					
ΔXC_t	-0.1196 (-0.225)					
ΔDSX_t		-0.3370 (-1.769)				
$\Delta FISH_t$		0.1764 (2.004)		0.1570 (1.779)	0.1641 (1.818)	
ΔMX_t			0.1614 (0.912)			
PX_t			105.19 (1.481)	112.24 (1.660)		118.00 (1.699)
IX_{t-1}	0.8244 (5.185)	0.8048 (5.473)	0.8450 (5.412)	0.8422 (5.608)	0.7971 (5.273)	0.8674 (5.639)
IX_{t-2}	-0.2136 (-1.413)	-0.2516 (-1.784)	-0.2827 (-1.878)	-0.2981 (-2.037)	-0.2359 (-1.630)	-0.278 (-1.852)
	$r^2 = 0.49$ df = 36	$r^2 = 0.56$ df = 36	$r^2 = 0.53$ df = 36	$r^2 = 0.56$ df = 36	$r^2 = 0.52$ df = 37	$r^2 = 0.52$ df = 37

T-ratios are in brackets.

As a way of providing an alternative set of results of the analysis of the relationship between trade dependency, concentration of trade, and instability in export earnings, the model specifications were estimated with the measure of rate of growth of the average period export instability index, ΔIIX_t as the dependent variable. The lagged IX_t was then substituted for ΔIIX_{t-1}.

As in model 8.2.1, the following estimations were performed in a linear autoregressive model specification. Also, as in the previous analysis, the results of a unit root test determined whether the explanatory variables were entered in levels or in first differences, and the Schwarz (1978) criterion was employed to help determine the appropriate lag length.

The first equation to be estimated is presented below.

$$\Delta IIX_t = \alpha_0 + \beta_1 \Delta XG_t + \beta_2 \Delta XC_t + \beta_3 \Delta IIX_{t-1} + \varepsilon_t \qquad (8.2.7)$$

where ΔIIX = change in average export instability index at time t. The hypothesized signs on the basis of theory are: $\beta_1 > 0$; $\beta_2 > 0$; $\beta_3 > 0$

The results indicate that the goodness of fit of equation (8.2.7) is quite satisfactory. The adjusted coefficient of determination is equal to 0.87, and the model passes the F-test at the 5% level of significance. The estimation passes all the usual residual tests: With a Jarque-Bera chi-square test statistic of 1.27 and 2 degrees of freedom (df), the corresponding p-value is 0.55, and it can be concluded that the residuals are approximately normally distributed. Second, the Ramsey RESET tests were statistically insignificant at the 5% level indicating no specification error, with test statistics of 0.5404 (1,37 df), 1.5905 (2,36 df), and 2.1053 (3,35 df), and critical values of 4.12, 3.27, and 2.88 respectively. The results were then tested for autoregressive conditional heteroscedasticity using the ARCH(p) test. With p-values in excess of 0.75, it could be concluded that there is no problem of autoregressive conditional heteroscedasticity. Lastly, when checking the estimation for multicollinearity, using the Tolerance and Variance Inflation Factor tests, it could be concluded that there is no problem of multicollinearity. This is because the TOL_j values fall in the range 0.853 to 0.909, and therefore are approximating a value of 1, and the VIF_j values fall in the range 1.100 to 1.172, and hence are less than 10. All subsequent model modifications, equations 8.2.7-8.2.12 below, passed all standard residual tests.

The results of the estimation with ΔIIX_t as the dependent variable are reported in equations 8.2.7 – 8.2.12, and shown in Table 8.2.2 below.

The goodness of fit of all six estimations is very satisfactory with R-square values approximating 0.88 for all six estimations.

Overall, the results show, as in the case of the previous set of estimations, that ΔXG, ΔXC, and ΔMX are not statistically significant in explaining instability.

The lagged value of the rate of growth of income instability remains highly significant throughout all six model specifications. Additionally, ΔFISH remains statistically significant at the 10% level of significance, while PX does not pass the significance test at any level. It should be noted, however, that PX does bear the hypothesized sign. Similarly, ΔDSX does not pass the test of significance with ΔIIX as the dependent variable, however, it does continue to bear the negative sign as in the previous set of estimations. The lack of statistical significance of the PX and ΔDSX is likely the result of the high significance of the lagged value of ΔIIX.

Table 8.2.2

Estimation Results (Equations 8.2.7 – 8.2.12). Dependent Variable : ΔIIX_t

	Equations: 8.2.7 - 8.2.12					
	8.2.7	8.2.8	8.2.9	8.2.10	8.2.11	8.2.12
Explanatory Variables						
Constant	-0.0012 (-1.019)	-0.0099 (-2.145)	-0.0013 (-1.094)	-0.0093 (-2.016)	-0.0095 (-2.053)	-0.0013 (-1.110)
ΔXG_t	0.926E-05 (0.068)					
ΔXC_t	-0.23E-03 (-0.861)					
ΔDSX_t		-0.11E-03 (-1.097)				
$\Delta FISH_t$		0.11E-03 (1.956)		0.10E-03 (1.795)	0.10E-03 (1.834)	
ΔMX_t			-0.59E-05 (-0.064)			
PX_t			0.0360 (0.975)	0.0342 (0.985)		0.0365 (1.025)
ΔIIX_{t-1}	0.8132 (16.49)	0.7384 (12.30)	0.8067 (16.39)	0.7393 (12.28)	0.7388 (12.28)	0.8071 (16.75)
	r^2 = 0.88 df = 38	r^2 =0.88 df = 38	r^2 =0.87 df = 38	r^2 =0.88 df = 38	r^2 =0.88 df = 39	r^2 =0.88 df = 39

T-ratios are in brackets.

The following section analyses the consequence of instability in export earnings for economic growth, and this is followed by an analysis of the consequences in the case of Greenland.

8.3 Consequences of Export Instability

The various strands of argument about the domestic consequences of export instability have as their starting point the high degree of openness and trade-orientation of the economies of developing countries. Key among the arguments are that fluctuations in export earnings adversely affect economic growth partly because export earnings are a major source of foreign exchange, which is then used for importing necessary capital goods. Fluctuations in export earnings can therefore limit the ability to import capital goods, and thereby inhibit economic growth through a lack of capital accumulation and investment. In the private sector, fluctuations in export earnings may slow down private investment as the degree of risk associated with instability increases. Instability is then transmitted through the economy via various linkages. The public sectors' ability to raise revenue through taxation of imports and exports may also be hampered, which then presents difficulties for long range planning. In addition to this it is further argued that export earnings instability affects LDCs in a worse way than other countries because of their low per capita income and limited diversification. In this case resources cannot easily be transferred. Moreover, export earnings instability only adds to existing economic instability (Askari et al. (1974)).[14]

The literature on the consequences of export instability has tended to focus on the implications for domestic resource allocation and the rate of economic growth of export-induced instability in key macroeconomic variables. In most developing countries the government sector has a key role to play in promoting change. Hence, the literature has been preoccupied with the impact of export instability on government revenues and, in turn, on government's ability to plan and coordinate activity (Love (1987)).

As explained by Love (1987), it is assumed that governments derive a substantial proportion of total revenue from indirect taxes on exports. This is because of the importance of exports in total output, and because of the relative administrative convenience and low costs of identifying and collecting export taxes. Other sources of revenue may also be sensitive, either directly or indirectly, to changes in export earnings. First, small-scale producers may be selling their output to government agencies which typically, in many countries, have the sole right to purchase and then export local output. The difference between export proceeds and payments made to the producers constitutes revenue for the government.

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[14]As explained by Love (1987), the pessimistic orthodoxy on export instability holds that export instability may cause considerable hardship to domestic agricultural producers. The underlying assumptions are that production is based on small-scale units. Part of output in excess of producers' own immediate requirements is geared for the export market. It is also assumed that producers' money incomes are determined primarily by current receipts from export production and producers have a very low marginal propensity to save. On the other hand, if the export sector is characterized instead by large-scale expatriate firms and/or plantation systems, the impact of export instability on producers is argued to be more muted. This is because larger operations may be able to absorb the impact of unstable export earnings through variations in profits and/or in reserves held abroad, just as they may be able to make appropriate inventory adjustments, with stocks being accumulated in slack periods to be run down in boom periods. They are also able to borrow from the financial system (p. 12).

Also, the government can raise tax revenue by levying income tax on the producers. Secondly, changes in producers' income may result in multiplier effects, which may lead to changes in revenues from income and corporate taxation on other agents in the economy. Thirdly, in some cases revenues from import duties may be closely linked to developments in the export sector. This could be the case if the value of total imports is closely synchronized with changes in export proceeds, perhaps through a system of foreign exchange and import controls. Instability in export earnings may, for these reasons, cause instability in government revenues.

Uncertainty about the availability of government revenues, which is likely to result from the instability problem, is believed to complicate development planning and, subsequently, to reduce the rate of growth of the economy below the rate which would have been attained under greater certainty (Ibid. p. 13).[15]

Much of the debate over the link between export instability and the rate of economic growth centres around the impact of export instability on a country's capacity to import. Export earnings are a source of foreign exchange, and in turn, they are a key determinant of the capacity to import.[16] According to MacBean (1966), if export instability results in delays or attempts to substitute inferior domestic goods for imported capital, it may result in adverse consequences for the development process. Similarly, Lim (1976) argued that export instability, through its impact on the ability to import, may

[15]It is also held that export instability may impact negatively on the rate of economic growth through its effect on movements from trend in aggregate demand and resulting impact on inflationary pressures. The uncertainty created in this case is believed to lower the rate of private investment. Demand fluctuations suggest the prospect of alternate periods of over - and under-utilization of productive capacity, while the likelihood of inflationary pressures complicates the process of business calculation. This may give rise to more risk averse behaviour and in turn a shift away from more risky but higher-yielding projects towards less risky but lower-yielding projects (Love (1987)).

[16]Developing countries are held to depend heavily on imports as a source of machinery, equipment and other items essential to investment programmes.

compound the difficulties of implementing development plans. And scarce skilled personnel may have to be diverted from other tasks to cope with the recurrent balance of payments crisis and other administrative problems that result from instability.[17]

However, several authors have challenged the pessimistic orthodoxy surrounding export instability. Some authors, notably MacBean (1966) and Coppock (1962) found no evidence in support of the proposition that LDCs experience more fluctuations in export earnings than do developed countries, and nor did evidence indicate any negative impact on economic growth in LDCs of export instability.[18] In sharp contrast, however, studies by authors such as Massel (1970), Naya (1973) and Glezakos (1973) indicated that LDCs experience more export instability than more developed countries, and more over, export instability is a deterrent to economic growth.[19]

Using cross-country and time series analyses, MacBean (1966) examined the short-run impact of export instability on national income and on variables central to the debate, namely, imports, fixed capital formation, inflation, domestic prices and foreign exchange reserves. He concluded that out of the variables studied only imports appeared to be significantly related to export instability (p. 85).[20] Similarly, Kenen and Voivodas

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[17]Lim (1976) also noted the impact on risk averse behaviour.

[18]MacBean (1966) presented a study covering Uganda, Tanganyika, Puerto Rico, Pakistan and Chile. MacBean considered the impact of export instability on income, exports, imports, investment, producers' incomes, prices and government reserves and expenditures. Of the five countries examined, only one, Uganda, showed evidence of sensitivity to export instability.

[19]In his regression model Glezakos (1973) used the real per capita GDP growth rate, derived after fitting an exponential trend to annual data, as the dependent variable. Like MacBean, Glezakos included in his explanatory variable set the average annual growth rate of exports and an instability index. Glezakos found that export instability seemed to have a significant negative effect on the real per capita income growth rate (p. 673).

[20]Maizels (1968) challenged MacBean's findings. He presented an analysis which suggested a close connection between fluctuations in exports and GNP (p. 577).

(1972) presented evidence to suggest that export instability was not a deterrent to income growth (pp. 793-4).[21]

Prior to MacBean, Reynolds (1963) attempted a systematic case study of the domestic consequences of export instability on the economy of Chile.[22] Reynolds investigated the relationship between instability in export earnings from copper and economic growth over the period 1925-59 by tracing a "reaction path" through: retained export earnings; inventory adjustments; distributive shares in the export industry; local purchases on capital account by the export sector; the value of domestic foreign exchange earnings derived from the export sector; and economic growth. He did not find evidence to suggest a general impact on growth.[23]

Some of the more recent literature on the association between export instability and economic growth has also shown mixed results. For instance, Shinha (1999) analysed the relationship between export instability, investment, and economic growth for nine Asian countries using annual data from the early 1950s to 1997. Export instability was measured as the absolute value of deviations of exports from a five-year

[21]Kenen and Voivodas (1972) used the standard error from a first-order autoregressive scheme or modified random walk to measure instability. They found that the use of their instability index appeared to make little difference to the results since with the same time period and sample countries as those in MacBean's study, they replicated most of MacBean's results.
[22]Chile was dependent on exports of copper for over 50 percent of its total export proceeds (Reynolds, 1963).
[23]Reynolds suggested that there may be a relationship between copper's export earnings instability and Chilean income via government fiscal policy (p. 97). But he but also presented evidence to suggest a number of factors contributing to a loosening of the connection between export instability and the domestic economy: e.g. tendencies for the profit share in the value of sales to fluctuate more widely than any other variables and for profits not to be included in retained domestic earnings because of foreign ownership in the copper industry; the stabilizing effects of the copper industry's inventory adjustment policy on the incomes of local suppliers of labour, intermediate goods and raw materials; and the small scale of local capital expenditures by the copper industry in comparison with the amounts of foreign exchange made available to the local economy by the industry. Reynolds also considered the impact of export instability on the capacity to import and aggregate investment; the price level; and the ability of the government and business to engage in long-range development plans (pp 95- 99).

moving average of exports. In contrast to earlier studies this study analysed the time series properties of the variables by testing for unit roots and cointegration. A negative relationship between export instability and economic growth was found for Japan, the Philippines and Sri Lanka, whereas for South Korea, Myanmar, Pakistan and Thailand the evidence suggested a positive relationship between export instability and economic growth.

Ghirmay et al. (1999), examined the causal relationship between export instability, income terms of trade instability, investment, and economic growth employing cointegration analysis and the multivariate error correction model, using time series data for 14 developing countries. The study concluded based on cointegration results that exports and income terms of trade instability have long-run relationships with output. For most countries, instability in income terms of trade was negatively related to output while the results for export instability were mixed. They further found that, with respect to causality, export instability and income terms of trade instability play a causal role in the development process via a variety of avenues.

Bhat et al. (1998), computed the export instability index of selected items of agricultural exports of India using a semi-log linear trend equation. The Spearman's rank correlation was then employed to examine the association between export instability of agricultural products and economic growth for the years 1970-71 to 1995-96. The results suggested that instability in export earnings of tea, jute, oil-cake, and spices were low, and that the relationships with economic growth was insignificant. The export instability indices of coffee, tobacco, fruits, and vegetables were also low, but their respective associations with economic growth emerged positive and statistically significant.

It has been suggested in the literature that instability might in fact have positive effects (e.g. Caine (1954, 1958), Hirschman (1959), and Michaely (1962)). First, investors may be attracted by risky or uncertain projects where export instability may hold out prospects of higher yield on investment. Secondly, periods of high export earnings may create a climate of optimism leading to increased investment, and such investment may not be counterbalanced by lower investment in periods of low income. Thirdly, it is also possible that those people who experience unstable incomes may accumulate greater precautionary balances than recipients of relatively stable incomes. This may lead to higher levels of investible resources. And fourthly, investment decisions may not be affected to any significant degree by short-run instability (Love (1987) pp. 15-6).

Amongst those who have found evidence to suggest a positive relationship between instability and economic growth can be found Knudsen and Parnes (1975) who investigated the impact of instability on economic growth by regressing the growth of GNP and the growth of GNP per head on the weighted average index of instability. They concluded that instability had a positive effect on the income growth measures, and that a priori arguments on the detrimental effects of export instability are incorrect. Also, as noted above, Bhat et al. (1998), found a positive association between export instability of some agricultural products and economic growth in India.

Thus, while much of the literature suggests that instability is a deterrent to economic growth, some research has presented evidence that suggests that the opposite holds true. In the following section the consequences of export instability in the Greenland economy are analysed.

8.3.1 Testing the Consequences of Export Instability in Greenland

As outlined in the previous section, much of the literature on export instability suggests a negative relationship between instability in export earnings and the rate of economic growth. This section presents an empirical analysis of the impact of export instability on the rate of economic growth in Greenland over the period 1955-1998.

In the previous section it was found that the ratio of fish to total exports and the primary export ratio are positively related to export instability. If the results of the following analysis provide evidence to suggest that export instability is negatively related to economic growth then concentration of trade, as measured by the share of fish in total exports and the primary export ratio, can be viewed as an obstacle to economic development. Additionally, if it is further postulated that Greenland is highly concentrated by virtue of its smallness then economic size in itself can be viewed as an obstacle to economic development.

This section tests the hypothesis that export instability is negatively related to the rate of growth of real GDP. It tests for unidirectional causality between the rate of growth of average export instability and the rate of growth of real GDP in Greenland over the period 1955-1998. In order to test empirically this hypothesis, a Granger causality analysis is employed. This allows the study to test both the relationship between export instability and economic growth, and the direction of causality between the two variables.

Model Specification and Empirical Analysis

Two variables are tested in the model; the rate of growth of real GDP ($RGDP_t$), and the rate of change in average export instability (IIX_t). The rate of change of the IIX_t index was chosen over the level of instability (IX_t) for this analysis. The choice to use IIX_t was based on goodness of fit tests.

Before proceeding with the estimation, the presence of a unit root problem was considered. It was already established in an earlier chapter that the $RGDP_t$ series does not have a unit root in growth rates. The variable IIX_t was checked using the Phillips-Perron unit root test. It could be concluded that this variable also fails the unit root hypothesis, and hence this variable is stationary in levels.

Based on a specification test and the Schwarz (1978) test for lag length the following specification of the causality model was chosen:

$$RGDP_t = \alpha_0 + \sum_{i=0}^{1} a_i IIX_{t-i} + \sum_{i=1}^{1} b_i RGDP_{t-i} + U_t \qquad (8.3.1)$$

$$IIX_t = \beta_0 + \sum_{i=1}^{1} c_i IIX_{t-i} + \sum_{i=0}^{1} d_i RGDP_{t-i} + V_t \qquad (8.3.2)$$

where $RGDP_t$ is the rate of growth of real GDP; and IIX_t is the rate of growth of average export instability.

Tests for lag length determined that in the case of equation (8.3.1) IIX is entered at time t-i (i = 0;1), and RGDP is entered at time t-1 In equation (8.3.3) RGDP is entered at time t-i (i = 0;1) and IIX is entered at time t-1.

First, the Hausman (1978) test for simultaneity bias was performed. The results suggested that the specification is not affected by simultaneity bias since the t-statistic of the estimated residuals (1.050) is less than the critical value of 2.030.

Next, the standard residual tests were performed. Both equations passed the Jarque-Bera test for normality, indicating that the residuals are approximately normally distributed. The Ramsey RESET tests for equation mis-specification were performed for both equations. With test statistics in equation (8.3.1) of 1.6295, 0.8224, and 0.9971, and corresponding critical values of 4.10, 3.26, and 2.88 respectively, and in the case of equation (8.3.2) test statistics of 0.6978, 3.1226, and 2.5083, it could be determined that there is no specification error in either of the two equations. Additionally, both equations passed the Tolerance and Variance Inflation Factor tests suggesting that multicollinearity is not a problem. And finally, the ARCH(p) test for autoregressive conditional heteroscedasticity did not show evidence of a problem in this regard with p-values ranging from 0.70-0.91 in the case of (8.3.1), and likewise from 0.74-0.90 in the case of equation 8.3.2.

The Granger causality test itself is based solely on the significance of an F-test without attention to the statistical significance of individual variables or the goodness of fit as indicated by the R-square. Nonetheless, since this study is interested not only in testing the presence of causality and its direction, but also in uncovering the statistical significance of the independent variables and their sign, the following is briefly reporting on the results of the significance tests.

The Granger causality test results are presented in Table 8.3.1 below.

Table 8.3.1

Results of Granger Causality Test (Equations 8.3.1 and 8.3.2).

RESULTS OF GRANGER CAUSALITY TEST		
Direction of Causality	F-Statistic	Critical Value (α=5%)
IIX $\Rightarrow$ RGDP	17.83	F(1,40) = 4.08
RGDP $\Rightarrow$ IIX	9.82	F(1,40) = 4.08

The results of the Granger causality test suggest bilateral causality between IIX_t and $RGDP_t$ in Greenland in the period 1955-1998. The results show that the rate of growth of export instability Granger-causes the rate of growth of real GDP since the estimated F value of 17.83 exceeds the critical F value of 4.08 at the 5% level of significance. Similarly, the rate of growth of real GDP Granger-causes the rate of growth of instability since the estimated F value of 9.08 exceeds the critical value of 4.08 at the 5% level of significance.

Additionally, and as noted above, while the Granger-causality test is only an F-test, it is useful to briefly consider the t-ratios of the estimated coefficients of the two equations. These results are not presented at length here since the main purpose here is to draw conclusions about the F-test. Briefly, however, the estimation results of (8.3.1) showed that IIX_{t-1} bears a negative sign and is statistically significant at the 5% level with a t-ratio of –3.711. The variable $RGDP_{t-1}$, on the other hand, has a t-ratio of 0.505, and therefore is not significant in explaining $RGDP_t$. In the case of equation (8.3.2), only the variable IIX_{t-1} is statistically significant. It has a t-ratio of 16.60. $RGDP_{t-1}$, on the other hand, fails the significance test with a t-ratio of –1.232. Overall, at the 5% level of significance these results (8.3.1) support the theoretical proposition that export instability reduces economic growth. Additionally, the results of equation 8.3.2 suggest that export instability fuels further instability.

It should also be noted that the Granger causality results are sensitive to the number of lags used in the estimation. Thus, a different number of lags could yield a different result. The test for lag length, however, as indicated above, suggested that a lag length of one year was the appropriate length.

The results lend support to the argument advanced previously that Greenland has not developed the mobility and flexibility in resource allocation that may be deemed necessary to allow the country to respond to, and mitigate against, shocks and disturbances to the domestic economy. The findings support the theoretical proposition that export instability inhibits economic growth through its impact on a country's ability to import capital goods, which subsequently leads to a lack of capital accumulation and investment. In addition, the negative association between instability and growth may be explained by the effect on private investment caused by risk associated with instability. It may also be related to the impact on long-range planning due to greater uncertainty, as well as the impact on the ability of government to raise revenue. These results support the findings of authors such as Massel (1970), Naya (1973), and Glezakos (1973) who found a negative association between export instability and economic growth.

This section and the previous one have presented an empirical analysis of the causes and consequences of export instability. While an investigation into instability in the export sector is of key importance to this study, the question of instability in the overall economy, as represented by real GDP, is likewise of prime importance. Hence, in the following the measurement of income instability is briefly analysed, and this is then followed by an econometric analysis of both the causes and the consequence of instability in income in Greenland over the period under study.

8.4 Measuring Income Instability in Greenland

This section measures income instability in Greenland, where instability refers to fluctuations of real GDP around trend values. It measures income instability using the same methodology that was employed in section 8.1.1 of this study. As in the case of export instability, two measures of instability are presented, and they are; first, an index of the level of instability at time t; and second, a measure of the average overall instability for the period, 1955-1998.

Measurement and Analysis

The first index of income instability is calculated using the following formula:

$$IG_t = \sqrt{\left(\frac{RES_t}{\hat{G}_t}\right)^2} * 100 \qquad (8.4.1)$$

where IG_t is an index of income instability at time t; RES_t is the residual at time t that is obtained by regressing real GDP on a time trend. Please refer to chapter 7, equation 7.2 for estimation results; and $\hat{G}_t$ is the predicted value of real GDP at time t which was obtained from estimation of equation 7.2.

IG_t is graphed in Figure 8.4.1 below.

Figure 8.4.1

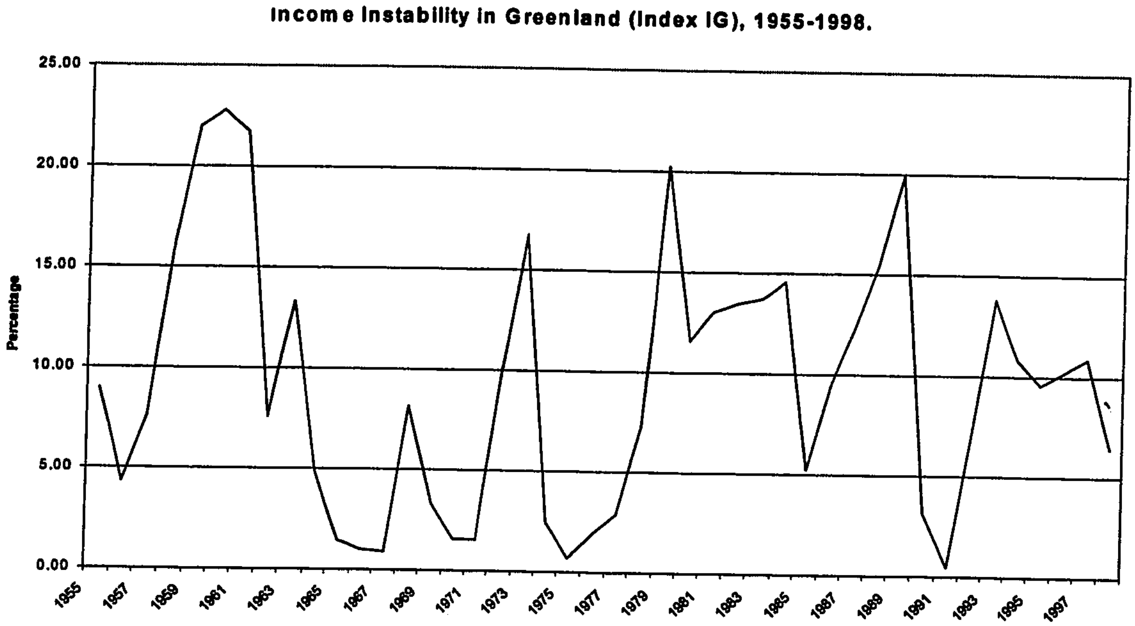


Figure 8.4.1 shows evidence of considerable fluctuations in instability over time. Nonetheless, the fluctuations, as measured by squared deviations from trend values, are smaller than those seen in the case of instability of export earnings. Specifically, the index, IG_t, ranges from a low of 0.5% to a high of 22.8%, which can be compared to IX_t which saw fluctuations in the range of 0.2 – 54.4%. Hence, there is evidence to suggest that export earnings have experienced more instability than real GDP. Explanations for the significant difference in the degree of instability may be found, firstly, in the sensitivity of the export sector to resource supply shocks and external shocks and disturbances, such as the decrease in the world price of shrimp in recent years. And second, it may be explained by the large annual transfer from the Danish State which has a GDP trend stabilizing effect because the size of the block grant is adjusted in relation to the development in wages and prices in Denmark.

As shown in Figure 8.4.1, and as in the case of export instability, income instability reached its highest levels in the latter part of the 1980s and in the years following the introduction of Home Rule. In addition, the latter part of the 1950s and early 1960s also saw high instability. This period coincides with the years following the implementation of the G-50 economic development initiatives. The following section presents an econometric analysis of the causes of instability in income.

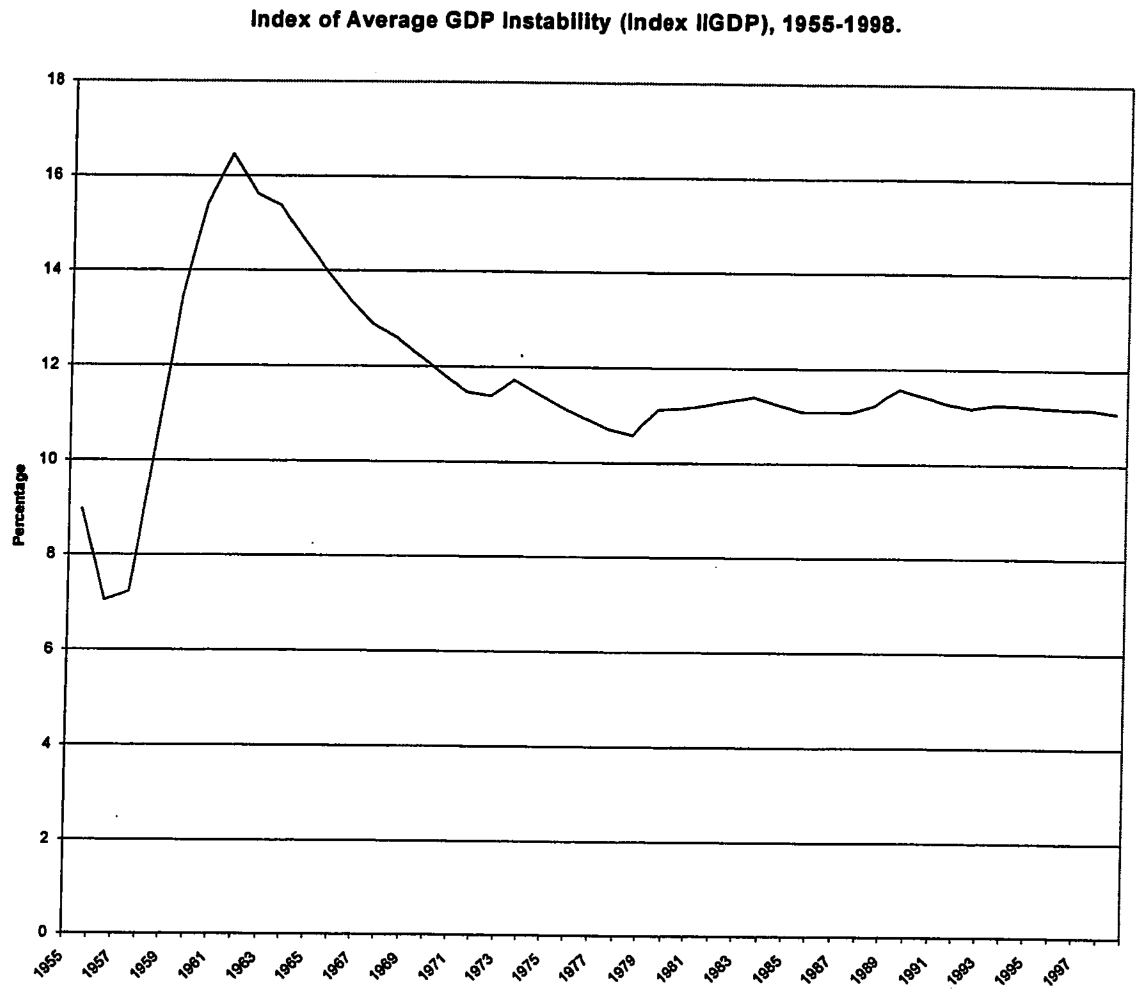
A measure of the overall instability of the entire period was also calculated. Again, the formula employed is the same as that used in the case of export instability, and the formula is:

$$IIG = 100\left[\tfrac{1}{n}\cdot\sum_{t=1}^{n}\left(RES_t/\hat{G}_t\right)^2\right]^{\frac{1}{2}} \tag{8.4.2}$$

where IIG is the index of average income instability for the period 1955-1998; RES_t are the residuals from estimation of equation 7.2 in chapter 7; and $\hat{G}_t$ is the predicted value of real GDP.

The value of average income instability, IIG, over the period 1955-1998 was measured to be equal to 11.10%. The index can take on values ranging from 0 – 100%. Figure 8.4.2 shows the general increase in the index from the beginning of the period under study till the early 1960s, at which point the index started a general decline that lasted till the time of Home Rule. Since Home Rule the index of average instability has been less pronounced in its annual fluctuations.

Figure 8.4.2

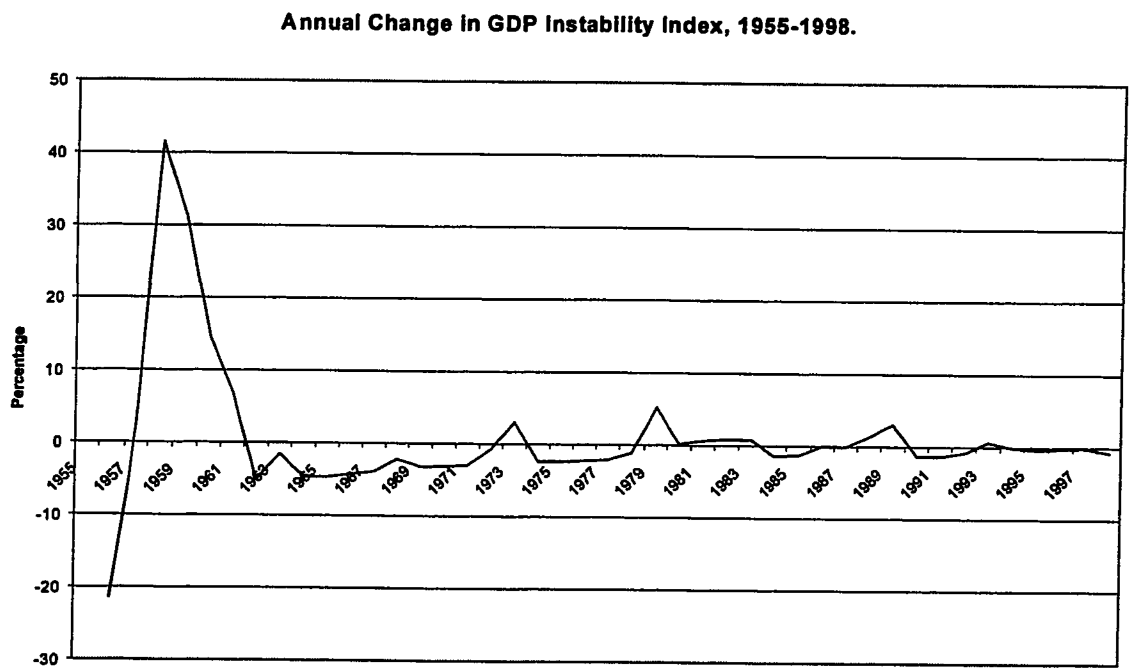


The instability index was also calculated for two sub-periods; 1955-1974 and 1975-1998. It was found that instability was greatest in the former period with an index value of 11.7%, while the latter period saw instability of 9.7%. The sub-period analysis was also performed with a log-specification of the trend correction model. This produced indices equal to 8.22% and 6.87% for the two periods respectively. The log-specification indices can be compared to those found for export instability in the two sub-periods, where instability was measured to be 10.15% and 7.84% respectively. These results suggest that instability was greater in the export sector than in the overall economy.

As in the case of the analysis of export instability, the annual change in the average income instability index is calculated. Obtaining the growth rates of the instability index is useful because it sheds additional light on increasing and decreasing trends in instability over time. The annual change in the average instability index series is graphed in Figure 8.4.3 below.

Figure 8.4.3 depicts the spike in instability in the latter part of the 1950s and early 1960s. Smaller spikes are seen in the mid 70s, the time surrounding implementation of Home Rule, and the latter part of the 1980s to early 1990s which was the time of the major resource supply shock.

Figure 8.4.3



Two measures of instability of income were defined and measured. The indices show evidence of increasing instability within key periods of the Greenlandic post-colonial era. The following section takes a closer look at the causes of income instability in Greenland.

8.5 Causes of Income Instability in Greenland

In a previous section the causes of export instability were analysed. In this section the interest turns to the question of what causes instability in real GDP in Greenland. Specifically, the question of interest is that of the extent to which indicators of dependency, as identified in chapter 5, are statistically significant in determining the variation in instability over time. The problem of instability, as discussed earlier, is of importance to this study because of the theoretical proposition that instability is a deterrent to economic growth. The next section will test the consequences of instability.

Model Specification and Empirical Analysis

This section presents two models for the analyses of causes of income instability in Greenland. The main question is that of the relationship between income instability and indicators of trade, financial and technological dependence. This will be followed by a test of the impact of indicators of trade concentration.

The variables to be tested were introduced in chapter 5 and in the previous section of this study, and they are:

Dependent Variable:

IG_t = income instability index at time t; an index of the instability in real GDP.

ΔIIG_t = the rate of growth of average income instability.

Independent Variables (as defined earlier):

XMG, DKPOP, KM, DKEXP, XC, XG, MC, MG, DSM, DSX, MX, PX, FISH, IG_{t-1}.

An autoregressive model specification was chosen. Unit root test results were used in determining whether variables entered the model in levels or in differences. Similarly, the Schwarz (1978) criterion for lag length was employed to arrive at the appropriate lag length of the independent variables. The unit root test results of all variables, except IG, was reported in previous sections. A unit root test was performed on the IG series, and the results suggested that this variable is stationary in levels.

Six different equations were estimated. The first equation to be estimated is presented below in equation 8.5.1:

$$IG_t = \alpha_0 + \beta_1 \Delta XMG_t + \beta_2 \Delta DKPOP_{t-1} + \beta_3 KM_{t-2} + \beta_4 \Delta DKEXP_t + \beta_5 IG_{t-1} + \varepsilon_t \tag{8.5.1}$$

The hypothesized signs are: $\beta_1 > 0$; $\beta_2 < 0$; $\beta_3 < 0$ $\beta_4 < 0$; $\beta_5 > 0$

The model shown as equation (8.5.1) is specified as a linear autoregressive equation with income instability at time t as the dependent variable. There are five independent variables. The first variable is the first-differenced proxy for trade dependency (ΔXMG_t), which is hypothesized to bear a positive sign. The second variable is the change in the first-differenced lagged ratio of the working age population born outside of Greenland to that born in Greenland ($\Delta DKPOP_{t-1}$). This variable is hypothesized to be inversely related to the dependent variable. The third variable is the capital-import ratio lagged two time periods (KM_{t-2}), which is hypothesized to be inversely related to income instability. The fourth variable is the change in the ratio of Danish expenditures on Greenland to GDP at time t ($\Delta DKEXP_t$), which is hypothesized to be negatively related to the dependent variable; and fifth, the one period lagged income instability variable (IG_{t-1}), is expected to bear a positive sign.

Goodness of fit tests were performed along with all standard residual tests. The results of the Jarque Bera test for normality of the residuals showed that the residuals are approximately normally distributed with a test statistic of 0.8733 with 2 df and a corresponding p-value of approximately 0.80. The Ramsey RESET tests indicated that there is no specification error; the tests were statistically insignificant at the 5% level with test statistics of 0.2232, 0.1089, and 0.5896, and corresponding critical values of 4.12, 3.28, and 2.88. The ARCH(p) test showed no evidence of the error variance being affected by autoregressive conditional heteroscedasticity with p-values in excess of 0.50. Similarly, the Tolerance and Variance Inflation Factor tests indicated that there is no problem of multicollinearity. The TOL_j values fall in the range between 0.883 to 0.986, and thus are approximating a value of one, while the VIF_j values are all less than 10, falling in the range between 1.014 to 1.133.

The results of the estimated equation (8.5.1) are as follows:

$$\hat{IG}_t = \underset{(3.015)}{15.378} + \underset{(0.451)}{3.976}\, \Delta XMG_t - \underset{(-0.507)}{43.726}\, \Delta DKPOP_{t-1} - \underset{(-2.257)}{0.484}\ \text{periods}\ KM_{t-2} +$$

$$\underset{(2.512)}{0.262}\, \Delta DKEXP_t + \underset{(4.982)}{0.658}\, IG_{t-1}$$

On the whole, the results of the OLS estimation of equation (8.5.1) indicate that the goodness of fit along with the residual tests is satisfactory. The value of the R-square is 0.46, and the F-test is statistically significant at the 5% level.

The estimation of equation (8.5.1) indicates that only two of the dependency indicators are statistically significant in explaining the variation in income instability, and they are: first, the lagged capital-import ratio (KM_{t-2}) with a t-statistic of –2.257 and a critical value of 2.021. This suggests that an increase in the lagged value of import of capital equipment reduces instability in income. Second, the first-differenced ratio of Danish expenditures on Greenland to GDP is statistically significant at the 5% level with a t-statistic of 2.512. This result suggests a positive association between Danish expenditures on Greenland and instability of income. This indicates that an increase in Danish expenditures on Greenland as a ratio of GDP has resulted in GDP deviating from trend values. Such deviations may be the direct result of increased public expenditures, but they may also be the result of instability related to crowding out of private initiatives in Greenland. With respect to the lagged index of instability, it is also positively related to the instability as hypothesized. Two variables; the change in the lagged ratio of the working age population born outside of Greenland to that born in Greenland ($\Delta DKPOP_{t-1}$), and the first-differenced proxy for trade dependency (ΔXMG_t), are not statistically significant. It should be noted here, however, that both of these variables bear the hypothesized signs.

A number of equation modifications were undertaken and they are presented in Table 8.5.1 below.

Table 8.5.1

Estimation Results (Equations 8.5.1 – 8.5.6). Dependent Variable : IG_t

	Equations: 8.5.1 - 8.5.6					
	8.5.1	8.5.2	8.5.3	8.5.4	8.5.5	8.5.6
Explanatory Variables						
Constant	15.378 (3.015)	1.5658 (0.111)	4.4947 (2.885)	4.3334 (2.806)	27.786 (0.833)	29.054 (0.879)
ΔXMG_t	3.9764 (0.451)					
$\Delta DKPOP_{t-1}$	-43.726 (-0.507)					
KM_{t-2}	-0.4842 (-2.257)					
$\Delta DKEXP_t$	0.2616 (2.512)					
ΔXC_t		-0.3191 (-1.164)		-0.3896 (-1.512)		
ΔXG_t		-0.0535 (-0.369)				
MC_t		0.1277 (0.207)				
ΔMG_t		0.0944 (0.537)				
ΔDSM_t			0.0757 (0.513)			
ΔDSX_t			-0.0289 (-0.275)			
ΔMX_t				-0.0541 (-0.578)	-0.0230 (-0.241)	
PX_t					-25.231 (-0.702)	-26.479 (-0.743)
$\Delta FISH_t$						-0.0173 (-0.177)
IG_{t-1}	0.6577 (4.982)	0.5330 (3.854)	0.5329 (3.903)	0.5365 (4.009)	0.5389 (3.930)	0.5329 (3.897)
	r^2 = 0.46 df = 35	r^2 =0.33 df = 36	r^2 =0.29 df = 38	r^2 =0.32 df = 38	r^2 =0.29 df = 38	r^2 =0.29 df = 38

T-ratios are in brackets.

Equations 8.5.2 – 8.5.6 test the relationship between the index of income instability and indicators of trade concentration. The results of these estimations is of interest to this study because they will help shed light on the extent to which trade concentration in Greenland has a direct impact on the overall national economy. In section 8.2.1 the impact of trade concentration on instability in export earnings was analysed.

The standard residual tests for normality, equation specification error, autoregressive conditional heteroscedasticity, and multicollinearity were performed for each of the five estimations. As in the case of equation 8.5.1, the tests were all favourable.

The goodness of fit as indicated by the value of the adjusted coefficient of determination is, however, only adequate with the R-squares of equations 8.5.2 – 8.5.6 falling in the range between 0.29-0.33. All estimations passed the F-test for overall significance at the 5% level.

The estimation results, as shown below in Table 8.5.1, suggest that none of the indicators of trade concentration are statistically significant in explaining variations in the index of deviations from trend of real GDP.

Specifically, there is no statistically significant relationship between income instability and measures of commodity and geographic export concentrations of trade, and commodity and geographic import concentrations of trade. Additionally, there is no evidence of a relationship between income instability and the Danish shares in Greenland's imports and exports. Similarly, the three explanatory variables that measure Greenland's dependency on its natural resource sector, i.e. the primary export ratio, the share of fish export earnings in total export revenue, and the share of mineral export earnings in total export earnings, are all statistically insignificant at the 5% and 10%

levels. Thus, while PX and ΔFISH were statistically significant in explaining variations in the index of export instability, there is no evidence to suggest that there is a similar relationship in the case of income instability.

Following the estimation of equations 8.5.1 – 8.5.6, the dependent variable was substituted with the index of the annual rate of growth in the average index of income instability (IIG_t). Similarly, the lagged IG_t was substituted with IIG_{t-1}. The first equation to be estimated (8.5.7) is shown below:

$$IIG_t = \alpha_0 + \beta_1 \Delta XMG_t + \beta_2 \Delta DKPOP_{t-1} + \beta_3 KM_{t-2} + \beta_4 \Delta DKEXP_t + \beta_5 IIG_{t-1} + \varepsilon_t \quad (8.5.7)$$

Hypotesized signs: $\beta_1 > 0$; $\beta_2 < 0$; $\beta_3 < 0 \beta_4 < 0$; $\beta_5 > 0$

The results of the OLS estimation indicate that the goodness of fit is satisfactory. The adjusted R-square is equal to 0.55, and the model passes the F-test at the 5% level, thus indicating that the variables taken together are statistically significant in determining the variation in the annual change in the index of income instability. Additionally, the estimation performs well in terms of the standard residual tests: the estimation passes the Ramsey RESET tests at the 5% level; the ARCH(p) test shows no sign of a problem of autoregressive conditional heteroscedasticity; and the Tolerance and Variance Inflation Factor tests show no sign of multicollinearity, with TOL values falling in the range 0.788 to 0.977, and VIF values falling between 1.024 and 1.269. The subsequent model modifications, 8.5.8 – 8.5.12, similarly passed conventional residual tests, and showed satisfactory goodness of fit, albeit at somewhat lower coefficients of determination.

The estimation results of equations 8.5.7 – 8.5.12, and as shown below in Table 8.5.2, suggest that, as in the case of the analysis with IG as the dependent variable, only two variables are statistically significant in explaining variations in instability, and they are; KM_{t-2} and $\Delta DKEXP_{t-1}$. All other variables remain statistically insignificant.

The analysis of the causes of income instability in Greenland has provided evidence to suggest that instability of real GDP is related to two measures of dependency; technological dependency as measured by the capital-import ratio, and financial dependency as measured by the ratio of Danish expenditures to GDP.

While technological and financial dependency were found to be statistically significant, the evidence suggested that trade dependency and concentration of export earnings are insignificant in explaining variations in income instability.

Having obtained answers to the question of the extent of income instability in Greenland, and with statistical evidence on the relationship between dependency and instability, the next step is to test the consequence of instability.

Table 8.5.2

Estimation Results (Equations 8.5.7 - 8.5.12). Dependent Variable : ΔIIG_t

Equations: 8.5.7 - 8.5.12						
	8.5.7	8.5.8	8.5.9	8.5.10	8.5.11	8.5.12
Explanatory Variables						
Constant	0.1170 (1.727)	0.0380 (0.206)	0.0091 (0.795)	0.0082 (0.715)	-0.1857 (-0.433)	-0.1543 (-0.363)
ΔXMG_t	-0.1707 (-1.554)					
$\Delta DKPOP_{t-1}$	-0.8095 (-0.773)					
KM_{t-2}	-0.0046 (-1.618)					
$\Delta DKEXP_t$	0.0033 (2.723)					
ΔXC_t		-0.0027 (-0.763		-0.0029 (-0.857)		
ΔXG_t		0.51E-03 (0.268)				
MC_t		-0.0013 (-0.157)				
ΔMG_t		0.31E-03 (0.135)				
ΔDSM_t			0.48E-03 (0.253)			
ΔDSX_t			0.30E-03 (0.223)			
ΔMX_t				-0.74E-03 (-0.615)	-0.66E-03 (-0.542)	
PX_t					0.2087 (0.453)	0.1756 (0.384)
$\Delta FISH_t$						0.23E-03 (0.186)
ΔIIG_{t-1}	0.5043 (3.940)	0.5287 (4.193)	0.5331 (4.328)	0.5298 (4.367)	0.5403 (4.421)	0.5405 (4.407)
	$r^2 = 0.55$ df = 35	$r^2 = 0.35$ df = 36	$r^2 = 0.34$ df = 38	$r^2 = 0.35$ df = 38	$r^2 = 0.34$ df = 38	$r^2 = 0.34$ df = 38

T-ratios are in brackets.

8.6 Consequences of Income Instability in Greenland

The purpose of this section is to test the consequence of income instability in Greenland. Specifically, it tests the relationship between the rate of economic growth and the rate of growth of average income instability. In continuing on with the methodology employed in the analysis of export instability, the present section uses a Granger causality test for this analysis. This testing procedure allows for the analysis of the direction of causality, just as it provides the result of a basic significance test.

As in the case of the analysis of the consequence of export instability, it is hypothesized that income instability Granger causes economic growth and that instability of income is negatively related to the rate of growth of real GDP.

In the previous section it was found that certain indicators of dependency in Greenland are statistically significant in explaining instability. Given this result, the question that needs to be answered is that of whether instability impacts negatively on economic growth. A negative link between instability and growth would lend support to the argument that indicators of dependency have an indirect impact on economic growth through the impact on instability, and that this association is positive.

Model Specification and Empirical Analysis

Based on a specification test and the Schwarz (1978) test for lag length the following specification of the causality model was chosen for the analysis:

$$RGDP_t = \alpha_0 + \sum_{i=0}^{3} a_i IIG_{t-i} + \sum_{i=1}^{1} b_i RGDP_{t-i} + U_t \tag{8.6.1}$$

$$IIG_t = \beta_0 + \sum_{i=1}^{4} c_i IIG_{t-i} + \sum_{i=0}^{1} d_i RGDP_{t-i} + V_t \tag{8.6.2}$$

where $RGDP_t$ is the rate of growth of real GDP; and IIG_t is the annual rate of growth of average income instability.

Using the Phillips-Perron unit root test it was found that both variables are stationary in growth rates.

The test for lag length suggested that residual errors are minimized by entering RGDP with a one year lag, and by entering IIG at time t-i where i=0,1,2,3. In equation (8.6.2), RGDP was entered at time t-i where i=0,1, while IIG was entered at time t-i where i=1,2,3,4.

The Hausman (1978) test for simultaneity bias was performed, and the results suggested that the specification is not affected by simultaneity bias since the t-statistic of the estimated residuals (-1.775) is less than the critical value of 2.030.

The standard residual tests were performed. Both equations passed the Jarque Bera test for normality. The Ramsey RESET tests for equation misspecification were both favourable, and neither of the two estimations showed evidence of misspecification at the 5% level. The Tolerance and Variance Inflation Factor tests both indicated no serious problem of multicollinearity. The ARCH(p) tests for autoregressive conditional heteroscedasticity indicated that neither of the two equations had a problem with the error variance.

The results of the Granger causality test, as presented in Table 8.6.1 below, show evidence of unidirectional causality between the rate of growth of income instability in Greenland and the growth rate of real GDP for the period 1955-1998.

The results suggest that the rate of growth of instability Granger-causes the rate of economic growth. The F-statistic (4.39) is statistically significant at the 5% level with a critical value of 2.86. The opposite direction of causality, however, does not hold. The results indicate that $RGDP_t$ does not Granger-cause IIG_t. The F-test here is statistically insignificant at the 5% level with an F-statistic of 2.81 and a critical value of 4.10.

Table 8.6.1

Results of Granger Causality Test (Equations 8.6.1 and 8.6.2).

RESULTS OF GRANGER CAUSALITY TEST		
Direction of Causality	F-Statistic	Critical Value (α=5%)
IIG $\Rightarrow$ RGDP	4.45	F(3,38) = 2.86
RGDP $\Rightarrow$ IIG	2.81	F(1,37) = 4.10

The evidence (instability Granger-causes economic growth) lends support to the proposition that instability is a deterrent to economic growth through its impact on savings, investment, and planning. As noted earlier, while the Granger-causality test is only an F-test, it is useful to briefly consider the t-ratios of the estimated coefficients. Only the results of equation 8.6.1 will be briefly considered, since only this equation passed the F-test. These results are not presented at length here since the main purpose here is to draw conclusions about the F-test. Briefly, however, the results of the significance test in equation (8.6.1) showed that RGDP has a t-ratio of 0.1994, and hence is not statistically significant. However, the IIG variable is statistically significant at the 10% level at time t-0 with a t-ratio of –1.943, which exceeds the critical value of 1.690. Also, it is statistically significant at the 5% level at time t-1 with a t-ratio of –2.461, which exceeds the critical value of 2.030. Hence, not only does instability Granger-cause economic growth, but the relationship is a negative one.

The analysis of the consequence of income instability could suggest that Greenland is suffering from a lack of economic diversification and resource flexibility, which is preventing the country from averting or mitigating against the negative consequences of shocks to the domestic economy. The negative association could suggest a difficulty in predicting and reacting correctly to shocks to the domestic economy, and a difficulty in applying the correct timing for stabilization policies.

8.7 Conclusion

This chapter presented a macroeconomic time series analysis of economic instability in Greenland in the period 1955-1998. Specifically, it measured export and income instability, and presented an empirical analysis of the causes and consequences of instability in the Greenland economy.

Structural causes of developing countries' instability have in the literature been focused primarily on the dependence on primary products, the degree of commodity concentration and degree of geographic concentration. Empirical investigations have provided little support for the proposition that commodity and geographic concentration are important factors contributing to the instability in export earnings in developing economies.

Similarly, the results of this study did not find statistical support for the theoretical proposition that commodity and geographic concentrations of trade are statistically significant in explaining instability. However, when alternative measures of commodity and geographic concentration were introduced, i.e. the primary export ratio, the share of fish in total exports, and the Danish share in Greenland's exports, the results suggested statistically significant relationships, albeit only at the 10% level of significance.

Although the results suggested that an increase in the primary-export ratio and the share of fish exports in total exports will lead to greater instability in export earnings, caution should be exercised in inferring from this that diversification into non-traditional exports would create greater stability in export earnings. Such an argument would necessarily require further empirical investigations.

The empirical analysis suggested that the Danish share in Greenland's exports (DSX) was statistically significant in explaining instability, and contrary to a priori reasoning, that an increase in DSX reduces instability. The a priori argument advanced in the literature is that geographic concentration of trade leaves a country susceptible to economic conditions in one or a few countries. But such an argument is based on the assumption that trading partner markets are unstable, and subsequently, that instability is being transmitted to a country's export earnings. However, as suggested by others such as Massell (1970), it is quite possible that countries whose exports are highly concentrated geographically tend to have more effective methods for smoothing out the fluctuations in export receipts, perhaps because of some sort of bilateral commodity arrangements. It is also possible that the dominant trading partner either pegs the price of the staple exports or else imports a guaranteed amount, in either case insulating the exporter from the full impact of market forces. Hence, the close ties between Greenland and Denmark coupled with special trading arrangements may help explain why DSX is negatively related to export instability.

The analysis of the causes of income instability in Greenland provided evidence to suggest that instability in real GDP is related to two indicators of dependency: technological dependency as measured by the capital-import ratio, and financial dependency as measured by the ratio of Danish expenditures to GDP. However, the estimation results showed no statistically significant relationship between income instability and indicators of trade dependency and concentration of export earnings.

Much of the debate on export instability suggests that fluctuations in earnings adversely affect the economic growth records of developing countries. In the case of Greenland, the empirical results support the theoretical proposition of export instability being a deterrent to economic growth. It has been argued in the literature that instability affects less developed countries in worse ways than other countries because of lower per capita incomes and limited diversification. And in this case resources cannot easily be transferred. Similarly, in the case of Greenland the lack of economic diversification and the significant constraints that exist in resource flexibility may offer some explanations for the relationship between export instability and the economic growth record of this country.

Additionally, this study found evidence to suggest that income instability is a deterrent to economic growth. It has been suggested by some authors that instability may have positive effects on economic growth; first, because investors may be attracted by risky or uncertain projects. Second, because periods of optimism and increased investment may not be counterbalanced by lower investments in periods of low income. Third, because investment decisions may not be affected to any significant degree by short-run instability. However, this study did not find evidence of such positive effects: rather the evidence indicated that instability has been a deterrent to economic growth in Greenland. The Granger-causality results of the consequences of instability for Greenland lend support to the argument that the country has not developed the mobility and flexibility in resource allocation that may be deemed necessary to allow a country to respond and adjust favourably to shocks to the domestic economy.

Much of the debate in the literature has centered around the issue of whether all deviations from trend should be considered valuable. For instance, it has been argued that not all deviations are problematic in as much as they reflect long term shifts in consumer tastes, technology, or factor supplies (Wilson, 1994), whereas sporadic elements of deviations are likely to be a greater concern. Fluctuations are undesirable when they trigger fluctuations in other variables such as government revenue and investment which might in turn impact on short term macroeconomic stability and longer run economic development. But it is also possible for income to fluctuate over time and yet be known in advance with certainty (Massell; 1970). In such cases, events that are predictable or certain do not necessarily have adverse consequences. For instance, regularly reversing fluctuations make it easier to predict the level of exports each year and also judge the correct timing for implementing stabilization policies. It all depends on a country's ability to predict and react correctly, and on its capacity for raising reserves to implement stabilization policies. Seen in this light, and given that the results of this study point to unidirectional causality running from instability to growth, with this association being a negative one, it can be argued that in the case of Greenland and over the period under study, events that cause instability have either not been predictable or certain, or alternatively, the country has been unable to predict and react correctly. Export instability was found to be greater than instability in income. This is likely the result of the greater variability in earnings from primary exports resulting from shocks to the domestic resource supply, and the result of external demand shocks, in particular the changing world price of shrimp in later years. Additionally, the block grant arrangement provides some degree of stability to the Greenland economy, which may be reflected in the relatively lower income instability when compared to export instability.

Chapter 9

Concluding Comments

The main objective of this thesis has been an empirical investigation into obstacles to economic development in Greenland. A central theme has been the degree of trade, financial and technological dependency, and its consequences for economic growth and instability.

Chapter two provided an overview of Greenland and its economy. It outlined some of the key problems facing Greenland. These include a significant level of economic dependency; a high degree of concentration in trade; and a heavy reliance on imported personnel. Also, the harsh arctic climate combined with geographical realities and constraints imposed by smallness, means that progress on the economic development front is slow in Greenland.

In chapter three the study presented an overview and discussion of Danish and Greenlandic goals and objectives regarding economic development. Since obtaining Home Rule policy objectives have been focused on achieving full political and economic autonomy while attempting to address shortcomings and failures of the Danish administration in the era before Home Rule. The key development goals flowing from these policy objectives have, since Home Rule, centred around the achievement of a higher degree of independence from annual Danish block-grants, an increase in export earnings and employment, a reduction in Greenland's dependence on imported Danish personnel, and a more differentiated business structure. However, despite two decades of Home Rule the Greenland economy remains narrowly based, economic dependency continues at high levels, and attempts to decentralize and include the settlement populations in the process of economic development have not been met with a great deal of success.

Chapter four focused on Greenland's key source of economic activity, the fishery based export sector. The chapter provided an analysis of the ability of the primary export sector to fuel economic growth in Greenland. The results suggested that primary exports have been able to produce trickle-down effects that have been a contributing factor in the economic growth process in Greenland's post-colonial history. This lends support to the broad range of development strategies, which to a large extent were focused on export-promotion strategies throughout the era since the end to colonial rule. While the evidence provides support for the strategy that has been in place, it does however not reveal anything about the impact of concentration in exports on instability and growth. This question was left for later chapters.

The issue of Greenland's dependency on the external environment, particularly Denmark, was further explored in chapter five. In this chapter the study investigated the degree of dependency in Greenland as measured by various indicators of trade, financial and technological dependency. The analysis pointed to a continued high level of external dependency. Although dependency has declined as suggested by indicators of trade, financial, and technological dependency, it has remained high. The point was put forward that countries designated as dependent are not all trapped in a permanent situation of foreign control and regulation where they are destined to endure low growth rates and low levels of income. The numerical measures of dependency may change through time. In the case of Greenland the analysis indicated that this economy has experienced fluctuations in the level of dependency, but the general picture remains largely unchanged: dependency ties to Denmark continue, and at a high level. While more advanced economies may score high on dependency indicators, they tend to have a high degree of resource flexibility and economic diversification, which permit them to minimize the adverse effects of external shocks and disturbances through the utilization of domestic and foreign substitutes. In contrast, a small, open and overspecialized economy, such as Greenland, can be categorized as dependent because it is weak on both resource mobility and the ability to develop substitutes, which presents impediments to effectively mitigate against the adverse consequences of external shocks and disturbances.

In chapter six this study undertook an empirical investigation into the relationship between economic growth in Greenland and economic dependency. It tested the statistical significance of selected indicators of trade, financial, and technological dependency in explaining variations in economic growth, in the period 1955-1998. The results did not lend support to the theoretical proposition that a negative association exists between economic growth and dependency. Rather, the evidence pointed to a positive association between growth and some indicators of dependency. The results suggested that technological dependency (measured by the lagged first-difference of the Danish share of the Greenlandic working age population, and the lagged capital-import ratio) is positively associated with growth. Likewise, two indicators of trade dependency (the primary-export ratio and the first-difference of the Danish share in Greenland's import) were positively related to economic growth. Only financial dependency (measured by the first-difference of the ratio of Danish expenditures on Greenland to the size of GDP) was negatively associated with economic growth. It should be kept in mind that financial dependency was not measured simply by the annual increase in real Danish State expenditures on Greenland, since that would not capture the degree of dependency. However, to gain further insight into the association between Danish financing and economic growth in Greenland, an estimation was undertaken using the first-difference of real Danish expenditures on Greenland as the measure of financial dependency. The results of this estimation indicated that when financial dependency is measured simply as the first-difference of Danish expenditures, and not as a ratio of GDP, then financial dependency is positively associated with economic growth. Other dependency indicators were found to be not statistically significant, i.e. commodity concentration of exports and imports, the export and import ratios, and the Danish share in Greenland's exports.

The negative association between financial dependency and economic growth, and the positive association between technological dependency and rate of economic growth were of particular interest. The technological and financial dependency variables reflect in broad terms two of the key aspects of the Danish development initiatives in respect of Greenland in the period under study. A causality analysis was undertaken to gain insight into the question of the success of these policies in terms of their impact on economic growth in Greenland. In the case of technological dependency the Granger-causality results indicated bi-directional causality. This suggested that technological dependency has been a contributing factor in Greenland's economic growth process, and furthermore, that the rate of economic growth has fuelled further dependency on technology. With respect to financial dependency, the results similarly pointed to a case of bi-directional causality, although this relationship was not as statistically significant as in the case of technological dependency. The analysis provided evidence, although only at the 10% level of significance, to suggest that financial dependency causes growth retardation. The results further pointed to a negative feedback effect running from growth to financial dependency. The negative causality running from financial dependency to economic growth raises questions regarding the increase in financing in relation to the growth of the Greenland economy. A lot of debate has surrounded the potential negative consequences of the high level of financial dependency in Greenland. In particular, much has been written about the crowding out of private initiative in this economy. As a side note, the results of the causality test, using the rate of growth of real Danish expenditures as an alternative measure of dependency, were briefly reported on. When financial dependency was measured as the rate of growth of Danish expenditures the results continued to show bi-directional causality, but the findings indicated that the rate of growth of Danish expenditures fuels economic growth.

Although the analysis did not provide much evidence in support of a dependency-growth stagnating relationship in the case of Greenland, dependency may have adverse consequences for economic instability. High levels of dependency in Greenland, coupled with the lack of flexibility and mobility in resources, may leave the country more vulnerable to shocks and disturbances. Thus, in chapter seven the study presented a macroeconomic analysis of structural change and instability in Greenland in the period, 1955-1998. Specifically, it tested for the presence of permanent level breaks and one-time pulse changes in the real export and real GDP macroeconomic time series for the period under study. The results suggested, first, that a positive supply shock in 1973 caused a break point in the export series, with the economy never returning to its pre-break level; second, that the implementation of Home Rule did not cause a structural change or break point in either of the two series; and third, that a structural change, as indicated by a negative level shift in the real exports and real GDP series, occurred as a result of a negative supply shock in 1990. This analysis pointed to the sensitivity of the Greenland economy to shocks to its natural resource supply. Additionally, the results highlight the lack of a real change in policy regime with the implementation of Home Rule. This result points to the stabilizing effect of the block grant arrangement and the absence of a break in the size of service delivery. It also suggests that the heavy reliance on imported Danish advisors and personnel in general, has allowed the Danish influence to continue which may have contributed to a lack of change in economic structure before and after Home Rule.

The analysis of economic instability and its relationship to dependency was taken a step further in chapter eight. Chapter eight presented a macroeconomic time series analysis of economic instability in Greenland in the period, 1955-1998. Specifically, it measured export and income instability, and it analysed the causes and consequences of both types of instability. In general, the results suggested that concentration in trade is associated with export instability. The results of this study did not find statistical support for the theoretical proposition that commodity and geographic concentrations of trade are statistically significant in explaining instability. However, when alternative measures of commodity and geographic concentration were introduced, i.e. the primary export ratio, the share of fish in total exports, and the Danish share in Greenland's exports, the results suggested statistically significant relationships, albeit only at the 10% level of significance. The results suggested that the primary export ratio and the share of fish in total exports are positively associated with export earnings' instability, while the Danish share in Greenland's exports, contrary to a priori reasoning, was found to be negatively associated with instability.

In the case of income instability, the results provided evidence to suggest that instability in real GDP is positively related to financial dependency, and negatively related to technological dependency as measured by the capital-import ratio. However, the estimation results showed no statistically significant relationship between income instability and indicators of trade dependency and concentration of export earnings. Thus, the evidence suggests that Greenland's export sector only impacts on export instability, while income instability is affected by dependency on external financing and technology. In addition, the results of a Granger-causality analysis suggested that both exports and income instability are deterrents to rate of economic growth.

These results may shed some light on a possible indirect negative impact of dependency on economic growth. First, the analysis of the dependency-growth relationship suggested, in broad terms, that trade and technological dependency have been positively associated with economic growth. From these results it was inferred that dependency has in some cases been growth generating. At the same time, however, the results indicated that economic instability is a deterrent to economic growth, and furthermore, that some indicators of dependency are statistically significant in explaining economic instability. Hence, in the absence of further testing, it could be suggested preliminarily, that while trade and technological dependency do not impede economic growth directly, a negative indirect impact on growth may exist. This argument flows from the reported evidence of a statistically significant association between dependency and instability, and the results pointing to instability as a deterrent to economic growth. Thus, for instance, while a reliance on primary exports has a direct positive impact on economic growth, it may also have an indirect negative impact on growth through its relationship to instability, i.e. the primary export ratio is positively associated with export instability, and export instability is a deterrent to economic growth. Also, the empirical tests suggested that a positive association exists between dependency and economic instability, and a negative relationship exists between instability and economic growth. Hence, if it is assumed that Greenland's small size has been a factor in determining the level of trade concentration (as discussed in chapter five), then it is possible that Greenland by virtue of its small size is experiencing economic instability. Moreover, as suggested by the evidence, instability in Greenland is an impediment to economic growth. Hence, the empirical findings could point to smallness as an obstacle to economic development in Greenland. However, to establish conclusive evidence on a link between small size, trade concentration, and instability in Greenland further empirical analysis is required.

While much of the debate surrounding the source of Greenland's economic problems has been heated, often with many divergent views, a common consensus has been that trade concentration is linked to the small size of Greenland, and that smallness is an important factor complicating progress on the economic development front. The extent to which small size has become an obstacle in economic development as a result of

Danish State policies is an interesting question, which, however, would require further research and is beyond the scope of the present study. Although, it could be argued that shortcomings in development policies, and some of the inappropriate and inadequate Danish development strategies in many respects perpetuated the problem surrounding small size in Greenland. It is possible that Greenland could mitigate against some of the adverse consequences of small size and dependency through on-going commitments to enhance flexibility and resource mobility, and through further commitment to economic diversification. This would require significant effort and time, financial commitment, and new and innovative approaches to economic development.

The results of the empirical analyses presented in this study, however, should be viewed with some caution. More conclusive evidence on the relationships between economic dependency, growth, and instability, is contingent upon improvements in data reliability, the availability of a larger database in the future, and further development of a more complete and accurate system of national income accounting in Greenland.

While this study has analysed in broad terms the causes and consequences of economic dependency in Greenland in the period 1955-1998, no attempt was made to empirically answer the question of whether dependency and instability has changed since Home Rule. Thus, this study did not answer the question of the extent of the success of Greenlandic Home Rule. Except for the analysis of structural change in chapter seven, where it was found that structural change did not occur at the time of implementation of Home Rule, this study did not provide evidence on the impact of Home Rule on economic trends in Greenland. In assessing empirically the success or failure of Home Rule at least three empirical approaches could have been employed, and these may form the basis for further research: the analysis could have undertaken, first, a before and after analysis of economic indicators in Greenland; second, it could have compared the Greenland economy, both pre-Home Rule era and post-Home Rule economy to other arctic societies, although it would be difficult to obtain good comparators; and third, it could have compared the economy in the post-Home Rule era with a projection of the Greenland economy assuming a continuation of the pre-Home Rule trends. Such analyses, however, were beyond the scope of the present study.

Although this study has not provided empirical evidence to permit an evaluation of the success or failure of Home Rule, some general comments and observations can be made.

In the era before Home Rule, the Danish approach of centralization and modernization was instrumental in bringing about rapid social and economic advances in Greenland. But the population of Greenland was largely left out of the development process, which meant that the influence of Greenlanders themselves was either absent or weak in the design, implementation and execution of this process. In general, the strategy created a very complex web of dependency ties to Denmark that in broad terms can be referred to as trade, financial and technological dependency. The level of dependency has declined in more recent years as suggested by some indicators, but the overall level remains high.

The standard of living in Greenland at the time of implementation of Home Rule was significantly higher than that seen in other arctic societies. It was a standard of living that had been achieved through many years of development initiatives, planned, and overseen by Denmark. But above all, it was a standard of living paid for by the

Danish State. So far, Greenland has been unable to support this standard of living without further financing from Denmark. Today, despite more than two decades of Home Rule, any prospects for greater economic autonomy remain limited. A lack of alternative sources of income continues to be a key factor undermining any immediate prospects for achieving a higher degree of economic independence.

While the Home Rule government has focused on the utilization of the living resources as part of its industrial policy, steps taken to develop and modernize the fishing industry and improve the marketing and processing of marine products have not led to a higher level of economic diversification that could help sustain the Greenland economy. A main concern continues to be the high export concentration of marine products. Additionally, a high proportion of fish and other marine exports continues to be exported either non-processed or semi-processed. The lack of processing means that Greenland is loosing value added and as such also potential employment opportunities. Little has been done in Greenland to increase the degree of processing of export products. In this respect, things are not much changed since the era of the Danish administration.

In more recent years efforts have also been geared toward developing alternative sources of income through a more diversified business structure, with emphasis placed on mineral resources, tourism and other land-based trades. However, attempts to diversify the Greenland economy have so far been largely unsuccessful. As in the case of the era before Home Rule, no permanent solutions have been found to the persistent problems related to small size, the scattered population pattern, remoteness, and high cost of transportation. To strengthen the Greenland economy over the long term, the Home Rule government has initiated a comprehensive process aimed at increasing the efficiency and competitiveness of trade and industry. Since the end of the 1980s the Home Rule government has focused on operating the publicly owned enterprises as commercial companies. This represents a clear departure from Home Rule policies of many years to maintain employment levels and ensure supply through subsidized and protected public enterprises. In many respect this is also one of the more disappointing trends, not least because it is a reversal of policies of the 1980s which sought to address the shortcomings of economic development approaches prior to Home Rule. The trends of more recent years show that the Greenland government has begun to adopt features more in line with a free market ideology. This includes commercialization of Home Rule owned enterprises and deregulation, just as it entails talk of privatizations and a removal of the current uniform price system. However, so far it has proven difficult to reconcile the structural features of the Greenland economy with a free market ideology. In particular, history has shown that, by and large, public enterprise has been the only type of ownership that has been able to solve societal goals, and ensure supply and distribution in Greenland. Private enterprise on a large scale has been hampered by problems related to smallness, lack of economies of scale, and high cost of transportation. The arctic realities call for a different system of allocation than the free market. The issue of market structure and ownership was discussed by Winther (1998a), who raised the question of whether a market economy is even possible in Greenland? For instance, privatization was attempted in the post war years in Greenland, but, as discussed in chapter three, it failed, and ultimately the public sector was needed to solve the problem of supply and distribution in Greenland. Also, as noted by Sveistrup (1967), traditional Greenlandic society is based more on cooperation than individual achievement. Value systems that tend to emphasize cooperation and downplay goals of profit maximization tend not to fare well in societies that promote a free market ideology, liberalization, private initiative, and private bureaucracy (e.g. Winthers, 1998). Yet, current Home Rule objectives seem to be leaning toward such an ideology (Raadgivende Udvalg, 1997). As noted by Skydsbjerg (1999), of the many projects undertaken during the course of economic development in Greenland, many have failed whenever they have attempted to copy a production, system, or model of some other country that cannot be compared to Greenland. Greenland does not have a real market economy. The population is too small and scattered, which makes most enterprise monopolistic.

The Danish development initiatives in the period before Home Rule were widely criticized for their stance toward Greenlandic settlements. However, the implementation of Home Rule does not appear to have done much to reverse the failures of the Danish administration in this regard. Although the Home Rule government set out to restore the living conditions in the villages and the outer districts, the efforts on this front have been limited and mixed. Various steps in respect of villages have been taken, including providing electricity and water plants in villages, building helicopter platforms in many places, and establishing small industrial plants, for fish and meat preparation, to create greater income opportunities for hunters and fishermen and to create jobs. The persistent pressure on public funds and the economic crisis of the early 1990s, however, led to a critical reassessment of public investment projects, and in turn impaired the position of smaller communities in the competition for scarce public funds (Larsen, 1993). The emphasis of current policy initiatives, as noted above, is now being placed on commercialization of industry and a more market driven economy. These policies have in many respects been in conflict with the societal objectives of decentralization and revitalization of communities and the desire to protect the Greenlandic culture. However, as noted in chapter four, in 1998 the Home Rule government established Nuka Inc., a small Home Rule owned corporation that deals with assignments related to Greenlandic settlements. But in general, public investments and development efforts have since Home Rule been concentrated in major towns, in particular in four principal towns; Nuuk, Sisimiut, Illulissat, and Qaqortoq. So far, the Home Rule government has not taken any steps toward implementing a comprehensive community economic development strategy.

The development efforts of the Home Rule government have also led to a more unequal distribution of income, with the population in the villages making a living from subsistence and wage work, while the population in the towns are engaged primarily in wage work (e.g. Lyck (1995), Larsen (1993)). Additionally, income disparity continues to exist between Danes and Greenlanders. For instance, Lyck (1997), estimates that the 10 per cent of the population with the highest incomes earn about 40 per cent of the income, and that 7 of the 10 per cent are Danes.

Another contentious issue is the persistent reliance on Danish imported personnel. This dependency has not diminished significantly since Home Rule. Since Home Rule Danes have continued to occupy the majority of the leading positions in public administration, which has meant that they have been able to continue to play an important role in the political decision making process (e.g. Larsen, 1993). As a result, Home Rule has in many ways continued to imitate the practices of the former colonial government.

Many observers have argued that Greenland is living far beyond its means, and that the administration of Greenland's public sector must be diminished and adjusted to the Greenland reality. However, a radical cut in the public sector would cause massive unemployment, lower incomes, and most likely an out-migration of educated Greenlanders and Danes. Such a scenario would undermine and destroy any gains made in economic development since the beginning of the Danish modernization policy, and could once again push Greenland to the margin of modern society (e.g. Lyck (1995); Larsen (1993); Paldam (1994)). Many critics of the current system argue that there is a need to eliminate financial dependency on the Danish State, but that a reduction in dependency would have to occur through a gradual phasing out of the annual block grant.

One of the most serious problems facing Greenland continues to be the shortage of Greenlanders with relevant education, especially higher education. Although the level of educational attainment has improved markedly, the inefficiencies of the educational system in Greenland and the general lack of educational attainment continue to pose critical challenges to the economic development of this country. A lack of educational attainment is among the main impediments to the realization of economic development and financial independence in Greenland. At the same time the education of the local population is one factor that is achievable and that could contribute to overcoming some of the dependency on Denmark, and help compensate for some of the more rigid structural problems and geographical factors confronting this country. But in order to take advantage of a more educated workforce, Greenland would have to find ways of creating economic and employment opportunities domestically and start matching educational attainment with job opportunities. This would have to include a continued strategy of replacing Danes with local labour.

The task of finding a strategy of economic development that can raise domestic production and reduce the degree of external dependency continues to be met with significant challenges on several fronts, including major resource constraints and constraints imposed by geographic and climatic realities. The main challenge for the future will be to find a strategy that creates a sound economic base while enabling Greenland to maintain a workable balance between modernization and protection of the culture of Greenland. Being successful on all these fronts simultaneously will, however, require a significant long-term commitment by all levels of government including the Danish State. Achieving greater economic autonomy while protecting the current standard of living may, ironically, necessitate increased dependency well into the future. Also, achieving success will require finding and testing out new and innovative approaches to economic development.

As suggested by the empirical analyses, dependency and economic instability in Greenland continue to pose critical challenges to the economic growth record of this country. A main concern for Greenland will be that of realizing long-run sustained growth. This will most likely require both resource flexibility and resource mobility as well as innovation sufficient to permit shifts into new export lines and possibly shifts into production for the domestic market, just as it may require the capacity to enter into new foreign markets. Greenland will continue to be confronted by a number of challenges, including the existing limits on resource flexibility, the constraints on finding, and entering into new foreign markets, and the difficulties associated with the small and scattered population base, which represent barriers to achieving economies of scale in domestic markets.

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