

British Columbia Population Forecast 09/06

July 2009

Technical Appendix
- Forecast Assumptions -



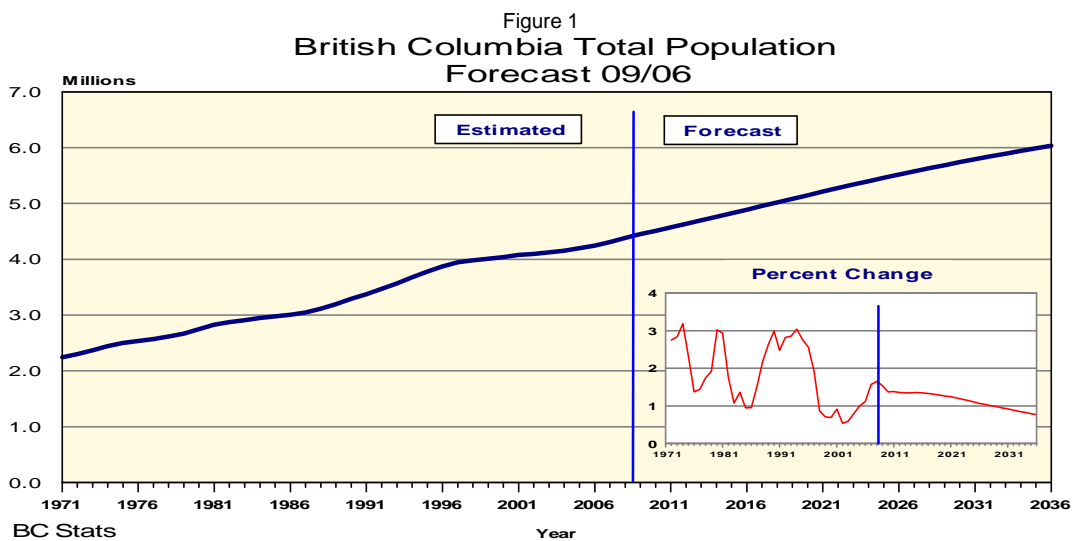
Population Forecast 09/06 Technical Appendix - Forecast Assumptions -

Forecast 09/06 provides forecasts of the size as well as age and sex structure of the population of British Columbia from 2009 to the year 2036. The forecast is the result of the application of a "Component/Cohort-Survival" population model to assumptions dealing with fertility, mortality and migration.

The Component/Cohort-Survival method requires separate forecasts of each of the components of population change, namely fertility, mortality and migration. With this information, and with a base year age-specific estimate of population, a forecast for any subsequent year is made by promoting each age group in the preceding year to the next highest age group, while at the same time taking into account the effects of net migration, deaths and births.

The term "forecast", as opposed to "projection", has been used when referring to the future provincial population. The two terms are often used interchangeably, but strictly speaking, a projection is a simulation based primarily on historical data. A forecast, on the other hand, represents adjustments to a trend based on the professional judgement of the forecaster regarding the way in which future growth will be affected by current and future developments.

The present forecast is the latest in a series that has been produced using a computer program developed by the Population Section of BC STATS. Forecasts in this series are released on an annual basis, or when significant developments make a new forecast necessary. These forecasts will be numbered according to the year and month of preparation. This forecast was prepared in June of 2009 and will be referred to as Forecast 09/06.



COMPONENT/COHORT-SURVIVAL METHOD

The Component/Cohort-Survival Method of population projection as implemented for Forecast 09/06 involves first breaking up population change into the components of:

- (1) births,
- (2) deaths,
- (3) interprovincial and international in-/out-migration;

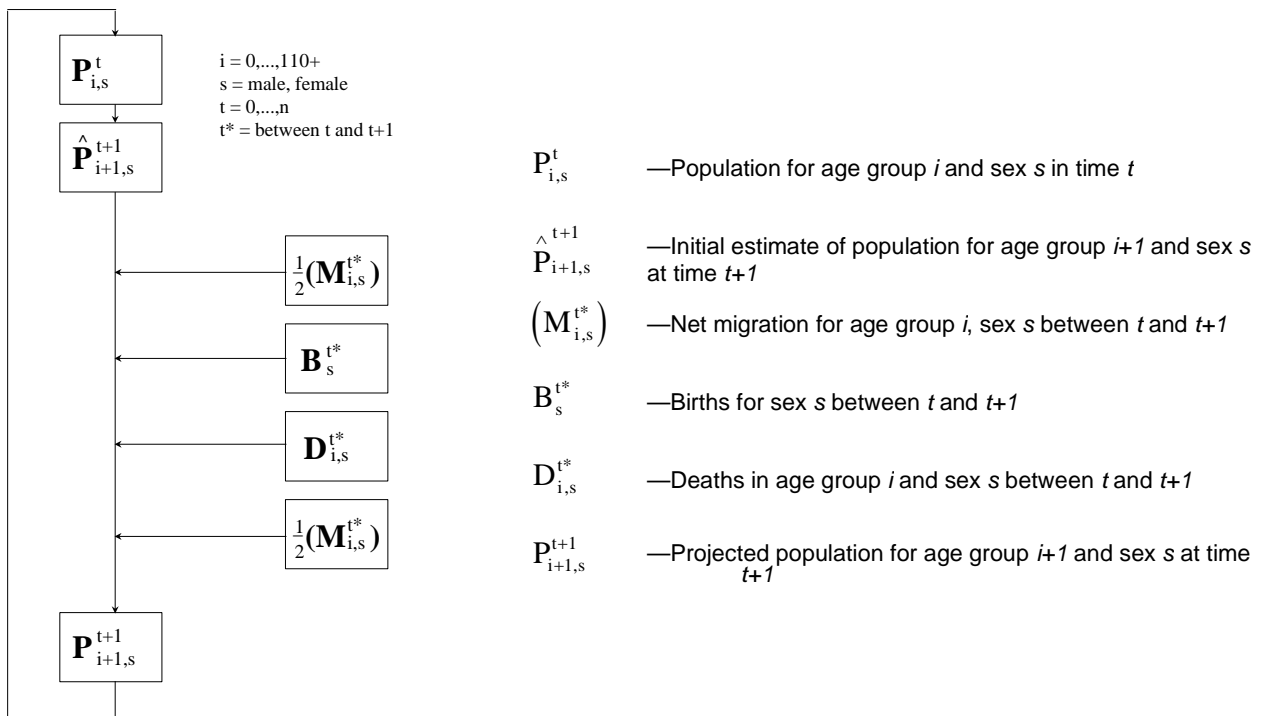
then projecting each component and summing to give total population change.

Specifically, beginning from a base year estimate of population by single year of age and sex, each age group i in the base year t is promoted to the next higher age group $i+1$ in time $t+1$, while at the same time taking into account the effects of net migration, births and deaths in that age cohort. This process is then repeated for the number of years required.

A diagrammatic representation of the process is given in Figure 2.

Figure 2

Provincial Population Forecast Model Flow Chart



The source and derivation of each of the components of Figure 2 will be outlined over the remainder of this section.

BASE POPULATION

The base population adopted for this forecast was the July 1, 2008 postcensal population estimate by sex and single year of age for British Columbia, prepared by Statistics Canada.¹ Each estimate is derived from an earlier year's estimate, which are based upon the most recent 'Censal Estimate'.

For each year after a census, Statistics Canada produces an estimate that uses as its reference base the most current Census of Canada adjusted for net census undercount (the 'censal estimate'). Net census undercount is the difference between the number of people who were missed in the census and the number of people who were counted more than once. The adjustment for net census undercount added approximately 121,500 people to the 2006 Census population of British Columbia, which amounts to 2.90 per cent of the adjusted population (down from 4.04 in 2001 and 3.68 in 1996).

FERTILITY FORECASTS

Birth forecasts for each year are a function of two variables:

- (1) the number of females of child bearing ages (defined as 15-49), and
- (2) the expected fertility of these women.

The fertility rate of women in a specific age group can be summarized by the number of births occurring to women in that age group divided by the number of women in that age group. This "propensity to give birth" is termed the Age Specific Fertility Rate (ASFR) and is expressed as the number of births per 1,000 women.

The Total Fertility Rate (TFR) is the summation of the age specific fertility rates, and represents a summary measure of the fertility pattern of the population. In the calculation of the TFR, each ASFR is given an equal weight. The end result is a measure of fertility which is of the approximate magnitude of the total number of children 1,000 women will bear in their lifetime (i.e., completed family size).

As can be seen in Figure 3, the estimated 2008 TFR for British Columbia is in the neighbourhood of 1,510 births per 1,000 women aged 15 to 49, down from 2,240 in 1971 and 3,953 in 1960.

¹ Statistics Canada, Demography Division, Population Estimates Section.

Figure 3
British Columbia Total Fertility Rate

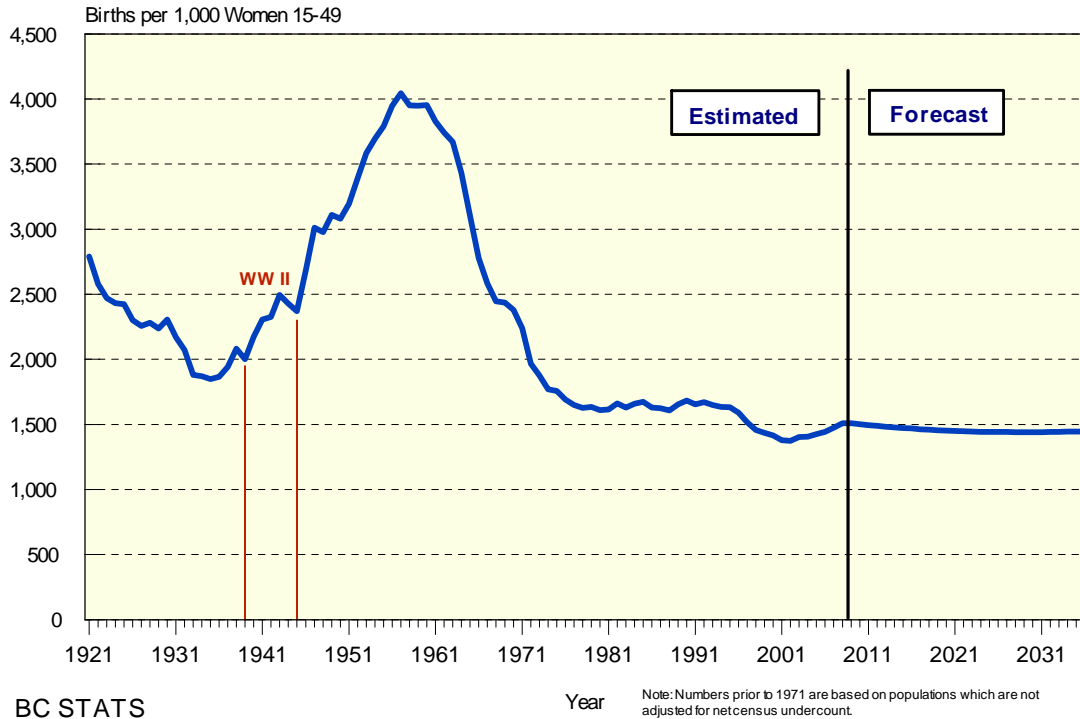
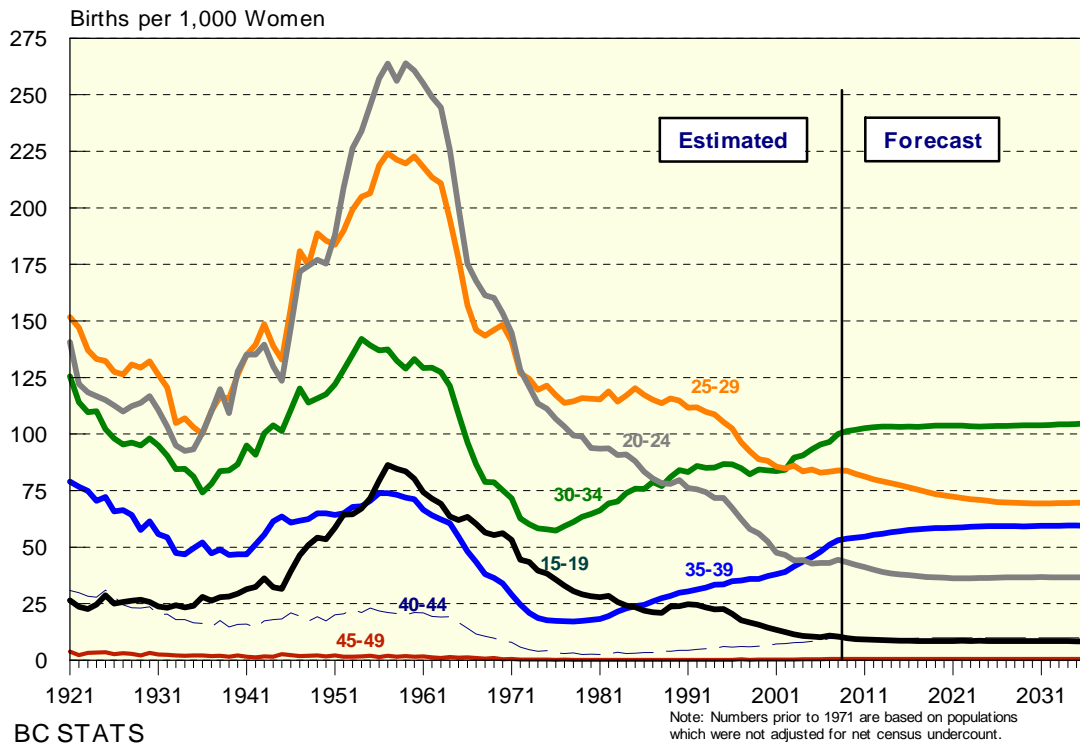


Figure 4
Age Specific Fertility Rates



The TFR is expected to decrease slightly but remain relatively stable over the entire forecast period. However, there will be observable shifts in the age at which women have children. As seen in Figure 4, the provincial age specific ASFR's vary significantly with age and time. At present, the most fertile age groups are the 25-29, 30-34 and 35-39 year olds. Looking at the historical record, one can observe a dramatic general increase in most ASFR's from the mid-1930's up to 1960, and then a drop through the 60's and early 70's. This variation in fertility has been termed the "baby-boom" (followed by the "baby-bust"), and was evident to different extents in all but the 45-49 year old age group.

During the baby-boom period, the 20-24 year old age group recorded the greatest fertility rate increases and subsequent decreases. Since 1959, the fertility rate of this age group has been declining and has now fallen below that of the 25-29, 30-34 and 35-39 year old age groups. Current data indicate that the fertility rate for this age group is showing some stability, unlike increases in other older age groups.

One of the more significant developments since the mid-seventies has been the increase in the fertility rates among the 30-34 and 35-39 year old age groups. This increasing trend in the fertility rates of older women (30-39), coupled with the decreasing fertility rates among the younger age groups (less than 24), may be interpreted as a desire to postpone child bearing to later in life. Increases in female labour force participation during this period are thought to be a factor in this tendency to defer child-bearing.

MORTALITY FORECASTS

The provincial mortality forecast was derived from a set of forecasts covering each of the age/sex specific death rates for the province. These age/sex specific death rates were converted into "life table survival ratios", which were then applied to the population to produce the surviving population by age and sex.

Changes in age/sex specific mortality rates are dependent upon a number of factors, including advances in medical science, access to timely medical assistance, and greater emphasis on preventative medicine such as diet, exercise, reduction of environmental hazards, etc.

As seen in Figures 5 and 6, the most significant improvements in mortality rates over the last three decades were in the younger age groups (under 14 years). Mortality rates over the next three decades are expected to continue to improve in most age groups although at reduced rates.²

² This forecast makes no attempt to assess the impact of Acquired Immunodeficiency Syndrome, or AIDS, on the future rates of mortality of the population.

Figure 5
Age Specific Mortality Rates - Males

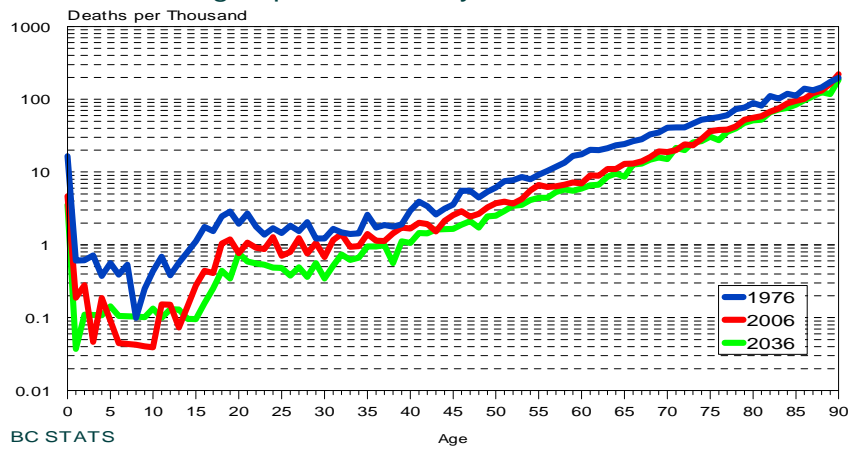


Figure 6
Age Specific Mortality Rates - Females

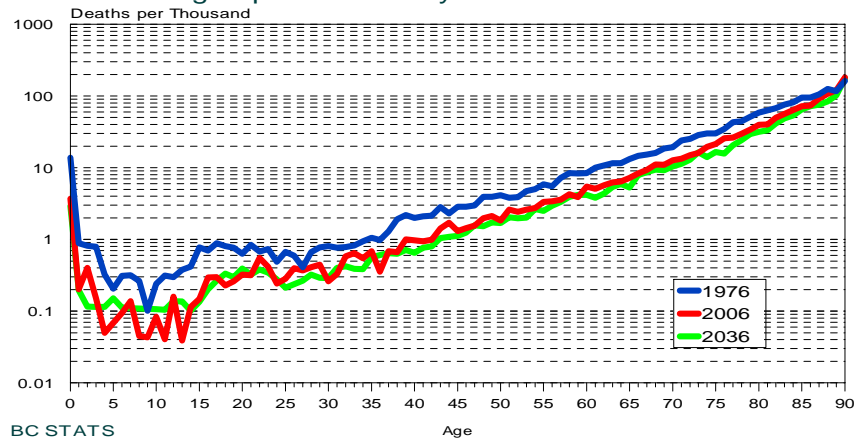
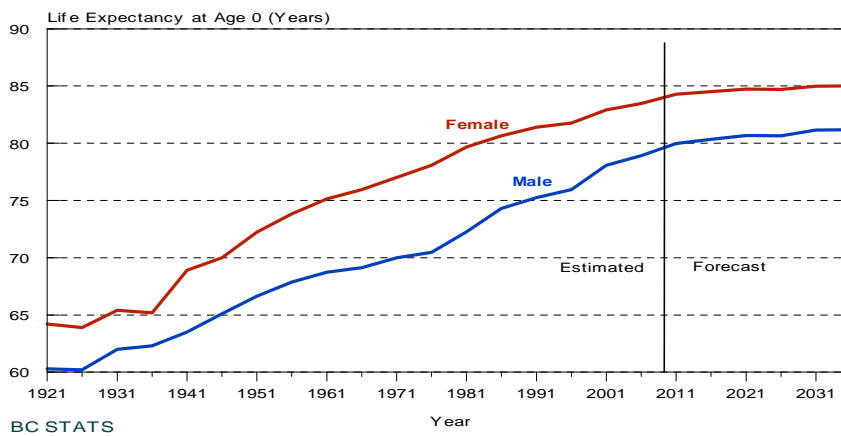


Figure 7
Life Expectancy - Male and Female



As seen in Table 1 and Figure 7, life expectancy at age 0 (a summary measure of the age-specific death rates) has generally been increasing over the last 75 years.

Table 1

British Columbia Life Expectancy at Age 0				
Time Period	Male (years)	Avg Annual Change (years)	Female (years)	Avg Annual Change (years)
1921	60.3	--	64.2	--
1926	60.2	-0.03	63.9	-0.09
1931	62.0	0.59	65.4	0.47
1936	62.3	0.10	65.2	-0.06
1941	63.5	0.38	68.9	1.11
1946	65.1	0.50	70.0	0.32
1951	66.7	0.48	72.2	0.61
1956	67.9	0.35	73.8	0.45
1961	68.7	0.26	75.1	0.35
1966	69.1	0.11	75.9	0.22
1971	70.1	0.25	77.0	0.28
1976	70.5	0.11	78.1	0.29
1981	72.3	0.51	79.7	0.41
1986	74.3	0.55	80.7	0.25
1991	75.2	0.24	81.4	0.17
1996	76.0	0.21	81.8	0.10
2001	78.1	0.55	82.9	0.27
2006	78.9	0.20	83.5	0.14
2011	80.0	0.28	84.3	0.19
2016	80.3	0.08	84.5	0.05
2021	80.7	0.10	84.7	0.05
2026	80.9	0.05	84.8	0.02
2031	81.1	0.05	85.0	0.05
2036	81.2	0.02	85.0	0.00

Sources: Dhruva Nagnur, Statistics Canada, *Longevity and Historical Life Tables* (catalogue 89-506); BC STATS, Ministry of Management Services, Province of British Columbia.

Note: Change is Average Annual Compound Change.

The most significant overall factor contributing to the increased life expectancy over the past 60 years has been the reduction in infant and early childhood mortality, which in turn, has been caused by the effective control of diseases such as polio, tuberculosis, diphtheria and others. The trend of increasing life expectancy is expected to continue throughout the forecast period, though at a lower rate than in the past. For males, this means an increase from the 2006 value of 78.9 years to 81.2 years by 2036, and for females, an increase from 83.5 in 2006 to 85.0 by 2036.

MIGRATION FORECASTS

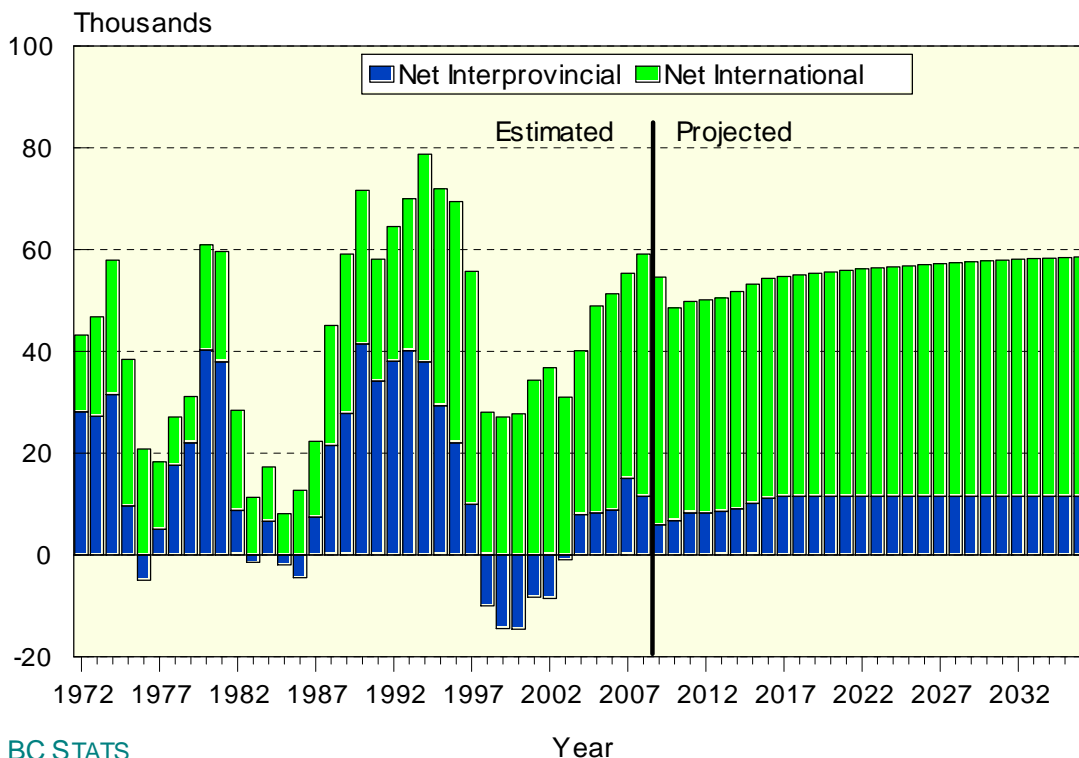
The net migration forecast is the result of separate forecasts of British Columbia interprovincial in- and out-migration, as well as of international immigration and emigration. The migration forecasts are intended to capture only the average levels expected over the next 28 years, and will not fully reflect any fluctuations that may occur from year to year.

[1] INTERPROVINCIAL MIGRATION

Interprovincial migration is influenced by a wide variety of economic, demographic, social and political factors. Many view interprovincial migration as a combination of "push" factors that pressure a migrant to seek better opportunities, and "pull" factors that attract a migrant to a particular location. Consequently, movement between provinces under this Push-Pull hypothesis results from differences in economic and non-economic conditions in respective regions.

Figure 8

British Columbia Net Migration

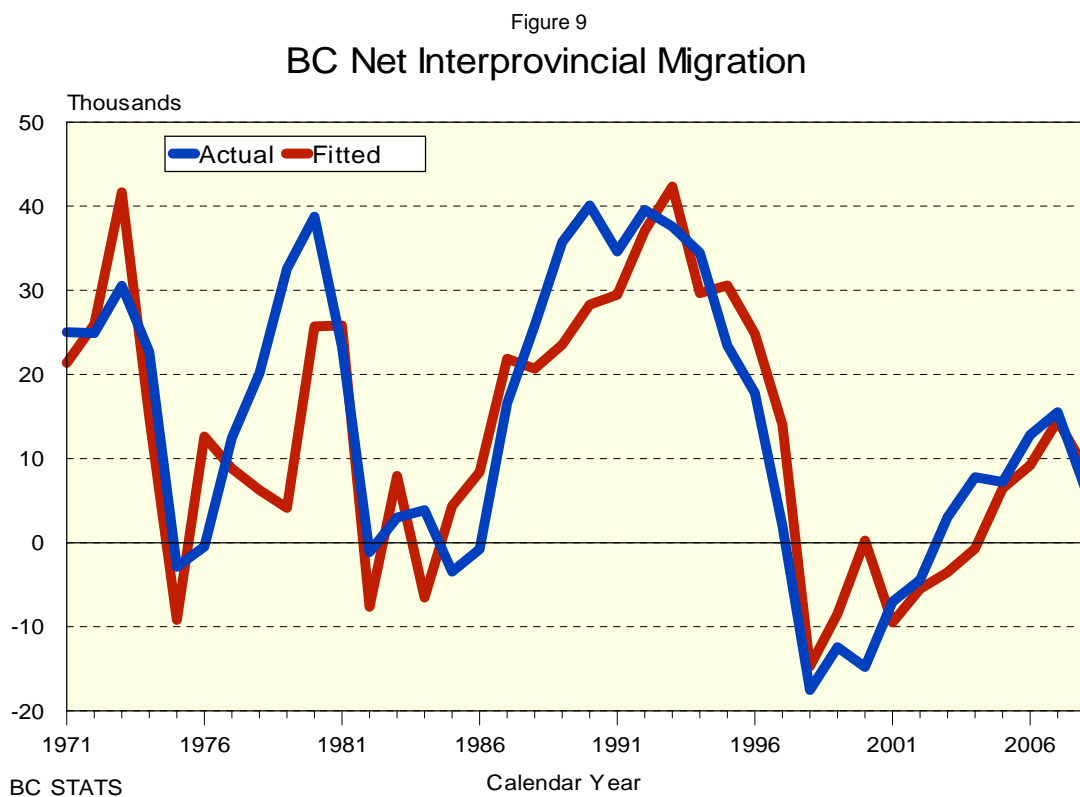


BC STATS

As noted above, the factors that draw other Canadians to British Columbia are both economic and non-economic in nature. Non-economic factors such as climate or life-style are slow to change. Hence, it is the economic factors, or

more specifically, the relative economic conditions between British Columbia and the other provinces, in particular Alberta and Ontario, that must be considered when predicting changes to British Columbia net interprovincial migration.

Statistical analysis indicates that over the past twenty-five years, fluctuations in British Columbia net interprovincial migration have been correlated to a significant degree with relative differences in the British Columbia/Alberta unemployment rates, as well as differences in the growth in real per capita Gross Domestic Product (GDP) of British Columbia relative to the rest of Canada.³ As can be seen from Figure 9, these variables, when combined in a statistical regression equation, can track the trend, with reasonable accuracy, of past net interprovincial migration for British Columbia.



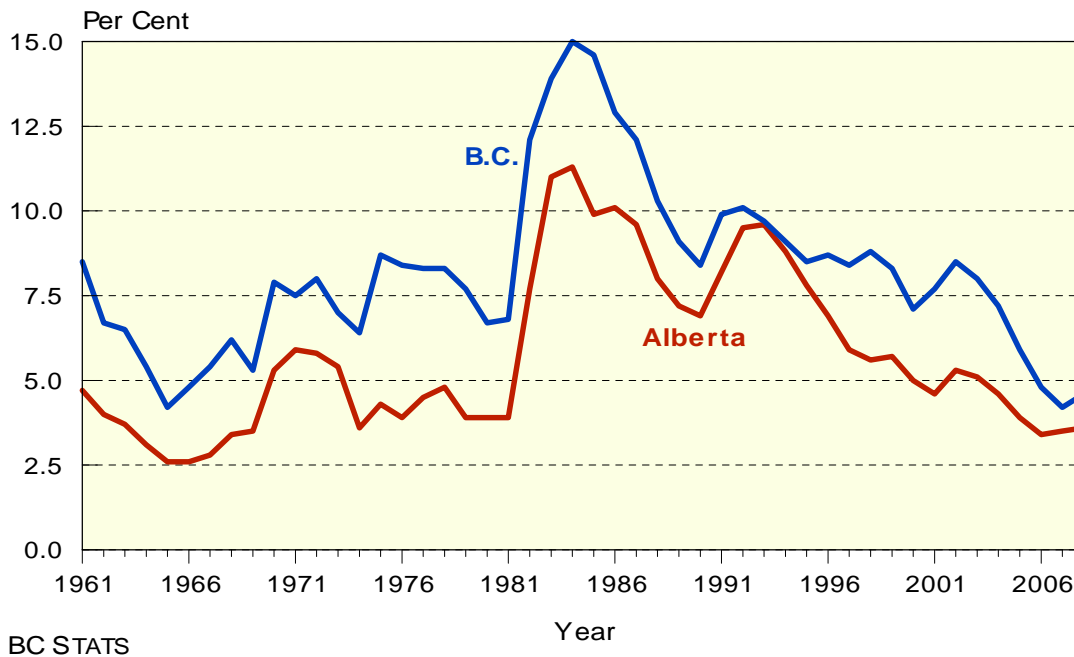
Many other economic factors likely play a role in influencing population movement; however, in many instances empirical data on these factors are not available for a sufficient historical period to conduct statistical analysis. In addition, in order to forecast migration, consideration must be given to the practicality of forecasting the theorised determinants of migration. Both these

³ See "An Econometric Model Describing the Movement of the Population Between British Columbia and the Rest of Canada," Schrier and McRae, Population Section, BC STATS, Ministry of Management Services, Government of British Columbia, February 2000.

constraints put limits on the number and type of variables considered as drivers of interprovincial migration. Consequently, the factors noted above do not uniquely describe interprovincial migration flows, but rather are the ones that fit the criterion of statistically significant correlation with past migration flows, and have the potential to be forecast themselves.

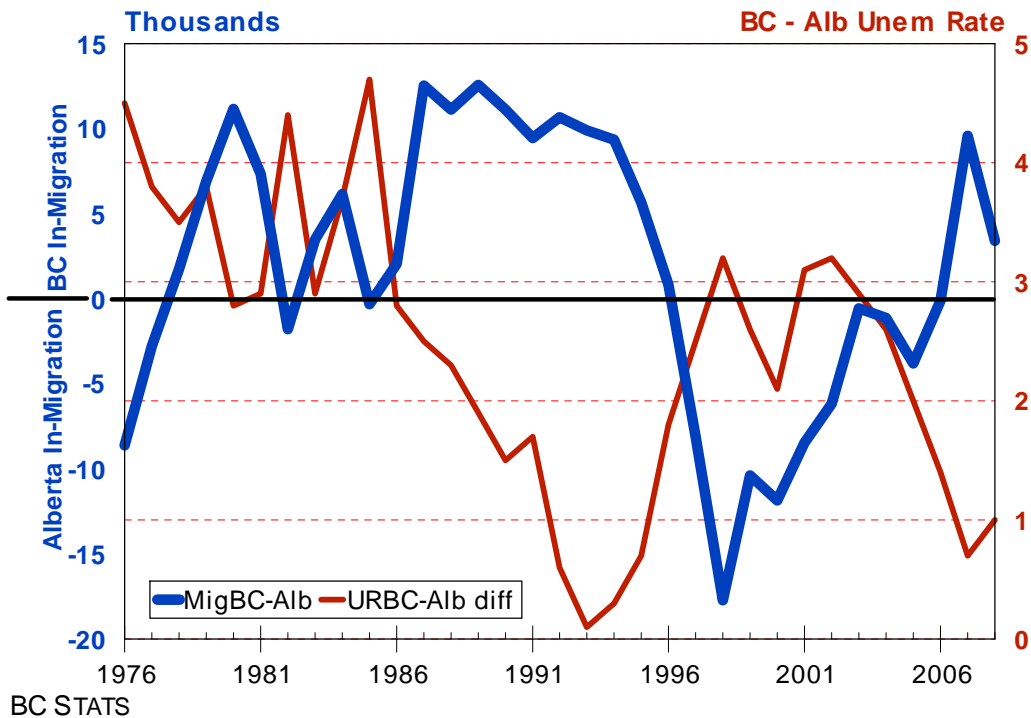
Unemployment Rate Forecast Scenario:

Figure 10
**Unemployment Rates
 B.C. vs. Alberta**



As indicated by Figure 10, the high levels of interprovincial in-migration from Alberta and the rest of Canada experienced in the late eighties and through most of the nineties were largely a reflection of the relative unemployment rates. Over the last thirty-five years, British Columbia has always had a higher unemployment rate than Alberta (2.4 percentage points on average), but for most of that period, British Columbia has received population from Alberta, the exceptions being the early eighties and late nineties into this century when the differential reached the 3 to 5 percentage point mark. During 1993, the Alberta and British Columbia unemployment rates were virtually equal, which contributed to the unusually high net inflow of population to British Columbia from Alberta. After 1996 the gap widened, which resulted in net outflows from British Columbia to Alberta during the 1997 to 2006 period.

BC-Alberta Migration vs Unemployment Rate Differentials



Strong exports in the oil and gas sectors in concert with the policy restructuring that has been occurring since the late eighties have led to strong and stable growth for the Alberta economy. This has eased unemployment rates downward. In the short-term, the gap between British Columbia and Alberta unemployment rates is expected to remain slightly below the historical average, meaning net inflows from Alberta will remain positive. In the long-term, it is anticipated that British Columbia unemployment will fall and the unemployment rate gap between the two provinces will stabilize. This will mean that net migration from Alberta will continue in the long-term.

With regard to economic growth, as reflected in growth in GDP, it is expected that the growth rate in British Columbia will, on average, demonstrate greater strength relative to the rest of Canada for the term of the projection period.

[2] IMMIGRATION

Net international migration to British Columbia is driven largely by federal immigration policy. Currently, the federal government sets an overall annual immigration planning range for Canada. These planning levels are not intended to be rigid quotas; hence actual immigration may exceed the planning level or fall short. In fall 2008 the federal government released a policy document that set out immigration planning levels for 2009. The total planning level unchanged since 2007.

In the short term, it is expected that Canadian immigration levels will be at the lower end of the planning target. Despite previous mention of the federal government raising target immigration levels to approximately one percent of the population each year, BC STATS' immigration forecast for Canada projects immigration to continue near the current share of three-quarters of a per cent. This will bring the Canada level immigration forecast to 275,000 by 2024.

The planned immigration intake since 2002 is given in Table 2 along with the actual immigration.

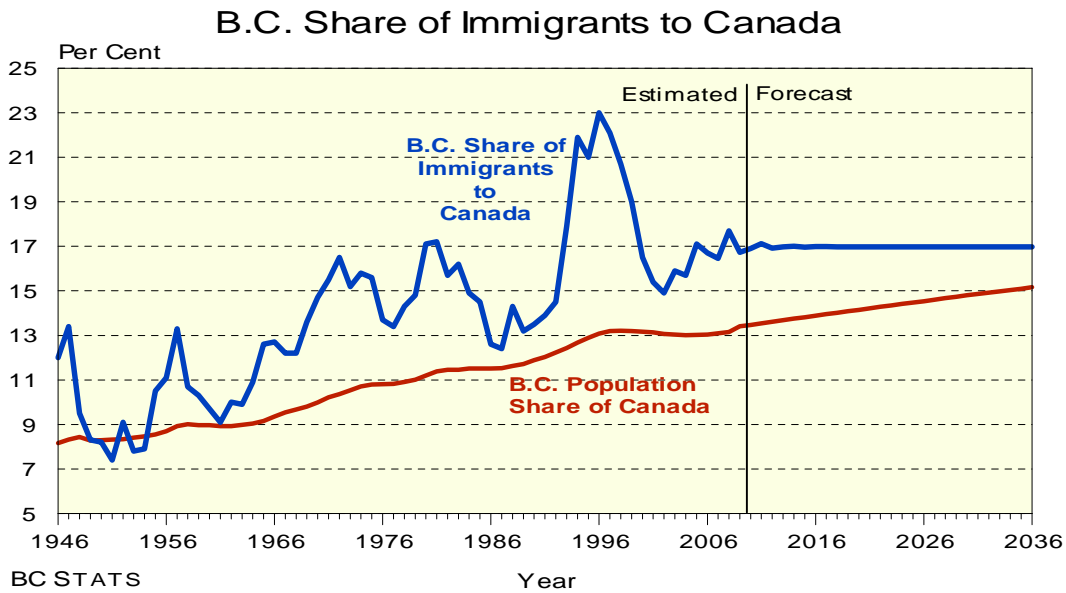
Table 2
Canadian Immigration

Year	Planning Level (000's)	Actual (000's)	B.C. Share (%)
2002	210-235	229	14.9
2003	220-245	221	15.9
2004	220-245	236	15.7
2005	220-245	262	17.1
2006	225-255	252	16.7
2007	240-265	237	16.5
2008	240-265	247	17.7
2009	240-265		

British Columbia Immigration Share

Over the past four decades the share of Canadian immigrants arriving in British Columbia has ranged from a low of 12.2 per cent in 1968 to a high of 23.0 per cent in 1996. Over the same period there has been a significant shift in the area of origin of Canadian immigrants. In 1968 approximately 65 per cent of all Canadian immigration originated in Europe, followed by 12 per cent from Asia and 11 per cent from the United States. However by 2008, only 16 per cent of all Canadian immigration originated from Europe, with 5 per cent from the United States and 57 per cent from Asia. The comparable figures for British Columbia in 2008 were 13 per cent from Europe, 6 per cent from the United States and 72 per cent from Asia.

Figure 11



During 1993, British Columbia experienced a significant increase in its share of immigrants coming to Canada. The 1996, 23 per cent share, represents a forty year record high for British Columbia. The only other period where British Columbia experienced an immigration intake share in excess of 17 per cent was during 1980 to 1981, which was due to a one time influx of refugees from Vietnam (the "Boat People crisis"). This dramatic increase in the proportion of immigrants choosing British Columbia as a destination may be due to a number of factors, such as the increasing dominance of Asian immigrants and British Columbia's location on the Pacific Rim, a well-established Asian community that could aid the settlement process, and a preference, among new immigrants, for the relatively mild climate and natural beauty of the province.

Another factor that may have affected the higher share of immigration to British Columbia in the 1994 to 1997 period was the low immigration share going to Quebec. Quebec, which is the only province in Canada to have responsibility for the selection of some classes of immigrants, dropped its share of immigration from 18 per cent in 1993 to around 13 per cent over the 1994 to 1997 period. The Quebec share has recovered to around 17 per cent in the last two calendar years. Ontario's share of immigration increased strongly in the 2000-2002 period, but declined in 2003 to be more in line with its 30 year average.

Over the next few years the British Columbia immigration share is expected to remain at levels slightly higher than average historical levels. Beyond the short term, it is possible the origins of immigrants to Canada may change somewhat, to include more immigrants from Central American and Eastern European countries. If this happens, the share of immigrants to British Columbia will likely

fall as the relative proximity of British Columbia to Asia will no longer serve as a competitive advantage.

[3] EMIGRATION

Canadian Emigration

Historically, emigration from Canada has ranged from a high of 108,000 in 1967 to a low of 37,000 in 2003. Generally speaking, the largest outflows from Canada occurred during the 1960's, and were probably associated with what has been termed the "Brain Drain" to the United States. Since the 1960's, emigration from Canada has generally declined, to the present level of around 40,000 annually.

It is assumed that emigration flows from Canada are influenced by return migration (i.e., as immigration increases so will the number of return migrants, resulting in a slight increase in emigrants from Canada in the future). Accordingly, it is expected that Canadian emigration will increase at approximately the rate of population growth to the end of the forecast period.

British Columbia Emigration Share

The British Columbia share of Canadian emigration has ranged from a low of 6.8% in 1967 to a high of 19.6% in 2002. The abnormally high share during the last six years may reflect the emigration of East Asian immigrants that arrived in the mid-nineties. British Columbia's share of Canadian emigration is expected to remain in the 15% range for the duration of the projection.

[4] OTHER COMPONENTS OF MIGRATION

Non-Permanent Residents

Non-Permanent Residents are defined as persons residing temporarily in Canada who hold a student, work, or minister's permit, or who are refugee claimants. The number of non-permanent residents varies significantly from year to year, and since it is a net measure (i.e., inflows minus outflows), the figure can be negative. However, in the past twenty-five years there have been only four periods with a net outflow, all of which occurred in the nineties. More recently, British Columbia has seen significant growth in net non-permanent residents. For the duration of the projection period an inflow slightly above the historical trend is forecast.

Returning Emigrants

Returning Emigrants are persons who have emigrated from Canada in the past and who are returning with the intention of once again becoming permanent residents. This component is dependent on the level of previous emigration (since people cannot return to Canada as a returning emigrant without first

emigrating). For this reason, the forecast for Canadian returning emigrants is tied to previous emigration. For British Columbia, the proportion of returning emigrants to emigrants is expected to remain relatively constant.

Temporarily Abroad

Persons Temporarily Abroad are residents who have temporarily moved to another country, but have the intention of returning to live in Canada (essentially, these people are the flip side of non-permanent residents; that is, they are non-permanent residents of another country). The temporarily abroad figure is a net figure of people leaving the country minus people returning from being temporarily abroad. Therefore, this figure is subtracted from the population (the same as is done with emigrants). The reason for its inclusion is that empirical evidence shows that the temporary outflows do not generally equal inflows as previously believed. In fact, there is a positive slope to the temporarily abroad data (i.e., the net of outflows over inflows is increasing over time). This component is forecast to grow for British Columbia at the same rate as emigration.

[5] AGE AND SEX BREAKDOWN OF MIGRANTS

As seen in Figures 12 and 13, the age and sex structures of interprovincial and international in and out-migrants are different. Immigrants to British Columbia tend to be somewhat more heavily concentrated in the younger age groups than are emigrants, while interprovincial in-migrants tend to be slightly older than out-migrants. For this reason, the age and sex distribution for each migration flow was forecast separately.

Figure 12

B.C. Immigration and Emigration 2003/2004 to 2007/08 Average

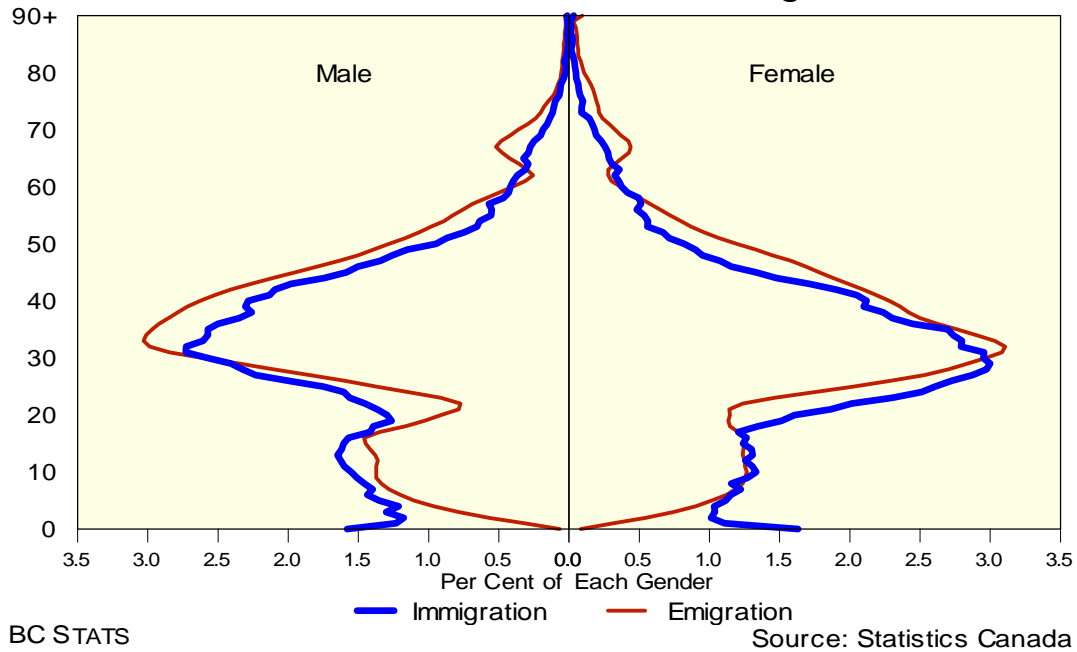
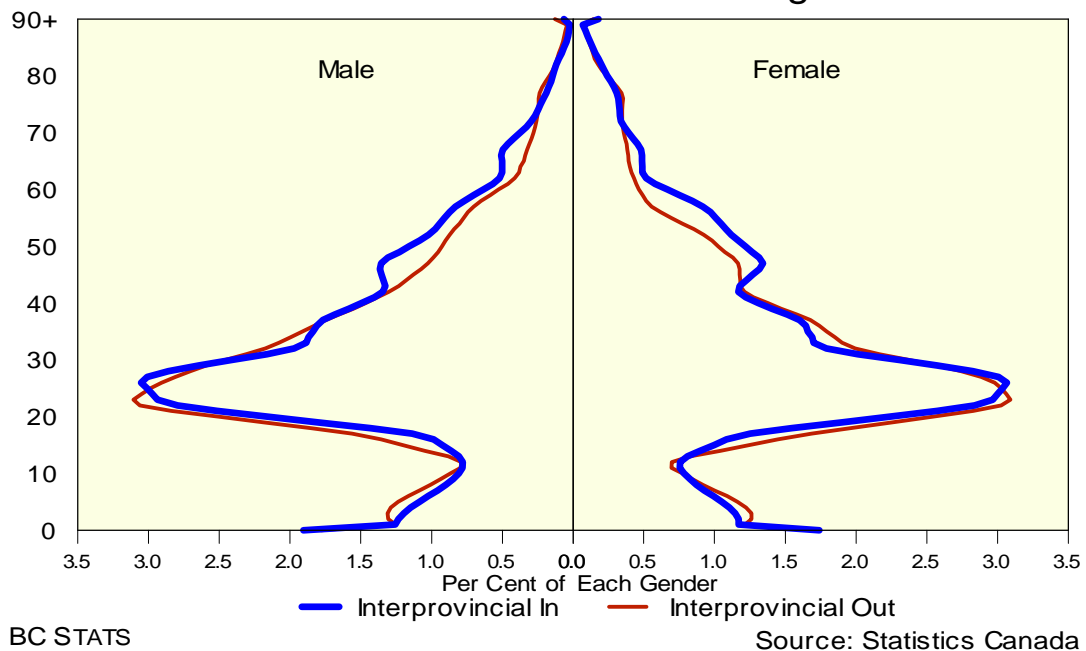


Figure 13

B.C. Interprovincial In- and Out- Migration 2003/2004 to 2007/08 Average



Forecasts of the age and sex distributions of interprovincial and international out-migration were made by applying the average of the 2000/2001 to 2005/06 age and sex specific out-migration rates (i.e. age/sex specific out-migration divided by

the British Columbia population) to an age/sex specific forecast of population. The resulting out-migration distribution was calculated and applied to the forecast of total interprovincial and international out-migration. In effect, this approach assumes that changes in the forecast age and sex distribution of out-migrants are tied to changes in the age and sex distribution of the British Columbia population.

A similar approach, using the age/sex population distribution for the rest of Canada, was used to forecast the age/sex distribution of British Columbia interprovincial in-migrants. The emigration distribution was also used for people temporarily abroad. For returning emigrants, the distribution from the base year was used throughout the forecast.

Data collected since 1961 indicate significant changes in the age/sex composition of immigrants to British Columbia. From 1961/62 to 1974/75, the age distribution of immigrants was similar to that of interprovincial migrants, and displayed an approximately equal sex composition. From the early 1960's through the mid 1970's, the age distribution showed a bimodal structure, with peaks in the youngest ages and the 20-25 year olds. From the late 1970's to the mid 1980's the youngest age group peak flattened out, and another peak in the 50-60 year old age ranges became visible. Since the mid 1980's this older peak has disappeared and the early twenties peak has aged to centre on the mid to late 20's age group. The sex distribution is slightly weighted toward females. These shifts in the British Columbia immigration age/sex structure seem to correspond to changes in the relative shares of immigration "classes"⁴. Recent years have seen a greater percentage of immigrants in the skilled worker classes and these people tend to be concentrated in younger middle age groups. As well, since the 1980's the increasing number of business class immigrants - who tend to have families with younger children - have contributed to the rise of a younger immigrant distribution overall.

Forecasts of immigration distributions are made by taking a five year average of age/sex distributions by class (using a breakdown into four classes: business, skilled worker, family, and refugee) and applying these to a projection of class distribution (i.e., the percentage that each class represents of the total immigration), then calculating an age/sex distribution for total immigration.

The federal government emphasises attracting immigrants with the skills necessary to enter directly into the work force. As a result, this forecast assumes that the skilled worker class will continue to represent the largest portion of the immigrant distribution. It is likely that Canada will also continue to pursue the policy of family reunification, which means the family class will also retain a large share of the distribution.

⁴ Citizenship and Immigration Canada processes immigration applications according to the following classes: Family, Refugee, Designated, Assisted Relatives, Other Independents, Entrepreneurs, Self Employed and Investors.