Jouko Kinnunen

MIGRATION, IMPERFECT COMPETITION AND STRUCTURAL ADJUSTMENT

- ESSAYS ON THE ECONOMY OF THE ÅLAND ISLANDS

HELSINKI SCHOOL OF ECONOMICS

ACTA UNIVERSITATIS OECONOMICAE HELSINGIENSIS

A-258

Jouko Kinnunen

MIGRATION, IMPERFECT COMPETITION AND STRUCTURAL ADJUSTMENT

- ESSAYS ON THE ECONOMY OF THE ÅLAND ISLANDS

HELSINKI SCHOOL OF ECONOMICS

ACTA UNIVERSITATIS OECONOMICAE HELSINGIENSIS

A-258

ISSN 1237-556X
ISBN 951-791-931-X
ISBN 951-791-932-8 (Electronic dissertation)

Helsinki School of Economics -
HeSE print 2005

ABSTRACT: This dissertation studies the issues and problems of the Åland Islands related to European integration and globalisation. These are migration (essay 1), competition in the domestic (local) market of Åland (essays 2 and 3), and the economy-wide consequences of changes in shipping and alcohol policy in the Nordic countries and in the European Union (essay 4). The analyses are conducted with an econometric examination of micro level data (essays 1 and 2) and with a dynamic applied general equilibrium model (essays 3 and 4) that was constructed during the course of this study.

Essay 1 examines the characteristics of migration flows to and from the Åland Islands. Estimated migration equations are well in line with the current theories and earlier empirical results. In addition, it is shown that the local unemployment rate affects mainly the migration tendency of non-natives. However, the probability of living in Åland has a decreasing time trend for native Ålanders, while the opposite is true for the persons born in mainland Finland. **Essay 2** tries to explain the high price level of groceries in Åland by comparing individual price observations in Åland to those in the southwestern part of mainland Finland. Lack of scale economies, as well as high concentration levels in retailing and in the food processing industry, are some of the suggested explanations. In addition, transport costs and VAT border administration are Åland-specific, yet minor factors in raising prices. There are not many policy options available for rectifying the situation, but added competition in the local market through relaxed entry barriers could be one measure. **Essay 3** introduces a dynamic imperfect competition CGE model. One of the major contributions of the model is the introduction of migration that makes economic growth endogenous in the model. An increase in the threat of entry from outside the home region is simulated with the model. This would increase the concentration of local industries, but also would increase consumer welfare. **Essay 4** studies the economy-wide consequences of changes in shipping and alcohol policy of the EU and the Nordic countries. The Finnish Government's decision to increase subsidies to shipping from 2005 onward seems to compensate quite well for the decreased profitability of tax-free sales onboard. New subsidies increase two-fold the budgetary net transfers from Finland to Åland.

Key words: migration, regional labour markets, imperfect competition, dynamic CGE models, shipping

TIIVISTELMÄ: Tämä väitöstutkimus tarkastelee Ahvenanmaalle ongelmallisia EU-integraatioon ja globalisaatioon liittyviä kysymyksiä. Näitä ovat muuttoliike (essee 1), kilpailutilanne Ahvenanmaan paikallisilla markkinoilla (esseet 2 ja 3), sekä Pohjoismaiden ja EU:n alkoholi- ja merenkulkupolitiikan muutosten kokonaistaloudelliset vaikutukset Ahvenanmaalla (essee 4). Analyysit on toteutettu hyödyntämällä ekonometrisia estimointeja mikrodatalla (esseet 1 ja 2), sekä soveltamalla dynaamista yleisen tasapainon (YTP) mallia (esseet 3 ja 4), joka rakennettiin osana väitöstutkimusta.

Ensimmäisessä esseessä tutkitaan Ahvenanmaan muuttoliikkeen luonnetta, ja havaitaan sen käyttäytyvän teorioiden ja aikaisempien empiiristen tulosten mukaisesti. Lisäksi havaitaan, että työttömyyden muutokset vaikuttavat lähinnä ei-syntyperäisten asukkaiden muuttamistodennäköisyyteen. Lisäksi havaitaan, että syntyperäisten todennäköisyys pysyä maakunnassa laskee yli ajan, kun taas maakuntaan Manner-Suomesta muuttaneilla se nousee. **Toisessa** esseessä etsitään syitä Ahvenanmaan päivittäistavarakaupan korkeaan hintatasoon vertaamalla paikallisista kaupoista kerättyjä hintahavaintoja vastaavien tuotteiden hintoihin Varsinais-Suomessa. Tärkeimmät syyt korkeaan hintatasoon ovat skaalaetujen ja kilpailun puute vähittäiskaupassa sekä elintarviketeollisuudessa. Vähemmän tärkeitä syitä ovat kuljetuskustannukset sekä Ahvenanmaan ja Manner-Suomen välisen verorajan aiheuttamat lisäkustannukset. Hintatason laskeminen ei ole helppoa, mutta maakunnan viranomaiset voisivat lainsäädännöllisin keinoin pyrkiä vähentämään markkinoille tulon esteitä ja siten lisäämään markkinoiden kilpailullisuutta. **Kolmannessa** esseessä esitellään dynaaminen epätäydellisen kilpailun YTP-malli. Mallin suurimpiin kontribuutioihin kuuluu työvoiman kasvun endogenisoiminen muuttoliikkeen avulla. Mallilla simuloidaan maakunnan ulkopuolelta tulevan kilpailu-uhan lisääntymisen vaikutusta talouteen. Havaitaan, että sillä olisi maakunnan yritysrakennetta keskittävä, mutta kuluttajien hyvinvointia lisäävä vaikutus. **Neljännessä** esseessä tutkitaan EU:n ja Pohjoismaiden alkoholi- ja merenkulkupolitiikan muutosten kokonaistaloudellisia vaikutuksia samaa YTP-mallia hyödyntämällä. Havaitaan, että Suomen valtion vuoden 2005 alusta myöntämät uudet merenkulun tuet näyttäisivät kohtuullisen hyvin korvaavan laivojen verovapaan myynnin kannattavuuden laskun. Uudet tuet kaksinkertaistavat valtion nettokulut Ahvenanmaalla.

Asiasanat: muuttoliike, alueelliset työmarkkinat, epätäydellinen kilpailu, dynaamiset YTP-mallit, merenkulku

LIST OF THE ESSAYS

ESSAY 1

Jouko Kinnunen: *Modelling the propensity to live and stay in the Åland Islands – A case of diminishing insider advantage of the natives?*, unpublished.

ESSAY 2

Ville Aalto-Setälä – Jouko Kinnunen – Katri Koistinen (2004): *Reasons for high food prices in small market areas - The case of the Åland Islands*, Agribusiness – An International Journal, Volume 20, Number 1, Winter 2004, pp. 17-29, Wiley.

ESSAY 3

Jouko Kinnunen: *DALAGEM -A dynamic applied general equilibrium model of the Åland Islands economy*, unpublished.

ESSAY 4

Jouko Kinnunen: *Future challenges for the Åland Islands in a cross-swell of alcohol and shipping policy changes - A CGE analysis*, unpublished.

FOREWORD

The inception of my postgraduate studies can be dated back to autumn 1992, when my supervisor Pertti Haaparanta invited me to participate in the first computable general equilibrium (CGE) research project of the Helsinki School of Economics. Simultaneously, I had started with my postgraduate studies. Together with Johanna Jerkkola and Johanna Pohjola, we studied the CO_2 abatement costs for the Finnish economy.

Thanks to Pertti, the method of CGE modelling thus became familiar to me. But, being young and restless, I left the project and took a break with my studies, in order to experience life in Bolivia as a UN associate expert. The supposedly two-year-long break became extended to seven and a half years. It was not until the spring 2001 that all the necessary pieces fell in place, and I could continue with the studies. Until then, I had lived in La Paz, Bolivia, and in Vienna, Austria, and finally had found a new home and employment in Mariehamn, Åland. In addition, our two daughters, Emilia and Karolina, were born during this study break. Through my work at the Statistics and Research Åland, I found a new subject of study worthy of the effort of continuing with postgraduate studies. Interestingly, CGE modelling proved to be a vital part of my doctoral thesis after all.

During this journey towards the culmination of my studies, numerous persons have been instrumental, all of whom cannot be mentioned here. Apart from Pertti, who without hesitation welcomed me back to the studies after such a long break, I would like to thank Pekka Ilmakunnas, Juha Honkatukia, and Risto Vaittinen, who, together with Pertti, all are my supervisors, and who have helped me in numerous ways. Risto Vaittinen has been an indispensable source of support and clear-sightedness in the later phases of the CGE modelling effort. Apart from being my mentor for econometric and labour market issues, my advisor Pekka Ilmakunnas has provided me with insightful comments on numerous drafts of this thesis. The encouragement and practical help from Juha Honkatukia was important in the early phases of the CGE modelling effort.

I am also very grateful to Ville Aalto-Setälä for the encouragement to revive my efforts at postgraduate studies. Without his enthusiasm, not a single one of these essays would be

published. I am also indebted to Katri Koistinen, whose professionalism with the spatial analysis of competition was very beneficial to our joint essay on the price level of grocery retailing in Åland.

Moreover, I am thankful for all the guidance I got from Almas Heshmati through his very instructive courses on applied econometric modelling that I was lucky to attend. I would also like to express my thanks to John Sumelius at the Department of Agriculture of the University of Helsinki and Stein Holden at the Agricultural University of Ås, Norway, who both let me participate in their Ph.D. courses, which were vital for advancing in my studies. I was lucky to enjoy the teaching of Sherman Robinson and Hans Lofgren during the course held in Ås, Norway in August 2003. Without their willingness to share their knowledge - and source code - with their students, my studies would not have advanced to this final phase.

Several other persons have guided me through some of the tricks of the trade in CGE modelling, including Ali Bayar, Roberto de Santis, Dirk Willenbockel, Lars Bergman, Olga Ivanova, and Lars Bohlin, to all of whom I owe many thanks.

I am also very thankful for having had the possibility to count on the advice, expertise, data, and material support from my superior Bjarne Lindström at the Statistics and Research Åland. My colleague Richard Palmer is worthy of many thanks for his effort in preliminary language revision of this thesis (apart from essay nr 2, which was revised by Carolyn Holton). I would also like to express my gratitude to Liisa Roponen, who made the final language revision of this thesis. I also want to thank my other colleagues in the Statistics and Research Åland for their encouragement. My friends Sten Eriksson and Päivi Alho-Eriksson have provided me with useful comments on several drafts of this thesis. Lilian Norring-Öhman, the librarian of the Åland Parliament, did a tremendous job in linking me to the resources of the Nordic academic libraries, thus facilitating my studies on the Åland Islands, far away from big universities.

I would also like to thank the personnel of the Regional Accounts Department of Statistics Finland – Kari Ritvanen, Aku Alanen, Ville Tolkki, Erkki Niemi and Mikko Koutaniemi - for all their help and guidance concerning national accounts methods and data during the years. In addition, Esa Österberg and Thomas Karlsson at the National Research and Development

Centre for Welfare and Health (STAKES) have always been generous in sharing their profound knowledge on the Nordic alcohol policy.

This study would not have been realised without the support provided by the Finnish Cultural Foundation and the Yrjö Jahnsson Foundation, to which I extend my profound appreciation. In addition, I was fortunate to benefit from several travel grants from the Finnish Association of Professors and Docents of Economics, as well as from the Helsinki School of Economics Foundation.

I would also like to thank my pre-examiners Hannu Tervo and Lars Westin for their useful observations and suggestions, which have greatly benefited the final edition of the thesis.

I would also like to thank Mika Kuisma for his company and encouragement during the years of studying at common postgraduate courses.

I would like to convey my thanks to my parents and parents-in-law for supporting our family in various ways during my studies. However, I owe the greatest debt of gratitude to my wife Åsa for having put up with me during all these years of monomaniacal studying. What is more, without her inspiration it would never have occurred to me to study the economy of the Åland Islands, her and our daughters' place of birth, and the current home of our family.

CONTENTS

Introduction: The Åland Islands as a case of policy-oriented studies in economics

Jouko Kinnunen

1. Introduction

This thesis contains four essays that have at least two things in common. First, the subject of all the studies is an aspect of the economy of the Åland Islands. Second, the policy issues related to the research questions addressed in the essays below have been debated lately among regional and state-level policymakers. Therefore, the research questions raised here are relevant and timely for the economic policy of the Åland province.

In the public debate of the policy issues studied here, economic reasoning may have been overshadowed by other considerations that are emotionally more appealing. It may even be true that some of the issues covered here are sort of blind spots for the general public of Åland, which makes it more difficult to analyse them without bias. In consequence, the study themes tend to challenge the objectivity of the researcher as well. Therefore, one of the motivations for this study, apart from the apparent academic interest, is to try to contribute to the increased role of economic reasoning in local policymaking, by highlighting economic consequences of different policies.

In section two, we present such background information on the Åland Islands that bears relevance for these studies. Section three provides the basic facts on the development and structure of Åland's economy. Section four presents the summaries of the four essays under the three themes of this study: migration and labour market, imperfect competition, and the role of alcohol and shipping policies in the forthcoming structural changes of the Åland economy. Section five gives the major conclusions.

2. Special characteristics of the Åland Islands

The Åland Islands with its 26,500 inhabitants, populating around 65 of its 6,500 islands, is the smallest of the Finnish NUTS 3 regions. Apart from its small population, Åland differs from a normal Finnish region in numerous ways. Most importantly, its status of internationally guaranteed political autonomy was ratified in 1921 by the League of Nations as an effort to resolve the conflicting territorial claims between the governments of Sweden and Finland, that were also accompanied with the inhabitants' plea for reunification with Sweden (Hannikainen, 2004). In the same year, Finland and Sweden also signed a bilateral agreement to guarantee the people of Åland their birthright to the Swedish language, culture, and local traditions (Lindström, 2000). Autonomy was not the solution that inhabitants had asked for, so it took time before it gained public support (Myntti, 2002).

In addition to being autonomous, the Ålands Islands are demilitarised, meaning that there can be no military presence on the Islands nor can it be fortified. Åland is also neutralised, and should therefore be kept outside the war zone in case of conflict (Government of Åland and the Åland Parliament, 2004).

One of the main characteristics of the Åland Islands is the clear linguistic border between Åland and Finland. Whereas 93 per cent of Ålanders speak Swedish, the same per cent of the population speaks Finnish on the mainland in Finland. Preserving the unilingual Swedish culture from encroachment by the majority Finnish population has been described as the very raison d'etre of Åland autonomy (Lindström, 2000).

Since the beginning of autonomy, two major revisions (1951 and 1991) to the Autonomy Act have been carried out, strengthening the autonomy (Government of Åland and the Åland Parliament, 2004). Currently, the governing body on the Åland Islands has the right to pass laws on internal matters like local administration, internal transports, law and order, culture and education and health care. In addition, taxation powers as well as authority over economic policy are shared between the state and the Government of Åland, with the local taxation authority limited to municipal taxes, and to additional taxes on income and on the local trade and industries at the provincial level. However, jurisdiction for provincial taxation has never been utilised (Berghäll, 2003). Promotion of industries is under the jurisdiction granted by

autonomy, but in sectors like primary production and shipping, the authority is divided between the state and the autonomous province. In practice, the state is responsible for a major part of subsidies to agriculture, and in the case of shipping, the state finances all subsidies currently in use. However, in other areas of the economy, provincial subsidies are applied quite extensively. In per capita terms, state and provincial subsidies to Åland firms in 1998 were double the level of mainland Finland (Berghäll, 2003).

According to Myntti (2002) "The very character of the guarantees for the preservation of the Swedish character of Åland is the right of domicile, the regional Åland citizenship, introduced through the 1951 Autonomy Act." The right of domicile is necessary for exercising several individual rights, e.g. to acquire real estate, conduct business, or vote in the elections of the Legislative Assembly of Åland. In order to qualify, an in-migrant has to be resident and legally domiciled in Åland for five consecutive years, and has to be satisfactorily proficient in the Swedish language.

When Finland and Åland joined the EU in 1995, Åland succeeded in acquiring a permanent exemption from the Community's indirect tax legislation for Åland, as a result of the accession negotiations with EC/EU, (Fagerlund, 1997). This derogation placed Åland outside EU's indirect tax union, and enabled the continuation of tax-free sales on the passenger ferries between Sweden and Finland[1], even after the June 30th 1999, when the era of tax-free sales within the Community was discontinued (Silverström, 2003).

As a consequence of Åland's third country status regarding indirect taxation within the EU, there is a fiscal frontier, or a "VAT border" between Åland and the rest of the EU, also extending to mainland Finland (Silverström, 2003). Goods traded between continental Finland and Åland, as well as with the rest of the EU go through customs similar to goods from a third country outside the Union, thus making the amount of red tape higher than it would be otherwise in trade with neighbouring regions (Lindman – Kinnunen, 1999).

The financial relations between the Government of Åland and the Finnish state are very different from those between the central government and other regions in Finland. The latest,

[1] Ferries have to stop in Åland, i.e. exit the Union's VAT territory, in order to have a right to tax-free sales onboard.

1991 revision of Autonomy Act that came into effect in 1993, increased the budgetary autonomy of the Åland Government. Instead of a state grant based on itemized budgetary comparison of the regional government and the Finnish state administration, Åland currently receives a lump sum grant, called the "amount of equalisation", which is 0.45% of the state budget income excluding new loans. This amount is not an actual state subsidy, but rather is the reimbursement of taxes levied in Åland by the state (Palmgren, 1997). Consequently, the economic autonomy of Åland has increased considerably, as the provincial Government can decide its budget outlays independently, without having to submit every budgetary item for state approval (Turunen – Eriksson, 2004).

The new system also includes an incentive designed to promote economic policy that leads to increased tax income generation in Åland. If income and property taxes levied in Åland exceed 0.5 per cent of the corresponding taxes in the entire country, the excess shall be redistributed to Åland (known as the "tax recompense"; Government of Åland, 2004). No similar system has been introduced for indirect taxation (Turunen – Eriksson, 2004).

The system has proven to be quite favourable for Åland. Once Finland started to recover from the recession of the early 1990s, its tax revenues increased, while the state budgetary spending continued to be subjected to strict control. However, the amount of equalisation was by definition unobtainable with this budgetary control. While the state budgetary outlays grew quite modestly (state expenditure in total), budget expenditure during the late 1990s soared in Åland. The increased budgetary income from the equalisation amount, together with the changes brought by the EU membership, has been a major factor for the increased growth rate of public sector spending and employment. These clearly exceed those of the mainland Finland (for a more detailed account, see Turunen – Eriksson, 2004).

3. Structure of the Åland economy

By learning to cope with its geographical isolation, Åland has succeeded in turning this disadvantage into a comparative advantage in the maritime sector. Already in the 19th century, Ålanders supplemented its agricultural income with fishing, and by selling the products to the neighbouring population centres (Lindström, 2002a). At the end of 1950s, the modern auto ferry traffic started, which lead to a radical transformation of the agrarian society into a modern service-based economy (Lindström, 2002a). Thus, taking advantage of Åland's insular location at the mid-centre between the major urban centres of Sweden and Finland lead to a development of an active regional economy.

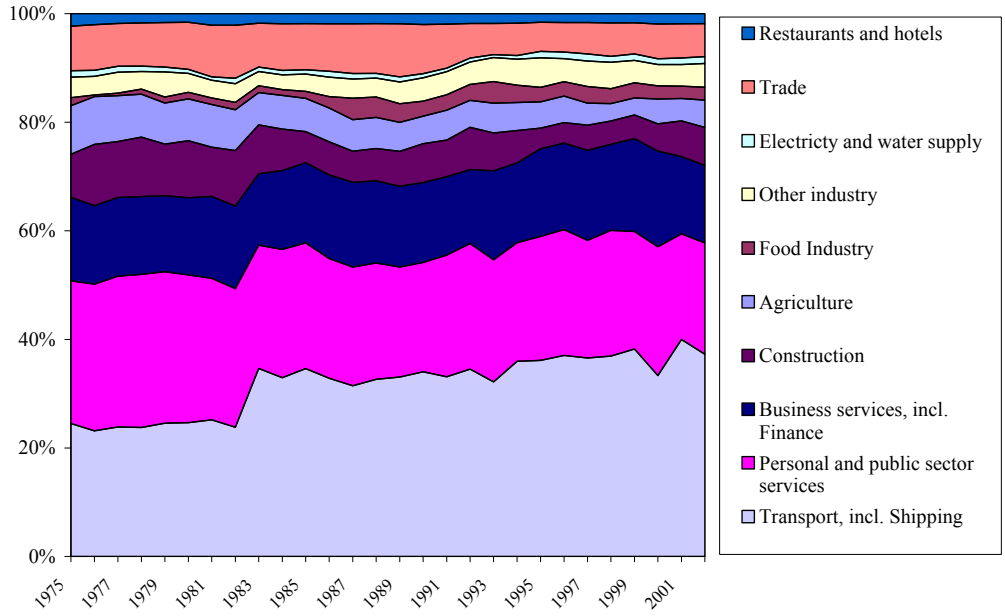
To date, Åland's GDP per capita is the highest among Finnish regions, and it surpasses the national average approximately by a third. National income per capita is about 25 per cent higher than the national average (Statistics Finland, 2004a). Compared to the Nordic countries, only Norway enjoys a higher GDP per capita, measured in PPP euro (Statistics and Research Åland, 2004a).

The production structure of the Åland economy is dominated by shipping which accounts for approximately one third of the value added. In comparison with other shipping clusters in the Baltic and Nordic as well as Northern European countries, Åland is highly reliant on shipping (Lindström, 2002a). Furthermore, in Åland the reliance is concentrated heavily on the shipping companies themselves, most of which is passenger related, with tax-free sales of alcohol, tobacco and cosmetics (Lindström, 2002a). About 70 per cent of the turnover of the Finnish passenger vessels comes from the sale of tax-free products (see e.g. Granfelt, 1996). In the middle of 1990s, when intra-EU tax-free sales were still allowed, the sale of tax free products per capita in Åland was almost 1,000-fold that of the average EU economy (for EU figures, see Gebauer et al, 2004; for Åland figures, see Kinnunen, 1998; Statistics Finland 2004b).

Manufacturing, which in many other regions generates a considerable share of the value added, accounts only for seven per cent of the total value added in Åland (Statistics Finland, 2004a).

Service industries, i.e. all industries except primary production, manufacturing and construction, generated around 80 per cent of the value added in 2002. Figure 1 presents the development of the value added shares at the aggregation level used here. We see that until the turn of century, the share of transport industry was increasing, with only temporary downturns in 1990s (due to the Nordic recession and the Estonia disaster). In the beginning of 1980s, introduction of new passenger vessels accounted for a considerable growth thrust in shipping.

Figure 1. Value added shares of industries 1975-2002



Source: Statistics Finland, 2004a.

Regarding the lopsidedness of the economy, Åland resembles other island economies, which tend to be less likely to diversify (Baldacchino, 2005). Island economies are often thought to be more vulnerable to economic shocks, and their limited reserve of human resources may lead to the recruitment and promotion of mediocre personnel; in other words, the labour market may not allocate resources efficiently. Small islands also lack economies of scale due to small internal markets; insularity and remoteness may also lead to higher transport costs (see e.g. Baldacchino, 2005 or Azzopardi, 2005). These assumed structural weaknesses of island economies greatly overlap with the central themes of this thesis.

4. Selected areas of study

The issues considered in the following sections are greatly affected by two parallel forces driving change, namely globalisation and EU integration. Baldwin and Martin (1999) suggest that the key aspects of globalisation are its effects on:

- trade, investment, migration and factor prices
- capital flows and markets, and
- industrialisation, and on income convergence/divergence.

Globalisation decreases the costs of transporting goods as well as ideas (through decreases in telecommunication prices), providing more peripheral regions with an improved access to overseas goods, capital, and innovation markets. The development has also been referred to as "the death of distance". Increased possibilities for trade, foreign direct investment as well as international service outsourcing, are fundamentally changing the international division of labour and the degree of industrialisation in the developed and emerging economies. Shipping, the main industry of Åland, is inherently mobile and global and the economy is dependent on the sector's ability to cope with the pressures of change. International differences in the cost structure promote a much easier movement of capital than in other industries (Selkou – Roe, 2004). Therefore, it is only logical that the structural challenges following changes in the preconditions of shipping activities are studied here.

Although not always included in the debate, migration is identified as a key factor in the globalisation process. For instance, Freeman (2003), claims that immigration, capital flows, and technology transfer have greater impacts on the labour market than trade, which has been the focus in much economic debate. Vaittinen (2004) concludes that effects of increased migration from the Central and Eastern European economies, are clearly higher for the new EU members themselves, by reducing their work force, thus pushing up the pace of income convergence with the old EU member countries. For a small region like Åland with remarkable migration in- and outflows, further changes in migration may trigger considerable economic and social changes.

EU integration has opened up national markets to more intensive international competition through trade and the entry of foreign firms to domestic markets, leading to at least some convergence of prices and taxation in the EU. In Finland, changes in the agricultural production and foodstuff industry (Mäkelä, 2005) as well as in financial markets (Junka, 2005) have been considerable during the last decade, although development might have been similar even if Finland had remained outside the EU. From the viewpoint of the Åland Islands, the most remarkable example of the EU-induced change has been the revision to the Nordic alcohol policies (Karlsson et al, 2005). These, in conjunction with the EU and Finnish maritime polices, largely define the future of the Åland economy.

For the Åland Islands, the changes induced by globalisation and the EU integration pose challenges as well as possibilities that differ from those of the neighbouring regions and nations. Next we present summaries of the four essays within the three themes of study: migration, imperfect competition, and structural adjustment induced by changes in alcohol and shipping policies. The aim of the studies is to shed light on the issues from a micro- and macroeconomic modelling viewpoint, and to single out policy recommendations that arise from the analysis.

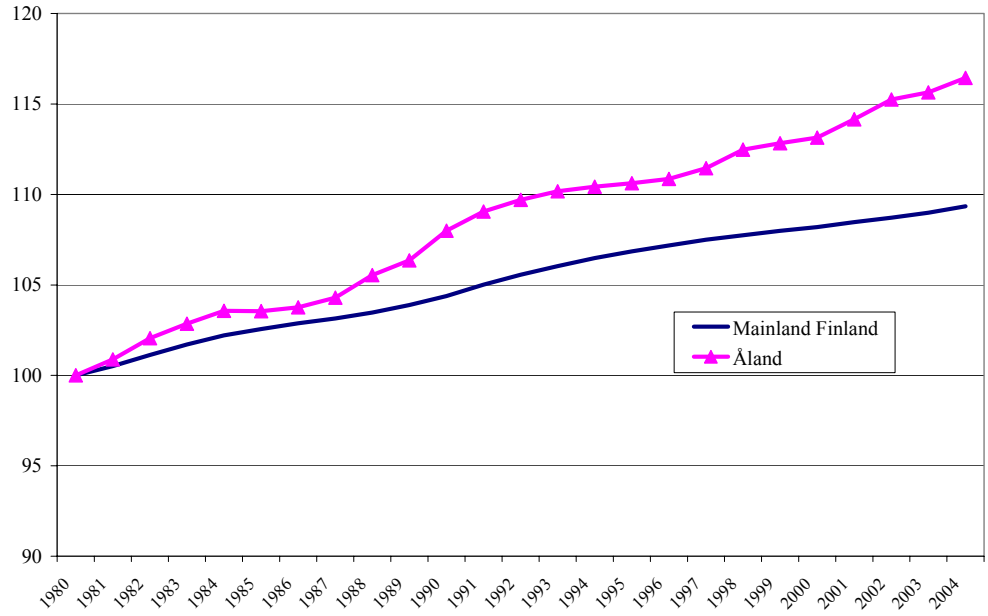
4.1. Migration: a determinant of labour supply - and a part of the language question

Literature on the relationship between migration and regional economic conditions has been steadily increasing during the last decade, also in Finland. This is understandable given the fact that migration flows to the Finnish population centres from peripheral regions have increased since the middle of the 1990s (Nivalainen 2000; Haapanen, 2002; Häkkinen, 2000). Out of 20 Finnish (NUTS 3) regions, seven experienced on average positive net migration during 1990-2002, the Åland Islands being one of them (Statistics Finland, 2004c).

Migration has become an increasingly important determinant of labour supply in Åland. During 1990-2002, net migration averaged 0.36 per cent of the population, a level corresponding to that of the fast-growing areas in the Southern Finland exception for the capital city region Uusimaa. In 2002, however, the highest net migration rate of all the

Finnish NUTS 3 regions, was registered in Åland (0.84 per cent; Statistics Finland, 2004c). During 1980-2003, net migration accounted for 65 per cent of the population growth in Åland, boosting the population growth of the Islands to a clearly higher level than in mainland Finland (see figure 2).

Figure 2. Population in Åland and the mainland Finland, 1980 = 100



Source: Statistics Finland, 2005.

Being a small province in a small country, even minor absolute changes in of migrant flows may produce major shifts in the population structure in the long run. Thus, migration is of great importance as a determinant of the amount and quality of labour supply. Some 12,000 individuals of its 26,000 inhabitants are in the labour force, which makes the absolute number of jobs with similar qualifications very limited (Statistics and Research Åland, 2004a).

Due to its unilingual status, the official language of authorities in Åland is Swedish and this extends to communications with the mainland Finland (Myntti, 2002). In fact, it is articulated in the legislation that local authority personnel is not required to master the Finnish language (Government of Åland, 2004). However, it has been shown that knowledge of the Finnish language is very useful and necessary in many public sector posts. In a recent study among public sector, a clear indication of the current need of the Finnish language was noted: in

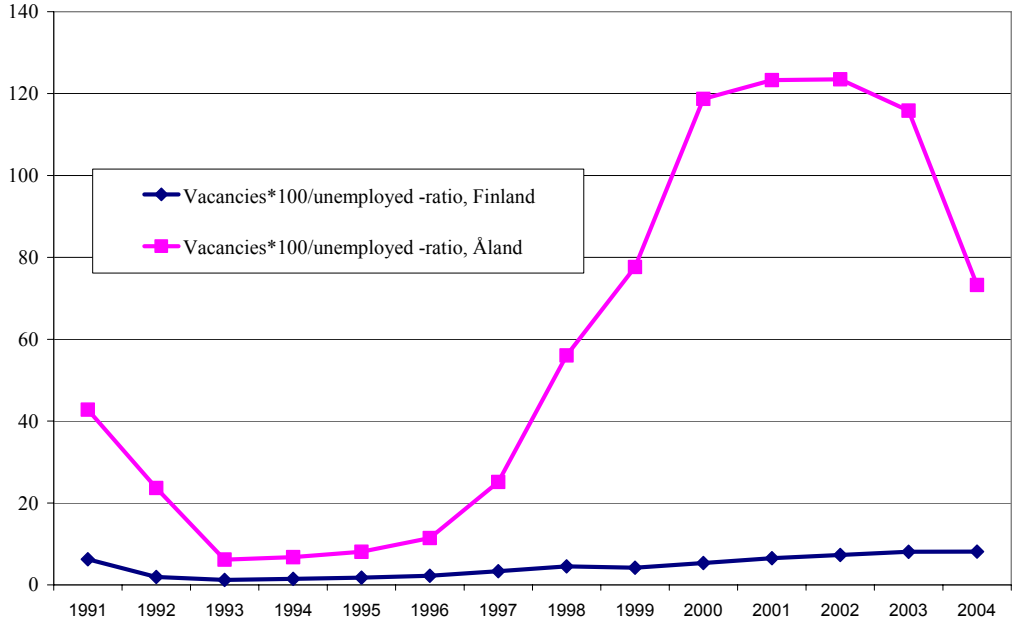
practically every sector and post, knowing Finnish was desirable, if not a necessary skill (Sanders, 2003).

The demand for employees proficient in Finnish is thus a problematic, taboo-affected issue for the public sector in Åland. In a recent editorial of a local newspaper (Nya Åland 10th May 2004), this problem was worded as follows (translated by the author from Swedish): "Dare we say it aloud? If an Åland public official or politician knows Finnish, it is probably good for Åland, not vice versa. […] It is rational. But may be too early." Private sector in turn has quite clearly expressed the need for staff proficient in Finnish (Nya Åland, Oct 29th 2002; Nya Åland Jan 1st 2003). But the Åland companies as well as the public sector are, at times accused of giving too much emphasis to the knowledge of the Finnish language in recruitment (Tidningen Åland, Aug 23rd 2002, Aug 28th 2002, Feb 3rd 2004, Feb 10th 2004).

An important feature of the Åland economy is the comparatively low level of "creative destruction" or dynamics in the labour market. Using establishment-level data covering years 1990-1997, Böckerman and Maliranta (2001) studied the structure and evolution of Finnish regional labour markets in terms of gross job and workers flows. According to almost every indicator included in their study (job creation, job destruction, job reallocation, hiring rate, separation rate etc.), Åland had the smallest level of structural change. Therefore, it seems that employees stay at their posts in Åland. Böckerman and Maliranta (2001) characterize Åland as being "an island of sleepy life" in terms of reallocation within the local labour market. If job reallocation is not effective within the region, migration becomes more important a venue for career development.

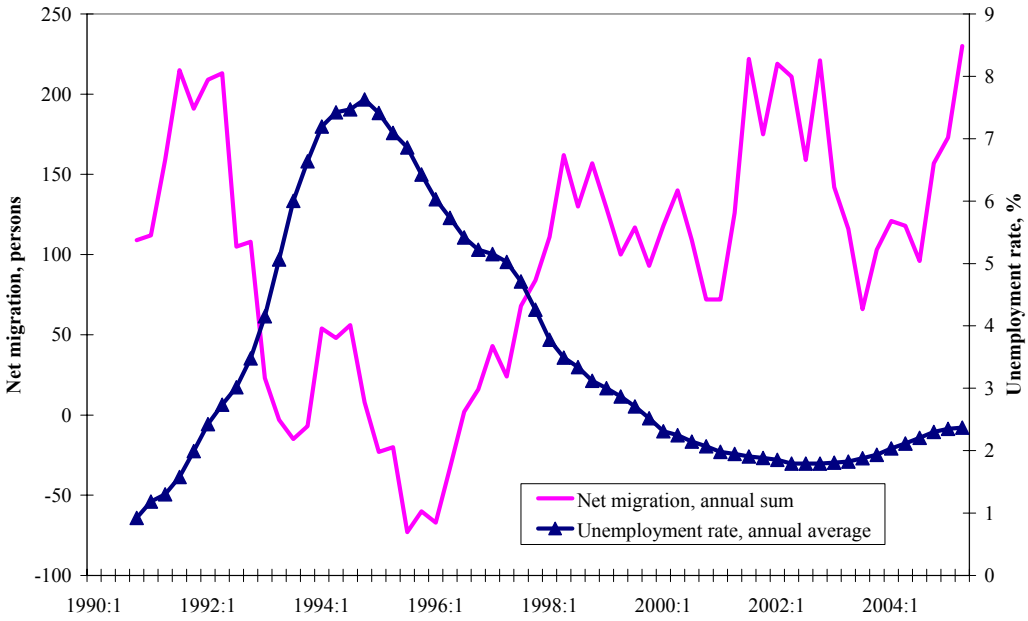
Traditionally, unemployment rate has been clearly lower in Åland than in the rest of Finland, currently indicating almost full employment (2.6 per cent in 2003; versus 9 per cent for mainland Finland; Statistics Finland, 2004c). The number of vacancies in ratio to the number unemployed has been very high for some time now, which witnesses of the extreme "tightness" of the Åland labour market (see figure 3).

Figure 3. Vacancies/unemployed ratio, Åland and Finland, 1991 - 2004



Sources: Statistics Finland, 2005, Statistics and Research Åland, 2005a.

Figure 4. Unemployment and net migration, 1990:1 – 2005:2



Source: Statistics and Research Åland, 2005a, 2005b.

Migration has been the way of escaping the limitations of the small local market, both in periods of high economic growth and recession. The unemployment rate and net migration are strongly correlated, as can be seen in figure 4 (correlation between the four-quarter moving average of unemployment and the four-quarter sum of net migration amounts to –0.79).

During the last three decades, the main source of migration inflows has been mainland Finland, whereas the main destination for out-migration has been Sweden (Statistics and Research Åland, 2004a). However, in-migration from non-Nordic countries has been on a steady increase in recent years, reflecting increased mobility of the citizens of the new EU member countries (Lindström, 2005).

Essay 1 studies the recent developments and nature of migration in the Åland Islands by means of discrete choice models. The main object of the study is to examine the determinants of migration inflows and outflows, and to see whether they differ from those in the rest of the country, as Pekkala (2003) presumes.

Recently, discrete choice models have been in extensive use in migration studies (see, e.g. Ritsilä – Tervo, 1999; Häkkinen, 2000; Fischer et al., 2000; Haapanen, 2002). The theoretical background is human capital theory, first applied by Sjaastad (1962) to migration, complemented with recent theoretical developments on the role of region- and household-specific amenities (see e.g. Fisher et al, 2000, and Althaus, 2004).

The analysis is conducted by using individual data from longitudinal population censuses, which allows the use of individual-specific characteristics and a panel data specification in the analysis, which has been rather uncommon in migration studies. A ten per cent sample was drawn from those inhabitants who had lived in Åland during the whole period. A sample of 20 per cent was drawn from those who migrated to or from Åland during that period. It was shown that the decision regarding and individual's place of residence is clearly an issue of state dependence and of duration. The signs of the statistically significant variables followed the suggestions of the migration theory and were in line with earlier empirical results as well. For example, individuals living with a partner or a family are less likely to out-migrate, as are Swedish-speaking, high-wage earners, and those who have lived on the island already in 1990. In contrast, the well educated, especially native-born, the unemployed, and younger

persons are more inclined to leave the island. These results are thus well in line with the current theories and empirics.

In addition, the essay proposes a method for to estimating a net migration equation from a binomial probability model. The estimated net migration rate of native Ålanders turned out to be quite insensitive to variation in unemployment, which illustrates the strong preferences of the native inhabitants for their home region. In contrast, a major part of labour supply adjustment comes from changes in the net migration of inhabitants born outside Åland. However, there seems to be a decreasing tendency for native Ålanders to return to their home province once they out-migrate. The opposite was true for those born on the mainland Finland, for whom a significantly positive time trend was noted in the probability to live and remain in Åland.

It could well be the case that the increasing contacts of Ålanders with private businesses and authorities of the mainland Finland have increased the demand for staff proficient in both the Finnish and Swedish languages. However, Ålanders are known to have only rudimentary skills in the Finnish language. This could be a reasonable explanation for our results.

Mainland Finland has obviously been able to provide Åland with a suitable labour force, whereas native Ålanders have migrated mainly to Sweden. If the pattern of migration flows is causally related to a growing demand in proficiency in the Finnish language, and in particular if this trend continues, it is an indication of the problematic paradox that Åland's language policy may create. By not advocating better command of the Finnish language in Åland in order to protect the status of its Swedish language as the sole lingua franca, the regional government is lowering the chances of expatriate Ålanders of finding employment on the Islands, making their return more difficult. This may also lie behind the inflow of bilingual labour force from mainland Finland, as a replacement for those not returning to Åland. Possible future increases in migration from the new EU countries will add to the complexity in coping with multiculturalism in Åland.

4.2. Imperfectly competitive domestic markets

The degree of competitiveness of the domestic market in Åland is less than perfect, not only because of its geographical isolation and small volumes, but also due to administrative-legislative barriers to entry. Having regional citizenship is necessary in order to conduct permanent business in Åland. Furthermore, the local administration uses discretionary selection in granting business licences, thus restricting potential competition from neighbouring regions. EU membership did not introduce any fundamental changes to the business environment in this respect, as Åland was exempted from the EU regulations governing competition through the specific treaty accession protocol No 2 on the Åland Islands, which is a part of Act of Finnish Accession to the European Union (Scarpulla, 2002; Lindström, 2002b).

The historical goal of the business license system was primarily to protect the existence of an ethnic-linguistic minority. When the League of Nations was dissolved, the protection of Åland's nationality needed revision. After several years of preparatory work, new legislation governing the right to conduct business was passed in 1957. Interestingly, in the motivations for the new law it was stated that it was urgently needed, because "Finnish firms had shown an interest in starting up activities in the province. If that were allowed, it would endanger the economic relations in the province" (Lindström, 2002b). Consequently, the system was mainly concerned with language policy, although even elements of protectionism were present as well. In later revisions of the legislation, two primary objectives are articulated in further support of the instrument. First, the aim of the legislation is to confirm the status of the Swedish language in Åland, and second, to promote positive development for Åland's private sector (Lindström, 2002b).

In practice, temporary licenses are routinely granted to providers of specialised services, e.g. to construction companies. It is very rare for an applicant to be denied a temporary license. Therefore, Åland-based firms have occasionally called for a more restrictive practice. However, current legislation still probably limits potential competition from non-Åland businesses, as widespread impression among these firms seems to be that Åland is not accessible to them. According to interviews, the firms that had obtained the temporary license at least once, considered the existence of the system to give them a competitive advantage for,

as many of their potential competitors in the Finnish mainland were unfamiliar with the administrative process of the temporary business licences. However, the exact effects of the business license system are knot known (see Lindström, 2002b).

Essay 2 approaches the theme of imperfect competition by studying consumer prices of one industry, grocery retailing. In 1933, Chamberlin presented a model of monopolistic competition in which many firms sell nearly identical products in the market. The firms have downward sloping demand curves and U-shaped cost functions. If the sizes of the firms equal the cost-minimizing size, production has been organized efficiently. However, the cost-minimizing size of a firm may be problematically large in many industries and markets, thus limiting competition. The problems caused by U-shaped cost curves and fixed costs are especially severe in small market areas, which generally suffer from the lack of economies of scale and of competition. Panzar (1989) concludes that if only one or a few firms can be part of an efficient industry configuration, that industry simply cannot be structurally competitive. If we examine this obvious fact from a different point of view, we see that if the production technology of the industry exhibits significant economies of scale and if, for some reason, there are many firms in the market, that industry cannot be cost-efficient. In other words, there is a trade-off between utilizing economies of scale and competition. This trade-off is especially notable in small markets.

Grocery retailing is one industry where such a trade-off between economies of scale and competition exists. This is due to the existence of store-level economies of scale (Cotterill, 1999; Aalto-Setälä, 2002), as grocery services must be provided in the location where consumers live.

Many comparisons (e.g. Finnish Consumer Agency, 1999; 2000) confirm that food prices are high in Åland compared to the rest of Finland. The price difference between Åland and the Turku region (the Turku region is located in south-west Finland, and has a price level equal to the Finnish average) is 10-20 %. Such a big price difference in grocery prices is a significant issue for the consumers.

The study data consist of store characteristics (including prices for some stores), market structure data, demographic information, product origin, and retail entrepreneur surveys. The

price data were collected by Statistics Finland on 158 products from 15 stores in the Turku region on the mainland of Finland, and from 13 stores in Åland.

Additional data were collected through a mail survey to retail grocery entrepreneurs in Åland. The most important questions concerned purchase prices, transportation costs, VAT border administration, wholesale prices of products produced in Åland, and cost differences between small and large stores.

The empirical model of the study estimated the combined effect of market power and scale economies (see, for example, Cotterill and Iton, 1993, or Azzam, 1997) for grocery prices in Åland. The aim was to determine how important are the small average store size, inelastic demand and concentrated market structure, as well as a lower risk of entry, as determinants of high prices. The difference in food prices between Åland and the Turku region – a small isolated market area and a large market area was decomposed. Pricing was first examined at the store level. The object was to find out whether food prices are higher in Åland even after taking store-level and market-level characteristics into consideration. This estimation was conducted in the customary way of examining price level through store-level and market-level information only. However, as these did not fully explain the price difference, another model was estimated, in which the store-level and market-level as well as the product-level characteristics were accounted for.

Decomposition of price differences reveals results that are intuitive: high food prices in this small market area were mainly attributable to a lack of scale economies and to the concentrated structure of the food retailing market and food processing industry. Transportation costs, VAT border administration costs, and inelasticity of the demand proved to be additional Åland-specific price factors. The main problem in a small market area is that it is not sufficient to support a competitive and cost-efficient distribution industry. If there are enough firms to create a competitive environment, they lack economies of scale, and if there are only a couple of firms, the market is not competitive. An additional aspect in Åland is the strong regional spirit of the consumers: Ålanders are willing to pay higher prices for products produced locally. It appears that there are “natural” causes for the significant differences in grocery prices compared to the rest of Finland, and that there is no simple way to reduce food price in Åland.

One option available to the local government for reducing food prices would be to use legislative measures to enhance competition and to increase the risk of entry of new competitors in retailing and related services, like goods transport. The political sentiment has traditionally effectively precluded this option, but recent development indicates that this position could to be changing to support increased competitive pressure in the local market.

It is also clear that Åland consumers play a critical role in improving the competitiveness of grocery markets. If Ålanders were willing to buy cheaper items produced in neighboring regions, the price level of food would probably fall a few percent. But if they are unwilling to do so, they will continue to support the higher prices and the higher profits in retailing and food processing in Åland.

Essay 3 deals with the theme of imperfect competition in a different framework, computable general equilibrium (CGE) modeling. CGE models have been in extensive use in the policy analysis during the last decades (for an overview, see Bergman, 1990, or Devajaran – Robinson, 2002). CGE models are used for the analysis of trade policies, economic integration, tax reforms and public spending, labour market issues, structural adjustment, regional development, as well as income distribution. With the development of new solution algorithms, improved software and computing capacity, as well as ready-made model packages, the start-up costs in time and effort have diminished, making this sort of modelling increasingly accessible to new groups of users. The focus and subjects of CGE studies have varied from the village level to the global level, which exemplifies the flexibility of this modelling approach.

The main emphasis of essay 3 is in the presentation of a recursively dynamic, imperfect competition, one-region CGE model with endogenous labour supply and relatively inelastic real wages.

The imperfect competition (IC) module of the model introduces Cournot-conjectural variations model for multi-product activities with fixed yields for each commodity per unit of activity. The IC module is based on the work of Francois and Roland-Holst (1997), Willenbockel, (2002), and De Santis (2002), although none of these studies were applied to a multi-product case.

Due to the model specification, where the labour supply of subsequent period depends on the current unemployment rate and wage level compared to neighbouring regions, and due to a Philips-curve type relationship between the local unemployment rate and wage increase, the labour market exhibits hysteresis. In this setting, the growth rate of labour supply is endogenous, making the GDP growth rate endogenous as well. The dynamic adjustment path of the economy resembles that of estimated for the various states of USA in the seminal paper of Blanchard and Katz (1992).

Investment, and thus the growth of capital stock, depends on the profitability of the industry through a Monash-type investment module (see Dixon et al., 2002), very similar to the investment equations used in Vaittinen (2004), and in Bayar et al. (2004). The functioning of the model is demonstrated by introducing a competitiveness shock to the economy through an amendment to the local business license rules.

It is shown that by relaxing the entry barriers, the perceived rate of competition increases, leading to lower mark-ups and to a smaller number of domestic firms in the local market because of the growing need for scale economies. The economy of Åland as a whole would be better off. Activities characterised by perfect competition would benefit more from the change than imperfectly competitive, home market-oriented firms. The difficult policy question is whether the alleged linguistic benefits of the current system outweigh its economic costs.

4.3. Structural adjustment induced by changes in alcohol and shipping policies

The changes brought about by the globalisation and the European integration are radically reshaping the economic conditions of the Åland Islands. Åland is dependent on one industry, shipping, which is specialised in passenger ferry traffic relying on tax-free sales of alcohol, tobacco and cosmetics. The EU recognized this during the Finnish accession negotiations. In consequence, Åland was provided with a permanent exemption from the Community indirect tax legislation (Fagerlund, 1997). This derogation enabled continued tax-free sales on the ferry routes trafficking Åland even after the June 30th 1999, when the era of tax-free sales within the Community came to its end. As shipping in general is due to its genuinely “foot-

loose" character sensitive to differences in the factor costs, increased European integration poses a threat to the future well-being of the Ålanders.

Essay 4 uses the model presented in essay 3 for an analysis of the future economic development of Åland in the face of major policy changes. The current and expected policy changes primarily affect the shipping industry of Åland, but have significant effects on its overall economy as well. The most important changes in the working environment of the passenger shipping companies were identified to be as follows:

- lowered alcohol taxation in Finland, and probably later in Sweden as well
- relaxed restrictions in personal imports of duty-paid alcohol
- increased competition in the Nordic sea freight markets as well as in the passenger traffic.

The key focus of the policy analysis section of this paper is on the future economic development in the middle of these policy changes. What effects will the newly introduced subsidies on passenger traffic have on the economy as a whole? How will the local labour market adjust? What will happen to other indicators, e.g. the balance of state tax revenues and outlays in Åland?

Analysis of the current policy changes affecting passenger shipping, Åland's most important sector by far, shows that the action taken by the Finnish government to introduce new subsidies to shipping in the beginning of the year 2005 seems relatively successful, particularly if the objective is to stabilise the development of shipping, and the welfare of Ålanders. Without the new subsidies, the economy of Åland would nose-dive. Recovery of the labour market, in terms of unemployment rate, would take about 6-7 years. However, changes in the level and growth rate of labour supply have a longevity trend surpassing our study period 2000-2020, because of the way interconnections between unemployment, wages and migration are modelled here.

The dependency of the Åland economy on transfers from the Finnish state becomes more transparent when the indirect subsidies in form of "tax expenditure" through accruing tax-free sales onboard, are converted into budgetary outlays that are decided in the parliament of Finland. New subsidies increase two-fold the budgetary net transfers from Finland to Åland.

The Government of Åland has repeatedly requested for more legal autonomy in taxation. A total takeover in Åland of the central government responsibilities does not seem plausible, at least if we assume that it would not lead to savings in public expenditure.

It would be quite costly for Åland to subsidise shipping on the current terms. Therefore, if the Government of Åland is willing to assume more judicial authority and financial responsibilities from the state, one should ask, what are the benefits that would justify a measure which would increase the costs to the province by some 17 million euro annually (at the current level of shipping activity).

5. Summary of findings

The four essays of this thesis examine the nature of an island economy, the Åland Islands from three aspects, migration, imperfect competition and structural change. All these issues overlap with the general weaknesses of island economies. Island economies are reduced in size, both in economic and in population terms, and therefore vulnerable e.g. to migration shocks. Furthermore, the reduced size and isolation of the economy makes it difficult to ensure simultaneous exploitation of economies of scale and maintenance of competitive market structures. What is more, island economies are generally not diversified, which increases their vulnerability to external shocks. Ongoing changes induced by globalisation and European integration affect migration, competitiveness, and pose structural challenges for the Åland Islands through different channels. Below we list our major findings.

- Estimated migration equations are well in line with the current theories and earlier empirical results. In addition, it is shown that the local unemployment rate affects mainly the migration tendency of non-natives. However, the probability of living in Åland has a decreasing time trend for native Ålanders, suggesting that the insider advantage of those not knowledgeable in the Finnish language is eroding.

- The high price level in grocery retailing has intuitive explanations. Lack of scale economies and high concentration levels in retailing and in the food processing industry are some of the suggested explanations. In addition, transport costs and VAT

border administration are Åland-specific, yet minor factors in raising prices. There are not many policy options available, but added competition in the local market through relaxed entry barriers could be one measure.

- Relaxation of entry barriers is expected to make the local production structure even more concentrated, but simultaneously more efficient. The industries with main markets outside Åland would benefit most from an increased threat of entry. Overall effects of an increased threat of entry would be positive, when examining the economic indicators only. The difficult policy question is whether the current regulations serve the intended linguistic purposes as assumed.

- Recently, there have been numerous changes in the working environment of passenger shipping. The Finnish Government's decision to increase subsidies to shipping from 2005 onward seems to compensate quite well for the decreased profitability of tax-free sales onboard. New subsidies increase two-fold the budgetary net transfers from Finland to Åland, turning the dependence of the Åland economy on transfers from the Finnish state more apparent.

References

Aalto-Setälä, Ville (2002): *The effect of concentration and market power on food prices; evidence from Finland*, Journal of Retailing, 78, pp 207-216.

Althaus, Paul G. (2004): *A Life-Cycle Model of Locational Choice in a Two-Region Economy,* Journal of Regional Science, Vol. 44. No. 2, pp. 351-366, Blackwell Publishing.

Azzam, A. (1997): *Measuring market power and cost-efficiency effects of industrial concentration*, Journal of Industrial Economics, 155, 377-386.

Azzopardi, Marie (2005): *Small Islands and the European Union*, Paper for the XIV Convention of the Nordic Political Science Association, Workshop on Small States in International and European Affairs, Reykjavik, Iceland, 11-13 August 2005.

Baldacchino, Godfrey (2005): *Successful Small-Scale Manufacturing: A Comparative Assessment Across Five European Island Regions*, Bank of Valletta Review, No. 31, Spring 2005.

Baldwin, Richard E. – Martin, Philippe (1999): *Two Waves of Globalisation: Superficial Similarities, Fundamental Differences*, Working Paper 6904, National Bureau of Economic Research, Cambridge.

Bayar, Ali – Cornelisse, Peter – van der Hoek, Peter - Mohora, Christina (2004): *Tax Harmonisation and public expenditures restructuring in Romania, in the process of preparation for the EU accession – A CGE modeling exercise*, presented at the ECOMOD conference 2004, available at: http://www.ecomod.net/conferences.htm.

Berghäll, Elina (2003): Veropaineet Virosta ja Ahvenanmaan itsehallintoalueelta, in *Verokilpailu ja Suomen verojärjestelmä*, eds. Hjerppe R. – Kari, S. – Kiander, J. – Poutvaara, P., WSOY, Vantaa, ISBN 951-0-27822-X (in Finnish).

Bergman, Lars (1990): The Development of Computable Equilibrium Modeling, in *General Equilibrium Modeling and Economic Policy Analysis*, eds. Lars Bergman, Dale W. Jorgenson, and Erno Zalai, pp. 3-30, Basil Blackwell, Cambridge.

Blanchard, D. G. – Katz, L. F. (1992): *Regional Evolutions*, Brookings Papers on Economic Activity, no. 1, pp. 1-75.

Böckerman, Petri – Maliranta, Mika (2001): *Regional disparities in gross job and worker flows in Finland*, Finnish Economic Papers, Vol 14 No. 2, Autumn 2001, pp 84-103.

Chamberlin, E., (1933): *The theory of monopolistic competition*, Cambridge, MA.

Cotterill, R. (1999): *Market power and the Demsetz quality critique: an evaluation for food retailing*, Agribusiness: An International Journal, 15, 101-118.

Cotterill, R., and Iton, C. (1993): A PIMS Analysis of the Structure Profit Relationship in Food Manufacturing, in R. Cotterill, Eds., *Competitive Strategy Analysis in the Food System*, Westview Press, pp. 25-44.

De Santis, Roberto A. (2002): A conjectural variation computable general equilibrium model with free entry, in *Policy Evaluation with Computable General Equilibrium Models*, eds. Fossati, Amadeo – Wiegard Wolfgang, Routledge, London, ISBN 0-415-25671-2.

Devajaran, Shantayanan – Robinson, Sherman (2002): *The Influence of Computable General Equilibrium Models on Policy*, International Food Policy Research Institute (IFPRI), Trade and Macroeconomics Division, TMD Discussion Paper No. 98, available at http://www.cgiar.org/ifpri/divs/tmd/dp.htm.

Dixon, Peter B. – Parmenter, Brian R. – Rimmer, Maureen T. (2002): CGE models for practical policy analysis: The Australian experience, in *Policy Evaluation with Computable General Equilibrium Models*, eds. Fossati, Amadeo – Wiegard Wolfgang, Routledge, London, ISBN 0-415-25671-2.

Fagerlund, Niklas (1997): The Special Status of the Åland Islands in the European Union, in *Autonomy and Demilitarisation in International Law: The Åland Islands in a Changing Europe*, eds. Hannikainen, Lauri – Horn, Frank, Kluwer Law International, The Hague, ISBN 90-411-0271-X.

Finnish Consumer Agency (1999): Pointti: *Kuluttajaviraston päivittäistavarakori, 1999* (in Finnish).

Finnish Consumer Agency (2000): Pointti: *Kuluttajaviraston päivittäistavarakori, 2000* (in Finnish).

Fischer, Peter A. – Holm, Einar – Malmberg, Gunnar - Straubhaar, Thomas (2000): *Why do People Stay? Insider Advantages and Immobility*, HWWA Discussion Paper 112, Hamburg Institute of International Economics, available at http://www.hwwa.de.

Francois, Joseph – Roland-Holst, David (1997): Scale Economies and Imperfect Competition, in *Applied Methods for Trade Policy Analysis – A Handbook*, edited by Francois, Joseph – Reinert, Kenneth, Cambridge University Press, Cambridge, ISBN 0-521-58997-5.

Freeman, Richard B. (2003): *Trade Wars: The Exaggerated Impact of Trade in Economic Debate*, Working Paper 10000, National Bureau of Economic Research, Cambridge.

Gebauer, Andrea – Woon Nam, Chang – Parsche, Rüdiger (2004): *Lessons of the 1999 Abolition of Intra-EU Duty Free Sales for the New EU Member States*, presented in 44TH Congress European Regional Science Association, ERSA, Porto (full text available in the Congress CD-ROM, abstract available at http://www.apdr.pt/ersa/).

Government of Åland (2004): *Ålands Lagsamling 2004*, Mariehamn, ISBN 951-8946-96-5. Available at http://www.ls.aland.fi (in Swedish).

Government of Åland and the Åland Parliament (2004): *Åland in Brief*, Mariehamn. Available at: http://www.aland.fi/virtual/.

Granfelt, Jarmo (1996): *Tax-free –myyntimahdollisuuden mahdollisen poistumisen taloudelliset vaikutukset suomalaisen matkustaja-alustoiminnan toiminta- ja kannattavuusedellytyksiin*, The Helsinki Research Institute for Business Administration, LTT, Series B 126, Helsinki, ISBN 951-774-006-9 (in Finnish).

Haapanen, Mika (2002): *Labour Migration and Wages*, University of Jyväskylä, School of Business and Economics, Licentiate thesis N:o 29/2002, Jyväskylä.

Hannikainen, Lauri (2004): *De folkrättsliga grunderna för Ålands självstyrelse och svenskspråkighet*, Insitutet för mänskliga rättigheter vid Åbo Akademi, Åbo, ISBN 952-12-1228-4 (in Swedish).

Häkkinen, Ida (2000): *Muuttopäätös ja aluevalinta Suomen sisäisessä muuttoliikkeessä*, Government Institute for Economic Research, VATT Research Reports 65, Helsinki (in Finnish).

Junka, Teuvo (2005): Pääomaliikkeiden vapauttaminen, Chapter 8 in *Suomi 10 vuotta Euroopan unionissa, Taloudelliset vaikutukset*, Kiander, Jaakko – Romppanen, Antti (eds.), VATT Publications 42, Government Institute for Economic Research, Helsinki, ISBN 951-561-560-7 (in Finnish).

Karlsson, Thomas – Österberg, Esa – Tigerstedt, Christoffer (2005): *Developing border regions, regulating alcohol in the Nordic countries*, Nordic Studies on Alcohol and Drug NAT, vol. 22. 2005 – English supplement, pp. 102 – 114.

Kinnunen, Jouko (1998): *Tax free i skärgårdstrafiken – Förutsättningar och konsekvenser*, Statistics and Research Åland, ÅSUB Rapport 1998:1, Mariehamn (in Swedish).

Lindman, Josefine – Kinnunen, Jouko (1999): *Det åländska skatteundantaget inom EU – Effekter för företag, branscher och samhällsekonomi*, Statistics and Research Åland, ÅSUB Rapport 1999:1, Mariehamn, ISSN 1455-1977 (in Swedish).

Lindström, Bjarne (2000): Culture and Economic Development in Åland, in *Lessons from the Political Economy of Small Islands – The Resourcefulness of jurisdiction*, edited by

Baldacchino, Godfrey and Milne, David, Institute of Island Studies, University of Prince Edward Island, Macmillan Press Ltd, ISBN 0-333-77817-0.

Lindström, Bjarne (2002a): *Det åländska rederiklustret*, Statistics and Research Åland, ÅSUB Rapport 2002:1, Mariehamn, ISSN 1455-1977 (in Swedish).

Lindström, Bjarne (2002b): *Den åländska näringsrätten*, Statistics and Research Åland, ÅSUB Rapport 2002:5, Mariehamn, ISSN 1455-1977 (in Swedish).

Lindström, Bjarne (2005): *Konjunkturläget – hösten 2005*, Statistics and Research Åland, ÅSUB Rapport 2005:4, Mariehamn, ISSN 1455-1977 (in Swedish).

Myntti, Kristian (2002): The Åland Model – Its Background and Special Characteristics, in *The second Åland Islands question – Autonomy or independence?*, edited by Jansson, Harry and Salminen, Johannes, the Julius Sundblom Memorial Foundation, Mariehamn, ISBN 952-91-4613-2.

Mäkelä, Pekka (2005): Kotimarkkina-alojen avautuminen ja sopeutuminen, chapter 5 in *Suomi 10 vuotta Euroopan unionissa, Taloudelliset vaikutukset*, Kiander, Jaakko – Romppanen, Antti (eds.), VATT Publications 42, Government Institute for Economic Research, Helsinki, ISBN 951-561-560-7 (in Finnish).

Nivalainen, Satu (2000): *Muuttoliikkeen vaikutus alueelliseen väestörakenteeseen, 2000-2010*, Pellervo Economic Research Institute, Working Papers N:o 36, Helsinki (in Finnish).

Nya Åland (2002): *Finska är ofta merit på Åland*, article, Törnroth-Sarkkinen Titte, Oct 29th 2002 (in Swedish).

Nya Åland (2003): *Finskan i näringslivet – lyssna på ungdomarna*, letter to the editor, Jan 1st 2003 (in Swedish).

Nya Åland (2004): *Nordlunds (c) ministerium kan vara bra utgångspunkt*, editorial, Tuominen Harriet, 10th May 2004 (in Swedish).

Palmgren, Sten (1997): The Autonomy of the Åland Islands in the Constitutional Law of Finland, Chapter 5 in *Autonomy and Demilitarisation in International Law: The Åland Islands in a Changing Europe*, eds. Hannikainen, Lauri – Horn, Frank, Kluwer Law International, Netherlands, ISBN 90-411-0271-X.

Panzar, J., (1989): Technological determinants on firm and industry structure, in Schmalensee, R. and Willig, R., (ed.), *Handbook of Industrial Organization*, Volume I, Elsevier.

Pekkala, Sari (2003): *What Draws People to Urban Growth Centers: Jobs vs. Pay?*, Government Institute for Economic Research, VATT Discussion Papers 310, Helsinki.

Ritsilä, Jari - Tervo, Hannu (1999): Regional Differences in the Role of Migration in Labour-market Adjustment: The Case of Finland, in *Regional Unemployment, Job Matching, and Migration*, edited by Crampton, Graham, European research in regional science, Pion Limited, London, ISBN 0-85086-170-5.

Sanders, Gunilla (2003): *Rapport efter intervjuundersökning om det svenska språkets ställning på Åland*, Töftö 30th August 2003, memorandum (in Swedish).

Scarpulla, Claudio (2002): The special status of Åland in Finland and the European Union, in *The second Åland Islands question, Autonomy or independence?*, Jansson, Harry – Salminen, Johannes (eds.), the Julius Sundblom Memorial Foundation, Mariehamn, ISBN 952-91-4613-2.

Selkou, Evangelia – Roe, Michael (2004): *Globalisation, Policy and Shipping – Fordism, Post-Fordism and the European Union Maritime Sector*, Transport Economics, Management and Policy, Edwar Elgar Publishing Ltd., Cheltenham, ISBN 1-84376-934-4.

Silverström, Sören (2003): *Ahvenanmaa Euroopan unionissa*, Eurooppa-tietoa 176/2003, Eurooppa-tiedotus, Ulkoasiainministeriö, Helsinki ISBN 951-724-384-7 (in Finnish).

Sjaastad, L. A. (1962): *The Costs and Returns of Human Migration*, Journal of Political Economy vol. 70, pp. 80-93.

Statistics and Research Åland (2004a): *Statistical Yearbook of Åland 2004*, Mariehamn, ISSN 0358-8629.

Statistics and Research Åland (2005a): Statistical times series database on unemployment in Åland, based on Ministry of Labour data, unpublished.

Statistics and Research Åland (2005b): Statistical publications series and database on population, including several publications. Available at: http://www.asub.aland.fi.

Statistics Finland (2004a): *Aluetilinpito 1975-2002**, Tuotannon ja työllisyyden aluetilit, available at: http://www.stat.fi/til/atutyo (in Finnish).

Statistics Finland (2004b): Gross freight statistics on Åland shipping, unpublished statistical tables.

Statistics Finland (2005): Statfin Web Statistics, available at: http://statfin.stat.fi (in Finnish).

Tidningen Åland (2002): *Det borde vara självklart för företag att välja ålänningar*, article, Anders Hägerstrand, Aug 23rd 2002 (in Swedish).

Tidningen Åland (2002): *Hur ska Åland kunna behålla sina välutbildade ungdomar?*, editorial, Jansson, Harry, Aug 28th 2002 (in Swedish).

Tidningen Åland (2004): *En systematisk diskriminering av ålänningar*, letter to the editor, pseudonyme ”Två tjejer”, Feb 3rd 2004 (in Swedish).

Tidningen Åland (2004): *Gnäll leva utan finska?*, letter to the editor, pseudonyme ”Två tjejer”, Feb 10th 2004 (in Swedish).

Turunen, Juhani – Eriksson, Dan E. (2004): *Det skattefinansiella utjämningssystemet mellan landskapet Åland och staten: 1990-talets erfarenheter*, Ministry of Finance & Government of Åland, available at: http://www.ls.aland.fi/.composer/upload/modules/publikationer/ekonomisk_utredning_2004.pdf (in Swedish).

Vaittinen, Risto (2004): *Trade Policies and Integration – Evaluations with CGE –models*, Dissertation, Helsinki School of Economics, A-235, Helsinki, ISBN 951-791-843-7.

Willenbockel, Dirk (2002): *Specification Choice and Robustness in CGE Trade Policy Analysis with Imperfect Competition*, presented in ECOMOD conference 2002, available at http://www.ecomod.net/conferences.htm.

ESSAY 1: Modelling the propensity to live and stay in the Åland Islands – A case of diminishing insider advantage of the natives?

Jouko Kinnunen

Abstract: This essay presents by means of discrete choice and time series models the nature and the recent development of migration to and from the Åland Islands. The main analysis is conducted by using individual data from longitudinal population censuses, which allows the use of individual-specific characteristics and a panel data specification in the analysis. The results lend support to Harris-Todaro –type expected-wage hypothesis, as well as to migration theories based on the concept of human capital. The results even support the insider advantage hypothesis by showing that staying in Åland is state and duration dependent, i.e. those already living in Åland, having stayed longer, and being native Ålanders are more likely to remain as residents. However, the results also reveal that there is an increasingly negative tendency in the probability of native Ålanders to reside in Åland, whereas the probability of Finnish mainland-born migrants to live in Åland has slightly risen during the 1990s. The author suggests that this development may be due to growing internalisation, e.g. through the EU membership, as well as the failure to revise the education policy to the changing demand of language skills.

Key words: Regional labour markets, discrete choice models, panel data

JEL Codes: J61, R23, C33, C35

1. Background

There has been a steady increase of literature dealing with migration and regional economic conditions, even in Finland. The increased academic interest is natural, as migration flows to the Finnish population centres from peripheral regions have increased since the middle of the 1990s (Nivalainen 2000; Haapanen, 2002; Häkkinen, 2000). Out of the 20 Finnish (NUTS 3) regions, seven experienced on average a positive net migration during 1990-2002, one of these being the Åland Islands (Statistics Finland, 2003a).

Åland Islands, located in the Baltic Sea in between Finland and Sweden, is a small autonomous province of Finland, inhabited by 26,500 people on 65 of its 6,500 islands. Migration has become an increasingly important source of labour supply in Åland. During 1990-2002, net migration averaged 0.36 per cent of the population, a level corresponding to that of the growth areas in Southern Finland, except for the capital city region Uusimaa. In 2002, however, the net migration rate in Åland at 0.84 per cent, was the highest of all the Finnish NUTS 3 regions.

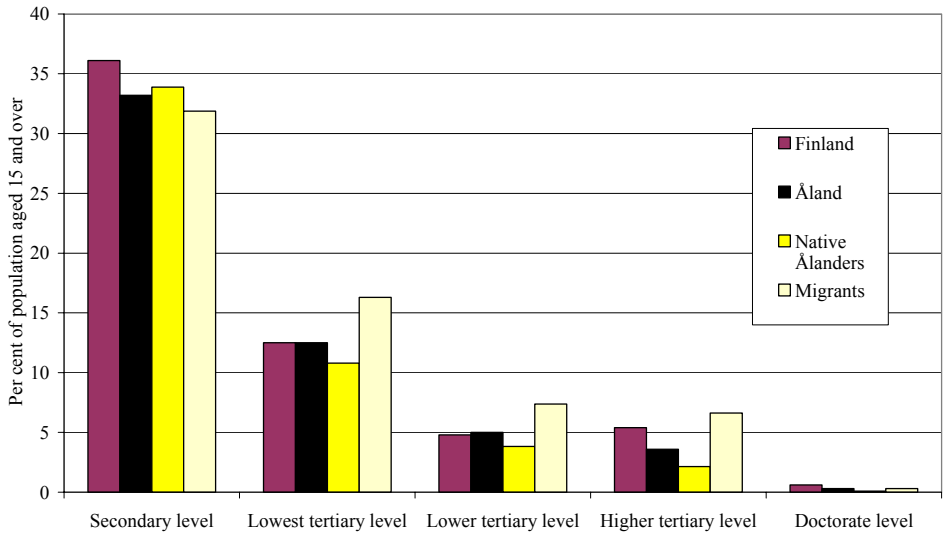
In general, the educational level of Ålanders is somewhat lower than in the rest of the country, but that of non-native inhabitants in Åland is higher than for the native population, and even exceeds the general educational level on the mainland (see figure 1). Migration has thus been important for supplying and maintaining human capital stock in Åland.

Another way to look at the importance of migrants to the local labour market is to compare their presentation in different socio-economic groups. We see that the ratio of migrants among the unemployed and white-collar workers, as well as officials exceeds their population share. In contrast, their share is low among entrepreneurs and blue-collar workers (see figure 2). The educational and socio-economic breakdown basically reflects the same situation: positions requiring high human capital input are manned to a considerable degree by migrants, while the native islanders, on the other hand, are dominant among entrepreneurs.

The high rate of unemployment among migrants could be due to the accompanying spouses not finding a work after moving to Åland. Åland's rather one-sided structure of the economy may make it hard for spouses with specialised education or without a working knowledge of

the Swedish language to find employment[2]. Nivalainen (2005) has studied the post-move employment situation of two-wage-earner families in Finland. She finds that migration has a negative impact on the employment of wives, whereas migration leaves the majority of husbands unaffected or with improved employment. Indeed, in our longitudinal sample data for the years 1990-2000, female migrants had a higher incidence of unemployment according to a two-by-two cross-tabulation of unemployed by gender and place of birth ($p = 0{,}00003$ for χ^2 with d.o.f. = 1), thus supporting Nivalainen's "tied migration" hypothesis.

Figure 1. Educational levels in Finland and Åland



Source: Statistics Finland, 2003a.

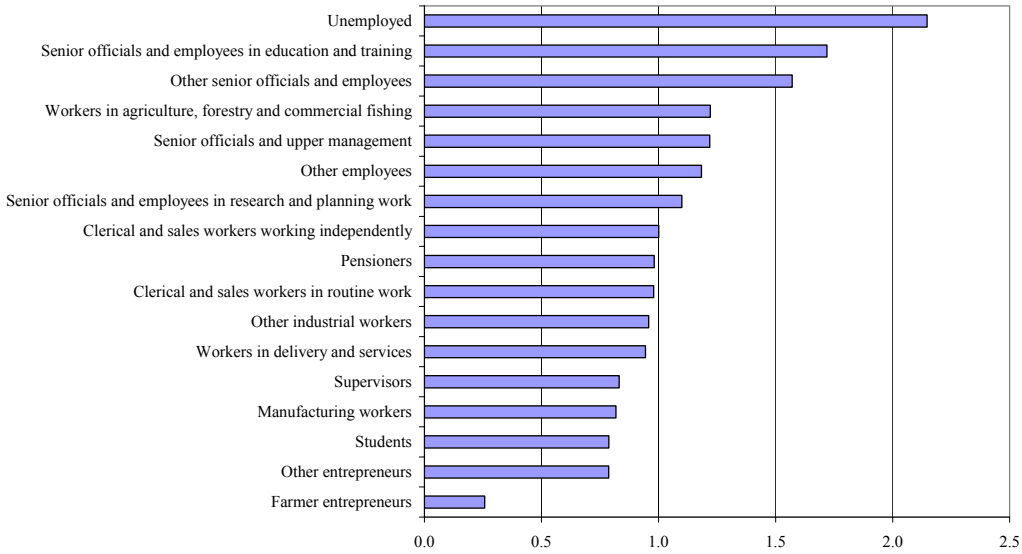
In addition to geographic isolation from the mainland Finland, the linguistic characteristic of Åland distinguishes it effectively from the rest of the country: 93 per cent of Ålanders speak Swedish as their mother tongue, while 93 per cent speak Finnish on mainland Finland (Statistics Finland, 2003a). Furthermore, the autonomous position of Åland with its own legislative powers has reinforced this distinction. Åland, in many ways, is also more closely linked to Sweden than other regions in Finland. This no doubt accounts for the fact that in

[2] Almost 40 per cent of the gross regional product is generated by marine transport, and the share of industrial production is less than 10 per cent.

Åland the share of foreigners among the inhabitants is the highest of all Finnish regions (8.6 per cent in Åland in 2002, 2.9 in the entire country; Statistics Finland, 2003a).

In the 1990s, the number of students studying in universities outside Åland grew rapidly, but concentrated in places other than on the mainland. Currently, the majority of the young Ålanders prefer Swedish universities: 71 per cent of the external university students were enrolled in Swedish universities, with only 24 per cent studied on the mainland (Statistics and Research Åland, 2004; see figure 3). One of the reasons for this development may be the fact that the Finnish language was no longer compulsory in the matriculation exam as of 1995 (Åland Government, 1994), and consequently, the number of students learning the language has decreased dramatically.

Figure 2. The share of migrants compared to native islanders among the various socio-economic groups

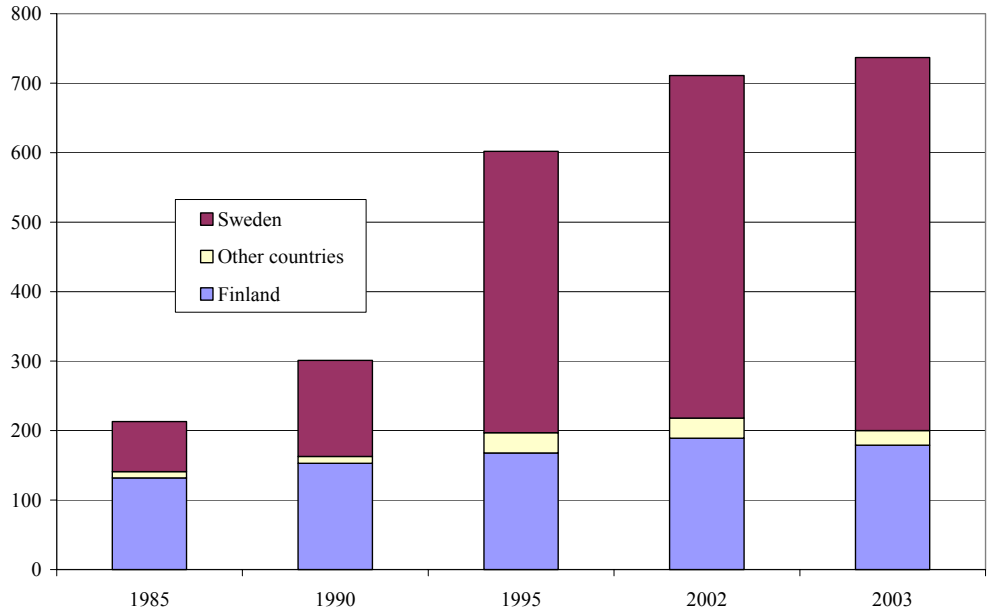


Note: Value 1 indicates that the ratio of migrants and natives is equal within the group.
Source: Statistics Finland, 2003a.

Therefore, a study that concentrated only on national migration would give only a partial picture of the migration flows of Åland.

Ålanders have a strong identity with their home region, and can more readily consider themselves as being Nordic rather than Finno-Swedish or Finnish (Häggblom – Kinnunen - Lindström, 1999). There is in fact a small but active group lobbying Åland to become an independent state. This group, Ålands Framtid (Åland's Future) managed to get two seats in the regional parliament in the last elections. The strong ties to the home region may act as a constraint to out-migration, thus increasing the immobility of Ålanders (see Fischer et al., 2000).

Figure 3. Number of students studying outside Åland according to country of study



Source: Statistics and Research Åland, 2004.

Åland also has legislation governing regional "citizenship" called the right of domicile. To be able to own and retain real estate in Åland, for example, one needs to have the right of domicile. Therefore, migrants moving to Åland cannot buy detached houses e.g. without an exceptional permit. To obtain the right of domicile, one has to have lived in Åland for five years and have a satisfactory knowledge of Swedish. Furthermore, anyone living off the islands for five years or more forfeits the right of domicile. This also applies to native Ålanders (Åland Government and the Legislative Assembly, 2002). These restrictions most probably act as deterrents to in-migration, and perhaps also to some out-migration.

Due to these special characteristics, Åland is occasionally omitted from the regional analysis of migration. Pekkala (2003) puts it as follows: "The special character of Åland could affect the analysis as it is likely that the personal migration determinants in Åland differ from those in the rest of the country." Her reasoning introduces the question: what are those determinants? The attempt of this study is to try to shed light on this issue.

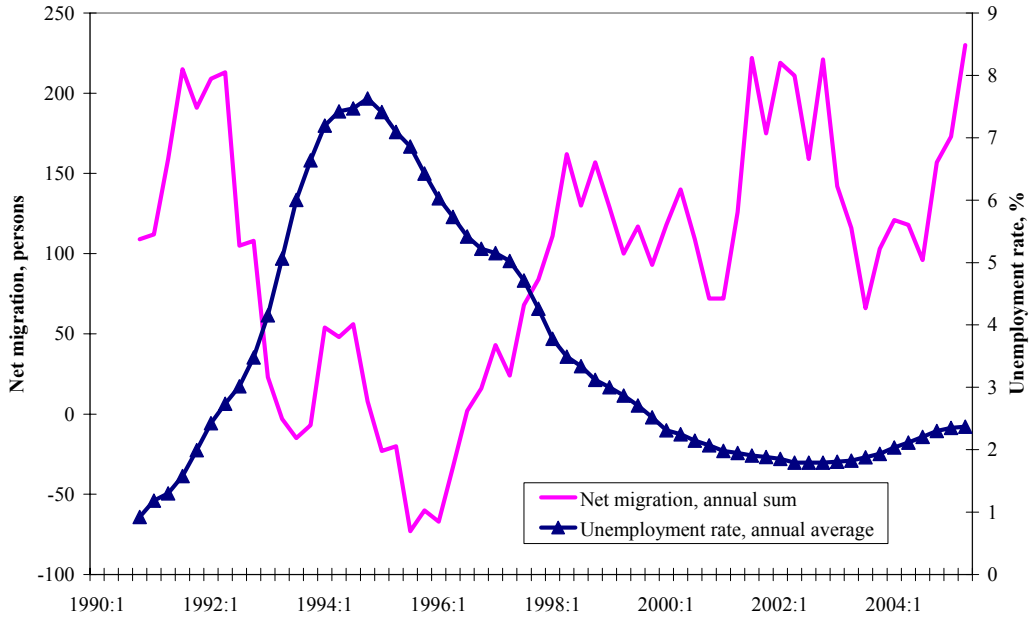
Although Åland is normally classified as a peripheral rather than as a growth-centre region (see e.g. Haapanen, 2002), it behaves like a growth-centre with regard to migration, although on a miniature scale. One of the reasons could be Åland's language profile: the Swedish-speaking minority in Finland represents only 5.1 per cent of the total Finnish population (Statistics Finland 2003a). This makes Åland with its unilingual Swedish-speaking status an interesting migration target.

Apart from Åland, only regions around the Finnish capital, which have considerable Swedish-speaking minorities, have experienced positive net migration flows and increases in the number of Swedish-speakers during the last decade. Other Swedish-speaking regions have suffered from population loss (Statistics Finland, 2003a). Åland thus seems to be an important migration target for the Swedish-speakers. Another factor enhancing the growth-centre-like migration behaviour of Åland may have been the expansion of its public sector, where employment increased, between 1991 and 2000, by 24 per cent, whereas private sector employment grew only by 1.3 per cent (Statistics Finland, 2003c).

According to the population census 2000, 79 per cent of Åland's inhabitants who had been born on the mainland Finland were Swedish-speaking and 21 per cent Finnish-speaking. Together they represent one fifth of Åland's inhabitants (Statistics Finland, 2003b). According to the sample data used below, 58 per cent of Åland's migrants from the mainland had lived in a municipality where Finnish was the main language. It implies that these migrants have clearly had more exposure to the Finnish language than the average Ålander. The unemployment rate of Åland has traditionally been lower than in the rest of Finland, currently indicating almost full employment (2.6 per cent in 2003 versus 9.0 per cent for the mainland; Statistics Finland, 2004a). The net migration flow of Åland is clearly negatively correlated with the unemployment rate, as can be seen from figure 4 (correlation between the time series of the figure 4 amounts to –0.79). Another interesting fact is that at least during the last three decades, net migration from mainland Finland has always been positive,

whereas these flows with the rest of the world have varied from positive to negative (Statistics Finland, 2003d). In recent years, migration from other than Nordic countries has rapidly increased; it stood for more than 60 per cent of net migration in 2004, reflecting increased mobility of the citizens of the new EU member countries (Lindström, 2005). As the regional government is prone to guard the "language balance" of the province, migration tendencies of non-Swedish-speakers is a contentious political issue.

Figure 4. Unemployment and net migration



Source: Statistics and Research Åland, 2005a, 2005b.

2. Theoretical underpinnings and earlier empirical results

Migration can originate with the optimising behaviour of individuals who consider migration to be an investment in their human capital. Sjaastad (1962) was the first to apply the human capital theory in the context of migration. An individual migrates when the expected discounted utility streams (U^e_{jt}) in a new location exceed those of the current location (U^e_{it}), after subtracting the costs (I_{ij}) attached to migration (see e.g. Häkkinen, 2000, and Hämäläinen and Böckerman, 2002).

$$\int_{t_0}^{T} \left[U^e_{jt} - U^e_{it}\right] e^{-rt} dt - I_{ij} \qquad (1)$$

The application of this theoretical framework has normally assumed that the utility of moving to a location depends on the expected wage level, discounted by the local costs of living. Local unemployment rate at destination, or its mirror image, 100 - unemployment rate, is often used to indicate the probability of finding a job.

There are also non-pecuniary gains and costs in changing the place of residence. These differences in local amenities, such as the availability of cultural activities, provision of public services, or such circumstances as the climate and clean nature, have been suggested as explanations for the empirical findings of low or no convergence of wage levels between regions (see discussion in Goetz, 1999). In bilingual countries like Canada and Finland, where the population with different mother tongues are spatially separated, language may be a key variable in defining the set of plausible migration targets (see Häkkinen, 2000).

The costs of migration are supposed to depend positively on the distance between location of the origin and target. Even psychological costs may depend on the distance, as the greater the distance between locations, the costlier it is to keep contact with relatives and friends in the place of origin. In the context of Åland, it is natural to assume that psychological costs of moving to Åland are higher if an individual needs to cross the language frontier as well. In Åland, most of the public and many of the private services are only available in the Swedish language. Learning a new language, or brushing up existing skills, poses additional costs as

well as time required to master it. To sum up, it seems much less likely that a person belonging to the Finnish-speaking majority migrates to Åland.

Human capital theory and empirical evidence also suggest that the younger and educated individuals would have a higher probability of migrating, because of longer planning horizons and better employment prospects (Häkkinen, 2000; Nivalainen, 2003; Pekkala, 2003).

Harris and Todaro (1970) formulated a model of rural-urban migration in which individuals choose their place of residence according to the differences in the rural and urban wage and unemployment levels. An individual chooses a location where the expected gain, i.e. probability of employment times wage, is the highest. Pekkala (2003) applied the Harris-Todaro model in conjunction with the human capital theory. By using a sample of the Finnish population census data from 1985-1996 in the estimation of multinomial logit models, she showed that increases in urban wages and employment significantly increase mobility to these regions, whereas similar development in rural areas reduces it. However, higher rural wages do not raise migration to rural areas. She concludes that the employment opportunity is the most important determinant of migration, but several individual-specific characteristics were also shown to be significant. Higher education, for example, promotes migration, whereas family size and home ownership tend to deter people from moving.

Ritsilä and Tervo (1999) study the effect of unemployment on migration behaviour with a one per cent sample from population censuses of 1985 and 1990. They find that personal unemployment increases the probability of re-locating only if the unemployment is of a short-term character. Long-term unemployment does not seem to affect out-migration propensity. Regional unemployment increases the likelihood of out-migration, and it was one of the major determinants of the migration behaviour in their analysis.

Pekkala and Tervo (2002) show that the unemployed are not necessarily better off if they migrate to other regions. In fact, the exact opposite may be true in the short term. It is predominantly other, partly unobservable characteristics such as human capital and ability that determine whether a person finds employment. Thus, migration seems to be only partly based on rational decision-making. The unemployed, however, were more inclined to migrate than employed individuals.

Nivalainen (2003) shows that the unemployed are more prone to move both from urban municipalities to rural ones, and vice versa. Having an earlier history of migration also increases its probability. Individuals who live in rental housing were shown to be more mobile than owner-occupiers. Swedish-speakers are less prone to move to urban areas.

In her study of determinants governing individuals' migration decisions in Finland, Häkkinen (2000) notes that Swedish-speakers have a lower propensity to migrate. According to her, uni- or bilingually Swedish municipalities are only a few in number, so the lack of interesting migration destinations may reduce this group's tendency to re-locate. Her results also supported the hypothesis of earlier migration history increasing the probability of moving again.

Nakosteen and Zimmer (1980) study the earnings of migrants and non-migrants in the USA. The binomial relocation decision is coded as one if the individuals moved to another state, zero otherwise. First, they estimate a mover/stayer model in which they used a probit equation to explain which persons moved to another state, and then use OLS to estimate hourly wages for migrants and non-migrants, including a selection bias variable obtained from the probit equation.

Bellemare (2004) studies the out-migration propensities of immigrants using the German Socio-Economic Panel (GSOEP). He concludes that out-migration, measured with panel attrition, is more probable for those having lower labour market earnings and work propensities.

Fischer et al. (2000), focussing on an opposite perspective, modelled immobility. This approach is well grounded, as the majority of people do not migrate, but prefer to stay in their home region despite regional differences in wages and employment prospects. They provide thus an "amenities-approach" -like explanation for the low convergence of wages and unemployment rates that has been recognised in many studies (Goetz, 1999;see also Pekkala and Tervo, 2002; Evans, 1990).

Fischer et al. (2000) coin their perspective as an *insider-advantage approach*, according to which insider advantage results from the accumulation of location-specific "social capital". This social capital or "regional amenity value" accumulates both during working and leisure

time. The insider advantage can also be divided into society-specific, firm-specific and place-specific benefits, which open up the possibility of different kinds of social capital accumulation among different societal groups. These location-specific investments would become sunk costs in the event of migration. As the insider advantage accumulates over time, people become increasingly immobile. Therefore, the duration of stay (leisure time -based social capital accumulation) as well as the years on the job (working time -based social capital accumulation), and number of previous moves (low accumulation of insider advantage) were central explanatory variables in analysis of Fischer et al. (2000). Empirical findings from the Swedish micro data confirm that these indeed are important in determining the probability of staying, and have expected signs. Also different variables describing the phases of life and societal groups (age, age^2, number of children, unemployed, foreign born, level of education, earlier migration history etc.) are statistically significant determinants of the probability of staying. With the inclusion of the age variable, the authors control for the possibility that older people tend to be less mobile in general, thus eliminating this effect from the "duration of stay" variables.

Finally, Althaus (2004) presents a life-cycle model where households choose between two locations of residence during three life periods. The model assumes that there exists location-specific amenity or social capital that both accumulates and depreciates over time. Therefore, the amenity-level of a region is not constant over households, but depends on the characteristics of the individual households. Being born in a region can be assumed to give a higher level of location-specific amenity capital through extensive social networks etc. Small differences between households make their life-cycle behaviour dramatically different in this setting. This feature of the model is an advantage, as empirical studies have found that there are always people relocating in "wrong" directions, when the attraction of a region is explained e.g. by employment prospects and wage level.

In the context of present study, it seems apparent that duration of stay, place of birth, as well as mother tongue are important determinants of the level and accumulation of location-specific amenity or social capital, or in the words of Fischer et al. (2000), accumulation of insider advantage. Therefore, they should be added as explanatory variables for migration equations. In addition, earlier research has shown that migration flows are connected to the unemployment levels, as well as to wages in both the destination and departure regions.

3. Empirical model

The earlier studies mentioned above have focused on modelling in- and out-migration as separate flows, or the decision of staying or moving as a binomial variable. The focus of the present study is on *net migration* through modelling the propensity to *stay in or migrate to* Åland, which receives the same code in the data (both equal 1). In order to enhance comparison with earlier research, as well as to get a richer interpretation of the results, even a mover-stayer model is estimated. However, the coding of the mover-stayer model is reversed, in order to enable comparison with the net migration model. Thus, stayers are coded with value 1, and movers with zeros.

By using the net migration specification, we suggest that it is possible to interpret the results of the estimations as net migration flows, once the propensity to live in Åland is multiplied with a relevant population figure. However, in the present case the data are affected by a sample bias, covering only those who lived in Åland at least during one of the years covered by the data. This poses problems for the estimations, which are discussed below. Another difference with the majority of the above referenced migration literature is that the panel structure of the dataset is explicitly utilised in the analysis.

A dynamic discrete choice model specification is motivated by a realistic assumption of state dependence in choosing a place of residence. Current inhabitants are assumed to have a higher propensity to live in Åland during the next period than those living somewhere else. Separation of state dependence from unobserved heterogeneity is possible only if one has access to panel data (Hsiao, 2003; see also Hämäläinen, 2003).

A dynamic binomial latent regression model can be expressed as follows (see e.g. Hsiao, 2003, for a general formulation of the dynamic discrete panel data model, and Hämäläinen, 2003, in the context of persistency of unemployment):

$$y_{it}^{*} = a_0 + \gamma y_{i,t-1} + \phi \sum_{s=1}^{t-1} \prod_{l=1}^{s} y_{i,t-l} + \lambda' z_i + \beta' x_{it} + u_{it}, \quad i = 1,...,N, \quad t = 2,...,T \tag{2}$$

y_{it}^{*} denotes the unobserved, underlying propensity to stay in Åland, y_{it-1} stands for the indicator variable stating whether the person lived in Åland in the previous period, and z_i denotes individual's time-invariant, observable characteristics. x_{it} denotes time-varying variables, and u_{it} is a two-component error term consisting of an individual-specific and of a random term.

$$u_{it} = \alpha_i + \varepsilon_{it} \tag{3}$$

y_{it} is the observed state of affairs, i.e. whether the individual stayed in Åland or not, which depends on the unobserved index function y_{it}^{*} as follows:

$$y_{it} = \begin{cases} 1 \; if \; y_{it}^{*} > 0 \\ 0 \; if \; y_{it}^{*} \le 0 \end{cases} \tag{4}$$

In order to account for the accumulation of insider advantages, the duration of the recent stay in Åland (within the study period), $\sum_{s=1}^{t-1}\prod_{l=1}^{s} y_{i,t-l}$, is included as an explanatory variable. By assuming that both the error terms follow a random unitary normal distribution or a logistic distribution, either random effects probit or logit model will be the workhorse of the analysis. However, the logit specification may not behave so well when the probability of some of the possible occurrences is low, as the logistic probability distribution has heavier tails (Greene, 2000). A fixed effects panel data model is not an attractive option, as our data constitute a random sample from a larger total population. An additional issue to be tackled with the dynamic models is that of the initial conditions (see Hsiao, 2003). The model requires an assumption on the relationship between the initial observations y_{i1} and the unobserved heterogeneity component u_{it} (Hämäläinen, 2003). We can either assume that the initial conditions are independent of the unobserved heterogeneity, or we can allow for a correlation between them. A practical way of relaxing the independency assumption is to follow the proposition by Woolridge (2002), and model the distribution of the unobserved effect conditional on the initial value and explanatory variables. In other words, the first-year observation of place of residence is included as a time-invariant characteristic variable for

periods t = 2…T. In addition, inclusion of the first-year observation of place of residence may compensate for the fact that our duration-of-stay variable is truncated. Then u_{it} can be expressed as follows:

$$u_{it} = a_i + y_{i1} + \varepsilon_{it} \tag{5}$$

4. Data

The central estimations in this study are conducted with longitudinal population census data of Statistics Finland, covering years 1990-2000. Individuals aged 15-65 were included in the frame population. However, the age condition had to be fulfilled only during one of the years included in the study. Therefore, given the dynamic modelling framework, individuals' minimum age is 6 and maximum age 75, during the estimation period of 1991-2000. A ten per cent sample was drawn from those who lived in Åland during the whole period. There were 16,272 such individuals in the population, of whom 1,616 were included in the sample. A sample of 20 per cent was drawn from those who migrated to or from Åland during the same period. In total, there were 4,519 such persons (5,754 persons were excluded due to low/high age or death), and 909 individuals were drawn. Thus, in total there are 2,525 individuals in the sample. Over-sampling of migrants was motivated by the reduced number of migrants: during 1990-2000, only 479 individuals moved to and 407 moved from Åland on average per year, resulting in an annual net migration of 72 persons.

However, this sampling scheme did not readily result in an adequate annual representation of individuals who stayed, moved in, or moved out from Åland. Therefore, each individual was assigned each year to one of the three groups according to their migration decision. The relative sizes of the groups were compared to register data, and corrective weights were employed so that annual streams of in- and out-migration flows were in correct proportion to those who stayed in Åland. The statistical package then automatically takes into account the weights calculating the asymptotic covariance matrices (Greene, 2002).

Table 1. Descriptive data for years 1991-2000

Native Ålanders					
	Mean	Std. Dev.	Minimum	Maximum	Cases
Lived in Åland during t	0.915	0.278	0	1	14830
Lived in Åland during t-1	0.925	0.264	0	1	14830
Stayed in Åland during t	0.968	0.175	0	1	14830
Lived in Åland year 1990	0.951	0.217	0	1	14830
Duration of stay in Åland	4.871	3.099	0	10	14830
Family size 2 -	0.783	0.412	0	1	14830
Native Ålander	1.000	0.000	1	1	14830
Male	0.519	0.500	0	1	14830
Native male Ålander	0.519	0.500	0	1	14830
Swedish-speaker	0.995	0.739	0	1	14830
Age	36.711	16.385	6	74	14830
(Age)^2/100	16.161	12.927	0.36	54.76	14830
Educational level	0.256	0.653	0	4	14830
Income class in FIM 10.000 (0-40)	10.319	7.774	0	40	12618
Educational level * Native Ålander	0.256	0.653	0	4	14830
Age * Native Ålander	36.711	16.385	6	74	14830
(Age)^2/100 * Native Ålander	16.161	12.927	0.36	54.76	14830
Born in mainland of Finland	0.000	0.000	0	0	14830
Time trend	6.493	2.871	2	11	14830
Time trend * Native Ålander	6.493	2.871	2	11	14830
Time trend * Born in mainland of Finland	0.000	0.000	0	0	14830
Ln (unemployment rate, %)	1.361	0.464	0.69	2.03	14830
Unemployed	0.030	0.171	0	1	14830
Migrants					
	Mean	Std.Dev.	Minimum	Maximum	Cases
Lived in Åland during t	0.641	0.480	0	1	10420
Lived in Åland during t-1	0.603	0.489	0	1	10420
Stayed in Åland during t	0.939	0.239	0	1	10420
Lived in Åland year 1990	0.507	0.500	0	1	10420
Duration of stay in Åland	2.752	3.159	0	10	10420
Family size 2 -	0.646	0.478	0	1	10420
Native Ålander	0.000	0.000	0	0	10420
Male	0.435	0.496	0	1	10420
Native male Ålander	0.000	0.000	0	0	10420
Swedish-speaker	0.747	0.434	0	1	10420
Age	35.350	13.834	6	75	10420
(Age)^2/100	14.410	10.818	0.36	56.25	10420
Educational level	0.453	0.880	0	4	10420
Income class in FIM 10.000 (0-40)	10.198	7.429	0	40	8274
Educational level * Native Ålander	0.000	0.000	0	0	10420
Age * Native Ålander	0.000	0.000	0	0	10420
(Age)^2/100 * Native Ålander	0.000	0.000	0	0	10420
Born in mainland of Finland	0.669	0.471	0	1	10420
Time trend	6.405	2.870	2	11	10420
Time trend * Native Ålander	0.000	0.000	0	0	10420
Time trend * Born on mainland Finland	4.286	3.822	0	11	10420
Ln (unemployment rate, %)	1.369	0.465	0.69	2.03	10420
Unemployed	0.060	0.237	0	1	10420

Note: Variable explanations are provided in appendix 1.

Thus, both the over-sampling and the annual representativeness were simultaneously accounted for. The data include variables on individual characteristics and on general economic conditions. However, variables x_{it} with both cross-sectional and annual variation are observed only for those that stayed inside the borders of Finland. Consequently, annual earnings, e.g., cannot be used in regressions that include those who migrated to Åland from abroad. They are included in the stayer-mover regression only (see table 1).

Given the international nature of migration patterns to and from Åland, the definition of a relevant population size of those living beyond Åland was problematic. The individual, time-variant data are available only for those staying within the Finnish borders. Individual-level data are not given out to institutions abroad, so data for Åland-born individuals living outside Finland was not available for this study. [3]

Those who have not lived in Finland (during the study period) are therefore naturally excluded from the material. What is more, a considerable share of migration from abroad is return migration, so that it is reasonable to frame the population to include only such persons who have lived in Åland at least during one of the sample years. However, this definition of the frame population, together with exclusion of the deceased may somewhat bias the results towards excessive mobility. In the later sections, the effects of this population specification will be discussed.

[3] An exception to this rule is a recent project initiated by the Nordic Council of Ministers, in which national statistical authorities of Finland, Sweden, Norway and Denmark linked the national employment registers in order to describe international commuting between the countries during year 2001 (see Nordic Council of Ministers, 2004).

5. Results

Due to reasons to be given below, the results of the time series regression explaining net migration based on quarterly data covering years 1990-2003 are presented first. The dependent variable is the yearly sum of net migration that is explained by the unemployment rate (four-quarter average) and by the lagged dependents. We see that unemployment has dynamic effects, and due to the logarithmic form of the variable, its effect on net migration depends on the unemployment level.

Table 2. Results of the time series regression

Dependent:	Net migration (annual, 4-quarter sum)		
Nr. of observations: 49 quarters		Period: 1991:4 - 2003:4	
Variable	Coefficient	t-Statistic	Std. Error
Constant	116.811	3.916***	29.826
Ln(unemployment rate, %)	-58.866	-3.506**	16.792
Net migration t-1	0.573	4.078***	0.141
Net migration t-2	0.264	1.569	0.168
Net migration t-3	-0.079	-0.474	0.167
Net migration t-4	-0.293	-2.238*	0.131
R-squared	0.842	Mean dependent var	85.510
Adjusted R-squared	0.824	S.D. dependent var	81.540
S.E. of regression	34.254	Akaike info criterion	10.020
Sum squared resid	50453.1	Schwarz criterion	10.251
Log likelihood	-239.48	F-statistic	45.799
Breusch-Godfrey Serial Correlation LM Test: F-stat.	1.351 (prob = 0.269)	Prob(F-statistic)	0.000000
Long-term coefficients			
Constant	218.5		
Unemployment	-110.1		

Note: *** (**,*) indicates a significance level of 0.1 (1, 5) per cent.

In order to allow a comparison with earlier studies and to facilitate a richer interpretation of the "net migration" estimations, we first estimate a traditional mover-stayer model where the staying individual accrues the code 1 (thus we call it a stayer-mover model). We place the net migration in quotation marks, as the results may suffer from the sample bias as those who never have lived in Åland are excluded. This dataset, however, suffers from no sample bias with regard to out-migration. In this analysis, first-year in-migrants are naturally excluded from the sample. The estimation results are shown in table 3. Two alternative specifications

are presented. We see that persons living with a partner or a family are less prone to out-migrate, as are those who are Swedish-speakers, high-wage earners, and/or lived in the island already in 1990. In contrast, the well educated, especially the native-born ones, unemployed, and younger persons are more inclined to leave the island. These results are well in line with the above-mentioned theories and empirics.

Table 3. Results for a stayer-mover model

Dependent:	RE probit, time trend			RE probit, time dummies		
Stayed in Åland during t	Coeffi.	t-ratio	Marg.Eff.	Coeffi.	t-ratio	Marg.Eff.
Constant	1.329	4.256***	0.01767	2.777	7.975***	0.03577
Family size 2 -	0.379	6.022***	0.00503	0.377	5.67***	0.00485
Lived in Åland year 1990	0.878	8.101***	0.01167	0.821	6.273***	0.01057
Duration of stay in Åland	-0.160	-6.84***	-0.00213	-0.149	-5.304***	-0.00192
Native Ålander	0.126	0.803	0.00168	0.089	0.126	0.00115
Swedish-speaker	0.181	2.287*	0.00240	0.177	2.112*	0.00228
(Age)^2/100	0.093	4.09***	0.00124	0.097	4.126***	0.00125
Educational level * Native Ålander	-0.166773	-2.292*	-0.00222	-0.171	-2.187*	-0.0022
Time trend	0.148	9.416***	0.00197	-	-	-
Time trend* Native Ålander	0.00046	0.007	0.00001	-	-	-
Year 1991	-	-	-	-1.027	-3.935***	-0.01323
Year 1992	-	-	-	-1.103	-5.889***	-0.01421
Year 1993	-	-	-	-0.871	-4.394***	-0.01122
Year 1994				-0.508	-2.77**	-0.00655
Year 1995	-	-	-	-0.433	-2.464*	-0.00558
Year 1996	-	-	-	-0.258	-1.5	-0.00333
Year 1997	-	-	-	-0.082	-0.464	-0.00105
Year 1998	-	-	-	-0.153	-0.871	-0.00197
Year 1999	-	-	-	0.064	0.359	0.00083
Year 1991*Native Ålander	-	-	-	0.022	0.033	0.00028
Year 1992*Native Ålander	-	-	-	0.071	0.112	0.00091
Year 1993*Native Ålander	-	-	-	0.457	0.786	0.00588
Year 1994*Native Ålander	-	-	-	-0.08	-0.158	-0.00103
Year 1995*Native Ålander	-	-	-	0.082	0.172	0.00106
Year 1996*Native Ålander	-	-	-	-0.069	-0.161	-0.00089
Year 1997*Native Ålander	-	-	-	-0.01	-0.021	-0.00013
Year 1998*Native Ålander	-	-	-	0.214	0.535	0.00275
Year 1999*Native Ålander	-	-	-	0.229	0.548	0.00295
Age	-0.055	-3.19**	-0.00073	-0.057	-3.253**	-0.00074
Educational level	-0.117	-3.271**	-0.00155	-0.118	-3.191**	-0.00153
Income class	0.015	3.359***	0.00020	0.016	3.466***	0.00021
Duration of stay * Native Ålander	0.107	1.774	0.00142	0.098	1.43	0.00127
Personal unemployment	-0.439	-5.122***	-0.00584	-0.458	-5.226***	-0.00590
Random effect parameter ρ	0.112	2.055*	-	0.11	1.783	-
Log likelihood		-1246.217			-1235.773	
Nr of observations		20,258			20,258	

Note: *** (**,*) indicates a significance level of 0.1 (1, 5) per cent.

Table 4. Results for the "net migration" model

Dependent:	RE probit time trend			RE probit time dummies		
Lived in Åland during t	Coeff.	t-ratio	Marg.Eff.	Coeff.	t-ratio	Marg.Eff.
Constant	-1.539	-18.001***	-0.1901	-	-	-
Family size 2 -	1.017	36.657***	0.1255	1.022	36.094***	0.1246
Lived in Åland year 1990	0.397	6.988***	0.0490	0.403	6.883***	0.0491
Duration of stay in Åland	0.054	5.472***	0.0067	0.049	4.74***	0.0059
Native Ålander	0.924	4.326***	0.1141	-	-	-
Swedish-speaker	0.083	1.781	0.0102	0.084	1.759	0.0102
(Age)^2/100	0.020	8.983***	0.0025	0.021	9.198***	0.0026
Educational level * Native Ålander	-0.142	-3.809***	-0.0175	-0.14	-3.71***	-0.0171
Time trend* Native Ålander	-0.089	-7.836***	-0.0110	-	-	-
Time trend* Born in mainland Finland	0.02400	3.226**	0.0030	-	-	-
Year 1991	-	-	-	-0.078	-1	-0.0094
Year 1992	-	-	-	0.694	5.827***	0.0846
Year 1993	-	-	-	2.355	12.107***	0.2871
Year 1994				2.544	12.086***	0.3100
Year 1995	-	-	-	2.183	11.249***	0.2660
Year 1996	-	-	-	1.775	10.596***	0.2164
Year 1997	-	-	-	1.495	10.38***	0.1822
Year 1998	-	-	-	0.891	8.065***	0.1086
Year 1999	-	-	-	0.335	3.252**	0.0408
Year 1991*Native Ålander	-	-	-	0.771	5.465***	0.0940
Year 1992*Native Ålander	-	-	-	1.098	7.648***	0.1338
Year 1993*Native Ålander	-	-	-	0.776	5.374***	0.0946
Year 1994*Native Ålander	-	-	-	0.597	4.274***	0.0728
Year 1995*Native Ålander	-	-	-	0.627	4.284***	0.0764
Year 1996*Native Ålander	-	-	-	0.573	3.92***	0.0699
Year 1997*Native Ålander	-	-	-	0.293	2.097*	0.0357
Year 1998*Native Ålander	-	-	-	0.31	2.163*	0.0378
Year 1999*Native Ålander	-	-	-	0.22	1.55	0.0268
Ln (unemployment rate, %)	-0.128	-3.267**	-0.0158	-2.173	-18.188***	-0.2649
Native male Ålander	0.156	2.67**	0.0193	0.153	2.626**	0.0186
Age*Native Ålander	-0.027	-2.258*	-0.0033	-0.036	-6.084***	-0.0044
(Age)^2/100*Native Ålander	0.050	3.255**	0.0062	0.062	6.627***	0.0076
Born in mainland Finland	-0.420	-5.819***	-0.0518	-0.261	-5.23***	-0.0318
Lived in Åland during t-1	2.009	49.1***	0.2481	2.039	47.925***	0.2485
Random effect parameter ρ	0.07	3.336***	-	0.076	3.548***	-
Log likelihood		-4351.642			-4331.195	
Nr of observations		25,250			25,250	

Note: *** (**,*) indicates a significance level of 0.1 (1, 5) per cent.

There is also a declining tendency over time to out-migrate, which is similar among island natives and migrants. However, among the non-natives, this is outweighed by an increasing tendency to out-migrate through the negative coefficient of variable for the duration of stay.

Is this an example of increasing "wanderlust" or depreciating social capital? Time-trend and annual dummy specifications yield very similar results in this and in other respects.

Table 4 presents estimation results for the "net migration" for the two random effects probit models.[4] As theories do not indicate any exact definitions for individual characteristics variables, several combinations of background variables (e.g. gender, age, education, place of birth and mother tongue) were tested in the specification of both stayer-mover and net migration models. The competing specifications were tested with the likelihood ratio test for nested models, and with Davidson – Mackinnon (1993) artificial regression test for non-nested models. Finally several variables were excluded from the equations presented above, due to their poor explanatory power (e.g. educational level and age are excluded from the net migration estimation).

The personal unemployment variable is omitted as we have no information on the employment status of individuals living outside Finland. Instead, a general unemployment level is used here, which, however, poses an identification problem for the model with year dummies: the constant has to be omitted. The coefficient of the unemployment rate then turns out to be unrealistically high, as the constant is merged with the unemployment rate that is invariant over the cross-sectional observations. However, we see that, apart from the time dummies and the unemployment variable, other variables of the time dummy model show similar results with the time trend specification. The coefficient of the unemployment rate does not suffer from the same problem in the time trend specification, and it can be used in further analysis. In effect, the role of the time dummy specification here is to render credibility for the time trend specification, which is more unusual in a migration context, but is central for the discussion below.

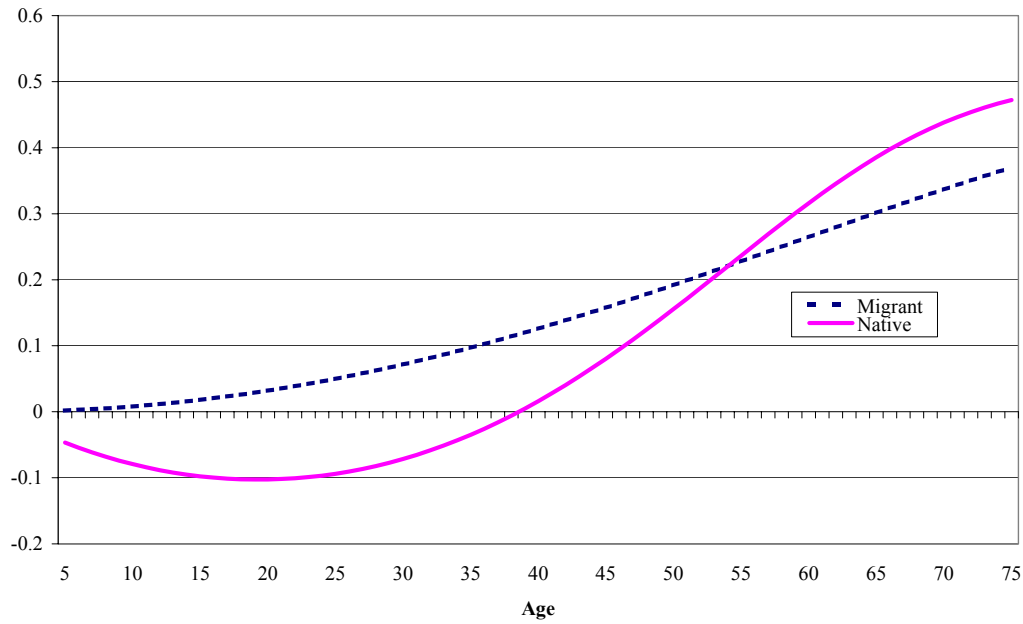
The probability of living in (or moving to) Åland increases with age for both groups. However, for native islanders, there is a greater tendency to leave the home region at a young age and return later. Brunström (2003) showed in a study based on a mail survey to in- and out-migrants that among the native Ålanders the young are over-represented among the out-

[4] Logit and pooled probit models were also tried but they either performed poorly (random effects) or provided similar results as the probit model (pooled version). The pooled probit results were not especially informative vis-à-vis random effects models, but can be obtained from the author on request.

migrants, whereas the retired are a considerable group of in-migrants, an observation which supports our results. These results are compatible with the life-cycle model by Althaus (2004), where migration to other regions during working age and returning after retirement was an optimal decision for a part of the population. Figure 5 depicts the contribution of age to the value of probability function.

The results support the insider advantage hypothesis, as all related variables, namely the indicator variable for the initial place of residence, previous year's place of residence, and duration of recent stay, as well as being a native Ålander, all have positive and very significant values. Male Ålanders are even more inclined to live in their home province than their female counterparts. The duration variable has no significant difference between the native-born and migrants, which probably means that background differences are covered by other variables on characteristics.

Figure 5. Contribution of age to the probability of living in Åland



However, there is also a significantly negative time trend present for native Ålanders, which at the end of the study period (year 2000) eliminates the positive contribution of "Native Ålander" – dummy. Therefore, one could argue that the insider advantage of native Ålanders

is eroding. Conversely, the probability mainland-born Finns to stay in Åland rises over time which, by following the same line of reasoning, should be interpreted as increasing the insider-advantage for this group. However, the same picture is not conveyed by the time-dummy specification, where the effect of general economic conditions is mixed with the time dummies.

We also see that educated persons are less prone to live in their home region. Given the small size and one-sidedness of the Åland labour market, this result seems plausible. Furthermore, earlier research has often confirmed the existence of the relations proposed by human capital theories of migration (see e.g. Pekkala and Tervo, 2002; Nivalainen, 2002, Haapanen, 2002).

Having a partner and/or family increases the probability of living in Åland by nearly 13 per cent, which, apart from higher opportunity costs of moving, may reflect the virtues of a small society: short distances, safety, effective social control etc. Dummy variables for different family sizes were tried, but those describing other than one-person households have very similar coefficients.

The results thus lend support to the Harris-Todaro –type expected wage hypothesis if we consider Åland as a central area, and are also in agreement with the earlier empirical results from Finland (see e.g. Pekkala, 2003, or Ritsilä - Tervo, 1999).

The data include other variables for characteristics such as employer's sector and industry, but they have no explanatory power. Interestingly, the variable for mother tongue is not a strong explanatory variable in this setting. Its coefficient is positive, but significant only at 10 % level.

The random effect parameter ρ describes the share of individual heterogeneity in the error variance, i.e. $\rho = \frac{\sigma_a^2}{\sigma_a^2 + \sigma_\varepsilon^2}$. The size of the coefficient is relatively modest. Thereby it would seem that our explanatory variables capture the essence of the characteristics of the population.

In conclusion, the determinants of migration flows in Åland seem to be in line with those of other regions. However, there is a clear language-dominated selection mechanism that effectively filters out the Finnish-speakers from the in-migrants. Nevertheless, our dataset is readily pre-selected, because it excludes persons who never lived in Åland. Therefore, indicator variables for mother tongue have only a minor role in this estimation.

Comparison of the stayer-mover model and the "net migration" model shows that the time trends in them work in different directions. If there is a general negative tendency to out-migrate, and simultaneously there is a negative trend for the net migration of natives, it suggests that the return migration of natives is declining. Being a Swedish-speaker increases the probability of staying, but at the same time does not contribute significantly to the net migration. However, while the presence of the sample bias may affect the results of the migrants, this would be less so for the natives. The vast majority of the natives are represented in our sample. In addition, if the behaviour of those who are excluded does not deviate from the other groups, there is no bias due to the omission. We believe that the dataset captures the essence of the net migration for the native islanders, because the only in-migration of natives is return migration.

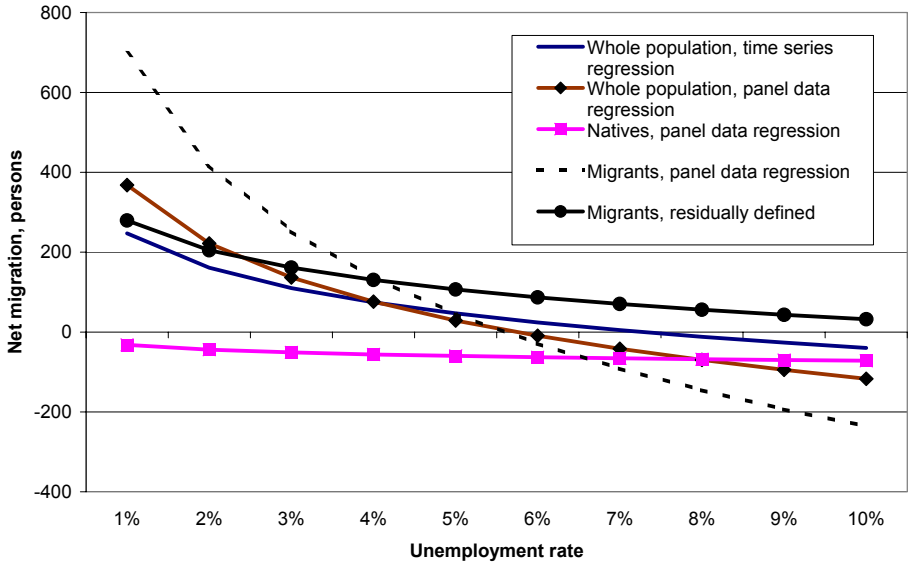
In order to observe how well the panel estimation of "net migration" model works, let us compare it with the time series estimation. In figure 6, probability of living in Åland is multiplied with a relevant population figure, which is interpreted to be the registered size of the population group, divided by the estimated probability of in-migration/staying for that group. Hence, the actual population figure and the probability of in-migration/staying are made compatible.

In the figure, only unemployment level varies, other x-variables are given values corresponding year 2000, according to population census or, if no registered-based figure was available, mean values for 1991-2000, according to the sample data. The changes in the population levels are interpreted as changes in net migration. New linear regressions were then conducted with the unemployment rate as the only explanatory variable. Thus we apply ceteris paribus for the other, non-economic variables.

We see that the net migration equation of the non-native inhabitants as well as that of the whole population seem overly sensitive to changes in unemployment level. However, that of

the native islanders is quite irresponsive to changes in unemployment. Sample bias should be a lesser problem for the natives, as noted above. Therefore, calculation of a net migration flow of non-natives should be less biased, when it is calculated as a residual between the time series equation for the whole population, and the panel regression estimate of natives (see figure 6).

Figure 6. Comparison of time series and probit model regressions



6. Discussion

In this paper, a method for estimating a net migration equation from a binomial probability model was presented. It was shown that the decision on the place of residence is clearly an issue of state dependence and of duration. The signs of the statistically significant variables are in accordance with the migration theories and they are in agreement with earlier empirical results.

The estimated net migration rate for native Ålanders was quite non-responsive to different unemployment levels, which illustrates the native inhabitants' strong preference for their home region.

There seems to be a decreasing tendency for native Ålanders to return to their home province once they out-migrate. However, these changes are too small to cause any discernible restructuring of the population structure in the foreseeable future, and the dramatic title of this article may be unwarranted. It is nevertheless interesting, to try to analyse reasons behind this development.

It could well be the case that Ålanders' increasing contacts with private businesses and authorities on the mainland Finland, e.g. to search for new markets, or because of the EU membership[5], have increased the demand for proficiency in both Finnish and Swedish. However, Ålanders are known to have very rudimentary skills in the Finnish language and a clear picture of the current need was recently drawn: in practically every industry and post, especially in the public sector, knowledge of the Finnish language was desirable, if not a necessary skill (Sanders, 2003). Being forced to communicate in Finnish is a problematic, taboo-laden issue for the public sector because of Åland's unilingual status. Some of those interviewed had the impression that the number of contacts with mainland Finland had increased over the last years (Sanders, 2003). Consequently, the insider advantage of those not fluent in Finnish may well be eroding.

[5] Åland is represented by Finland in the EU. A considerable amount of information between Åland and the EU is channelled through the national authorities of Finland. Majority of the preparatory material is written in Finnish only.

Mainland Finland has obviously been able to provide Åland with a suitable labour force, whereas native Ålanders have migrated mainly to Sweden. If the shape of migration flows is causally related to the increasing demands for proficiency in the Finnish language, and in particular if the estimated migration pattern is continued and reinforced, it would indicate that Åland's language policy may is faced with a problematic paradox: by not taking steps to advocate a better command of the Finnish language in Åland in order to protect the status of the Swedish language as the sole lingua franca, the regional government may diminish the chances of "out-flown" native Ålanders to find employment on the islands, making their return to Åland more difficult. In the future, an increase in migration from the new EU member countries is to be expected, which will add to the complexity of coping with language issues in Åland.

References

Althaus, Paul G. (2004): *A Life-Cycle Model of Locational Choice in a Two-Region Economy,* Journal of Regional Science, Vol 44. No. 2, pp. 351-366, Blackwell Publishing.

Bellemare, Charles (2004): *Identification and Estimation of Economics Models of Outmigration Using Panel Attrition*, IZA Discussion Paper No. 1065, Bonn.

Brunström, Erik (2003): *In- och utflyttningen till och från Åland 1998-2003 – Vem flyttar vart och varför*, Ålands arbetsförmedlingsbyrå, Mariehamn (in Swedish).

Davidson, R. – MacKinnon, J. G. (1993): *Estimation and Inference in Econometrics*, Oxford University Press.

Fischer, Peter A. – Holm, Einar – Malmberg, Gunnar - Straubhaar, Thomas (2000): *Why do People Stay? Insider Advantages and Immobility*, HWWA Discussion Paper 112, Hamburg Institute of International Economics, available at www.hwwa.de.

Evans, Alan W. (1990): *The Assumption of Equilibrium in the Analysis of Migration and Interregional Differences: A Review of some Recent Research*, Journal of Regional Science, Vol 30, No 4, pp. 515-531.

Goetz, Stephan G. (1999): *Migration and Local Labor Markets*, The Web Book of Regional Science, Regional Research Institute, West Virginia University, available at: http://www.rri.wvu.edu/WebBook/Goetz/contents.htm

Greene, William H. (2000): *Econometric Analysis*, Fourth Edition, Prentice Hall International.

Greene, William H. (2002): Econometric Modeling Guide Vol. 1, Econometric Software, Inc.

Haapanen, Mika (2002): *Labour Migration and Wages*, University of Jyväskylä, School of Business and Economics, Licentiate thesis N:o 29/2002, Jyväskylä.

Harris, J. – Todaro M. (1970): *Migration, Unemployment and Development: a Two-sector Analysis*, American Economic Review, 60, pp. 126-142.

Hsiao, Cheng (2003): *Analysis of Panel Data,* Second Edition, Econometric Society Monograps, Cambridge University Press.

Häggblom, Kenth – Kinnunen, Jouko – Lindström, Bjarne (1999): *Ålänningar och deras identitet*, Radar, Åländsk tidskrift för samhälle och kultur Nr 1 1999, Mariehamn (in Swedish).

Häkkinen, Ida (2000): *Muuttopäätös ja aluevalinta Suomen sisäisessä muuttoliikkeessä*, Government Institute for Economic Research, VATT Research Reports 65, Helsinki (in Finnish).

Hämäläinen, Kari (2003): *Education and unemployment: State Dependence in Unemployment Among Young People in the 1990s*, Government Institute for Economic Research, VATT Discussion Papers 312, Helsinki.

Hämäläinen, Kari – Böckerman, Petri (2002): *Regional Labour Market Dynamics, Housing and Migration*, Government Institute for Economic Research, VATT Discussion Papers 284, Helsinki.

Lindström, Bjarne (2005): *Konjunkturläget – hösten 2005*, Statistics and Research Åland, ÅSUB Rapport 2005:4, Mariehamn, ISSN 1455-1977 (in Swedish).

Nakosteen, R. - Zimmer, M. (1980): *Migration and Income: The Question of Self-Selection*, Southern Economic Journal 46: 840-851.

Nivalainen, Satu (2000): *Muuttoliikkeen vaikutus alueelliseen väestörakenteeseen, 2000-2010*, Pellervo Economic Research Institute, Working Papers N:o 36, Helsinki (in Finnish).

Nivalainen, Satu (2003): *Where do migrants go? An Analysis of Rural and Urban Destined/Originated Migration in Finland 1996-1999*, Pellervo Economic Research Institute Working Papers No. 66, Helsinki.

Nivalainen, Satu (2005): *Interregional Migration and Post-Move Employment in Two-Earner Families: Evidence from Finland*, Regional Studies, (forthcoming).

Nordic Council of Ministers (2004): *Nordisk Pendlingskarta, Delrapport 1 – Sverige och Norge,* TemaNord 2004:514, Köpenhavn, ISBN 92-893-0997-0.

Pekkala, Sari (2003): *What Draws People to Urban Growth Centers: Jobs vs. Pay?*, Government Institute for Economic Research, VATT Discussion Papers 310, Helsinki.

Pekkala, Sari – Tervo, Hannu (2002): *Unemployment and Migration: Does Moving Help?*, Scandinavian Journal of Economics 104(4), pp. 621-639.

Ritsilä, Jari - Tervo, Hannu (1999): Regional Differences in the Role of Migration in Labour-market Adjustment: The Case of Finland, in *Regional Unemployment, Job Matching, and Migration*, edited by Crampton, Graham, European research in regional science, Pion Limited, London, ISBN 0-85086-170-5.

Sanders, Gunilla (2003): R*apport efter intervjuundersökning om det svenska språkets ställning på Åland,* Töftö 30th August 2003, memorandum (in Swedish).

Sjaastad, L. A. (1962): *The Costs and Returns of Human Migration*, Journal of Political Economy vol. 70, pp. 80-93.

Statistics and Research Åland (2004): *Statistical Yearbook of Åland*, Mariehamn.

Statistics and Research Åland (2005a): Statistical times series database on unemployment in Åland, based on Ministry of Labour data, unpublished.

Statistics and Research Åland (2005b): Statistical publications series and database on population. Publications available at: http://www.asub.aland.fi.

Statistics Finland (2003a): *Statfin Web Statistics*, available at: http://statfin.stat.fi.

Statistics Finland (2003b): unpublished registry data from the population census 2000.

Statistics Finland (2003c): unpublished employment data.

Statistics Finland (2003d): unpublished material on migration.

Statistics Finland (2004a): *Statistical Yearbook of Finland 2004*, ISBN 952-467-350-9.

Woolridge, J. M. (2002): *Econometric Analysis of Cross Section and Panel Data*, The MIT Press, Cambridge, Massachusetts.

Åland Government (1994): *Förslag till budget för landskapet Åland 1995*, Landskapsstyrelsens framställning nr 3, Mariehamn (in Swedish).

Åland Government and Legislative Assembly (2002): *Åland in Brief*, Mariehamn.

Appendix 1. List of variables

Lived in Åland during t	Place of residence Åland at the end of year t
Lived in Åland during t-1	Place of residence Åland at the end of year t-1
Stayed in Åland during t	Place of residence Åland at the end of years t-1 and t
Lived in Åland year 1990	Place of residence Åland at the end of year 1990
Duration of stay in Åland	Number of consecutive years in Åland since 1990
Family size 2 -	1, if size of family two or greater, otherwise 0
Native Ålander	1 for native Ålanders, 0 otherwise
Male	1 for males, 0 otherwise
Swedish-speaker	1 for Swedish-speakers, 0 otherwise
Age	Age at the end of year t
(Age)^2/100	Contents acc. to the formula
Educational level	0 = Primary or secondary education 1 = Lowest level tertiary education 2 = Lower-degree level tertiary education 3 = Higher-degree level tertiary education 4 = Doctorate or equivalent level tertiary education
Income class in FIM 10.000 (0-40)	Income subject to taxation, class 40 = income FIM 400.000 or higher
Born on mainland Finland	Place of birth on mainland Finland
Time trend	equals 2-11 for the years 1991-2000
Ln (unemployment rate, %)	Natural logarithm of the average unemployment rate in Åland during the year in question
Unemployed	Employment status unemployed at the end of the year t

Sources of data: Statistics Finland, population census /longitudinal employment register; Statistics and Research Åland, labour market data.

ESSAY 2: Reasons for high food prices in small market areas - The case of the Åland Islands*

Ville Aalto-Setälä**
Jouko Kinnunen***
Katri Koistinen**

*Published in Agribusiness – An International Journal,
Volume 20, Number 1, Winter 2004, pp. 17-29, Wiley

** National Consumer Research Centre
*** Statistics and Research Åland

Abstract: This article considers the reasons for high grocery prices in a small isolated market. The starting point of our study is the knowledge that the price of food in the Åland Islands – a small archipelago between Finland and Sweden – is significantly higher than in continental Finland. We also know that store-level economies of scale in grocery retailing mean that the structure of a small market is – even in the best case – either inefficient or uncompetitive. The article compares the price level of stores in Åland and Finland. Our aim is to decompose the price differences and allocate them between their various causes. The empirical results of the study are in accordance with the theory: high prices in Åland arise from a small average store size, high concentration in both the retailing and the food processing sector, border taxes, and transportation costs. An additional source of high prices is the strong regional spirit of the Ålanders: they are prepared to pay higher prices for products that are made in Åland.

Key words: Market structure, imperfect competition, pricing, retail trade
JEL codes: D430, L110, L810

ACKNOWLEDGEMENTS: The authors are grateful for helpful comments from Carolyn Holton, Tero Kuitunen, the anonymous referee of this journal and Ronald Cotterill (editor), the Summer Seminar of Economics at the University of Jyväskylä, and to representatives of Köpmannaföreningen, the society of local retailers in Åland.

1. Introduction

In 1933, Chamberlin presented a model of monopolistic competition in which many firms sell nearly identical products in the market. The firms have downward sloping demand curves and U-shaped cost functions. If the sizes of the firms equal the cost-minimizing size, production has been organized efficiently in the sense of cost minimizing. However, the cost-minimizing size of a firm may be problematically large in many industries and markets, thus limiting competition. Another problematic consequence of U-shaped cost curves is a restricted number and variety of products (Spence, 1976). Fixed costs force an economy to choose from the large set of all conceivable products. Markets choose according to the profitability of the variants, and the variants chosen by the market mechanism are, of course, not necessarily the same ones that would maximize social welfare.

The problems caused by U-shaped cost curves and fixed costs are especially severe in small market areas, which generally suffer from a lack of economies of scale and lack of competition. Panzar (1989) concludes that if only one or a few firms can be part of an efficient industry configuration, that industry simply cannot be structurally competitive. If we observe this obvious fact from another point of view, we see that if the production technology of the industry exhibits significant economies of scale and if, for some reason, there are many firms in the market, that industry cannot be cost-efficient. In other words, there is a trade-off between utilizing economies of scale and competition. This trade-off is especially notable in small markets.

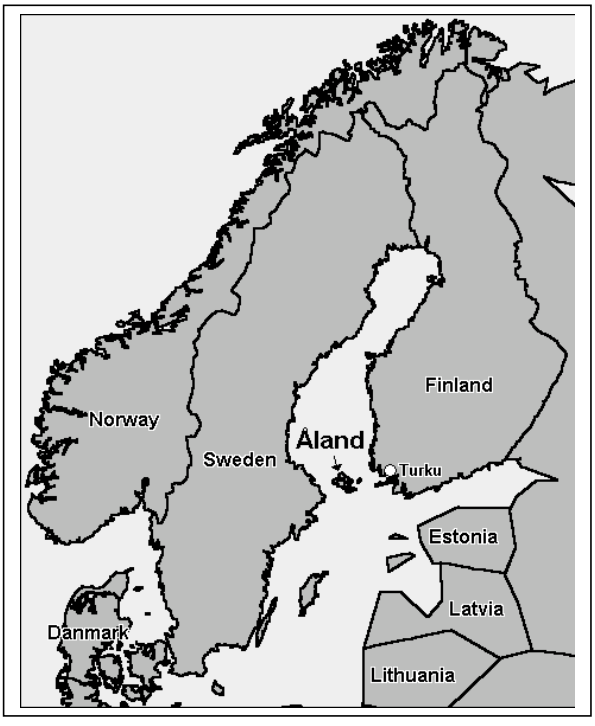
Grocery retailing is among the industries where such trade-off between economies of scale and competition exists. This is due to the existence of store-level economies of scale (Cotterill, 1999; Aalto-Setälä, 2002), as grocery services must be produced in the location where consumers live. The present study examines the grocery retailing industry in Finland's autonomous archipelago province – the Åland Islands (Åland for short) – located between Finland and Sweden. The Åland archipelago consists of around 6,500 islands, of which some 60 are populated. Earlier studies (Finnish Consumer Agency, 1999; 2000) have shown that grocery prices in Åland are quite high. This study compares the price level of grocery stores in Åland and continental Finland. Our aim is to decompose the existing price differences and to allocate them between their various causes.

The study concludes that the main reasons for the high price of food in Åland are the small average size of the grocery stores and the lack of competition, as could be expected based on the theory of monopolistic competition. Other reasons for the high food prices in Åland are high wholesale prices, inelastic demand for groceries, transportation costs, and VAT border administration. The remainder of the paper is organized as follows: Section 2 describes the grocery retailing industry in Åland, Section 3 presents the study data, Section 4 considers the empirical model, and Section 5 concludes the paper.

2. The grocery retailing industry in Åland

Åland is an autonomous Finnish province located between Finland and Sweden (Figure 1). The islands have about 26,000 inhabitants, of whom up to 90% live on the main island. Åland is a wealthy region compared to continental Finland. GDP per capita in 1998 was equivalent to about 31,600 euros in Åland versus about 22,300 euros in Finland.

Figure 1. Åland is an archipelago located between Finland and Sweden



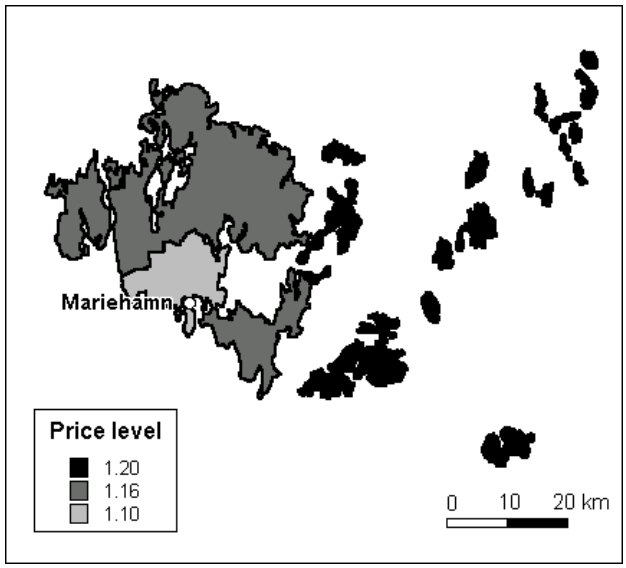
The main source of the Ålanders' wealth is without doubt the flourishing passenger ferry industry, which has accounted for around 35% of GDP in recent years. Åland's passenger ferries have long made extraordinary profits from tax-free sales of liquor and tobacco aboard as a result of the heavy taxation of these products in the neighboring regions of Sweden and Finland. In 1995, sales of alcohol and other tax-free products aboard ferries amounted to 17% of Åland's GDP.

Åland is a part of Finland, but it has significant autonomy in many respects. For example, it has its own parliament, the Åland Legislative Assembly, and a local Åland Government. The Legislative Assembly decides on the budget of Åland, which is mostly financed by a lump sum allocation from the Finnish state: 0.45% of the national tax revenue is allocated to Åland. The budgetary control enables the Åland Government to promote local business, for example, through infrastructure investments and subsidies. Another way of enhancing local businesses is through protectionist administrative rules concerning the right to conduct business in Åland. To run a business in the province, an entrepreneur must possess regional citizenship or otherwise qualify for that right. Local outlets of bigger non-Ålander firms are in practice run through daughter companies, in which at least two thirds of the corporate board members have to have regional citizenship. The local administration uses discretionary power in granting business licenses. Furthermore, non-Ålander road-hauling companies entering Åland with a shipment are not allowed to offer transport services on their way back to the continent. Instead, the trucks have to leave Åland empty (Kinnunen, 1999). Potential competition from neighboring regions is thereby severely restricted.

Another peculiarity of Åland is that, although a member of the European Union (like the rest of Finland), it is outside the EU Community's value-added tax (VAT) union, but inside the Community's customs union. Åland chose to stay outside the Community tax union mainly to safeguard continued tax-free sales after 30th June 1999 when tax-free sales within the tax union ceased. As a consequence, there is a "VAT border" between Åland and the rest of the EU, including continental Finland. Goods traded between Åland and continental Finland, as well as with the other EU members, have to pass through customs as if they had come from a third country outside the EU. So, the amount of red tape needed to trade with neighboring regions is higher than it would otherwise be.

Several comparisons (Finnish Consumer Agency, 1999; 2000) have shown that the price of food in Åland is quite high compared to the rest of Finland. For example, the difference in grocery prices between Åland and the Turku region (the Turku region is located in southwest Finland, and has a price level equal to the Finnish average) is 10-20%, as seen in Figure 2. Since Åland in itself is by no means a homogeneous region, it has been divided into three areas in the figure. The first comprises Mariehamn, the biggest town and capital of Åland, together with its surrounding municipality, Jomala. This could be characterized as the province's main urban area with its 14,000 inhabitants (Åland's total population is 26,000). All but one of the supermarkets in Åland are located here. Most Ålanders use these supermarkets for their bigger grocery purchases. The second area covers the rest of the main island. This is countryside, and the grocery stores here – with one exception – are small convenience stores. The only supermarket in the rural part of the main island is a full-service outlet selling everything from diapers to tractors. The third area consists of the numerous smaller islands of the archipelago, with typically only one small store (if any) on each island. These stores are used by locals for small purchases, and by tourists. Many of these small stores have full opening hours only in the summertime, when tourists from Finland and Sweden increase the number of inhabitants in these island villages manifold.

Figure 2. Price level of groceries in Åland (price level in the Turku region is scaled to be 1)



Apart from the administrative trade barrier – the local business license system - at least three potential explanations can be given for the high level of grocery prices in Åland: high retailing costs, uncompetitive market structure and inelasticity of the demand for groceries. Of the many components that increase retailing costs in Åland as compared to bigger market areas, the most obvious have to do with goods transport and VAT border administration. These have been estimated to comprise about 1.3% on average of the total turnover of Åland grocery stores (Kinnunen et al., 2000). However, this estimate was obtained by combining survey data reported by retail outlets and transport companies with data from other sources, so there is a risk of overreporting. Another factor which raises the retail cost level is the small size of many of the stores around the province, and small stores generally have higher costs than larger stores. Other potential reasons are related to the special characteristics of Åland's food processing and wholesale industries, which are very concentrated and lack the benefits of scale economies. Based on a survey among grocery retailers (Kinnunen et al. 2000), combined with balance sheet and CPI weight data, the higher purchase prices of local products may increase retail prices by as much as 2.7%. It is, therefore, reasonable to assume that the wholesale prices of foods produced in Åland are higher than food wholesale prices in continental Finland. But even this estimate is riddled with the social desirability problem: the higher the costs reported by retailers, the smaller their own mark-up appears to be.

Table 1. Market shares of grocery retailing groups in continental Finland and Åland in 1998

	Åland	Finland
K-group	71.9	38.2
Spar-group	10.6	10.5
S-group	3.9	26.3
Independent stores	13.5	5.2
Tradeka+Elanto	0.0	12.2
Wihuri	0.0	4.7
Stockmann	0.0	2.9
Total	100.0	100.0

Sources: AC Nielsen, 1999; Business register of Statistics Finland; regional accounts material of ÅSUB.

The high concentration of Åland's grocery market is demonstrated by the distribution of the retail market (Table 1). The K-group, with a market share as high as 71.9%, is clearly the

dominant retailing group. However, its market power is not necessarily as great as expected – given a market share of over 70% – because the organizational structure of the group is vertically separated. So, at least in principle, K-stores cannot price cooperatively[6].

Domestic per capita consumption expenditure on groceries in 1998 corresponded to 1,700 euros in Åland and 1,400 euros in the rest of Finland (Ahlqvist and Pajunen, 2000). One reason for this difference of around 20% is that the average expendable income of households in Åland is higher than in Finland. Since the income elasticity of food is known to be low (Bearse et al, 1997; Song et al, 1997), it is likely that a more important reason for the high expenditure in Åland is the high level of grocery prices. Another factor that raises the demand for groceries in Åland are tourists' purchases – worth about 10 million euros in 1998 (ÅSUB, 1999). Since the total demand for groceries was equivalent to about 54 million euros, the share of tourists' purchases was nearly 20%[7]. It is natural to assume that tourists' demand for groceries is not price-sensitive, which gives Åland stores an incentive to charge high prices.

3. Data

Our study data consist of store characteristics (including prices for a subset of the stores), market structure data, demographic information and an indicator variable for Ålander products. The market structure and demographic data are from 1998 and all the other data from 1999. With this information, we now examine how store characteristics, demand, market structure, and the goods' place of origin affect food prices.

Store characteristics include exact location, turnover, selling space, and retail group for all stores in Åland and the Turku region. These data are from A.C. Nielsen. In addition, Statistics Finland has collected a price list of 158 products from 15 stores in the Turku region and 13 stores in Åland. Even though 13 stores is small as a sample, one has to remember that there

[6] In principle, K-stores are independent entrepreneurships and the Promotion of Competition Act prohibited them from pricing cooperatively in the years under consideration. In practice, however, the K-group is able to influence the stores' pricing decisions (Aalto-Setälä, 1999).

[7] The high share of tourists' purchases is explained by the many visits made by yachts or caravans, and by tourists who rent summer cottages in Åland.

are just 41 stores altogether in Åland, and the 13 stores in the sample include all of the biggest stores. Thus, the Åland stores in the price data sample represent 63% of total grocery turnover in the Åland Islands. Further, we know from the Finnish Consumer Agency's price comparisons that the prices of the 15 stores in the Turku region are very close to the average level in continental Finland.

This price collection was part of the Consumer Price Index (CPI) calculation process of Statistics Finland and took place during one week in May 1999. The price inspectors of Statistics Finland visited the stores and simply recorded the prices observed. The products in the price list represent the average consumption of a Finnish household. Groceries have a weight of one fifth in the whole CPI basket. Some of the products are branded and, thus, perfectly homogeneous: for example, 1.5 liters of Coca Cola or 300 g package of frankfurters made by Saarioinen (a Finnish food processing company). The rest of the products are homogeneous in principle, but there may be some quality differences. These include items such as 1 kg of salmon fillet or 1 kg of potatoes.

There are missing observations in the price data, because most stores do not carry all the 158 products in the sample market basket. On average, each store in Åland lacked 20 of the items belonging to the basket, and the corresponding number in continental Finland was 11. We calculated a price index for each store and weighted the price observations in the index according to the average consumption in Finland. The missing observations were then replaced by these averages. Because of this substitution, the indexes may be biased towards the averages, but this bias is not significant since the budget share of the products with a high number of missing observations is very modest. Consequently, even though 9.5% of the price observations are missing, only 5.7% of the weighted price observations are.

The demographic data include number of inhabitants, number of households, medium income and size of households, and car density in the area. These data are in grid form, so it has been possible to determine market areas for each store and to calculate demographic variables and market concentration for these areas (for more detailed methodology, see Aalto-Setälä, 1999). The determined market areas are quite small. For example, each island is treated as a market area of its own, since the grocery stores located on small islands are used for convenience purchases by locals as well as by tourists. In both cases, one island is a relevant market area.

The data sets include an indicator showing whether the product was produced in Åland, which enables price comparisons between goods of Åland origin and those from outside the region. We assume that the prices of Ålander products are higher on average than the prices of other products.

Descriptive Statistics

Figure 3 presents the Herfindahl indexes of grocery stores in Åland and in the Turku region. Grocery retailing is much more concentrated in Åland, and concentration is especially high on small islands. A clear relationship can be seen to exist between the concentration of stores and the price level (Figures 2 and 3).

Figure 3. Market concentration in Åland and in the Turku region

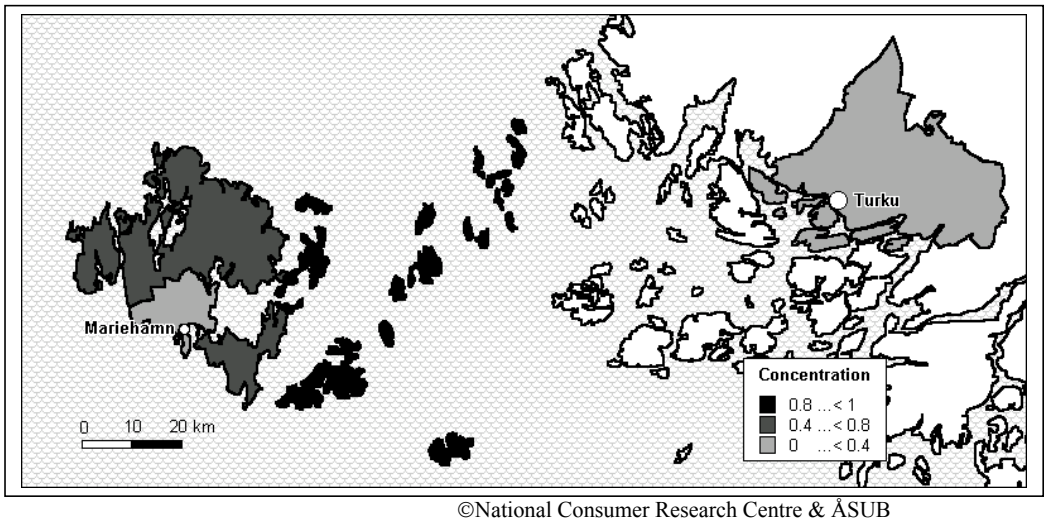


Table 2 presents all the variables – except for the indicator variables – used in the empirical analysis. The selling space variable describes only the selling space devoted to groceries, not the total size of the store. Stores in Åland are generally very small. The average grocery selling space in the study data is 370 m^2 for Åland and 1,010 m^2 for continental Finland. The income level in Åland is higher than elsewhere in Finland, and the concentration of grocery stores is also very high.

Table 2. Variables describing stores

	Åland			Continental Finland		
	Average	Minimum	Maximum	Average	Minimum	Maximum
Selling space (in 100^2)	3.7	0.8	12.5	10.1	0.3	33.4
Price index	115	96	126	101	86	128
Income (in thousands euros)	27.0	21.1	33.1	22.5	17.2	34.4
Herfindahl	0.55	0.06	1.00	0.34	0.07	1.00

4. Model specification and the results

The empirical model of the study estimates the joint effect of market power and scale economies (see, for example, Cotterill and Iton, 1993, or Azzam, 1997) for grocery prices in Åland. Our target is to see how important the small average store size, inelastic demand and concentrated market structure, as well as a lower risk of entry, are as determinants of high prices. We intend to decompose the difference in food prices between Åland and the Turku region – a small isolated market area and a large market area. Section 4.1 first examines pricing at the store level. The idea is to find out whether food prices are higher in Åland even after taking store-level and market-level characteristics into consideration. This estimation follows the customary way of studying price level by using store-level and market-level information only. These do not fully explain the price difference, however, and so Section 4.2 specifies another model, which takes into account store-level and market-level as well as product-level characteristics.

4.1. Price difference at the store level

Although our store-level data comprise most of the grocery retail turnover in Åland, they contain only a relatively small number of observations (N=28). As a consequence, we can use only a limited number of explanatory variables in our store-level analysis. Therefore, only

variables that are shown in current literature to have an effect on the price level of the store are included in the analysis.

The size of the store is an important factor affecting its price level (Bucklin 1986; Cotterill, 1986 and 1999; Aalto-Setälä, 2002). Most studies suggest that an increasing store size reduces the prices (and costs) of the store but at a decreasing rate. Prices may even rise after a certain size. In other words, we expect store size $(Space)$ to have a negative and squared store size $(Space^2)$ to have a positive effect on prices. According to a previous study (Aalto-Setälä, 2000), location in the center of the city is another store-level characteristic that increases the price level of the store significantly. Thus, we include an indicator variable for stores located in the city center (D^{centre}) in our store-level model.

Moreover, several studies have indicated that a concentrated market structure has an impact on prices in food retailing (McFall Lamm, 1981; Cotterill, 1986 and 1999; Aalto-Setälä, 2002). In this study we measure market structure by the Herfindahl index $(Herfind)$. Concentration is obviously expected to raise the price level. It is also known that food prices are affected by demand factors (Cotterill, 1986 and 1999; Aalto-Setälä, 2002). Thus, we use income per household $(Income)$ as an explanatory variable and expect prices to be higher in high-income areas. The last explanatory variable is an indicator variable for stores located in Åland $(D^{Åland})$. If the other explanatory variables of equation (1) explain the price differences between grocery prices in Åland and continental Finland, then the Åland indicator should be zero. Respectively, if the differences are not fully explained by these other variables, the Åland indicator will not be zero.

Thus, the price function describing store-level pricing is

(1) $Index_i = \alpha_0 + \alpha_1 Space_i + \alpha_2 Space_i^2 + \alpha_3 Income_i + \alpha_4 D_i^{centre} + \alpha_5 Herfind_i + \alpha_6 D_i^{Åland} + \varepsilon_i$

where $i = 1,...,28$.

We tested the model and the data in several different ways and found that the model fulfils the assumptions of the classical linear regression model. For example, White's test value was 1.33 (p=0.32). Thus, we estimated the equation by OLS.

Table 3 presents the estimation results of equation (1). The coefficients describing store size are as expected: selling space has a negative and squared selling space a positive coefficient. Both coefficients are statistically significant. The consequence is that the stores have U-shaped cost functions. The minimum price is achieved by a store size of about 2,100 square meters (22,600 square feet).This is about twice the size of the largest store in Åland (see Table 2). Thus, the cost minimizing store size is large compared to the sizes of stores in Åland.

Table 3. Estimation results of equation (1)

Dependent variable: price level of the store		
Independent variables	Coefficient	T-value
Constant	98.97	
Selling space	-1.80**	-4.01
Selling space^2	0.042**	3.24
Income level	0.057	1.09
Center indicator	8.33**	2.94
Herfindahl index	8.38	1.87
Åland indicator	6.35*	2.26
R^2	0.87	
White heterosked. test	F-value: 1.33	

**Significant at 1% level

*Significant at 5% level

The signs of the other variables in the equation are also as expected. Income level has a positive effect on prices, and location in the center of a city and a concentrated market structure increase the price level of the store as well. The estimate of the indicator variable for stores in Åland is positive and statistically significant: the price difference not explained by the other variables of equation (1) is as high as 6%. In other words, even though we take into account the size and location of the store, demand conditions and concentration of the market, the prices of Åland stores are still 6% higher than the prices of stores in continental Finland. We next attempt to explain this price difference by considering product-specific characteristics.

4.2. Price difference at the product level

Because the entire price difference between Åland and the Turku region could not be explained by store- and market-level factors, we try to explain the difference by a product-level model. This is very similar to the store-level model. It explains the prices of single products by the same variables as in equation (1) and also by product-level indicator variables that tell whether the product was made in Åland. The reason for including product-level Åland indicators is that the province has considerable local food production of its own. Because the food processing industry in Åland is so concentrated, we may expect the wholesale prices of Ålander products to be high. The survey estimates of Kinnunen et al. (2000), in fact, suggest that the wholesale prices of Ålander products are higher than of products elsewhere in Finland. Further, the province boasts a strong regional spirit and it is likely that consumers in Åland are prepared to pay more for products of Åland origin. We, therefore, tested the indicator variables for various Ålander product groups. We included significant indicator variables: Åland-produced fresh products $\left(D^{\text{Åfresh}}\right)$, bakery products $\left(D^{\text{Åbread}}\right)$, and fish $\left(D^{\text{Åfish}}\right)$. The estimated equation is:

$$\begin{aligned}(2)\quad \Pr ice_i = {} & \beta_0 + \beta_1 Space_i + \beta_2 Space_i^2 + \beta_3 D_i^{Centre} + \beta_4 Income + \beta_5 Herfind_i \\ & + \beta_6 D_i^{\text{Åfresh}} + \beta_7 D_i^{\text{Åbread}} + \beta_8 D_i^{\text{Åfish}} + \beta_9 D_i^{\text{Åland}} + \varepsilon_i \end{aligned},$$

where $i = 1,...,3426$.

The product-specific model (equation (2)) was tested with the same tests as the store-level model (equation (1)). The results show that the relationships between independent and dependent variables are linear, the right-hand side variables are exogenous and the residuals are nearly homoscedastic. However, because the sample size is so large (N=3,426), White's test for heteroscedasticity rejected the null hypothesis.

Table 4. Estimation results of equation (2)

Dependent variable: price level of the product		
Independent variables	Coefficient	T-value
Constant	95.65	
Selling space	-1.30**	-4.53
Selling space^2	0.032**	4.39
Center indicator	10.71**	6.13
Income level	0.061*	2.43
Herfindahl index	9.01**	3.03
Åfresh	6.48**	4.39
Åbread	14.60**	4.21
Åfish	-15.26**	-2.79
Åland indicator	3.30*	1.99
R^2	0.146	

**Significant at 1% level

* Significant at 5% level

We, therefore, estimated the equation by weighted least squares, which provides correct estimates of coefficient covariances in the presence of heteroscedasticity of an unknown form (EViews4, 2000).

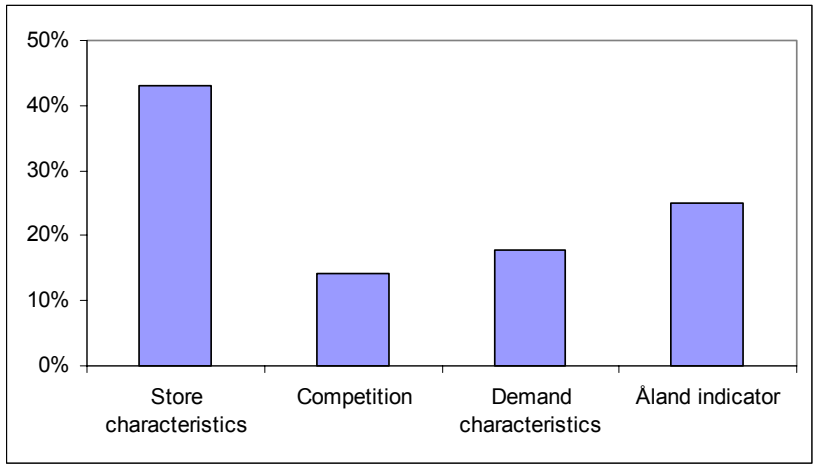
Table 4 gives the estimation results of equation (2). Fortunately, the signs of the variables included in both equations (1) and (2) are the same and even their magnitudes are similar. The statistical significances of the coefficients in these two equations are, of course, very different due to the huge difference in sample sizes (28 stores vs. 3,426 products). Selling space has a negative coefficient in equation (2), while squared selling space has a positive coefficient. The coefficients of the city center indicator, income level and the Herfindahl index are positive and very significant. In other words, location in the center of the city, high income level and high concentration in the store's market area raise the prices of its products.

The indicator variables for Åland-produced items are important, statistically significant explanatory variables of the price differences between Åland and continental Finland. These refer to product groups in which Åland has substantial production of its own. In most cases they are branded goods and easy to recognize as local products. The estimated price premium

for bread (the sum of the indicator variables Åbread, Åfresh and Åland) is as high as 24.4%. The price premium for other fresh products is 9.8%**.** On one hand, the high prices of Ålander products are due to the high concentration and small scale of the food processing industry in the province. On the other hand, it would be possible to import these products to Åland, and such imported goods would be cheaper than the local equivalents. However, it is clear that Ålanders are ready to pay a price premium for products made in Åland. For fish, however, the case is quite the opposite. The price of fish is quite naturally cheaper in the Åland Islands than in continental Finland. Additionally, fish products do not enjoy such local sentiment as other products, particularly if they come from fish farms that are significant local polluters of the marine environment. The estimated price difference for fish is about –5.5%.

Figure 4 summarizes the sources of the high level of grocery prices in Åland. The figure shows that 43% of the price difference between Åland and continental Finland is explained by store characteristics, 14% by competition, 18% by demand factors, and 25% is left to other reasons. These shares were calculated based on the estimates in equation (2) and the differences in the averages of the variables between Åland and Finland (Table 2).

Figure 4. Sources of price difference between Åland and continental Finland



In equation (2), the variables selling space, squared selling space and the indicator variable for location in the city center measure store characteristics, the Herfindahl index measures the

competitive situation, and the variables income level and the product category indicators for Ålander products measure demand conditions. These category indicators could also be interpreted as measuring competition in Åland's food processing industry. We interpret them as measures of demand, because although it would be possible to import cheaper products from neighboring regions, consumers appear to be willing to pay higher prices of Ålander products.

Of the total price difference, 25% is attributable to other reasons – in other words, 25% of the difference is explained by the Åland indicator (3.3 in equation (2)). This includes VAT border administration and transportation costs. Only Ålander stores have VAT border administration costs and, even though all stores have transportation costs, these are higher in Åland than in continental Finland. These two together have been estimated to incur an additional cost of 1-2% for Ålander stores (Kinnunen et al., 2000). In equation (2), the estimate of the Åland indicator is even higher (3.3%). One explanation for the extra difference might be the administrative entry barrier. It seems plausible to assume that the lower risk of entry in Åland would be reflected in prices as well. The fact that the price difference between small stores in Åland and continental Finland is not as high as the difference between large stores[8] suggests that the entry barrier is especially important for large stores.

5. Concluding remarks

This article has dealt with the problem of small isolated markets in the grocery retailing sector. Our starting point was the knowledge that food prices in Åland are significantly higher than in continental Finland, the price difference being about 13%. Our specific aim was to decompose this difference in food prices between a small (Åland) and a large market (continental Finland) and allocate them to various causes. The results of the study are intuitive: the high food prices in the small market area were mainly attributable to a lack of scale economies and to the concentrated structure of the food retailing market and the food

[8] The indicator variable Åland indicator* selling space fits the data even better than the Åland indicator alone. However, we did not use the interaction variable in the final model, because there was no solid theoretical argument to support it.

processing industry. Transportation costs, VAT border administration costs, and inelasticity of the demand for groceries proved to be additional Åland-specific price factors.

The main problem in a small market area is that the market is not sufficient to support a competitive and cost-efficient distribution industry. If there are enough firms to create a competitive environment, they lack economies of scale, and if there are only a couple of firms, the market is not competitive. An additional aspect in Åland is the strong regional spirit of consumers: Ålanders are willing to pay higher prices for products that are made in Åland. This prevents the import of various products – like fresh milk - from continental Finland and Sweden. It appears that there are "natural" causes for the significant differences in grocery prices between Åland and continental Finland, and that there is no easy way to lower the price of food in Åland.

One option available to the local government for reducing food prices would be to use legislative measures to enhance competition and raise the risk of entry in retailing and related services, like goods transport. Traditionally, the political sentiment has quite effectively precluded this option. According to the latest news, however, a Finnish grocery chain is seriously considering entry to Åland. Furthermore, the local government policy seems to be changing, as a Swedish clothing retailer chain as well as a Finnish hamburger chain have recently been allowed to enter the Åland market.

It is clear that Åland's consumers play a critical role in improving the competitiveness of grocery markets. If Ålanders were willing to buy cheaper items produced in the neighboring regions, the price level of food would probably fall a few per cent. If they are unwilling to do so, however, they will continue to support the higher price level of food and the higher profits in retailing and food processing in Åland.

References

Aalto-Setälä, V. (1999): *Economies of scale, product differentiation, and market power,* Helsinki School of Economics and Business Administration A-162.

Aalto-Setälä, V. (2000): *Economies of scale in grocery retailing in Finland*, Journal of Retailing and Consumer Services*,* 7, 207-213.

Aalto-Setälä, V. (2002): *The effect of concentration and market power on food prices; evidence from Finland*, Journal of Retailing, 78, 207-216.

Azzam, A. (1997): *Measuring market power and cost-efficiency effects of industrial concentration*, Journal of Industrial Economics*,* 155, 377-386.

Ahlqvist, K., and Pajunen A. (2000): *Changes in Household Consumption Expenditure in the 1990s,* Statistics Finland, Income and Consumption 2000:28 (Unpublished regional material from the household consumption study was made available to us).

Bearse, P., Bozdogan, H., and Schlottmann, A. (1987): *Empirical econometric modelling of food consumption using a new informational complexity approach*, Journal of Applied Econometrics*,* 12, 563-592.

Bucklin, L., (1986): *Competition among European food distribution systems in concentrated markets*, International Journal of Research in Marketing*,* 3, 249-262.

Chamberlin, E. (1933): *The theory of monopolistic competition,* Cambridge, MA.

Cotterill, R. (1986): *Market power in retail food industry: evidence from Vermont*, Review of Economics and Statistics, 68, 379-386.

Cotterill, R., and Iton, C. (1993): A PIMS Analysis of the Structure Profit Relationship in Food Manufacturing, in R. Cotterill, Eds., *Competitive Strategy Analysis in the Food System*, Westview Press, pp. 25-44.

Cotterill, R. (1999): *Market power and the Demsetz quality critique: an evaluation for food retailing*, Agribusiness: An International Journal, 15, 101-118.

EViews4 (2000): *Eviews User's Guide,* Quantitative Micro Software.

Finnish Consumer Agency (1999): *Pointti: Kuluttajaviraston päivittäistavarakori, 1999* (in Finnish).

Finnish Consumer Agency (2000): *Pointti: Kuluttajaviraston päivittäistavarakori, 2000* (in Finnish).

Kinnunen, J. (1999): *Det åländska transportstödet – dess betydelse och effekter,* Department of Statistics and Research in Åland, ÅSUB Rapport 1999:14 (in Swedish).

Kinnunen, J., Aalto-Setälä, V., and Koistinen, K. (2000): *Dagligvarupriserna på Åland – en komparativ analys,* ÅSUB Rapport 2000:1 (in Swedish).

McFall Lamm, R. (1981): *Prices and concentration in the food retailing industry*, Journal of Industrial Economics*,* 30, 67-78.

Panzar, J., (1989): Technological determinants on firm and industry structure, in Schmalensee, R. and Willig, R., (ed.), *Handbook of Industrial Organization,* Volume I, Elsevier.

Song, H., Liu X., and Romilly P. (1998): *A comparative study of modeling the demand for food in the United States and the Netherlands*, Journal of Applied Econometrics*,* 12, 593-613.

Spence, M., (1976): *Product selection, fixed costs, and monopolistic competition*, Review of Economic Studies*,* 43, 217-235.

ÅSUB (1999): *Turisminkomsterna för olika sektorer i den åländska ekonomin år 1998,* Statistics and Research Åland (in Swedish).

ÅSUB (2001): *Nationalräkenskapsdata för Åland 1993-1998*, Statistikmeddelande 2001:1, Statistics and Research Åland (in Swedish).

ESSAY 3: DALAGEM
- A dynamic applied general equilibrium model of the Åland Islands economy

Jouko Kinnunen

Abstract: This study presents a recursive dynamic, imperfect competition, one-region computable general equilibrium (CGE) model called DALAGEM (**D**ynamic **A**a**L**and **A**pplied **G**eneral **E**quilibrium **M**odel), with endogenous labour supply and relatively inelastic real wages. Due to the fact that the labour supply of the subsequent period depends on the unemployment rate of the current period and on the growth rate of wages compared to wage increases in the neighbouring regions, and due to a Philips-curve type relationship between the local unemployment rate and wage increase, labour market exhibits hysteresis. In this setting, the growth rate of the labour supply is endogenous, making the GDP growth rate endogenous as well. Investment, and thus growth of the capital stock, depends on the profitability of the industry through a Monash-type investment module. An imperfect competition module introduces a Cournot model for multi-product activities with fixed yields for each commodity per unit of activity. The functioning of the model is presented by introducing a competitiveness shock into the economy of liberalising regulations regarding local business licenses. It is shown that by relaxing the barriers to entry, the economy of Åland would be better off. Export-oriented activities characterised by perfect competition would benefit more from the change than imperfectly competitive, home market-oriented activities.

Keywords: dynamic CGE models, imperfect competition, endogenous labour supply

JEL Codes: C68, L13, H20.

1. Introduction

Computable or applied general equilibrium (AGE/CGE) modelling has proved to be an instrumental tool in both research and policy analysis. Modelling capacity of this sort can be found in at least twenty countries around the world (Devajaran – Robinson, 2002). The models have been used for the analysis of trade policies, economic integration, tax reforms and public spending, labour market issues, structural adjustment, regional development, as well as income distribution. With the development of new software and computing capacity, as well as ready-made model packages, the start-up costs in time and effort have diminished, making this sort of modelling increasingly accessible to new groups of users. The focus of CGE studies has varied from the village level to the global level, which exemplifies its flexibility.

This paper is the first to document the current, dynamic model version, which we plan to use as a generic tool in the future work of Statistics and Research Åland (ÅSUB). Our model tries to capture the specific features of the economy of Åland: extensive migration, which turns the development of labour supply endogenous, the special lump sum financing system of the public sector, imperfect competition in the domestic market, as well as transaction costs in trade with the rest of the world (due to geography and institutional reasons).

To explain the use of the model, we present a simulation of an increased threat of entry to the domestic market of Åland, which reduces the degree of cooperation between firms and pushes the markets closer to perfect competition.

Given the purpose of this essay of documenting the model, some of its features may be superfluous for the current policy issue. Thus, we are aware of probably breaking the modellers' own version of the "Occam's razor" rule of policy modelling: use the simplest model adequate for the task at hand, as advocated by Devajaran and Robinson (2002). We kindly ask the reader to have patience with the extensive model documentation.

This study is organised as follows. Section two provides the historical background of the policy issue. Section three introduces CGE modelling as a method, guides the reader through the central features of the present model, and presents the data and parameter estimates used

in the analysis. The fourth section presents the simulations and their results. Section five concludes.

2. Background

The degree of competitiveness of the domestic market in Åland is less than perfect, not only because of its geographical isolation, but also due to administrative-legislative barriers to entry. Entrepreneurs need to possess the Åland regional citizenship in order to conduct a permanent business in Åland.

The historical background of the business license system is primarily related to protecting the ethnic-linguistic Swedish-speaking minority. When the League of Nations was dissolved, voices were raised for revised protection of Åland's nationality. After several years of preparatory work, the new legislation concerning the right to conduct business was passed in 1957. Interestingly, as justification it was mentioned that new law was needed urgently, as "Finnish firms had shown interest in starting up activities in the province. If this is to be allowed, it will endanger the economic relations in the province" (Lindström, 2002).

Accordingly, setting up of the system was mainly motivated by language policy, although there were elements of protectionism as well. In later revisions of the legislation, two primary objectives were provided for the continued existence of the instrument. First, the aim of the legislation is to secure the status of the Swedish language in Åland, and second, to promote positive development for the private sector of the Åland economy (Lindström, 2002). EU membership did not bring about any fundamental change to the state of affairs, as Åland was exempted from the EU regulations on competition through specific treaty accession protocol No 2 on the Åland Islands, which is a part of Act of Finnish Accession to the European Union (Scarpulla, 2002; Lindström, 2002).

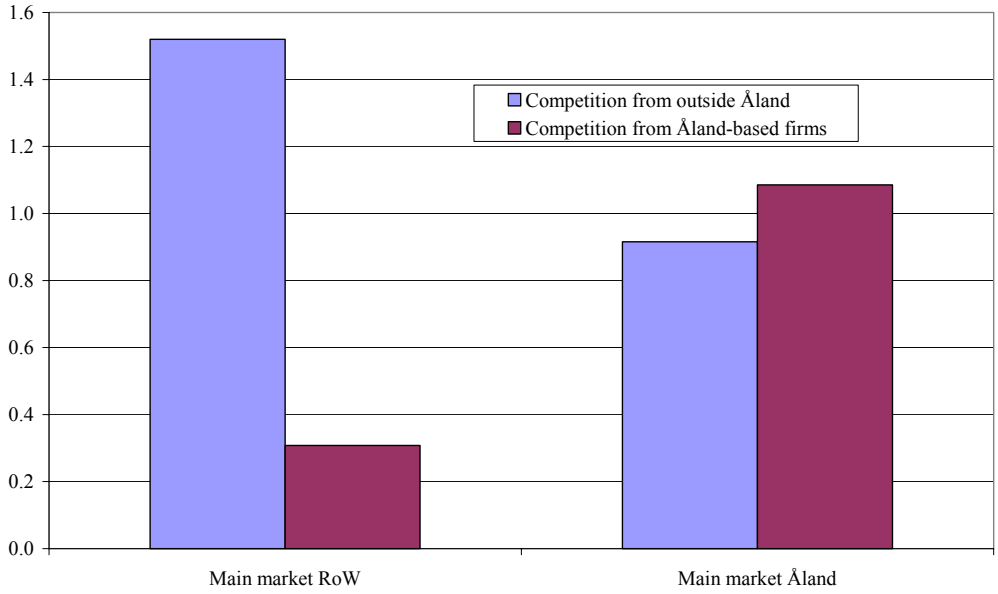
In practice, temporary licenses are routinely granted to providers of specialised services, e.g. to construction companies. It is very rare for a temporary license not to be granted for an applicant. Consequently, Åland-based firms have occasionally raised the call for a more restrictive practice. However, current legislation probably limits potential competition from

non-island businesses, as widespread impression among these firms seems to be that Åland is not accessible to them. According to interviews, firms that had been granted the temporary license at least once considered the existence of the system to have given them a competitive advantage, as many of their potential competitors in the Finnish mainland had not learnt to cope with the administration process of the temporary business licences. However, the exact effect of the business license system is not known (see Lindström, 2002).

In a recent study of growth industries in Åland, Fellman (2004) reports that entrepreneurs regarded competition from firms based outside Åland as a greater obstacle to their development than local competition. However, the perceived severity of competitive threat is closely linked to the share of the domestic (i.e. Åland), market in their sales. The higher the sales outside Åland, the greater the importance of outside competition, and vice versa. In figure 1, respondents to a recent survey are divided into two groups, those having their main market in Åland, and those having it in the rest of the world (hereafter RoW). We see that competition beyond the islands is naturally more important for outward-oriented businesses. In addition, we see that outside competition is not perceived to be as important as local competition, although the difference is very small, given the qualitative nature of the indicators.

We can also draw a conclusion that for a part of the economy, markets beyond the home region are not so relevant in terms of competition. In the sections below, we explain how imperfect competition is introduced in the model, and give a general presentation of the model structure.

Figure 1. Average responses to the claim that competition hampers development of a firm



Degree of competition graded from 0 for not at all, to 3 meaning a considerable amount

Source: Survey data by Fellman, 2004.

3. Model structure and data

3.1. General features of CGE models

Johansen introduced CGE modelling for the first time in 1960 (Devarajan – Robinson, 2002; Bergman, 1990). But the CGE modelling did not become more widely used until the 1970s, when computational power and solution algorithms, as well as user interfaces, were developed and became more commonly accessible. Nowadays, the CGE models are widely used all over the world in academic studies as well as in applied policy analysis concerning trade policy, agriculture, migration and labour markets, public finance, structural adjustment, income distribution etc. (see Devarajan – Robinson, 2002). Devarajan and Robinson (2002) suggest that the ability of the models to provide timely and relevant results for various policy questions on hand is one of the reasons why a considerable share of CGE modelling development takes place in government agencies and research institutes, rather than within the academia.

In a CGE model, agents maximise their objective functions (welfare or profits) according to the budget or other constraints they face. Some of the agents, like the public sector, have their behaviour determined by exogenous parameters, without having an explicit objective function. Production and demand of agents are typically specified with smooth, twice differentiable functions. Maximising behaviour is captured by solving the first-order-conditions (FOCs) of their maximisation problem, and by using the FOCs in the description of the agents' behaviour. For example, factor demands are derived from the FOCs of a firm's profit maximisation problem (see equations A.15 and A.16 in appendix 4). Using the FOCs enables us to have several maximisation problems simultaneously present in the model, without having to explicitly maximise any of them when the model is solved.

A CGE model is calibrated in such a way that it produces the base year data as its solution when no shocks are introduced. To accomplish this, the model draws both on the data included in the SAM, as well as on extraneous information that determines the behavioural parameter values of the model. When a shock is introduced into the model, a CGE model obtains a new equilibrium through the adjustment of both prices and quantities, according to specifications of each market.

3.2. IFPRI Standard Model, antecedent of the present model

This modelling exercise has resulted in a recursive dynamic model for the Åland economy, which originates from a static computable general equilibrium (CGE) model called IFPRI Standard Model, developed by the International Food Policy Research Institute. The IFPRI Standard Model is an example of the neoclassical-structuralist modelling tradition (see Lofgren at al, 2002). As the above characterisation suggests, the model leans heavily on the neoclassical micro theoretical foundation. However, the structuralist features of the model are present in order to increase its relevance as a realistic representation of the economy it describes. An example of these features is the presence of exogenous wage differentials between activities.

The IFPRI Standard Model is primarily designed for country-level analysis, but it is easily adjusted to different levels of analysis like regions or even villages (Lofgren et al, 2002). One of its special features is particularly useful for analysing Åland, namely the explicit modelling of transaction costs. For an island economy, the size of transaction costs may considerably affect the development of industries. Furthermore, the costs of the fiscal frontier in Åland can be included in the transaction costs[9].

The model is constructed around a social accounting matrix (SAM), which is a comprehensive, economy-wide data framework that includes input-output data, national accounts, as well as transactions between the institutions of the economy (Lofgren et al, 2002). The advantage of SAMs is that they can provide a comprehensive and consistent record of the interrelationships within an economy at the level of individual production sectors, factors, households, and the institutions of the economy (Reinert – Roland-Holst, 1997). In a SAM, the rows represent receipts, and columns outlays of an account, according to definition must balance.

The accounts of a SAM can be divided into four groups: activities, commodities, factors and institutions. Activities describe the production of output. Commodity accounts establish the source of the commodities including local production and imports, as well as their destination. Factor accounts describe the source and destination of factor incomes. Institution accounts include the expenditure and income of different institutions, including saving-investment accounts, as well a RoW account. Table 1 below shows the basic structure of a SAM. Note that home consumption, i.e. consumption of own products by primary producers is not included in the SAM of the present model. The Åland SAM is constructed for the base year 2000 (see appendix 2). The key sources of the data were the regional input-output accounts of Statistics Finland (2000), several regional accounts publications by ÅSUB and Statistics Finland, tax income statistics, as well as numerous studies by ÅSUB (see Lindström – Kinnunen, 2004).

[9] Lindström and Kinnunen (2004) analysed the importance of the fiscal frontier with a static version of the model, which showed that the administrative costs have quite limited effects on the economy. However, the model cannot capture effects of possibly missing trade due to reluctance of potential trade partners to engage in trade with Åland, in fear of time-consuming bureaucracy.

Table 1. Structure of a Social Accounting Matrix (SAM)

Receipts	Expenditures					
	Activities	Commodities	Factors	Domestic Institutions	Rest of World	Totals
Activities		Market sales		Home consumption		Activity income
Commodities	Intermediate inputs	Transactions costs		Final market demands	Exports	Commodity demand
Factors	Value added				Transfers	Factor income
Domestic Institutions	Taxes	Tariffs, Taxes	Income, Taxes	Transfers, Taxes, Savings	Transfers, Savings	Institution income
Rest of World		Imports				Foreign exchange outflow
Totals	Activity spending	Commodity supply	Factor spending	Institution spending	Foreign exchange inflow	

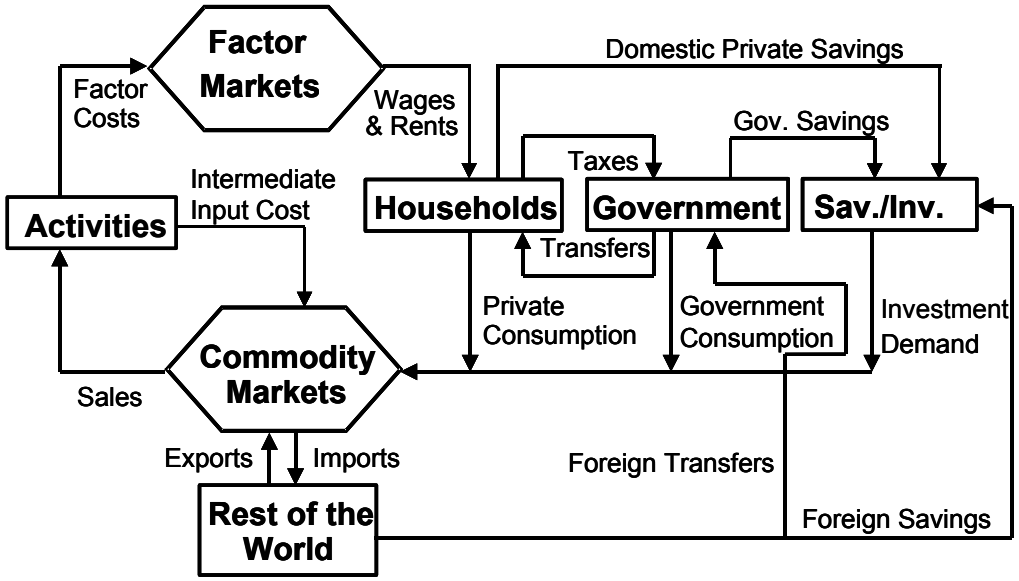
Source: Lofgren et al, 2002.

The key problem in producing a SAM is how to reconcile the theoretical neatness with real-world data, which often have to be collected from various sources that use diverging methods and definitions, or simply produce contradictory figures. Therefore, the available data have to be adjusted to produce a collection of accounts that balance, in order to provide a snapshot of an economy, where all the income has corresponding outlays in equal amounts (see also Leadership group SAM, 2003). SAM balancing can be accomplished by several methods. The Åland SAM was balanced by using a cross entropy method, which is akin to the standard "RAS" method.[10] Robinson et al. (2001) showed with Monte Carlo simulations that the cross entropy method should be the preferred choice (for the cross entropy programme code, see Robinson – El-Said, 2000).

A SAM reflects the structure and level of aggregation of the model it serves as platform for. The model has to account for all the monetary flows presented in a SAM. Figure 2 presents a simplified version of the monetary flows in our model economy.

[10] The name refers to an estimation problem of generating new coefficient matrix A* from the old one (A), once the new row and column sums are known: $A^* = r^* A s^*$.

Figure 2. Stylised model structure

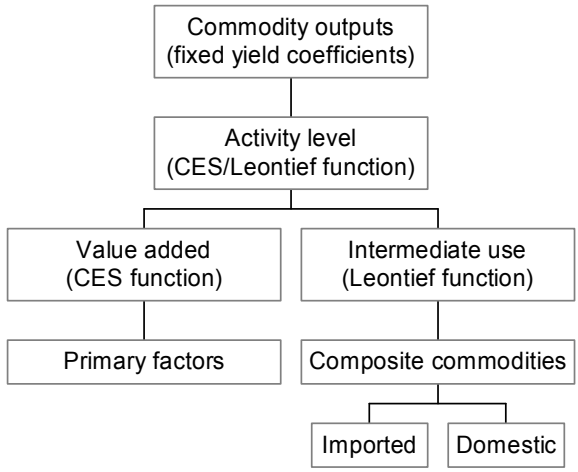


Source: Lofgren et al., 2002.

Most of the flows depicted in figure 2 have a physical counterpart going to the opposite direction. Activities maximise profits according to the technological constraints they face and allocate production between exports and domestic use as described above. The government sector collects taxes from households (and firms, not included in the figure) and, in turn, allocates transfers to them. Households receive payment for providing production factors and from the transfers. Savings account balances total savings and investment expenditures. Changes in foreign savings ensure that investments are financed with a corresponding amount of total savings.

Production technology is described with nested CES/Leontief functions very much in the standard manner of these models. However, in contrast to several other models, each activity can produce more than one commodity according to fixed yield coefficients. This feature is very important for the Åland SAM, as several firms placed under a NACE-code have important secondary activities in addition to their main business.

Figure 3. Production technology



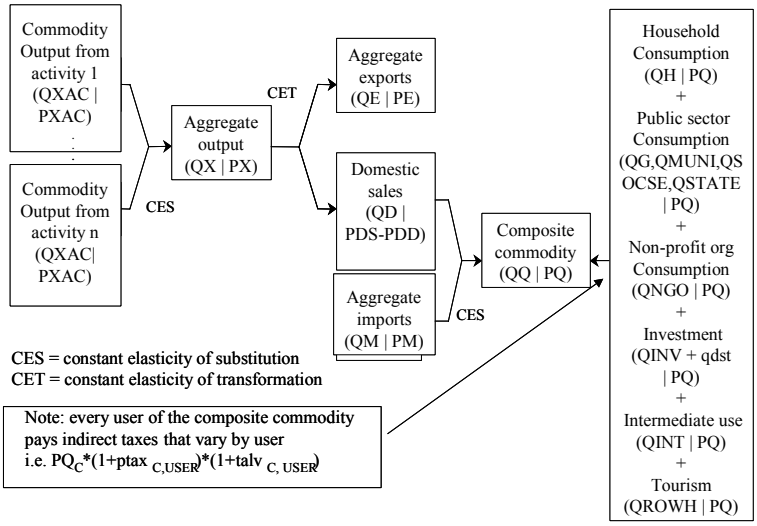
Source: Lofgren et al., 2002.

A typical example of this phenomenon is tourism, which frequently is registered under some other activity than NACE 55 “Hotels and Restaurants”.

If each activity produced only one commodity, there would not be any need for commodity accounts, as there would be a one-to-one mapping from activities to commodities. Each activity (producer) maximises profits subject to the production technology. Allowing for multi-commodity production opens the possibility of several activities producing the same commodity (see fig. 3). In the IFPRI Standard model, it is assumed that commodities produced by different activities are imperfect substitutes to each other.

The commodity market is modelled as follows: the commodities produced by different activities are aggregated into a composite good by a constant-returns-to-scale aggregator CES function which could be considered as a virtual wholesaler who buys his inputs and combines them according to a diminishing technical rate of substitution that follows from the CES form of his “production function”. The composite domestic product is either sold domestically or exported, which is determined by a CET function (Armington, 1969). The portion going to the local market is combined with imports as a final aggregate commodity that is used by agents (see fig. 4).

Figure 4. Aggregation in the commodity market



Source: adapted from Lofgren et al., 2002.

3.3. Central features of the present model

The size of the present model code is approximately the double that of the Standard Model, if size is measured by the number of (groups of) equations. The most important changes, together with the central original features of the model, are presented below in detail. In order to make reading of this study at least a little bit easier, a major part of the model documentation is given in the appendices. In appendix 1, the level of aggregation and the industries of the model are presented. Appendix 2 presents Åland SAM year 2000. Explanations for the sets, parameters and variables of the model are found in appendix 3. Equations of the model are presented in appendix 4. Appendix 5 introduces the first steps in the derivation of one of the central equations for the imperfect competition module. Finally, appendix 6 presents a table outlining the results of non-linear estimation of production function parameters for the activities of the model.

3.3.1. Agents/institutions

The present model has four public sector agents: the regional government, the central government, the municipalities, and social security funds. This distinction is necessary in order to model the economic relations between the Åland government and state. Introduction of the municipalities can be justified by the fact that the regional government utilises its own taxation authority on a very limited basis (although it has authority to collect corporate taxes on top of the state taxes), whereas municipal taxation is an important source of financing of the activities in the 16 municipalities of Åland. As the model allows for unemployment, and a part of the expenditure of social security funds is determined by the unemployment rate, it is practical to have a separate account for these funds. Responsibility for most of the social security funds belongs to the state administration and potential financial deficits are thus born by the state, although transactions between the state authorities fall outside this model. Thus, rest-of-the-world (RoW) finances the deficit of social security funds in this setting.

Another agent introduced in the present model is a "tourist household" that spends money on tourism according to a Cobb-Douglas expenditure function. The level of total expenditure is exogenous. Another agent applied here is a "firms account", which allocates the capital earnings from production activities to different destinations.

Two households are introduced: native households, the head of which is a native Ålander, and migrant households. These households have similar LES expenditure functions (consumption information is scarce), but they differ in certain respects, e.g. the share of capital income is higher for the native households, and migrants have a higher propensity to become unemployed and to migrate (more on these issues below).

3.3.2. VAT and product taxes

In the Standard Model, indirect taxes are structured so that sales taxes are equal for every user. This present model has been adjusted to reflect the VAT and product tax system applied in Finland. Therefore, the amount of product taxes and non-deductible VAT varies by user

and commodity according to the Finnish input-output tables 2000 (Statistics Finland, 2004a). In other words, we assume that Ålanders' consumption generates VAT payments in the same fashion as on the mainland Finland. Easy access to tax-free products may actually lower the "VAT-intensity" of private consumption in Åland. However, this effect has not been taken into account due to lack of data.

3.3.3. Imperfect competition

The IFPRI Standard Model assumes perfect competition. In the present model, the user determines the degree of competition by activity. Imperfect competition with increasing returns to scale, caused by recurrent fixed costs, is modelled by assuming that firms within the same activity produce homogenous commodities in a Cournot-type oligopolistic competition according to the specification of Francois – Roland-Holst (1997), but as stated above, same commodities from different activities are imperfect substitutes. For example, accommodation services produced by hotels are imperfect substitutes to the B&B accommodation offered by farmers. Each IC activity is assumed to have a recurrent fixed cost that requires a mark-up between the price and marginal cost of the activity so that firms can reach a normal profitability level. In the base year equilibrium, the mark-up covers only the fixed cost and hence extraordinary profits are zero. The mark-up definition then becomes as follows (we ignore possible taxes and subsidies, as well wage rigidities between industries):

$$PA_A \cdot QA_A \cdot \left(1 - \frac{\Omega_A}{n_A * \varepsilon_A}\right) = PVA_A \cdot QVA_A + PINTA_A \cdot QINTA_A - n_A \cdot \sum_F QFZ_{A,F} \cdot W_F \qquad (1)$$

Where:

PA_A	Price of activity A
PVA_A	Price of value added
$PINTA_A$	Price of a composite intermediate good
W_F	Price of factor F (capital or labour)
QA_A	Quantity of activity
QVA_A	Quantity of value added
$QINTA_A$	Quantity of composite intermediate good
$QFZ_{A,F}$	Recurrent fixed quantity of factor F

n_A	Number of firms
Ω_A	Conjectural variations variable
ε_A	Perceived elasticity of demand for the activity

Note that on the right-hand-side, the recurrent fixed cost is subtracted from the total costs in order to get variable costs. Similarly, on the left-hand-side, the equation tells us which part of the total revenue covers variable costs. Note how the quantity of value added is positive, only after using factors $QF_{F\,A}$ in amounts exceeding the recurrent fixed amount needed to carry on with production.

$$QVA_A = \alpha_A^{VA} \cdot \left(\sum_F \delta_{F\,A}^{VA} \cdot (QF_{F\,A} - n_A \cdot QFZ_{F\,A})^{-\rho_A^{VA}} \right)^{-\frac{1}{\rho_A^{VA}}} \quad (2)$$

where:

α_A^{VA}	Efficiency parameter in the CES value-added function
$\delta_{F\,A}^{VA}$	CES value-added function share parameter for factor F in act. A
ρ_A^{VA}	CES value-added function exponent.

The number of symmetric domestic firms is calculated as reciprocals of Herfindahl concentration index similarly to Willenbockel (1994). An inverse Herfindahl index represents the number of hypothetical symmetric, equal-sized firms, which would result in the same concentration level as the actually observed level (Willenbockel, 1994). The indices calculated for the study industry aggregates are output-weighed averages (turnover and value added applied here) over Herfindahl indices for three-digit NACE branches within each model industry. If the indices were calculated directly for the study industries, it would lead to serious understatement of concentration levels (Willenbockel, 1994). In some industries, three-digit NACE data may still be too aggregated to describe the actual situation. However, even this level of aggregation produces very high concentration levels in Åland, except in construction, where there are several small, specialised firms in the market. Business registry of firms in Åland (obtained from Statistics Finland's nationwide registry) was the source of data for the calculation. An arbitrary number of 100 is employed for the primary sector, as the majority of primary producers are not registered as firms, and therefore are excluded from the database used here. Furthermore, perfect competition is assumed to prevail on the market of agricultural products (see table 2).

Table 2. Concentration levels by industry

	Number of symmetric firms	Herfindahl index
Primary production	100	0.01
Food industry	1.27	0.786
Other manufacturing	1.57	0.636
Gas, electricity, heating, water supply	2.44	0.41
Construction	11.83	0.085
Trade	4.57	0.219
Restaurants and hotels	8.37	0.119
Transport	2.37	0.421
Business services	2.29	0.402
Personal services	2.35	0.426

Source: own calculation based on the Business registry data of Statistics Finland.

Not all the other activities are assumed to operate in imperfectly competitive markets either. Non-competitive behaviour is assumed to be mostly present in activities, which mainly operate on the domestic market (i.e. on the Åland islands). The geographical situation of "insulated" markets, together with VAT border, and administrative barriers to entry, create markets protected from outside competition (for the case of groceries, see essay 1 of this dissertation; for the effect of Ålands' administrative barriers to entry, see also Lindström, 2002).

Price-cost margins vary inversely with the number of firms and the market elasticity of demand. If free entry is assumed, extraordinary profits are always zero. In effect, as capital is sector-specific, economic growth with a fixed number of firms would lead to higher capital earnings, not to extraordinary profits. Therefore, no distinction is made between "pure profits" and other returns to capital. This is also justified by the fact that there is no information on the amount of pure profits in the base year. The variable for conjectural variations and the number of firms are assumed to adjust according to the following function.

$$\Omega_A = \frac{\Omega_A^0 \cdot n_A^0}{n_a \cdot \psi_A} \tag{3}$$

where:

Ω_A^0 Initial value for conjectural variations variable

n_A^0 Initial number of firms

ψ_A Competitive pressure from firms based outside the home region.

Hence an increased number of firms present in the domestic market augments the perceived rate of competition, and reduces the size of Ω_A. In the limiting case of zero value of Ω_A, the model is back in perfect competition. The formula differs from the textbook example of Francois and Roland-Holst (1997) in one respect: parameter ψ_A is added here to reflect competitive pressure coming from outside the home region. It is assumed to equal unity initially. If the Government of Åland relaxes barriers to entry, ψ_A gets a higher value, which is - regarding Ω_A - equivalent of having a larger number of firms present in the domestic market.

As stated above, increasing returns to scale follow from the assumption of a recurrent fixed cost. Chambers (1988) shows that returns to scale (RTS) equal the ratio between average costs and marginal costs. Cost disadvantage ratio, CDR, defined as (AC-MC)/AC defines the size of mark-up. By using the Cournot - conjectural variations version of the Lerner oligopoly-pricing rule together with the above information, we get (see Francois – Roland-Holst, 1997).

$$CDR_A = \frac{AC_A - MC_A}{AC_A} = 1 - \frac{1}{RTS_A} = \frac{\Omega_A}{n_A \varepsilon_A} \tag{4}$$

The model is calibrated by using an extraneous estimate on the returns to scale and number of firms, and by calculating the perceived elasticity of demand. Conjectural variations parameter Ω_A is thus calibrated residually. Ω_A reconciles the rest of the data with each other; if it had to equal unity for all the industries, we would have to calibrate some other parameter(s) residually (for different calibration strategies, see e.g. Willenbockel, 2002).

There are several options available for calculating the perceived elasticity of demand. Actually, the model would work even if we just guessed the elasticity values, or used survey information for them, for example. Here we opted to calculate the elasticity as if the firms were aware of the form of the demand system in the model. The exact way of doing this borrows from the examples given by Willenbockel (2002), De Santis (2002), and Francois – Roland-Holst (1997), although none of these were applied to a multi-product case.

It is assumed here that the firm first calculates the price elasticity for each of its products, and then takes their weighted average in order to obtain the price elasticity of its *activity*. In doing so, the firm goes through from the bottom of the demand system, nest by nest to the final demand level on the top of the demand system.

In the first phase of this calculation, the producer must consider the share of its activity in the aggregation of the relevant product over all activities. Therefore, the perceived price elasticity is dependent on the CES elasticity of substitution between products from different activities. By making use of dual price indices and other features of CES functions, a simple version of the demand elasticity ε_{AC} for a product C from activity A appears as follows:

$$\varepsilon_{AC} = \sigma_C^{AC} + (1 - \sigma_C^{AC}) \cdot \frac{PXAC_{AC} \cdot QXAC_{AC}}{PX_C \cdot QX_C} \tag{5}$$

where:

σ_C^{AC}	CES elasticity for the domestic commodity aggregation
$PXAC_{AC}$	Price of commodity C produced by A
$QXAC_{AC}$	Quantity of commodity C produced by A
PX_C	Price of domestic commodity aggregate C
QX_C	Quantity of domestic commodity aggregate C.

The above formula is in fact identical with that of Francois – Roland-Holst (1997), although applied to the production of a commodity from different *regions* (see also Willenbockel, 2002; derivation of the equation (5) is found in appendix 5). However, in contrast with their models, the oligopoly producer of the current model perceives the effect of changing his production level on the aggregate product expenditure $PX_C \cdot QX_C$, which then produces the next nest in the chain of derivations. By applying a small-country assumption, and by assuming limited foresight concerning the expenditure on transaction costs and investments, the formula for ε_{AC} turns out to be as follows:

$$
\begin{aligned}
&\varepsilon_{AC} = \sigma_C^{AC} + (1-\sigma_C^{AC}) \cdot \frac{PXAC_{AC} \cdot QXAC_{AC}}{PX_C \cdot QX_C} - \frac{PXAC_{AC} \cdot QXAC_{AC}}{PDS_C \cdot QD_C} \\
&\cdot [-\sigma_C^T + (1+\sigma_C^T) \cdot \frac{PDS_C \cdot QD_C}{PX_C \cdot QX_C} + \frac{PDS_C}{PDD_C} \cdot (1 + icd_{CC \in CD} \cdot \frac{QD_{C \in CT}}{QQ_{C \in CT}}) \\
&\cdot [-\sigma_C^Q + \sigma_C^Q \cdot \frac{PDD_C \cdot QD_C}{PQ_C \cdot QQ_C} + PDD_C \cdot QD_C \cdot [\{ \sum_{A \in ALEO} ica_{CA} \cdot inm_A \\
&\cdot (-\sigma_C^{AC} - (1-\sigma_C^{AC}) \cdot \frac{PXAC_{AC}}{PX_C \cdot QX_C}) \cdot \frac{PDD_C \cdot QQ_C}{PDS_C}\} + \\
&\sum_{A \in ACES} -\sigma_A^A \cdot QINTA_A \Big/ PINTA_A \cdot ica_{CA} \\
&- \sum_H (\beta_{CH} \cdot (EH_H - \sum_C PQ_C \cdot (1+t_{CH}^P) \cdot (1+t_{CH}^{VAT}) \cdot \gamma_{CH}) \\
&/ (PQ_C^2 \cdot (1+t_{CH}^P) \cdot (1+t_{CH}^{VAT}))) \\
&- \frac{\beta_C^{NGO} \cdot E_{NGO}}{PQ_C^2 \cdot (1+t_{C\,NGO}^P) \cdot (1+t_{C\,NGO}^{VAT})} - \sum_{TH} \frac{\beta_C^{TH} \cdot E_{TH}}{PQ_C^2 \cdot (1+t_{C\,TH}^P) \cdot (1+t_{C\,TH}^{VAT})} \\
&+ icm_{CC \in CM} \cdot \frac{QQ_C}{QD_C} \cdot \sigma_C^Q \cdot \frac{QM_C}{PDD_C} - (ice_{CC \in CE})^2 \cdot \sigma_C^T \cdot \frac{QE_C}{PE_C} - icd_{CC \in CD} \\
&\cdot \frac{QQ_C}{QD_C} \cdot \sigma_C^Q \cdot \frac{QD_C}{PDD_C}]]]
\end{aligned}
\tag{6}
$$

Where:

PDS_C	Supply price for commodity C produced and sold domestically
PDD_C	Demand price for commodity C produced and sold domestically
PQ_C	Price of final composite good C
QD_C	Quantity of domestic sales of C
QQ_C	Quantity of final composite good supply C
QE_C	Quantity of exports
QM_C	Quantity of imports
E_{NGO}	Expenditure of NGOs/NPOs (non-profit organisations)
E_{TH}	Expenditure of tourist households
ica_{CA}	intermediate input C per unit of aggregate intermediate
inm_A	aggregate intermediate input coefficient
β_{CH}	Marginal share of consumption spending on commodity C for H

β_C^{NGO}	Cobb-Douglas consumption share of C for non-profit organisations
β_C^{TH}	Cobb-Douglas consumption share of C for tourist households
σ_C^T	Exports-domestic sales transformation elasticity
σ_C^Q	Imports –domestic use elasticity of substitution
σ_A^A	Top-level elasticity between intermediates and value added
γ_{CH}	Subsistence consumption of commodity C by household H
t_{CH}^P	Product tax rate for commodity C and user H (other users in similar fashion)
t_{CH}^{VAT}	VAT rate for commodity C and user H (other users in similar fashion)
icd_{CC}	trade/transaction cost input of C per unit of C produced and sold domestically
icm_{CC}	trade/transaction cost input of C per unit of C imported
ice_{CC}	trade/transaction cost input of C per unit of C exported

Sets:

CD	Commodities with domestic sales of output
CE	Exported commodities
CM	Imported commodities
TH	RoW households, tourists (currently only one tourist household is used)

Note that we assume here that ε_{AC} is independent of Ω_A, as Willenbockel (2002) suggests. However, it is also possible to relax this assumption, as proposed by De Santis (2002) to be the correct way of deriving the perceived price elasticity of demand. However, this would lead to even more tedious calculations, so that option is not undertaken here.

The final ε_A is simply

$$\varepsilon_A = \sum_C \theta_{AC} \cdot \varepsilon_{AC} \tag{7}$$

Where

θ_{AC}	Yield of commodity C per unit of activity A. Note that $\sum_C \theta_{AC} = 1$.

Imperfect competition (IC) models have received criticism on the grounds that the introduction of a non-convexity – fixed costs – to the model, opens up the possibility of multiple equilibria. However, whether convexity of the producer problem is sustained depends on the parameter values, as well as on each individual model specification (Ginsburgh – Keyzer, 1997). Therefore, it is an "empirical" issue that cannot be resolved analytically beforehand. No signs of multiple equilibria were detected in using the present model.

Another, related problem is the numéraire issue. Ginsburgh (1994) shows by using a provocative example (as described by Willenbockel, 2002) that the choice of the numéraire may affect results more than elimination of market imperfections. However, Willenbockel (2002) shows that as far as the perceived elasticity of the producer is homogenous of degree zero in prices, the price normalisation issue does not "raise its ugly head". This happens when the monopolist/oligopolist is unaware of general equilibrium repercussions of variations in its own decision variable on other products' prices, wages and production (the "Ford effect"). Even in the case of less limited cognition of the producer, the effects of price normalisation are negligible, if the share of IC output in consumer expenditure is sufficiently small. In the present model, the perceived elasticity of the producer is homogenous of degree zero as well as the rest of the (static part of the) model, so price normalisation is not an issue here.

Another critical point is the plethora of different model specifications for describing the imperfectly competitive business environment. However, Willenbockel (2003) also shows that applied trade analysis should be more concerned with the numerical specification of trade elasticities, as IC model results according to his analysis seem quite robust for different specifications of imperfectly competitive behaviour. Abayarisi-Silva and Horridge (1996) show in turn that the different ways to model imperfect competition and economies of scale affect the size of the impact of non-competitive behaviour in simulations. The modelling strategy with the closest resemblance to the present model (Lerner oligopoly pricing rule and increasing returns to scale) is reported to cause the least differences with perfect competition, constant-returns-to-scale models in simulation with tariff cuts. This should be borne in mind when we analyse the simulations results below.

3.3.4. Labour market: in-period and dynamic adjustment

In the present model, the functioning of the labour market differs considerably from the original IFPRI model. However, demand for labour is practically identical to the original version. Demand for each factor is set to a level where its marginal revenue product (net of intermediate input costs) equals the activity-specific factor price (Lofgren et al, 2002).

$$W_F \cdot WFDIST_{F\,A} = PVA_A \cdot QVA_A \cdot \left(\sum_{F'} \delta_{F\,A}^{VA} \cdot QF_{F\,A}^{-\rho_A^{VA}} \right)^{-1} \cdot \delta_{F\,A}^{VA} \cdot QF_{F\,A}^{-\rho_A^{VA}-1} \tag{8}$$

where

$WFDIST_{F\,A}$	Factor wage distortion variable, exogenous for labour
$\delta_{F\,A}^{VA}$	CES value-added function share parameter for factor F in act. A
$QF_{F\,A}$	Quantity demanded of factor F from activity A
ρ_A^{VA}	CES value-added function exponent.

Note that the original feature of sector-specific fixed wage differentials is also kept unchanged. The exogenous wage differentials can be considered to embody different kinds of labour market institutional features and market imperfections like trade unions, efficiency wages etc. that are left outside explicit modelling effort. In addition, we assume that a negative relationship exists between the average wage rate and unemployment rate (see e.g. Blanchard and Katz 1992, Blanchflower and Oswald 1994, Bayar et al, 2004, or De Santis, 2003). Even the introduction of a wage curve can be assumed to be a reduced form for efficiency wage and bargaining models (De Santis, 2003).

$$W_L = WC \cdot \left[(CPI / CPI0) + wgr \cdot \left(\frac{U}{U^0} \right)^{\beta_u} \right] \tag{9}$$

where

W_L	Current-period wage rate (economy-wide average)
WC	Wage rate of the former period
wgr	Exogenous, national rate of increase in wages
U^0	Initial unemployment rate in Åland

U Current unemployment rate in Åland

β_u Elasticity parameter.

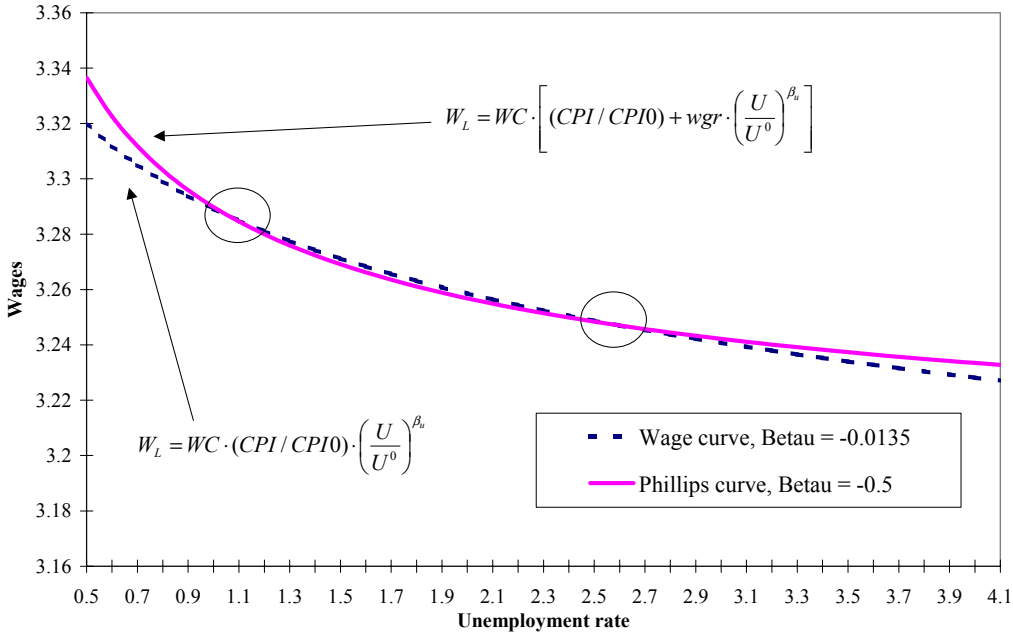
Note that we have chosen to direct the effect of unemployment to the rate of wage increase, instead of having it affect the wage rate directly. Thus, one could argue that instead of a wage curve, we introduce a Phillips curve, named after Phillips (1958), who in his seminal paper estimated a negative relationship between the rate of change of wages and unemployment (for a discussion on the matter, see Blanchflower and Oswald, 1994). Our choice makes sense in a dynamic setting, when adjustment of the labour market is assumed to be slow and to extend over a number of years. Moreover, the usual wage curve configuration is essentially a static, long-term relationship, and should thus be used in static models. What is needed here is a disequilibrium adjustment mechanism, as we assume that labour market is not perfectly competitive. The theory of regional adjustment to idiosyncratic shocks has gained interest in the recent years. For instance, Blanchard and Katz (1992) and Möller (2001) have presented analytical and empirical regional models, where wages adjust to changes in labour demand. By allowing wages to respond to changes in unemployment, the whole adjustment burden does not rest on the labour supply (through participation rate or migration). This specification leads us to a kind of regional NAIRU model (see e.g. Elhorst, 2003). In his dynamic version of GTAP model, Vaittinen (2004a) uses an equation that is essentially the same as (9). In our model, the wage increase parameter *wgr* is exogenous and is assumed to reflect nationwide agreements resulting from centralised wage bargaining in Finland. However, the situation in the local labour market is assumed to have an effect on the development of wages. Real wages are also essentially inflexible downwards in this setting, as wage increases approach asymptotically zero when unemployment rises.

However, wage curves are estimated normally for a configuration where the wage rate itself is affected, not its growth. Therefore, the choice of the value for β_u needs attention. Pekkarinen (2001) estimated a wage curve for the Finnish metal industry with regional industry panel data. Regional fixed effects estimates for the parameter corresponding β_u were –0.03 to –0.05, depending on the definition of unemployment rate and other explanatory variables.

However, it is still only half of the wage curve elasticity of approximately 0.1 estimated by Blanchflower and Oswald (1994) for several countries. A recent estimate of the wage curve in

Finland is provided by Sauramo (2004), who estimates the long-term elasticity of wages with respect to unemployment to be –0.13, which is well in line with the values reported by Blanchflower and Oswald (1994). On the other hand, Vaittinen (2004a) uses the value of 0.5 in his difference equation basing his choice on the estimations of Solow (1990), and on Kiander and Viren (2001), who show that it takes typically more than five years in the Western European countries for the labour markets to adjust to supply shocks of labour. In order to see the similarity of the two formulations, let us review them graphically.

Figure 5. Correspondence of two different wage curve formulations



We see from figure 5 that by applying the parameter values relevant in this study, a value of -0.0135 for the traditional wage curve formulation corresponds closely to the value of -0.5 in Vaittinen (2004a).[11]

[11] In fitting the two curves, the value for one per cent unemployment (the minimum allowed in the model), and 2.6 per cent, as the baseline unemployment rate, were used as check points. Note that WC stands for the wage level in the former period in the Phillips curve wage growth version, and that the assumed annual real wage increase is 2.2 per cent.

We assume that this value applies here as well; it took 7-8 years for the labour market in Åland to recover from the deep recession in the early 1990s, when the unemployment rate rose to around 8 per cent from less than one per cent in 1990.

Participation in the labour market is endogenous as well. The modelling strategy for in-period endogenous labour supply was inspired by Berck, Golan, and Smith (1996), who constructed a dynamic revenue model for the state of California. First, we assume that there exists a fixed relationship between the population and the maximum supply of labour (which decreases over time, as the population grows older). Second, participation of the members of each household H in the labour market is dependent on the level of wages, tax rates and transfers per capita.

$$QLST_H = LSMAX_H \cdot \frac{QLST_H^0}{LSMAX_H^0} \cdot \left[\frac{WPART_H \cdot CPI^0}{WPART_H^0 \cdot CPI} \right]^{\eta_H^W}$$
$$\cdot \left[\frac{TINS_H + TMUNI_H + t_H^{state} + (YIF_{H\,L} / YI_H) \cdot s\sec_H}{t_H^{ins} + t_H^{muni} + t0_H^{state} + (YIF0_{H\,L} / YI0_H) \cdot s\sec 0_H} \right]^{\eta_H^{tax}} \tag{10}$$
$$\cdot \left[\frac{\sum_{INSDNG} TRII_{H\,INSDNG} + \sum_{INSDG} trnsfr_{H\,INSDG} \cdot CPI + UNBEN_H + YIF_{H\,K}}{\sum_{INSDNG} TRII0_{H\,INSDNG} + \sum_{INSDG} trnsfr0_{H\,INSDG} \cdot CPI0 + UNBEN0_H + YIF0_{H\,K}} \cdot \frac{CPI0}{CPI} \cdot \frac{POPU0_H}{POPU_H} \right]^{\eta_H^{TR}}$$

Where:

	Variable/parameter names including 0 indicate initial values
$QLST_H$	Total domestic supply of labour, including labour exports
$LSMAX_H$	Maximum labour supply, i.e. population aged 15-64
$WPART_H$	Participation wage rate, see below
CPI	Consumer price index
t_H^{ins}	Initial direct tax rate of institution
t_H^{muni}	Initial municipal income tax rate, exogenous
t_H^{state}	State income tax rate
$TINS_H$	Direct tax rate of institution, includes others than income taxes detailed above
$TMUNI_H$	Municipal income tax rate
$YIF_{H\,F}$	Factor income (capital or labour) of household H

YI_H	Total income of household H
$ssec_H$	Social security fees of household H
$TRII_H^{INSDNG}$	Transfers from non-government institutions to H
$trnsfr_H^{INSDG}$	Transfers from government institutions to H
η_H^W	Wage elasticity of labour supply
η_H^{tax}	Tax elasticity of labour supply
η_H^{TR}	Transfer elasticity of labour supply

The higher unemployment benefits per capita in the event of rising unemployment discourage the labour supply in this setting, which further reinforces a contraction of the economy in case of a shock leading to high unemployment.

Available evidence on the elasticity of labour supply shows that the elasticities are low. Kuismanen (2001) reviews recent Finnish and international studies, which show that women's labour supply elasticities tend to be higher than those of men. Berck, Golan, and Smith (1996) report similar results from the USA. However, in Finland, elasticity values for women are lower than in other countries. The estimates reported by Kuismanen (2001) ranged from 0.08 to 0.29 (with respect to net wage), the lower values applying to men, and higher values for women. We assume here that an absolute value of 0.1 applies to all the labour supply elasticities. Our model differentiates labour neither according to gender nor to the income level, both of which are shown to affect the size of labour supply response.

Households are assumed to maximise their labour earnings. However, commuting to the RoW or being employed domestically are imperfect substitutes. Maximising a constant elasticity of transformation (CET) function for the decision to either work domestically or to commute captures this idea. The wage rate governing participation in the labour market, $WPART_H$, is thus a dual price index for a CET labour supply function. Therefore, $WPART_H$ is an aggregate for the domestic wage rate and the wage rate of commuters exporting their labour.

$$WPART_H = \frac{1}{\alpha_{L\,H}} \cdot \left[\delta_{L\,H}^{1/(1-\rho_L^H)} \cdot W_L^{\rho_L^H/(\rho_L^H-1)} + (1-\delta_{L\,H})^{1/(1-\rho_L^H)} \cdot W_{LEXP}^{\rho_L^H/(\rho_L^H-1)} \right]^{(\rho_L^H-1)/\rho_L^H} \qquad (11)$$

where:

$\alpha_{L\,H}$	Shift parameter for the labour supply CET function
$\delta_{L\,H}$	Share parameter for the labour supply CET function
$\rho_{L\,H}$	Labour supply CET function exponent
W_{LEXP}	Wage rate for labour exports

The amount of domestic labour supply to the domestic labour market, $LSALA_H$ is determined as follows by the equation, derived from first-order conditions of a labour income maximisation problem.

$$LSALA_H = LEXP_H \cdot \left[\frac{W_L \cdot (1-\delta_{L\,H})}{W_{LEXP} \cdot \delta_{L\,H}} \right]^{1/(\rho_L^H - 1)} \tag{12}$$

The wage rate for labour exports, W_{LEXP}, grows with the assumed rate of wage increases in the RoW. The level of wages, and the number of commuters are obtained by combining different statistical sources.

Labour market balance equation (13) has specialties that require comment. To begin with, the unemployment definition used here is the total unemployment rate, i.e. it includes those under special employment schemes funded by the public sector. In addition, as the current unemployment rate in Åland is extremely low (we can actually speak of full employment), there is a need to restrict the model from moving into equilibrium with zero unemployment. Such a situation would not be realistic notwithstanding even the choice of unemployment definition, as there will always be some frictional unemployment, as well as structural unemployment of those difficult to employ in all circumstances. Therefore, it is assumed here that the unemployment rate cannot decline below one per cent of labour force.

Another special feature is a considerable amount of labour imports (*LIMP*), i.e. commuting to Åland from other parts of the country. Some 54 per cent of the seamen employed by the Åland shipping companies live on the mainland Finland (Turunen - Eriksson, 2004).

$$\sum_{A} QF_{A\,L} + UNEMFIG = \sum_{H} QLST_{H} \cdot 0.99 - \sum_{H} LEXP_{H} + LIMP \tag{13}$$

As an overwhelming share of net commuting refers to shipping (some 98 %; Turunen - Eriksson, 2004), thus the wage rate W_{LIMP} and the amount of commuters, *LIMP* are modelled very simply. The income for commuting to Åland is estimated from comparison of different statistics on seamen's salaries, and the wage rate is estimated by dividing the total income by the number of commuters (acquired from the employment statistics of Statistics Finland). The obtained wage rate W_{LIMP} is assumed to have a fixed relation to the wages of the transport sector. Changes in the demand for labour in the transport sector are assumed to have the same proportional effect on commuting to Åland.

$$LIMP = (comrate_{L} \cdot W_{L} \cdot WFDIST_{L\,A-TRANS} \cdot QF_{L\,A-TRANS}) / W_{LIMP} = \psi_{LIMP} \cdot QF_{L\,A-TRANS} \tag{14}$$

where

$comrate_{L}$	Commuters' share of labour income in transport sector, fixed
$WFDIST_{L\,A-TRANS}$	Exogenous wage distortion variable (deviation from economy-wide average) for transport sector (A-TRANS)
W_{LIMP}	Commuters' wage rate
ψ_{LIMP}	Fixed share of seamen commuting to Åland from the RoW

Another important feature of the labour market module regarding the overall behaviour of the model is the dependency of migration on wages and unemployment. Therefore, we loosely build upon the ideas of Harris and Todaro (1970), and of Blanchard and Katz (1992). The net migration equation has been estimated from a panel data set covering the years 1990-2000, supplement by a time series estimation with quarterly data from 1991-2003. Results of the estimation are presented in essay nr 1. The operational formula of the migration equation appears as follows:

$$MIG_{H} = \frac{\sum_{H'} POPU_{H'}}{\sum_{H'} POPU^{0}_{H'}} \cdot \left[migconst_{H} + \beta^{H}_{MIG} \cdot \ln\left(U \cdot 100 \cdot \frac{W_{MIG} \cdot (CPI / CPI0)}{W_{L}} \right) \right] \tag{15}$$

As the population grows or declines, the absorbing capacity of the society regarding immigration is assumed to change proportionally with the population level. In contrast with the above-mentioned econometric estimation, the unemployment rate is also multiplied with the ratio of the migrants' reference wage W_{MIG} and the average wage rate in Åland. W_{MIG} grows at the same exogenous rate as the out-commuters' reference wage. In the initial equilibrium, W_{MIG} and W_L are assumed to be equal, but may have diverging trends in later periods. Therefore, any shock that affects the growth path of wages in Åland changes the growth rate of labour supply in the periods following the shock. The value of the coefficient β_{MIG}^{H} is negative and its absolute value is greater for migrant households, whose propensity to re-migrate was estimated to be higher, a result that is well in line with the existing theory on migration and social amenities (for exact parameter values; see appendix 4).

By excluding zero unemployment, the amount of net migration cannot approach infinity, as it could without the constraint in the labour market balance equation. The level of net migration corresponding to one per cent unemployment is marginally higher than the historical all-time high. However, the unemployment rate has also been lower than one per cent, so the choice of this specific numeric value for minimum unemployment is a compromise between these two indicators.

In the base year 2000, the unemployment rate among native household members was 2.0 per cent, while it was 4.3 per cent among the migrant household members. Unemployment has to be allocated between the two households. Due to a lack of time series data on the matter, it is assumed here that the share of each household in the total number of unemployed is fixed. It means that we assume the migrant households always to run a greater risk of unemployment. The assumption could be justified by the fact that native inhabitants have more extensive social networks, which help them to avoid unemployment. A qualitative study carried out by Kinnunen (2004) shows that Åland's labour market has many idiosyncrasies that positively differentiate in favour of the native "insiders".

Behaviour of the model depends crucially on the value of β_u. The more inflexible the wage setting rule (low β_u), the harder it is for the labour market to recover from shocks. If the absolute value of β_u is high, the wage level quickly responds to changes in the demand for labour, and unemployment stays close to its initial level. If wages are inflexible,

unemployment stays high after a negative shock, suppressing net migration. In consequence, total labour supply shrinks, economic growth is hampered, and the growth path of the economy is permanently changed through the changing labour supply. In other words, the degree of hysteresis the labour market exhibits depends mainly on the value of β_u (see Romer, 1996).

The way labour demand depends on wage formation can be seen by substituting (9) into (8) and by reformulating the equation to an explicit function of factor demand.

$$QF_{L\,A} = \left(WFDIST_{L\,A} \cdot WC \cdot \left[\frac{CPI}{CPI0} + wgr \cdot \left(\frac{U}{U^0} \right)^{\beta_u} \right] \right)^{-\sigma_A^{VA}} \cdot PVA_A^{\sigma_A^{VA}} \cdot QVA_A \cdot \alpha_A^{VA(\sigma_A^{VA}-1)} \cdot \delta_{F\,A}^{VA\ \sigma_A^{VA}} \quad (16)$$

The higher the value of exponent $-\sigma_A^{VA}\beta_u > 0$, the more responsive is the demand for labour. Given the considerable openness of the economy, the derived demand for labour can be very elastic, as the RoW buys from Åland according to the elasticity of transformation between exports and domestic produce, but the price in the foreign market is unaffected by the exports from Åland. The higher the transformation elasticity and the higher share of exports, the more elastic is the derived demand for labour. The transformation and trade elasticity values are chosen with their effect on demand for labour borne in mind.

Dynamic adjustment works in the labour market through migration and the changing share of the work-aged population, as well as through the population growth rate. Migration during period *t* is assumed to affect the population at *t+1*, in the same way as in the model of Seung (1996).

$$POPU_H^{t+1} = POPU_H^t \cdot (1 + popugrw_H) + MIG_H^t \quad (17)$$

Note that migrants become an integral part of the population at t+1, and there is no difference between the participation rate (and age) of newcomers and resident population within each household group. There is no reason to expect this to hold in reality, but this modelling solution was chosen for its simplicity. One method to approximate the effect of migration on the age structure of population would be to assume different trends in the participation rate for

native and non-native households. Surprisingly, according to the Population Census 2000 (Statistics Finland, 2003), the average age for the native and migrant households was 38 and 45 years, respectively. This implies that the in-migration of non-natives is concentrated on persons of working age or older. Another fact explaining the age difference is that the children of non-natives are by definition native Ålanders, if their parents were already living in Åland at the time of birth.

At the end of each period, migration increases or decreases the population, and thus the labour supply, which during each period is assumed to be rather inflexible. If the imposed wage increases are low in relation to changes in productivity, domestic products become more competitive and their demand increases; hence, the derived demand for labour increases, which in turn lowers unemployment, resulting in a large net migration. Figures 6 and 7 illustrate this. Let us assume that LS^0 describes the labour supply, after the incorporation of migrants. LD^0 describes what labour the demand would be without any changes in productivity. As productivity increases, labour demand moves to LD^1 (see figure 6), causing unemployment to decrease, which pushes up wages (see figure 7). The labour supply in the next period will be higher due to increased net migration LS^1. In case the wage elasticity of labour demand and a new productivity shock allow it, the increased labour supply is absorbed by the labour market. Thus, growth in the supply of labour turns into increased GDP.

Figure 6. Supply and demand of labour during a simulation period

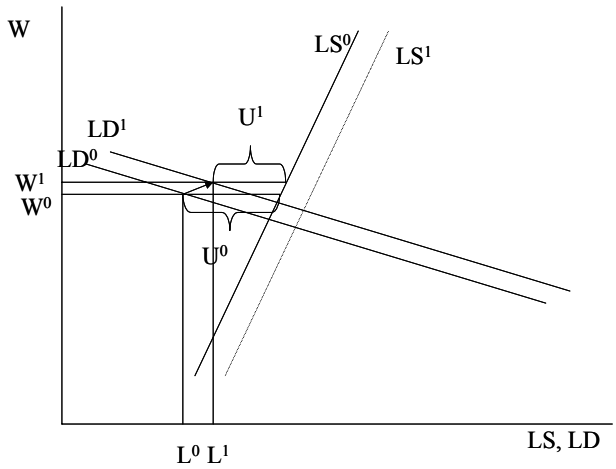
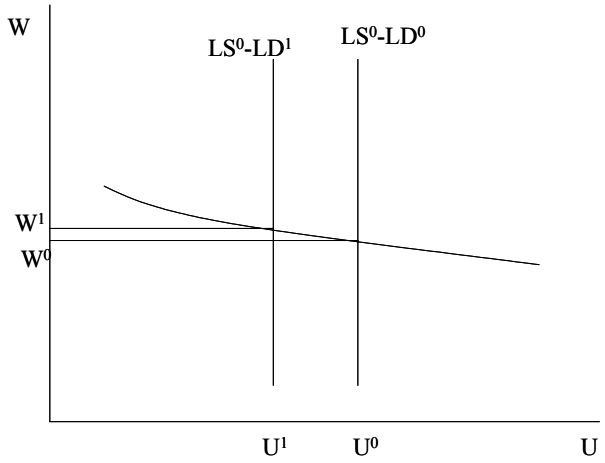


Figure 7. Determination of wage rate



In figure 7, the wage curve elasticity β_u is assumed to be quite low. The higher the elasticity, the higher the change in wages will be, assuming the same change in the unemployment level. As explained above, this would lead to smaller changes in unemployment and thus also would dampen changes in migration as well.

In order to further clarify the endogeneity of the steady state growth rate in this setting, let us examine a stylised version of the model. Let us assume that migration is dependent on unemployment rate U. Let us further assume that population growth is entirely driven by migration. We also assume that in a steady state, migration is positive, which is a plausible assumption for the Åland economy in the foreseeable future.

$$MIG_t = \delta_t(U_t)_M \cdot POP_t,\ \frac{\partial \delta}{\partial U_t} < 0,\ U_t = \frac{LS_t - L_t}{LS_t} \tag{18}$$

$$POP_{t+1} = POP_t + MIG_t = (1+\delta_t) \cdot POP_t \tag{19}$$

Labour supply is assumed to be inflexible during the period. Let us also assume that production *Y* uses only one factor *L*, and *A* grows at the productivity growth rate of *g*.

$$Y_t = A_t \cdot L_t^{\alpha_Y},\ A_{t+1} = (1+g) \cdot A_t \tag{20}$$

The growth rate of wages is expected to depend on the relation of the current unemployment level U_t on an exogenously given steady-state unemployment level U^*. As in the actual model, *wgr* is an exogenous nation-wide wage growth parameter.

$$\frac{w_{t+1}}{w_t} = 1 + wgr \cdot \left(\frac{U_t}{U^*} \right)^{\beta_u}, \beta_u < 0 \tag{21}$$

In a steady state, the growth of labour demand is such that the unemployment rate stays constant. Therefore,

$$\frac{LS_{t+1} - L_{t+1}}{LS_{t+1}} = U^* = \frac{LS_t - L_t}{LS_t} \Rightarrow \frac{L_{t+1}}{L_t} = (1 + \delta^*) \tag{22}$$

By solving the first-order-conditions of profit maximisation, we get the usual equation for the optimal labour demand, i.e. labour is in demand as long as its marginal productivity equals its cost.

$$L_t = \frac{P_t^Y \cdot \alpha_Y \cdot Y_t}{w_t} \tag{23}$$

Equation (23) implies that the following relation holds as well:

$$\frac{L_{t+1}}{L_t} = \frac{P_{t+1}^Y \cdot (1+g) A_t \cdot \alpha_Y \cdot L_{t+1}^{\alpha_Y} / w_{t+1}}{P_t^Y \cdot A_t \cdot \alpha_Y \cdot L_t^{\alpha_Y} / w_t} = \frac{P_{t+1}^Y \cdot (1+g) \cdot (1+\delta^*)^{\alpha_Y} \cdot L_t^{\alpha_Y}}{P_t^Y \cdot L_t^{\alpha_Y} \cdot (1+wgr)} \tag{24}$$

This yields the following relationship between wage growth, migration, and technological progress.

$$1 + wgr = (1+g) \cdot (1+\delta^*)^{\alpha_Y - 1} \cdot P_{t+1}^Y \Big/ P_t^Y \tag{25}$$

With decreasing returns to scale and constant product prices, the steady-state wage growth is somewhat less than the productivity growth. If the exogenous wage growth were set higher

than the terms on the right-hand side suggest, it would lead to an increasing unemployment rate. When a negative shock occurs, wages do not adjust downwards enough to prevent unemployment from increasing, which leads to a lower population growth rate, thereby diverting the economy from its earlier growth path. This can be seen from the following equations. We can easily see from (23) that the elasticity of labour demand with respect to P_Y equals unity, and the elasticity of wages with respect to P_Y can be calculated as follows:

$$\frac{\delta w}{\delta P}\cdot\frac{P}{w}=(\frac{\delta w}{\delta U}\cdot\frac{U}{w})\cdot(\frac{\delta U}{\delta L}\cdot\frac{L}{U})\cdot(\frac{\delta L}{\delta P}\cdot\frac{P}{L})=\frac{\beta_U\cdot wgr\cdot\left(\frac{U}{U^*}\right)^{\beta_u}}{1+wgr\cdot\left(\frac{U}{U^*}\right)^{\beta_u}}\cdot\frac{-(1-U)}{U}\cdot 1>0 \qquad (26)$$

The value of this elasticity depends on the level of unemployment, and on the parameter values. If we apply the parameter values used in the model at the steady-state level of unemployment, i.e. wgr = 0.022, β_u = - 0.5, $U=U^*$ = 0.026, the elasticity of wages with respect to product prices amounts to approximately 0.4. In other words, in the steady state, the changes in the product prices affect the demand for labour more than they change wages. Therefore, negative shocks lead to increased unemployment, and positive shocks to a decreased unemployment. However, as the elasticity of wages is negatively related to the level of unemployment, wage responses are higher at low levels of unemployment and vice versa, which will eventually return the unemployment level to its steady-state level. However, in the model used in the simulations, we assume that the ratio of wages in Åland to those in the RoW affects migration as well. In this setting, higher unemployment leads to a lagging wage development in Åland, which permanently dents the growth of the labour supply. Therefore, in this model setting, the economy may permanently fall from the earlier steady-state growth path as a result of a temporary shock.

3.3.5. Capital accumulation

Dynamic CGE models can be grouped into two categories, those that rely on the intertemporal maximisation of the economic agents, and those assuming static or adaptive expectations. In the intertemporal models, the economic agents typically have “perfect

foresight" and future events are taken into consideration in current decisions. As a consequence, the whole transition path of the economy from the first to last period has to be solved simultaneously. In the recursive models, each period is solved separately and the time periods are linked to each other through changes in the stocks of factors of production (and wealth). The expectations of the economic agents are either static or backward looking, i.e. adaptive, therefore, no information is needed from the forthcoming periods to solve the current one.

Although theoretically attractive, intertemporal models run more easily into problems with computing capacity than the recursive ones. Another critical point against the intertemporal models is the lack of historical evidence supporting perfect foresight. In effect, the majority of the applied models resort to recursive dynamics (Ginsburgh – Keyzer, 1997). In the survey-based study by Kinnunen (2003), empirical evidence supported static or adaptive rather than rational expectations[12] as the correct description of expectation formation among enterprises in Åland. Furthermore, as the present model includes the option for imperfect competition, recursive dynamics was chosen as the more feasible modelling strategy. This is not to say that intertemporal models could not handle imperfect competition: for example Keuschnigg and Kohler (1996) have presented such a one-country model for Austria, and Mercenier (2002) a multi-country model for Europe with similar characteristics.

The present model incorporates a recursive dynamic structure in order to determine how the economy adjusts to shocks that develop over the course of time. In each time period, the model is solved given the exogenous conditions assumed for that particular period. The equilibria are linked through capital accumulation and through changes in population and in the labour force. Furthermore, other exogenous changes like technical change (varies by activity), population growth, and changes in the RoW market prices are imposed in a between-the-periods simulation file. Also the accumulated wealth in the financial stocks in the RoW is updated between the periods.

In contrast with national CGE models, investment is determined independently of the regional savings in the present model. In the regional level of analysis, there is no reason to expect the

[12] However, the possibility of measurement errors was so great in the study that conclusive evidence either for or against rational expectations could not be extracted.

identity between domestic savings and investment to hold, as capital moves smoothly over province borders (see e.g. Berck – Golan – Smith, 1996). Therefore, the savings are modelled as a residual between income and expenditure, or as a fixed share of agent's income, or a fixed quantity. Foreign savings will thus balance the demand for capital.

In the present model, capital is sector-specific and has different returns in different industries. One reason for this modelling strategy is the quality of data available. In the regional input-output tables for the Finnish provinces (Statistics Finland 2000), the breakdown between capital and labour earnings is far from perfect. Therefore, a portion of entrepreneurs' labour income, especially in the case of primary producers, is registered under capital earnings, which explains the diverging returns on capital. Moreover, Åland has numerous small firms where the entrepreneur himself is the only source of labour, which of course aggravates the problem in comparison to other regions. Having the capital sector-specific, we can bypass the problem, without having to equalise the returns on capital between activities. However, e.g. Mercenier and Yeldan (1999) have called for a more careful consideration of the factor share issue, because faulty factor shares may not only affect the magnitude of effects, but also change the qualitative results of the model, the authors exemplify for Turkey. In our case, we just simply hope that in the future, input-output tables that are more consistent with the needs of the CGE modelling will be available.

First, investment I_{At} and capital accumulation ($K_{A\,t+1}$ - $K_{A\,t}$) are related in the standard way:

$$K_{A\,t+1} = (1 - \delta_A^K) \cdot K_{A\,t} + I_{A\,t} \tag{27}$$

Investment depends on expected rates of return for the year, which are determined by actual and past returns on capital, very similar to Vaittinen (2004a) and in Bayar et al. (2004), who, in turn, are indebted to the Australian Monash model (Dixon et al., 2002). The expected rate of return is specified as an inverse logistic function of the proportionate growth in the sector's capital stock. Vaittinen (2004a) provides an excellent description of these investment functions.

$$EEQROR_A = RORN_A + \frac{1}{C_A^I} \cdot \left[\ln\left(\frac{\frac{I_A - \delta_A^K \cdot K_A}{K_A} - KG_A^{MIN}}{KG_A^{TREND} - KG_A^{MIN}} \right) \cdot \ln\left(\frac{KG_A^{MAX} - \frac{I_A - \delta_A^K \cdot K_A}{K_A}}{KG_A^{MAX} - KG_A^{TREND}} \right) \right] \quad (28)$$

$$ROR_A = -1 + \left[\Pi_A^{GR} + (1 - \delta_A^K) \right] / (1 + RINT) \quad (29)$$

$$EEQROR_{A\,t} = ROR_{A\,t} - (1 - D_A^I) \cdot (ROR_{A\,t-1} - EEQROR_{A\,t-1}) \quad (30)$$

Please note that for brevity, time subscripts are suppressed whenever not indispensable. In contrast to Vaittinen (2004a), but similar to Bayar et al. (2004), actual rate of return of the current period (ROR_A) is used of for the current year, instead of an expected rate of return (called $EROR_i$ in Vaittinen, 2004a). Please note that the equations require no information on forthcoming periods due to the adaptive expectation formation.

In the above equations:

$EEQROR_A$	Expected equilibrium rate of return
$RORN_A$	Historically normal rate of return in activity A
ROR_A	Rate of return in activity A
KG_A^{MAX}	Maximum feasible growth rate of capital in activity A
KG_A^{MIN}	Minimum feasible growth rate of capital in activity A, equal to the opposite value of depreciation rate, equalling no investment
KG_A^{TREND}	Historically normal rate of capital growth
C_A^I	Sensitivity parameter in investment function, specified according to Vaittinen (2004a)
D_A^I	Adjustment parameter for the expectations on the rate of return, a fraction of the former period disequilibrium
δ_A^K	Depreciation rate of activity A
$RINT$	Reference interest rate, a fixed fraction of the average returns to capital in Åland
Π_A^{GR}	Gross profit rate of activity A

It is also assumed that a fixed relationship exists between capital stock and the flow of capital services each year. Historical trends in the growth of investment were estimated from the regional accounts statistics 1975-2002 of Statistics Finland (2004b). A growth trend in investment also determines the growth in the capital stock, as:

$$I_t = (g+\delta)\cdot K_t \;\Rightarrow\; \frac{I_{t+1}}{I_t} = \frac{(g+\delta)\cdot K_{t+1}}{(g+\delta)\cdot K_t} \Rightarrow \frac{(g+\delta)\cdot (K_t\cdot(1-\delta)+I_t)}{(g+\delta)\cdot K_t} = (1+g)\,. \tag{31}$$

The growth trends in investment for each activity are found in appendix 4. Note also that having different, historical growth rates for capital stocks for each activity, as well as diverging rates of return to capital is deviates from the steady state –modelling tradition, according to which all stock variables of the economy grow at the same rate on a balanced growth path characterising a steady state. This model pays no attention to such steady state properties, neither does the Monash model for Australia (see Dixon et al., 2002). As the structure of the economy changes, so does its growth rate, due to differences in the investment and productivity growth in each activity. Having the growth of labour force also endogenous considerably accentuates the endogenous nature of economic growth in the model.

3.3.6. Subsidies

The present model explicitly includes production subsidies, transport subsidies for exports and subsidies for marine passenger and cargo traffic (rather than having net tax rates). Subsidies affect the costs of the activities according to the variable to which the amount of subsidies is tied. For example, most of the subsidies for sea traffic are proportional to labour costs. All the subsidies are present below in the balance equation of revenues and costs for activities.

$$\begin{aligned} &PA_A\cdot QA_A\cdot(1+psub_A)+TCECOST_A\cdot tsub_A+SSUB_A^{CA}+SSUB_A^{PT} \\ &=PVA_A\cdot QVA_A+PINT_A\cdot QINT_A \end{aligned} \tag{32}$$

Where

$psub_A$ Production subsidy rate

$TCECOST_A$	Transport cost for exports
$tsub_A$	Transport subsidy rate
$SSUB_A^{CA}$, $SSUB_A^{PT}$	Subsidies for marine cargo and passenger traffic

3.3.7. Closure rules and the choice of numéraire

The present model includes three (groups of) macroeconomic balances: balance of the public sector institutions, savings-investment balance, and the external balance. The regional government of Åland is assumed to have a fixed budget balance, thus increases or decreases in its income level are reflected in its outlays. This seems to be a good approximation of reality, if one considers the development of the 1990s with large increases in expenditure when the amount of equalisation rose rapidly.

Also the amount of municipal savings is assumed as fixed, but here flexible municipal tax rates are used to balance the budget instead of having to adjust the level of expenditure. A large share of municipal outlays are statutory, thus municipal authorities have less room for adjusting their expenditure. The expenditure of municipalities is assumed to increase with the number of non-working-age persons.

The central government agencies in Åland are assumed to receive/pay a balancing transfer from/to the RoW. The same mechanism applies to the social security funds. Both institutions conduct only a minor part of their activities in Åland, and they do not have a balanced budget responsibility. The social security transfers are also assumed to depend on the number of persons outside the labour force.

Non-profit organisations are assumed to spend all their income according to their Cobb-Douglas expenditure function.

Savings-investment balance is achieved through flexible foreign savings. The amount of investment required is defined by the equations (28) - (30) above.

Consumer prices are fixed and CPI is the numéraire of the model, while domestic prices in relation to RoW prices, i.e. the real exchange rate EXR, are allowed to vary. In a CGE model, one of the prices has to be fixed, as the model defines only relative prices.

3.4. Data and parameter values

The most important part of the data needed for the model is included in the Åland SAM 2000, which can be found in appendix 2. Some parts of the SAM are especially difficult to determine. For example, only secondary indicators are available for distinguishing between savings and private imports from the RoW, carried out by households. Both savings and private imports are a sort of leakages from the local economy. However, a savings surplus that is not used for local investment is assumed to generate rental income from the RoW, which is cashed in during the next period, whereas consumption in the RoW does not generate any further monetary flows. We assume that the savings rate in Åland in the year 2000 was somewhat higher than in the whole of Finland reflecting a higher share of capital income of the disposable income. Private imports of Åland households are high, which is understandable given the reduced size of the domestic market and the limited assortment available in the home province. The high local price level also induces people to go shopping in the cities of the surrounding regions.

Apart from the SAM, numerous parameter estimates are needed. The central parameters are discussed below.

3.4.1. Production

Statistics Finland (2004b) has recently published a time series for the regional accounts by province and by industry 1975-2002. From that data we have estimated substitution elasticities between capital and labour, as well as between the value added and intermediate goods. The estimation was conducted in GAMS (see Brooke et al, 2003) by minimising the sum of squared errors for the CES production function below.

$$\ln QA_t = \ln \alpha_A^A + tc \cdot t - (RTS / \rho_A^A)$$
$$\cdot \ln\left(\delta_{AC}^{AC}\left[\delta_{KA}^{VA} \cdot QF_{KAt}^{-\rho_A^{VA}} + (1-\delta_{KA}^{VA}) \cdot QF_{LAt}^{-\rho_A^{VA}}\right]^{\frac{\rho_A^A}{\rho_A^{VA}}} + (1-\delta_{AC}^{AC}) \cdot QINTA_{At}^{-\rho_A^A} \right) + \varepsilon_t \quad (33)$$

where:

tc	Technical change
t	Time trend
RTS	Returns to scale
ε_t	Residual of year t, squared sum of which is the minimand of the optimisation problem

For some of the activities, corner solutions were found to be optimal for substitution elasticities in the two-stage nested CES estimation. For those activities, the technology assumption was adjusted, and Leontief top nest technology was applied. It was possible to obtain estimates also for returns to scale and technical progress. However, probably due to the fact that the fixed price time series has been obtained by using national deflators, the constant price time series may not be an exact description of the volume development in Åland, and RTS and technical change estimates did not seem trustworthy. Appendix 6 reports the values obtained from this estimation. Therefore, in the case of technical change, as a starting point, we have resorted to using the historical productivity changes by industry reported by Jalava (2004). After aggregating the historical figures according to the Åland SAM, we lowered some of the productivity figures somewhat in order to get plausible growth figures for the baseline simulation (see appendix 4).

3.4.2. Imperfect Competition

As discussed above, an inverted Herfindahl concentration index calculated from business registry was the source for the standardised number of firms, and returns-to-scale estimates obtained from the CES production function regression were supplemented with our own "guesstimates"[13]. The applied values are reported in appendix 4.

[13] In the case of the grocery trade in Åland, Aalto-Setälä, Kinnunen and Koistinen have shown in essay nr 2 that the size of the store is an important determinant of the price level, which supports the hypothesis of increasing

The source for trade elasticities as well as for the LES price elasticities for consumption was the values in GTAP database (Vaittinen, 2004b). The GTAP values were aggregated to the industry classification used here by calculating their weighed means, the weights being consumption shares of each commodity.

3.4.3. Migration

In the parameterisation of the migration equation, we use estimations reported in essay nr 1 of the present study. However, the estimations were conducted for individuals, while the model considers households. Furthermore, the shares of migrants in the two households differ. Therefore, the migration equation for native households applied here is a weighted average of the natives' and migrants' net migration, weighted according to population shares obtained from the Population Census 2000 (Statistics Finland, 2003). In order to ensure compatibility with the time series analysis, the migrant household equation is defined as a residual between the native household equation and the time series equation for the whole population.

3.4.4. Capital dynamics

In the dynamic part, the modeller has to provide estimates for several parameters in the equations describing investment dynamics. They were chosen here in such a way that the considerable openness coupled with the macro closure of the model would not lead to overly increasing growth rates.

As the population of Åland is ageing, the population forecast of Statistics Finland (see ÅSUB, 2004) presents a negative trend for the number of people living on the Islands, when we exclude migration. The same negative trend is assumed to apply to both household types, as no separate forecasts are available individually. This is of course a simplification, keeping in mind that the average age of migrants was higher than that of the natives.

---

store-level returns to scale. About two thirds of the price difference of 17 % between Åland and mainland Finland could be attributed to differences in size, demand characteristics, or to differences in competition.

Deprecation rates for each activity were obtained from the regional accounts database of Statistics Åland.

4. Simulation of an increase in the perceived competition

4.1. Assumptions

Let us now look at the behaviour of the model in a dynamic simulation in which we assume the Åland Government to change its policy concerning the temporary business licenses and to somewhat relax this entry barrier as of the year 2005. This is assumed to increase the potential of entry, but with differing intensities among activities. An accessible indicator for entry potential is the allocation of the number of temporary business licences over the period July 1st 1996- Dec 31st 2000 between industries, as reported in Lindström (2002). By using this breakdown and by adjusting it to our level of aggregation, we assume that about 45 per cent of companies interested in providing services in Åland are construction firms. The rest of the entry potential is divided among trade, business services and other services (15 % each), and restaurants and hotels (10%). We further assume that this entry potential would equal, in its effect to competition perceived by incumbent firms, presence of new firms amounting to 50% of the number of firms already existing in the market. The size of the effect is a mere guess, but it seems plausible to assume that there is only a limited interest in the RoW to enter such a small and special market like Åland. Based on these assumptions, we can calculate the total perceived threat of competition, expressed as a number of new firms entering each IC activity. Finally, we calculate the change in the parameter ψ_A in equation (3) by dividing the resulting number of potential new firms by the existing ones (the resulting new values are reported in table 3 below).

Table 3. New values of entry threat parameter ψ_A

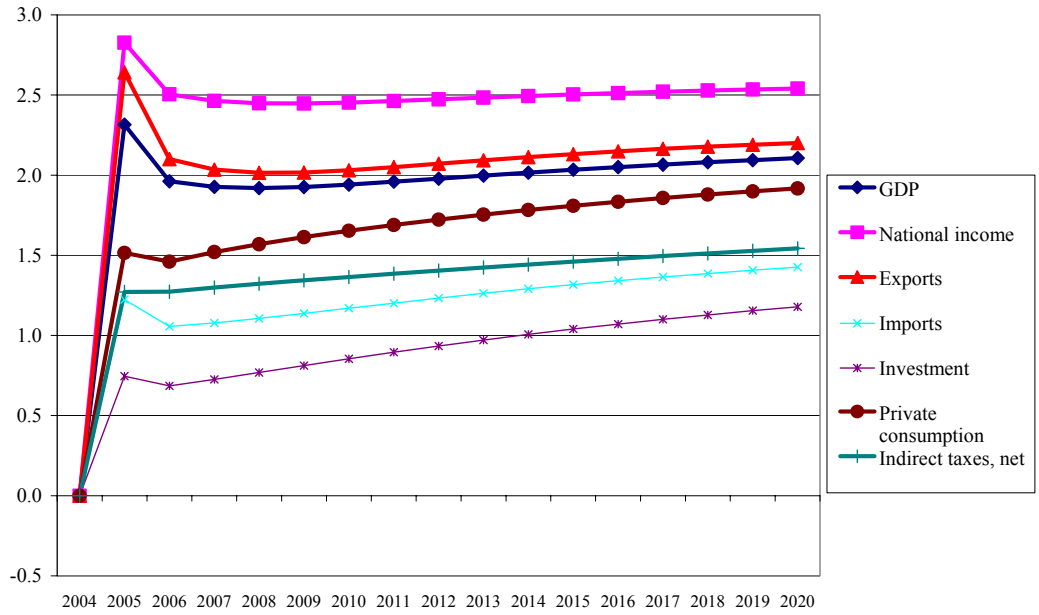
A-CONS	1.5
A-TRAD	1.5
A-RESH	1.2
A-BSER	2
A-OSERV	1.9

As a 'BASE' scenario, we will use the same one as in essay nr 4, where its assumptions will be described more in detail. In essence, it is a collection of changes anticipated for the coming years, with the exception that the recent and expected challenges in the transport sector are omitted. In the 'ENTRY' scenario, we assume that barriers to entry are reduced in 2005, resulting in the above-calculated change in the parameter ψ_A. We assume here as well that the capital stock needed in production stays in the hands of Ålanders. In case new capital is to be invested in Åland, but with the total level of investments remaining unchanged, this would first give a fresh capital injection that would increase the surplus of the current account. Later on, the capital investment would be followed by profit repatriation. However, simultaneously, Ålanders' capital gains from the RoW would have grown, as the foreign investment would free domestic capital to be invested in the RoW. Depending on the success of these two investment flows, it would lead either to an increased or a decreased net flow of capital gains to Åland. However, we assume here that no new foreign investment takes place.

4.2. Simulation results

An increased entry threat reduces the mark-up of firms (see equations (3) and (4)). In order to cover fixed costs, the average size of the firms must rise, leading to an increased concentration of domestic production. The ENTRY simulation results in a 5-20 per cent drop in the number of firms. Let us first examine the consequences of this change for different components of GDP in relation to the base scenario (see figure 8).

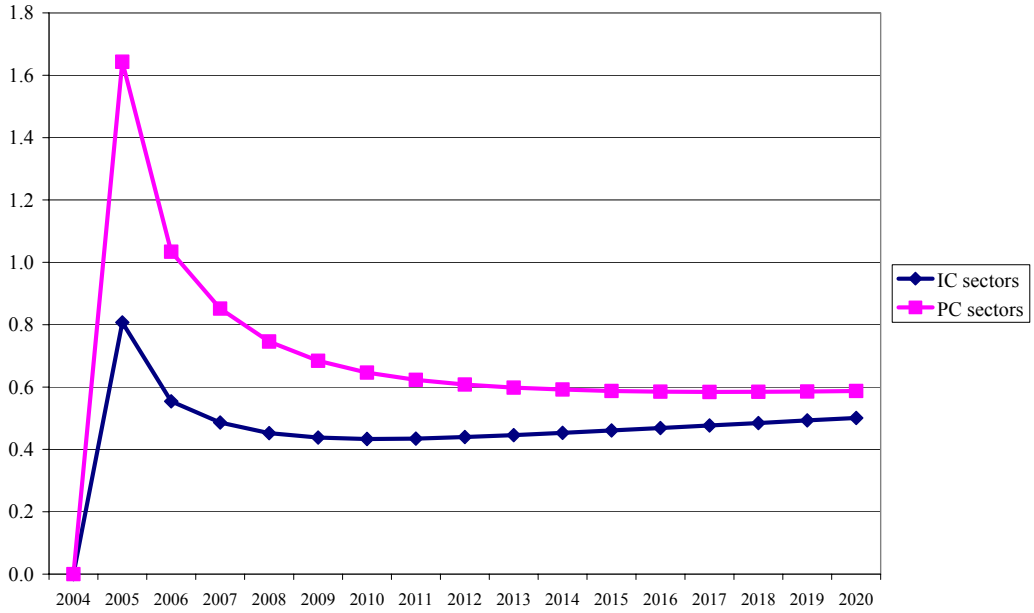
Figure 8. Effects of increased entry threat, deviation from the BASE scenario, per cent



We see that the economy receives a growth impulse that averages two per cent of the annual BASE levels, as measured in GDP. Increased competitiveness boosts exports more than imports, thus improving the trade balance. Households are clearly better off, as private consumption increases around 1.7 per cent from BASE. Investments rise, showing that the private sector as a whole is better off with increased threat of entry. National income rises even more rapidly, due to increased savings and capital gains abroad. What is more, the difference between ENTRY and BASE grows over time for several GDP items.

Let us take a look at the change in the production structure that follows the competition shock. In the following figures, we divide the economy into perfect competition (PC) and imperfect competition activities (IC). We see that the demand for labour is greater in the PC sectors that are more export-oriented and are assumed to be perfectly competitive (figure 9). IC firms, in turn, increase their demand for labour less dramatically in relation to the BASE scenario time path, yet the change also increases their labour demand. Table 4, presenting the growth of labour demand by activity, indicates that PC sectors without exception increase their demand, whereas the situation is more varied for the IC sectors.

Figure 9. Labour demand, deviation from the BASE scenario, per cent



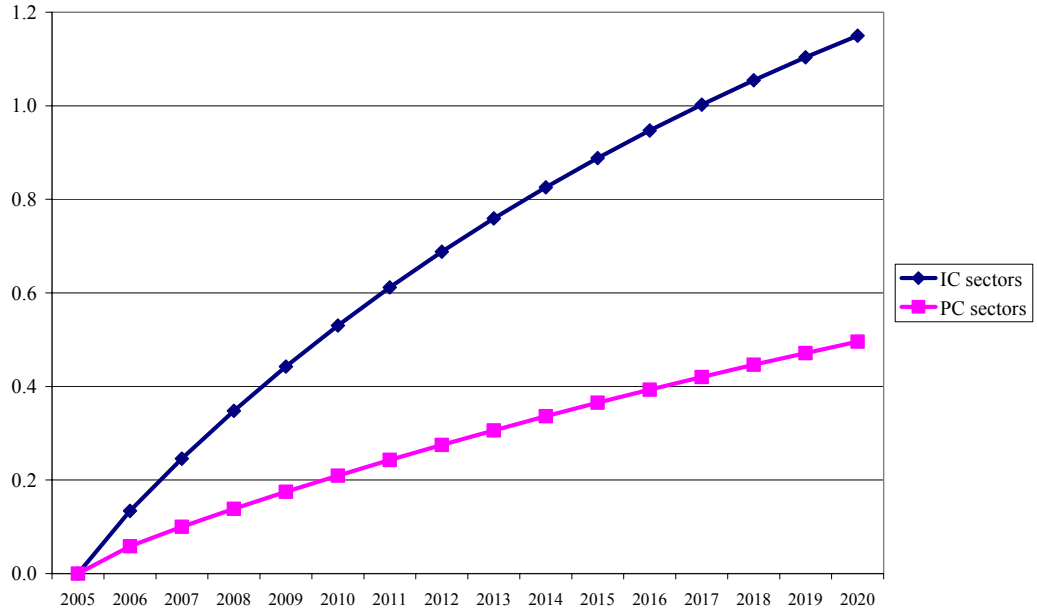
Another way to determine which part of the economy expands is to look at the accumulation of capital stock (figure 10). We see again that PC sector firms are the ones to gain more from the increased threat of entry. What is more, the effect of the simulation is cumulative: the capital stock of both PC and IC sectors diverges increasingly from the BASE path. In summary, growth of the open sector of the economy is intensified by the increased competition in the domestic market.

Table 4. Labour demand, deviation from BASE, per cent

			2004	2005	2006	2007	2008	2009	2010
Agriculture	A-AGRI	PC	0.00	1.86	1.16	1.00	0.92	0.87	0.84
Food Industry	A-FINDU	PC	0.00	1.52	0.89	0.75	0.68	0.64	0.61
Other industry	A-INDU	PC	0.00	1.97	1.19	1.07	1.04	1.04	1.07
Electricty and water supply	A-ELWA	PC	0.00	2.55	2.18	2.11	2.08	2.08	2.09
Construction	A-CONS	IC	0.00	0.02	-0.18	-0.26	-0.29	-0.30	-0.29
Trade	A-TRAD	IC	0.00	3.69	3.14	2.99	2.91	2.87	2.85
Restaurants and hotels	A-RESH	IC	0.00	0.20	0.07	0.09	0.11	0.13	0.15
Transport	A-TRANS	PC	0.00	1.89	1.18	0.95	0.82	0.74	0.69
Business services	A-BSER	IC	0.00	2.78	2.33	2.28	2.28	2.30	2.33
Personal services	A-OSERV	IC	0.00	-0.34	-0.48	-0.54	-0.58	-0.60	-0.62

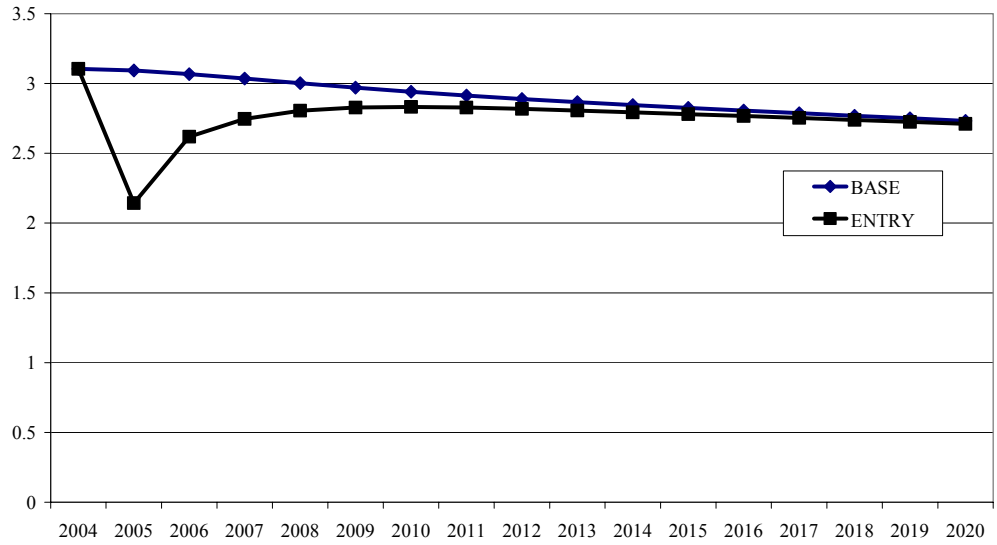
Source: model output.

Figure 10. Growth of capital stock, deviation from the BASE scenario, per cent



In the labour market, increasing demand for labour both in the open, PC sector and in the IC sectors leads instantly to lower unemployment, and what is more, although the effect tapers off over time, it persists almost for the whole study period. This illustrates the slow adjustment of the labour market (figure 11).

Figure 11. Unemployment rate according to the two scenarios



Finally, let us take a look at the distribution of benefits from increased competition. Among other things, the two types of households differ in their share of capital earnings, with the lower share accruing to the migrant households. However, we cannot observe from the available data which household owns what (e.g. division of capital income from the RoW and from home province, or from IC and PC activities), so that it is not possible to accurately measure the gains and losses according to household type. Furthermore, our division of households is very aggregated, which is simply not the most appropriate for the question at hand, but is currently the only one available. Having said this, let us present the current value of the equivalent variation, i.e. the sum of monetary income that would give the same utility for the households if the change (increased threat of entry) does not materialise.

Table 5. Division of utility from increased competition, measured in equivalent variation

	Equivalent variation, Present value 2000-2020 million euro	Population 100 persons	Equivalent variation, Present value 2000-2020 per capita, euro
Native households	72.7	186.82	3,892
Migrant households	35.6	70.94	5,015

Source: model output.

Although our data are very aggregated, the results confirm an important aspect: the division of utility from increased competition is not distributed evenly among the population. Generally speaking, every policy measure has its losers and winners. In our model, those with a higher share of income coming from capital earnings benefit less from the simulated change. However, the high level of aggregation does not allow us to identify the winners and losers more precisely.

In thinking of the reasons behind the reluctance of the Åland Government to increase competition in the domestic market, one explanation, apart from the apparent language policy argument, could be that policymakers have focused too much on the immediate, first-order adverse effects of increased competition on the IC companies that operate mainly in the local market.

Our results show that the private sector would be better off in total with less protection, which means that the current protectionist policy conflicts with its objective of promoting positive development in Åland. The overall effects of an increased threat of entry may have been overlooked. However, the results presented here are quite standard. For example, Mercenier (2002) provides similar results with his intertemporal imperfect competition model on Europe's move to the Single Market.

4.3. Sensitivity of the results

The fact that computable general equilibrium models contain parameters that are not econometrically estimated is said to be both their weakness, as well as their advantage. The weakness refers to the uncertainty of the assessments that depend on parameters for which the values are taken "from the literature" (see e.g. Hertel et al, 2004). The advantage refers to the famous Lucas critique of econometric models (Lucas, 1976; for a recent discussion on the issue see also Lindé, 2001a). Lucas (1976) argues that models estimated from historical time series produce behavioural parameters that are conditional on past policies. When policies change, forward-looking economic agents adjust their behaviour. Models based on historical data cannot capture the changes in behavioural parameters. In the field of real business cycle modelling, the relevance of Lucas critique has been intensively tested (for an overview, see

Lindé 2001b). One important conclusion seems to be that the behaviour of economic agents contains both backward-looking and forward-looking elements. In other words, according to these studies it is worthwhile to explore the information contained in the historical time series. Hertel et al. (2004) advocate for CGE model-consistent econometric estimation of Armington trade elasticities. In addition, validation criteria are being developed for CGE models. For example, Valenzuela et al. (2005) examine how well GTAP global CGE model can reproduce the price volatility observed in agricultural markets, and how to use the results to identify the weak points of a model.

Econometric estimation of all the parameters of a model like the present one requires such extensive quantities of data, time, and other resources that it cannot be accomplished as a part of the present study. As discussed above, econometric estimation was applied to migration and production functions, but the rest of the parameters are based on base-year calibration and estimates obtained from the literature. In addition, some of the parameter values were chosen through informal testing of the dynamic behaviour of the model.

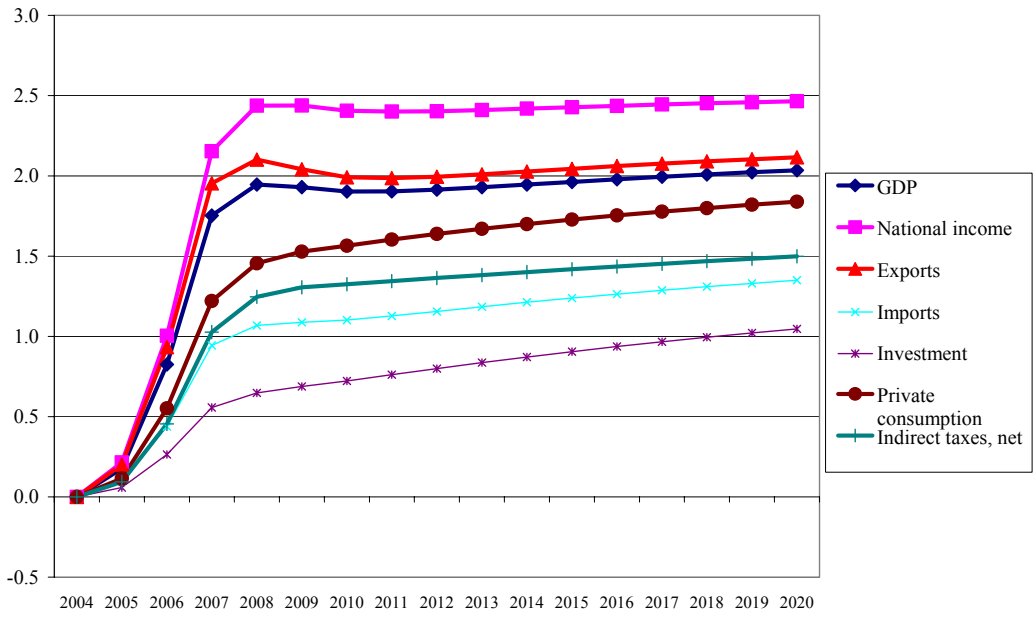
Another way to validate a CGE model is to do "back casting", i.e. to start from an historical date and run the model towards the current date. In such simulations, parameters that are normally exogenous are endogenised, and in turn, endogenous variables are turned into exogenous, in order to force the model to follow the path of economic development known as ascertained from national accounts and trade statistics (see Giesecke, 2002 and 2004, and Liu et al., 2003). By means of such simulations, estimates for the Armington elasticities of trade can be obtained, for example. However, even this approach is too resource and data intensive for our study. We opt for the most parsimonious method of sensitivity analysis, i.e. we present below how altering of some key parameter values affects our results.

In fact, the simulation example of this essay not very well suited for validation of the model, as there is no close counterpart to our simulation in recent history. However, we can study the sensitivity of our results with regard to the magnitude and to the time path of the competition shock. In addition, the effect of altering the Armington trade elasticities is studied. They define the ease of substitution between domestic products and imports, as well as between exports and domestics sales. Armington elasticities are often in the focus, when the validity of results from a global trade model is discussed (Hertel et al, 2004; Valenzuela et al, 2005).

First, let us consider the development of the competitiveness shock over time. Let us assume that knowledge of the policy change in Åland spreads according to a logistic growth curve, similarly to the diffusion of technological change modelled in the seminal paper by Griliches (1957). Let us further assume that it takes five years for the entry threat to reach the values reported in table 3 above. Second, we consider whether the size of the shock changes our qualitative results. We assume that the competitive threat is described in this simulation by values of ψ_A double to those in table 3. The new scenarios are called ENTRYL and ENTRY2. Finally, we halve the Armington trade elasticities and reiterate the simulations.

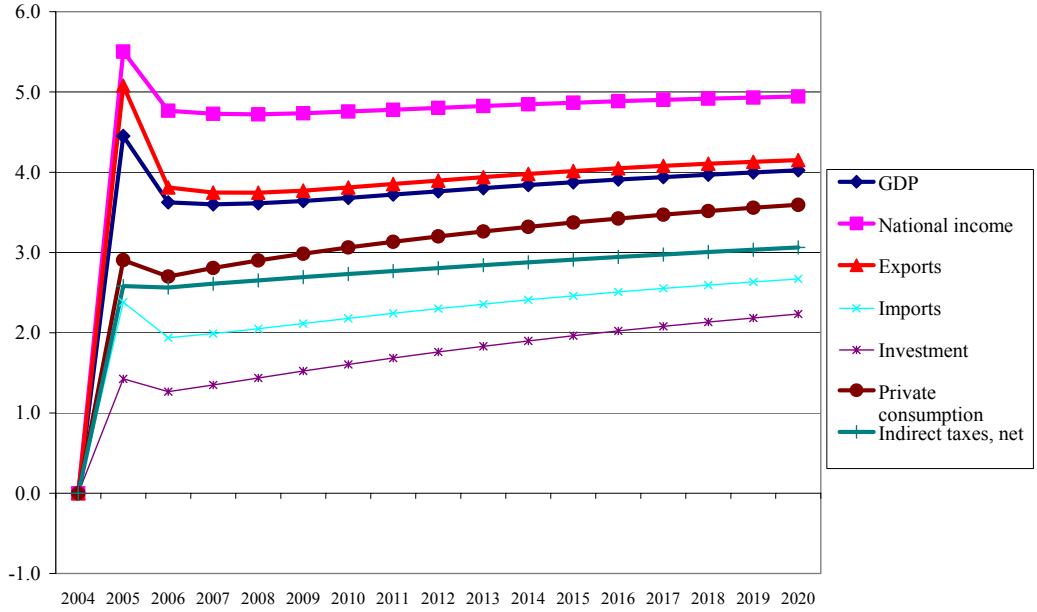
Let us first examine the effect of the evolution of shock. If the competitive threat develops according to a logistic curve instead of an instant "shock treatment", the results will naturally reflect the type of the shock. The delayed timing of the shock reduces the discounted value of equivalent variation somewhat, but the order of magnitude of the welfare change remains the same, as does its distribution between the two households.

Figure 12. Scenario ENTRYL, deviation from BASE, per cent



By doubling the values of parameter ψ_A in table 3, we change the results more or less proportionally. This can be seen in figure 13.

Figure 13. Scenario ENTRY2, deviation from BASE, per cent



In order to see whether different values of trade elasticities change our results, let us analyse at the present value of the equivalent variation. Table 6 shows that the results are quite similar in the corresponding scenarios. Lower trade elasticities lead to somewhat lower quantitative estimates, but the relative position of native and migrant households stay more or less the same.

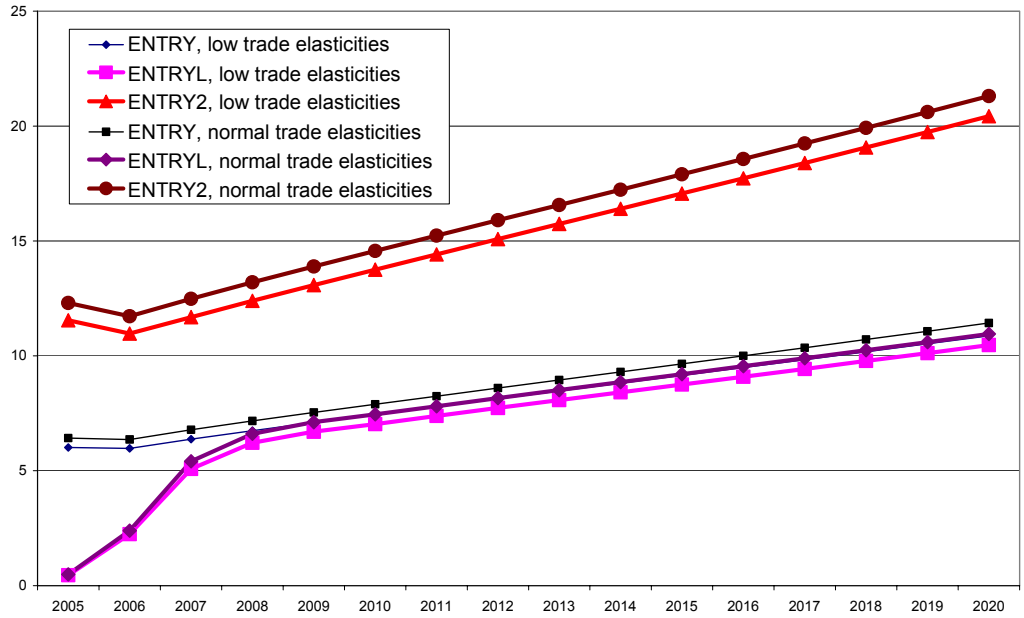
Table 6. Present value of equivalent variation, million euro

		ENTRY	ENTRYL	ENTRY2
Low trade elasticities	Native households	69.1	60.0	128.8
Low trade elasticities	Migrant households	33.3	28.8	61.9
Normal trade elasticities	Native households	72.7	62.9	134.8
Normal trade elasticities	Migrant households	35.6	30.7	66.1
Difference between normal and low		-5.0%	-4.6%	-4.5%
trade elasticity results, per cent		-6.5%	-6.2%	-6.4%

Note: low trade elasticities means halving the values reported in appendix 4.
Source: model output.

From figure 14 we can see that the sum of the equivalent variation over the households grows each year. However, the size of the trade elasticities is not as crucial for the quantitative results as are the assumptions on the size and the type of the change in the threat of entry. In general, the model specification itself may affect the results. One potential source of sensitivity is the assumption of perfect competition in the RoW markets. If export prices were sensitive to the quantities exported from Åland (i.e. if export demand were price inelastic), quantitative results could change. However, our preliminary tests with such a model specification suggest that even then the results remain more or less the same. Nevertheless, the results are not reported here as such a model would require different calibration parameters, as well as new sets of equations, which make direct comparisons cumbersome.

Figure 14. Sum of equivalent variation per year, million euros



5. Discussion

The model presented in this study captures several special features of the Åland islands. Less than perfectly competitive product markets, the interplay of the local labour market and migration, as well as the special financing system of the public sector are included in the model. Many of these features are almost redundant in the policy example of this essay, which may be a breach of the modellers' own version of the Occam's Razor: use the simplest model adequate for the task at hand (Devajaran – Robinson, 2002). However, as our model will be used in various contexts, our aim was to make a general presentation of it.

The imperfect competition (IC) module of the model introduces Cournot-conjectural variations model for multi-product activities with fixed yields of each commodity per unit of activity. The IC module is based on Francois and Roland-Holst (1997), Willenbockel, (2002), and De Santis (2002), although none of these were applied to a multi-product case.

Due to the model specification, where labour supply of the next period depends on the current unemployment rate and wage level compared to neighbouring regions, and due to a Phillips-curve type relationship between the local unemployment rate and wage increase, labour market exhibits hysteresis. In this setting, the growth rate of labour supply is endogenous, making GDP growth rate endogenous as well. The dynamic adjustment path of the economy resembles that estimated for the US states in the seminal paper by Blanchard and Katz (1992).

Investment, and thus growth of the capital stock, depends on the profitability of the industry through a Monash-type investment module (see Dixon et al., 2002), very similar to the ones used in Vaittinen (2004), and in Bayar et al. (2004). The functioning of the model is demonstrated by introducing a competitiveness shock to the economy by changing the local business license rules.

By analysing this problem in a computable general equilibrium framework, we can see that the usage of barriers to entry in the business sector entails a cost that increases over time. Furthermore, it seems that the beneficial effect of an increased domestic competition on the costs of export-oriented firms, through their intermediate domestic consumption, may have not gained the attention it deserves from the local policymakers. Therefore, it seems that

policymakers have focused too much on the immediate, first-order adverse effects of increased competition on the companies operating mainly on the home market of Åland.

It is beyond the scope of this study to evaluate in detail whether the current system is worth its cost. Ultimately, it is a question of determining the value of issues like protective language policy. This exercise does not claim to be able to provide any precise estimation of the procompetitive effects. By increasing the values of parameter ψ_A, the above-mentioned effects change more or less proportionally. However, the division of utility between the two household-types of the model seems quite robust to different assumptions regarding the size and type of the shock. In addition, different values of Armington trade elasticities do not markedly change the results in this respect.

References

Aalto-Setälä, Ville – Kinnunen, Jouko – Koistinen, Katri (2004): *Reasons for high food prices in small markets areas – The case of the Åland Islands*, Agribusiness – An International Journal, Volume 20, Number 1, Winter 2004, pp. 17-29, Wiley.

Abayarisi-Silva, Kaladura – Horridge, Mark (1996): *Economies of Scale and Imperfect Competition in an Applied General Equilibrium Model of the Australian Economy*, Centre of Policy Studies and the Impact Project, Monash University, Preliminary Working Paper No. OP-84, March 1996, ISBN 0-7326-0733-7.

Armington, P. (1969): *A theory of demand for products distinguished by place of origin*, IMF Staff Papers 16, pp. 159-178.

Bayar, Ali – Cornelisse, Peter – van der Hoek, Peter - Mohora, Christina (2004): *Tax Harmonisation and public expenditures restructuring in Romania, in the process of preparation for the EU accession – A CGE modeling exercise*, ECOMOD conference 2004 Available at: http://www.ecomod.net/conferences.htm.

Berck, P. – Golan, E. – Smith, B. (1996): *Dynamic Revenue Analysis for California*, University of California at Berkeley, available at: http://134.186.99.249/html/fs_data/dyna-rev/dynrev.htm.

Bergman, Lars (1990): The Development of Computable Equilibrium Modeling, in *General Equilibrium Modeling and Economic Policy Analysis*, eds. Lars Bergman, Dale W. Jorgenson, and Erno Zalai, pp. 3-30, Basil Blackwell, Cambridge.

Blanchard, D. G. – Katz, L. F. (1992): *Regional Evolutions*, Brookings Papers on Economic Activity, no. 1, pp. 1-75.

Blanchflower, David G. – Oswald, Andrew J. (1994): *The Wage Curve*, The MIT Press, Cambridge, ISBN 0-262-02375-X.

Brooke, A. – Kendrick, D. – Meeraus, A. – Raman, R. (2003): *GAMS – A User's Guide*, GAMS Development Corporation.

Chambers, Robert (1988): *Applied Production Analysis – A dual approach*, Cambridge University Press, Cambridge, ISBN 0-521-30699-X.

De Santis, Roberto A. (2002): A conjectural variation computable general equilibrium model with free entry, in *Policy Evaluation with Computable General Equilibrium Models*, eds. Fossati, Amadeo – Wiegard Wolfgang, Routledge, London, ISBN 0-415-25671-2.

De Santis, Roberto A. (2003): *The Impact of a Customs Union with the European Union on Internal Migration in Turkey*, Journal of Regional Science, Vol 43, No. 2, pp.349-372, Blackwell Publishing.

Devajaran, Shantayanan – Go, Delfin S. – Lewis, Jeffrey D. – Robinson, Sherman – Sinko, Pekka (1997): Simple General Equilibrium Modeling, in *Applied Methods for Trade Policy Analysis – A Handbook*, edited by Francois, Joseph – Reinert, Kenneth, Cambridge University Press, Cambridge, ISBN 0-521-58997-5.

Devajaran, Shantayanan – Robinson, Sherman (2002): *The Influence of Computable General Equilibrium Models on Policy*, International Food Policy Research Institute (IFPRI), Trade and Macroeconomics Division, TMD Discussion Paper No. 98, available at http://www.cgiar.org/ifpri/divs/tmd/dp.htm.

Dixon, Peter B. – Parmenter, Brian R. – Rimmer, Maureen T. (2002): CGE models for practical policy analysis: The Australian experience, in *Policy Evaluation with Computable General Equilibrium Models*, eds. Fossati, Amadeo – Wiegard Wolfgang, Routledge, London, ISBN 0-415-25671-2.

Elhorst, Paul J. (2003): *The Mystery of Regional Unemployment Differentials: Theoretical and Empirical Explanations*, Journal of Economic Surveys, 2003, vol. 17, issue 5, pp. 709-748.

Fellman, Katarina (2004): *På jakt efter tillväxt – En analys av utvecklingsmöjligheterna inom några landbaserade näringar på Åland*, ÅSUB Rapport 2004:6, Mariehamn (in Swedish).

Francois, Joseph – Roland-Holst, David (1997): Scale Economies and Imperfect Competition, in *Applied Methods for Trade Policy Analysis – A Handbook*, edited by Francois, Joseph – Reinert, Kenneth, Cambridge University Press, Cambridge, ISBN 0-521-58997-5.

Giesecke, James (2002): *Explaining regional economic performance: An historical application of a dynamic multi-regional CGE model*, Papers in Regional Science 81, 247-278.

Giesecke, James (2004): *The extent and consequences of the recent structural changes in the Australian economy, 1997-2002: Results from historical/decomposition simulations with Monash*, Centre of Policy Studies, Monash University, General Working Paper No. G-151, December 2004.

Ginsburgh, Victor (1994): In the Cournot-Walras General Equilibrium Model, There May Be "More to Gain" by Changing the Numeraire than by Eliminating Imperfections: A Two-Good Economy Example, in *Applied General Equilibrium Analysis and Economic Development: Present Achievements and Future Trends,* edited by Mercenier, J. – Srinivisan, T., Ann Arbor, University of Michigan press, pp. 217-224.

Ginsburgh, Victor – Keyzer, Michiel (1997): *The Structure of Applied General Equilibrium Models*, MIT Press, Cambridge, ISBN 0-262-57157-9.

Griliches, Zvi (1957): *Hybrid Corn: An Exploration in the Economics of Technological Change*, Econometrica, Vol. 25, No. 4 (Oct., 1957), pp. 501-522.

Harris J. R. – Todaro, M. P. (1970): *Migration and unemployment: a two-sector analysis*, The American Economic Review 60, 126-142.

Hertel, Thomas – Hummels, David – Ivanic, Maros – Keeney, Roman (2004): *How Confident Can We Be in CGE-Based Assessments of Free Trade Agreements?*, GTAP Working Paper No. 26, Revised Version, March 2004.

Jalava, Jukka, editor (2004): *Tuottavuuskatsaus 2003*, Tilastokeskus, Katsauksia 2004/3, Helsinki, ISBN 952-467-293-6 (in Finnish).

Keuschnigg, Christian – Kohler, Wilhelm (1996): *Commercial policy and dynamic adjustment under monopolistic competition*, Journal of International Economics 40, 373-409, Elsevier Science B.V.

Kiander, J. – Viren, M. (2001): *Measuring labour market flexibility in the OECD countries*, Empirica, 28.

Kinnunen, Jouko (2003): *Quantification of ordered-level business sentiment survey forecasts by means of external validation data*, Helsinki School Economics, Working Papers W-354, Helsinki, ISBN 951-791-790-2.

Kinnunen, Jouko (2004): *I Heard it Through the Grapevine – Personnel Managers' Attitudes and the Functioning of a Small and Isolated Labour Market*, unpublished draft, prepared as a course essay for a qualitative research course.

Kuismanen, Mika (2001): Työn tarjonta ja tuloverotus: katsaus teoriaan ja kotimaiseen empiiriseen evidenssiin, in *Työmarkkinat testissä*, edited by Seija Ilmakunnas, Government Institute of Economic Research, VATT-Publications 30, Helsinki, ISBN 951-561-371-X (in Finnish).

Leadership group SAM (2003): *Handbook on Social Accounting Matrices and Labour Accounts*, European Commission, Population and social conditions 3/2003/E/N 23, Luxemburg, available at http://forum/europa.eu.inte/Members/irc/dsis/employ/home.

Lindé, Jesper (2001a): *Testing for the Lucas Critique: A Quantitative Investigation*, The American Economic Review, Vol. 91 No. 4, September 2001, pp. 986-1005.

Lindé, Jesper (2001b): *The Empirical Relevance of Simple Forward- and Backward-looking Models: A View from a Dynamic General Equilibrium Model*, Sveriges Riksbank Working Paper Series, No. 130, December 2001.

Lindström, Bjarne (2002): *Den åländska näringsrätten*, Statistics and Research Åland, ÅSUB Rapport 2002:5, Mariehamn, ISSN 1455-1977 (in Swedish).

Lindström, Bjarne – Kinnunen, Jouko (2004): *Det åländska skatteundantagets samhällsekonomiska betydelse – i dag och i framtiden*, ÅSUB Rapport 2004:5, Mariehamn (in Swedish).

Liu, Jing – Arndt, Channing – Hertel, Thomas W. (2003): *Parameter Estimation and Measures of Fit in A Global, General Equilibrium Model*, GTAP Working Paper No. 23, March 2003.

Lofgren, Hans – Harris, Rebecca Lee– Robinson, Sherman, with assistance from Thomas, Marcelle and El-Said, Moataz (2002): *A Standard Computable General Equilibrium (CGE) Model in GAMS,* International Food Policy Research Institute, IFPRI, Microcomputers in Policy Research 5, ISBN 0-896-29720-9.

Lucas, Robert E., Jr. (1976): *Econometric Policy Evaluation: A Critique*, Carnegie-Rochester Conference Series on Public Policy, I, pp. 19-46.

Mercenier, Jean – Yeldan, Erinc (1999): *A Plea For Greater Attention on the Data in Policy Analysis*, Journal of Policy Modeling, 21(7): 851-873, North Holland.

Mercenier, Jean (2002): An applied intertemporal general equilibrium model of trade and production with scale economies, product differentiation and imperfect competition, in *Policy Evaluation with Computable General Equilibrium Models*, eds. Fossati, Amadeo – Wiegard Wolfgang, Routledge, London, ISBN 0-415-25671-2.

Möller, Joachim (2001): *Regional Adjustment Dynamics*, HWWA Discussion Paper 146, Hamburger Institute of International Economics, ISSN 1616-4814.

Pekkarinen, Tuomas (2001): *The Wage Curve: Evidence from the Finnish Metal Industry Panel Data*, Finnish Economic Papers, Vol. 14, Nr 1, Spring 2001, pp. 51-60.

Phillips, A. W. (1958): *The Relation Between Unemployment and the Rate of Change of Money Wage Rates in The United Kingdom, 1861-1957*, Economica 25 (November), pp. 283-299.

Reinert, Kenneth A. – Roland-Holst, David W. (1997): Social Accounting Matrices, in *Applied Methods for Trade Policy Analysis – A Handbook*, edited by Francois, Joseph – Reinert, Kenneth, Cambridge University Press, Cambridge, ISBN 0-521-58997-5.

Robinson, Sherman – Cattaneo, Andrea – El-Said, Moataz (2001): *Updating and Estimating A Social Accounting Matrix Using Cross Entropy Methods*, Economic Systems Research, Vol 13, No. 1, International Input-Output Association.

Robinson, Sherman – El-Said, Moataz (2000): GAMS Code for Estimating a Social Accounting Matrix (SAM) Using Cross Entropy Methods, Trade and Macroeconomics Divison, International Food Policy Research Institute, IFPRI, TMD Discussion Paper No. 64, available at: http://www.cgiar.org/ifpri.

Romer, David (1996): *Advanced Macroecomics*, McGraw-Hill, ISBN 0-07-053667-8.

Sauramo, Pekka (2004): *Palkkanormit ja palkanmuodostus Suomessa*, Labour Institute for Economic Research, Discussion Papers No. 207, Helsinki, ISBN 952-209-006-9, available at http://www.labour.fi (in Finnish).

Scarpulla, Claudio (2002): The special status of Åland in Finland and the European Union, in *The second Åland Islands question, Autonomy or independence?*, Jansson, Harry – Salminen, Johannes (eds.), the Julius Sundblom Memorial Foundation, Mariehamn, ISBN 952-91-4613-2.

Seung, Chang Kyu (1996): *A Dynamic General Equilibrium Analysis of State Tax Incentives for Economic Development*, Dissertation, Ohio State University.

Solow, Robert (1990): *Labour Markets as a Social Institution*, Basil Blackwell, Cambridge.

Statistics and Research Åland, ÅSUB (2004): *Statistical Yearbook of Åland*, Mariehamn, ISSN 0358-8629.

Statistics Finland (2000): *Regional Input-Output 1995 – Tables and Compilation Methods*, National Accounts 2000:19, Helsinki, ISBN 951-727-810-1.

Statistics Finland (2003): *Population Census 2000*, available at: http://v2000.stat.fi.

Statistics Finland (2004a): *Finnish input-output tables*, available electronically at: http://altika2.stat.fi/database/National%20accounts/National%20accounts.asp.

Statistics Finland (2004b): *Aluetilinpito 1975-2002*. Tuotannon ja työllisyyden aluetilit*, available only electronically at: http://www.stat.fi/til/atutyo/2002/index.html (in Finnish).

Turunen, Juhani – Eriksson, Dan E. (2004): *Det skattefinansiella utjämningssystemet mellan landskapet Åland och staten: 1990-talets erfarenheter*, Ministry of Finance & Government of Åland, available at http://www.ls.aland.fi/.composer/upload/modules/publikationer/ekonomisk_utredning_2004.pdf (in Swedish).

Vaittinen, Risto (2004a): *Trade Policies and Integration – Evaluations with CGE –models*, Dissertation, Helsinki School of Economics, A-235, Helsinki, ISBN 951-791-843-7.

Vaittinen, Risto (2004b): Personal communications containing information on parameter values used in the CGE models of Government Institute for Economic Research (VATT).

Valenzuela, Ernesto – Hertel, Thomas W. – Keeney, Roman – Reimer, Jeffrey J. (2005): *Assessing Global CGE Model Validity Using Agricultural Price Volatility*, GTAP Working Paper No. 33, September 2005.

Willenbockel, Dirk (1994): *Applied General Equilibrium Modelling – Imperfect Competition and European Integration*, John Wiley and Sons, Chichester, ISBN 0-471-95038-6.

Willenbockel, Dirk (2002): *Specification Choice and Robustness in CGE Trade Policy Analysis with Imperfect Competition*, presented in ECOMOD conference 2002, available at http://www.ecomod.net/conferences.htm.

Willenbockel, Dirk (2003): *The Numeraire Problem in General Equilibrium Models with Market Power: Much Ado About Nothing?,* presented in ECOMOD conference 2003, available at http://www.ecomod.net/conferences.htm.

Appendix 1. Aggregation in the Åland SAM 2000

Activities:

A-AGRI	Primary production, NACE 01-14
A-FINDU	Food industry, NACE 15-16
A-INDU	Other manufacturing, NACE 17-36
A-ELWA	Water, gas, and electricity supply, NACE 40-41
A-CONS	Construction, NACE 45
A-TRAD	Trade, NACE 50-52
A-RESH	Restaurants and hotels, NACE 55
A-TRANS	Transport and communication, NACE 60-64
A-BSER	Business services, NACE 65-74
A-OSERV	Personal services, NACE 75-93

Products:

C-AGRI	Primary products
C-FINDU	Food industry products
C-INDU	Other manufacturing commodities
C-ELWA	Water, gas, and electricity
C-CONST	Construction services
C-TRADE	Trade services
C-HOTEL	Restaurant and hotels services
C-TRANSP	Transport and communication services
C-BSERV	Business services
C-OSERV	Personal services
C-FINSERV	Ålanders' tourism on mainland Finland
C-ROWSERV	Ålanders' tourism in the RoW except Finland

Factors:

LABOR	Labour income
CAPI	Capital income

Transaction costs	
TRNCSTDOM	Domestic transaction costs
TRNCSTEXP	Account for transaction costs in exports
TRNCSTIMP	Account for transaction costs in imports

Institutions/tax accounts	
FIRMS	Firms
NGO	Non-profit organisations
STATE	Government of Finland
GOV	Government of Åland
MUNI	Municipalities
SOCSEC	Social security funds
PRODTAX	Product taxes
VAT	Value-added tax
PRODSUB	Product and production subsidies
TRANSSUB	Transport subsidy
CORPTAX	Corporate taxes
SINCTAX	State income tax
MINCTAX	Municipal income tax
SECFEE	Social security fees
OTAX	Other taxes and fees
S-I	Savings and investment account
NHHD	Native households
MHHD	Migrant households
LEXP	Labour exports
ROWHH	Tourist household from the rest of the world
ROW	The rest-of-the-world account

Appendix 2. Social Accounting Matrix of Åland 2000, million euro

(rows and columns with zero values are suppressed)

	A-AGRI	A-FINDU	A-INDU	A-ELWA	A-CONS
C-AGRI	11.084	16.241	7.841	0.176	0.712
C-FINDU	5.296	5.356	0.009	0.003	
C-INDU	10.117	3.233	40.573	1.872	24.486
C-ELWA	1.627	0.271	1.401	8.462	0.278
C-CONST	1.840	0.098	0.417	0.043	1.561
C-TRADE	6.273	0.331	0.534	0.136	8.648
C-HOTEL	0.025	0.217	0.932	0.154	0.023
C-TRANSP	1.048	2.631	3.628	0.168	0.193
C-BSERV	3.016	6.508	8.856	0.985	1.367
C-OSERV	1.068	0.279	1.876	0.192	0.004
LABOR	13.845	13.251	19.793	4.892	20.526
CAPI	37.760	3.353	9.264	4.169	20.647
PRODTAX	1.317	0.325	0.256	0.480	0.104
VAT	0.005	0.014	0.057	0.009	1.367
TOTAL	94.321	52.108	95.437	21.741	79.916

+	A-TRAD	A-RESH	A-TRANS	A-BSER	A-OSERV
C-AGRI	0.015	0.347	0.261	0.015	0.130
C-FINDU	0.544	8.790	6.633	0.056	2.571
C-INDU	8.931	0.428	40.026	2.614	17.465
C-ELWA	1.264		0.127	3.767	2.728
C-CONST	0.098	0.902	12.084	7.009	0.749
C-TRADE	6.691	2.261	28.878	2.543	12.611
C-HOTEL	0.393		1.714	0.696	1.487
C-TRANSP	2.828	0.042	86.915	3.252	5.077
C-BSERV	8.268	8.193	42.180	28.871	11.650
C-OSERV	1.095	0.538	0.332	1.644	10.946
LABOR	29.149	10.131	161.527	26.803	172.643
CAPI	16.824	3.186	99.634	83.065	27.505
PRODTAX	1.579	1.071	7.408	2.364	3.424
VAT	0.038		0.672	3.335	6.515
TOTAL	77.717	35.889	488.391	166.034	275.501

+	C-AGRI	C-FINDU	C-INDU	C-ELWA	C-CONST
A-AGRI	71.311	0.619			
A-FINDU	2.016	45.716		0.019	
A-INDU	1.649		87.618		
A-ELWA				21.060	
A-CONS					79.690
TRNCSTDOM	0.062	0.210	0.169	0.005	0.056
TRNCSTEXP	0.523	1.486	1.329	0.024	0.267
TRNCSTIMP	0.572	1.584	1.438	0.024	0.264
ROW	15.166	40.453	215.724	5.513	21.332
TOTAL	91.299	90.068	306.278	26.645	101.609

+	C-TRADE	C-HOTEL	C-TRANSP	C-BSERV	C-OSERV
A-AGRI		0.199		0.069	0.330
A-FINDU	3.299		0.112	0.039	
A-INDU	0.397		0.495	3.841	
A-ELWA				0.484	
A-TRAD	77.102			0.481	
A-RESH		33.252		0.003	1.973
A-TRANS	52.193	99.677	332.176	0.685	
A-BSER				163.066	
A-OSERV				15.919	259.460
TRNCSTDOM	0.224		0.019	0.006	0.060
TRNCSTEXP	1.323		0.153	0.045	0.477
TRNCSTIMP	1.369		0.167	0.049	0.518
ROW	56.880	0.697	96.408	99.264	4.609
TOTAL	192.787	133.825	429.530	283.951	267.427

+	C-FINSERV	C-ROWSERV	LABOR	CAPI	TRNCSTDOM
C-TRANSP					0.811
FIRMS				316.407	
SECFEE			76.102		
NHHD			200.386		
MHHD			108.715		
ROW	53.553	63.622	103.183	-11.000	
TOTAL	53.553	63.622	488.386	305.407	0.811

+	TRNCSTEXP	TRNCSTIMP	FIRMS	NGO	STATE
C-TRANSP	5.359	5.696			2.469
C-BSERV	0.268	0.289		0.220	0.516
C-OSERV				15.301	8.328
NGO			7.113		1.682
GOV					176.656
MUNI					0.017
SOCSEC					14.933
PRODSUB					20.186
CORPTAX			39.279		
OTAX			11.670		
S-I			136.318		
NHHD			88.861		
MHHD			27.780		
TOTAL	5.627	5.985	311.021	15.521	224.787

+	GOV	MUNI	SOCSEC	PRODTAX	VAT
C-INDU			1.359		
C-TRADE			1.085		
C-TRANSP	22.370		0.435		
C-BSERV	1.187				
C-OSERV	88.450	77.478	5.945		
NGO	5.885				
STATE				42.867	56.913
MUNI	20.780				
PRODSUB	11.752				
TRANSSUB	0.167				
S-I	29.266	7.573			
NHHD	0.233		80.290		
MHHD	0.103		35.652		
TOTAL	180.193	85.051	124.766	42.867	56.913

+	PRODSUB	TRANSSUB	CORPTAX	SINCTAX	MINCTAX
A-AGRI	21.793				
A-FINDU	0.847	0.060			
A-INDU	1.332	0.105			
A-ELWA	0.197				
A-CONS	0.226				
A-TRAD	0.133	0.001			
A-RESH	0.661				
A-TRANS	3.660				
A-BSER	2.968				
A-OSERV	0.121	0.001			
STATE			24.395	53.917	
MUNI			14.884		47.845
TOTAL	31.938	0.167	39.279	53.917	47.845

+	SECFEE	OTAX	S-I	NHHD	MHHD
C-AGRI			1.144	6.817	2.958
C-FINDU			0.955	14.517	6.358
C-INDU			44.471	14.987	6.538
C-ELWA				3.595	1.447
C-CONST			75.787	0.063	0.027
C-TRADE			8.812	27.158	11.771
C-HOTEL				14.317	6.210
C-TRANSP			0.451	10.231	4.449
C-BSERV			12.593	63.587	27.545
C-OSERV				12.582	5.473
C-FINSERV				35.268	18.285
C-ROWSERV				41.900	21.722
NGO				0.587	0.254
STATE		12.461			
MUNI		1.525			
SOCSEC	107.000				
PRODTAX			0.308	12.260	5.273
VAT			7.744	18.136	7.854
SINCTAX				36.605	17.312
MINCTAX				31.770	16.075
SECFEE				19.936	10.962
OTAX				1.735	0.581
S-I				9.476	2.962
TOTAL	107.000	13.986	152.265	375.527	174.056

+	LEXP	ROWHH	ROW	TOTAL
A-AGRI				94.321
A-FINDU				52.108
A-INDU				95.437
A-ELWA				21.741
A-CONS				79.916
A-TRAD				77.717
A-RESH				35.889
A-TRANS				488.391
A-BSER				166.034
A-OSERV				275.501
C-AGRI		2.946	40.612	91.299
C-FINDU		7.440	31.540	90.068
C-INDU		5.957	83.221	306.278
C-ELWA			1.678	26.645
C-CONST			0.931	101.609
C-TRADE		13.109	61.946	192.787
C-HOTEL		91.467	16.190	133.825
C-TRANSP		1.368	270.109	429.530
C-BSERV		0.322	57.530	283.951
C-OSERV		15.019	20.877	267.427
C-FINSERV				53.553
C-ROWSERV				63.622
LABOR	15.826			488.386
CAPI				305.407
TRNCSTDOM				0.811
TRNCSTEXP				5.627
TRNCSTIMP				5.985
FIRMS			-5.386	311.021
NGO				15.521
STATE			34.234	224.787
GOV			3.537	180.193
MUNI				85.051
SOCSEC			2.833	124.766
PRODTAX		6.698		42.867
VAT		11.167		56.913
PRODSUB				31.938
TRANSSUB				0.167
CORPTAX				39.279
SINCTAX				53.917
MINCTAX				47.845
SECFEE				107.000
OTAX				13.986
S-I			-33.330	152.265
NHHD			5.757	375.527
MHHD			1.806	174.056
LEXP			15.826	15.826
ROWHH			155.493	155.493
ROW				765.404
TOTAL	15.826	155.493	765.404	

Appendix 3. Sets, parameters, variables and equations of the model

Note that capital letters A, F and C are used to mark both the entire set and its individual members. Note also that the mathematical model statement below is to a great extent duplicated from Lofgren at et al. (2002).

A3.1. Sets and subsets

A	Activities
AC	Accounts in the SAM
$ACES$ ($\subset A$)	Actitivities with a CES function at the top of the technology nest
$AIMC$ ($\subset A$)	Activities with imperfect competition
$ALEO$ ($\subset A$)	Activities with a Leontief function at the top of the technology nest
C	Commodities
CD ($\subset C$)	Commodities with domestic sales of domestic output
CDN ($\subset C$)	Commodities not in CD
CE ($\subset C$)	Exported commodities
CEN ($\subset C$)	Commodities not in CE
CM ($\subset C$)	Imported commodities
CMN ($\subset C$)	Commodities not in CM
CT ($\subset C$)	Transactions service commodities
CX ($\subset C$)	Commodities with domestic production
EN ($\subset INSDNG$)	Firms (only one aggregate account used in the current version)
F	Factors
$FCAP$ ($\subset F$)	Capital factors (could be more than one)
$FLAB$ ($\subset F$)	Labour factors (could be more than one)
INS	Institutions (all institutions in SAM)

INSD ($\subset$ *INS*)	Institutions present in the domestic market (includes the RoW households)
INSDG ($\subset$ *INSD*)	Domestic public sector institutions
INSDNG ($\subset$ *INSD*)	Domestic nongovernmental institutions (RoW households excluded)
INSDGMRG ($\subset$ *INSDG*)	Domestic public sector institutions except regional government
H ($\subset$ *INSDNG*)	Households, i.e. native (NHHD) and migrant (MHHD) households
TH ($\subset$ *INSD*)	RoW (i.e. tourist) households
USER ($\subset$ *AC*)	Activities and institutions consuming commodities

A3.2. List of parameters

Latin letters

C_A^I	Sensitivity parameter in investment function
$comrate_L$	Commuters' share of labour income in transport sector
$cwts_C^H$	Weight of commodity C in the CPI (calculated over households)
D_A^I	Adjustment parameter for the expectations on the rate of return, a fraction of the former period disequilibrium
$dwts_C$	Weight of commodity C in the producer price index
$exfac_{F\ ROW}$	Transfer from abroad to factor F
$ica_{C\ A}$	Quantity of C as intermediate input per unit of activity A
$icd_{CC'}$	Quantity of commodity C as trade input per unit of C' produced and sold domestically (in Åland)
$ice_{CC'}$	Quantity of commodity C as trade input per exported unit of C'
$icm_{CC'}$	Quantity of commodity C as trade input per imported unit of C'

inm_A	Quantity of aggregate intermediate input per activity unit
iva_A	Quantity of value added per activity unit
KG_A^{MAX}	Maximum feasible growth rate of capital in activity A
KG_A^{MIN}	Minimum feasible growth rate of capital in activity A, equal to the opposite value of depreciation rate, equalling no investment
KG_A^{TREND}	Historically normal rate of capital growth
$migconst_H$	Constant in the migration equation of household H
$\overline{mps}_I$	Base savings rate for domestic institutions I
$mps01_I$	0-1 parameter with 1 for institutions with potentially flexed direct tax rates
$popugrw_H$	Annual population growth rate during 2000-2020
$psub_A$	Production subsidy rate
pwe_C	Export price (foreign currency)
pwm_C	Import price (foreign currency)
$qdst_C$	Quantity of stock change (set to zero here)
$\overline{qg}_C$	Base-year quantity of regional government demand of C
$\overline{qinv}_C$	Base-year quantity of investment demand
$\overline{qmuni}_C$	Base-year quantity of municipalities' demand of C
$\overline{qsoc}_C$	Base-year quantity of social security funds demand of C
$\overline{qstate}_C$	Base-year quantity of central government (state) demand of C
$RORN_A$	Historically normal rate of return in activity A
$seawsh_A^{CA}$	Share of sea wages from cargo traffic of activity A wages
$seawsh_A^{PT}$	Share of sea wages from passenger traffic of activity A wages
$shif_{I\,F}$	Share for domestic institution I in income of factor F
$shii_{I\,I'}$	Share of net income of I' to I ($I' \in INSDNG'; I \in INSDNG$)
$shpsub_I$	Share of institution I in financing $PSUB$ ($I \in INSDG$)
$shptax_I$	Share of institution I of tax income from $t^P_{C\,USER}$ ($I \in INSDG$)

shrimbinc	Share of state income taxes included in the REIMBASE calculation (a part of "income" taxes in reality other taxes, but related to income for simplicity)
$shtins_I$	Share of institution I of tax income from *tins* ($I \in INSDG$)
$shtcorp_I$	Share of institution I of tax income from *tcorp* ($I \in INSDG$)
$shtalv_I$	Share of institution I of tax income from $t^{VAT}_{C\,USER}$ ($I \in INSDG$)
$s\sec_H$	Social security fee for labour income paid by households
$s\sec_F$	Social security fee for factor income paid by firms
$ssubr^{CA}_A$	Wage subsidy rate for cargo traffic by sea
$ssubr^{PT}_A$	Wage subsidy rate for passenger traffic by sea
$ssubsh^{CA}_I$	Share of institution I in financing $\sum_A SSUB^{CA}_A$ ($I \in INSDG$)
$ssubsh^{PT}_I$	Share of institution I in financing $\sum_A SSUB^{PT}_A$ ($I \in INSDG$)
$t^{P}_{C\,USER}$	Product tax, differentiated by user
$t^{VAT}_{C\,USER}$	Non-deductible VAT, differentiated by user
t^{muni}_I	Initial municipal income tax rate
t^{state}_I	State income tax rate
t^{ins}_I	Initial direct tax rate of institution, other than income taxes
ta_A	Tax rate for activity A
$tcorp_I$	Corporate income tax rate
te_C	Export tax rate
tf_F	Direct tax rate for factor F
$tins01_I$	0-1 parameter with 1 for institutions with potentially flexed direct tax rates
tm_C	Import tariff rate
$tmunit01_I$	0-1 parameter for potential flexing of municipal income tax rate of institution I

$trnsfr_{I\,I'}$	Transfer from institution I' to institution I
$tsub_A$	Transport subsidy rate
$unberate_H$	Unemployment benefit per unemployed in household H
wgr	Exogenous, national wage growth rate
$wpoprate_H$	Share of working aged members of household H

Greek letters

α_A^A	Efficiency parameter in the CES activity function
α_A^{VA}	Efficiency parameter in the CES value-added function
α_A^{AC}	Shift parameter for domestic commodity aggregation function
α_A^q	Armington function shift parameter
α_A^T	CET function shift parameter
$\alpha_{L\,H}$	Shift parameter for the labour supply CET function
$\beta_{C\,H}$	Marginal share of consumption spending on commodity C for H
β_C^{NGO}	Cobb-Douglas consumption share of C for non-profit organisations
β_C^{TH}	Cobb-Douglas consumption share of C for tourist households
β_{MIG}^H	Coefficient of the migration equation
β_u	Unemployment elasticity of wage rate
$\gamma_{C\,H}$	Subsistence consumption of commodity C by household H
δ_A^A	CES activity function share parameter
$\delta_{A\,C}^{AC}$	Share parameter for domestic commodity aggregation function
δ_A^K	Depreciation rate of activity A
δ_C^Q	Armington function (exports – dom. sales) share parameter
σ_C^T	Exports-domestic sales transformation elasticity
$\delta_{F\,A}^{VA}$	CES value-added function share parameter for factor F in act. A
$\delta_{L\,H}$	Share parameter for the labour supply CET function

η_H^W	Wage elasticity of labour supply
η_H^{tax}	Tax elasticity of labour supply
η_H^{TR}	Transfer elasticity of labour supply
θ_{AC}	Yield of commodity C per unit of activity A
ρ_A^A	CES production function exponent
ρ_A^{VA}	CES value-added function exponent
ρ_C^{AC}	Domestic commodity aggregation function exponent
ρ_C^Q	Armington function exponent ($\rho_C^Q = \frac{1-\sigma_C^Q}{\sigma_C^Q}$)
ρ_C^T	Trade CET function exponent ($\rho_C^T = \frac{1+\sigma_C^T}{\sigma_C^T}$)
$\rho_{L\,H}$	Labour supply CET function exponent
σ_A^A	Top-level elasticity between intermediates and value added
σ_C^{AC}	CES elasticity for the domestic commodity aggregation
σ_C^Q	Imports – domestic use elasticity of substitution
σ_C^T	Exports – domestic sales elasticity of transformation
ψ_{LIMP}	Fixed share of seamen commuting to Åland from the RoW

A3.3. Variables

$ASHAREC_{A\,C}$	Share of activity A in production of exported commodity C
CPI	Consumer price index, model numéraire
COMLABF	Amount of commuters to Åland, per hundred people
$DEPRE_A$	Value of depreciation in activity A
DMPS	Change in domestic institution savings rates (= 0 for base; exogenous)
DMUNIT	Change in the municipal tax income rate (= 0 for base)
DPI	Producer price index for domestically marketed output
DTINS	Change in domestic institution tax rate (= 0 for base; exogenous)
E_{NGO}	Expenditure of NGOs/NPOs (non-profit organisations)
E_{TH}	Expenditure of tourist households (exogenous)
$EEQROR_A$	Expected equilibrium rate of return
EG	Regional government expenditure
EH_H	Consumption spending for household H
EMUNI	Expenditure of municipalities
ESOCSEC	Expenditure of social security funds
ESTATE	Expenditure of state in Åland
EXOGLUMP	0 if REIMB is less than zero, otherwise 1
EXR	Real exchange rate
FDEBT	Cumulative foreign debt or claim
FSAV	Foreign savings
FININCTAX	Tax revenue from income taxes on the Finnish mainland (included in the calculation of recompense)
GADJ	Government consumption adjustment factor

$GOVSHR$	Government share in nominal absorption
$GSAV$	Government savings
I_A	Value of fixed capital formation of activity A
$IADJ$	Investment adjustment factor
$INVMULT_A$	Adjustment coefficient for the investment market
$INVSHR$	Investment share in nominal absorption
K_A	Capital stock of activity A
$LEXP_H$	Quantity of labour exports
$LIMP$	Amount of labour imports, i.e. commuting from the RoW
$LSALA_H$	Amount of domestic labour supply to domestic labour market by H
$LSMAX_H$	Maximum labour supply, i.e. population aged 15-64
$LUMP$045	0.45 per cent lump sum from Finnish state budget income
$LUMPSUM$	Total lump sum from the state to the regional government
MIG_H	Net migration to/from household H
MPS_I	Marginal propensity of institution I to save
$MPSADJ$	Savings rate scaling factor (=0 for base)
$MUNIADJ$	Municipalities' demand scaling factor
$MUNISAV$	Savings of municipalities
$MUNIT_I$	Municipal income tax rate
$MUNITADJ$	Adjustment factor of municipal income tax rate
n_A	Number of firms in activity A
$NOUNEM_H$	Number of unemployed in household H
PA_A	Price of activity A
PDD_C	Demand price for commodity C produced and sold domestically
PDS_C	Supply price for commodity C produced and sold domestically
PE_C	Export price (domestic currency)

PI	Price of a composite investment good
$PINTA_A$	Price of a composite intermediate good
PM_C	Import price (domestic currency)
$POPU_H$	Population for household H (hundreds; exogenous)
PQ_C	Price of final composite good C (excluding VAT and prod. taxes)
$PRODTSUM$	Sum of consumer and product-specific product taxes
$PSUBSUM$	Sum of production subsidies paid
PVA_A	Value-added price (factor income per unit of activity)
PX_C	Producer price of domestic commodity aggregate C
$PXAC_{AC}$	Producer price of commodity C produced by A
QA_A	Quantity of activity
QD_C	Quantity of domestic sales of C
QE_C	Quantity of exports
$QF_{F\ A}$	Quantity demanded of factor F from activity A
QFS_{FCAP}	Total supply of capital services (exogenous)
$QFZ_{A,F}$	Recurrent fixed quantity of factor F
QG_C	Regional government consumption demand for commodity C
$QH_{C\ H}$	Quantity of commodity C consumed by household H
$QINTA_A$	Quantity of composite intermediate good
$QINT_{C\ A}$	Quantity of commodity C as intermediate input to activity A
$QLST_H$	Total domestic supply of labour, including labour exports
QM_C	Quantity of imports
$QMUNI_C$	Quantity of commodity C demanded by municipalities
$QNGO_C$	Quantity of commodity C demanded by non-profit organisations
$QROWH_C^{TH}$	Quantity of commodity C demanded by tourist household TH
$QSOCSEC_C$	Quantity of commodity C demanded by social security funds
$QSTATE_C$	Quantity of commodity C demanded by state
QQ_C	Quantity of final composite good supply C

QT_C	Quantity of commodity demanded as trade input
QVA_A	Quantity of value added
QX_C	Quantity of domestic commodity aggregate C
$QXAC_{AC}$	Quantity of commodity C produced by A
REIMB	Recompense of Åland's income tax revenues exceeding 0.5 per cent of Finnish state income tax revenues
RINT	Reference interest rate, a fixed fraction of the average returns to capital in Åland
ROR_A	Current period rate of return in activity A
ROWIR	Interest rate for capital invested in the RoW, exogenous
SINALA	Income base for state lump sum (amount of equalisation)
$SSUB_A^{CA}$, $SSUB_A^{PT}$	Subsidies for cargo and passenger traffic by sea in act A
TABS	Total nominal absorption
TALVSUM	Sum of non-deductible VAT
$TCECOST_A$	Transport cost for exports of activity A
TIMFIN	Tax income in the mainland of Finland
$TINS_I$	Direct tax rate for institution I ($I \in INSDNG$)
TINSADJ	Direct tax scaling factor (= 0 for base, exogenous)
$TRII_I^{I'}$	Transfers from I' to I (both in the set INSDNG)
TRSADJ	Adjustment factor of state transfer from the ROW
TRSOCADJ	Adjustment factor of social security fund transfers to/from the ROW
TRSUBSUM	Sum of transport subsidies paid
U	Unemployment rate
$UNBEN_H$	Unemployment benefits received by household H
UNEMFIG	Number of unemployed surpassing minimum number (1% of labour force)

W_F	Average price of factor F (L and K in the current version)
W_{LEXP}	Wage rate for labour exports
W_{LIMP}	Commuters' wage rate
$WALRAS$	Savings-investment imbalance (should be zero)
WC	Labour wage rate of period t-1
$WFDIST_{F\,A}$	Factor wage distortion variable, exogenous for labour
$WPART_H$	Participation wage rate
$WSEACA_A$	Sea wages of cargo traffic within activity A
$WSEAPT_A$	Sea wages of passenger traffic within activity A
YF_F	Incomes of factor F
YG	Income of the regional government
YI_I	Total income of domestic non-government institutions
$YIF_{I\,F}$	Factor F income of institution I
$YIFSUM_F$	Sum of YIF over institutions after deduction of social security payments
$YMUNI$	Income of municipalities
$YROWH_{TH}$	Total expenditure of tourist household TH
$YSOCSEC$	Income of Social sec funds from fees paid by Ålanders (commuters' contributions excluded)
$YSTATE$	Income of state in Åland (all income)
Ω_A	Conjectural variations variable of activity A
ε_A	Perceived elasticity of demand for the whole activity A
ε_{AC}	Perceived elasticity of demand of commodity C for activity A
Π_A^{GR}	Gross profit rate of activity A

A3.4. Model Equations

A3.4.1. Price block

$$PM_C = pwm_C \cdot (1+tm_C) \cdot EXR + \sum_{CT} PQ_{CT} \cdot icm_{CT\,C} \qquad C \in CM \qquad \text{(A.1)}$$

$$PE_C = pwe_C \cdot (1-te_C) \cdot EXR - \sum_{CT} PQ_{CT} \cdot ice_{CT\,C} \qquad C \in CE \qquad \text{(A.2)}$$

$$PDD_C = PDS_C + \sum_{CT} PQ_{CT} \cdot icd_{CT\,C} \qquad C \in CD \qquad \text{(A.3)}$$

$$PQ_C \cdot QQ_C = PDD_C \cdot QD_C + PM_C \cdot QM_C \qquad C \in (CD \cup CM) \qquad \text{(A.4)}$$

$$PX_C \cdot QX_C = PDS_C \cdot QD_C + PE_C \cdot QE_C \qquad C \in CX \qquad \text{(A.5)}$$

$$PA_A = \sum_C PXAC_{A\,C} \cdot \theta_{A\,C} \qquad \text{(A.6)}$$

$$PINTA_A = \sum_C PQ_C \cdot (1+t^P_{C\,A}) \cdot (1+t^{VAT}_{C\,A}) \cdot ica_{C\,A} \qquad \text{(A.7)}$$

$$PA_A \cdot (1+psub_A) \cdot QA_A + TCECOST_A \cdot tsub_A + SSUB^{CA}_A + SSUB^{PT}_A = PVA_A \cdot QVA_A + PINTA_A \cdot QINTA_A \qquad \text{(A.8)}$$

$$CPI = \sum_{C,H} cwts_{C\,H} \cdot PQ_C \cdot (1+t^P_{C\,H}) \cdot (1+t^{VAT}_{C\,H}) \qquad \text{(A.9)}$$

$$DPI = \sum_C PDS_C \cdot dwts_C \qquad \text{(A.10)}$$

A3.4.2. Production and trade block

$$QA_A = \alpha^A_A \cdot \left(\delta^A_A \cdot QVA_A{}^{-\rho^A_A} + (1-\delta^A_A) \cdot QINT_A{}^{-\rho^A_A}\right)^{-\frac{1}{\rho^A_A}} \qquad A \in ACES \qquad \text{(A.11)}$$

$$\frac{QVA_A}{QINTA_A} = \left(\frac{PINTA_A}{PVA_A} \cdot \frac{\delta^A_A}{1-\delta^A_A}\right)^{\frac{1}{1+\rho^A_A}} \qquad A \in ACES \qquad \text{(A.12)}$$

$$QVA_A = iva_A \cdot QA_A \qquad A \in ALEO \qquad \text{(A.13)}$$

$$QINTA_A = inm_A \cdot QA_A \qquad A \in ALEO \qquad \text{(A.14)}$$

$$QVA_A = \alpha^{VA}_A \cdot \left(\sum_F \delta^{VA}_{F\,A} \cdot (QF_{F\,A} - n_A \cdot QFZ_{F\,A})^{-\rho^{VA}_A}\right)^{-\frac{1}{\rho^{VA}_A}} \qquad \text{(A.15)}$$

$$W_F \cdot WFDIST_{F\,A} = PVA_A \cdot QVA_A \cdot \left(\sum_{F'} \delta^{VA}_{F\,A} \cdot QF_{F\,A}{}^{-\rho^{VA}_A}\right)^{-1} \cdot \delta^{VA}_{F\,A} \cdot QF_{F\,A}{}^{-\rho^{VA}_A - 1} \qquad \text{(A.16)}$$

$$QINT_{C\,A} = ica_{C\,A} \cdot QINTA_A \qquad \text{(A.17)}$$

$$QXAC_{A\,C} = \theta_{A\,C} \cdot QA_A \qquad \text{(A.18)}$$

$$QX_C = \alpha_C^{AC} \cdot \left(\sum_A \delta_{AC}^{AC} \cdot QXAC_{AC}^{-\rho_C^{AC}} \right)^{-\frac{1}{\rho_C^{AC}}} \tag{A.19}$$

$$PXAC_{AC} = PX_C \cdot QX_C \cdot \left(\sum_{A'} \delta_{A'C}^{AC} \cdot QXAC_{A'C}^{-\rho_C^{AC}} \right)^{-1} \cdot \delta_{AC}^{AC} \cdot QXAC_{AC}^{-\rho_C^{AC}-1} \tag{A.20}$$

$$QX_C = \alpha_C^T \cdot \left(\delta_C^T \cdot QE_C^{\rho_C^T} + (1-\delta_C^T) \cdot QD_C^{\rho_C^T} \right)^{\frac{1}{\rho_C^T}} \qquad C \in (CE \cap CD) \tag{A.21}$$

$$\frac{QE_C}{QD_C} = \left(\frac{PE_C}{PDS_C} \cdot \frac{1-\delta_C^T}{\delta_C^T} \right)^{\frac{1}{\rho_C^T-1}} \qquad C \in (CE \cap CD) \tag{A.22}$$

$$QX_C = QD_C + QE_C \qquad C \in (CD \cap CEN) \bigcup (CE \bigcup CDN) \tag{A.23}$$

$$QQ_C = \alpha_C^Q \cdot \left(\delta_C^Q \cdot QM_C^{-\rho_C^Q} + (1-\delta_C^Q) \cdot QD_C^{-\rho_C^Q} \right)^{-\frac{1}{\rho_C^Q}} \qquad C \in (CM \cap CD) \tag{A.24}$$

$$\frac{QM_C}{QD_C} = \left(\frac{PDD_C}{PM_C} \cdot \frac{\delta_C^Q}{1-\delta_C^Q} \right)^{\frac{1}{1+\rho_C^Q}} \qquad C \in (CM \cap CD) \tag{A.25}$$

$$QQ_C = QD_C + QM_C \qquad C \in (CD \cap CMN) \bigcup (CM \bigcup CDN) \tag{A.26}$$

$$QT_C = \sum_{C'} (icm_{C\,C'} \cdot QM_{C'} + ice_{C\,C'} \cdot QE_{C'} + icd_{C\,C'} \cdot QD_{C'}) \qquad C \in CT \tag{A.27}$$

$$ASHAREC_{AC} = \frac{QXAC_{AC}}{\sum_{A'} QXAC_{A'C}} \qquad C \in CE \tag{A.28}$$

$$TCECOST_A = \sum_{CE} \sum_{CT} ice_{CT\,CE} \cdot PQ_{CT} \cdot QE_{CE} \cdot ASHARE_{A\,CE} \tag{A.29}$$

A3.4.3. Institution block

$$YF_F = \sum_A W_F \cdot WFDIST_{F\,A} \cdot QF_{F\,A} + exfac_{F\,'ROW'} \cdot EXR + (W_{LEXP} \cdot \sum_H LEXP_H)_{F \in FLAB} \tag{A.30}$$

$$YIFSUM_F = \left((1-tf_F)\cdot YF_F - comrate_F \cdot W_F \cdot WFDIST_{F\,'A-TRANS'} \cdot QF_{F\,'A-TRANS'}\right) /(1+s\sec_F) \tag{A.31}$$

$$YIF_{I\,F} = shif_{I\,F} \cdot YIFSUM_F \qquad I \in INSD \tag{A.32}$$

$$YI_I = \sum_F YIF_{I\,F} + \sum_{I' \in INSDNG'} TRII_{I\,I'} + \sum_{INSDG} trnsfr_{I\,INSDG} \cdot CPI + trnsfr_{I\,ROW} \cdot EXR (+UNBEN_I)_{I \in H} \qquad I \in INSDNG \tag{A.33}$$

$$TRII_{I\,I'} = shii_{i\,i'} \cdot (1-MPS_{I'}) \cdot ((1-TINS_{I'} - tcorp_{I' \in EN} - t^{muni}_{I' \in H} - t^{state}_{I' \in H}) \cdot YI_{I'} - s\sec_{I' \in H} \cdot YIF_{I'\,LABOR}) \qquad I, I' \in INSDNG \tag{A.34}$$

$$EH_H = \left(1 - \sum_{INSDNG} shii_{INSDNG\,H}\right) \cdot (1-MPS_H) \cdot ((1-TINS_H - t^{muni}_H - t^{state}_H) \cdot YI_H - s\sec_H \cdot YIF_{H\,LABOR}) \tag{A.35}$$

$$PQ_C \cdot QH_{C\,H} \cdot (1+t^P_{C\,H}) \cdot (1+t^{VAT}_{C\,H}) = PQ_C \cdot \gamma_{C\,H} \cdot (1+t^P_{C\,H}) \cdot (1+t^{VAT}_{C\,H}) + \beta_{C\,H} \cdot \left(EH_H - \sum_{C'} PQ_{C'} \cdot \gamma_{C'\,H} \cdot (1+t^P_{C'\,H}) \cdot (1+t^{VAT}_{C'\,H})\right) \tag{A.36}$$

$$QG_C = GADJ \cdot \overline{qg}_C \tag{A.37}$$

$$QMUNI_C = MUNIADJ \cdot \overline{qmuni}_C \tag{A.38}$$

$$QSTATE_C = \overline{qstate}_C \tag{A.39}$$

$$QSOCSEC_C = \overline{qsoc}_C \tag{A.40}$$

$$PQ_C \cdot (1+t^P_{C\,NGO}) \cdot (1+t^{VAT}_{C\,NGO}) \cdot QNGO_C = \beta^{NGO}_C \cdot E_{NGO} \tag{A.41}$$

$$SINALA = \sum_H t^{state}_H \cdot YI_H + \sum_H TINS_H \cdot YI_H + \sum_{EN} tcorp_{EN} \cdot YI_{EN} + shptax_{STATE} \cdot PRODTSUM + shtalv_{STATE} \cdot TALVSUM \tag{A.42}$$

$$PRODTSUM = \sum_{C} \sum_{A} QINT_{C\,A} \cdot PQ_C \cdot t^{P}_{C\,A} + \sum_{C} (PQ_C \cdot QG_C \cdot t^{P}_{C\,GOV} + PQ_C \cdot QNGO_C \cdot t^{P}_{C\,NGO} + PQ_C \cdot QMUNI_C \cdot t^{P}_{C\,MUNI} + PQ_C \cdot QSTATE_C \cdot t^{P}_{C\,STATE} + PQ_C \cdot QSOCSEC_C \cdot t^{P}_{C\,SOCSEC} + PQ_C \cdot QINV_C \cdot t^{P}_{C\,INV} + \sum_{H} PQ_C \cdot QH_{C\,H} \cdot t^{P}_{C\,H} + \sum_{TH} PQ_C \cdot QROWH^{TH}_{C} \cdot t^{P}_{C\,TH}) \quad (A.43)$$

$$TALVSUM = \sum_{C} \sum_{A} QINT_{C\,A} \cdot PQ_C \cdot (1 + t^{P}_{C\,A}) \cdot t^{VAT}_{C\,A} + \sum_{C} (PQ_C \cdot QG_C \cdot (1 + t^{P}_{C\,GOV}) \cdot t^{VAT}_{C\,GOV} + PQ_C \cdot QNGO_C \cdot (1 + t^{P}_{C\,NGO}) \cdot t^{VAT}_{C\,NGO} + PQ_C \cdot QMUNI_C \cdot (1 + t^{P}_{C\,MUNI}) \cdot t^{VAT}_{C\,MUNI} + PQ_C \cdot QSTATE_C \cdot (1 + t^{P}_{C\,STATE}) \cdot t^{VAT}_{C\,STATE} + PQ_C \cdot QSOCSEC_C \cdot (1 + t^{P}_{C\,SOCSEC}) \cdot t^{VAT}_{C\,SOCSEC} + PQ_C \cdot QINV_C \cdot (1 + t^{P}_{C\,INV}) \cdot t^{VAT}_{C\,INV} + \sum_{H} PQ_C \cdot QH_{C\,H} \cdot (1 + t^{P}_{C\,H}) \cdot t^{VAT}_{C\,H} + \sum_{TH} PQ_C \cdot QROWH^{TH}_{C} \cdot (1 + t^{P}_{C\,TH}) \cdot t^{VAT}_{C\,TH}) \quad (A.44)$$

$$LUMP045 = 0.0045 \cdot (TIMFIN \cdot \frac{CPI}{CPI0} + SINALA) \quad (A.45)$$

$$REIMB = REIMBASE - 0.005 \cdot (FININCTAX \cdot CPI / CPI0 + REIMBASE) \quad (A.46)$$

$$LUMPSUM = LUMP045 + REIMB \cdot EXOGLUMP \quad (A.47)$$

$$REIMBASE = \sum_{F} tf_F \cdot YF_F \cdot shrimbinc + shtcorp_{STATE} \cdot \sum_{EN} tcorp_{EN} \cdot YI_{EN} \quad (A.48)$$

$$YG = LUMPSUM + shtins_{GOV} \cdot \sum_{I \in INSDNG} TINS_I \cdot YI_I + trnsfr_{GOV\,ROW} \cdot EXR + shtcorp_{GOV} \cdot \sum_{EN} YI_{EN} \cdot tcorp_{EN} + shptax_{GOV} \cdot PRODTSUM + shtalv_{GOV} \cdot TALVSUM \quad (A.49)$$

$$EG = \sum_{C} PQ_C \cdot QG_C \cdot (1 + t^{P}_{C\,GOV}) \cdot (1 + t^{VAT}_{C\,GOV}) + \sum_{INSD} trnsfr_{INSD\,GOV} \cdot CPI + TRSUBSUM + shpsub_{GOV} \cdot PSUBSUM + ssubsh^{CA}_{GOV} \cdot \sum_{A} SSUB^{CA}_{A} + ssubsh^{PT}_{GOV} \cdot \sum_{A} SSUB^{PT}_{A} \quad (A.50)$$

$$YSTATE = \sum_F tf_F \cdot YF_F + \sum_C tm_C \cdot pwm_C \cdot QM_C \cdot EXR + \sum_C te_C \cdot pwe_C \cdot QE_C \cdot EXR$$
$$+ \sum_F YIF_{STATE\ F} + TRSADJ \cdot trnsfr_{STATE\ ROW} \cdot EXR + shtins_{STATE} \cdot \sum_{I \in INSDNG} TINS_I \cdot YI_I$$
$$+ \sum_H t_H^{state} \cdot YI_H + shtcorp_{STATE} \cdot \sum_{EN} tcorp_{EN} \cdot YI_{EN} + shptax_{STATE} \cdot PRODTSUM \quad (A.51)$$
$$+ shtalv_{STATE} \cdot TALVSUM$$

$$ESTATE = shpsub_{STATE} \cdot PSUBSUM + \sum_{I \in INSDNG} trnsfr_{I\ STATE} \cdot CPI + LUMPSUM$$
$$+ trnsfr_{MUNI\ STATE} \cdot CPI + trnsfr_{SOCSEC\ STATE} \cdot CPI$$
$$+ \sum_C PQ_C \cdot (1 + t_{C\ STATE}^P) \cdot (1 + t_{C\ STATE}^{VAT}) \cdot QSTATE_C + ssubsh_{STATE}^{CA} \cdot \sum_A SSUB_A^{CA} \quad (A.52)$$
$$ssubsh_{STATE}^{PT} \cdot \sum_A SSUB_A^{PT}$$

$$YSOCSEC = shtins_{SOCSEC} \cdot \sum_{I \in INSDNG} TINS_I \cdot YI_I + trnsfr_{SOCSEC\ STATE} \cdot CPI$$
$$+ \sum_F s\sec_F \cdot YIFSUM_F + \sum_H s\sec_H \cdot YIF_{H\ LABOR} + TRSOCADJ \cdot trnsfr_{SOCSEC\ ROW} \cdot EXR \quad (A.53)$$

$$ESOCSEC = \sum_C PQ_C \cdot (1 + t_{C\ SOCSEC}^P) \cdot (1 + t_{C\ SOCSEC}^{VAT}) \cdot QSOCSEC_C$$
$$+ \sum_{I \in INSD} trnsfr_{I\ SOCSEC} \cdot CPI + \sum_H UNBEN_H \quad (A.54)$$

$$YMUNI = shtins_{MUNI} \cdot \sum_{I \in INSDNG} TINS_I \cdot YI_I + \sum_{INSDG} trnsfr_{MUNI\ INSDG} \cdot CPI$$
$$+ shtcorp_{MUNI} \cdot \sum_{EN} tcorp_{EN} \cdot YI_{EN} + \sum_{I \in INSDNG} TMUNI_I \cdot YI_I \quad (A.55)$$
$$shptax_{MUNI} \cdot PRODTSUM + shtalv_{MUNI} \cdot TALVSUM$$

$$EMUNI = \sum_C PQ_C \cdot (1 + t_{C\ MUNI}^P) \cdot (1 + t_{C\ MUNI}^{VAT}) \cdot QMUNI_C + \sum_{I \in INSD} trnsfr_{I\ MUNI} \cdot CPI \quad (A.56)$$

$$QROWH_C^{TH} = \frac{\beta_C^{TH} \cdot YROWH_{TH}}{PQ_C \cdot (1 + t_{C\ TH}^P) \cdot (1 + t_{C\ TH}^{VAT})} \quad (A.57)$$

$$E_{NGO} = (1 - \sum_{I \in INSDNG} shii_{I\ NGO}) \cdot (1 - TINS_{NGO}) \cdot YI_{NGO} \quad (A.58)$$

$$WSEACA_A = seawsh_A^{CA} \cdot W_L \cdot WFDIST_{L\,A} \cdot QF_{L\,A} \tag{A.59}$$

$$WSEAPT_A = seawsh_A^{PT} \cdot W_L \cdot WFDIST_{L\,A} \cdot QF_{L\,A} \tag{A.60}$$

$$SSUB_A^{CA} = ssubr_A^{CA} \cdot WSEACA_A \tag{A.61}$$

$$SSUB_A^{PT} = ssubr_A^{PT} \cdot WSEAPT_A \tag{A.62}$$

$$TRSUBSUM = \sum_A TCECOST_A \cdot tsub_A \tag{A.63}$$

$$PSUBSUM = \sum_A psub_A \cdot QA_A \cdot PA_A \tag{A.64}$$

A3.4.4. Labour market

$$QLST_H = LSMAX_H \cdot \frac{QLST_H^0}{LSMAX_H^0} \cdot \left[\frac{WPART_H \cdot CPI^0}{WPART_H^0 \cdot CPI} \right]^{\eta_H^W}$$
$$\cdot \left[\frac{TINS_H + TMUNI_H + t_H^{state} + (YIF_{H\,L} / YI_H) \cdot s\sec_H}{t_H^{ins} + t_H^{muni} + t0_H^{state} + (YIF0_{H\,L} / YI0_H) \cdot s\sec 0_H} \right]^{\eta_H^{tax}} \tag{A.65}$$
$$\cdot \left[\frac{\sum_{INSDNG} TRII_{H\,INSDNG} + \sum_{INSDG} trnsfr_{H\,INSDG} \cdot CPI + UNBEN_H + YIF_{H\,K}}{\sum_{INSDNG} TRII0_{H\,INSDNG} + \sum_{INSDG} trnsfr0_{H\,INSDG} \cdot CPI0 + UNBEN0_H + YIF0_{H\,K}} \cdot \frac{CPI0}{CPI} \cdot \frac{POPU0_H}{POPU_H} \right]^{\eta_H^{TR}}$$

$$WPART_H = \frac{1}{\alpha_{L\,H}} \cdot \left[\delta_{L\,H}^{1/(1-\rho_L^H)} \cdot W_L^{\rho_L^H/(\rho_L^H-1)} + (1-\delta_{L\,H})^{1/(1-\rho_L^H)} \cdot W_{LEXP}^{\rho_L^H/(\rho_L^H-1)} \right]^{(\rho_L^H-1)/\rho_L^H} \tag{A.66}$$

$$QLST_H = \alpha_{L\,H} \cdot \left(\delta_{L\,H} \cdot LSALA_H{}^{\rho_L^H} + (1-\delta_{L\,H}) \cdot LEXP_H{}^{\rho_L^H} \right)^{\frac{1}{\rho_L^H}} \tag{A.67}$$

$$LSALA_H = LEXP_H \cdot \left[\frac{W_L \cdot (1-\delta_{L\,H})}{W_{LEXP} \cdot \delta_{L\,H}} \right]^{1/(\rho_L^H-1)} \tag{A.68}$$

$$W_{LIMP} = cwratio_L \cdot W_L \cdot WFDIST_{L\,A-TRANS} \tag{A.69}$$

$$LIMP = (comrate_L \cdot W_L \cdot WFDIST_{L\ A-TRANS} \cdot QF_{L\ A-TRANS}) / W_{LIMP} \tag{A.70}$$

$$W_{LEXP} = EXR \cdot W^0_{LEXP} \tag{A.71}$$

$$U = 0.01 + \frac{UNEMFIG}{\sum_H QLST_H} \tag{A.72}$$

$$NOUNEM_H = \frac{NOUNEM0_H}{\sum_H NOUNEM0_H} \cdot U \cdot \sum_H QLST_H \tag{A.73}$$

$$UNBEN_H = NOUNEM_H \cdot unberate_H \cdot CPI / CPI0 \tag{A.74}$$

$$MIG_H = \frac{\sum_{H'} POPU_{H'}}{\sum_{H'} POPU^0_{H'}} \cdot \left[migconst_H + \beta^H_{MIG} \cdot \ln\left(U \cdot 100 \cdot \frac{W_{MIG} \cdot (CPI / CPI0)}{W_L} \right) \right] \tag{A.75}$$

$$W_L = WC \cdot \left[(CPI / CPI0) + wgr \cdot \left(\frac{U}{U^0} \right)^{\beta_u} \right] \tag{A.76}$$

$$LSMAX_H = wpoprate_H \cdot POPU_H \tag{A.77}$$

A3.4.5. Investment module

$$\Pi^{GR}_A = \frac{\sum_{FCAP} W_{FCAP} \cdot WFDIST_{FCAP\ A} \cdot QF_{FCAP\ A}}{K_A \cdot PI} \tag{A.78}$$

$$DEPRE_A = deprate_A \cdot K_A \cdot PI \tag{A.79}$$

$$QINV_C = IADJ \cdot \overline{qinv}_C \tag{A.80}$$

$$\sum_A I_A = \sum_C PQ_C \cdot (1+t^P_{C\,INV}) \cdot (1+t^{VAT}_{C\,INV}) \cdot QINV_C \tag{A.81}$$

$$PI = \frac{\sum_C PQ_C \cdot (1+t^P_{C\,INV}) \cdot (1+t^{VAT}_{C\,INV}) \cdot QINV_C}{\sum_C QINV_C} \tag{A.82}$$

$$ROR_A = -1 + \left[\Pi^{GR}_A + (1-\delta^K_A)\right]/(1+RINT) \tag{A.83}$$

$$EEQROR_{A\,t} = ROR_{A\,t} - (1-D^I_A) \cdot (ROR_{A\,t-1} - EEQROR_{A\,t-1}) \tag{A.84}$$

$$EEQROR_A = RORN_A + \frac{1}{C^I_A} \cdot \left[\ln\left(\frac{\frac{I_A - \delta^K_A \cdot K_A}{K_A} - KG^{MIN}_A}{KG^{TREND}_A - KG^{MIN}_A} \right) \cdot \ln\left(\frac{KG^{MAX}_A - \frac{I_A - \delta^K_A \cdot K_A}{K_A}}{KG^{MAX}_A - KG^{TREND}_A} \right) \right] \tag{A.85}$$

$$RINT = \frac{0.25 \cdot \sum_A \sum_{FCAP} W_{FCAP} \cdot WFDIST_{FCAP\,A} \cdot QF_{FCAP\,A} - DEPRE_A}{\sum_A K_A \cdot PI} \tag{A.86}$$

A3.4.6. Imperfect competition module

$$\begin{aligned} &PA_A \cdot QA_A \cdot (1+psub_A) \cdot \left(1 - \frac{\Omega_A}{n_A * \varepsilon_A}\right) = PVA_A \cdot QVA_A + PINTA_A \cdot QINTA_A \\ &- TCECOST_A \cdot tsub_A - SSUB^{CA}_A - SSUB^{PT}_A - n_A \cdot \sum_F QFZ_{A,F} \cdot W_F \cdot \overline{WFDIST}_{F\,A} \end{aligned} \tag{A.87}$$

$$\Omega_A = \frac{\Omega^0_A \cdot n^0_A}{n_a \cdot \psi_A} \tag{A.88}$$

$$\varepsilon_{AC} = \sigma_C^{AC} + (1-\sigma_C^{AC}) \cdot \frac{PXAC_{AC} \cdot QXAC_{AC}}{PX_C \cdot QX_C} - \frac{PXAC_{AC} \cdot QXAC_{AC}}{PDS_C \cdot QD_C}$$
$$\cdot [-\sigma_C^T + (1+\sigma_C^T) \cdot \frac{PDS_C \cdot QD_C}{PX_C \cdot QX_C} + \frac{PDS_C}{PDD_C} \cdot (1 + icd_{CC \in CD} \cdot \frac{QD_{C \in CT}}{QQ_{C \in CT}})$$
$$\cdot [-\sigma_C^Q + \sigma_C^Q \cdot \frac{PDD_C \cdot QD_C}{PQ_C \cdot QQ_C} + PDD_C \cdot QD_C \cdot [\{ \sum_{A \in ALEO} ica_{CA} \cdot inm_A$$
$$\cdot (-\sigma_C^{AC} - (1-\sigma_C^{AC}) \cdot \frac{PXAC_{AC}}{PX_C \cdot QX_C}) \cdot \frac{PDD_C \cdot QQ_C}{PDS_C}\} +$$
$$\sum_{A \in ACES} -\sigma_A^A \cdot QINTA_A \Big/ PINTA_A \cdot ica_{CA}$$
$$- \sum_H (\beta_{CH} \cdot (EH_H - \sum_C PQ_C \cdot (1+t_{CH}^P) \cdot (1+t_{CH}^{VAT}) \cdot \gamma_{CH})$$
$$/(PQ_C^2 \cdot (1+t_{CH}^P) \cdot (1+t_{CH}^{VAT})))$$
$$- \frac{\beta_C^{NGO} \cdot E_{NGO}}{PQ_C^2 \cdot (1+t_{C\,NGO}^P) \cdot (1+t_{C\,NGO}^{VAT})} - \sum_{TH} \frac{\beta_C^{TH} \cdot E_{TH}}{PQ_C^2 \cdot (1+t_{C\,TH}^P) \cdot (1+t_{C\,TH}^{VAT})}$$
$$+ icm_{CC \in CM} \cdot \frac{QQ_C}{QD_C} \cdot \sigma_C^Q \cdot \frac{QM_C}{PDD_C} - (ice_{CC \in CE})^2 \cdot \sigma_C^T \cdot \frac{QE_C}{PE_C} - icd_{CC \in CD}$$
$$\cdot \frac{QQ_C}{QD_C} \cdot \sigma_C^Q \cdot \frac{QD_C}{PDD_C}]]] \tag{A.89}$$

$$\varepsilon_A = \sum_C \theta_{AC} \cdot \varepsilon_{AC} \tag{A.90}$$

A3.4.7. System constraint block

$$QFS_{FCAP} = \sum_A QF_{FCAP\,A} \tag{A.91}$$

$$\sum_{FLAB} \sum_A QF_{FLAB\,A} + UNEMFIG = \sum_H QLST_H \cdot 0.99 - \sum_H LEXP_H + LIMP \tag{A.92}$$

$$QQ_C = \sum_A QINT_{C\,A} + \sum_H QH_{C\,H} + QG_C + QMUNI_C + QSOCSEC_C + QSTATE_C$$
$$+ QNGO_C + QINV_C + qdst_C + QT_C + \sum_{TH} QROWH_C^{TH} \tag{A.93}$$

$$\sum_C pwm_C \cdot QM_C + \sum_F comrate_F \cdot W_F \cdot WFDIST_{F\,A-TRANS} \cdot QF_{F\,A-TRANS} / EXR =$$
$$pwe_C \cdot QE_C + \sum_{I \in INSDNG} trnsfr_{I\,ROW} + \sum_F exfac_{F\,ROW} + W_{LEXP} \cdot \sum_H LEXP_H / EXR \tag{A.94}$$

$$YG = EG + GSAV \tag{A.95}$$

$$YSTATE = ESTATE \tag{A.96}$$

$$YSOCSEC = ESOCSEC \tag{A.97}$$

$$YMUNI = EMUNI + MUNISAV \tag{A.98}$$

$$TINS_I = t_I^{ins} \cdot (1 + TINSADJ \cdot tins01_I) + DTINS \cdot tins01_I \qquad I \in INSDNG \tag{A.99}$$

$$TMUNI_H = t_H^{muni} \cdot (1 + MUNITADJ \cdot munit01_H) + DMUNIT \cdot munit01_H \tag{A.100}$$

$$MPS_I = \overline{mps}_I \cdot (1 + MPSADJ \cdot msp01_I) + DMPS \cdot msp01_I \qquad I \in INSDNG \tag{A.101}$$

$$\begin{aligned} &\sum_{I \in INSDNG} MPS_I \cdot ((1 - TINS_I - tcorp_{I \in EN} - TMUNI_{I \in H} - t_{I \in H}^{state}) \cdot YI_I - s\sec_{I \in H} \cdot YIF_{I\ LABOR}) \\ &+ GSAV + MUNISAV + FSAV \cdot EXR = \sum_C PQ_C \cdot (1 + t_{C\ INV}^P) \cdot (1 + t_{C\ INV}^P) \cdot QINV_C \\ &+ \sum_C PQ_C \cdot (1 + t_{C\ DSTK}^P) \cdot (1 + t_{C\ DSTK}^P) \cdot qdst + WALRAS \end{aligned} \tag{A.102}$$

A3.4.8. Recursive dynamics

$$POPU_H^{t+1} = POPU_H^t \cdot (1 + popugrw_H) + MIG_H^t \tag{A.103}$$

$$K_A^{t+1} = K_A^t + (I_A^t - DEPRE_A^t) / PI^t \tag{A.104}$$

$$FDEBT^{t+1} = FDEBT^t + FSAV^t \tag{A.105}$$

$$exfac_{FCAP\ ROW}^{t+1} = -ROWIR \cdot FDEBT^t \tag{A.106}$$

Appendix 4. Central parameter and elasticity values

ε_A Initial perceived price elasticity of demand for the whole activity

A-CONS	0.381
A-TRAD	2.083
A-RESH	1.807
A-BSER	1.773
A-OSERV	0.506

Ω_A^0 Conjectural variation variable, initial value

A-CONS	0.409
A-TRAD	1.723
A-RESH	1.249
A-BSER	0.369
A-OSERV	0.108

RTS_A Returns to scale

A-CONS	1.1
A-TRAD	1.221
A-RESH	1.09
A-BSER	1.1
A-OSERV	1.1

Armington and CET elasticities by commodity

σ_C^T Exports-domestic sales transformation elasticity

σ_C^Q Imports –domestic use elasticity of substitution

	σ_C^Q	σ_C^T
C-AGRI	0.55	1.1
C-FINDU	0.55	1.1
C-INDU	0.55	1.1
C-ELWA	1.3	0.5
C-CONST	0.5	0.5
C-TRADE	0.5	1.0
C-HOTEL	0.5	0.75
C-TRANSP	0.5	0.5
C-BSERV	0.5	0.5
C-OSERV	0.5	0.5

$\sigma_A^{VA} = \frac{1}{1+\rho_A^{VA}}$ Elasticity of substitution between factors in activity a

A-AGRI	1.275
A-FINDU	1.384
A-INDU	0.835
A-ELWA	1.535
A-CONS	2.15
A-TRAD	1.738
A-RESH	0.331
A-TRANS	1.8
A-BSER	1.048
A-OSERV	1.087

CET elasticity between domestic labour supply and export of labour

NHHD	1.5
MHHD	1.5

σ_A^A Elasticity of substitution between aggregate factor & intermediate commodities - top of technology nest

A-AGRI	n.a.	Leontief technology assumed
A-FINDU	0.653	
A-INDU	0.413	
A-ELWA	n.a.	Leontief technology assumed
A-CONS	1.294	
A-TRAD	0.312	
A-RESH	0.282	
A-TRANS	n.a.	Leontief technology assumed
A-BSER	2.147	
A-OSERV	n.a.	Leontief technology assumed

LES expenditure elasticity of market demand for commodity C by household H

	NHHD	MHHD
C-AGRI	0.3700	0.3700
C-FINDU	0.4923	0.4923
C-INDU	1.0828	1.0828
C-ELWA	0.9635	0.9635
C-CONST	0.9635	0.9635
C-TRADE	1.0783	1.0783
C-HOTEL	1.0783	1.0783
C-TRANSP	1.0826	1.0826
C-BSERV	1.0948	1.0948
C-OSERV	1.1007	1.1007
C-FINSERV	1.1190	1.1190
C-ROWSERV	1.1190	1.1190

σ_C^{AC} Output aggregation elasticity for commodity C : 2.0 for all the products

Frisch parameter for household LES demand: -1.5 for both households

β_u	Wage curve elasticity parameter:	-0.5
η_H^W	Wage elasticity of labour supply	0.1
η_H^{tax}	Tax elasticity of labour supply	-0.1
η_H^{TR}	Transfer elasticity of labour supply	-0.1

β_{MIG}^H	Migration equation coefficient
NHHD	-0.26297
MHHD	-0.83825

C_A^I	Coefficient in the investment function
A-AGRI	19.259
A-FINDU	18.803
A-INDU	18.683
A-ELWA	21.105
A-CONS	18.627
A-TRAD	19.523
A-RESH	21.171
A-TRANS	21.215
A-BSER	18.385
A-OSERV	18.129

Total factor productivity growth of activity A

tfpgrw('A-AGRI') =	0.0185
tfpgrw('A-FINDU') =	0.015
tfpgrw('A-INDU') =	0.013
tfpgrw('A-ELWA') =	0.008
tfpgrw('A-CONS') =	0.0063
tfpgrw('A-TRAD') =	0.01
tfpgrw('A-RESH') =	0.0089
tfpgrw('A-TRANS') =	0.0009
tfpgrw('A-BSER') =	0.0065
tfpgrw('A-OSERV') =	0.0008

KG_A^{TREND} Growth trend in investment of activity A

A-AGRI	=	-0.0024;
A-FINDU	=	0.021;
A-INDU	=	0.0363;
A-ELWA	=	0.0051;
A-CONS	=	0.01;
A-TRAD	=	-0.0053;
A-RESH	=	-0.002;
A-TRANS	=	-0.00171;
A-BSER	=	0.01;
A-OSERV	=	0.01;

KG_A^{MAX} Maximum feasible growth rate of capital in activity A

$$KG_A^{MAX} = KG_A^{TREND} + 0.02$$

D_A^I Adjustment parameter for the expectations on the rate of return, = 0.5

Population growth rate: births minus deaths

NHHD	-0.001
MHHD	-0.001

Rate of growth or decline in the share of working population

NHHD	-0.004
MHHD	-0.004

Appendix 5. Derivation of the perceived elasticity of demand of product C - the simple version

Consider the Lagrange function of the maximisation problem of a "virtual wholesaler" who aggregates the commodities $QXAC_{A\,C}$ into QX_C with zero profits and constant returns to scale:

$$L = PX_C \cdot QX_C - \sum_A PXAC_{A\,C} \cdot QXAC_{A\,C} + \lambda \left[-QX_C + \alpha_C^{AC} \cdot \left(\sum_A \delta_{A\,C}^{AC} \cdot QXAC_{A\,C}^{\;-\rho_C^{AC}} \right)^{-\frac{1}{\rho_C^{AC}}} \right] \quad \text{(A5.1)}$$

The FOCs of the maximisation problem, after substituting the most trivial one $PX_C = \lambda$ into (3), are as follows:

$$\frac{\partial L}{\partial \lambda} \Rightarrow QX_C = \alpha_C^{AC} \cdot \left(\sum_A \delta_{A\,C}^{AC} \cdot QXAC_{A\,C}^{\;-\rho_C^{AC}} \right)^{-\frac{1}{\rho_C^{AC}}} \quad \text{(A5.2)}$$

$$\frac{\partial L}{\partial QXAC_{A\,C}} \Rightarrow PXAC_{A\,C} = PX_C \cdot QX_C \cdot \left(\sum_{A'} \delta_{A'\,C}^{AC} \cdot QXAC_{A'\,C}^{\;-\rho_C^{AC}} \right)^{-1} \cdot \delta_{A\,C}^{AC} \cdot QXAC_{A\,C}^{-\rho_C^{AC}-1} \quad \text{(A5.3)}$$

After some manipulation, (2) can be substituted into (3):

$$PXAC_{A\,C} = PX_C \cdot QX_C \cdot \left(\frac{QX_C}{\alpha_C^{AC}} \right)^{\rho_C^{AC}} \cdot \delta_{A\,C}^{AC} \cdot QXAC_{A\,C}^{-\rho_C^{AC}-1} \quad \text{(A5.4)}$$

By recalling that $\sigma_C^{AC} = \frac{1}{1+\rho_C^{AC}}$, we get the following formula

$$QXAC_{A\,C} = PXAC_{A\,C}^{-\sigma_C^{AC}} \cdot PX_C^{\sigma_C^{AC}-1} \cdot \alpha_C^{AC(\sigma_C^{AC}-1)} \cdot \delta_{A\,C}^{AC\sigma_C^{AC}} \cdot EX_C \quad \text{(A5.5)}$$

where $EX_C = PX_C \cdot QX_C$, i.e. total sales of/expenditure in C. This is the demand function for C from the imperfectly competitive producer activity A. If the producer A does not perceive

the effect of his own action on EX_C, the perceived elasticity of demand can be calculated as follows. First, let us take logarithm of (5):

$$\ln(QXAC_{AC}) = -\sigma_C^{AC} \cdot \ln(PXAC_{AC}) + (\sigma_C^{AC} - 1) \cdot \ln(PX_C) + (\sigma_C^{AC} - 1) \cdot \ln(\alpha_C^{AC}) + \sigma_C^{AC} \cdot \ln(\delta_{AC}^{AC}) + \ln(EX_C) \tag{A5.6}$$

By derivating (6) with respect to $\ln(PXAC_{AC})$, we get $-\varepsilon_{AC}$:

$$-\varepsilon_{AC} = -\sigma_C^{AC} + (\sigma_C^{AC} - 1) \cdot \frac{\partial \ln(PX_C)}{\partial \ln(PXAC_{AC})} = -\sigma_C^{AC} + (\sigma_C^{AC} - 1) \cdot \frac{PXAC_{AC} \cdot QXAC_{AC}}{PX_C \cdot QX_C} \tag{A5.7}$$

In order to see why $\frac{\partial \ln(PX_C)}{\partial \ln(PXAC_{AC})} = \frac{PXAC_{AC} \cdot QXAC_{AC}}{PX_C \cdot QX_C}$, consider that PX_C can be defined both as a dual price index aggregate for $PXAC_{AC}$ according to (8), and through expenditure identity in (9), as Devajaran et al. (1997) suggest:

$$PX_C = \frac{1}{\alpha_C^{AC}} \cdot \left(\sum_A \delta_{AC}^{AC\sigma_C^{AC}} \cdot PXAC_{AC}^{1-\sigma_C^{AC}} \right)^{\frac{1}{1-\sigma_C^{AC}}} \tag{A5.8}$$

$$PX_C = \frac{\sum_A PXAC_{AC} \cdot QXAC_{AC}}{QX_C} \tag{A5.9}$$

Derivation of (8) with respect to $PXAC_{AC}$, and by using (5), gives us the following:

$$\frac{\partial PX_C}{\partial PXAC_{AC}} = \frac{1}{\alpha_C^{AC}} \cdot \left(\sum_A \delta_{AC}^{AC\sigma_C^{AC}} PXAC_{AC}^{1-\sigma_C^{AC}} \right)^{\frac{\sigma_C^{AC}}{1-\sigma_C^{AC}}} \cdot PXAC_{AC}^{-\sigma_C^{AC}} = \alpha_C^{AC(\sigma_C^{AC}-1)} \cdot PX_C^{\sigma_C^{AC}} \cdot PXAC_{AC}^{-\sigma_C^{AC}} = \frac{QXAC_{AC}}{QX_C} \tag{A5.10}$$

We can easily see that derivation of (A5.9) gives us the same result. The rest follows from the definition of log-derivation. In order to derive the full-fledged version of ε_{AC}, we assume that the producer A considers also the effect of $QXAC_{AC}$ on the composite sales/expenditure

EX_C, which results in a chain of similar derivations through the CET/CES nests of exports-domestic sales, imports-domestic sales and, finally, through final demand. Small complications are caused by the treatment of transaction costs, including different technologies concerning the top nest of the production function (whether it is Leontief or CES; equation (A.89) covers both the cases). However, the calculation in its essence is just a reiteration of the phases presented here.

Appendix 6. Results of the CES/Leontief production function estimation in GAMS

	Top nest technology	Labour variable used	Fixed parameters or binding constraints	Returns to scale (RTS)
A-AGRI	Leontief	Employment	RTS=1	1
A-FINDU	CES	Employment	RTS=1	1
A-INDU	CES	Employment	RTS=1	1
A-ELWA	Leontief/CES	Real wage sum	RTS=1	1
A-CONS	CES	Real wage sum	RTS=1, both deltas	1
A-TRAD	CES	Employment	TC=0	1.221
A-RESH	CES	Employment	TC=0	1.09
A-TRANS	Leontief	Real wage sum	RTS=1	1
A-BSER	CES	Real wage sum	RTS=1, TC=0	1
A-OSERV	Leontief	Real wage sum	RTS=1, both deltas	1
	Technical change (TC)	Subst. Elasticity Labour-Capital	Subst. Elasticity VA - Intermediates	R2
A-AGRI	0.028	0.511	n.a.	0.857
A-FINDU	0.01	1.384	0.653	0.991
A-INDU	0.006	0.835	0.413	0.986
A-ELWA	0.011	1.535	0.793	0.946
A-CONS	0.001	2.15	1.294	0.997
A-TRAD	0	1.738	0.312	0.997
A-RESH	0	0.331	0.282	0.998
A-TRANS	0.002	1.8	n.a.	0.993
A-BSER	0	1.048	2.147	0.999
A-OSERV	0.009	1.087	n.a.	0.982

Note: for A-ELWA, Leontief technology was used for labour-capital substitution elasticity estimation.
The obtained parameter value was imposed in the CES estimation.
Deltas are share parameters of the CES equations.

ESSAY 4: Future challenges for the Åland Islands in a cross-swell of alcohol and shipping policy changes - A CGE analysis

Jouko Kinnunen

Abstract: This study deals with the reliance of Åland on its largest industry, shipping. The fate of shipping in Åland is contingent on the alcohol and shipping policies of the Nordic countries, which are beyond the control of the regional policymakers. The simulations conducted with the model show that the new state-financed subsidies to shipping introduced in the beginning of 2005 seem to compensate more or less for the diminished profitability caused by the reduced alcohol taxation in the Nordic countries, as well as increased competition from the new EU members in the Baltic Rim. This policy doubles up the net budget expenditure of the Finnish state administration in Åland. If the financial responsibility of shipping were transferred from the Finnish state to the Åland Government, it would be quite costly for the province. This study is conducted with a recursive dynamic, imperfect competition, one-region computable general equilibrium (CGE) model.

Key words: CGE models, imperfect competition, endogenous labour supply, shipping

JEL Codes: C68, L13, H20, L92.

1. Introduction

The point of departure of this paper stems from the extreme reliance of the Åland economy on tax-free sales, and consequently, on the alcohol policy of its neighbouring countries. The philosophy of the Nordic countries' alcohol policy, which relies on heavy taxation of alcohol for public health related purposes, is coming to an end. What will happen to Åland, where success was built during the latter half of the 20th century on passenger ships selling "the world's most expensive tax free liquor"? The analysis of unprecedented structural changes like the one facing Åland is exactly what applied or computable general equilibrium modelling is good for.

The key focus of the policy analysis part of this paper is on the future development of Åland's economy in the midst of the cross-swell of policy changes. What effects will the newly introduced subsidies to passenger traffic have on the economy as a whole? How will the local labour market adjust? How will it affect the other indicators, e.g. the balance of state tax revenues and outlays in Åland?

The main finding of the policy analysis is that the new subsidies for shipping, adopted by the Finnish government in the beginning of 2005, seem fairly successful seen from the viewpoint of the economic development of Åland. GDP growth and the welfare of the inhabitants resemble very much the situation as it was in 2000, although the working environment of shipping is totally different. However, with the introduction of the new shipping subsidies, the financial balance between state tax revenue and budget expenditure in Åland worsens considerably.

This study is organised in the following manner. Section two provides a historical background of the development of the Åland economy and its financial-institutional relations with mainland Finland. Section three briefly introduces the model used in the study. The fourth section presents the simulations and their results. Section five concludes.

2. Background

2.1. A new system of public financing

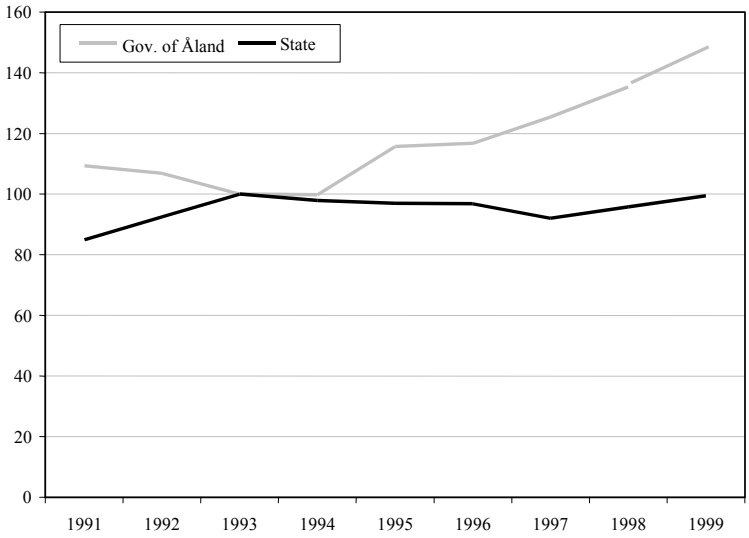
Let us present the relevant milestones in the political-economic landscape of Åland during the last decade in order to get a better picture of the current policy setting. To begin with, the financial flows between the state of Finland and the Government of Åland were reorganised in 1993. Instead of a state grant based on an item-by-item comparison between budgetary outlays of the Government of Åland and those of the Finnish state administration, Åland receives a lump sum grant, called "the amount of equalisation", totalling to 0.45% of the state budget income excluding new loans. This amount is not actually a state subsidy, but rather a reimbursement of the taxes levied by the state in Åland, that also takes into consideration the costs of state administration in Åland and the provision of public services to Ålanders (Palmgren, 1997).

As a consequence, the economic autonomy of Åland increased considerably, as the regional Government now decides its budget outlays independently, without having to submit every budgetary item to state approval (Turunen – Eriksson, 2004).

If the income and property taxes levied in Åland exceed 0.5 per cent of the corresponding tax in the entire country, the excess is reverted to Åland ("tax recompense"; see Government of Åland, 2002). The system has proven to be quite generous for Åland. Once Finland started to recover from the recession of the early 1990s, its tax revenues increased, but state budgetary spending was still under strict control. However, the amount of equalisation was, by definition, excluded from this budgetary control. While state budgetary outlays grew quite modestly (total state expenditure), budget expenditure in Åland soared during the late 1990s (see figure 1). The increased budgetary income, together with the changes brought by the EU membership, has been a major cause of the increased growth rate of public sector spending and employment, which clearly exceed those of the mainland Finland (Turunen – Eriksson, 2004).

The rapid expansion of the lump sum faded out after the millennium, which compelled the Government of Åland to cut budget spending. The Åland government budget proposal for 2005 projects a balanced budget after two years of deficit (Government of Åland, 2004).

Figure 1. Growth of government spending by Åland and the Finnish state, 1993 =100



Source: Turunen – Eriksson, 2004.

2.2. The quest for having the cake and eating it: EU membership

Another factor of importance the economic development on the Islands is that Finland, together with Åland, became a member of the EC/EU in 1995. In addition to drastically changing the working conditions of the primary producers, EU membership has had a major impact on the ferry companies specialised in passenger traffic that rely on profits from the sale of tax-free alcohol, tobacco and cosmetics. A major part of the Finnish passenger vessels are registered in Åland, and in 2003, measured in wages, its passenger vessels represented 59 per cent of the traffic in Finland (Seamen's Pension Fund, 2004).

However, the dramatic changes that were anticipated to result from ongoing changes in the EU legislation were considerably cushioned when that Finland (and Åland) succeeded in acquiring a permanent derogation for the province from the indirect tax legislation of the Community (Fagerlund, 1997). This derogation excluded Åland from the Community indirect tax union, and allowed the continuation of the tax-free sales on the ferry routes between

Sweden and Finland[14], beyond the cut-off date of June 30th 1999, when the era of tax-free sales within the Community came to an end. All the time of the accession negotiations, it was generally assumed that the permanent tax exemption request ran the greatest risk of rejection of all Finland's demands with respect to Åland (Fagerlund, 1997).

Åland's unquestionable dependence on tax-free sales is one of the reasons behind the benevolent treatment of this issue in the accession negotiations. However, the EU has also resorted to special solutions with other, similar EU entrants, like Azores, Isle of Man or Channel Islands (Palmer, 2004). The Government of Åland issued a report that its economy could diminish as much as 50 per cent if tax-free sales were abruptly discontinued (Fagerlund, 1997). A recent estimate on the role of tax-free sales, calculated with an earlier, static version of the CGE model used in the current analysis, suggests that in the longer run, approximately 35 per cent of GDP would be a more accurate order of magnitude, because of relatively weak linkages of shipping to the rest of the economy. What is more, the economy is assumed to have adjusted to the new situation through the optimal use of the labour force and capital with reallocation between industries (Lindström – Kinnunen, 2004).

One way of measuring this reliance on passenger ferries is to calculate tax-free sales per capita for comparison with other countries. Gebauer et al (2004) report that combined intra- and extra-EU duty-free sales per capita amounted to 14.0 ECU, and intra-EU duty-free sales totalled 9.7 ECU per capita in 1995. Kinnunen (1998) estimates with secondary indicators that the tax-free sales onboard Ålander vessels amounted to 6,340 ECU (FIM 35,800) per capita in 1995. These figures for Åland for the year 2002 and 2003, are around EUR 13,400 and 12,200 per capita, respectively, according to unpublished statistical material of Statistics Finland. This suggests the earlier estimate for the year 1995 may be biased downward.[15] Therefore, the dependence of Åland on tax-free sales seems to be almost 1,000-fold compared to the average of the EC/EU countries in mid-1990s.

[14] Ferries have to leave the Union VAT territory, i.e. to stop in Åland, in order to have the right to sell tax-free goods onboard.

[15] Own calculation based on the vessel income statistics of Statistics Finland. Please note that tax-free sales at the Mariehamn's airport are not included.

The "third country" -status with regard to indirect taxation also implied the necessity of setting up a fiscal frontier, or a "VAT border", between Finland and Åland in March 1997. This arrangement allowed tax-free sales to be conducted even on ferry and flight routes between Åland and mainland Finland. This has increased the number of tourists visiting Åland. Lindman and Kinnunen (1999) estimate that on an annual basis, the fiscal frontier has induced some 70,000 additional passengers to visit Åland[16]. The drawback of the fiscal frontier has been the increased bureaucracy for the exporting and importing enterprises and individuals, thus raising transaction costs of trade with the rest of the world. However, studies by Lindman and Kinnunen (1999), and by Lindström and Kinnunen (2004) show that the advantages of continued tax-free traffic clearly outweigh the disadvantages of the fiscal frontier.

2.3. Integration of the Nordic alcohol policy with the rest of the EU

Since the traditionally restrictive Nordic alcohol policy collided with the free trade policy endorsed by the EU, alcohol policy had to adjust (Karlsson – Tigerstedt, 2004). However, both Finland and Sweden were authorised to apply until the end of 2003 a temporary exemption from the Community legislation regulating the import of alcoholic beverages for personal use within the EU. Since January 1st 2004, all restrictions have been abolished.

The Finnish government reacted by reducing the alcohol taxation on average by 33 per cent in the beginning of March 2004, which has lead to a 22 per cent decrease in consumer prices. According to recent estimates, the annual alcohol consumption in Finland has surpassed, for the first time in modern times, the 10-litre mark of pure alcohol per capita (Österberg, 2004).

The different alcohol taxation between Sweden and its neighbouring countries have triggered extensive cross-border shopping from Sweden. A Swedish alcohol and drug policy research institute SoRAD (2005) estimates that during 2002-2004, the private import of liquor, wine and beer increased by 81, 14 and 40 per cent, respectively, calculated as litres of pure alcohol.

[16] The number of passengers arriving in Åland currently hovers around 2 million per year, including people living in Åland. The resident population is around 26,500 people.

The Swedish government has been more hesitant than Finland to reduce taxes as a counter measure. Surprisingly, the Swedish Government decided in August 2005 not to lower its alcohol taxes in 2006, notwithstanding the plummeting sales of the national alcohol retail monopoly, Systembolaget, the sales of which cover less than half of the alcohol consumption in Sweden (SOU, 2005; Svenska Dagbladet Aug 16th 2005).

2.4. New Community members

Another significant change to the economy of Åland was the entrance of the ten new Community members, particularly Estonia with its booming shipping industry. As a Community member, the Estonian fleet is now allowed to travel between intra-EU ports, which increases competition among the ferry companies, as well as in cargo traffic. Several companies, Estonian and Åland shipping companies included, are now planning or introducing new vessels for traffic in the Baltic Sea.

Estonia is also the main destination for tourists from Finland. Current estimates show that private imports of alcohol from Estonia have doubled or tripled during 2004 (Österberg, 2004). The growth in private imports of alcohol has benefited the ferry companies only marginally through an increased number of passengers, as the main suppliers for the added alcohol demand have been the land-based retail outlets in the neighbouring countries (Estonia, Denmark, Germany). Therefore, the latest developments have double-dented the profitability of ferry companies: first, by reducing the profit margin of tax free sales, as the share of taxes of consumer prices on-land has reduced, and second, by redirecting demand towards on-land consumption, either in the home country, or in the neighbouring countries with lower taxation.

2.5. Changes in the European and the Finnish maritime policy

The maritime policy of the EU was changed considerably during the 1990s, as the share of the world fleet flying under an EU-flag was halved from its level in the beginning of 1980s. The rush to transfer vessels to the so-called open registries began to worry policymakers, as they were running the risk of loosing control of the maritime sector, considered important for safety and environmental reasons, among others (Selkou – Roe, 2004). It was also recognised that the main additional cost of a vessel being registered under a EU flag was largely wages

and corporate taxation. In 1997, new Community Guidelines on State Aid to Maritime Transport were published (Selkou – Roe, 2004), with the main goal of allowing the EU countries to compensate for the additional costs of a vessel under the flag of a member state.

The Finnish shipping companies urged Finland to also implement the state aid it had approved along with the other member countries. However, many other countries were quicker in applying these rules (Selkou – Roe, 2004), and there was an over-hanging threat that a major part of the fleet under the Finnish flag would be flagged out to a foreign register with more favourable terms. Ultimately, the Finnish government consented to the wishes of the shipping companies and introduced new subsidies. It is possible that a maritime cluster study, confirming the extensive links to the coastal regions of Finland, affected the stance of the Finnish Government (Viitanen et al., 2003). If one looks at only the share of shipping in the value added of the private sector, shipping seemed to be the unique headache of Åland. While shipping accounted for 0.9 per cent of the value added of Finland's entire private sector in the year 2000, it accounted for 50 per cent in Åland (Ålands sjöfartsarbetsgrupp, 2003).

Meanwhile, some of the Finnish cargo fleet changed flags. In addition, one of the Ålander passenger ferries was also transferred to the Swedish registry. No discernible impact on the unemployment situation in Åland has been yet registered by the recent out-flagging. However, the benefit of out-flagging is gained only to the extent that the personnel of the out-flagged vessel are of Swedish nationality, due to the design of the Swedish shipping subsidies. This augurs a declining employment of persons with a non-Swedish nationality onboard this vessel in the long run.

In 2001, Finland increased subsidies for cargo traffic in order to compensate for certain employer costs such as pension fees and different insurance policies. State aid grew by 60 per cent from € 25.6 million to € 41.0 million. The payroll taxes of seamen had been covered by this subsidy already before the change.

In the middle of 2002, state aid was introduced for passenger traffic in form of a 97 % repayment of payroll taxes to seamen (with a half year's lag in reimbursement). The subsidy was paid in full for the first time in 2003. From the year 2005 on, state aid to passenger traffic is nearly doubled, as the earlier aid is maintained, whereas ferry companies will be totally exempt from transferring payroll taxes to the tax administration. The loss of tax income for

other tax recipients is fully compensated by the state. The earlier subsidy based on payroll taxes is estimated to cover approximately 94.4 per cent of the wage-based employer fees (Government of Finland, 2004).

According to the calculations and estimations made for this study, subsidies to Åland's shipping companies based on manning costs are presented in table 1[17].

Table 1. Wage-based subsidies for Åland's shipping 2000-2005, million euro

Million euro						
	2000	2001	2002	2003	2004	2005
Passenger traffic	0.0	0.0	8.2	16.3	14.5	26.9
Cargo traffic	3.2	8.8	8.4	8.3	8.2	9.6
Total	3.2	8.8	16.6	24.6	22.7	36.5
Share of wages, %	3.2	8.5	16.4	24.6	25.0	39.0

Sources: own calculations based on State budgets 2001-2005, Seamen's Pension Fund.

During autumn 2004, the shipping companies managed to negotiate a wage agreement with the trade unions that resulted in a smaller wage increase than in the neighbouring countries. Wages, however, are rapidly increasing, especially in Estonia, at around 10 per cent per year (Statistical Office of Estonia, 2004), which makes it less attractive as an out-flagging destination for Åland vessels. The current differences in labour costs between Finland and Sweden are also expected to fade over the forthcoming wage agreement period covering the years 2005-2008 (Ålands Redarförening, 2004). However, the largest shipping company in Åland, Viking Line, decided in autumn 2005 to transfer one of its vessels under the Estonian flag, exemplifying the sensitivity of the shipping industry to differences in labour costs (Nya Åland, Oct 5th, 2005).

In short, the economic environment of Åland has been quite turbulent and is expected to continue in a similar manner in the foreseeable future. In this situation, there is a great need for an applied analysis of the net effect of different forces working in opposite directions.

The focus of the study is a small region with only 26,500 inhabitants, so it is no wonder that it is dependent on its surrounding economies. However, it is useful for the reader to take note of

[17] Estimated subsidies for the whole of Finland have been allocated to Ålander companies in relation to their share of seamen's wages. Wage information was obtained from the Seamen's Pension Fund.

the degree of openness of the Åland economy. Especially manufacturing sector, which is divided into food industry and other manufacturing, sells majority of its production to the rest of the world (RoW), whereas imports from RoW account for a major part of local consumption. The major exporter, the transport sector, which includes shipping, operates almost exclusively on the RoW market as well. Palmer (2004) compares the openness of Åland with its neighbouring countries and other small (island) economies. He finds that the economy of Åland, when measured as the share of exports and imports of goods and services of GDP (trade with mainland Finland included), is twice as open as that of Finland and Sweden, but not as open as in Luxembourg and Malta e.g. Other Nordic island autonomies have greater openness than Åland, when measured according to the trade in goods only, which constitutes only a third of Åland's external transactions.

Table 2. Production characteristics of the economy (figures in percentages)

		Share of value added	Share of production	Employment share	Share of exports	Export of output	Share of imports	Imports of demand
Primary products	C-AGRI	6.7	5.5	5.7	6.9	53.5	2.3	31.0
Food industry	C-FINDU	2.0	3.4	2.4	5.4	64.9	6.0	71.8
Other manufacturing	C-INDU	3.5	6.5	5.0	14.2	93.5	32.0	97.4
Elect. Gas, Water	C-ELWA	1.1	1.6	0.8	0.3	7.8	0.8	22.2
Construction services	C-CONST	5.3	5.9	5.6	0.2	0.8	3.2	21.5
Trade	C-TRADE	9.6	9.8	12.7	10.6	45.6	8.4	44.5
Hotal and restaurants	C-HOTEL	8.5	9.8	8.8	2.8	12.2	0.1	0.6
Transport	C-TRANSP	23.0	24.6	20.8	46.2	81.1	14.3	60.6
Business services	C-BSERV	15.9	13.6	9.1	9.8	31.1	14.7	43.9
Other services	C-OSERV	24.4	19.3	29.0	3.6	7.8	0.7	2.1
Touristic services in RoW							17.4	100.0
Total		100.0	100.0	100.0	100.0	42.7	100.0	46.7

Source: Social accounting matrix of the model, see appendix 2 of the essay 3 of this dissertation.

The next section describes the model structure and the database used for the calibration of the model. Additional idiosyncrasies of the Åland economy are also presented.

3. The model

Our model called DALAGEM (**D**ynamic **A**a**L**and **A**pplied **G**eneral **E**quilibrium **M**odel) is a recursive dynamic, imperfect competition, computable general equilibrium model that has been developed from an existing model package called the Standard Model of the International Food Policy Research Institute (IFPRI; see Lofgren et al, 2002). The model is

presented in detail in essay 3 of this dissertation, so here we will provide only a short summary on its functioning.

3.1. Agents/Institutions

The model has four public sector agents: the state, regional government, municipalities, and social security funds. This division allows us to model the transfers between themselves and with other agents in the economy. Due to the special financing system of the public sector in Åland, having a breakdown between state and regional government in the model is imperative. Equations (1)-(3) portray how the amount of equalisation and recompense are determined.

$$LUMP045 = 0.0045 \cdot (TIMFIN \cdot \frac{CPI}{CPI0} + SINALA) \quad (1)$$

$$REIMB = REIMBASE - 0.005 \cdot (FININCTAX \cdot CPI / CPI0 + REIMBASE) \quad (2)$$

$$LUMPSUM = LUMP045 + REIMB \cdot EXOGLUMP \quad (3)$$

Where:

*LUMP*045	0.45 per cent lump sum from Finnish state budget income
TIMFIN	Tax income in the mainland of Finland
SINALA	State income in Åland, basis for the amount of equalisation
REIMB	Recompense of SINALA exceeding 0.5 per cent of F state income
REIMBASE	State revenue from income and property taxes in Åland; income base for REIMB
FININCTAX	Tax revenue from income taxes in the mainland of Finland
LUMPSUM	Total lump sum from the state to the regional government
EXOGLUMP	0 if REIMB is less than zero, otherwise 1

Thus, the development of revenue for the Government of Åland depends crucially on the state finances. Åland is guaranteed an income of 0.45 per cent of the state budget revenues (net of borrowing), but in the event that state income tax revenue in Åland exceeds more than 0.5 per cent of all revenue, the state pays a recompense surpassing 0.5 per cent.

The presence of the state in Åland results both in income and costs in addition to those presented above. In the model, state income and state expenditure in Åland, taking into account all the tax and other income, as well as all the expenditure in Åland, are balanced through a transfer from the state treasury, beyond the range of the model. Therefore, it is modelled as a transfer from rest of the world (RoW).

Two households are introduced: native households, the head of which is a native Ålander, and migrant households. The households differ in certain respects, e.g. the share of capital income is higher for the native households, and migrants have a higher propensity to become unemployed and to migrate.

Another agent introduced in the model is a tourist household that spends money on tourism according to a Cobb-Douglas expenditure function. The level of expenditure in tourism is exogenous.

3.2. Production

Production is undertaken by activities (i.e. industries, sectors) that produce commodities. This modelling strategy originating from the IFPRI Standard Model departs from in other models customary assumption that each activity produces only one output. Here, activities may produce several commodities, but with fixed yield coefficients, which makes the modelling effort easier. In addition, similar commodities may be produced by several activities, but are imperfect substitutes for each other. Finally, the model uses a Firms account, the task of which is to allocate the capital earnings from the production activities to other agents.

Production functions are two-level nested CES or CES/Leontief, according to empirical estimation results. Capital and labour are the only production factors, both of which are used in aggregated form, so that the model includes only one type of capital and labour.

Furthermore, it is assumed that five of the ten activities in the model are characterised by imperfect competition (IC) and increasing returns to scale. The main market of these IC

sectors is in their own province. Increasing returns are caused by recurrent fixed costs in production. In the initial equilibrium, it is assumed that the fixed costs are fully covered by mark-ups on the marginal cost of production, thus leaving extraordinary profits to equal zero. Entry of new firms keeps pure profits at zero.

3.3. Subsidies

Rather than have net tax rates, the model explicitly includes production subsidies, transport subsidies for exports and subsidies for passenger and cargo sea traffic. Subsidies affect the costs of the activities according to the variable to which the amount of subsidies is tied. For example, the subsidies for sea traffic are proportional to labour costs.

3.4. Labour market

Activities demand labour according to their marginal revenue functions, and households supply labour according to a relatively inflexible labour supply function. Wage setting is assumed to follow a nation-wide wage negotiation process, which results in a national wage increase. This increase is adjusted by changes in the local unemployment rate. Therefore, the model includes a dynamic version of the wage curve, also known as Phillips curve (for discussion, see Blanchflower - Oswald, 1994). This modelling strategy makes real wages inflexible downwards from the former period's end value. Labour is assumed to be perfectly mobile between activities.

A considerable amount of the labour supply in Åland comes from neighbouring regions, as the Ålander shipping industry demands more labour than the local labour market can supply. Furthermore, vessels are mobile activity units by their nature and easy to commute to. It is assumed that the amount of labour force commuting to Åland is proportional to the demand for labour in the transport sector.

Equally important for labour supply is migration, which is assumed to react to the local unemployment rate as well as to wage differences between Åland and the neighbouring regions. After a period of one year, migrants are included in the population and labour force.

These features cause hysteresis in the labour market, i.e. the level and the growth of labour supply become dependent on past economic development. Thus, shocks have quite permanent effects on the growth path of economy.

3.5. Capital accumulation

Investment and capital accumulation are modelled in the same fashion as in Vaittinen (2004), and in Bayar et al. (2004), i.e. by utilizing the inverted logistic investment functions first presented in the Monash model of the Centre of Policy Studies (Dixon et al, 2002). Capital stock is assumed to be sector-specific, and the level of investment rises with increasing returns to capital. Investments increase capital stock that depreciates at a sector-specific, constant rate. When capital earnings are at the base-year, normal level of return, capital growth is at a historically normal level.

3.6 Macroeconomic closure

The present model includes three (groups of) macroeconomic balances: balance of the public sector institutions, savings-investment balance, and the external balance. The regional government of Åland is assumed to have a fixed budget balance, thus increases or decreases in its income level are reflected in its outlays.

Also the amount of municipal savings is assumed as fixed, but here flexible municipal tax rates balance the budget instead of expenditure being adjusted. A large portion of municipal outlays are statutory, thus municipal authorities have less room for adjusting expenditures. The expenditure of municipalities is assumed to increase with the number of non-working-age persons.

The Finnish state authorities present in Åland are assumed to receive/pay a balancing transfer from/to the RoW. The same mechanism applies to the social security funds. Both these agencies have only a minor part of their activities in Åland, and are not balanced-budget accountable to the headquarters. Transfers of social security funds are also assumed to depend on the number of persons outside the working age.

Savings-investment balance is achieved through flexible foreign savings. The consumer price index, *CPI*, is fixed and it is the numéraire of the model, while domestic prices are allowed to vary in relation to RoW prices, measured by the real exchange rate *EXR*.

4. Simulations

4.1. Assumptions

As recapitulation from section 2, the most important changes in the working environment of the passenger shipping companies are as follows:

- lowering alcohol taxation in Finland
- relaxed restrictions in the private import of duty-paid alcohol
- increased competition in the Nordic sea freight markets
- increased competition in the passenger traffic in the Baltic Sea.

Other factors of importance to the future of Åland's economy are:

- lower participation rate in the labour market and growing need for social and health services
- competitive pressure in agriculture and manufacturing from developing countries and economies in transition
- gradual loss of competitiveness in tourism as neighbouring countries in the Baltic Rim become ever-more attractive destinations
- Increased tax competition between countries leading to lower income taxation.

These changes are introduced in the model as described in table 3. In addition, growth occurs in investments and in productivity, as specified in appendix 4 of essay 3 of this dissertation.

It is appropriate to comment on some of the chosen parameter values. In tourism, the development of accommodation nights has been on a decrease over the last years (see ÅSUB, 2004). Competition of Baltic States is often mentioned as one of the reasons for this development as well as the high prices in Åland (Lindström et al, 2004). Furthermore, the lowering alcohol taxes will decrease the incentive to take a ferry trip to Åland. As there appears to be no change in the state of affairs at sight, I assume here a negative trend for tourism.

Table 3. Key assumptions for exogenous changes in simulations

Population growth rate	- 0.1 % annual change for both household types
Participation rate	- 0.4% annual change for both household types
Regional government services	1 % annual increase
Municipal services	Changes according to the share of population in non-working age
State services	0 % annual increase
Social security fund services	Changes according to the share of population in non-working age
World market price of agricultural products	-2.0 % annual change
World market price of food industry products	-1.5 % annual change
World market price of other manufacturing	-2.5 % annual change
World market price of trade	-1.0 % annual change
Tourism	-2.0 % annual change in demand
National real wage increase	2.2 % annually
Change in state income, excluding state income in Åland	1.77 % annual increase
World market price in transports (reflects the composition of Ålands exports in transports, affected by lowering tax free margins)	a decrease of 2 %-points in 2001 a decrease of 1 %-point in 2002 no change in 2003 a decrease of 4 %-points in 2004 a decrease of 2 %-points in 2005 a decrease of 1 %-point in 2006 no change thereafter

The level of wage increase corresponds closely with the change in productivity foreseen for the Finnish economy for the years 2004-2015. Jalava and Pohjola (2004) calculate that during 2004-2015, productivity of the whole economy (public sector included) will grow by 2.1 per cent annually, and during 2015-2030, by 2.5 per cent. However, we assume that the tax income does not follow this pace because of the increased tax competition between countries. Instead, we assume that the growth rate of state income taxes will be 1.77 per cent. In addition, the income tax rate is expected to decrease by 1.17 per cent each year (not percentage points), while income tax revenues for the mainland Finland are assumed to grow by 0.5 per cent annually.

Changes in the price level of shipping are central to the analysis. In calculating these, we have utilised the income statistics of the Ålander vessels (produced by Statistics Finland for ÅSUB, unpublished). According to this source, the 2000-2003 incomes of the Åland vessels can be grouped as follows:

Table 4. Income from sea traffic between Finland and abroad

Million euro, current prices				
Year	2000	2001	2002	2003
Passenger income	84	91	90	84
Restaurants and shops	356	370	352	331
Freight and other income	49	45	49	47
Total	488	506	491	461
Shares, per cent				
Passenger income	17.1	18.0	18.3	18.1
Restaurants and shops	72.9	73.0	71.8	71.7
Freight and other income	9.9	8.9	9.9	10.3
Total	100.0	100.0	100.0	100.0

Note: 97% of the income figures pertain to passenger vessels.

Source: unpublished material obtained from Statistics Finland, 2001-2004.

The change in the on-shore prices of alcohol affects the sales marginal both in the restaurants and shops, but customers are probably more price-conscious of products in the tax-free shops than in the restaurants. Furthermore, the product assortment and sales strategies will certainly be adapted to changing conditions. The shipping companies have become more aggressive in marketing products through loudspeakers, for example. Exotic foodstuffs are also increasingly offered among the tax-free product selection. Thus, it seems overtly pessimistic to assume that the 22 per cent decrease on land prices would have a direct adverse effect on the sales of

restaurants and shops, without compensating changes in volume. A simple arithmetic calculation would imply a 16 per cent decrease in total income. During 2000-2003, the total income decreased by 5.5 per cent. Quarterly reports of listed shipping companies show that during 2004, the number of passengers has increased, but sales per passenger and total sales have decreased (see. e.g. Viking Line, 2005). However, we do not have sufficient information to decompose the difference into volume and price changes. A study of tax-free sales outlets (two Åland shipping companies and the airline SAS) by Asplund and Friberg (2001) shows that although nominal tax-free prices may have rather persistent rigidities within a "band of inaction" when changes in taxes or exchange rates are small, they follow major changes in relative prices.

In a standard supply-demand framework, a decrease in the taxation can be understood as an inward shift of the demand curve of tax-free alcohol, as the price of its close substitute, on-shore duty-paid alcohol, decreases, subsequently increasing the demand for duty-paid products.

In sum, it is assumed that the changes in the working environment result in a 10 per cent decrease in the year 2000 world market level by the end of year 2006. By postulating that the world market price of transport does not decrease thereafter, we implicitly assume that the relative price competitiveness of the Åland shipping companies improves. This seems plausible, when we consider the recent, double-digit increases of in the salaries of seamen in Estonia. However, at the turn of the century, manning costs of Estonian vessels were only a third of that of Finnish ships, and total costs for a passenger ferry were 15-20 per cent less than under the Finnish flag (Kiuru et al, 2000). Therefore, a downward pressure on the price level of passenger traffic beyond what is assumed here cannot be excluded.

Three scenarios are studied here. First, the base ('BASE') scenario assumes that the working environment of shipping will more or less be the same as in the year 2000. Therefore, all the other changes apart from those in the world market price in transports apply to the base simulation.

The second scenario includes the changes in shipping as well, but assumes that no new subsidies are given to sea traffic in addition to those in existence in the year 2000 ('PWEDECR'). The third scenario combines the changes in the working environment with

subsidies for the shipping companies ('PWESSUB'). In order to determine the long-term differences in the outcome with and without subsidies, it is also assumed here that the temporarily approved new subsidies will become permanent. The simulations are run until the year 2020.

4.2. Results

Let us first examine the economic growth of Åland according to these scenarios. We see that the deteriorating business climate for shipping in the PWEDECR scenario depresses most exports, imports and the sum of indirect taxes (subsidies subtracted). GDP decreases more than the national income.

Table 5. National accounts indicators for the non-base scenarios

Deviation of PWEDECR from BASE, per cent							
	2004	2005	2006	2007	2008	2009	2010
GDP	-2.84	-3.61	-3.87	-3.70	-3.59	-3.53	-3.53
National income	-1.93	-2.47	-2.62	-2.45	-2.34	-2.29	-2.28
Exports	-5.23	-6.59	-7.06	-6.78	-6.58	-6.48	-6.46
Imports	-3.76	-4.85	-5.41	-5.47	-5.54	-5.62	-5.73
Investment	-1.60	-2.09	-2.36	-2.40	-2.44	-2.49	-2.55
Private consumption	-2.09	-2.80	-3.25	-3.43	-3.58	-3.71	-3.84
Indirect taxes, net	-3.29	-4.36	-5.06	-5.36	-5.64	-5.91	-6.18
Deviation of PWESSUB from BASE, per cent							
	2004	2005	2006	2007	2008	2009	2010
GDP	-0.79	0.15	-0.29	-0.26	-0.24	-0.24	-0.25
National income	-0.58	0.15	-0.14	-0.10	-0.07	-0.06	-0.06
Exports	-1.44	0.29	-0.58	-0.53	-0.51	-0.51	-0.54
Imports	-0.60	0.50	-0.13	-0.16	-0.19	-0.23	-0.28
Investment	-0.18	0.19	0.00	0.00	0.00	-0.01	-0.02
Private consumption	-0.11	0.38	0.07	0.02	-0.02	-0.05	-0.09
Indirect taxes, net	-43.10	-57.00	-55.57	-54.58	-53.56	-52.53	-51.50

Source: model output.

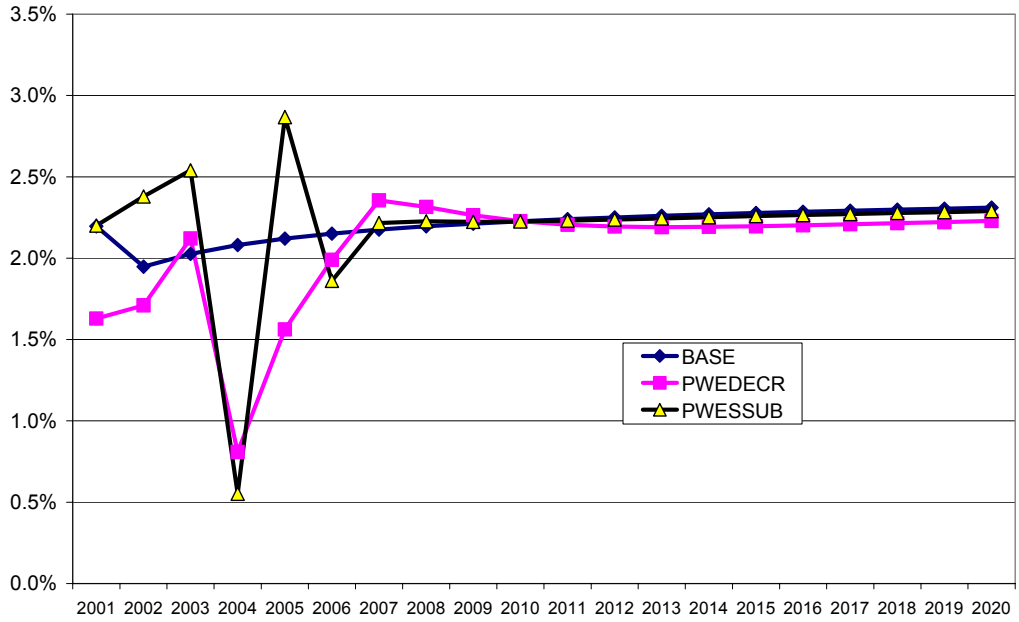
Due to the fact that a fifth of all the wages in Åland are paid to non-Ålander seamen, national income may be a better indicator of the development in Åland. Another factor speaking in favour of national income instead of GDP is the constant flow of savings from Åland abroad,

which results in repatriated capital incomes from RoW, thus raising national income. Regardless of the indicator, decreasing profitability of shipping depresses the whole economy. When subsidies are introduced, the differences between BASE and PWESSUB turn out to be rather small, compensating fairly well for the decrease in transport sector income.

The most drastic decrease is found in the amount of tax income generated, subsidies subtracted, which is only around fifty per cent of the BASE values. Figure 2 shows that by the year 2010, the growth in the national income is more or less stabilised to almost the same rates in all three scenarios. The deep dive in the non-base scenarios in year 2004 is offset in PWESSUB with the increase in subsidies in 2005.

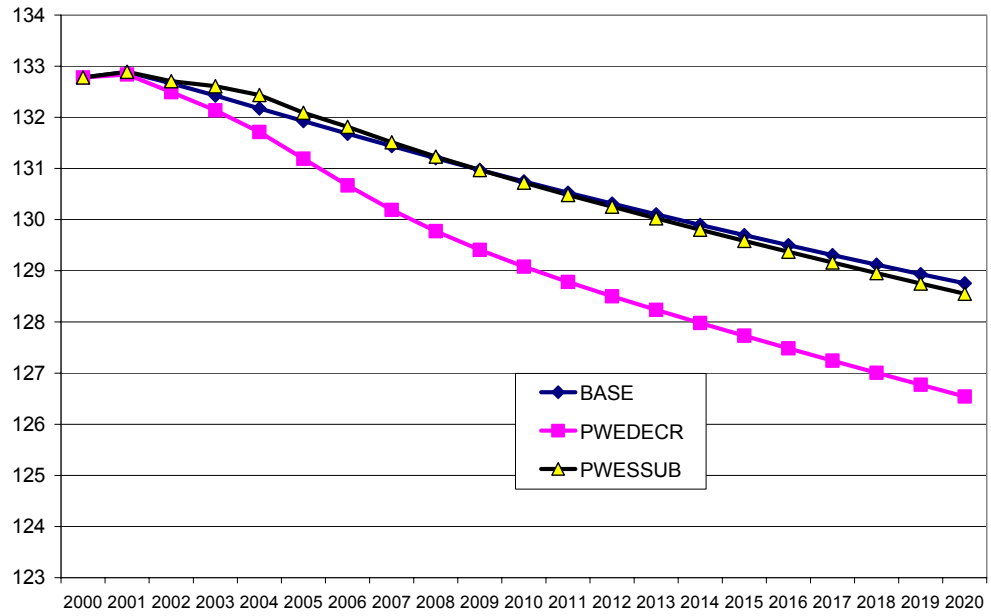
Different timing of decreased profitability (a great dip in transport prices in 2004) and compensating subsidies (2005) make the pattern of economic growth zigzag before setting on a stable growth path. To make the model more realistic, either more lagged adjustment variables or partially forward-looking behaviour (knowledge of new subsidies in the future) should be added to the model. However, such an exercise is not undertaken here.

Figure 2. National income growth 2000-2020



The labour market is permanently affected by the shock. Decreased labour demand in PWEDECR causes the labour supply to adjust permanently to lower levels than in BASE (figure 3). In addition, changes in the growth rate of labour supply have a longevity surpassing our study period.

Figure 3. Domestic labour supply according to the three scenarios, in 100s



Due to the fact that wage levels in RoW and Åland are diverging as a result of the Åland-specific shock in shipping, net migration that is dependent both on the unemployment rate and the relative wage levels is affected, thus causing growth rates of labour supply vary. The unemployment rate, however, reverts almost to its base year level in ten years (see figure 4).

In order to measure the changes in the welfare of Ålanders, we apply an equivalent variation (EV), which measures changes in utility in money-metric terms. EV uses the BASE prices and asks what income change would be equivalent to the proposed change (PWEDECR or PWESSUB) in terms of its impact on utility (see Varian, 1992). It is measured by an indirect compensation function that is derived from the expenditure function (Bloenigen et al, 1997). Here we calculate present value of the EV per household, over the study period 2000-2020, by using a 2 per cent real interest rate.

Figure 4. Unemployment rate according to the three scenarios, per cent of labour force

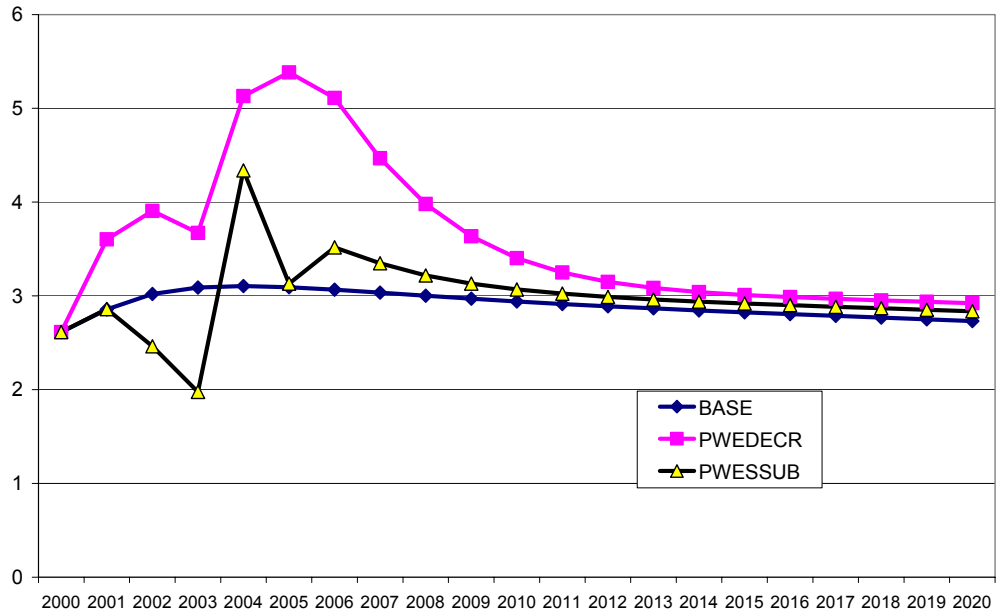


Table 6. Present value of equivalent variation 2000-2020, million euro

	PWEDECR vs. BASE	PWESSUB vs. BASE
Native households	-188.2	-3.5
Migrant households	-94.4	-1.3
Total	-282.6	-4.8

Source: model output.

A close resemblance of PWESSUB to BASE in welfare terms is confirmed by the small equivalent variation between them. Consumers in Åland would be almost as well off with the new shipping subsidies as they would, if business conditions of the year 2000 would prevail in shipping. Without the new shipping subsidies, the welfare of Ålanders would decrease considerably. These conclusions, however, depend on our correct parameterisation of the changes in the profitability of shipping.

In the PWEDECR scenario, the transport sector's downturn leads to a rise in agriculture (A-AGRI), industrial activities (A-FINDU and A-INDU) and in restaurants and hotels (A-RESH). Increased price competitiveness through lower transport prices would increase the exports of these outward-oriented activities. The development for the restaurants and hotels (A-RESH) activity would be totally different if we had assumed that the tourist flows were

negatively affected by changes in alcohol taxation. Business services due to the linkages to shipping, would be quite seriously hit by the problems foreseen in the transport sector. In the PWESSUB scenario, changes from the BASE scenario are reduced in size. One noteworthy detail is the unfavourable development of non-food industry in this scenario. Higher wage levels would erode the future development of this industry, for which demand is assumed to be very price sensitive because a high share of sales are destined to the perfectly price elastic world market. We see also that the changes accumulate to gradually increasing differences between the BASE and other scenarios: by the year 2020, production lost in PWEDECR amounts to more than 6 per cent of the BASE value.

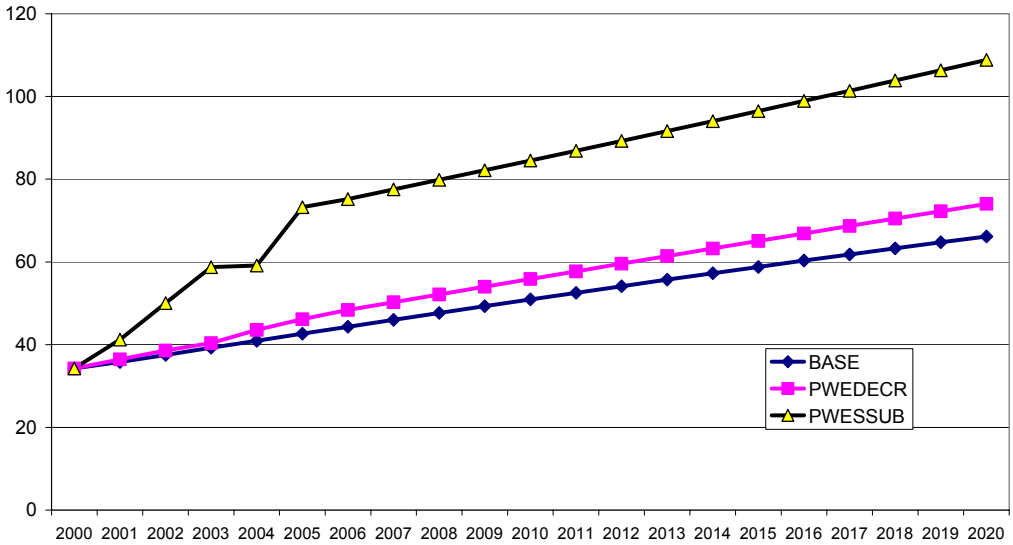
The issue for the state of Finland the regional government of Åland is how to handle the growth in the annual net transfers to Åland, predicted to increase from about 34 million euro in year 2000 to 82 million euro by 2009, when the temporary shipping subsidies are concluded. However, the increase in transfers to Åland is partly illusory, akin to the changes in the Finnish agricultural policy after entry to the EU. Prohibitive tariffs and import restrictions were partly replaced with direct subsidies to farmers, making the cost of agricultural policy more tangible for the general public. In the same fashion, indirect, less visible non-budgetary subsidies in form of tax free sales –which diminish the state's tax revenue from corresponding land-based activities - are thus partially converted into tangible, budgetary subsidies to shipping. In consequence, Åland shipping may become more vulnerable to political feuds and turnarounds than during the era of traditional, Nordic alcohol policy.

Table 7. Change in the quantity of total production by activity

Deviation of PWEDECR from BASE per cent						
	2005	2006	2007	2008	2009	2020
A-AGRI	0.69	0.99	1.33	1.65	1.94	4.22
A-FINDU	1.49	2.21	2.96	3.60	4.12	8.04
A-INDU	1.77	2.65	3.60	4.48	5.26	10.81
A-ELWA	-1.09	-1.05	-0.82	-0.63	-0.51	-0.49
A-CONS	-2.59	-2.78	-2.65	-2.59	-2.59	-3.67
A-TRAD	-2.96	-3.02	-2.68	-2.44	-2.33	-3.10
A-RESH	5.25	6.24	6.78	7.28	7.71	9.59
A-TRANS	-10.10	-11.09	-11.01	-11.03	-11.15	-14.15
A-BSER	-0.86	-1.03	-1.12	-1.17	-1.23	-1.88
A-OSERV	-0.22	-0.10	0.07	0.20	0.28	0.23
TOTAL	-3.61	-3.86	-3.67	-3.56	-3.51	-4.32
Deviation of PWESSUB from BASE, per cent						
	2005	2006	2007	2008	2009	2020
A-AGRI	-0.05	0.11	0.17	0.25	0.32	1.03
A-FINDU	0.11	0.32	0.50	0.66	0.79	2.11
A-INDU	-0.21	0.03	0.21	0.40	0.56	2.11
A-ELWA	0.23	0.13	0.18	0.23	0.26	0.37
A-CONS	0.26	-0.02	0.02	0.05	0.06	-0.10
A-TRAD	0.47	0.13	0.22	0.30	0.34	0.21
A-RESH	-0.50	0.12	0.23	0.34	0.45	1.41
A-TRANS	0.21	-1.15	-1.15	-1.18	-1.25	-2.62
A-BSER	0.15	0.20	0.19	0.21	0.22	0.22
A-OSERV	0.06	0.03	0.07	0.11	0.13	0.19
TOTAL	0.13	-0.32	-0.28	-0.25	-0.25	-0.55

Source: model output.

Figure 5. Net state transfer to Åland, million euros



4.3. Sensitivity analysis

The behaviour of CGE models depends crucially on the parameter values utilised. There are several methods of how to study the sensitivity of a CGE model and how to validate it (see, e.g. Hertel et al, 2004, Liu et al., 2003, Valenzuela et al., 2005, or Giesecke, 2004). Even the effects of different model specifications can be studied (Willenbockel, 2002). In the following, we describe how our model responds to changes in the two types of elasticities. One of the central parameter values in the present model, β_u, defines the wage response to changes in unemployment rate. Another set of parameters that has been altered is the CES elasticity for the domestic commodity aggregation σ_C^{AC}, which defines the ease of substitution within the same category of products produced by different domestic activities. The different values applied are given in table 8 below.

Table 8. Elasticity values for different model specifications

	β_u	σ_C^{AC}
Model used	0.50	2.0
Low wage elasticity of unemployment	0.25	2.0
Low wage and comm. aggr. elasticities	0.25	1.1
High wage elasticity of unemployment	1.0	2.0
High wage and comm. aggr. elasticities	1.0	4.0

Let us examine how different items included in GDP (expenditure definition) change within the different parameter specifications and scenarios. Here we measure the average annual absolute relative deviation $\bar{\hat{x}}_A^Y$ between the model used above and alternative model specifications, measured in per cent. Formally, the deviation measure can be defined as follows:

$$\bar{\hat{x}}_A^Y = 100 \cdot \sum_I \sum_S \frac{\left| \frac{x_{ISA}^Y - x_{ISA_0}^Y}{x_{ISA_0}^Y} \right|}{(n_I \cdot n_S)}$$

Where

$x^{Y}_{I\,S\,A}$	Value of a GDP item I in year Y according to scenario S in model specification A. A_0 refers to the model specification used in this study.
I	GDP components: private consumption, public consumption, investments, exports, imports and tourism income.
S	Scenarios BASE, PWEDECR, and PWESSUB
n_I, n_S	Number of items in sets I and S.

Figure 6. Average deviation of GDP items, $\bar{\hat{x}}^{Y}_{A}$, for the different model specifications, per cent

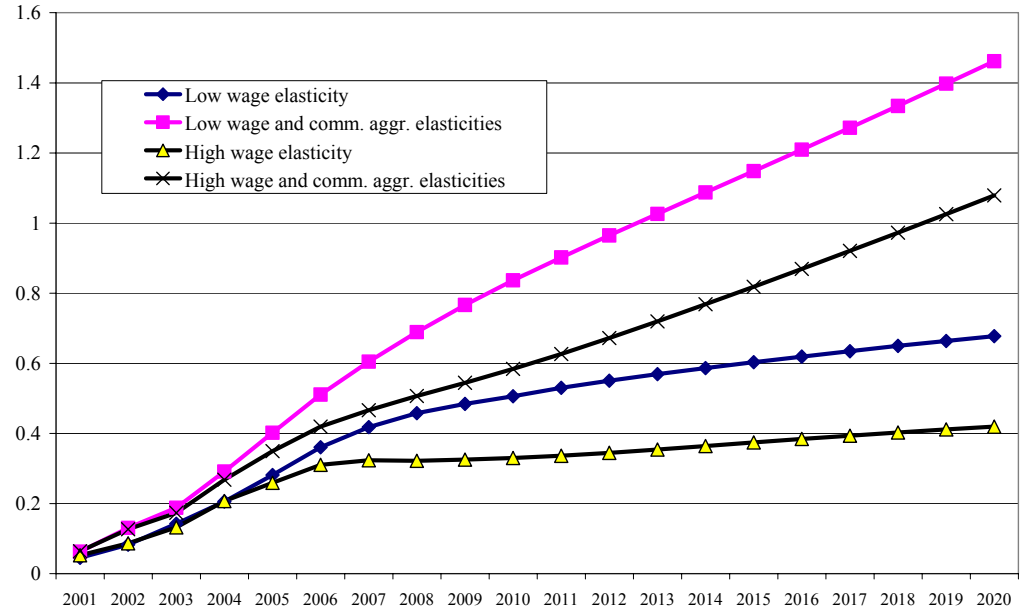


Figure 6 above shows how the average differences in the model specifications develop over time. We can see that both the values of σ_C^{AC} and β_u are significant for the behaviour of the model. High as well as low values of parameters lead to deviations that increase over time.

Furthermore, we can see in figures 7 and 8 how the unemployment rate and labour supply depend on the same parameters. The development of the variables is depicted for the PWEDECR scenario, which shows the most drastic effects in the analysis above. We see that low values of β_u and σ_C^{AC} lead to a higher unemployment level in the long run, as well as to

lower labour supply. For the behaviour of the labour market, the value of β_u is naturally more important.

Figure 7. Unemployment rate in PWEDECR scenario with different specifications

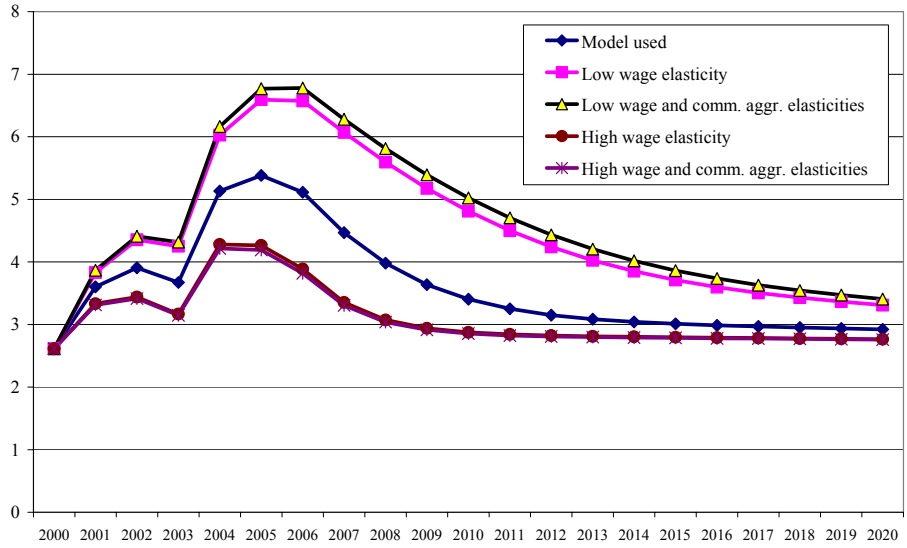
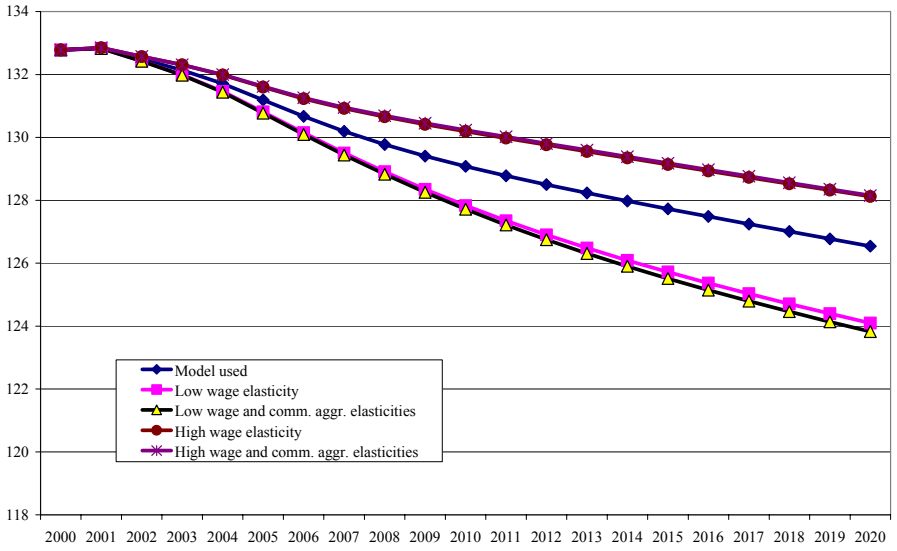


Figure 8. Labour supply in PWEDECR scenario with different specifications, 100s of persons



4.4. A remark on out-flagging

So far, we have not analysed the consequences of one of the major threats, and an important motivation for the introduction of the new shipping subsidies, i.e. flagging out of the Ålander vessels. The Finnish government, as many other EU governments, is interested in having a fleet under its flag, not least of all because of national security related issues.

A change of flags would transfer overnight a part of the capital stock abroad. However, this would merely convert a share of capital income into a transfer from RoW, thus inducing only minor changes in the capital earnings portion of the national income. The real potential for adverse consequences lies in the labour market. Would the same seamen be employed if the vessels changed flags? If not, this would rapidly increase unemployment and suppress net migration, and thus reduce labour force permanently.

It seems reasonable to assume that a change of flags would lead to layoffs and reduced demand for Finnish seamen. If they find new employment abroad - and continue living in Åland - nothing much really would change in terms of the level of national income: factor incomes from abroad would at least partially compensate for the loss of labour income in the home region. In that case the adverse effects of changing flags would be quite small, although business services and financing of the public sector of Åland could be affected. Whether business services would be affected depends on the way intermediate consumption of shipping companies reacts to a change of flags. At least for the contributions that are regulated by national law, such as pension contributions, out-flagging may signify drastic changes. If intermediate consumption were unaffected by the flag change, it would merely change the shares of exports, imports, and local consumption, reduce GDP, but leave the total of national income more or less unaffected. However, public sector does seem to lose a part of its tax base, whatever choices shipping companies make (see e.g. Fellman et al, 2003). Therefore, the largest potential of adverse consequences from out-flagging seems to concentrate on the labour market and the public sector. Nevertheless, a closer analysis of out-flagging is beyond the scope of this study.

5. Discussion

Analysis of the current policy changes affecting passenger shipping, Åland's most important sector, shows that the action taken by the Finnish government to introduce new shipping subsidies seems justifiable if the objective is to reach a development path resembling our "status quo" scenario, the BASE. Without the new subsidies, the economy of Åland would nose-dive. The recovery of the labour market in terms of unemployment rate would take several years, even a decade. However, changes in the labour supply level and in its growth rate have a longevity that surpasses our period of study, because of the manner in which interconnections between unemployment, wages and migration are modelled here.

The reliance of the Åland economy on transfers from the Finnish state becomes more obvious, when the indirect subsidies in the form of "tax expenditure" through the possibility of tax-free sales onboard, are converted into budgetary outlays to be decided by the parliament. What is Åland's most effective policy in this situation? The Åland Government has repeatedly requested for more extended taxation authority. A total takeover of state responsibilities by Åland does not seem plausible, particularly if we assume that it would not lead to savings in public expenditure. The estimated state expenditure in Åland of 73 million euro for the year 2005 constitutes about 29 per cent of the total budgetary expenditure of the Government of Åland. New shipping subsidies represent around 40 per cent of this state expenditure.

However, if Åland were to assume the responsibility for shipping, and if seamen's and shipping companies' income tax payments were excluded from the lump sum calculus, other things being equal, a part of the shipping subsidies would still be borne by Finland, namely the portion corresponding to the loss of tax income from wages of seamen living on the mainland Finland. Nevertheless, it would still be quite costly for Åland to subsidise shipping on the current terms, as the Ålander seamen's share of the wage subsidies amounts to about 17 million euro in 2005. Therefore, before the Åland Government has the responsibility of the shipping sector transferred from the state to itself, the following question needs to be studied: are the disadvantages of not having total control – and financial responsibility – of the shipping policy really so great that the additional costs to the public sector of the size approximated here can be justified?

References

Asplund, Marcus – Friberg, Richard (2001): *The Law of One Price in Scandinavian Duty-Free Stores*, The American Economic Review, Vol. 91 No. 4 September 2001, pp. 1072-1083.

Bayar, Ali – Cornelisse, Peter – van der Hoek, Peter - Mohora, Christina (2004): *Tax Harmonisation and public expenditures restructuring in Romania, in the process of preparation for the EU accession – A CGE modeling exercise*, ECOMOD conference 2004 Available at: http://www.ecomod.net/conferences.htm.

Blanchflower, David G. – Oswald, Andrew J. (1994): *The Wage Curve*, The MIT Press, Cambridge, ISBN 0-262-02375-X.

Bloenigen, Bruce A. – Flynn, Joseph E. – Reinert, Kenneth A. (1997): Sector-Focused General Equilibrium Modeling in *Applied Methods for Trade Policy Analysis – A Handbook*, edited by Francois, Joseph – Reinert, Kenneth, Cambridge University Press, Cambridge, ISBN 0-521-58997-5.

Dixon, Peter B. – Parmenter, Brian R. – Rimmer, Maureen T. (2002): CGE models for practical policy analysis: The Australian experience, in *Policy Evaluation with Computable General Equilibrium Models*, eds. Fossati, Amadeo – Wiegard Wolfgang, Routledge, London, ISBN 0-415-25671-2.

Fagerlund, Niklas (1997): The Special Status of the Åland Islands in the European Union, in *Autonomy and Demilitarisation in International Law: The Åland Islands in a Changing Europe*, eds. Hannikainen, Lauri – Horn, Frank, Kluwer Law International, The Hague, ISBN 90-411-0271-X.

Fellman, Katarina – Lindström, Bjarne – Rundberg-Mattsson, Maria – Kinnunen, Jouko – Karlsson, Jonas (2003): *Konjunkturbedömning för den kommunala sektorn hösten 2003*, ÅSUB Rapport 2003:5, Mariehamn (in Swedish).

Gebauer, Andrea – Woon Nam, Chang – Parsche, Rüdiger (2004): *Lessons of the 1999 Abolition of Intra-EU Duty Free Sales for the New EU Member States*, presented in 44TH Congress European Regional Science Association, ERSA, Porto (full text available in the Congress CD-ROM, abstract available at http://www.apdr.pt/ersa/).

Giesecke, James (2004): *The extent and consequences of the recent structural changes in the Australian economy, 1997-2002: Results from historical/decomposition simulations with Monash*, Centre of Policy Studies, Monash University, General Working Paper No. G-151, December 2004.

Government of Finland (2004): *Hallituksen esitys Eduskunnalle laiksi eräiltä matkustaja-aluksilta saadusta merityötulosta toimitetun ennakonpidätyksen väliaikaisesta maksuvapautuksesta*, HE 94-2004 vp, available at: http://finlex1.edita.fi (in Finnish).

Government of Åland (2002): Act on the Autonomy of Åland, unofficial translation, Appendix 1 in *The second Åland Islands question – Autonomy or independence?*, Editors Jansson, Harry – Salminen, Johannes, Julius Sundblom Memorial Foundation, Mariehamn, ISBN 952-91-4613-2.

Government of Åland (2004): *Förslag till Budget för landskapet Åland 2005*, Ålands landskapsregering, Framställning nr 1/2004-2005 (in Swedish).

Hertel, Thomas – Hummels, David – Ivanic, Maros – Keeney, Roman (2004): *How Confident Can We Be in CGE-Based Assessments of Free Trade Agreements?*, GTAP Working Paper No. 26, Revised Version, March 2004.

Jalava, Jukka – Pohjola, Matti (2004): Työn tuottavuus Suomessa vuosina 1900-2030, in *Talouskasvu ja julkistalous ikääntyneen väestön oloissa*, Valtioneuvoston kanslian julkaisusarja 32/2004, Helsinki, pp. 29-77, (in Finnish).

Karlsson, Thomas – Tigerstedt, Christoffer (2004): *Testing new models in Finnish, Norwegian and Swedish alcohol policies*, Nordic Studies on Alcohol and Drugs, NAT, English Supplement, vol. 21, pp.79 –91, Ekenäs.

Kinnunen, Jouko (1998): *Tax free i skärgårdstrafiken – Förutsättningar och konsekvenser*, ÅSUB Rapport 1998:1, Mariehamn (in Swedish).

Kinnunen, Jouko (2004): *Konjunkturläget – hösten 2004*, ÅSUB Rapport 2004:8, Mariehamn (in Swedish), available at http://www.asub.aland.fi.

Kiuru, Pertti – Martikainen, Minna – Mäkelä, Outi – Niilola, Kari – Pulkkinen, Matti (2000): *Matkustaja-alustoiminnan kehitysnäkymät*, LTT-Tutkimus, Helsinki, ISBN 951-774-047-6 (in Finnish).

Lindman, Josefine – Kinnunen, Jouko (1999): *Det åländska skatteundantaget inom EU – Effekter för företag, branscher och samhällsekonomi*, Statistics and Research Åland, ÅSUB Rapport 1999:1, Mariehamn (in Swedish).

Lindström, Bjarne (2002): *Den åländska näringsrätten*, Statistics and Research Åland, ÅSUB Rapport 2002:5, Mariehamn, ISSN 1455-1977 (in Swedish).

Lindström, Bjarne – Kinnunen, Jouko (2004): *Det åländska skatteundantagets samhällsekonomiska betydelse – i dag och i framtiden*, ÅSUB Rapport 2004:5, Mariehamn (in Swedish).

Lindström, Bjarne – Fellman, Katarina – Rundberg-Mattsson, Maria – Kinnunen, Jouko (2004): *Konjunkturläget – hösten 2004*, ÅSUB Rapport 2004:8, Mariehamn, ISSN 1455-1977 (in Swedish).

Liu, Jing – Arndt, Channing – Hertel, Thomas W. (2003): *Parameter Estimation and Measures of Fit in A Global, General Equilibrium Model*, GTAP Working Paper No. 23, March 2003.

Lofgren, Hans – Harris, Rebecca Lee– Robinson, Sherman, with assistance from Thomas, Marcelle and El-Said, Moataz (2002): *A Standard Computable General Equilibrium (CGE) Model in GAMS,* International Food Policy Research Institute, IFPRI, Microcomputers in Policy Research 5, ISBN 0-896-29720-9.

Nya Åland (2005): *Nu blir Rosella estnisk, Alla ombord placeras på nya jobb*, article published on October 5th, 2005 (in Swedish).

Palmer, Richard (2004): *EU-medlemskapets effekter på den åländska ekonomin i ett internationellt perspektiv – En förberedande studie*, ÅSUB Rapport 2004:10, Mariehamn (in Swedish).

Palmgren, Sten (1997): The Autonomy of the Åland Islands in the Constitutional Law of Finland, Chapter 5 in *Autonomy and Demilitarisation in International Law: The Åland Islands in a Changing Europe*, eds. Hannikainen, Lauri – Horn, Frank, Kluwer Law International, Netherlands, ISBN 90-411-0271-X.

Seamen's Pension Fund (Merimieseläkekassa): unpublished statistical tables on the wages and salaries of seamen 2000-2003.

Selkou, Evangelia – Roe, Michael (2004): *Globalisation, Policy and Shipping – Fordism, Post-Fordism and the European Union Maritime Sector*, Transport Economics, Management and Policy, Edwar Elgar Publishing Ltd., Cheltenham, ISBN 1-84376-934-4.

SoRAD (2005): *Resandeinförsel av alcohol, Svenska resenärers införsel av spritdrycker, vin och öl till Sverige varje månad, från juni år 2000 och framåt, Uppdaterad till och med augusti 2005 (2005-09-30)*, Centrum för socialvetenskaplig alkohol- och drogforskning, available at: http://www.sorad.su.se.

SOU (2004): *Var går gränsen? Delbetänkande för Alkoholinförselutredningen (Where is the border limit? First government report by the Alcohol Import Commission)*, Statens Offentliga Utredningar, SOU 2004:86, Stockholm, (in Swedish).

SOU (2005): *Gränslös utmaning – alkoholpolitik i ny tid. Delbetänkande av Alkoholinförselutredningen (A Challenge without boundaries – alcohol policy in the present day. Second report by the Alcohol Import Commission)*, Statens offentliga utredningar 2005:25, Stockholm (in Swedish).

Statistical Office of Estonia (2004): Average Monthly Gross and Net Wages (Salaries) by Year, Quarter, available at http://www.stat.ee.

Statistics and Research Åland, ÅSUB (2004): *Statistical Yearbook of Åland*, Mariehamn, ISSN 0358-8629.

Statistics Finland (2004): Vessel income statistics, unpublished material on Ålander vessels.

Svenska Dagbladet (2005): *V och mp säger nej till sänkt spritskatt*, article published on Aug 16th 2005 (in Swedish).

Turunen, Juhani – Eriksson, Dan E. (2004): *Det skattefinansiella utjämningssystemet mellan landskapet Åland och staten: 1990-talets erfarenheter*, Ministry of Finance & Government of Åland, available at:
http://www.ls.aland.fi/.composer/upload/modules/publikationer/ekonomisk_utredning_2004.pdf (in Swedish).

Vaittinen, Risto (2004): *Trade Policies and Integration – Evaluations with CGE –models*, Dissertation, Helsinki School of Economics, A-235, Helsinki, ISBN 951-791-843-7.

Valenzuela, Ernesto – Hertel, Thomas W. – Keeney, Roman – Reimer, Jeffrey J. (2005): *Assessing Global CGE Model Validity Using Agricultural Price Volatility*, GTAP Working Paper No. 33, September 2005.

Varian, Hal R. (1992): *Microeconomic Analysis, Third Edition*, W. W. Norton & Company, New York, ISBN 0-393-95735-7.

Viitanen, Mikko – Karvonen, Tapio – Vaiste, Johanna – Hernesniemi, Hannu (2003): *Suomen meriklusteri*, TEKES, Teknologiakatsaus 140/2003, Helsinki, ISBN 952-457-126-9 (in Finnish). available at http://www.hex.com.

Viking Line Abp (2005): *Börsmeddelande 6.9.2005, Delårsrapport för perioden 1.11.2004 – 31.7.2005* (in Swedish).

Willenbockel, Dirk (2002): *Specification Choice and Robustness in CGE Trade Policy Analysis with Imperfect Competition*, presented in ECOMOD conference 2002, available at http://www.ecomod.net/conferences.htm.

Ålands redarförening (2004): personal communication from shipping advisor Kimo Kostiainen.

Ålands sjöfartsarbetsgrupp (2003): *Förslag till sjöfartspolitiska åtgärder som kan säkerställa sjöfartsnäringens konkurrenskraft och utveckling i Finland och på Åland inom ramen för gemenskapens riktlinjer för statligt stöd till sjöfarten*, memorandum.

Österberg, Esa (2004): Presentation at "Tiedosta hyvinvointia" – conference, Oct 26th 2004.

HELSINGIN KAUPPAKORKEAKOULUN JULKAISUJA
Publications of the Helsinki School of Economics

A-SARJA: VÄITÖSKIRJOJA - DOCTORAL DISSERTATIONS. ISSN 1237-556X.

A:211. TOMMI KASURINEN: Exploring Management Accounting Change in the Balanced Scorecard Context. Three Perspectives. 2003. ISBN 951-791-736-8.

A:212. LASSE NIEMI: Essays on Audit Pricing. 2003. ISBN 951-791-751-1.

A:213. MARKKU KAUSTIA: Essays on Investor Behavior and Psychological Reference Prices. 2003. ISBN 951-791-754-6.

A:214. TEEMU YLIKOSKI: Access Denied: Patterns of Consumer Internet Information Search and the Effects of Internet Search Expertise. 2003. ISBN 951-791-755-4.

A:215. PETRI HALLIKAINEN: Evaluation of Information System Investments. 2003. ISBN 951-791-758-9.

A:216. PETRI BÖCKERMAN: Empirical Studies on Working Hours and Labour Market Flows. 2003. ISBN 951-791-760-0.

A:217. JORMA PIETALA: Päivittäistavarakaupan dynamiikka ja ostoskäyttäytyminen Pääkaupunkiseudulla. 2003. ISBN 951-791-761-9.

A:218. TUOMAS VÄLIMÄKI: Central Bank Tenders: Three Essays on Money Market Liquidity Auctions. 2003. ISBN 951-791-762-7.

A:219. JUHANI LINNAINMAA: Essays on the Interface of Market Microstructure and Behavioral Finance. 2003. ISBN 951-791-783-X.

A:220. MARKKU SALIMÄKI: Suomalaisen design-teollisuuden kansainvälinen kilpailukyky ja kansainvälistyminen. Strateginen ryhmä –tutkimus design-aloilta. 2003 ISBN 951-791-786-4.

A:221. HANNU KAHRA: Consumption, Liquidity and Strategic Asset Allocation. 2003. ISBN 951-791-791-0.

A:222. TONI RIIPINEN: The Interaction of Environmental and Trade Policies. 2003. ISBN 951-791-797-X.

A:223. MIKKO SYRJÄNEN: Data Envelopment Analysis in Planning and Heterogeneous Environments. 2003. ISBN 951-791-806-2.

A:224. ERKKI HÄMÄLÄINEN: Evolving Logistic Roles of Steel Distributors. 2003. ISBN 951-791-807-0.

A:225 SILJA SIITONEN: Impact of Globalisation and Regionalisation Strategies on the Performance of the World's Pulp and Paper Companies. 2003. ISBN 951-791-808-9.

A:226. EIREN TUUSJÄRVI: Multifaceted Norms in SMC Export Cooperation: A Discourse Analysis of Normative Expectations. 2003. ISBN 951-791-812-7.

A:227. MIKA MALIRANTA: Micro Level Dynamics of Productivity Growth. An Empirical Analysis of the Great Leap in Finnish Manufacturing Productivity in 1975-2000. 2003. ISBN 951-791-815-1.

A:228. NINA KOISO-KANTTILA: Essays on Consumers and Digital Content. 2003. ISBN 951-791-816-X.

A:229. PETER GABRIELSSON: Globalising Internationals: Product Strategies of ICT Companies. 2004. ISBN 951-791-825-9, ISBN 951-791-826-7 (Electronic dissertation).

A:230. SATU NURMI: Essays on Plant Size, Employment Dynamics and Survival. 2004. ISBN 951-791-829-1, ISBN 951-791-830-5 (Electronic dissertation).

A:231. MARJA-LIISA KURONEN: Vakuutusehtotekstin uudistamisprosessi, matkalla alamaisesta asiakkaaksi. 2004. ISBN 951-791-833-X, ISBN 951-791-834-8 (Electronic dissertation).

A:232. MIKA KUISMA: Erilaistuminen vai samanlaistuminen? Vertaileva tutkimus paperiteollisuusyhtiöiden ympäristöjohtamisesta. 2004. ISBN 951-791-835-6, ISBN 951-791-836-4 (Electronic dissertation).

A:233. ANTON HELANDER: Customer Care in System Business. 2004. ISBN 951-791-838-0.

A:234. MATTI KOIVU: A Stochastic Optimization Approach to Financial Decision Making. 2004. ISBN 951-791-841-0, ISBN 951-791-842-9 (Electronic dissertation).

A:235. RISTO VAITTINEN: Trade Policies and Integration – Evaluations with CGE -models. 2004. ISBN 951-791-843-7, ISBN 951-791-844-5 (Electronic dissertation).

A:236. ANU VALTONEN: Rethinking Free Time: A Study on Boundaries, Disorders, and Symbolic Goods. 2004. ISBN 951-791-848-8, ISBN 951-791-849-6 (Electronic dissertation).

A:237. PEKKA LAURI: Human Capital, Dynamic Inefficiency and Economic Growth. 2004. ISBN 951-791-854-2, ISBN 951-791-855-0 (Electronic dissertation).

A:238. SAMI JÄRVINEN: Essays on Pricing Commodity Derivatives. 2004. ISBN 951-791-861-5, ISBN 951-791-862-3 (Electronic dissertation).

A:239. PETRI I. SALONEN: Evaluation of a Product Platform Strategy for Analytical Application Software. 2004. ISBN 951-791-867-4, ISBN 951-791-868-2 (Electronic dissertation).

A:240 JUHA VIRRANKOSKI: Essays in Search Activity. 2004. ISBN 951-791-870-4, ISBN 951-791-871-2 (Electronic dissertation).

A:241. RAUNI SEPPOLA: Social Capital in International Business Networks. Confirming a Unique Type of Governance Structure. 2004. ISBN 951-791-876-3, ISBN 951-791-877-1 (Electronic dissertation).

A:242. TEEMU SANTONEN: Four Essays Studying the Effects of Customization and Market Environment on the Business Success of Online Newspapers in Finland. 2004. ISBN 951-791-878-X, ISBN 951-791-879-8 (Electronic dissertation)

A:243. SENJA SVAHN: Managing in Different Types of Business Nets: Capability Perspective. 2004. ISBN 951-791-887-9.

A:244. JUKKA MÄKINEN: John Rawlsin oikeudenmukaisuuskäsityksen merkitys normatiiviselle taloustieteelle. 2004. ISBN 951-791-889-5, ISBN 951-791-890-9 (Electronic dissertation).

A:245. ERJA KETTUNEN: Regionalism and the Geography of Trade Policies in EU-ASEAN Trade. 2004. ISBN 951-791-891-7, ISBN 951-791-892-5 (Electronic dissertation).

A:246. OLLI-PEKKA RUUSKANEN: An Econometric Analysis of Time Use in Finnish Households. 2004. ISBN 951-791-893-3, ISBN 951-791-894-1 (Electronic dissertation).

A:247. HILPPA SORJONEN: Taideorganisaation markkinaorientaatio. Markkinaorientaation edellytykset ja ilmeneminen esitystaideorganisaation ohjelmistosuunnittelussa. 2004. ISBN 951-791-898-4, ISBN 951-791-899-2 (Electronic dissertation).

A:248. PEKKA KILLSTRÖM: Strategic Groups and Performance of the Firm - Towards a New Competitive Environment in the Finnish Telecommunications Industry. 2005. ISBN 951-791-904-2, ISBN 951-791-905-0 (Electronic dissertation).

A:249. JUHANI YLIKERÄLÄ: Yrityshautomokokemuksen vaikutukset tradenomiopiskelijan yrittäjäuran syntyyn ja kehittymiseen. Yrityshautomotoiminta liiketalouden alan ammattikorkeakoulun yrittäjäkoulutuksessa. 2005. ISBN 951-791-910-7.

A:250 . TUURE TUUNANEN: Requirements Elicitation for Wide Audience End-Users. 2005. ISBN 951-791-911-5, ISBN 951-791-912-3 (Electronic dissertation).

A:251. SAMULI SKURNIK: Suomalaisen talousmallin murros. Suljetusta sääntelytaloudesta kaksinapaiseen globaalitalouteen. 2005. ISBN 951-791-915-8, ISBN 951-791-916-6 (Electronic dissertation).

A:252. ATSO ANDERSÉN: Essays on Stock Exchange Competition and Pricing. 2005. ISBN 951-791-917-4, ISBN 951-791-918-2 (Electronic dissertation).

A:253. PÄIVI J. TOSSAVAINEN: Transformation of Organizational Structures in a Multinational Enterprise. The case of an enterprise resource planning system utilization. 2005. ISBN 951-791-940-9, ISBN 951-791-941-7 (Electronic dissertation).

A:254. JOUNI LAINE: Redesign of Transfer Capabilities. Studies in Container Shipping Services. 2005. ISBN 951-791-947-6, ISBN 951-791-948-4 (Electronic dissertation).

A:255. GILAD SPERLING: Product, Operation and Market Strategies of Technology-Intensive Born Globals. The case of Israeli Telecommunication Born Globals. 2005. ISBN 951-791-954-9, ISBN 951-791-954-9 (Electronic dissertation).

A:256. ARLA JUNTUNEN: The Emergence of a New Business Through Collaborative Networks – A Longitudinal Study In The ICT Sector. 2005. ISBN 951-791-957-3.

A:257. MIRJAMI LEHIKOINEN: Kuluttajan suhdemotivaatio päivittäistavaroihin. Miksi äiti liittyy Piltti-piiriin? 2005. ISBN 951-791-925-5, ISBN 951-791-926-3 (Electronic dissertation).

A:258. JOUKO KINNUNEN: Migration, Imperfect Competition and Structural Adjustment. Essays on the Economy of the Åland Islands. 2005. ISBN 951-791-931-X, ISBN 951-791-932-8 (Electronic dissertation).

B-SARJA: TUTKIMUKSIA - RESEARCH REPORTS. ISSN 0356-889X.

B:44. ELINA HENTTONEN – PÄIVI ERIKSSON – SUSAN MERILÄINEN: Teknologiayrittämisen sukupuoli. Naiset miesten maailmassa. 2003. ISBN 951-791-737-6.

B:45. KIRSI KORPIAHO: "Kyllä siinä pitää elää mukana!" Kirjanpitäjien tarinoita työstä, osaamisesta ja oppimisesta työyhteisönäkökulmasta analysoituna. 2003. ISBN 951-791-742-2.

B:46. NIILO HOME (toim.): Puheenvuoroja ECR-toiminnasta. Discussions on ECR – Summaries. 2003. ISBN 951-791-749-X.

B:47. PÄIVI KARHUNEN – RIITTA KOSONEN – MALLA PAAJANEN: Gateway-käsitteen elinkaari Venäjän-matkailussa. Etelä-Suomi Pietarin-matkailun väylänä. 2003. ISBN 951-791-756-2.

B:48. ANNELI KAUPPINEN – ANNE ARANTO – SATU RÄMÖ (toim.): Myyttiset markkinat. 2003. ISBN 951-791-771-6.

B:49. MIKKO SAARIKIVI – SIMO RIIHONEN: Suomen puuteollisuuden kilpailukyvyn parantaminen ja kansainvälistyminen piha- ja ympäristörakentamisessa. 2003. ISBN 951-791-779-1.

B:50. KATARIINA KEMPPAINEN – ARI P.J. VEPSÄLÄINEN – JUKKA KALLIO – TIMO SAARINEN – MARKKU TINNILÄ: From Supply Chain to Networks: A Study of SCM Practices in Finnish Industrial Companies. 2003. ISBN 951-791-780-5.

B:51. SAMI SARPOLA: Enterprise Resource Planning (ERP) Software Selection and Success of Acquisition Process in Wholesale Companies. 2003. ISBN 951-791-802-X.

B:52. MATTI TUOMINEN (ed.): Essays on Capabilities Based Marketing and Competitive Superiority. Fimac II - Research: Mai Anttila, Saara Hyvönen, Kristian Möller, Arto Rajala, Matti Tuominen. 2003. ISBN 951-791-814-3.

B:53. PÄIVI KARHUNEN – RIITTA KOSONEN – ANTTI LEIVONEN: Osaamisen siirtyminen Suomalais-venäläisissä tuotantoalliansseissa. Tapaustutkimuksia pietarista ja leningradin alueelta. 2003. ISBN 951-791-820-8.

B:54. JARMO ERONEN: Kielten välinen kilpailu: Taloustieteellis-sosiolingvistinen tarkastelu. 2004. ISBN 951-791-828-3.

B:47. PÄIVI KARHUNEN – RIITTA KOSONEN – MALLA PAAJANEN: Gateway-käsitteen elinkaari Venäjän-matkailussa. Etelä-Suomi Pietarin-matkailun väylänä. 2004. ISBN 951-791-846-1, korjattu painos.

B:55. TAISTO MIETTINEN: Veron minimointi yritysjärjestelyissä. 2004. ISBN 951-791-856-9.

B:56. SOILE TUORINSUO-BYMAN: Part-Time Work, Participation and Commitment. ISBN 951-791-866-6.

B:57. PIIA HELISTE – RIITTA KOSONEN – KAROLIINA LOIKKANEN: Kaksoiskaupunkeja vai kaupunkipareja? Tapaustutkimukset: Helsinki–Tallinna, Tornio–Haaparanta, Imatra–Svetogorsk. 2004. ISBN 951-791-886-0.

B:58. JARMO ERONEN: Central Asia – Development Paths and Geopolitical Imperatives. 2005 ISBN 951-791-906-9.

B:59. RIITTA KOSONEN – MALLA PAAJANEN – NOORA REITTU: Etelä-Suomi venäläisten turistien länsimatkailussa. 2005. ISBN 951-791-942-5.

B:60. Kari Lilja (ed.): The National Business System in Finland: Structure, Actors and Change. 2005. ISBN 951-791-952-2.

B:61. HANNU KAIPIO – SIMO LEPPÄNEN: Distribution Systems of the Food Sector in Russia: The Perspective of Finnish Food Industry. 2005.
ISBN 951-791-923-9, ISBN 951-791-924-7 (Electronic research reports).

E-SARJA: SELVITYKSIÄ - REPORTS AND CATALOGUES. ISSN 1237-5330.

E:102. DAN STEINBOCK: The U.S. CIBER Experience: The Centers for International Business Education and Research (CIBERs). 2003. ISBN 951-791-781-3.

N-SARJA: HELSINKI SCHOOL OF ECONOMICS. MIKKELI BUSINESS CAMPUS PUBLICATIONS.
ISSN 1458-5383

N:15. ELINA HAVERINEN: Etelä-Savon pk-yritysten Viron kauppa. Ulkomaankaupan erityisraportti 2003. ISBN 951-791-732-5.

N:16. REETA RÖNKKÖ: Latinalainen Amerikka markkina-alueena Argentiina ja Brasilia. Ulkomaankaupan erityisraportti 2003. ISBN 951-791-733-3.

N:17. JAAKKO VARVIKKO – JUHA SIIKAVUO: Koulutus, oppiminen ja akateeminen yrittäjyys. 2003. ISBN 951-791-745-7.

N:18. ANNE GUSTAFSSON-PESONEN – SATU SIKANEN: Yrittäjäkoulutuksesta yrittäjäksi. 2003 ISBN 951-791-763-5.

N:19. TOIVO KOSKI: Impact of a venture capitalists´ value added on value of a venture. 2003. ISBN 951-791-764-3.

N:20. LAURA HIRVONEN: Itävalta suomalaisyritysten markkina-alueena. 2003.
ISBN 951-791-765-1.

N:21. LAURA MALIN: Etelä-Savon pk-yritysten vienti Belgiaan. 2003. ISBN 951-791-766-X.

N:22. JUKKA PREPULA: Ranska suomalaisten pk-yritysten vientikohteena. 2003.
ISBN: 951-791-767-8.

N:23. HENNA HUCZKOWSKI: Pk-yritysten perustaminen Puolaan. 2003.
ISBN 951-791-768-6.

N:24. HENNA KATAJA – LEENA MÄÄTTÄ: Kiina suomalaisen pk-yrityksen vientikohteena.
2003. ISBN: 951-791-769-4.

N:25. KAROLIINA IJÄS: Etelä-Savon pk-yritysten vienti Puolaan. 2003. ISBN: 951-791-770-8.

N:26. MARJO VAHLSTEN: Matkailupalvelujen markkinoinnin kehittäminen verkkoyhteistyön avulla. 2003. ISBN: 951-791-792-9.

N:27. TUULI SAVOLAINEN: Slovakia suomalaisten pk-yritysten markkina-alueena. 2003. ISBN: 951-791-793-7.

N:28. HARRY MAASTOVAARA: Etelä-Savon yritysten ulkomaankauppa 2001. 2003. ISBN: 951-791-794-5.

N:29. RIIKKA PIISPA: Yhteistoiminnallisuus alueen taloudellisen kehityksen edellytyksenä. 2003. ISBN 951-791-795-3.

N:31. HANNA PERÄLÄ: Etelä-Savon pk-yritysten vienti Ruotsiin. 2003. ISBN: 951-791-799-6.

N:32. SATU SIKANEN – MAARIT UKKONEN: Etelä-Savon Venäjän-kauppa 2003. 2003. ISBN 951-791-800-3.

N:34. TOIVO KOSKI – ANTTI EKLÖF: Uudenmaan yrityshautomoista irtaantuneiden yritysten menestyminen, Yrittäjien näkemyksiä yrityshautomotoiminnasta sekä selvitys ”yrittämisestä Työtä 2000” –projektin asiakkaiden yritystoiminnasta. 2003. ISBN 951-791-805-4.

N:36. MAARIT UKKONEN: Yrittäjyysmotivaatio ja yrittäjyysasenteet Helsingin kauppakorkeakoulun BScBa -tutkinto-opiskelijoiden ja Mikkelin ammattikorkeakouluopiskelijoiden keskuudessa. 2004. ISBN 951-791-874-7.

N:37. MIKKO SAARIKIVI: Helsingin kauppakorkeakoulun henkilöstön yrittäjyysmotivaatio ja yrittäjyysasenteet vuonna 2004. 2004. ISBN 951-791-882-8.

N:38. MIKKO SAARIKIVI: Helsinki-Tallinn: The Twin City of Science Interreg III A Project. 2004. ISBN 951-791-883-6.

N:39. MIKKO SAARIKIVI: Tieteen kaksoiskaupunki Helsinki-Tallinna Interreg III A -projekti. 2004. ISB 951-791-884-4.

N:40. TOM LAHTI: The Role of Venture Capital in Filling the Equity Gap. An Analysis of Policy Issues. 2004. ISBN 951-791-885-2.

N:41. VESA KOKKONEN: Etelä-Savon yritysten ulkomaankauppa 2003. 2004. ISBN 951-791-897-6.

N:42. MAARIT UKKONEN – MIKKO SAARIKIVI – ERKKI HÄMÄLÄINEN: Selvitys Uudenmaan yrityshautomoyritysten mentorointitarpeista. 2005. ISBN 951-791-900-X.

W-SARJA: TYÖPAPEREITA - WORKING PAPERS . ISSN 1235-5674.
ELECTRONIC WORKING PAPERS, ISSN 1795-1828.

W:335. SATU NURMI: Sectoral Differences In Plant Start-up Size. 2003. ISBN 951-791-738-4.

W:336. SATU NURMI: Plant Size, Age And Growth In Finnish Manufacturing. 2003. ISBN 951-791-739-2.

W:337. PETRI HALLIKAINEN – HANNU KIVIJÄRVI: Appraisal of Strategic it Investments: Payoffs And Tradeoffs. 2003. ISBN 951-791-740-6.

W:338. SENJA SVAHN: Knowledge Creation in Business Networks – A Dynamic-capability Perspective. 2003. ISBN 951-791-743-0.

W:339. KRISTIAN MÖLLER – SENJA SVAHN: Role of Knowledge in the Value Creation in Business Nets. 2003. ISBN 951-791-744-9.

W:340. ELI MOEN – KARI LILJA: European Works Councils in M-Real and Norske Skog: The Impact of National Traditions in Industrial Relations. 2003. ISBN 951-791-750-3.

W:341. KJELD MÖLLER: Salatulla ”arvopaperistamisella” tuhottiin yrittäjyyttä. 2003. ISBN 951 791-752-X

W:342. ATSO ANDERSEN: Competition Between European Stock Exchanges. 2003. ISBN 951-791-753-8.

W:343. MARKO MERISAVO: The Effects of Digital Marketing on Customer Relationships. 2003. ISBN 951-791-757-0.

W:344. KLAUS KULTTI – JUHA VIRRANKOSKI: Price Distribution in a Random Matching Model. 2003. ISBN 951-791-759-7.

W:345. PANU KALMI: The Rise and Fall of Employee Ownership in Estonia, 1987-2001. 2003. ISBN 951-791-772-4.

W:346. SENJA SVAHN: Managing in Networks: Case Study of Different Types of Strategic Nets. 2003. ISBN 951-791-774-0.

W:347. KRISTIAN MÖLLER – SENJA SVAHN: Crossing East-West Boundaries: Knowledge Sharing in Intercultural Business Networks. 2003. ISBN 951-791-775-9.

W-348. KRISTIAN MÖLLER – SENJA SVAHN: Managing in Emergence: Capabilities for Influencing the Birth of New Business Fields. 2003. ISBN 951-791-776-7.

W:349. TOM RAILIO: The Taxation Consequences of Scandinavian Mutual Fund Investments and After-Tax Performance Evaluation. 2003. ISBN 951-791-777-5.

W:350. KIRSI LAPOINTE: Subjektiivinen ura työurien tutkimuksessa ja teorioissa. 2003. ISBN 951-791-778-3.

W:351. PANU KALMI: The Study of Co-operatives in Modern Economics: A Methodological Essay. 2003. ISBN 951-791-783-X.

W:352. MARJA TAHVANAINEN: Short-term International Assignments: Popular Yet Largely Unknown Way Of Working Abroad. 2003. ISBN 951-791-784-8.

W:353. MARKKU KUULA – ANTOINE STAM: An Interior Point Method for Multi-party Negotiation Support. 2003. ISBN 951-791-787-2.

W:354. JOUKO KINNUNEN: Quantification of Ordered-level Business Sentiment Survey Forecasts by Means of External Validation Data. 2003. ISBN 951-791-790-2.

W:355. TOM RAILIO: The Nature of Disagreements and Comparability Between Finnish Accumulating Mutual Funds and Voluntary Pension Insurances. 2003. ISBN 951-791-798-8.

W:356. JUKKA JALAVA: 'Has Our Country the Patience Needed to Become Wealthy?' Productivity in the Finnish Manufacturing Industry, 1960-2000. 2003. ISBN 951-791-803-8.

W:357. JARI VESANEN: Breaking Down Barries for Personalization – A Process View. 2003. ISBN 951-791-804-6.

W:358. JUHA VIRRANKOSKI: Search Intensities, Returns to Scale, and Uniqueness of Unemployment Equilibrium. 2003. ISBN 951-791-809-7.

W:359. JUHA VIRRANKOSKI: Search, Entry, and Unique Equilibrium. 2003. ISBN 951-791-810-0.

W:360. HANNA KALLA: Exploration of the Relationship Between Knowledge Creation, Organisational Learning, and Social Capital: Role of Communication. 2003. ISBN 951-791-813-5.

W:361. PEKKA SÄÄSKILAHTI: Strategic R&D and Network Compatibility. 2003. ISBN 951-791-817-8.

W:362. MAIJU PERÄLÄ: Allyn Young and the Early Development Theory. 2003. ISBN 951-791-818-6.

W:363. OSSI LINDSTRÖM – ALMAS HESHMATI: Interaction of Real and Financial Flexibility: An Empirical Analysis. 2004. ISBN 951-791-827-5 (Electronic working paper).

W:364. RAIMO VOUTILAINEN: Comparing alternative structures of financial alliances. 2004. ISBN 951-791-832-1 (Electronic working paper).

W:365. MATTI KELOHARJU – SAMULI KNÜPFER – SAMI TORSTILA: Retail Incentives in Privatizations: Anti-Flipping Devices or Money Left on the Table? 2004. ISBN 951-791-839-9 (Electronic working paper).

W:366. JARI VESANEN – MIKA RAULAS: Building Bridges for Personalization – A Process View. 2004. ISBN 951-791-840-2 (Electronic working paper).

W:367. MAIJU PERÄLÄ: Resource Flow Concentration and Social Fractionalization: A Recipe for A Curse? 2004. ISBN 951-791-845-3 (Electronic working paper).

W:368. PEKKA KORHONEN – RAIMO VOUTILAINEN: Finding the Most Preferred Alliance Structure between Banks and Insurance Companies. 2004. ISBN 951-791-847-X (Electronic working paper).

W:369. ANDRIY ANDREEV – ANTTI KANTO: A Note on Calculation of CVaR for Student´s Distribution. 2004. ISBN 951-791-850-X (Electronic working paper).

W:370. ILKKA HAAPALINNA – TOMI SEPPÄLÄ – SARI STENFORS – MIKKO SYRJÄNEN – LEENA TANNER : Use of Decision Support Methods in the Strategy Process – Executive View. 2004. ISBN 951-791-853-4 (Electronic working paper).

W:371. BERTTA SOKURA: Osaamispääoman ulottuvuudet. Arvoa luova näkökulma. 2004. ISBN 951-791-857-7 (Electronic working paper).

W:372. ANTTI RUOTOISTENMÄKI – TOMI SEPPÄLÄ – ANTTI KANTO: Accuracy of the Condition Data for a Road Network. 2004. ISBN 951-791-859-3 (Electronic working paper).

W:373. ESKO PENTTINEN: Bundling of Information Goods - Past, Present and Future. ISBN 951-791-864-X. (Electronic working paper).

W:374. KASIMIR KALIVA – LASSE KOSKINEN: Modelling Bubbles and Crashes on the Stock Market. ISBN 951-791-865-8 (Electronic working paper).

W:375. TEEMU SANTONEN: Evaluating the Effect of the Market Environmento on the Business Success of Online Newspapers. 2004. ISBN 951-791-873-9 (Electronic working paper)

W:376. MIKKO LEPPÄMÄKI – MIKKO MUSTONEN: Signaling with Externality. 2004. ISBN 951-791-880-1 (Elektronic working paper).

W:377. MIKKO LEPPÄMÄKI – MIKKO MUSTONEN: Signaling and Screening with Open Source Programming. 2004. ISBN 951-791-881-X (Electronic working paper).

W:378. TUURE TUUNANEN – KEN PEFFERS – CHARLES E. GENGLER: Wide Audience Requirements Engineering (Ware): A Practical Method And Case Study. 2004. ISBN 951-791-889-5. (Electronic working paper).

W:379. LARS MATHIASSEN – TIMO SAARINEN – TUURE TUUNANEN – MATTI ROSSI: Managing Requirements Engineering Risks: An Analysis and Synthesis of the Literature. 2004. ISBN 951-791-895-X (Electronic working paper).

W:380. PEKKA KORHONEN – LASSE KOSKINEN – RAIMO VOUTILAINEN: Finding the Most Preferred Alliance Structure between Banks and Insurance Companies from a Supervisory Point of View. 2004. ISBN-951-791-901-8 (Electronic working paper).

W:381. PEKKA J. KORHONEN – PYRY-ANTTI SIITARI: Using Lexicographic Parametric Programming for Identifying Efficient Units in Dea. 2004. ISBN 951-791-902-6. (Electronic working paper).

W:382. PEKKA MALO – ANTTI KANTO: Evaluating Multivariate GARCH models in the Nordic Electricity Markets. 2005. ISBN 951-791-903-4 (Electronic working paper).

W:383. OSSI LINDSTRÖM – ALMAS HESHMATI: Interacting Demand and Supply Conditions in European Bank Lending. 2005. ISBN 951-791-903-4 (Electronic working paper).

W:384. ANTTI PIRJETÄ – ANTTI RAUTIAINEN: ESO valuation under IFRS 2 – considerations of agency theory, risk aversion and the binomial model. 2005. ISBN 951-791-920-4 (Electronic working paper).

W:385. MIKA HYÖTYLÄINEN – HANNA ASIKAINEN: Knowledge Management in Designing and Developing ICT Consulting Services. 2005. ISBN 951-791-921-2 (Electronic working paper).

W:386. PEKKA KORHONEN – LASSE KOSKINEN – RAIMO VOUTILAINEN: A Customer View on the Most Preferred Alliance Structure between Banks and Insurance Companies. 2005. ISBN 951-791-922-0 (Electronic working paper).

W:387. MIIA ÄKKINEN: Conceptual Foundations of Online Communities. 2005. ISBN 951-791-959-X (Electronic working paper).

W:388. ANDRIY ANDREEV – ANTTI KANTO – PEKKA MALO: Simple Approach for Distribution Selection in the Pearson System. 2005. ISBN 951-791-927-1 (Electronic working paper).

W:389. ANDRIY ANDREEV – ANTTI KANTO – PEKKA MALO: On Closed-form Calculation of CVaR. 2005. ISBN 951-791-928-X (Electronic working paper).

W:390. TUIJA VIRTANEN: Konsernijohtaminen parenting-teorian näkökulmasta. 2005 ISBN 951-791-929-8 (Electronic working paper).

Y-SARJA: HELSINKI SCHOOL OF ECONOMICS.
CENTRE FOR INTERNATIONAL BUSINESS RESEARCH. CIBR RESEARCH PAPERS.
ISBN 1237-394X.

Y:8. REIJO LUOSTARINEN – MIKA GABRIELSSON: Globalization and Marketing Strategies of Born Globals in SMOPECs. 2004. ISBN 951-701-851-8.

Z-SARJA: HELSINKI SCHOOL OF ECONOMICS.
CENTRE FOR INTERNATIONAL BUSINESS RESEARCH. CIBR WORKING PAPERS. ISSN 1235-3931.

Z:10. V.H. MANEK KIRPALANI – MIKA GABRIELSSON: Need for International Intellectual Entrepreneurs and How Business Schools Can Help. 2004. ISBN 951-791-852-6.

Kaikkia Helsingin kauppakorkeakoulun julkaisusarjassa ilmestyneitä julkaisuja voi tilata osoitteella:

KY-Palvelu Oy
Kirjakauppa
Runeberginkatu 14-16
00100 Helsinki
Puh. (09) 4313 8310, fax (09) 495 617
Sähköposti: kirjak@kyyppari.hkkk.fi

Helsingin kauppakorkeakoulu
Julkaisutoimittaja
PL 1210
00101 Helsinki
Puh. (09) 4313 8579, fax (09) 4313 8305
Sähköposti: julkaisu@hkkk.fi

All the publications can be ordered from

Helsinki School of Economics
Publications officer
P.O.Box 1210
FIN-00101 Helsinki
Phone +358-9-4313 8579, fax +358-9-4313 8305
E-mail: julkaisu@hkkk.fi