

Kinnunen, Jouko; Lindström, Bjarne; Fellman, Katarina

Conference Paper

Foreseeing supply and demand for competence and education until 2025 with a regional CGE model

55th Congress of the European Regional Science Association: "World Renaissance: Changing roles for people and places", 25-28 August 2015, Lisbon, Portugal

Provided in Cooperation with:

European Regional Science Association (ERSA)

Suggested Citation: Kinnunen, Jouko; Lindström, Bjarne; Fellman, Katarina (2015) : Foreseeing supply and demand for competence and education until 2025 with a regional CGE model, 55th Congress of the European Regional Science Association: "World Renaissance: Changing roles for people and places", 25-28 August 2015, Lisbon, Portugal, European Regional Science Association (ERSA), Louvain-la-Neuve

This Version is available at:

<https://hdl.handle.net/10419/124556>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

Foreseeing supply and demand for competence and education until 2025 with a regional CGE model

Jouko Kinnunen, ÅSUB *

Bjarne Lindström, ÅSUB

Katarina Fellman, ÅSUB

* Statistics and Research Åland, Mariehamn, Åland Islands, Finland.

Contents

Abstract	3
1 Background.....	4
2 The Model.....	7
3 Three Scenarios	9
3.1 Base scenario.....	9
3.2 Growth scenario	10
3.3 Deceleration scenario.....	11
4 Results	11
4.1 Economy-wide results	11
4.2 Changes in employment.....	15
4.3 Recruiting need	17
4.4 The role of education	20
4.5 The role of migration.....	21
References.....	23
APPENDIX 1. Level of aggregation in the model database.....	25

Figures

Figure 1. In- and outmigration as percent of resident population at the beginning of the year.....	5
Figure 2. Employment by industry and gender in 2010	6
Figure 3. Educational system in Åland.....	7
Figure 4. GDP Growth.....	11
Figure 5. Population Growth 1995-2012 and by Scenario until 2025	12
Figure 6. Development of Labor Force 1995-2010 and by Scenario 2011-2025.....	13
Figure 7. Dependency Ratio	13
Figure 8. Participation rate.....	14
Figure 9. Employment	14
Figure 10. Employment for Base scenario by Industry, Nr of Jobs.....	15
Figure 11. Difference in Employment between Growth and Base by Industry, Nr of Jobs.....	16
Figure 12. Difference in Employment between Deceleration and Base by Industry, Nr of Jobs	17
Figure 13. Recruitment Need, Base Scenario, Nr of Persons by Gender and Skill Level.....	18
Figure 14. Recruiting Need by Field of Education, Base Scenario, Persons	19
Figure 15. Recruiting Need by Field of Occupation, Base Scenario, Persons	19
Figure 16. Number of Graduations by Scenario and Type of Education	20
Figure 17. Change in Supply minus Demand for Low-skilled Labor by Gender and Scenario.....	22
Figure 18. Change in Supply minus Demand for High-skilled Labor by Gender and Scenario	22

Abstract

The economic development of Åland is analyzed by means of an imperfect competition, recursive-dynamic computable general equilibrium model. The future changes are gauged by means of three scenarios: *Base*, *Growth* and *Deceleration* with varying assumptions regarding the competitive pressures, structure of labor demand, productivity and export demand growth among other things. Even industry-specific assumptions are varied, especially regarding shipping, the main industry of Åland.

In addition to the industrial dimension, the labor market is divided into two levels by educational attainment. However, additional disaggregation of labor supply and demand is carried out outside the behavioral core of the model: labor demand and supply are disaggregated according to sex, age, field of education and occupational grouping. The contribution of migration and education to the disaggregate labor supply are explicitly modeled with the help of detailed statistics on education and migration flows during the past decade. We show that exits from the labor market represent a major part of the recruiting need rather than changes in aggregate labor demand.

Also, the results reveal that anticipated structural changes in the economy affect male and female labor force differently. By assuming that the current gender division in each occupational grouping stays unchanged, we can compare changes in labor demand and supply by gender. We show that female workers with lower educational attainment (up to secondary level education) meet a decreasing recruitment need, whereas demand for higher educated, predominantly female labor seems to grow substantially. In contrast, recruiting need within occupations with predominantly male workers seems to be decreasing slowly. In the future, it may be necessary for men to be employed within traditionally female-dominated occupations, as well as women may have to make sure to acquire sufficiently high education, since occupations with rather low educational content risk disappearing. These changes require that education provided in Åland is flexible, strategically focused and coordinated with other policy areas, e.g. with housing and migration issues.

The results of this study are also uploaded on the ÅSUB website in form of user-friendly, downloadable PC-Axis data matrices:

<http://pxweb.asub.ax/PXWeb/pxweb/en/Utbildningsbehov/?rxid=862657a4-a5a1-4afc-acf5-2af22f34fe21>

Keywords: Regional economic activity, Labor force and employment, CGE models

JEL codes: R11, J21, C68

1 Background

The Åland Islands is a small autonomous island region in Finland with its own governmental powers. The autonomy covers, among other things, legislative powers, as well as administration and policy development concerning education as well as industrial policy. Thus, there is a clear need for policy-oriented studies concerning the development of the local labor market as a whole, as well as regarding supply and demand for different skills.

Åland is the smallest of the Finnish NUTS3 regions with its 29,000 inhabitants. One of the distinguishing features of the Åland Islands is the reverse linguistic composition of the population: the majority, around 90 percent of the population speaks Swedish, whereas Finnish is the equally dominant mother tongue within mainland Finland. Preserving the unilingual Swedish culture from encroachment by the majority Finnish population has been described as the very *raison d'être* of Åland autonomy (Lindström, 2000).

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, even after June 30th 1999, when the era of tax-free sales within the Community was discontinued (Silverström, 2003; Kinnunen and Palmer, 2006).

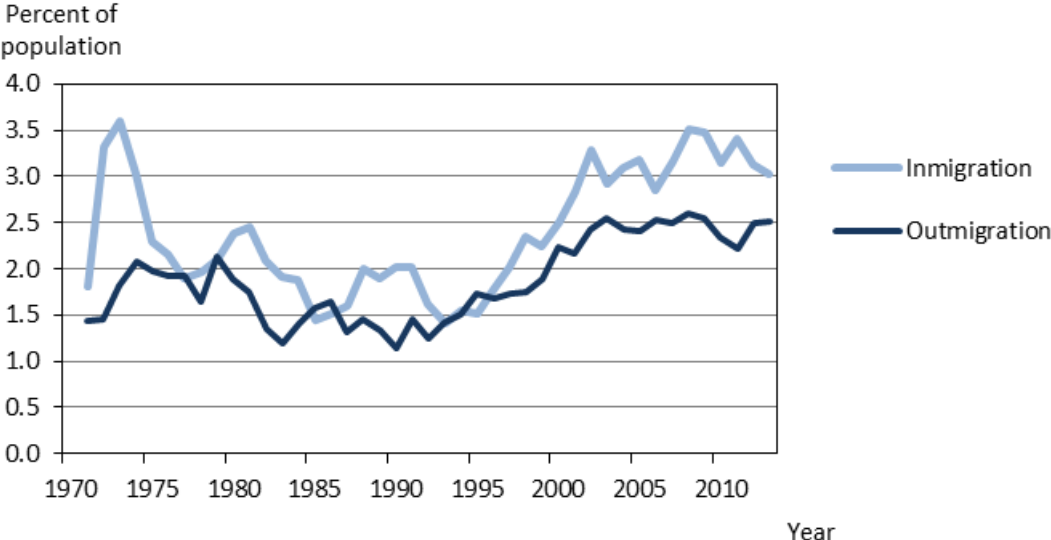
The cornerstone and principal driving force of the economy is international shipping which accounts for about one fifth of the island's GDP and almost 30 percent of the value added produced in the private sector (Statistics and Research Åland, 2014a). As a matter of fact, Åland's economy is more dependent on shipping than most other nations and regions which host various kinds of shipping clusters around the world (Kinnunen and Lindström, 2011). Furthermore, the passenger shipping industry in Åland is heavily dependent on operations with on board tax-free sales of alcohol, tobacco and cosmetics (Kinnunen, 2005). Mariehamn, the capital city of Åland, is the geographical and commercial center of the international ferry and cruise shipping industry using the busy shipping lanes between Sweden, Åland, Finland and Estonia (Lindström and Palmer, 2011).

Tourism is also an important source of demand for local hotels and restaurants. Each year around 2 million passengers enter the harbors of Åland. However, many of the passengers stay in Åland just to change vessels. At any rate, around half a million nights spent in accommodation are recorded each year. Land-based tourism accounts for around four percent of Åland's GDP (Rundberg and Kinnunen, 2014).

Until the end of the 20th century, the transport industry's share of Åland's GDP, with shipping as the main mover, was around 35 to 40 percent of the total value added in the private sector. However, since the turn of the millennium the development of Åland's international shipping industry has stalled and its share of value added has been shrinking. The declining relative weight of the shipping business is compensated by a steady growth in the land-based business-to-business sector, including economic, juridical and logistic support to the shipping industry (Fellman et al., 2015).

Åland has developed into a modern service economy with high standard of living, low unemployment (4.0 percent in 2014) and growing population. The gross domestic product (GDP) is around 1.2 billion euros. This implies a GDP per capita of close to 34,000 euros (PPP), one of the highest per capita income figures in the world, about 16 percent higher than the Finnish national average and some 7 percent higher than the corresponding Swedish figure (Statistics and Research Åland, 2014a). The population growth is fuelled by a significant influx of migrants, mainly from Finland and Sweden, but also – in growing numbers – from Eastern Europe and the rest of the world (Statistics and Research Åland, 2013; Fellman et al., 2015). The positive net migration boosted by favorable employment prospects has helped keep the population growth on a healthy annual rate of 0.5 to 1 percent. Migration flows increased significantly after Finland, including Åland, entered the European Union in 1995 (see Figure 1). The high volume of simultaneous gross inward and outward migration also lowers the regional unemployment rate in Finland due to more efficient matching between employees and establishments (Böckerman, 2001).

Figure 1. In- and outmigration as percent of resident population at the beginning of the year



Source: Own calculations based on Statistics and Research Åland, statistical database.

However, despite the continuous positive net migration flow, Åland is one of the most rapidly aging regions of Northern Europe, alongside with the rest of Finland: in the next 25 years, the demographic dependency ratio is expected to have the strongest growth in Finland and Åland. In year 2030, it is expected that persons over 65 will make up 50 percent of the adult population (Nordic Statistical Yearbook 2014).

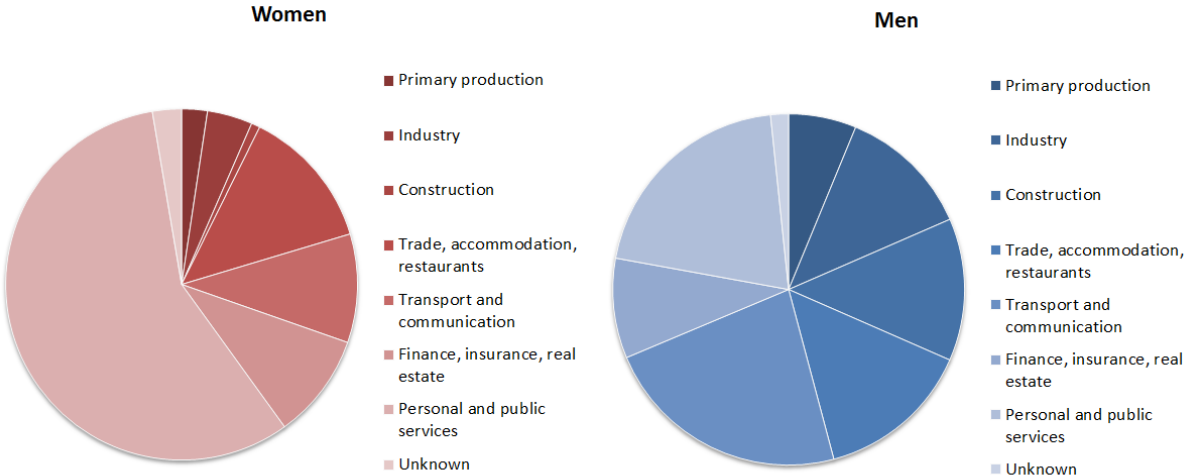
The Åland Islands employed around 14,300 inhabitants in 2013 (Statistics and Research Åland, 2014b). However, the total number employed in Åland is around 15,400, as the seamen living outside Åland but working on the vessels registered in Åland are counted as commuting to Åland.

In terms of employment, the largest industries in Åland are health and social care, transports and trade. The general administration and education employ over 1,000 persons. During the past decade, employment has been on a decline within primary production and transports. For transports, the main reason for the decline has been out-flagging of vessels to other countries, like Sweden and

Estonia. Within agriculture, the average size of farms has been growing and the number of farmers declining.

The structure of employment differs with gender. In simple terms, men transport, build and produce industrial goods, while women take care of the sick, young and old and educate as well as take care of the public administration (see Figure 2).

Figure 2. Employment by industry and gender in 2010

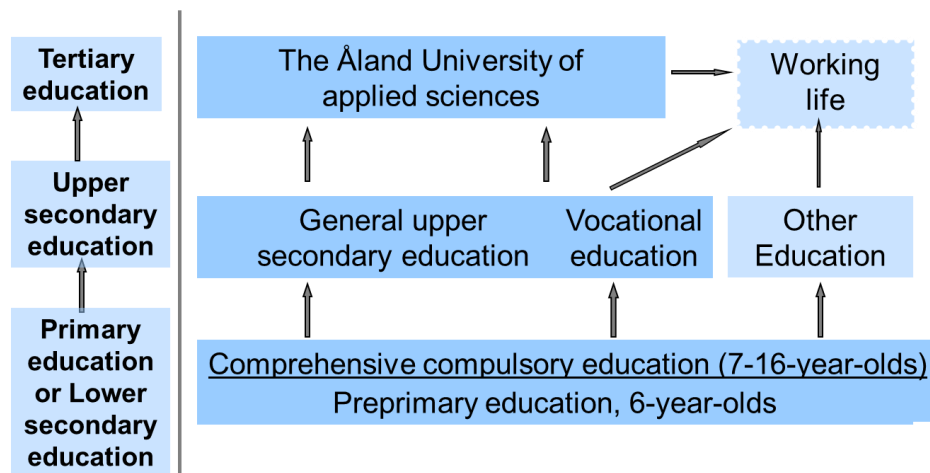


Source: ÅSUB employment statistics database.

The educational system of Åland is composed of primary, secondary and tertiary educational facilities. There are 23 primary or lower secondary schools, and upper secondary education is provided for general preparatory education for university studies (Åland’s Lyceum), as well as for around a dozen different vocational education profiles. The Åland University of Applied Sciences provides seven different study programs, in which shipping-related vocations are particularly well-represented.

There were around 1,900 pupils at elementary level and 950 at lower secondary level in the beginning of the school year 2014/2015 in Åland (ÅSUB 2014c). At the same time, upper secondary schools had around 470 students in preparatory education for further studies, and 670 in vocational studies. The Åland University of Applied Sciences had 490 students (ÅSUB, 2014d). Around 1,300 students were studying outside Åland, mainly in Sweden and mainland Finland. 81 percent of the students were enrolled in tertiary level educational facilities (ÅSUB 2014e). Other education consists of courses and programs that do not lead to examination. In 2013, over 10,000 persons participated in such courses in five different educational facilities.

Figure 3. Educational system in Åland



Source: Government of Åland.

2 The Model

Computable General Equilibrium (CGE) models are built with a combination of economic theories on the behavior of the actors of the economy, together with national accounts coupled with other data on production, consumption, employment and transfers. The combination of detailed data and theory, coupled with econometric and other estimates of central parameters provide us with a reasonably realistic description of how the economy might evolve and develop over time.

In a CGE model, each group of actors is assumed to work in accordance with their preferences and budget restrictions. It is up to the developer/user of the model to define how each actor meets its budget restrictions, e.g. by borrowing, reducing spending, raising taxes, transfers from the rest of the world etc. The bundle of these choices made is called the closure of the model.

Our CGE model for Åland, called DALAGEM (Dynamic AaLand Applied General Equilibrium Model), 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 et al., 2002). As the above characterization 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.

In contrast to its antecedent, DALAGEM is a sequentially (recursive) dynamic, imperfect completion model with endogenous labor supply and relatively inelastic real wages. Due to the fact that the labor 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 neighboring regions, and due to a Philips-curve type relationship between the local unemployment rate and wage increase, labor market exhibits hysteresis. In this setting, the growth rate of the labor 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 key features and equations of the model are explained in more detail in Kinnunen (2005).

However, the model has been continuously developed since its first version. The labor force was first divided into two educational levels by Kinnunen and Palmer (2006). The same division is used in this current version, where those with post-secondary education form the higher qualification category.

Improved demographic dynamics was first introduced in Kinnunen and Lindström (2011), and it is used in this study as well. The improved demographic module makes population growth endogenous through migration, while fertility and mortality rates follow exogenously determined paths, and each age cohort is kept record of.

New to this study is the increasingly detailed treatment of migration flows. By means of combining several years of register data on education, population and employment, we have been able to establish average characteristics of the in- and outflow of persons in terms of age, gender, education field and level, as well as recent occupation (if any). Thus, the gross migration flows are disaggregated into fine detail, which then update the demographic and labor composition available for the economy in the beginning of the next one-year period. And as we also keep track of the gender composition of employment (by assuming that the gender composition stays constant within each industry-educational level –occupation combination), we have the possibility to contrast development of labor supply and demand by gender as well, which is one of the novelties of this study. In addition, we also assume that the recent gender differences in educational choices will prevail in future as well.

However, all these details are not included within the behavioral core of the model, which only keeps track of the employment by educational attainment by industry. The rest of the calculations (gender, field of study and occupation) are taken care of as post-solve disaggregations of the core model solutions.

The base year of the underlying Social Accounting Matrix (SAM) is 2010 (Statistics and Research Åland, 2014f), and therefore our simulations start from that year. However, available statistics until 2012 were used when setting up the Base scenario of the model (the study was finalized in 2013, and it was first reported in Kinnunen, Lindström and Fellman (2013, in Swedish).

The complexity of the model has increased substantially compared to its former versions. The current version consists of around a quarter of a million equations. The economy is divided into 15 industries producing 17 commodities. There are two tourist households, one aggregate domestic household as well as eight sub-households that are used to calculate changes in the consumption parameters (more on that below). In addition, there are 11 tax or subsidy accounts and 96 age cohorts (0 to 95+). The public sector is divided into state, regional government, municipalities and social security funds. There is also one account for NGOs (the accounts of the Åland SAM 2010 are listed in the appendix).

3 Three Scenarios

Here, the future changes are gauged by means of three scenarios: *Base*, *Growth* and *Deceleration* with varying assumptions regarding the competitive pressures, structure of labor demand, productivity and export demand growth among other things. Even industry-specific assumptions are varied, especially regarding shipping.

3.1 Base scenario

The Base scenario represents mostly a continuation of past trends in investments, productivity and wages. Regarding nativity, mortality and fertility, we follow the assumptions of the Statistics Finland population forecast (2012).

There are a couple of developments that we chose to include within the Base scenario. For example, the sulfur directive of the European Commission entered into force in the beginning of 2015. According to this treaty, all the vessels trafficking the Baltic Sea shall use fuels with low sulfur contents (0.1 percent of weight). The change of fuels incurs additional costs to the shipping companies. We assume that the bunker costs of the shipping companies rise by 40% under our Base scenario.²

We also assume that the continued aging of the population is reflected in the structure and size of both private and public consumption. Regarding private consumption, we make use of consumption profiles of households grouped into eight groups by the age of the reference person (the one with highest earnings). The relative sizes of the household subgroups are rescaled according to the foreseen demographic development.³ The changes that are brought about by aging are reduced in size, the most notable of them being an increase in the private expenditure on health care services.

The expenditure pressures of public consumption are assumed to react to changes in the size and age composition of the population more or less according to the estimates reported in Honkatukia et al (2009). However, worsening public financial balance reduces the possibilities to meet the increasing expenditure pressure only by increasing consumption. Our assumption is that all available measures are taken to bring the public economy into balance. Thus, we assume that during the first years of our simulation period, the public sector runs deficits which are gradually declining. In addition, we assume that the public consumption in relation to expenditure needs declines either by improved productivity or by decreasing service standards (which have the same effect on public finances in our model). What is more, we assume that the municipalities (there are 16 of them in Åland) increase their effective tax rates throughout the simulation period. Budget support transfers provided by the Government of Åland to the municipalities are assumed to grow very slowly.

² At the time of our study, the sudden and marked decline in the world market price of oil in 2014-2015 was not foreseen. Thus, our base scenario calculations may be on the pessimistic side regarding the cost development within shipping.

³ We use the consumption study of Statistics Finland (2006) in the calculation of the consumption function parameters.

Regarding migration, we assume that the boost to in-migration provided by the entrance of new Baltic and other member states in 2004 will be attenuated and we thus assume a somewhat lower net migration in 2013-2025 than was the case during the past decennium.

Regarding agriculture, we assume that public support continues, but subsidies decline somewhat. On the other hand, we expect the global demand for agricultural products to continue growing rapidly, while increases in production are lower than that of demand due to scarcity of resources (FAO-OECD, 2013). Within the agriculture of Åland, national and EU subsidies stand for a considerable share of the gross income, actually the income net of intermediate consumption would be close to negative without them. Over the simulation period, lower subsidy levels should be compensated by greater external demand for Åland's produce.

Labor demand is assumed to slowly move towards an increasing demand for specialist and expert knowledge at the cost of more general proficiencies.

Education in Åland is assumed to carry on with the same composition of educational profiles. In addition, the observed shares of age cohorts are expected to graduate each year. However, regarding the Åland University of Applied Sciences, we assume a somewhat higher number of graduations to be produced. The gender balance in each educational profile is assumed to follow the average structure observed during 2007-2012.

The investment rate of Åland's economy was rather high during 2008-2010 (Alanen, 2013), but several of the most important industries in Åland operate in saturated markets, and with low long-term growth prospects. Thus, we do not assume any sudden (exogenous) expansion of investments, and therefore the capital stock grows rather slowly.

3.2 Growth scenario

Increased productivity growth is the most important driver of long-term growth. On the other hand, productivity is a factor that is difficult to analyze and understand. In the *Growth* scenario we assume a generally higher productivity growth which could, for example, be explained by increased usage of ICT solutions (see e.g. Jalava and Kavonius, 2008; Jalava and Pohjola, 2002).

In this scenario we even assume that new companies are established in Åland. In recent years, foreign and mainland companies have opened up subsidiaries in Åland, which has increased the perceived (and factual) competitive pressure in the local, otherwise rather isolated market. This change brings about lower price marginal and higher utilization of economies of scale, leading to higher average sizes of companies.

Furthermore, we assume that the external demand for Åland products is higher than under the *Base* scenario, as well as the number of tourists visiting Åland is assumed to be a couple of percent higher.

Regarding labor supply, in this scenario we assume that two factors raise it. Firstly, we assume that net migration – ceteris paribus – is somewhat higher than under Base scenario. Secondly, we assume that the average length of active years within the labor market rise by one year (from around 37.3 to 38.3 years; mortality taken into account in this calculus). One plausible reason for such a change could be changing retirement rules.

Finally, we assume that the demand for specialist and expert knowledge grows faster than under the *Base* scenario. This change follows the idea of the Goal scenario of Finnish National Board of Education that assesses the demand for labor and education at the national level until 2025 (Hanhijoki et al. 2011).

3.3 Deceleration scenario

In this scenario, we take a more pessimistic stance in general. Productivity growth is assumed to be lower than under the *Base*. In the same fashion, net migration is assumed to be lower. Export and tourism are assumed to grow at a lower rate, and additional costs of shipping from changing to low sulfur fuels are assumed to be 75% of the current costs (the *Base* assumption was a rise of 40%).

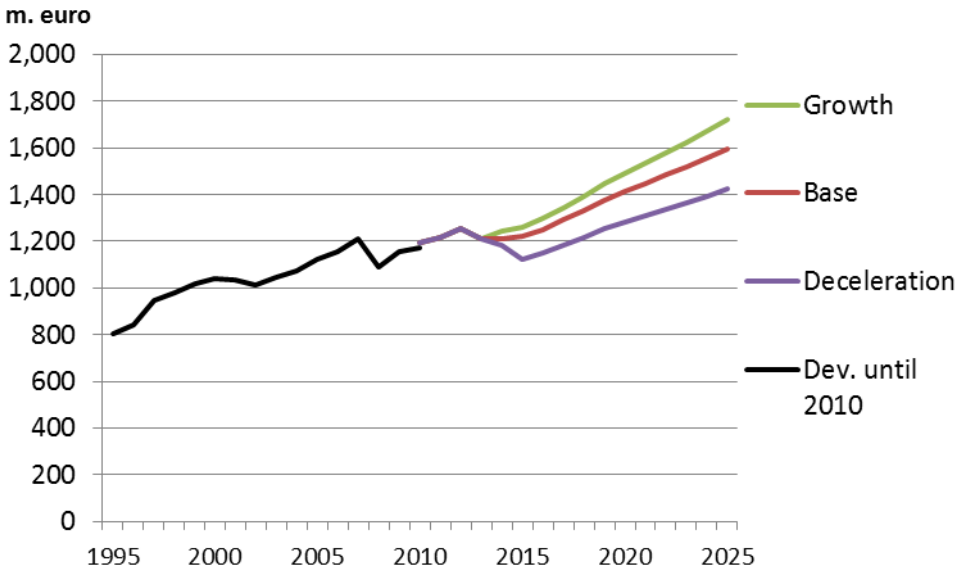
Regarding demand for labor, no changes are assumed in the composition of the demand. Therefore, demand for specialists and experts is lower than under the *Base* scenario. Furthermore, we do not assume any growth in the labor force participation rate.

4 Results

4.1 Economy-wide results

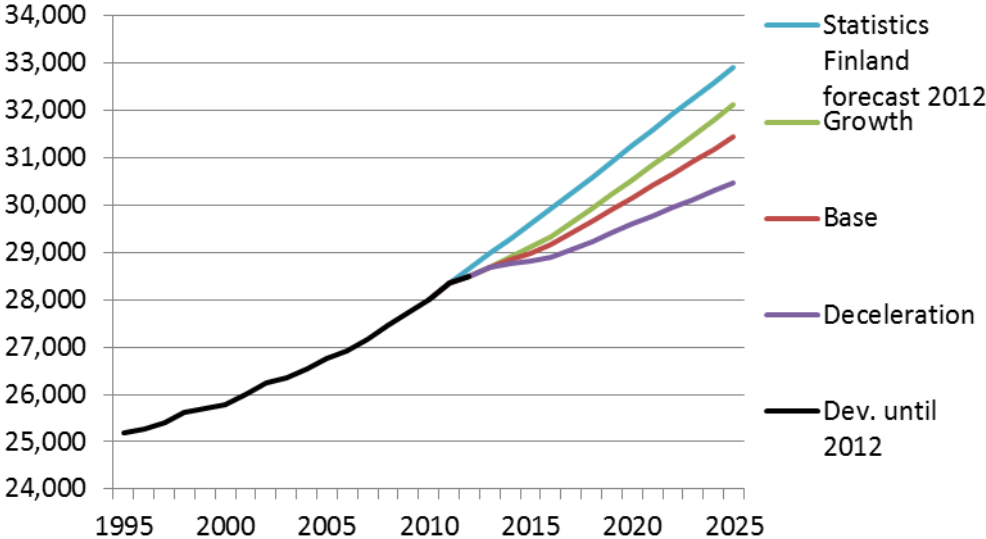
The average GDP growth under the *Base* scenario hovers around two percent, although with some yearly variation, especially in the beginning of the simulation period, as the general conditions of seafaring and economy in general are changing. In the *Growth* scenario the growth rate averages 2.5 percent, while under the *Deceleration* it stays at 1.2 percent under 2011-2025. During 1995-2010, the average GDP growth per annum was 2.7 percent in Åland.

Figure 4. GDP Growth



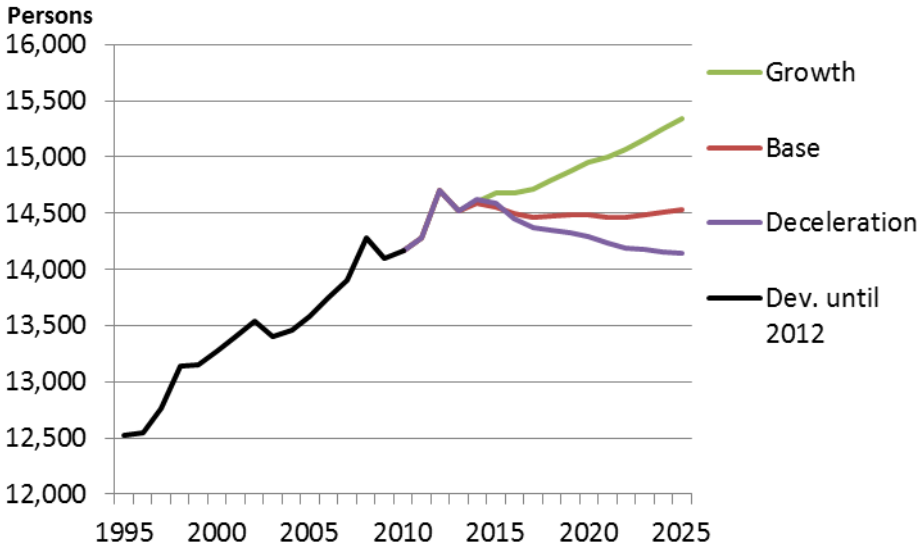
Population growth was around 0.73 percent during 1996-2012. Under the *Base* scenario it averages 0.76 percent. One explanation for this higher population growth lies within the age structure of the population: our migration data shows that the elderly are not very prone to migrate from Åland, and those retiring mostly stay within the province. As we will see below, the share of elderly will be rising during the coming decade. On the other hand, job openings induce new migrants to enter Åland, which leads to population growth. From Figure 5 below, we can see that our scenarios are somewhat more pessimistic than the latest population forecast of Statistics Finland (2012). However, we have had the luxury of having more information, as our scenarios were constructed one year later.

Figure 5. Population Growth 1995-2012 and by Scenario until 2025



The change in labor supply is heavily affected by the demographic momentum of the large post-WWII-born age cohorts entering retirement age, while the younger cohorts are not as large. As we can see from Figure 6, the growth of labor force stays quite reduced even in the most optimistic case. Under the *Base* scenario, the growth of labor force from 2010 to 2025 is only 2.5 percent. Actually, it seems that the labor force reached its maximum already in 2012 and decreases thereafter. The *Growth* scenario produces a growth of 8.3 percent during 2010-2025.

Figure 6. Development of Labor Force 1995-2010 and by Scenario 2011-2025



The definition of the dependency ratio is that those aged 20 to 64 are assumed to be active in the labor market, while those aged under and over are the dependent ones. We can see from Figure 7 that the dependency ratio worsened markedly during the past decade, and the same development is going to continue until 2025, which ever scenario we are considering. For each 100 persons in working age there will be 80 to 85 persons outside working age.

Figure 7. Dependency Ratio

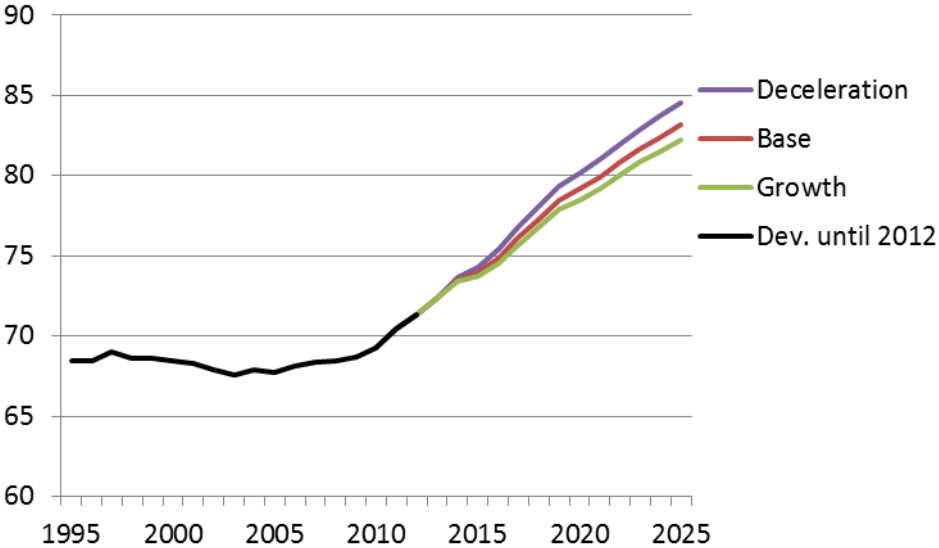


Figure 8 depicts the change in the labor force participation rate, here defined for those between 15 and 74 years old. Due to ongoing aging, the overall participation rate declines, although the participation rate of each age cohort stays the same. We see that the overall participation rate is bound to decrease in each scenario. However, the increased old-age participation rate assumed in the *Growth* scenario attenuates the decline. The lowest participation rate is reported in the *Base*

scenario, as under the *Deceleration* scenario, the decline in migration decreased the unemployment rate to below *Base* levels, which affects the wage growth positively and increases the participation rate of the resident population. In addition, lower productivity growth keeps the public demand for labor higher – *ceteris paribus* - than under the *Base* scenario.

Employment has grown quite rapidly during 1995-2010, but according to our Base case assumptions the growth evens out. Both the supply and demand of labor limit the growth in employment under the *Base*. In contrast, the *Growth* scenario represents growth that is more comparable to the recent past. This can be seen from Figure 9 below.

Figure 8. Participation rate

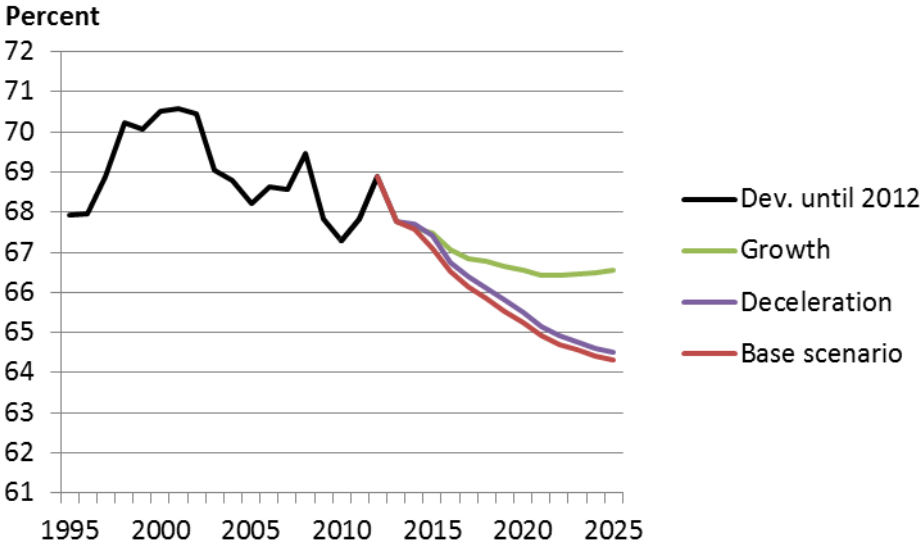
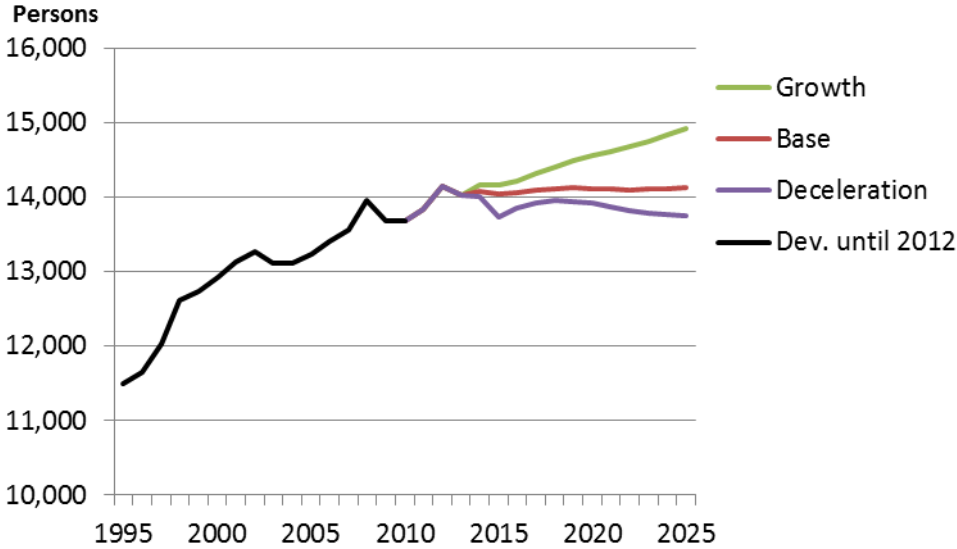


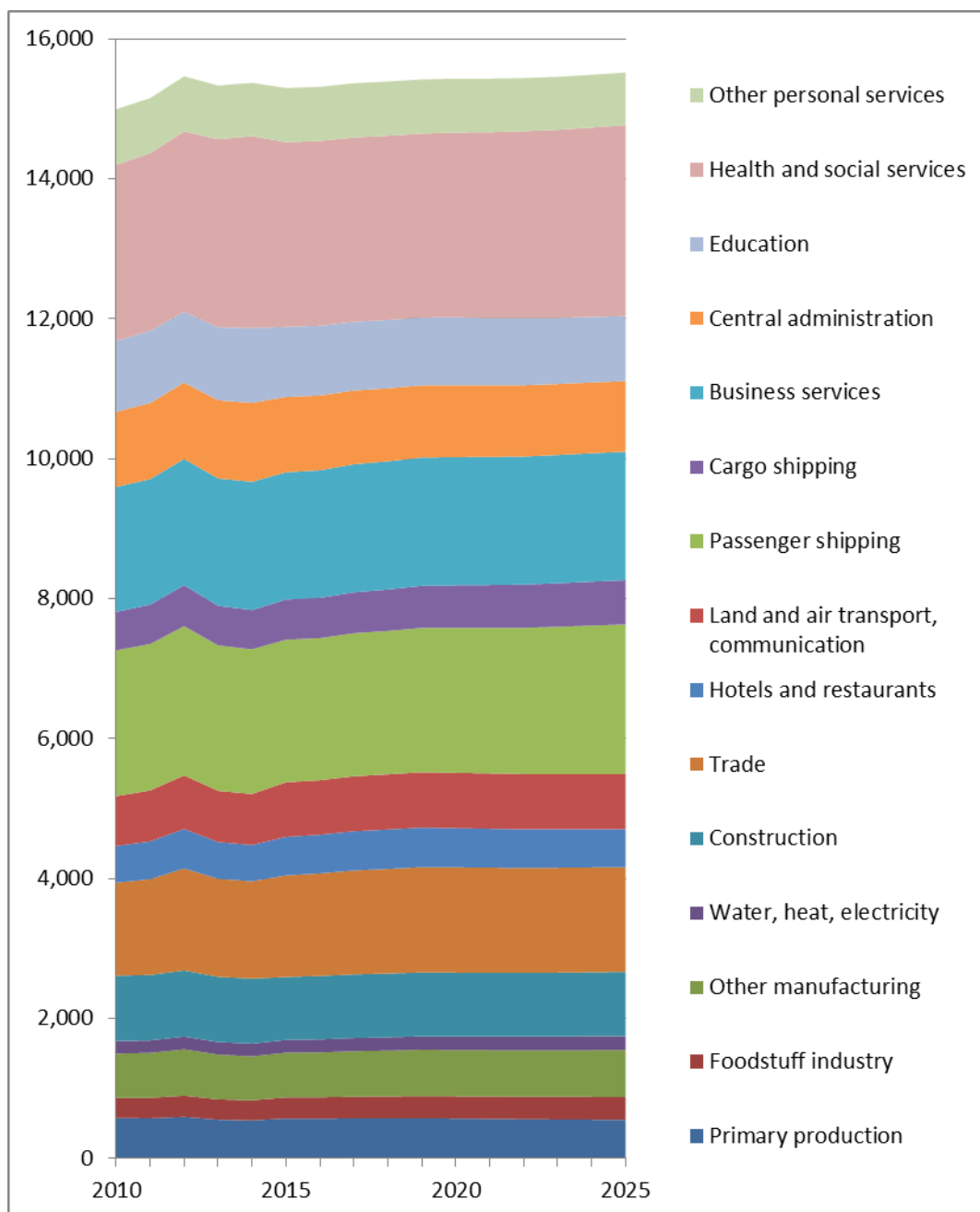
Figure 9. Employment



4.2 Changes in employment

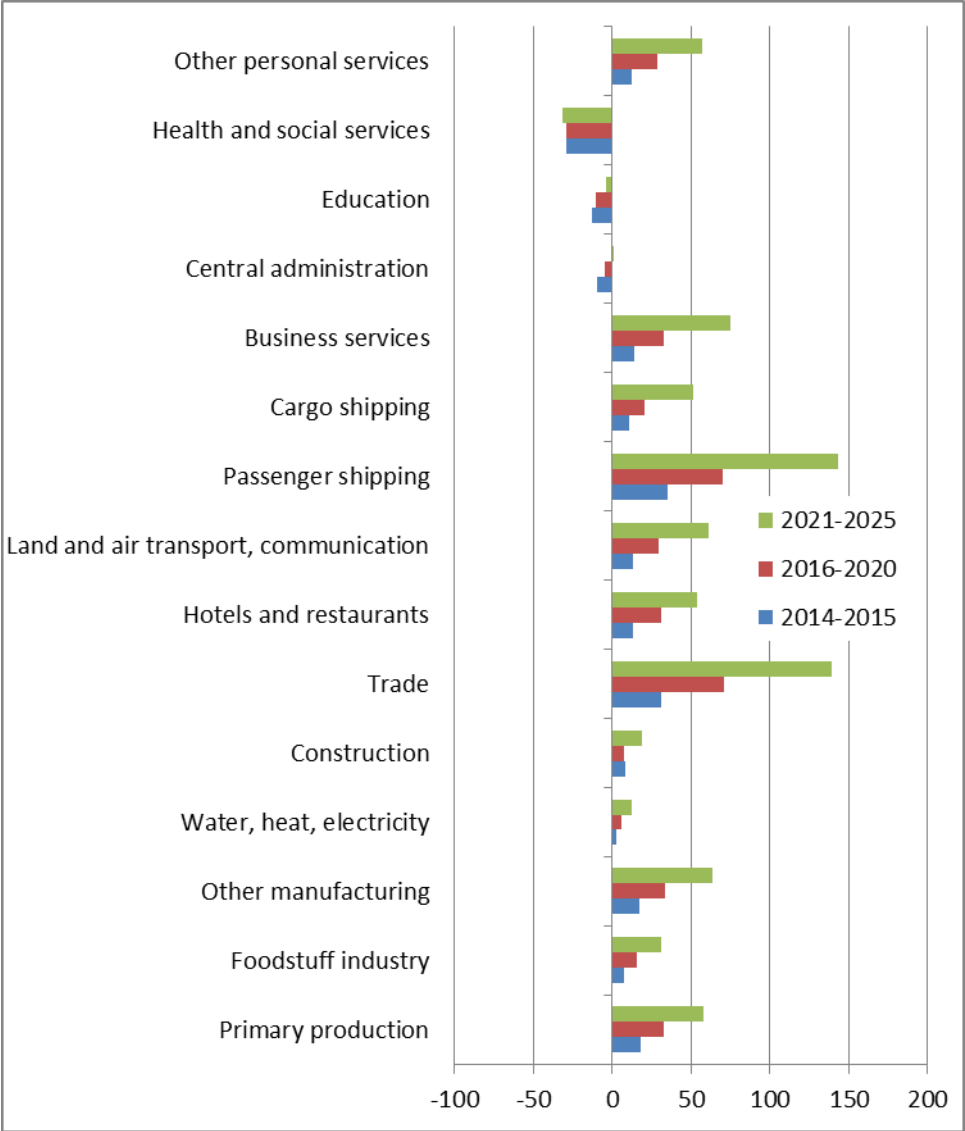
Here, we start by showing the employment changes by industry under the *Base* scenario. We see that the development is quite undramatic during our simulation period (Figure 10). We foresee that once we have passed the current years of recession, the cargo shipping, for example, would generate a growth of 15 percent by the end of the simulation period. Almost the same growth rate is anticipated within the foodstuff industry, which may benefit from the increasing interest in locally-produced small-scale food. The need for health and social care increases, but the lack of public resources slows down the growth. During 2013-2025, the total employment would grow by around 190 places to over 15,500 jobs.

Figure 10. Employment for Base scenario by Industry, Nr of Jobs



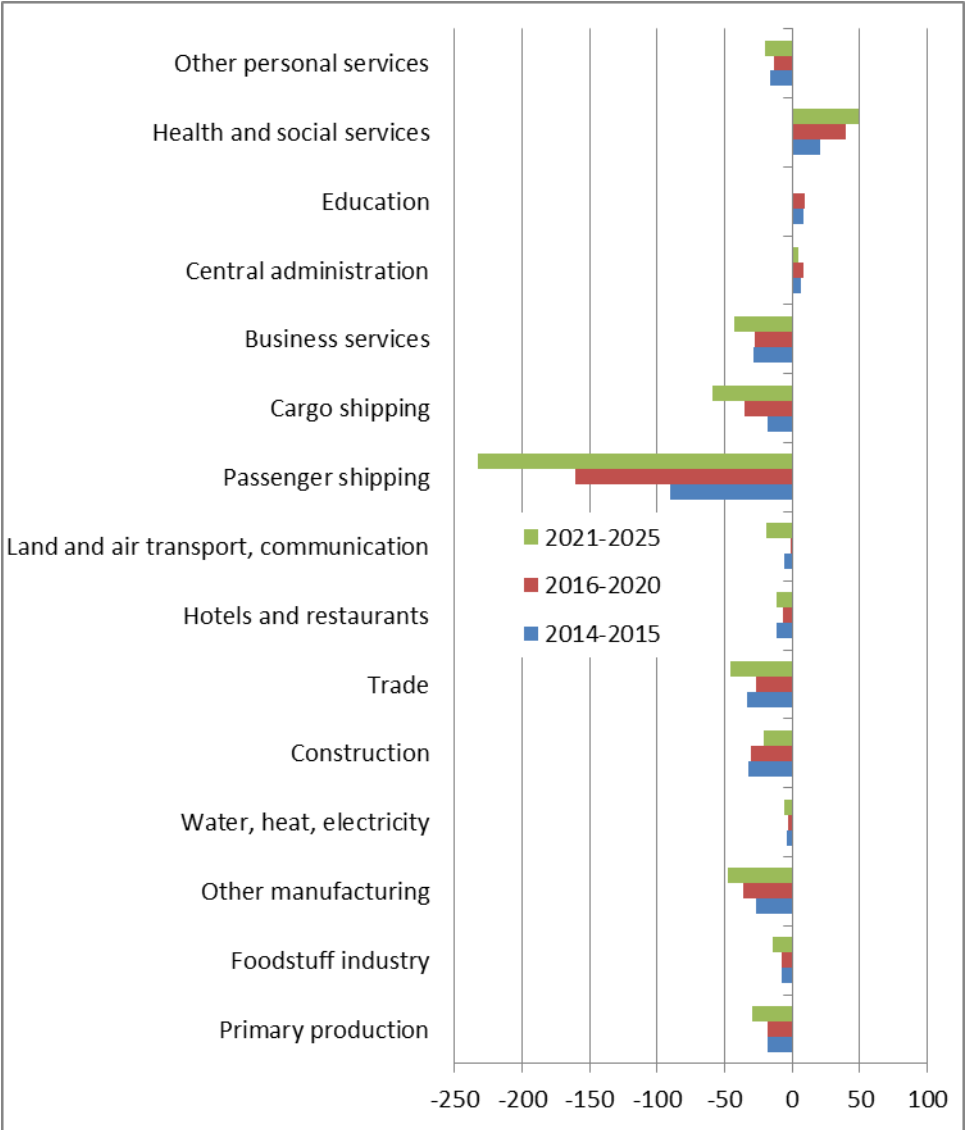
Under the *Growth* scenario, almost every job category would record a growth in employment, the only exception being the public sector industries, which by enjoying the same productivity growth as the others, face a quite inflexible demand that does not react to changes in price. Thus, the public sector would shrink. Figure 11 shows the average difference in number of jobs for between the *Growth* and *Base* scenarios for the simulation period divided into three sub-periods.

Figure 11. Difference in Employment between Growth and Base by Industry, Nr of Jobs



An opposite picture emerges when the *Deceleration* and *Base* scenarios are compared (Figure 12). Again the public sector employment develops into a different direction than that of the other industries. Passenger shipping would suffer greatly if the additional costs of sulfur directive would be as punitive as under this scenario.

Figure 12. Difference in Employment between Deceleration and Base by Industry, Nr of Jobs



4.3 Recruiting need

In our model setting, recruiting need is defined as the growth in the number of jobs plus the number of persons leaving the labor market. It is worth mentioning that this measure falls short of the actual gross worker flows. Böckerman and Maliranta (2001) estimated, among other things, the worker outflow rate of the Finnish NUTS3 regions during 1990-1997. Åland showed the lowest average outflow rate of 21 percent⁴. Our calculations by means of yearly register data on employment between 2008-2009 and 2009-2010 gave outflow rates of 21.0 and 20.2 respectively. In terms of the

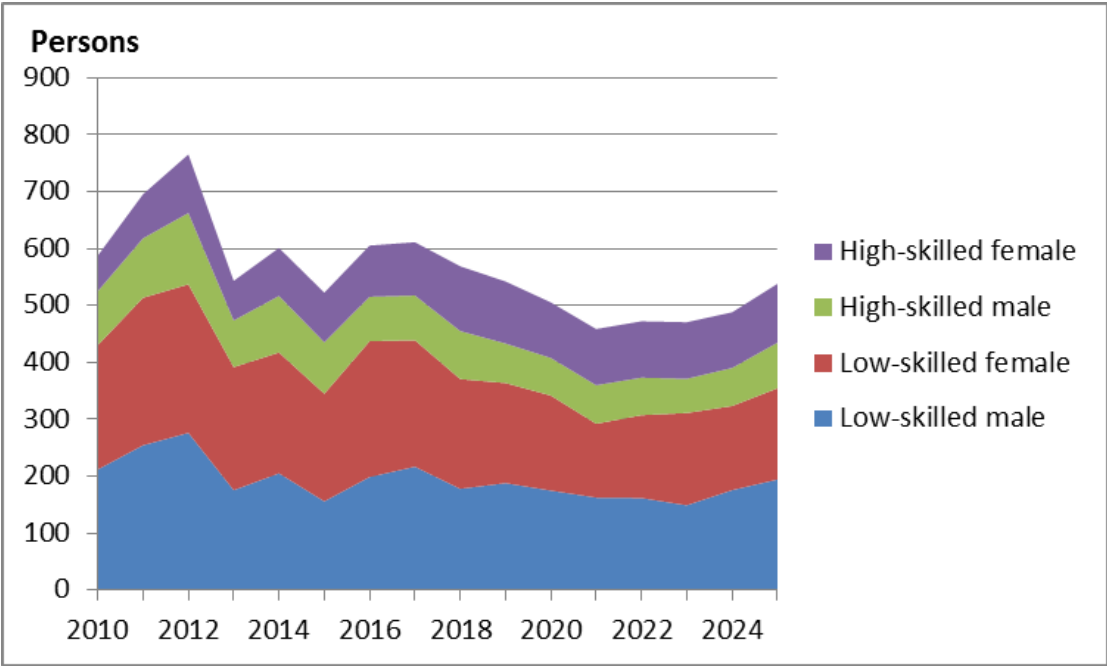
⁴ Åland is called in Böckerman and Maliranta (2001) by its Finnish name Ahvenanmaa.

number of jobs, this means roughly 2,800 job endings per year (includes only inhabitants, not commuters).

According to ÅSUB’s yearly employment survey (Palmer, 2014), the estimated recruiting need during the next 12 months has hovered around 500-700 jobs. In other words, even the employers have trouble in foreseeing the actual amount of labor force turnover. Still another measure of worker flows is provided by the Work in Åland (the government labor market office), which recorded around 2,100 filled vacancies per year during 2011-2012.

Our model calculations for the size of the recruitment need tallies quite well with the labor survey estimate: During the first years of our simulation period, the recruitment need moves around 550-750 persons to fall somewhat towards the end of the simulation period. In other words, the employers seem not to weigh in the amount of worker turnover caused by job-changers etc. Figure 13 below shows that the largest decline in recruiting need is to be expected among low-skilled women, followed by high-skilled men. When the start and the end of the simulation period are compared, the only gender-skill combination showing growth in recruitment need is high-skilled women.

Figure 13. Recruitment Need, Base Scenario, Nr of Persons by Gender and Skill Level



As our model produces a myriad of results, below we concentrate on the recruiting need results for the *Base* scenario only. The data matrices on ÅSUB’s website contain the results for all the scenarios:

<http://pxweb.asub.ax/PXWeb/pxweb/en/Utbildningsbehov/?rxid=862657a4-a5a1-4afc-acf5-2af22f34fe21>

Recruiting need by field of education shows that service sector educations continue recruiting throughout the simulation period, while general or unknown educational background is expected to become ever less interesting on the labor market. Technical sciences also seem to be recruiting fewer newcomers, which depends mainly on the current age profile of the workers with that educational

background (see Figure 14). Seen by occupational grouping, most occupations have quite stable recruitment needs, with the exception of “other occupations” and farmers (Figure 15).

Figure 14. Recruiting Need by Field of Education, Base Scenario, Persons

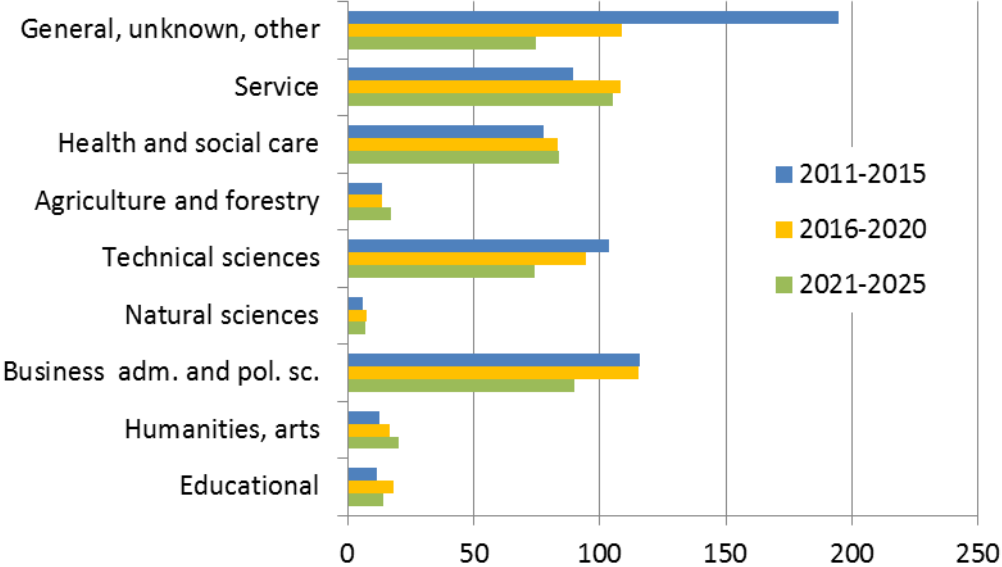
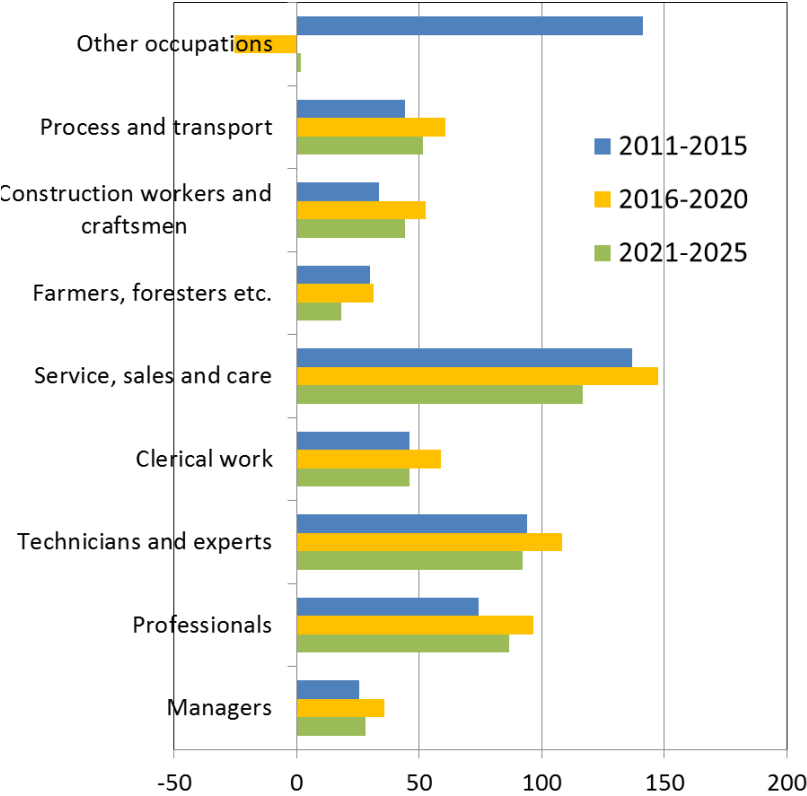


Figure 15. Recruiting Need by Field of Occupation, Base Scenario, Persons



4.4 The role of education

The skills needed within the economy can either be produced locally through education or imported through migration. In effect, around a quarter of those moving in to Åland are return migrants, many returning after studies outside Åland (Statistics and Research Åland, 2014g). Figure 16 shows how the number of upper secondary and tertiary level graduations develops over time in the different scenarios. As we have not specified any behavioral changes between the scenarios, the outcomes are solely governed by differences in the size of relevant age cohorts between the scenarios.

Figure 16. Number of Graduations by Scenario and Type of Education

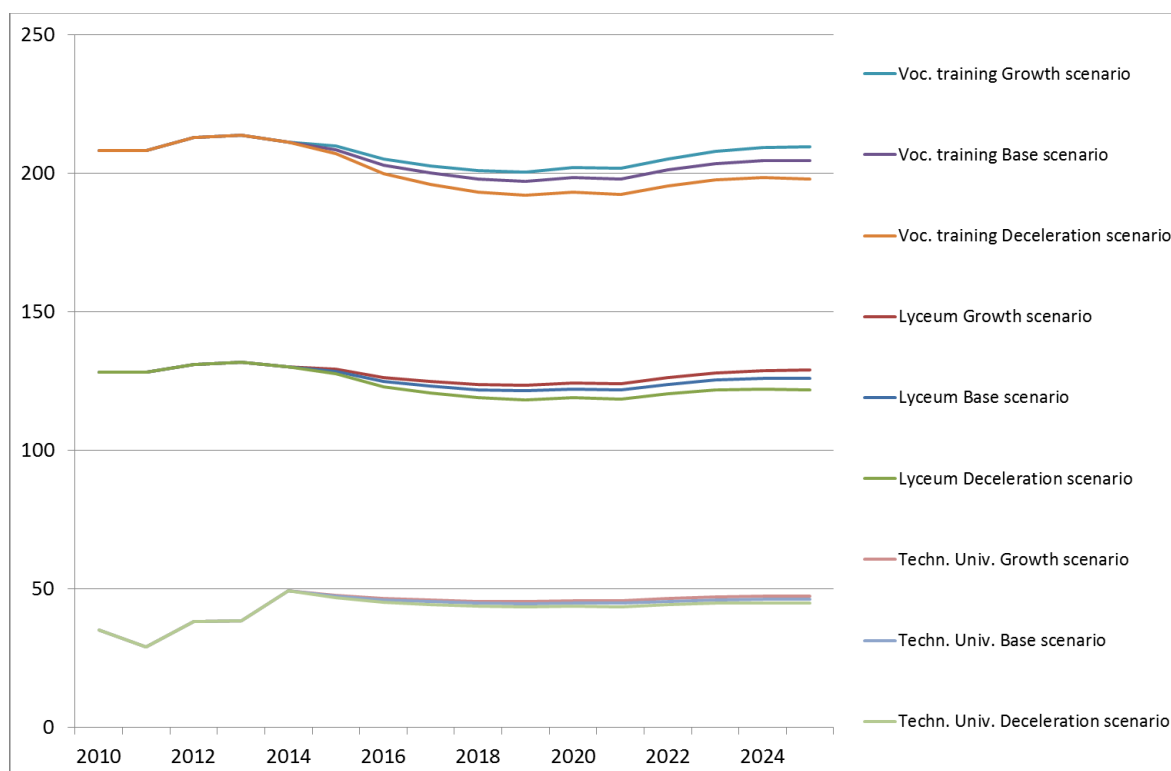


Table 1 below shows how the local “production” of competence satisfies the anticipated recruitment need. The general tendency seems to be that the local education is satisfying a decreasing share of humanities, health and social care as well as service related competence. In contrast, the share of local examinations of the anticipated recruiting need is growing for business administration and political sciences as well as technical sciences. However, our modeling exercise has to be done at a fairly aggregated level due to very small size of our region, and thus many details remain uncovered.

Table 1. Share of Recruiting Need covered by Local Education, Percent

		Year		
		2011-2015	2016-2020	2021-2025
Humanities, arts	<i>Base</i>	68.5	48.1	40.9
Humanities, arts	<i>Growth</i>	64.2	42.6	37.3
Humanities, arts	<i>Deceleration</i>	78.9	49.9	44.1
Business adm. and pol. sc.	<i>Base</i>	45.3	44.4	57.8
Business adm. and pol. sc.	<i>Growth</i>	43.4	40.7	50.1
Business adm. and pol. sc.	<i>Deceleration</i>	50.4	44.7	62.4
Technical sciences	<i>Base</i>	67.3	71.6	92.6
Technical sciences	<i>Growth</i>	63.8	64.2	78.9
Technical sciences	<i>Deceleration</i>	79.7	69.2	101.8
Health and social care	<i>Base</i>	56.8	52.3	53.1
Health and social care	<i>Growth</i>	54.9	48.5	48.2
Health and social care	<i>Deceleration</i>	62.2	52.0	55.9
Service	<i>Base</i>	83.3	66.9	69.8
Service	<i>Growth</i>	80.0	62.1	64.0
Service	<i>Deceleration</i>	96.7	64.4	73.2
General, unknown, other	<i>Base</i>	67.4	114.1	168.7
General, unknown, other	<i>Growth</i>	63.7	93.1	121.8
General, unknown, other	<i>Deceleration</i>	82.6	101.8	208.5

4.5 The role of migration

The role of migration can be seen with the help of the two figures below. Figure 17 shows what the balance between the supply and demand in the labor market looks like for men and women with lower educational level. To reiterate, we here assume that the past structure of migration regarding gender, educational field and level applies both to in- and outmigration. It seems that after accounting for migration, lower-skilled women would be in short supply. Most of the out-migrant females are migrating for further studies, and it seems that in-migrants have rather high qualifications. The opposite holds true for men: there seems to be a small surplus of lower-educated men. However, the differences are quite small.

For higher-educated persons the situation is reverse. Figure 18 shows that when counting in the effect of migration, the supply of higher-educated women exceeds the demand, while educated men are in short supply. This is naturally easily solved in the labor market: there has to be a change in the occupational mix of either educational levels or the genders. Or, the structure of migration will have to adjust accordingly. At any rate, jobs with higher qualifications that have been more male-dominated seem to need more labor force: will these jobs be filled by men or women in the future?

Figure 17. Change in Supply minus Demand for Low-skilled Labor by Gender and Scenario

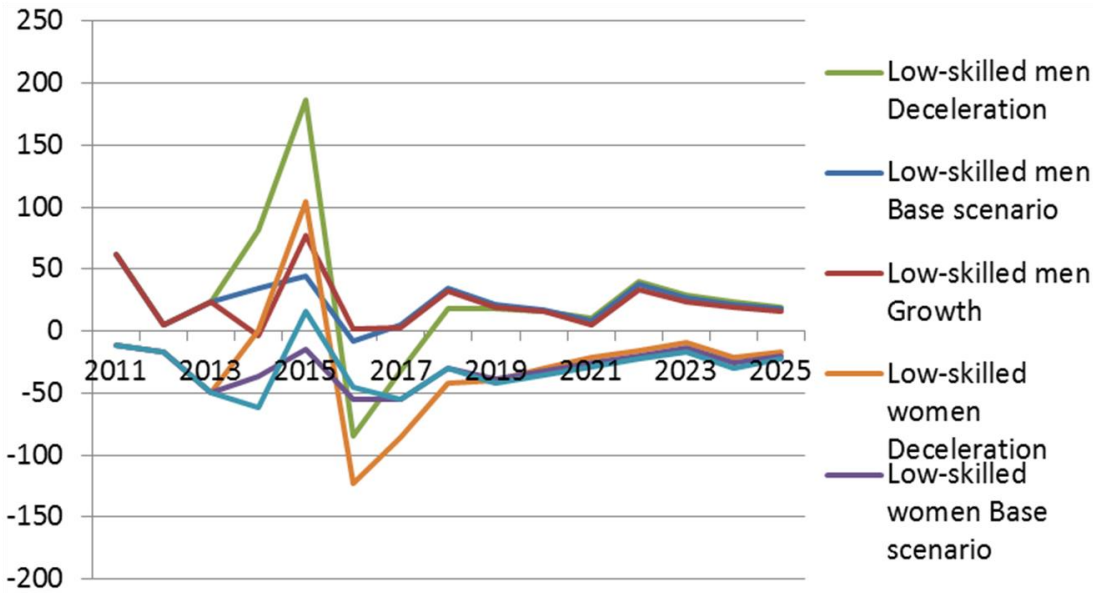
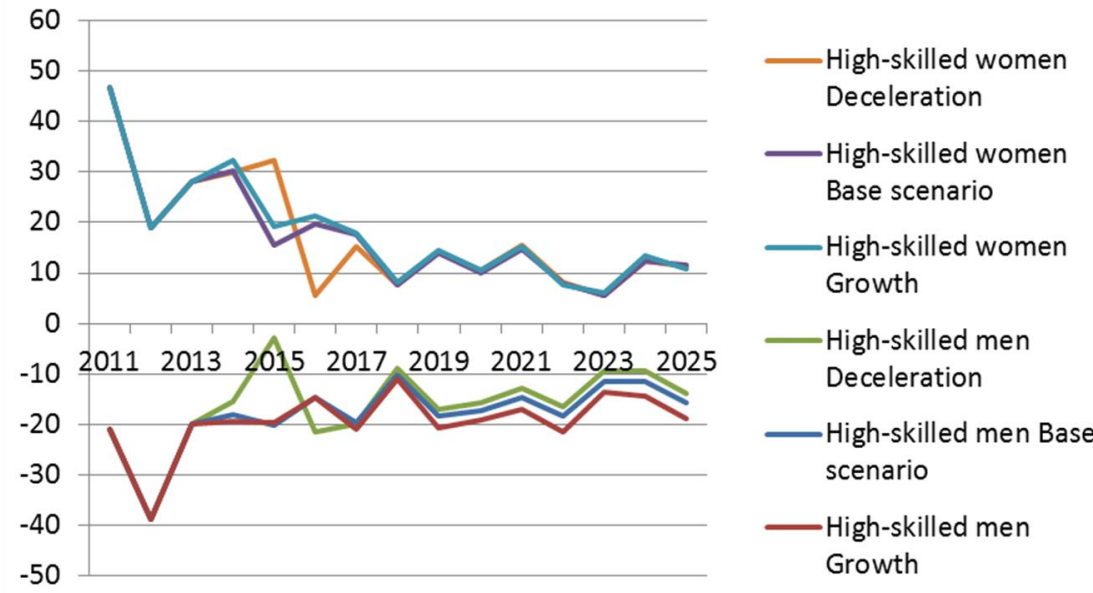


Figure 18. Change in Supply minus Demand for High-skilled Labor by Gender and Scenario



References

Alanen, Aku (2013): *Investointien maantiede*, Tieto&trendit 3/2013, Statistics Finland (in Finnish).

Böckerman, Petri (2001): *Unravelling the Mystery of Regional Unemployment in Finland*, Labour Institute for Economic Research, Discussion Papers 171.

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, Jouko Kinnunen, Bjarne Lindström and Richard Palmer (2015): Pathways to successful entrepreneurship in small island economies: the case of Åland, in Baldacchino, Godfrey (ed.) *Entrepreneurship in Small Island States and Territories*, Routledge, ISBN 978-1-13-878998-2, forthcoming.

Honkatukia Juha, Jouko Kinnunen and Kimmo Marttila (2009): *Väestön ikääntymisestä johtuvien julkisten kulutusmenojen kasvun rakenteelliset vaikutukset*, VATT-tutkimuksia 147 (in Finnish).

Hanhijoki Ilpo, Jukka Katajisto, Matti Kimari and Hannele Savioja (2011): *Koulutus ja työvoiman kysyntä 2025, Ennakointituloksia tulevaisuuden työpaikoista ja koulutustarpeista*, Finnish National Board of Education, Raportit ja selvitykset 2011:25 (in Finnish). Available at: http://www.oph.fi/julkaisut/2011/koulutus_ja_tyovoiman_kysynta_2025

Jalava, Jukka and Matti Pohjola (2002): Economic growth in the New Economy: evidence from advanced economies, *Information Economics and Policy*, Elsevier, vol. 14(2), pages 189-210, June.

Jalava, Jukka and Ilja Kristian Kavonius (2008): *The Effect of Durable Goods and ICT on Euro Area Productivity Growth?* European Central Bank, Working Paper Series No. 940.

Kinnunen, Jouko (2005): *Migration, Imperfect Competition and Structural Adjustment – Essays on the Economy of the Åland Islands*, Helsinki School of Economics, Acta Universitatis Oeconomicae Helsingiensis, A-258, Helsinki. Available at: <http://hsepubl.lib.hse.fi/FI/diss/?cmd=show&dissid=289>.

Kinnunen, Jouko and Bjarne Lindström (2011): *A Study of Cluster Impacts and the Future of the Shipping Industry in Åland Islands*, ERSA Congress Paper, Barcelona.

Kinnunen, Jouko, Bjarne Lindström and Katarina Fellman (2013): *Utbildningsbehov och arbetsmarknad 2025*, ÅSUB Report 2013:4, Mariehamn (in Swedish), available at: http://www.asub.ax/files/rapport_2013_4_0.pdf

Kinnunen, Jouko and Richard Palmer (2006): *Future Demand of Labour and the Need of Education in the Åland Islands*, ECOMOD Conference Paper.

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 and Richard Palmer (2011): *The significance of duty-free sales on board ferries to the transnational transport system in the Baltic Sea Region*, ÅSUB Report 2011:8, Mariehamn, Statistics and Research Åland.

Nordic Council of Ministers (2014): *Nordic Statistical Yearbook 2014*, ISBN 978-92-893-3850-9, Copenhagen.

Palmer, Richard (2014): *Arbetsmarknadsbarometern 2014*, ÅSUB Rapport 2014:5, Statistics and Research Åland, Mariehamn (in Swedish), available at: http://www.asub.ax/files/arbetsmarknadsbarometern_2014_1.pdf

Rundberg, Maria and Jouko Kinnunen (2014): *Turismens samhällsekonomiska betydelse för Åland 2013*, ÅSUB Rapport 2014:1 (in Swedish). Available at: http://www.asub.ax/files/rapport_2014_1.pdf

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

Statistics and Research Åland, ÅSUB (2013): *Befolkningen 2012*, Statistikrapport 2013:6. Mariehamn: Statistics and Research Åland (in Swedish), available at: <http://www.asub.ax/files/befolkning2012.pdf>

Statistics and Research Åland, ÅSUB (2014a): *Nationalräkenskapsdata 2011*. Statistikmeddelande 2014:1 (in Swedish), available at: http://www.asub.ax/files/bnp_meddelande_2011.pdf

Statistics and Research Åland, ÅSUB (2014b): *Befolkningen efter huvudsaklig verksamhet den 31.12.2013, preliminära siffror* (in Swedish), available at: http://www.asub.ax/archive.con?iPage=12&art_id=1571

Statistics and Research Åland, ÅSUB (2014c): *Grundskolan hösten 2014*, Statistikmeddelande Utbildning 2014:3 (in Swedish), available at: <http://www.asub.ax/files/grundskola2014.pdf>

Statistics and Research Åland, ÅSUB (2014d): *Utbildning efter grundskolan samt vid Högskolan på Åland hösten 2014*, Statistikmeddelande Utbildning 2014:4 (in Swedish), available at: <http://www.asub.ax/files/utbildning14.pdf>

Statistics and Research Åland, ÅSUB (2014e): *Studerande utanför Åland 2013* (in Swedish), available at: http://www.asub.ax/archive.con?iPage=12&art_id=1475

Statistics and Research Åland, ÅSUB (2014f): *Ålands socialräkenskapsmatris* (in Swedish), available at: http://www.asub.ax/archive.con?iPage=12&art_id=1488

Statistics and Research Åland, ÅSUB (2014g): *Flyttningsrörelsen 2013* (in Swedish), available at: http://www.asub.ax/archive.con?iPage=12&art_id=1526

Statistics Finland (2012): *Population projection* [e-publication]. ISSN=1798-5153. Helsinki: Statistics Finland [referred: 30.1.2015]. Available at: http://www.stat.fi/til/vaenn/index_en.html

Statistics Finland (2006): *Households' consumption* [e-publication]. ISSN=2323-3028. Helsinki: Statistics Finland [referred: 30.1.2015]. Available at: http://www.stat.fi/til/ktutk/tie_en.html

APPENDIX 1. Level of aggregation in the model database

The accounts used in the Åland SAM 2010 are listed below. Åland SAM 2010 has been published as a separate web statistics (in Swedish) and it can be read and downloaded from ÅSUB's web page:

http://www.asub.ax/archive.con?iPage=12&art_id=1488

The following accounts are used in Åland SAM 2010:

Code name	Clarification
Activities	
A-AGRI	Primary production
A-FINDU	Food stuff industry
A-INDU	Other industries
A-ELWA	Electricity, water and heat production and distribution
A-CONS	Construction
A-TRAD	Trade
A-RESH	Restaurants and hotels
A-OTRANS	Land and air transport, communications
A-STRANSP	Passenger shipping
A-STRANSG	Freight shipping
A-BSER	Business services
A-ADMIN	Public administration
A-EDUC	Education
A-HLTH	Health care and social services
A-OSERV	Other personal services (mainly private sector)
Products	
C-AGRI	Primary products
C-FINDU	Food stuffs
C-INDU	Other industrial products
C-ELWA	Electricity, water and heat
C-CONST	Construction services

C-TRADE	Trade services
C-HOTEL	Restaurant and lodging services
C-OTRANSP	Land and air transport, communications
C-WTRANPP	Passenger shipping
C-WTRANPG	Freight shipping
C-BSERV	Business services
C-ADMIN	Public administration
C-EDUC	Education services
C-HLTH	Health care and social services
C-OSERV	Other personal services (mainly private sector)
C-FINSERV	Service and products acquired by Ålanders in Finland
C-ROWSERV	Service and products acquired by Ålanders in rest-of-world

Transaction cost accounts (transport and trade margins)

TRNCSTDOM	Transaction costs in the local market
TRNCSTEXP	Transaction costs of exports
TRNCSTIMP	Transaction costs of imports

Production factors

LABOR	Labor income (even entrepreneurs' labor income)
CAPI	Capital income

Institution accounts

FIRMS	Firms
NPISH	NGOs
STATE	Finnish state
GOV	Åland government
MUNI	Municipalities
SOCSEC	Social security funds
HHD	Households

LEXP	Account for commuters' labor exports
FINHH	Account for Finnish tourist households
ROWHH	Account for tourist households from rest-of-world

Tax and subsidy accounts

COMTAX	Tariffs
PRODTAX	Indirect excise taxes, other than VAT
PRODTAXLR	Taxes and fees of Åland Government (pharmacy fee, lottery tax)
VAT	Value added tax
PRODSUB	Product and production subsidies of state
PRODSUBLR	Product and production subsidies of Åland government
CORPTAX	Corporate tax
SINCTAX	State income tax
MINCTAX	Municipal income tax
SECFEE	Social security fees (including pension fees)
OTAX	Other taxes and fees

Other accounts

S-I	Savings and investment account
ROW	Rest-of-world account
TOTAL	Column or row sum