

# Some Patterns and Social Impacts of External Migration on a Below-Replacement Population: Denmark by the Turn of the Millennium

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## Abstract

As with many other nations in Europe, Denmark has experienced below-replacement fertility over the past three decades. The impact on population growth of the recent fertility decline to a large extent has been offset by a positive net balance of external migration. To provide a factual basis for a wide range of policy issues and social and cultural impacts we start by studying external migration, differential fertility, naturalization of foreign nationals, and population growth in the framework of multidimensional life models. Migrants and naturalized citizens tend to have reproductive behavior and sex/age profiles that differ significantly from those of the remaining population. To study some concerted demographic and social impacts of such differentials, we construct a number of midterm projections based on existing and expected development of fertility, mortality, and migration.

Keywords: multidimensional population projections, international migration, naturalization, differential fertility, Denmark

## Introduction

As with many other nations in Europe, Denmark has experienced below-replacement fertility over the past three decades. To a large extent, the impact of the recent fertility decline on population growth has been offset by a positive net balance in external migration. The purpose of this paper is to provide a factual basis for a wide range of policy issues and social and cultural impacts related to external migration in

Denmark. To do this, we construct a multidimensional life model that incorporates external migration, differential fertility, the naturalization of foreign nationals, and population growth. Using Danish vital statistics data from 1992 and 1993, we explore a number of mid-term scenarios covering the next 50 years.

Many attempts by governments to influence fertility have been unsuccessful for the most part. However, the liberal admission of foreign nationals with high fertility might be one political strategy for preventing undesired low birth figures. Unlike fertility behavior, immigration is very susceptible to policy directives in most Western European nations. This is a consequence of the fact that Western Europe is perceived as a desirable migration market by much of the rest of the world. This "natural" demand for residence permits could easily be increased through active marketing policies if the desired numbers of potential immigrants with the required human capital mix are not available. Depending upon the skills and the human capital of the immigrants, however, such a policy might add to rather than alleviate social obligations such as those related to the support of unemployed persons and elderly people.

Denmark's fertility trends are fairly typical of most European nations (see e.g., Wright 1989) which have experienced a dramatic downturn in fertility from well above replacement throughout the 1950s to well below replacement since the late 1960s and early 1970s. In Denmark, the annual number of live births dropped by some 30,000 between 1966 and 1983. The country experienced a slight increase from 50,822 live births in 1983 to 67,726 live births in 1992 but this is associated with postponed family formation among the cohorts entering their childbearing ages in the late 1960s and the early 1970s (Hansen 1993, 1995). The cohorts born between the initial period of fertility decline from about 1966 to 1983 are now reaching the childbearing ages, thus, we would expect this minor upturn to be short-lived. With these cohorts of diminishing size entering their childbearing ages in the years to come, the annual number of live births almost surely is going to fall, or remain low, over the coming couple of decades.

The current and the anticipated development in the number of live births are but one manifestation of the population aging associated with below-replacement fertility. Since the beginning of the 1970s the ongoing aging of the population has caused concern in both public debate and in the demographic and economic literature (see e.g. Steinmann 1984; Bös and Cnossen 1992). Of course, it is a debatable question about whether population aging is a problem. Since the population process is subject to many restraints, nationally and among nations, there are no simple answers to this question. Outside highly stylized models, the problems raised by population aging can rarely be grasped in terms of simple growth rates and distributions by sex and age. In our opinion, the really intriguing issues concerning societal impacts of below-replacement fertility are mostly related to the composition and the quality of the population.

We believe that any practical, policy-relevant analysis of population dynamics under current conditions must use external migration as its starting point. We make this assumption for two main reasons. First, fertility patterns do not appear ready to change in the short term. Furthermore, even a rapid increase in fertility will not have substantial socioeconomic impacts, particularly as they relate to labor force activity, until many years into the future. Second, except for unforeseen catastrophes, near-term mortality is unlikely to change significantly. Current levels of medical technology and access make increased rates of mortality unlikely and recent increases in longevity are clearly marginal.

A lack of detailed data and the horrendous causal complexity make the demography and the economics of in-migration an exceedingly difficult research issue with which to cope. Any attempt to address these problems must therefore be partial in character. The issues studied in this paper relate to population heterogeneity regarding sex, age, and composition by citizenship in an open society with below-replacement ferti-

ity. Some of these topics have already been addressed in the literature. Arthur and Espenshade (1988) explore some of the implications of variations in the age distribution of immigrants to the United States based on the stable population model. Building upon the work of Arthur and Espenshade and others, Feichtinger and Steinmann (1992) studied the replacement impacts of immigration to Germany essentially within the framework of a simple life model. In their application, the chosen life model necessarily entails some simplistic and highly restrictive assumptions. For example, from their birth, children born in the recipient country of non-naturalized in-migrants automatically become subjected to the (averaged) demographic forces of German nationals. Furthermore, because of the one-dimensionality, naturalization is treated as an exogenous factor in the applied life model. Our approach is based on a multistate life model allowing for evaluation of reproduction and population projection in the presence of naturalization and external migration. The multidimensionality of the applied life model allows the simultaneous evaluation of a finite number of nationalities, or groupings of nationalities. Even complex multistate life models entail some restrictive assumptions, however, these are far fewer and far less restrictive than those required in unidimensional applications.

The present model application refers to residence in Denmark. Our application of probabilistic multistate life table methodology relies primarily on Hoem and Funck Jensen (1982) and their references. Nonstochastic references to this approach include Rogers (1975); a variety of working papers from the East/West Institute, Laxenburg, Austria; and chapters from the conference proceedings edited by Land and Rogers (1982).

Population simulations are certainly not unique entities and as we have indicated, some work in the current area of concern has been conducted by Feichtinger and Steinmann (1992). Before proceeding, however, some qualification of the term "simulation" is in order. In our application, this term refers to repeated random experiments in the framework of a statistical model. In simple or multidimensional life models the random experiments take place at the level of individual lives, time spent in successive life states over the life cycle (or a segment of it) being the stochastic element. Clearly, stochastic event history simulation may be conducted under alternative hazard regimes (possibly of great complexity). We call such computations "as-if-calculations" or "scenarios". In this paper all predictions are in terms of expectation values. We consider three scenarios called A, B, and C. Scenario A rests on the assumed absence of emigration and immigration (i.e., a "closed society"); Scenario B, conversely, allows for simultaneous emigration and immigration; Scenario C assumes absence of immigration. The three scenarios rest on standard *ceteris-paribus* assumptions as far as all other demographic forces are concerned.

The applied multidimensional life model and the related statistical analysis are briefly reviewed in the section on models and statistical analysis. The hazard estimates used in the predictions are analyzed and presented in the next section. Some main results from the projections are outlined in the section dealing with the primary results. Finally, the implications of the projections for such factors as intergenerational transfers, schooling and education, working force participation and employment, retirement and pension schemes and issues concerned with social security and welfare are addressed in the last section.

## **Models and statistical analysis**

Simulating population dynamics can be done either at the micro or the macro level. Normally, we would argue that micro simulation, although more complex, is the pref-

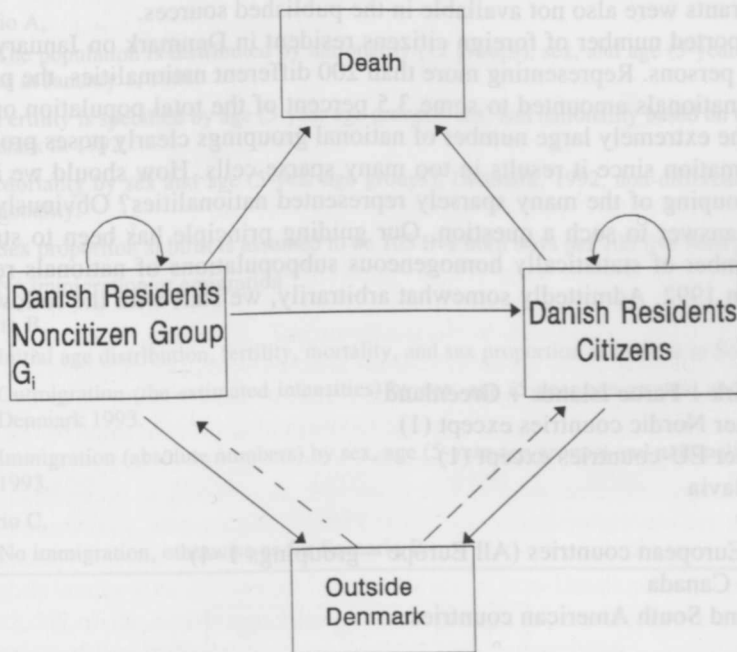
erable approach. Inherently, micro simulation allows for the construction of more detailed models employing a higher level of interaction between durations and state spaces. Unfortunately, we have not been able to obtain ready access to the data necessary for an appropriate micro simulation of the problem.

Thus, following the lead of several others who have explored this issue (Feichtinger and Steinmann 1992; Mitra, 1983; Espenshade et al. 1982), we have chosen to use a macro approach to provide an initial analysis of the problem. This macro approach does have some advantages in that the data are available, and the necessary simplifying assumptions make the mathematics substantially more tractable. In fact, the mathematics underlying the approach we employ has been available (but little used) in the literature for many years. Unfortunately, the macro data (official statistics) that we have access to are limited. Despite having a rich central population register system, Danmarks Statistik does not publish aggregate duration data on such crucial issues as duration between immigration and naturalization. Turnover or remigration data are also not available although it is possible to estimate that close to 35% of all immigrants to Denmark in the last decade remigrated, and that the remigration rate varied considerably across immigrant groups.

The state space of the applied multistate life model is shown in Figure 1. As depicted, this model refers to one-sex entities, with sex being treated as a background variable.

The notion of 'group  $x$ ',  $x = 1, \dots, n$  refers to groupings of foreign nationals with a Danish CPR (Central Population Register) number at the level of individuals. Excluding refugees and asylum seekers, the groupings refer to persons with a rather permanent residence in Denmark. The grouping "Denmark" denotes Danish citizens with individual CPR numbers. No distinction is made about whether the citizenship was acquired by birth or through naturalization.

Figure 1. State space of the multidimensional life model.



The arrows indicate permitted transitions in the state space. Each arrow, represented by a single solid line, is associated with a given force of transition. An arrow bending into the life state, from which it originates, is related to the demographic force of fertility. The arrows, alluding to flows of immigrants, are quantified in terms of crude numbers. Such flows are treated as exogenous elements in this life model.

Formally, let  $\zeta^{ij}(x, Z_k(t))$ ,  $\zeta = m$ , denote the force of transition from state  $i$  to state  $j$  over age  $[x, x+]$ , of person  $k$ , with personal covariates represented by the vector  $Z_k(t)$ ,  $t$  indicating time dependency. For  $\zeta = f$  we may drop the superscript  $j$ , as  $f(x, Z_k(t))$  is taken to indicate fertility in life state  $i$ .

The identity  $Z_k(t) \equiv Z_k$  implies absence of time dependence in the covariates. Furthermore, if  $Z_k \equiv Z$ , then the force  $\zeta^{ij}(x) \equiv \zeta^{ij}(x, Z) \equiv \zeta^{ij}(x, Z_k(t))$ , and  $\zeta = f, m$  is obviously referring to an age-inhomogeneous subpopulation of a given nationality (including Danish citizenship).

Due to severe limitations in the available data (published official statistics), the estimable intensities degenerate to  $m^{ij}(x)$  and  $f(x)$ . This means that information on duration dependency, such as sojourn in Denmark, is missing as for now. The estimated intensities are analyzed in the framework of a simple multiplicative model (log-linear intensity regression).

### Analysis and presentation of the hazard assumptions used in the projections

The starting data for our analysis were taken from Danmarks Statistik's *Befolkningens bevægelser* (vital statistics) publications for the years 1992 and 1993. With few exceptions, the data matrices consist of population counts broken down by nationality, sex and 5-year age groupings. The primary incompatibility consisted of the table relating to naturalization which was categorized into four crude age groupings. Duration data relating to sojourn time in Denmark before naturalization were not available, although current regulations require a minimum residency of 7 years before non-nationals can apply for Danish citizenship. Distributions of the residency duration for return migrants were also not available in the published sources.

The reported number of foreign citizens resident in Denmark on January 1, 1993, is 180,103 persons. Representing more than 200 different nationalities, the percentage of foreign nationals amounted to some 3.5 percent of the total population on January 1, 1993. The extremely large number of national groupings clearly poses problems for model estimation since it results in too many sparse cells. How should we identify a suitable grouping of the many sparsely represented nationalities? Obviously, there is no simple answer to such a question. Our guiding principle has been to strive for a limited number of statistically homogeneous subpopulations of nationals resident in Denmark in 1992. Admittedly somewhat arbitrarily, we start with the following classification:

- 1 Denmark + Faroe Islands + Greenland
- 2 All other Nordic countries except (1)
- 3 All other EU-countries except (1)
- 4 Yugoslavia
- 5 Turkey
- 6 Other European countries (All Europe – groupings 1–4)
- 7 USA + Canada
- 8 Latin and South American countries
- 9 Africa

- 10 Pakistan
- 11 All other Asian countries (residue)
- 12 Oceania (including Australia, New Zealand and the Pacific region) + residue (= all others)

Although it is somewhat crude, this breakdown does have the advantage of aggregating across some very small groups that have displayed considerable variability in terms of both immigration and emigration patterns over the last few years. The primary consequence for our model is that it provides a certain level of robustness that might not otherwise be evident using a much finer discrimination among national groups and a single year as a starting point. In other words, this higher level of aggregation adds to the validity of the implicit Markovian assumption underlying the model.

While we do not present the explicit results here, our analysis indicates that the emigration intensities of either sex have a multiplicative structure regarding citizens from the former Yugoslavia, Turkey, and Pakistan. Moreover, in striking contrast to the estimated emigration intensities of the Pakistani nationals, those of the Yugoslavian and Turkish nationals are found to be statistically homogeneous. The Pakistani rates are very different from the estimated emigration rates of the resident citizens of all other Asian nationalities.

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#### Assumptions Underlying Scenarios

##### General assumptions:

- All movements of the population are duration and time independent within the horizon of the projections (i.e., the model is Markovian).
- The time horizon is 1994–2043 for each of the three scenarios.
- Rates of naturalization by age, sex and nationality based on those for Denmark in 1992

##### Specific assumptions:

###### Scenario A,

- The population is distributed by nationality (12 groups), sex, and age (5-year age groups) as at January 1, 1994.
- Fertility is specified by age (5-year age groups), sex, and nationality based on that for Denmark in 1992.
- Mortality by sex and age (5-year age groups), Denmark, 1992, non-differentiated by nationality.
- Sex proportion at birth is assumed to be 105 live born boys per 100 live born girls.
- No immigration or emigration

###### Scenario B,

- Initial age distribution, fertility, mortality, and sex proportion at birth as in Scenario A.
- Outmigration (the estimated intensities) by sex, age (5-year age groups) and nationality, Denmark 1993.
- Immigration (absolute numbers) by sex, age (5-year age groups) and nationality, Denmark 1993.

###### Scenario C,

- No immigration, otherwise as for Scenario B
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## Primary results

### a) Population Totals

Expected population totals for our three scenarios are presented in Figures 2 and 3. Figure 2 depicts the estimates for the total population (Danes and non-Danes combined) while figure 3 depicts the projections for the non-Danish population only.

Scenario A assumes a closed society with no in- or out-migration, thus, the determinants of the population composition are simply fertility and mortality. Under these conditions, the scenario suggests that the overall population would decline by about 7.7% over the duration of the projections. This pattern of decline is consistent (although with varying rates) for all national groups in our analysis except those from Turkey and to a lesser extent, the former Yugoslavia. This is consistent with the fact that fertility rates vary considerably by citizenship group with those among the indigenous Danish population and Western Europe being the lowest.

Scenario C is similar to Scenario A except for the fact that out-migration is allowed. Under Scenario C, the population drops by about 34% over the duration of the projections. The substantial difference in the outcomes between Scenarios A and C illustrates the high rates of out-migration among both those of Danish and non-Danish citizenship. As with the other factors under consideration in this model, however, rates of out-migration vary significantly by nationality. In general terms, non-Danish citizens from Scandinavia and other Western industrialized nations have the highest rates of remigration. Other nationalities currently have far lower rates of turnover. While the specifics of this pattern may change in the future, this general trend has been evident within the Danish data for the last two decades and will probably continue in the near term.

Figure 2. Expected total population on January 1, 1994–2044. By scenario.

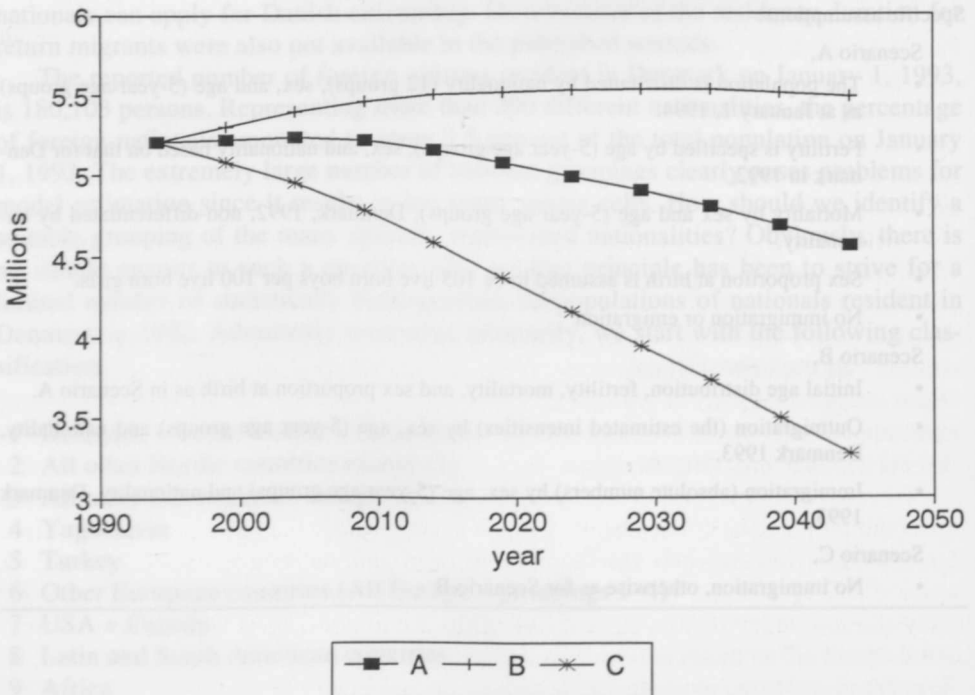
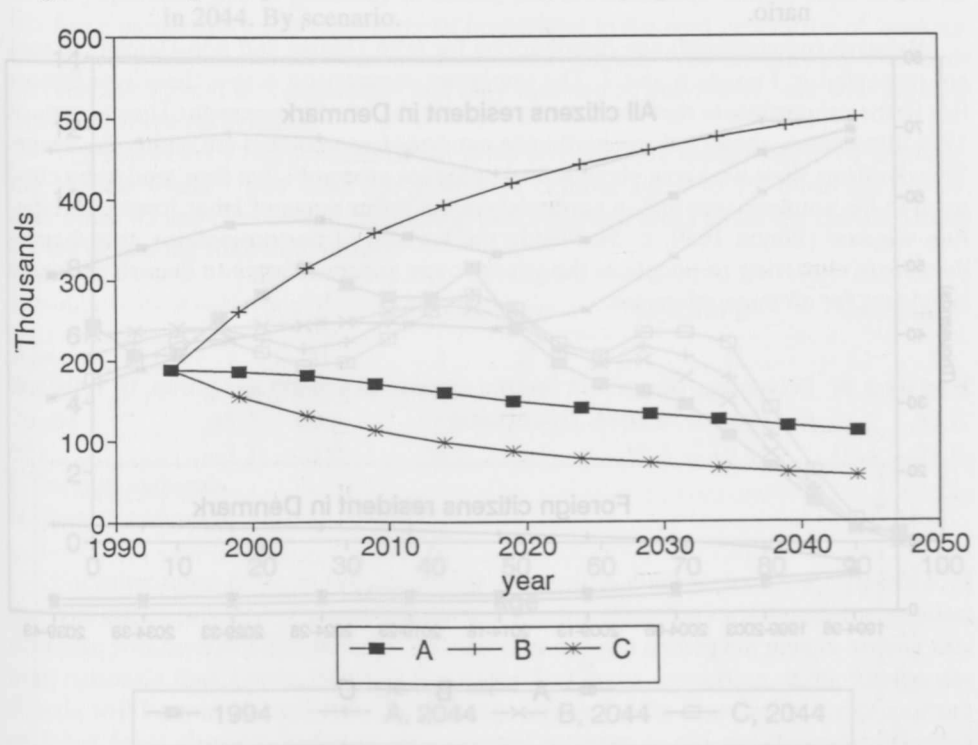


Figure 3. Expected number of resident foreign citizens, 1994–2044. By scenario.



By allowing for in-migration we obtain the projections identified as Scenario B. This scenario suggests a slow but steady growth over the period of the projection with a final population size approximately 12% higher than that currently experienced. By comparing these three scenarios it is clear that migration – both immigration and emigration – will play a tremendous role in shaping the structure of the Danish population in the near future. In fact, it is evident that the impact of immigration is far greater than that attributable to fertility alone.

#### b) Fertility

Fertility projections for the three scenarios as to the expected number of births are presented in Figure 4. As can be seen from this figure, the projected numbers of births of all resident citizens are not expected to rise to any great extent, even under Scenario B. Under this scenario, however, the number of births to resident foreign citizens is expected to increase somewhat. The implications of this pattern are easier to see in Figure 5 where the expected proportion of all live births attributable to resident foreign citizens is graphed. Under Scenario A, the proportion of births by non-Danes is expected to decrease over time because of aging and naturalization among non-Danish women. The trend is exaggerated for Scenario C since out-migration further reduces the proportion of non-Danish women at risk. Under the more realistic option of Scenario B, however, where current regimes of in- and out-migration are allowed, we notice a steady increase in the proportion of live births to non-Danish citizens. Already slightly under 10% of current live births are to non-Danes who currently represent only 3.5% of the total population. If current patterns continue, we could expect the proportion of live births to increase beyond 18% before 2044.



Figure 4. Expected annual number of live births by citizenship, 1994–2043. By scenario.

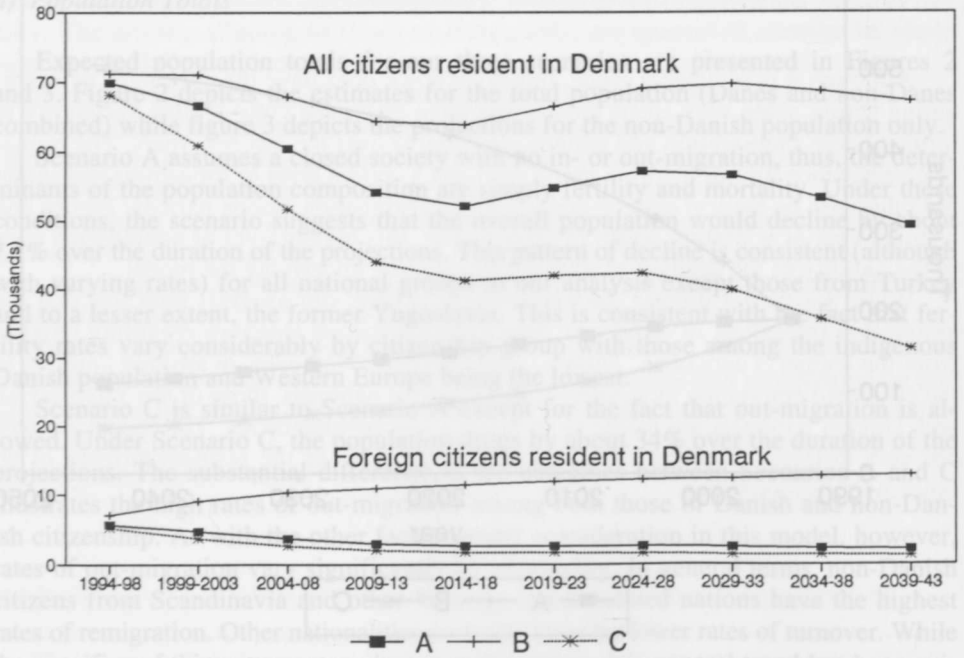


Figure 5. Expected percentage of live births by resident foreign citizens. By scenario.

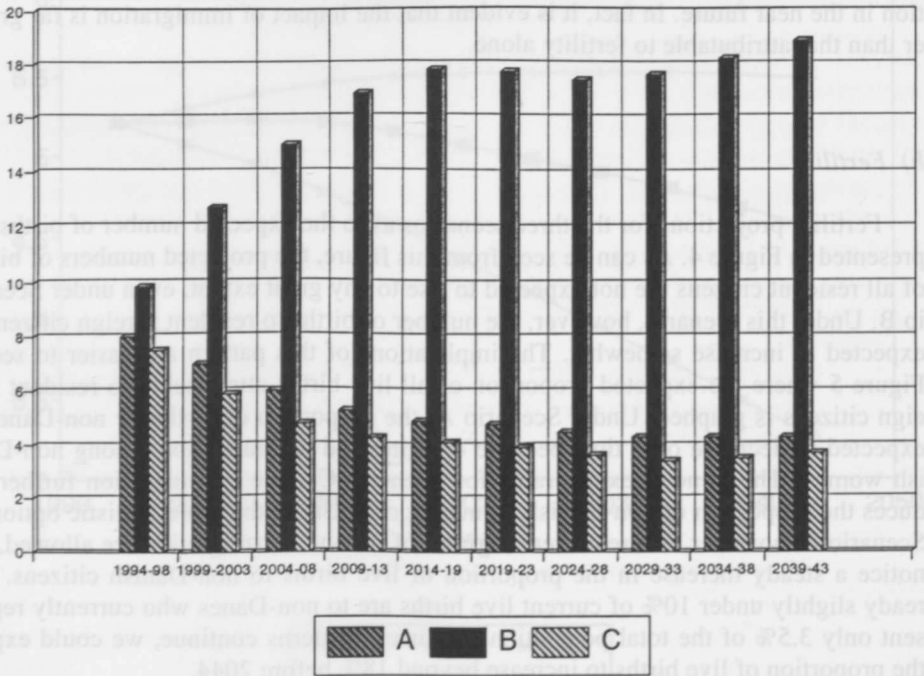


Figure 6. Percentage of resident Danish citizens by age, in 1994 and as expected in 2044. By scenario.

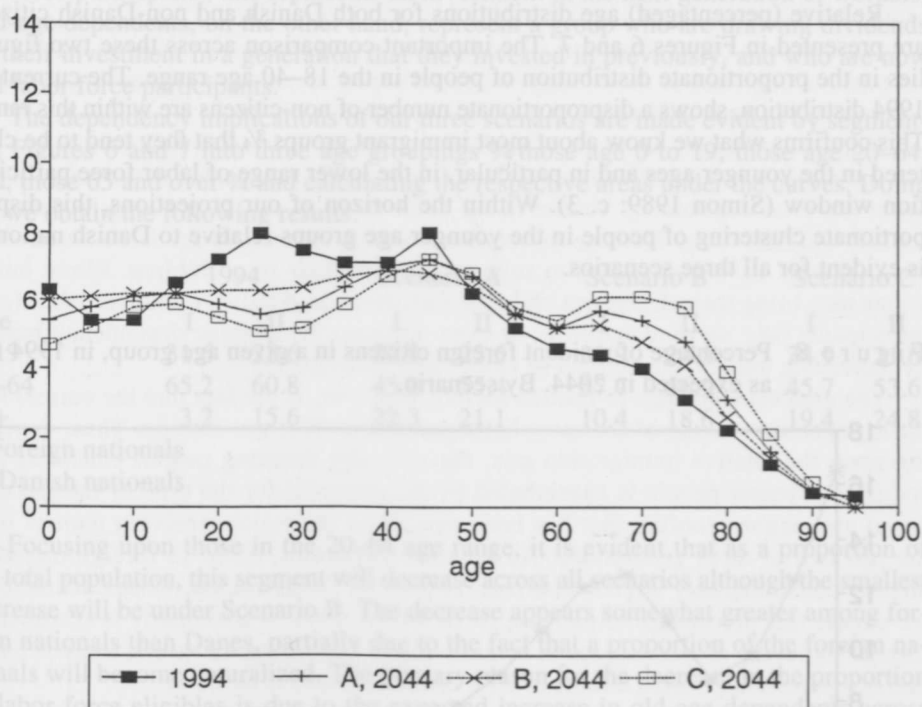
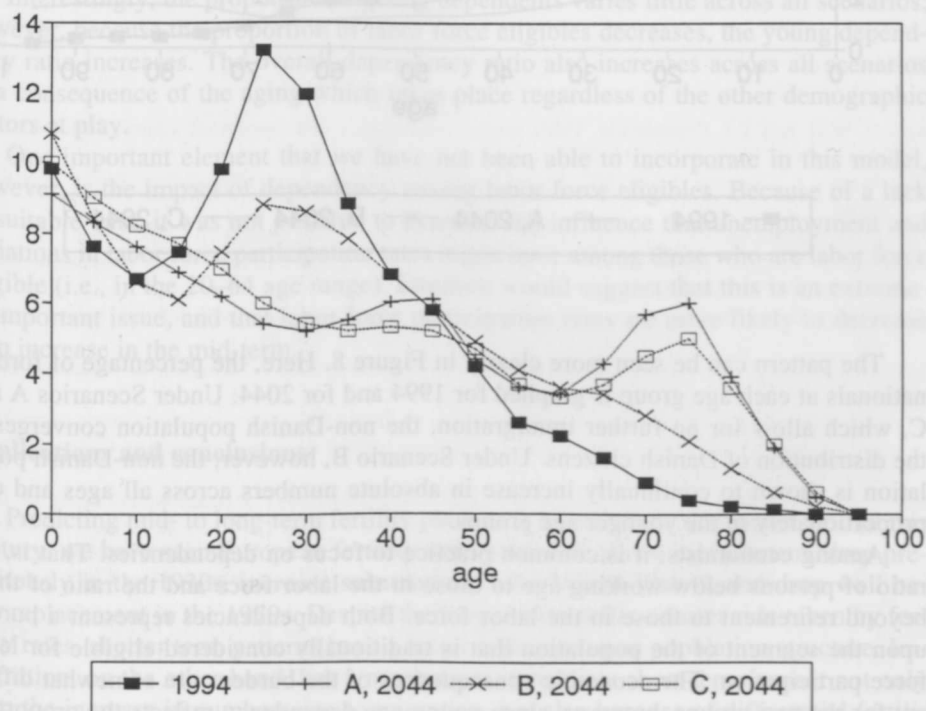


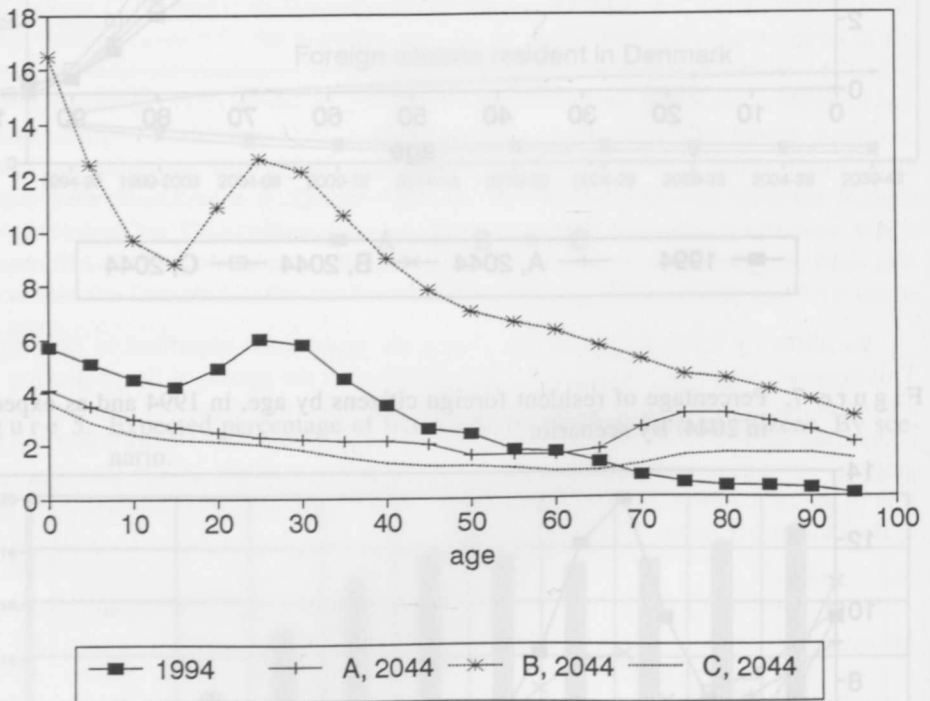
Figure 7. Percentage of resident foreign citizens by age, in 1994 and as expected in 2044. By scenario.



## c) Age profiles

Relative (percentaged) age distributions for both Danish and non-Danish citizens are presented in Figures 6 and 7. The important comparison across these two figures lies in the proportionate distribution of people in the 18–40 age range. The current, or 1994 distribution, shows a disproportionate number of non-citizens are within this range. This confirms what we know about most immigrant groups <sup>3</sup>/<sub>4</sub> that they tend to be clustered in the younger ages and in particular, in the lower range of labor force participation window (Simon 1989: c. 3). Within the horizon of our projections, this disproportionate clustering of people in the younger age groups relative to Danish nationals is evident for all three scenarios.

Figure 8. Percentage of resident foreign citizens in a given age group, in 1994 and as expected in 2044. By scenario.



The pattern can be seen more clearly in Figure 8. Here, the percentage of foreign nationals at each age group is graphed for 1994 and for 2044. Under Scenarios A and C, which allow for no further immigration, the non-Danish population converges to the distribution of Danish citizens. Under Scenario B, however, the non-Danish population is shown to continually increase in absolute numbers across all ages and disproportionately in the younger age groups.

Among economists, it is common practice to focus on dependencies. That is, the ratio of persons below working age to those in the labor force and the ratio of those beyond retirement to those in the labor force. Both dependencies represent a burden upon the segment of the population that is traditionally considered eligible for labor force participation. The economic consequences of the burdens are somewhat different for the two groups, however, since young-age dependency reflects the proportion

of the population that is generally in school and accumulating human capital. For labor force participants, this represents an investment in the next generation of workers. Old-age dependents, on the other hand, represent a group who are drawing dividends on their investment in a generation that they invested in previously, and who are now full labor force participants.

The dependency implications of our three scenarios are made evident by segmenting Figures 6 and 7 into three age groupings  $\frac{3}{4}$  those age 0 to 19; those age 20-64; and, those 65 and over  $\frac{3}{4}$  and calculating the respective areas under the curves. Doing so, we obtain the following results:

Age	1994		Scenario A		Scenario B		Scenario C	
	I	II	I	II	I	II	I	II
0-19	31.6	23.6	31.9	23.5	31.9	24.5	34.9	21.6
20-64	65.2	60.8	45.8	55.4	57.7	56.9	45.7	53.6
65+	3.2	15.6	22.3	21.1	10.4	18.6	19.4	24.8

I. Foreign nationals

II. Danish nationals

Focusing upon those in the 20-64 age range, it is evident that as a proportion of the total population, this segment will decrease across all scenarios although the smallest decrease will be under Scenario B. The decrease appears somewhat greater among foreign nationals than Danes, partially due to the fact that a proportion of the foreign nationals will become naturalized. The primary reason for the decrease in the proportion of labor force eligibles is due to the expected increase in old-age dependents across all scenarios. The smallest increase in the proportion of old age dependents is again under Scenario B. A comparison of the proportion old age dependents under Scenario B and Scenario C (where immigration is constrained) illustrates the impact of the downward biased age distribution of immigrants on the age distribution of foreign nationals.

Interestingly, the proportion of young dependents varies little across all scenarios; however, because the proportion of labor force eligibles decreases, the young dependency ratio increases. The overall dependency ratio also increases across all scenarios as a consequence of the aging which takes place regardless of the other demographic factors at play.

One important element that we have not been able to incorporate in this model, however, is the impact of dependency among labor force eligibles. Because of a lack of suitable data, it was not possible to examine the influence that unemployment and variations in labor force participation rates might have among those who are labor force eligible (i.e., in the 20-64 age range). Intuition would suggest that this is an extremely important issue, and that labor force participation rates are more likely to decrease than increase in the mid-term.

## Implications and conclusions

Predicting mid- to long-term fertility patterns is a precarious enterprise. Within this century, we have seen European fertility rates start well above replacement, drop precipitously in the 1930s, increase substantially after World War II, and drop well below replacement in the 1970s. Despite the longer term roller-coaster ride taken by fertility rates, shorter term patterns have a lesser influence upon population structure. Immigration, on the other hand, has a much more immediate short-term impact not only as to the increase in numbers due to migration, but also because of differential fertili-

ty patterns. Immigrant women from Africa, the Middle East, and Asia have higher fertility rates than Danish and other Western European women in all age groups, and especially in the early years of childbearing.

Current rates of reproduction are extremely low in Denmark and were it not for a net positive migration to the country, we could expect to see the total population shrink to levels experienced before the turn of this century by 2044.

If looked at simply in terms of dependency ratios, it is somewhat ironic that unlike an increase in the indigenous birth rate, increased immigration is the only way to lower the total dependency burden in the short term. A simple upswing in domestic fertility only serves to increase the burden on those already in the labor force since they not only have their elders to support but also their own children. While immigrants may bring their dependent children with them, as relatively younger labor force participants they serve to stabilize, or even decrease the average dependency burden by increasing the immediate pool of labor force participants.

The greatest challenge to Danish society, however, is the fact that the current resident population is one of the most homogeneous in Western Europe. Thus, depending upon the relative immigration mix, the normally daunting task of educating and socializing young people is exacerbated by the potential for the type of intergenerational and culture conflict that has been evident in the major receiving nations over the last two to three generations. As Figure 5 illustrates, births to foreign nationals already constitute only slightly less than 10% of all Danish births. Under Scenario B, we expect this percentage to increase to 18.9% by 2044. If nationality is considered, foreign nationals of non-European origin already contribute 7% of the current births and this percentage would double to 14% under Scenario B by 2044.

Combined with migrant children, these Danish born children of migrants would undoubtedly raise the types of political problems already faced by nations as varied as the United States and France to adapt the school system to different religions, cultures and the demand for instruction in the non-indigenous language.

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Interest in attitudes towards immigrants has been rather little even among researchers. Jaakkola has recently published (1995) a book on the increased tension among Finns in their attitudes to foreigners (Jaakkola 1995). Her study also makes a comparison between the Finnish and Swedish attitudes to immigrants. Some of the questions presented in her (Jaakkola 1995) study.

The results of this paper are based on empirical material which was collected in a pilot study in May 1994. The target group of the pilot study was all the students studying at the University of Turku at that time. The students were chosen because of their future intellectual and political leadership of the country. Being a student is usually difficult to influence their opinions in the future.

The aim of this paper is to study the attitudes towards immigrants and demographic characteristics of the students in Finland (especially in Turku).

- 1. What are the attitudes towards immigrants and demographic characteristics of the students in Finland (especially in Turku)?
- 2. What are the main factors explaining the differences?
- 3. How do the students fit into Berry's (1990, 1997) model of acculturation?

This model is based on two questions, which in this study were asked in the following way: 'What is your attitude towards immigrants?' and 'What is your attitude towards the host country?' The model consists of four acculturation groups: integrated, assimilated, segregated, and marginalized.

The material was collected in May 1994. The population of the study consisted of all the students who studied their studies between 1990-1992 at the University of Turku. The sample was 200 students.

Using factor analysis and semi-structured interviews, the results of the study indicated that Berry's model is also useful when categorizing the attitudes of the people of the host country. More than 90% of the globolists had an integrative opinion about immigration. As few as 4% of the globolists were marginalists (against immigration), while the corresponding figure among emigrants was 14%.

The attitudes were also studied by gender and the results were compared between Berry's model and the model of assimilation, segregation, and marginalization.

Migration in Finland - including refugees and immigrants - is a relatively new phenomenon in Finland. Traditionally, Finland has been the losing party in migration during the last hundred years. About 600,000 Finns have emigrated permanently (Kotiasari and Soderberg 1993). Since the late 1980s the migration balance has been positive to Finland due to decreased emigration and increased immigration from the former Soviet Union area. Also the number of refugees has increased. The total number of foreign citizens in Finland in January 1, 1992 was 62,000 (1.2% of the total population). This proportion is especially high in the Western European countries, but the growth rate is the fastest. The number of refugees in Finland is increasing rapidly.